

# 2011 Smoke Testing Results

Prepared by the City of Pacifica

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**List of Abbreviations**

CCTV	Closed-Circuit Television
CDO	Cease and Desist Order
City	City of Pacifica
CMMS	Computerized Maintenance Management System
GIS	Geographic Information System
GPS	Global Positioning System
I/I or I&I	Infiltration and Inflow
Master Plan	City of Pacifica Collection System Master Plan (October 2011)
OCE	Our Children's Earth Foundation
RMC	RMC Water and Environment
SFE	SFE Global

## 1 Introduction

This document presents the results of smoke testing conducted in the City of Pacifica (City) wastewater collection system during the fall 2011. The smoke testing program was conducted in accordance with the Illicit Discharges Elimination Program Plan prepared by the City in August 2011. The City is required to develop and implement a program to eliminate illicit discharges into its sanitary sewer system and conduct smoke testing in areas identified as having the most significant infiltration/inflow (I/I) in compliance with Cease and Desist Order No. R2-2011-0031 (CDO) adopted by the Regional Water Quality Control Board, San Francisco Bay Region, on May 11, 2011, and in accordance with the Consent Decree with Our Children's Earth Foundation (OCE) dated June 29, 2011.

The CDO states as follows:

*The Discharger shall develop and implement a program to detect and eliminate illicit discharges. By December 31, 2011, the Discharger shall complete and document the results of smoke testing of the portions of its collection system identified in the System Evaluation and Capacity Assurance Plan... as having the most significant I&I and as being most appropriate for smoke testing. The Discharger shall require private property owners to eliminate illegal drainage connections or defective laterals and shall eliminate any inappropriate cross-connections in Discharger-owned facilities identified during smoke testing.*

*By November 15, 2011, the Discharger shall adopt an ordinance, or amend existing ordinances, to provide the Discharger with the requisite authority to eliminate illicit discharges and shall take reasonable enforcement efforts under said ordinance(s) to eliminate identified illicit discharges. The Discharger shall take reasonable enforcement actions against any violators and maintain records to document any such enforcement actions.*

The Consent Decree states as follows:

*By July 1, 2011, the City shall commence development of a program to detect and eliminate illicit discharges. The City shall commence implementation of its program by September 1, 2011 and commence field work by October 30, 2011. The City shall thereafter continue to develop and implement its program. As part of its program, by December 31, 2011, the City shall complete smoke testing of the portions of its Collection System identified in the Master Plan...as having excessive I&I and are the most appropriate for smoke testing. By November 15, 2011, the City shall adopt an ordinance, or amend existing ordinances, to provide the City with the requisite authority to eliminate illicit discharges and shall take reasonable enforcement efforts under said ordinance to eliminate identified illicit discharges.*

## 2 Purpose, Application, and Limitations of Smoke Testing

The primary purpose of smoke testing is to identify potential illicit discharges, or sources of direct stormwater runoff ("direct inflow") to the sanitary sewer system. Such sources include roof downspouts, driveway and yard drains, and other types of area drains with direct piped connections to sanitary sewer laterals; as well as defective or open cleanouts on private property that are located in areas that may collect surface drainage. Other direct inflow sources include cross connections between storm drains and sanitary sewers, which could be located within the City's sewer system as well as in private systems.

Smoke testing is the most common method used for identification of direct inflow sources because it can be accomplished relatively inexpensively and cover a wide area. Smoke testing involves blowing a non-toxic smoke into sanitary sewers at manholes and recording observations of where the smoke emerges

from the ground, from sewer or drainage structures, or from buildings (called “smoke returns”). The smoke returns indicate the potential pathways of extraneous flow into the sanitary sewer system. Smoke testing can be used to identify infiltration sources (e.g., defective service laterals) as well as direct inflow connections if the testing is done when the soil is relatively dry, to allow the smoke to travel through the ground. However, not all such defective laterals will necessarily be detected. Direct inflow sources can be identified regardless of soil conditions as long as the piped connections are open (not filled with water).

Smoke testing is typically documented by taking photographs of the observed smoke returns and recording the location of the smoke and type of connection. However, if access to private property is restricted (e.g., due to fences or locked gates), some smoke returns may not be detected. Smoke testing is not effective for detecting such inflow connections as drainage sump pumps or foundation drains located inside buildings or underground.

### 3 Smoke Testing Program

Smoke testing was conducted in four areas of the City’s wastewater collection system identified as having the highest wet weather peaking factors based on the results of flow monitoring and hydraulic modeling conducted for the City’s Collection System Master Plan (Master Plan) completed in October 2011. The identified areas were the Pedro Point, Linda Mar, and Fairway Park districts, comprising approximately 182,000 feet of sanitary sewer mains (approximately 35 percent of the total sewer system), as listed in **Table 1** and shown in **Figure 1**. In many of these areas, the upper portions of the service laterals (portion located on private property) are known to be constructed of Orangeburg pipe. The flow monitoring and hydraulic evaluation of the system conducted for the Master Plan determined that the highest peak wet weather flows occur in the lower Linda Mar and Pedro Point areas in particular and have the greatest impact on predicted capacity deficiencies and required capacity improvements.

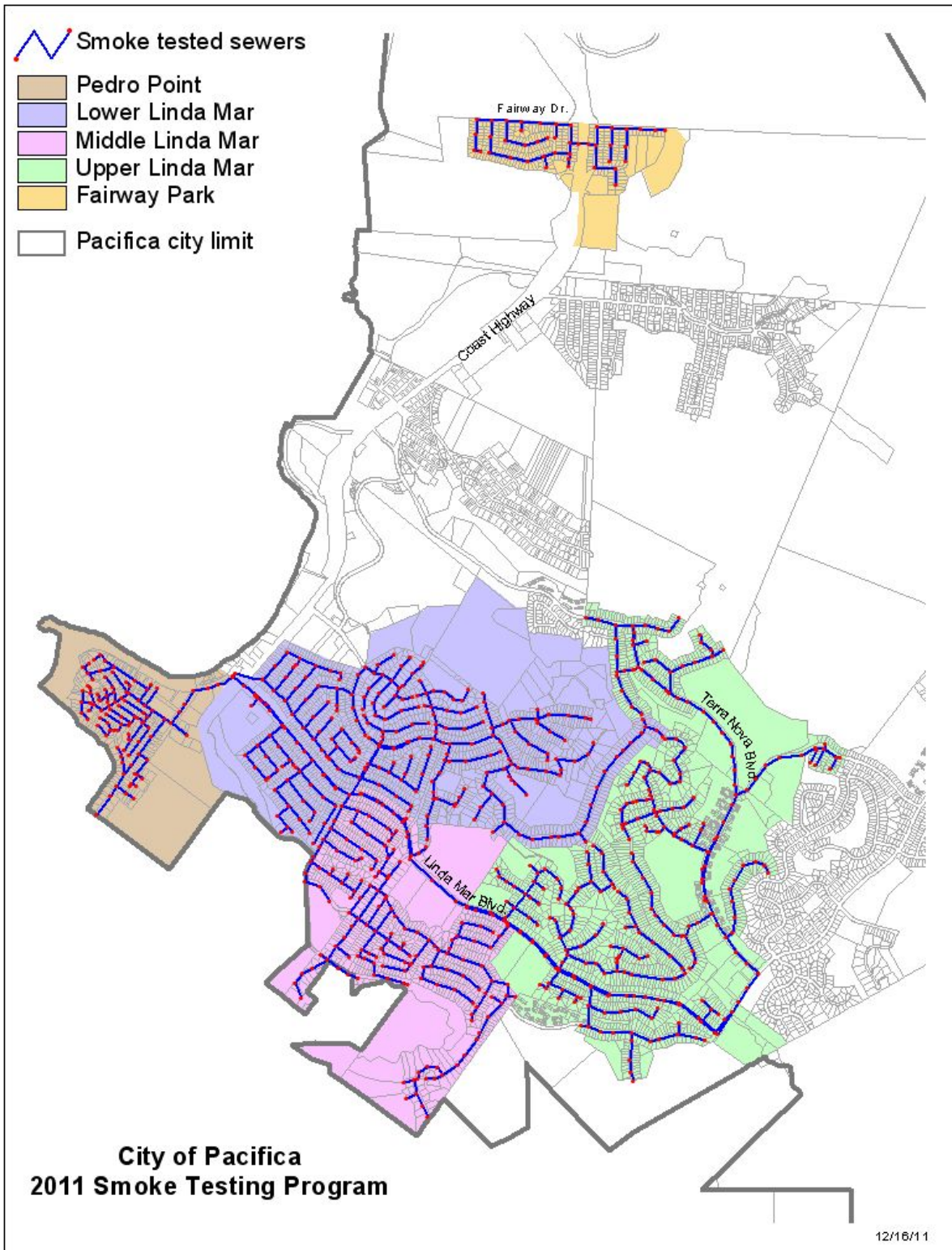
**Table 1: Smoke Testing Areas and Pipe Footages**

Area	Approximate Length of Sewer Mains (ft.)			Total	Estimated Number of Laterals*
	≤ 8"	10" – 15"	≥ 18"		
Pedro Point	16,300	500	0	16,800	440
Lower Linda Mar	50,300	5,300	2,800	58,400	1,460
Middle Linda Mar	26,200	7,000	2,900	36,100	870
Upper Linda Mar	47,700	12,700	700	61,100	1,590
Fairway Park	10,200	0	0	10,200	270
<b>Total</b>	<b>150,700</b>	<b>25,500</b>	<b>6,400</b>	<b>182,600</b>	<b>4,630</b>

\* Estimated assuming one lateral per 38 feet of 15-inch and smaller mainline sewers.

The smoke testing field work was conducted by a contractor, SFE Global (SFE), retained by the City based on a competitive procurement process. The work was conducted in accordance with the City’s specifications (Special Provisions) for smoke testing, included as **Attachment A** to this report. SFE was provided with GIS mapping of the areas targeted for smoke testing and a tabulation of the pipes included in each area. City operations staff familiar with the collection system provided assistance in locating manholes and overall oversight of the field activities. The City’s Master Plan consultant, RMC Water and Environment (RMC), reviewed the database deliverables and summarized the smoke testing results based on the database and reports provided by SFE.

Figure 1: 2011 Smoke Testing Areas



The smoke testing was completed during the four-week period from October 4 to November 3, 2011. The field crews recorded the date and location of each smoke blower setup and the extent (upstream and downstream manholes) of smoke transmission for each smoke test “run”; and documented the occurrences of smoke returns or other issues (called “incidents”) from each run. The coordinates (latitude/longitude) of each manhole and incident were determined using Global Positioning System (GPS) instruments, and the following information was recorded for each smoke test incident:

- Incident location (address and/or street)
- Upstream and downstream manholes
- Result status (positive or suspect)
- Leak source (service connection or main sewer)
- Leak type (see **Table 2**)
- Leak size (A through F, indicating relative inflow or infiltration potential)
- Leak surface cover (asphalt, concrete, dirt, grass, etc.)
- Observations (text description of location and type of leak or any problems/issues encountered)

In addition, a digital photograph was taken of each incident location (other than incidents such as no smoke observed from roof vents or manholes that could not be located).

**Table 2: Leak Type Codes and Descriptions**

Leak Type Code	Description
CB	Catch basin
CCD	Cleanout cap defective
CCM	Cleanout cap missing
DT	Drain tile (or yard drain)
MHC SAN	Sanitary manhole cover
NS	No smoke from vent
O	Other
RWL	Rainwater (roof) leader
SC	Service connection (lateral)
SI	Smoke in building
SM	Sewer main
?	Source unknown

The information recorded by the field crews on the field forms was entered into MS Access databases (separate database for each of the five smoke testing areas) and reviewed for quality control/quality assurance by SFE office staff. The databases were then transmitted to the City and RMC for final review. The final databases were used to generate reports showing the information for each incident. An example report is shown in **Attachment B**.

## 4 Smoke Testing Findings

Over 400 smoke testing “incidents” were recorded, of which 315 indicated some type of “leak” or potential source of infiltration or inflow into the sanitary sewer system. Approximately 93 percent of the leaks were found to be related to private property (service laterals, cleanouts, roof or yard drains) and 7 percent related to the public sewer system (manholes, sewer mains, potential storm drain cross-connections). An additional 34 smoke incidents indicated cases of faulty plumbing (smoke inside the building). The remaining recorded incidents were either cases of manholes that could not be located or

appeared to be buried (approximately 30 manholes) or situations where roof vents showed no smoke, indicating that the smoke had not traveled through the system to the connected properties (approximately 20 locations).

Most of the leaks (64 percent) were indicated to have “little if any” or “light” inflow or infiltration potential, indicating that the smoke intensity was light and the potential surface area draining to the leak is small. Another 29 percent were classified as “medium”. Only 8 percent were indicated to be “moderate” or “high”, primarily consisting of roof leaders, yard drains, or low-lying cleanouts with missing caps.

It should be noted that the relative lack of smoke incidents in the public sewer system does not necessarily indicate that that portion of the system is not subject to I/I. Rather, because much of the public system lies under pavement, smoke may not be able to travel and emerge at the ground surface. Therefore other methods such as closed-circuit television (CCTV) inspection are more appropriate for identifying potential I/I sources in the public portion of the system. The City has CCTV inspected about half of the system to date, and will complete the remainder by 2013.

Overall, the smoke testing identified relatively few potential sources of direct inflow to the sewer system. Only 7 directly connected roof leaders and 4 yard drains (categorized as “drain tiles” by the smoke testing crews) were found. The two public catch basins identified did not appear to be direct connections based on the intensity of the smoke, and may be cases of water being transferred indirectly between storm and sanitary systems through leaky joints or other defects in the pipes. Additional potential sources of surface inflow were a few identified low-lying manholes.

As is very typical of systems throughout the Bay Area, the majority of the identified leaks were in service laterals and defective cleanouts on private property. However, only an estimated five percent or less of the private laterals were found to have such leaks or defects.

**Table 3** summarizes the smoke testing results by area.

**Table 3: Summary of Smoke Testing Results by Area**

Leak Type	Number of Leaks					Total
	Pedro Point	Lower Linda Mar	Middle Linda Mar	Upper Linda Mar	Fairway Park	
Private						
Cleanout cap defective	2	8	13	0	12	35
Cleanout cap missing	6	7	8	0	5	26
Drain tile/yard drain	1	1	2	0	0	4
Roof leader	3	1	2	1	0	7
Service connection	13	68	55	43	21	200
Source unknown	7	5	8	2	0	22
Smoke in building	11	6	7	2	8	34
Public						
Catch basin	0	0	1	1	0	2
Manhole cover	9	1	5	1	0	16
Sewer main	1	1	1	0	0	3
<b>Total</b>	<b>53</b>	<b>98</b>	<b>102</b>	<b>50</b>	<b>46</b>	<b>349</b>
Estimated percentage of laterals with observed leaks	3%	5%	6%	3%	8%	<b>4%</b>
Estimated percentage of laterals with missing or defective cleanout caps	2%	1%	2%	0%	6%	<b>1%</b>



Note that the areas with the highest percentage of leaks in service laterals (Fairway Park and the lower and middle portions of Linda Mar) are those areas where the upper laterals are predominantly constructed of Orangeburg pipe. However, the number of observed leaks in laterals is still a very small percentage of the total number of laterals, indicating that smoke testing is not an effective method of identifying most defective laterals, as the smoke may not be able to reach the ground surface due to localized groundwater, saturated soil, or impermeable surface material.

## 5 Planned Follow-up Actions

Based on the results of the smoke testing, the City intends to take the following actions to further verify the identified potential sources of I/I and address other identified issues:

- Verify identified potential defective or missing cleanout caps, yard drains, and roof leaders by field visits and additional photo documentation if necessary.
- CCTV inspect laterals with recorded leaks identified through the smoke testing (including laterals on properties with leaks identified as “source unknown”).
- Inspect manholes identified as potential manhole cover leaks.
- CCTV inspect or review existing CCTV inspection records for sewer mains identified as potential leaks.
- Verify potential sanitary sewer/storm drain cross-connections (catch basin leaks) via dye testing and/or CCTV inspection as appropriate.
- CCTV inspect sewers in which the field crews indicated that smoke could not get through the line to determine if there are obstructions or surcharged pipes that prevented the smoke from traveling, and to confirm the connection points of laterals from adjacent properties. If necessary, dye testing could be employed to confirm the connection point of laterals for properties that did not show smoke from the building vents.
- Locate (and uncover if necessary) manholes that the smoke testing field crew could not locate or appeared to be buried, or make corrections to system maps if the manholes do not exist.

Based on the results of the above verification activities, the City will take the following actions:

- Notify property owners with illegal drain or roof leader connections that such connections are in violation of the City’s wastewater ordinance (Title 6, Chapter 13, Article 6 of the Municipal Code) and must be disconnected.
- Notify property owners with defective sewer laterals or cleanout caps that they must be repaired or replaced to meet the standards for maintenance of sewer laterals as set forth in the City’s ordinance.
- Seal and/or raise manholes subject to potential surface inflow through the manhole cover.
- Identify repair, rehabilitation, or replacement needed for any sewer mains or lower laterals for which the City is responsible, and issue a repair work order or schedule the work in the City’s sewer rehabilitation Capital Improvement Program as appropriate.

The City will track follow-up activities related to each identified smoke testing incident in a MS Excel spreadsheet or MS Access database maintained by the City’s Wastewater Division. The database will include the following information:

- Smoke testing date, location, and leak type information (from the smoke testing database).

- Date and results of follow-up verification activities.
- Name and contact information of property owner (if private property source).
- Date when property owner (if private inflow source or defective lateral) was notified of violation.
- Date and confirmation (e.g., reference to building permit signoff, official form signed by property owner and/or his/her contractor, City repair work order, etc.) that correction has been verified to be complete.
- Follow-up enforcement action taken if correction is not completed.

## 6 Conclusions

Smoke testing was conducted in the areas of Pacifica with the highest wet weather peaking factors; however, only a handful of direct inflow sources (e.g., yard and roof drains, low-lying manholes) were found. Only about 1 percent of the laterals were found to have defective or missing cleanout caps, and only about 4 percent of service laterals were identified as defective through the smoke testing. It may be that smoke testing is not as effective a method for I/I source detection in Pacifica because the high I/I areas are also low-lying and the soil is too saturated to easily allow the passage of the smoke. Based on these results, the City does not plan to conduct any further smoke testing in the system, but will rely on more effective methods such as CCTV inspection of sewer mains and laterals, along with visual inspection of cleanouts and potential low-lying manholes, to identify and prioritize potential I/I sources for repair and rehabilitation.

**Attachment A**  
**Smoke Testing Specifications**

## SPECIAL PROVISIONS

### **PART 1 - GENERAL**

#### **1.01 Scope of Work**

- A. It is the intent of this specification to provide for the smoke testing materials and procedures to be used in the investigation of the sanitary sewer facilities within the areas identified through the City's on-going Collection System Master Plan as having the highest peak infiltration/inflow ("I/I") rates. The purpose of the smoke testing is to identify potential direct inflow connections to the sanitary sewer system as well as other potential sources of I/I.
- B. All materials and procedures shall be consistent with these specifications, current industry standards, and as approved by the City's Project Manager.
- C. The Consultant shall minimize the need for confined space entry into the sanitary sewer facilities. If required, manhole entry shall be performed in accordance to CALOSHA regulations for confined space entry and other regulations that may apply. The Consultant shall provide all safety equipment required for manhole entry operations, including harnesses, ventilation equipment, etc.
- D. The project will include planning the work, coordinating with the City on distribution of notifications to affected properties, performing the smoke testing, making documentary photographs and reports of the smoke testing results, and compiling the smoke testing data in a database format and hard copy reports. The selected firm ("Consultant") will be provided with a GIS file of the sewer system to use in scheduling, tracking, and documenting the work. Since time is of the essence, the project must be completed and all deliverables must be submitted no later than November 30, 2011.
- E. Proposers are encouraged to expand on this scope of work and provide additional detail, as they deem necessary, to clearly describe their proposed approach and provide a complete and quality work product.

#### **1.02 Required Submittals**

- A. Sample Notification Documents. City will reproduce all necessary notifications and will assist Contractor with the distribution.
- B. Personnel Qualifications
- C. Method of Smoke Production
- D. Material Safety Data Sheet for the smoke products
- E. Testing and Work Schedule
- F. Traffic Control Plan

- G. Deliverables per Part 4 – Deliverables of these specifications.

**1.03 Personnel Qualifications**

- A. The Consultant's employees performing the smoke testing under these provisions shall be properly trained and thoroughly experienced in the use of the equipment and procedures. The supervisor shall have at least two years of previous testing experience obtained in the last four years prior to the closing date of this RFP. As a minimum, crew members shall have at least five (5) days of verifiable, previous testing experience. The five (5) days of experience shall have been acquired within a minimum of six (6) months prior to the date of award of this contract, unless specifically waived by the Project Manager.
- B. A list of employees with statements of qualifications shall be provided to the Project Manager to keep on file at the Calera Creek Water Recycling Plant. The information provided shall include the name and a copy of the driver's license of each individual.
- C. Each employee shall be provided with a photo ID identifying him by name, the name and contact information for the company. All job supervisors will have cards with contact information for the supervisor and company to provide to residents and occupants if requested.
- D. The Consultant shall require all personnel to demonstrate good judgement, in performing the testing.
- E. The Consultant shall take appropriate action to ensure that his employees are polite to the public in all aspects of the work and that immediate assistance is provided to property owners if needed.

**PART 2 – PRODUCTS AND EQUIPMENT**

**2.01 Blowers**

- A. The Consultant shall provide a portable blower designed and built specifically for the use of smoke testing. The blower shall be self-contained and powered by a minimum three (3) horsepower (HP) gasoline engine and be capable of producing a minimum 2000 cubic feet of air per minute (cfm), when working as a blow-in ventilator and 4000 cfm when working as a suction ventilator.
- B. The blower shall be of sufficient size to provide an adequate volume of smoke within the pipe segments being tested to allow for identification of all potential I/I sources connected to the pipe segment, including roof downspouts, area drains, and defective laterals and cleanouts on private property.

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- C. The base of the blower shall have appropriate adapters and seals to make a good connection to the manhole without excessive loss of air and smoke.

**2.02 Smoke Production**

- A. Smoke bombs shall produce a chemical reaction generating white to gray smoke, leaving no residue, and shall be non-toxic and non-explosive. Each bomb shall be capable of producing adequate volume of smoke when used alone or in combination with a number of bombs for the duration of the test.
- B. Smoke fluid shall produce smoke when exposed to the heat of the exhaust system of the motor for the blower. The smoke generated shall be white to gray smoke, leaving no residue, and shall be non-toxic and non-explosive.

**2.03 Other Equipment**

In addition to the blower, the Consultant shall provide all other equipment, tools, and incidentals required to perform smoke testing as required by these specifications and as directed by the Project Manager including but not limited to sewer line stoppers, sand bags, cameras, confined space entry equipment, and etc.

**PART 3 – EXECUTION**

**3.01 Work Progress** – Reproduction of Notification letters, flyers and/or door hangers will be the City's responsibility. The work shall generally be performed as follows:

- A. Pre-notifications – With the first notification, the Consultant shall assist City in notifying all affected occupants in the area that smoke testing will be performed within the next two (2) week period. This notification will be by using printed flyer (to be supplied by City) hung on each door of affected occupants and a press release to be issued by City in concert with the door hanging posting. The flyer and press release notice shall include:
  - 1. Contact numbers for the Consultant and the City's Project Manager if residents want additional information. (All persons who will be in contact with the public should be well versed in the smoke testing procedures, work schedule and content of all public notices). All local and toll free phone numbers on all contact information shall be provided.
  - 2. Warnings to the occupants that individuals with respiratory, heart problems, or others who should never be exposed to smoke, should be removed from the premises prior to the tests. Others, such as a house confined invalids, sleeping shift workers and locked in animals should be identified and evacuated before the test. The notice should also

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request that properties with these individuals be requested to be registered as "Persons of Concern."

- B. Regulatory Notifications – The Consultant shall notify the Police Department and Fire Department, and the County Department of Environment Health, just prior to distributing the flyers, supplied by City.
- C. Daily Notifications – In the Area of Daily Testing, the Consultant shall notify:
  - 1. The Consultant shall provide notification of work locations on a daily basis to the police and fire departments, and other specific officials (e.g. schools, etc.) via telephone, fax or email, as specified in the smoke testing plan.
  - 2. The Consultant shall assist City to notify, by hand delivery of a notification letter, doorknob hangtags or other acceptable methods to each address, all residences and businesses in the area to be tested 48 hours in advance of the testing. All notification letters or hangtags shall be bilingual in Spanish and English. All notifications reproductions will be the City's responsibility.
  - 3. The day of the testing, the Consultant shall check with all "Persons of Concern" to be sure that all persons that may be sensitive to smoke will be out of the property prior to testing.
- D. It shall be the Consultant's responsibility to coordinate with City to ensure that notices are distributed in accordance with the required smoke testing schedule.
- E. Performing the Testing:
  - 1. All testing will be performed with the approved testing plan and work schedule and any deviations will be reported to the Project Manager.
- F. Reporting the Data:
  - 1. All reporting shall be done on the approved forms.

**3.02 Testing Plan and Work Schedule**

- A. Upon award of the Contract and prior to commencing any work, the Consultant shall provide a complete Smoke Testing Plan and Work Schedule to the Project Manager for review and approval.
- B. Smoke Testing Plan shall indicate anticipated locations (by street name and cross streets and manhole IDs). The plan shall include a contact list of City and other relevant public officials (e.g. fire department, police, schools, etc.). The plan shall also describe the proposed equipment to be used, field

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procedures to be followed, and format of the forms and databases used for documenting results.

- C. The Work Schedule shall be typed and shall indicate the planned progress for the proposed work. The daily work hours will not be before 9:00 AM and no later than 5:00 PM on low traffic volume streets, and after 9:00 AM and before 4:00 PM on busy streets.
- D. The Work Schedule shall indicate the following:
  - 1. Street Name (when in easements – the names of the abutting streets)
  - 2. Street Limits (cross streets or property addresses)
  - 3. Upstream and Downstream Manhole Ids (from Project Maps)
  - 4. Date of Testing
  - 5. Starting Time
  - 6. Ending Time
- E. Acceptable Periods of Work
  - 1. The Consultant shall not commence testing before 9:00 AM and shall terminate testing no later than 5:00 PM each day except as noted above.
  - 2. If the Consultant wishes to test before 9:00 AM or after 5:00 PM, such testing shall be shown on the submitted Work Schedule and is subject to the above noted times and with the approval of the Project Manager.
  - 3. Work times in Commercial areas shall be scheduled to be prior to the opening of the majority of the businesses in that area.
  - 4. Smoke testing shall not be performed on weekends or on holidays without the prior approval of the Project Manager.
- F. Consultant shall not perform smoke testing on days that, in the opinion of the Project Manager, will hinder the results of the test. (For example, when high winds, heavy rains, or excessively high groundwater levels would interfere with the effectiveness of the testing).

**3.03 Traffic Control Plan**

- A. The Contractor shall be responsible for proper traffic control to assure work site safety.
- B. Traffic control to be performed in accordance with the Manual of Uniform Traffic Control Devices. The City can require additional traffic control measures as needed to provide for public safety.
- C. The Contractor shall submit a traffic control plan to the Project Engineer for review prior to commencement of work.



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- D. On residential local streets, the contractor shall be responsible to provide all required traffic control when work is being done in the right of way.
- E. All existing streets with a greater classification than a residential local street shall require a traffic control plan prepared by a professional engineer.
- F. No street or sidewalk closure shall be allowed without prior approval of the City staff.
- G. Continuous safe public access shall be maintained to residential, retail and commercial structures at all times.

**3.04 Performing the Testing**

A. Procedure

1. Safety

- a) The Consultant and his personnel shall be aware of and shall follow all Federal, State, and Local Safety laws and regulations.
- b) No entry into any part of the collection system shall be permitted until the Consultant has demonstrated that on-site personnel has been trained in applicable safety procedures and process a confined space certification and has the equipment on-site to allow those procedures to be followed.
- c) Prior to starting work the Consultant will submit traffic control plans for approval showing typical traffic control setups to be used for the various traffic conditions to be encountered. The area of work shall at all times be protected by means of an adequate number of cones, barricades, flags, or whatever means is necessary to properly and safely protect both vehicular and pedestrian traffic. Flag men shall be provided where designated in the traffic control plan.
- d) Any condition deemed to be an unsafe condition shall be immediately corrected by the Consultant. The failure of the Project Manager or his representatives to bring a potentially dangerous situation to the Consultants attention shall not relieve the Consultant from his responsibility for providing a safe work area.

2. Unless otherwise approved by the Project Manager, the sections of sewer subject to testing shall:

- a) Consist of a central manhole, where the blower will be positioned, and an upstream and downstream manhole and the

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- sewer pipe between them. With three (3) manholes and two pipe sections, lengths should not exceed 800 feet.
  - b) Consist of sections two (2) manholes and one pipe section. This allows a run of 400 feet to 800 feet of pipe.
  - c) Each blower setup shall be designated with a unique setup ID number, manhole ID, and the associated pipe segments used.
- 3. It is the intent of this specification that the smoke testing be accomplished without the need for bypass pumping. The Consultant shall provide temporary plugs, sandbags, or flow barriers as required to contain an adequate volume of smoke within the section of sewer being tested, or to limit the extent of sewer subjected to pressurized smoke. The Consultant shall monitor the resulting surcharged sewer at the manhole upstream of the section of sewer being tested, and prevent overflow conditions from occurring by removing the flow barriers.
- 4. Prior to placing any smoke into a manhole, the Consultant shall first evacuate the system with a blower to ensure that any collection of explosive gas and any odor that may be introduced into the adjacent properties have been dispersed prior to pressurizing the sewer with smoke. Removing the manhole covers of all manholes in the run, then placing a vacuum on the manhole where the blower is located, or, then blowing air into the manhole may accomplish evacuation.
- 5. All smoke observations ("smoke returns") shall be documented with digital photographs and accurately and neatly recorded on field forms. The forms shall document the type of defect or potential I/I source. For each sewer line segment test, the Consultant shall prepare a field log identifying each point of smoke ex-filtration from:
  - a) Roof gutters
  - b) Sewer cleanouts
  - c) Leakage in house laterals
  - d) Patio or area drains
  - e) Storm drain cross connections
  - f) Any other source not stated above
  - g) Indicate if roof vents showed evidence of smoke or not.
- 6. The points of ex-filtration, as identified above, shall be referenced and dimensioned to permanent landmarks or house or lot numbers.
- 7. The forms shall also document the following:
  - a) Type of surface cover (e.g. grass, pavement, etc)
  - b) Intensity of the smoke return (light, moderate, heavy)
  - c) Estimated defect drainage area
  - d) Location information (e.g. property address) associated with the defect.

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- e) Identify the setup ID and the pipe reach to which the I/I source is like connected (by upstream/downstream manhole ID).
  - f) Each smoke return shall be designated with a unique defect ID number.
8. A photograph of all leaks using a digital camera or approved substitute shall be included in the field log. All photographs shall be clearly cross-referenced to the typed and/or computer generated log indicating the location of the leak.

**PART 4 - DELIVERABLES**

**4.01 General**

- A. Consultant shall provide two complete sets of deliverables, as listed below:
  - 1. Log of smoke test setups with associated information as noted in these specifications.
  - 2. Field forms and associated photographs of all observed smoke returns, with associated information as noted in these specifications.
  - 3. Database of all smoke test results, including all associated information as noted in these specifications, with links to or filename of associated digital photographs.
- B. All deliverables shall be provided in both hard copy and digital format (on CD, DVD, or portable hard drive). Database information shall be in MS Excel or MS Access format. Field forms can be scanned images (if originals are clear and neat) or computer generated from the database.
- C. Consultant shall provide sufficient quality control/quality assurance to ensure that deliverables provided are accurate and complete.

**PART 5 - PAYMENT AND BID SUMMATION**

**5.01 Payment**

Smoke Testing satisfactorily done, complete in place as indicated in these specifications, including all work, labor, materials, equipment, tools and incidentals necessary to complete the work shall be paid for at the unit price per linear feet as indicated in the Bid Summation

REQUEST FOR PROPOSALS

Project Title: CITY OF PACIFICA WASTEWATER COLLECTION SYSTEM SMOKE TESTING FY 2011-2012  
(RFP NO. 11P-03WWTP)

**5.02 Bid Summation**

BID ITEM NO.	ITEM DESCRIPTION	QUAN TITY	UNIT	UNIT PRICE	EXTENSION
<b>PEDRO POINT</b>					
1.	≤ 8-INCH PIPE	16,300	LF		
2.	10-INCH TO 15-INCH PIPE	500	LF		
<u>SUBTOTAL</u>					
<b>LOWER LINDA MAR</b>					
3.	≤ 8-INCH PIPE	76,800	LF		
4.	10-INCH TO 15-INCH PIPE	12,200	LF		
5.	≥ 18-INCH PIPE	5,500	LF		
<u>SUBTOTAL</u>					
<b>UPPER LINDA MAR</b>					
6.	≤ 8-INCH PIPE	47,700	LF		
7.	10-INCH TO 15-INCH PIPE	12,700	LF		
8.	≥ 18-INCH PIPE	700	LF		
<u>SUBTOTAL</u>					
<b>FAIRWAY PARK</b>					
9.	≤ 8-INCH PIPE	10,200	LF		
<u>SUBTOTAL</u>					
<u>GRAND TOTAL</u>					

**Attachment B**  
**Example Smoke Test Incident Report**

**U11-160 Pacifica, CA Smoke Testing**  
**Smoke Test Incidents**



**Basin:** Lower Linda Mar      **Run:** 73

**Incident:** 65

**Incident Location:** 860 CRESPI DR

**Lat:** 37.59356 **Long:** 122.49381

**Upstream Manhole:** LLD21      **Lat:** 37.59368° **Long:** 122.49352°

**Downstream Manhole:** LLD22      **Lat:** 37.59353° **Long:** 122.49412°

**Result:** Positive      **Leak Source:** Service Connection

**Leak Type:** CCM

**Leak Size:** C

**Leak Surface Cover:** T



U11-160 LOWER LINDA MAR R73 I65

**Observations:** SMOKE EMITTING FROM UNCAPPED CLEANOUT TO RIGHT OF WALKWAY. 5' X 8'.

**Comments:**

**Basin:** Lower Linda Mar      **Run:** 74

**Incident:** 66

**Incident Location:** 828 CRESPI DR

**Lat:** 37.59316 **Long:** 122.49477

**Upstream Manhole:** UNK09      **Lat:** 37.59353° **Long:** 122.49427°

**Downstream Manhole:** LLD23      **Lat:** 37.59529° **Long:** 122.49503°

**Result:** Positive      **Leak Source:** Service Connection

**Leak Type:** SC

**Leak Size:** B

**Leak Surface Cover:** T



U11-160 LOWER LINDA MAR R74 I66

**Observations:** SMOKE EMITTING FROM GRASS TO LEFT OF DRIVEWAY INDICATING A LEAK IN SERVICE CONNECTION.

**Comments:**