



Audit of Fire Hydrant Inspection, Flow-Testing, and Maintenance Process

September 15, 2020

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Executive Summary

Objective and Scope

The objectives of this audit were to evaluate the processes the Department of Dallas Fire-Rescue uses to:

- Ensure City-owned (public) fire hydrants are inspected annually.
- Monitor and maintain private fire hydrants according to standards/industry best practices.

The scope of the audit was fire hydrant program operations in Fiscal Years 2018 and 2019.

What We Recommend

We recommend Dallas Fire-Rescue:

- Comply with standard operating procedures.
- Collect permit fees and assess compliance.
- Review accuracy of data in the Internal Document System.

Background

The City of Dallas is responsible for ensuring each of its more than 30,000 public fire hydrants are ready to provide water during a fire emergency. Dallas Fire-Rescue performs the annual inspection, flow-testing and maintenance of public fire hydrants. Dallas Water Utilities owns the public fire hydrants and is responsible for repairing leaking, damaged, and out-of-service public fire hydrants.

For about 400 private fire hydrants, Dallas Fire-Rescue is responsible for renewing permits, collecting permit fees, and verifying private fire hydrant owners are compliant with national fire and water standards.

Dallas Fire-Rescue inspected and maintained about 98 percent of all public fire hydrants consistently for the past two fiscal years. The City of Dallas received a higher ranking, when compared to the other larger Texas cities, from the Texas Department of Insurance's Public Protection Classification system.

What We Found

Dallas Fire-Rescue needed additional improvement in the following areas:

- Public fire hydrants: accurate counts, inspections, monitoring repair status, flow-testing, and documentation.
- Private fire hydrants: accurate counts, verifying compliance, and collection of revenues.
- Internal Document System: invalid access, limited data input and classification control.

Audit Results

As required by *City Council Resolution 88-3428*, departments will establish internal controls in accordance with the standards established by the Comptroller General of the United States pursuant to the *Federal Managers' Financial Integrity Act of 1982*. Administrative Directive 4-09, *Internal Control* prescribes the policy for the City of Dallas to establish and maintain an internal control system. The audit observations listed are offered to assist management in fulfilling their internal control responsibilities.

Observation A: Public Fire Hydrants

An evaluation of the Dallas Fire-Rescue public fire hydrant program's ongoing inspection and maintenance activities identified weaknesses including:

- (1) Having an inaccurate count of public fire hydrants.
- (2) Not inspecting approximately two percent of the public fire hydrants.
- (3) Inadequate monitoring of public fire hydrant repair status.
- (4) Incomplete flow-testing procedures.
- (5) Not documenting spot checks of inspections.

Noncompliance with public fire hydrant program's ongoing inspection and maintenance activities that identify, inspect, and monitor repair status of fire hydrants increases public safety risk that public fire hydrants may not work during emergencies.

Fire Hydrant Count

The Dallas Fire-Rescue Internal Document System, which tracks the inventory of all public fire hydrants, is inaccurate. The Internal Document System has 277 (almost one percent) fewer public fire hydrants than it should have compared to the official system of record. The official system of record is the Geographic Information System maintained by Dallas Water Utilities (See [Exhibit 1](#) below). Currently, there is not a review process to compare the two populations for accuracy.

Exhibit 1:

Number of Hydrants by Application

Department	Application	Count
Dallas Fire-Rescue	Internal Document System	30,430
Dallas Water Utilities	Geographic Information System	30,707

Sources: Dallas Fire-Rescue Information Document System; Dallas Water Utilities Geographic Information System.

Annual Inspections

Dallas Fire-Rescue did not inspect approximately two percent of the City's 30,430 public fire hydrants. Further analysis indicated that the Internal Document System counted new public fire hydrants added after the fiscal year as not inspected hydrants. The data issue inadvertently increased the number of hydrants that were not inspected for the audit scope. Dallas Fire-Rescue has a goal of inspecting 100 percent of all public fire hydrants annually. [Exhibit 2](#) shows the number of hydrants in use and inspected.

Exhibit 2:

Number of Hydrants Inspected

Fiscal Year	Hydrants In Use	Inspected	Percent Inspected
2018	30,430	29,935	98.4
2019	30,430	29,687	97.6

Source: Dallas Fire-Rescue Information Document System, January 15, 2020

Timely Repairs

Dallas Fire-Rescue does not monitor the status of public fire hydrants that are to be repaired by Dallas Water Utilities. A sample of 14 public fire hydrants pending repair in January 2020 showed that all 14 had not been repaired in the ten-business-day timeline established in Dallas Water Utilities procedures. Specifically, Dallas Fire-Rescue's Internal Document System data demonstrated that public fire hydrants repair requests were:

- Open and could last for months at a time without resolution or follow-up.
- Identified as needing repairs, when they only needed a data correction.
- Listed in the out-of-service report even after Dallas Water Utilities completed repairs and identified as 'OK' status

Flow-Testing

Dallas Fire-Rescue did not flow-test for at least one minute or use the static pressure gauge when flow-testing public fire hydrants as required by National Fire Protection Association standards. Dallas Fire-Rescue personnel can determine adequacy of flow rate by sight in a matter of seconds; however, use of static pressure gauge and following National Fire Protection Association standards provides additional comfort and certainty to fire hydrant operability. Refer to [Exhibit 3](#) on page 4 for how flow-testing is performed.

Exhibit 3:

Hydrant Flow-Testing



Photo Source: Office of the City Auditor

Battalion Chief Spot Checks

Battalion Chiefs are not documenting that the spot checks for ten percent of the public fire hydrants maintained in the previous month are performed. The standard operating procedure requires the Battalion Chiefs document their compliance and send results to the Deputy Chief and Fire Hydrant Maintenance Coordinator. There is currently not a method to record the spot checks in the Internal Document System.

Criteria

- ❖ Dallas Fire-Rescue Standard Operating Procedures 107.00, *Fire Hydrant Preventative Maintenance Program*
- ❖ Dallas Water Utilities Distribution System Procedure, DWU-WKI-072-DIST *Fire Hydrant Response Maintenance and or Replacement*
- ❖ *Memorandum of Understanding*: Dallas Water Utilities and Dallas Fire Rescue
- ❖ National Fire Protection Association 25, *Standard for the Inspection, Testing and Maintenance of Water-based Fire Protection Systems 2020*
- ❖ National Fire Protection Association 291, *Recommended Practice for Fire Flow-Testing and Marking of Hydrants 2019*

- ❖ American Water Works Association Manual of Water Supply Practices M17, *Fire Hydrants: Installation, Field Testing and Maintenance, Fifth Edition*
- ❖ Standards for Internal Control in the Federal Government, *Principle 10 – Design Control Activities; Principle 11 – Design Activities for Information System*

Assessed Risk Rating:

High

We recommend the **Chief of Dallas Fire-Rescue**

A.1: Maintain accuracy of public fire hydrant count by comparing the Dallas Fire-Rescue Internal Document System public fire hydrant list to the Dallas Water Utilities Geographic Information System hydrant list at least annually.

A.2: Assess and update the standard operating procedures as needed so that compliance can be achieved for:

- (1) Inspecting 100 percent of all public fire hydrants annually.
- (2) Monitoring the status of public fire hydrants in need of repair or out of service at least monthly.
- (3) Applying flow-test procedures using correct equipment.
- (4) Clarifying documentation procedures for Battalion Chief spot checks.

Observation B: Private Fire Hydrants

An evaluation of the Dallas Fire-Rescue private fire hydrant operations showed that Dallas Fire-Rescue did not:

- (1) Have a complete count of all private fire hydrants.
- (2) Collect annual permit fees from all private fire hydrant owners.
- (3) Verify that private fire hydrants maintain compliance with the City Code.

As a result, Dallas Fire-Rescue cannot rely on private fire hydrants functioning during emergencies in certain high-risk public areas where private fire hydrants are the primary source for fire suppression. Additionally, Dallas Fire-Rescue is losing revenue from not collecting annual permit fees as required of all private hydrant owners.

Count of Private Hydrants

The City does not have a sustainable process for ensuring a complete count of private fire hydrants. For example, as of this audit, Dallas Fire-Rescue and Dallas Water Utilities had inconsistent counts in the following sources:

- (1) Dallas Fire-Rescue’s Microsoft Excel spreadsheet had 248 private fire hydrants at 55 addresses.
- (2) Internal Document System had 343 private fire hydrants at 70 addresses.
- (3) Geographic Information System had 387 private fire hydrants at 64 addresses.

Permit Revenue

Dallas Fire-Rescue did not renew all private fire hydrant permits. Renewals of permits provides Dallas Fire-Rescue with additional revenue for fire department operations. The current practice is to issue one private fire hydrant and water supply permit and collect one \$350 fee for each address. See [Exhibit 4](#) for a summary of expected permit fee revenues for the audit scope.

Exhibit 4:

Expected Private Fire Hydrant Permits and Fees

Period	Permits Issued	Fees Collected	Expected Permits	Expected Fees	Expected Fees Not Collected
Fiscal Year 2018	34	\$11,900	55 to 70	\$19,250 – \$24,500	\$7,350 - \$12,600
Fiscal Year 2019	32	\$11,200	55 to 70	\$19,250 – \$24,500	\$8,050 - \$13,300
Both Years	66	\$23,100	110 to 140	\$38,500 – \$49,000	\$15,400 – \$25,900

Sources: Dallas Fire-Rescue Internal Document System; Dallas Water Utilities Geographic Information System.

Most private fire hydrant owners have more than one private hydrant at their address. Dallas Fire-Rescue uses additional time and effort to assess compliance; yet, the City receives the \$350 fee regardless the number of hydrants. For instance, three Dallas addresses account for 42 percent of the hydrants, ranging from 36 to 80 hydrants. Because the private fire hydrant fee is set per address, private fire hydrant owners with more hydrants pay much less per hydrant than those with fewer hydrants. See [Exhibit 5](#).

Exhibit 5:

Current Private Fire Hydrant Fee Cost Per Hydrant

Number of Private Fire Hydrants Per Address	Cost Per Private Fire Hydrant
1	\$350.00
2 (Median)	\$175.00
6 (Average)	\$ 58.33
10	\$ 35.00
80 (Maximum)	\$ 4.38

Sources: Dallas Fire-Rescue Internal Document System; Dallas Water Utilities Geographic Information System.

Ongoing Compliance

Dallas Fire-Rescue does not review private fire hydrant inspection documentation to ensure all private fire hydrants are compliant with City and national standards. Per City requirements, private fire hydrant owners are required to conduct annual inspections and maintain documentation prior to approval and renewal of permits. Dallas Fire-Rescue did not retain documentation to show that private fire hydrant inspection results were reviewed. A contributing factor could be that the *Manual of Procedures* used by the Inspection and Life Safety Education Division responsible for permits does not specify review of annual inspection documentation prior to issuing renewals.

Compensating Controls

The Dallas Fire-Rescue emphasized that there are compensating controls to mitigate reliance on private hydrants such as:

- 1,200-foot hoses on fire trucks that can extend to the nearest public fire hydrant, if fire emergency is on private grounds. The length of the fire hose is above the standard requirements.
- A tender truck that can provide an additional 2,000 gallons to the fire emergency immediately.
- Additional fire trucks equipped with hoses and water to assist in the fire emergency.

- City's water pipeline infrastructure which can redirect or increase water supply to the fire emergency area.

Auditors did not test these compensating controls to verify operability as these situations were not present during the course of the audit.

Criteria

- ❖ Dallas Fire Code, *Ordinance 30135, Section 1, 105.6.37 Private Fire Hydrants and Water Supplies and 105.8 Fees and Permit Schedule*
- ❖ National Fire Protection Association Manual 25, *Standard for Inspection, Testing and Maintenance of Water-based Fire Protection Systems 2020*
- ❖ Standards for Internal Control in the Federal Government, *Principle 6 – Define Objectives and Risk Tolerance; Principle 10 – Design Control Activities*

Assessed Risk Rating:

Moderate

We recommend the **Chief of Dallas Fire-Rescue**:

- B.1:** Develop a complete inventory of all private fire hydrant as part of the annual inspection process.
- B.2:** Collect renewal fees for private fire hydrants.
- B.3:** Evaluate the option to increase revenue collection by collecting fees reflecting the number of private hydrants per address, which may include using a tiered fee structure.
- B.4:** Review and retain evidence of compliance verification as part of the annual permitting process.

Observation C: System Controls

The Dallas Fire-Rescue Internal Document System access and data input controls are not maximized. This increases the risk that information collected in the Internal Document System may be modified without authorization or data input is inaccurate. Specifically,

- All City employees, including those without a valid business purpose, have access to modify fire hydrant information in the Internal Document System.
- Certain data input controls are not active such as date check and duplicate entry.
- Data classification is not complete. The fire hydrant information does not include certain details such as new installation.

Criteria

- ❖ Standards for Internal Control in the Federal Government, *Principle 11 – Design Activities for the Information System*

Assessed Risk Rating:

Low

We recommend the **Chief of Dallas Fire-Rescue:**

- C.1:** Ensure access to Dallas Fire-Rescue Internal Document System fire hydrant database is granted with prior approval to personnel with a valid business purpose.
- C.2:** Evaluate whether data input and data classification controls can be maximized to ensure accuracy of data.

Appendix A: Background and Methodology

Background

Fire hydrants provide firefighters the water they need to put out fires in emergencies. The City of Dallas owns more than 30,000 public fire hydrants throughout the City. National Fire Protection Association and American Water Works Association establish that fire hydrant owners must perform ongoing inspection, flow-testing, and maintenance to ensure fire hydrants work when they are needed.

Dallas Fire-Rescue and Dallas Water Utilities collaborate on the fire hydrant program to meet public safety goals. The collaboration offers an operational advantage to Dallas Fire-Rescue because completing annual maintenance requires Dallas Fire-Rescue to be aware of fire hydrant locations, viability, and potential functional mishaps of fire hydrants in their area, which reduces response time.

Dallas Fire-Rescue

Dallas Fire-Rescue’s mission includes preventing and suppressing fires and promoting public safety. The Emergency Response Bureau and Special Operations within Dallas Fire-Rescue assists in fire suppression and protection activities. Dallas Fire-Rescue station/company officers perform annual maintenance of the public fire hydrants to assist Dallas Water Utilities in preventive maintenance of public fire hydrants. Preventive maintenance includes verifying the public fire hydrant address, that it is facing the correct direction, that it can flow and drain properly, and that it does not leak. Maintenance also includes lubricating the operating nut, painting the hydrant, verifying or installing a reflective collar, replacing any caps or gaskets, and clearing away any vegetation.

Dallas Water Utilities

Dallas Water Utilities owns the water system infrastructure, including all public fire hydrants. The Water Delivery division is responsible for all activities related to water distribution, including public fire hydrants. The Water Delivery division performs activities related to new public fire hydrant installation, flow-testing, continued maintenance and repairs, and procurement of materials for existing public fire hydrants. [Exhibit 6](#) (on page 11) describes and roles and responsibilities for public fire hydrant preventive maintenance and inspections activities.

Exhibit 6:

Memorandum of Understanding: Roles and Responsibilities

Dallas Fire-Rescue	Dallas Water Utilities
Public fire hydrant assessment (inspection) including flow-testing.	Timely maintenance and repairs for identified public fire hydrants.
Preventative maintenance.	Maintaining an accurate record of all public fire hydrants.

Dallas Fire-Rescue	Dallas Water Utilities
Reporting to Dallas Water Utilities on public fire hydrant repairs and maintenance requests.	Flow-testing of public fire hydrants following installation or repairs.

Source: Memorandum of Understanding between Dallas Fire-Rescue and Dallas Water Utilities, May 2017

Private Fire Hydrants

The City of Dallas has traditionally discouraged private fire hydrants. As such, the City of Dallas has a small number — about 400 — private fire hydrants that are active. Private fire hydrant owners are responsible for ongoing inspection, maintenance, and flow-testing of the fire hydrants. The Dallas Fire Code requires that private fire hydrant owners pay an annual permit fee of \$350 fee which includes a verification that the private owner has performed maintenance activities testing in accordance with national standards. The Dallas Fire-Rescue’s Inspection, and Life Safety Education Division performs this verification prior to issuing a renewal permit. For all new private fire hydrant installations, Dallas Fire-Rescue is involved to ensure that the installation meets both national fire and water standards.

Public Protection Classification Ratings of Cities

The Texas Department of Insurance uses a national classification system called the Public Protection Classification ratings to assess each community’s local fire protection, which is used to help set property insurance rates. The rating awards up to 106.5 points in four categories, including emergency communications, fire department, water supply, and divergence. The water supply category includes a rating for fire hydrants. In comparison to four of the six largest cities in Texas, Dallas had the highest rating of the cities rated under the current scale (the higher the rating, the better).

- Dallas – 102.19
- Austin – 94.66
- San Antonio – 94.62
- Fort Worth – 92.65

Methodology

To achieve the objective, the following steps were performed:

- (1) Interviewed personnel for Dallas Fire-Rescue, Dallas Water Utilities, and Information & Technology Services.
- (2) Conducted site observations of fire hydrant maintenance and repair processes.
- (3) Reviewed policies and procedures and other industry best practices.
- (4) Performed various analyses and reviewed documents as needed to support conclusions.
- (5) Assessed program operations to consider fraud, waste, and abuse.
- (6) Evaluated information systems' internal controls, including an assessment of the reliability of the data.

This performance audit was conducted in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based upon our audit objective. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objective.

Major Contributors to the Report

Yzalida Hiley, MBA – Auditor

Daniel Genz, CIA – In-Charge Auditor

Mamatha Sparks, CIA, CISA, CRISC – Audit Manager

Appendix B: Management's Response

Memorandum



DATE: September 4, 2020
TO: Mark S. Swann, City Auditor
SUBJECT: Response to Audit of Fire Hydrant Inspection, Flow-Testing, and Maintenance Process

This letter acknowledges the City Manager's Office received the *Audit of Fire Hydrant Inspection, Flow-Testing, and Maintenance Process* and submitted responses to the recommendations in consultation with Dallas Fire-Rescue.

We are pleased the audit concluded Dallas Fire-Rescue has consistently inspected approximately 98 percent of the City's more than 30,000 public fire hydrants. Further, the City has a highly accurate count of public fire hydrants, capturing over 99 percent of the fire hydrants listed in the official system of record. In addition, we are pleased that the Texas Department of Insurance rates Dallas as having superior local fire protection to most comparable Texas cities.

However, Dallas Fire-Rescue agrees to continue strengthening the fire hydrant inspection process by:

- Periodically comparing Dallas Fire-Rescue's count of public fire hydrants to the system of record,
- Updating Dallas Fire-Rescue's Standards Operating Procedures, as needed, to ensure compliance,
- Strengthening controls over private fire hydrant inspections and renewal fees, and
- Enhancing access and data input controls over Dallas Fire-Rescue's fire hydrant database.

Sincerely,

A handwritten signature in blue ink, appearing to be "T.C. Broadnax", written over a large, stylized blue scribble.

T.C. Broadnax
City Manager

"Our Product is Service"
Empathy | Ethics | Excellence | Equity

Assessed Risk Rating	Recommendation	Concurrence and Action Plan	Implementation Date	Follow-Up/ Maturity Date	
High	We recommend the Chief of Dallas Fire-Rescue:				
	<p>A.1: Maintain accuracy of fire hydrant count by comparing the Dallas Fire-Rescue Internal Document System fire hydrant list to the Dallas Water Utilities Geographic Information System hydrant list at least annually.</p>	<p>Agree:</p>	<p>Dallas Fire-Rescue will maintain the accuracy of fire hydrant counts by comparing the DFR IDS fire hydrant list to DWU's GIS hydrant list annually. All discrepancies will be documented and corrected in IDS or forwarded to DWU for resolution.</p>	12/31/2021	12/31/2022
High	<p>A.2: Assess and update the standard operating procedures as needed so that compliance can be achieved for:</p> <ul style="list-style-type: none"> (1) Inspecting 100 percent of all public fire hydrants annually. (2) Monitoring the status of public fire hydrants in need of repair or out of service at least monthly. (3) Applying flow-test procedures using correct equipment. (4) Clarifying documentation procedures for Battalion Chief spot checks. 	<p>Agree:</p>	<p>Dallas Fire-Rescue will assess and update the standard operating procedures so that compliance can be achieved for:</p> <ul style="list-style-type: none"> (1) Propose changing the inspection of public fire hydrants to 98 percent in a calendar year, so that DFR can meet a manageable goal. (2) DFR will monitor the status of public fire hydrants in need of repair or out of service at least monthly. A List will be generated from the DFR IDS. (3) DFR will update the IDS Hydrant Page to include a Battalion Chief Checkoff Page. <p>For bullet number 3, DFR will accept the risk due to the expense of additional equipment for 58 engine companies.</p>	3/31/2021	9/30/2021
	Moderate	We recommend the Chief of Dallas Fire Rescue:			
	<p>B.1: Develop a complete inventory of all private fire hydrant as part of the annual inspection process.</p>	<p>Agree:</p>	<p>DFR will reconcile data from various sources to ensure that a complete inventory of all private fire hydrants is maintained on the DFR IDS.</p>	3/31/2021	9/30/2021

Assessed Risk Rating	Recommendation	Concurrence and Action Plan	Implementation Date	Follow-Up/ Maturity Date
	B.2: Collect renewal fees for private fire hydrants.	Agree: Dallas Fire-Rescue will ensure the private hydrants are functioning as designed and will invoice the permit fees for the private hydrants as part of the overall inspection process for a given facility.	3/31/2021	9/30/2021
	B.3: Evaluate the option to increase revenue collection by collecting fees reflecting the number of private hydrants per address, which may include using a tiered fee structure.	Agree: Dallas Fire-Rescue is currently evaluating the impact of a per hydrant fee approach as well as a tiered fee approach by evaluating current private hydrant systems in place in the City and collecting data from comparatively sized fire departments in the State of Texas.	3/31/2021	9/30/2021
	B.4: Review and retain evidence of compliance verification as part of the annual permitting process.	Agree: Records of performance testing will be required upon inspection of a facility with private hydrants and will be uploaded into the Streamline software data system for reference with the issued permit.	3/31/2021	9/30/2021
Low	We recommend the Chief of Dallas Fire Rescue:			
	C.1: Ensure access to Dallas Fire-Rescue Internal Document System fire hydrant database is granted with prior approval to personnel with a valid business purpose.	Agree: Dallas Fire-Rescue will add a password protected entry screen before an employee can access the IDS Hydrant Page. Only DFR personnel will be able to access hydrant data.	3/31/2021	9/30/2021
	C.2: Evaluate whether data input and data classification controls can be maximized to ensure accuracy of data.	Agree: Dallas Fire-Rescue will institute a password protected screen as a data input control. DFR will determine the feasibility of adding a "Date Inspected" field to the hydrant record. *DFR will determine the feasibility of adding the installation date to the hydrant record. This will have to be done in conjunction with DWU, as their records may be incomplete as some hydrants were installed over 30 years ago.	3/31/2021	9/30/2021