Docusign Envelope ID: DB5D0370-09D2-410C-A688-49E7FAB21041

| GUAM WATERWORKS AUTHORITY | STANDARD OPERATING PROCEDURE | No. | SOP-1500-WD-002 |
|---|---|---|---|
| | | Effective Date | 2/10/2025 |
| | Fire Hydrant Flushing and Maintenance | Final Approver | Miguel C. Bordallo, P.E.<br>General Manager |
| | | Revision Letter | A |

## 1.0 Purpose

This Standard Operating Procedure (SOP) establishes guidelines for flushing hydrants within the Guam Waterworks Authority's (GWA) water system. It is a fundamental aspect of GWA's preventive maintenance program to maintain water quality and system reliability. This process helps to maintain flow and pressure in the system and remove sediment and stagnant water. It also enables GWA to gather important information about the hydrants and water system, such as flow pressure and flowing gallons. Additionally, GWA inspects the overall condition of the fire hydrants to ensure they function properly and are ready for emergency situations.

## 2.0 Scope

This SOP is applicable to all GWA personnel directly involved in maintaining and operating the water distribution system. It specifically focuses on the routine flushing of both wet and dry barrel fire hydrants and covers procedures for planning and executing hydrant inspection, maintenance, and flushing activities.

## 3.0 Policy

It is the policy of GWA to conduct routine inspections and maintenance of fire hydrants at least annually and after each use; however, flushing may be done periodically to maintain water quality and ensure proper operation and system reliability. This SOP complies with the American National Standards Institute (ANSI)/American Water Works Association (AWWA) C502-14 for dry-barrel fire hydrants and C503-18 for wet-barrel fire hydrants.

## 4.0 Definitions

4.1. **American National Standards Institute (ANSI):** A private, non-profit organization that manages the U.S. voluntary standards and conformity assessment system, overseeing the development of standards for products, services, processes, and systems in the U.S., ensuring compatibility with international standards.

4.2. **American Water Works Association (AWWA):** An international, nonprofit, scientific, and educational society accredited by the ANSI, dedicated to ensuring safe and reliable water. It sets standards and best practices for water quality, treatment, and distribution.

4.3. **Auxiliary Valve:** The valve placed in the line leading between the hydrant and the main; the lateral line.

4.4. **Chlorine Comparator Kit:** A chlorine test kit with DPD reagents for free and total residual analysis, used to measure the chlorine level present in water.

4.5. **Deflector:** An instrument used to reduce or deflect the pressure and force of flowing water from fire hydrants. It is used to protect streets, traffic, and private property from damage resulting from the flow of water from a fire hydrant.

4.6. **Diffuser:** See definition for Deflector.

Docusign Envelope ID: DB5D0370-09D2-410C-A688-49E7FAB21041



4.7. **Dry Barrel Hydrant:** Manufactured in accordance with AWWA Standard C503, and has the main valve located below the ground and a drain valve that allows the barrel section to drain automatically.

4.8. **Flow Meter:** An instrument used to measure the flow rate and the water main capacity from the fire hydrant. It displays the flow rate and pressure via an integral digital display[1].

4.9. **Hydrant Wrench:** A tool used to remove fire hydrant caps and open the valve of the hydrant. Only regulation fire hydrant wrenches approved by GWA shall be used for the operation of fire hydrants[2].

4.10. **N, N-diethyl-p-phenylenediamine (DPD) Method:** A colorimetric method that relies on the reaction between chlorine and DPD reagents, which produces a colored compound. The intensity of the color is directly proportional to the chlorine concentration in the water sample[3].

4.11. **Pitot Gauge:** An instrument used to measure static pressure in fire hydrants. Measures the pressure of flowing water from fire hydrants.

4.12. **Pressure Gauge:** An instrument used for measuring and displaying the pressure of a liquid or gas.

4.13. **Rinami:** A software solution that integrates mobile applications with Oracle JD Edwards EnterpriseOne, enabling real-time access and management of Work Orders (WOs) from the field using a tablet.

4.14. **Trouble Dispatch Center:** The GWA 24/7 customer complaint response center. The Trouble Dispatch Center is responsible for receiving customer complaints and generating and assigning Work Order requests.

4.15. **Water / Wastewater System Control Center (SCC):** GWA's communications hub connecting field personnel with operation and management. GWA's Rovers send and receive data from the field to SCC. Problems, repairs, leaks, overflows, low water pressure, data collection for reservoir, etc. are communicated to SCC for generation of work orders and assignments.

4.16. **Water Hammer:** A hydraulic shock or surge occurs due to a sudden change in the pipeline's flow direction, causing noise, vibration, and potential pipe damage.

4.17. **Wet Barrel Hydrant:** Manufactured in accordance with AWWA Standard C502, and has the main valve located on each outlet nozzle.

## 5.0 Roles and Responsibilities

| | | |
|---|---|---|
| 5.1. | General Manager | Approves this SOP and all its subsequent changes. |
| 5.2. | Assistant General Manager for Operations (AGM-O) | Oversees the development, revision, and implementation of this SOP as the Policy Owner. |

[1] Accurate Flow Meter Rental for Fire Hydrant Testing: Flowhire
[2] 28 GAR §2116 (c), Hydrant Wrenches.
[3] Comparing Chlorine Measurement Methods (ysi.com)

Docusign Envelope ID: DB5D0370-09D2-410C-A688-49E7FAB21041



| | | |
|---|---|---|
| 5.3. | Operations & Maintenance (O&M) Manager, Water Distribution | Reviews this SOP annually and makes necessary changes to be presented to the AGM-O for consideration.<br><br>Ensures that proper training is provided to the affected employees to ensure proper compliance with this SOP. |
| 5.4. | Supervisor, Operation & Maintenance (O&M) | Monitors personnel to ensure compliance with this SOP and provides guidance if needed.<br><br>Uses the JDE CAM to assign, track and manage all preventative maintenance activity.<br><br>Gathers hydrant information, such as GIS mapping, to identify the hydrant location(s) and asset information.<br><br>Notifies the SCC 48 hours before planned road closures and ensures the required permits are obtained. |
| 5.5. | Trouble Dispatch Center | Receive information of valve exercising activity and generate Work Order requests.<br><br>Prepare water outage/road closure alert via Mailchimp and text message based on the information provided by the O&M leader or supervisor.<br><br>Assign work orders to maintenance personnel and coordinate with the WSCC dispatcher for necessary action. |
| 5.6. | Water Wastewater System Control Center (SCC) | Receives critical report or information from GWA field personnel about the operation of GWA facility.<br><br>Relays the report or information received and updates and logs all communications received in the SCC records for its reference. |
| 5.7. | Maintenance Personnel | Strictly abide by the contents of this SOP and conduct activities accordingly. When confronted by a situation not covered by this SOP or requiring clarification, seek the manager's or supervisor's assistance. |

## 6.0 Procedure Description

6.1. **Safety Considerations:** Adhere to all safety protocols. Safety briefings are held weekly to discuss these protocols. Use appropriate personal protective equipment (PPE) needed to perform the required work.

6.2. **General Preparations:**

Docusign Envelope ID: DB5D0370-09D2-410C-A688-49E7FAB21041



6.2.1. **Schedule and Assignment:** Preventive maintenance (PM) is performed based on various factors, including the manufacturer's recommendations, regulatory requirements, and historical data. The recommended PM is added and entered into the JDE CAM program to generate a Work Order (WO). The Maintenance Supervisor (Supervisor) shall use the JDE CAM to assign, track and manage all PM activity[4].

6.2.2. **Data Collection:** The Supervisor will gather hydrant information, such as GIS mapping, to identify the hydrant's location(s) and asset information.

6.2.3. **Road Closures:** If the work requires a road closure, the Supervisor shall notify the Water Wastewater System Control Center (SCC) 48 hours before the planned road closure[5] and ensure the required permits are obtained.

6.2.4. **High Traffic Areas/Busy Intersections:** Contact SCC to request additional traffic control assistance from the Guam Police Department. For further guidance, refer to GWA's traffic control policy[6].

6.3. **Pre-Departure Preparations:** The following shall be performed prior to departing the station:

6.3.1. Notify the Supervisor or the O&M Manager for Water Distribution of the day's scheduled preventive maintenance (PM).

6.3.2. **Vehicle Pre-Departure Checklist:** Conduct an inspection of each assigned GWA Official Vehicle daily to ensure that the vehicles are fully functional, ready for use, and stocked with the proper tools and equipment needed to perform the task. See the *GWA Official Vehicle Pre-Departure Checklist* **(Attachment 1)**.

6.4. **Inspection & Flushing Procedures:** Document all observations made during inspection and work performed during the PM and flushing process. See *Hydrant Inspection & Flushing Checklist* **(Attachment 2)**.

6.4.1. Upon arrival at the site, record the date, time of arrival, and location in the WO.

6.4.2. Establish traffic control measures around the fire hydrant and setup visible street signs to ensure a safe working area.

6.4.3. Conduct a preliminary inspection of the hydrant. Check the overall appearance for any visible damage or obstructions, including loose or missing parts, overgrown vegetation, or abandoned vehicle(s) or objects. Remove any obstructions that affect the view of the hydrant.

6.4.4. Check for leaks at the joint, seals, and packing.

6.4.5. Record the hydrant ID and initial condition in the WO.

6.4.6. Check to see whether the hydrant needs to be raised or lowered due to changes in the ground-surface grade. If adjustments are needed, schedule the work.

6.4.7. Check the breakaway device for damage.

[4] SOP GM-062, *Preventive Maintenance Scheduling & Assignment*.
[5] SOP-1500-WP-001, *Water Outage & Road Closure Notification to the Media/Public*.
[6] SOP T.103, *Traffic Control Policy*.

Docusign Envelope ID: DB5D0370-09D2-410C-A688-49E7FAB21041



6.4.8. Remove the outlet nozzle caps and visually observe for any leakage on the disc/seat. For dry-barrel hydrants, listen for valve-washer leakage. A listening stick may be used to determine if water is still flowing through the valve gate.

6.4.9. Install a pressure gauge to the hydrant, measure and record the system pressure (which should be within a minimum of 20 psi to a maximum of 90 psi[7]), and input the recorded data into the WO and *Water Loss Form* **(Attachment 3)** in the "Water Loss Details" section under "Pressure Before Repair (psi)."

6.4.10. Determine the method outlined in §6.5. to capture water loss:

6.4.10.1. Fire Hydrant Flow Meter Measurement.

6.4.10.2. Pitot Gauge.

6.4.10.3. Missouri Rural Water Association (MRWA) Hydrant Calculation.

6.4.11. Install the instrument used in the preferred method to the hydrant.

6.4.12. Attach a deflector or diffuser to protect the street, traffic, and private property from water expelled at high velocity.

6.4.13. Open the hydrant slowly to prevent water hammer. **Always Slowly Open, Slowly Close.** Flush to remove foreign material from the interior, sediment, and stagnant water. Continue to flush until the water is clear.

6.4.14. Measure the free chlorine residual levels using the DPD method[8]. The free chlorine residual should be a minimum of 0.2 mg/L and shall not exceed the Maximum Residual Disinfectant Level (MRDL) of 4.0 mg/L[9]. If chlorine residual is below the minimum of 0.2 mg/L continue flushing till minimum residual is attained.

6.4.15. Open each valve and test for ease of operation. If the valve stem action is tight, open and close several times until the opening and closing actions are smooth and free.

6.4.16. Record the duration of the flush and note the water clarity.

6.4.17. Remove the instrument from the hydrant.

6.4.18. Slowly close the hydrant and remove the deflector. **Always Slowly Open, Slowly Close.**

6.4.19. Check the drain valve's operation by placing one hand's palm over the outlet nozzle. Drainage should be sufficiently rapid to create noticeable suction. **This step only applies to dry-barrel hydrants.**

6.4.20. Use a listening device to check the main valve for leakage. **This step only applies to dry-barrel hydrants.**

6.4.21. If the main valve is not functioning properly, notify the Supervisor or Manager. This information will help identify hydrants that need to be replaced.

[7] 28 GAR §2103 (l), *Minimum Water Delivery Pressure*.
[8] A colorimetric chlorine test kit, such as the CN-66 from Hach Co. or an equivalent, may be used.
[9] 40 CFR §141.65, *Maximum Residual Disinfectant Levels*.

Docusign Envelope ID: DB5D0370-09D2-410C-A688-49E7FAB21041



6.4.22. Check operating nut threads.

6.4.23. Install the pressure gauge to the hydrant and take another reading to determine if there have been any positive or negative changes after the work. Measure and record the system pressure in the WO and Water Loss Form in the "Water Loss Details" section under "Pressure After Repair (psi)."

6.4.24. Remove the pressure gauge and flow meter used to measure and record the flow rate. Input the recorded data into the WO and Water Loss Form in the "Water Volume Calculation" section.

6.4.25. Remove outlet-nozzle caps, clean the threads, and check the condition of the gaskets. Replace if necessary.

6.4.26. Replace the outlet-nozzle cap. Leave it loose enough to allow air to escape. **This step only applies to dry-barrel hydrants.**

6.4.27. Replace the caps. Tighten them enough to form a good seal, then back off slightly so they are not excessively tight. If any caps are missing, note and record the number and size of missing caps. Replace them if available and on-hand. If not available, initiate order.

6.4.28. Locate and exercise the auxiliary valve[10]. If there are no leaks on the hydrant, leave the valve in the open position.

6.4.29. If the hydrant is inoperable or leaking, tag it with a clearly visible mark and schedule it for repair.

6.5. **Fire Hydrant Condition Assessment:** During inspection and maintenance, fire hydrants must be assessed to ensure their physical condition is recorded and updated in CAM using the RINAMI tablet (see **Attachment 4**). This process helps prioritize replacements under the fire hydrant capital improvement program.

6.5.1. Use the established *Fire Hydrant Rating Scale* found in **Attachment 5** (highlighted in red) to evaluate the physical condition of the fire hydrant.

6.6. **Flow Rate and Water Loss:** Accurate recording of water loss is essential for water management. One of the following methods shall be used to capture the flow rate and water loss during the flushing process. The data must be recorded in the WO and the Water Loss Form.

6.6.1. **Fire Hydrant Flow Meter Measurement:**

6.6.1.1. Attach the flow meter to the hydrant[11] and record the start meter reading.

6.6.1.2. Open the hydrant fully and observe the flow rate reading on the meter.

6.6.1.3. Record the flow rate in gallons per minute (GPM).

6.6.1.4. After flushing, close the hydrant slowly to prevent water hammer.

[10] Refer to the *Valve Exercising & Maintenance* SOP for further guidance.
[11] The flow meter needs to be calibrated correctly on an annual basis.

Docusign Envelope ID: DB5D0370-09D2-410C-A688-49E7FAB21041



6.6.1.5. Record the end reading on the flow meter.

6.6.2. **Pitot Gauge:**

6.6.2.1. Attach the pitot gauge to the hydrant and open the hydrant fully.

6.6.2.2. Insert the pitot tube. It should be held downstream and in the center of the nozzle.

6.6.2.3. Read the pressure from the pitot gauge.

6.6.2.4. Use the *Theoretical Discharge Through Circular Orifices Chart* **(Attachment 6)** from the National Fire Protection Association (NFPA) 291 to convert pressure to flow rate (GPM).

6.6.2.5. Record the flow rate and calculate the total water loss by multiplying the flow rate by the duration of the flush.

6.6.3. **Missouri Rural Water Association (MRWA) Hydrant Calculation:**

6.6.3.1. Measure the outlet pressure using a pressure gauge.

6.6.3.2. Determine the nozzle size of the hydrant.

6.6.3.3. Use the *MRWA Hydrant or Pipe Flush Flow Calculator* (MRWA Calculator) **(Attachment 7)** to calculate the flow rate based on the pressure and nozzle size. The MRWA Calculator may be accessed on their website at https://moruralwater.org/water-tools-files/tool_flush.php.

6.6.3.4. Record the flow rate and calculate the total water loss by multiplying the flow rate by the duration of the flush.

6.7. **General Post Flushing Procedures:**

6.7.1. **System Checks:** Check the pressure reading and record the data to ensure the system pressure returns to normal.

6.7.2. **Site Cleanup:** Remove all safety cones from the site, ensure the site is clean and free of debris or equipment, and restore any disturbed landscaping or public property to its original condition.

6.7.3. **Documentation:** Ensure all required data is recorded in the WO and the *Water Loss Form*, including the date, time, hydrant location, pressure, flow rate, water loss, duration of flushing, and any observations or issues encountered.

6.8. **Troubleshoot Issues and Response Procedures:** Conduct a visual inspection to identify the source of the problem.

6.8.1. Use effective troubleshooting techniques to determine the cause of the issue.

6.8.2. Use the comprehensive *Troubleshooting Checklist for Hydrants* **(Attachment 8)** to address and resolve identified issues thoroughly.

6.8.3. Make necessary repairs.

6.8.4. Contact SCC and the Supervisor or Manager to request additional support if needed.

Docusign Envelope ID: DB5D0370-09D2-410C-A688-49E7FAB21041



6.9. **Training:** The O&M Manager should conduct training for the fire hydrant flushing and maintenance when needed. New or relevant employees must receive training and sign the *Employee's Acknowledgment Receipt* **(Attachment 9)** to confirm their understanding and compliance with the procedures outlined in this SOP.

6.10. **Non-Compliance to this SOP:**

6.10.1. **Employee:** Failure of the employee to adhere and comply with any of the guidelines, policies, and procedures stated herein may result in progressive or adverse disciplinary action, including but not limited to suspension, demotion, or termination of employment as provided by GWA Personnel Rules and Regulations (PR&R).

6.10.2. **Supervisors and Managers:** Failure of the Manager or Supervisor to report and enforce all the guidelines, policies, and procedures stated herein may result in progressive or adverse disciplinary action, including but not limited to suspension, demotion, or termination or employment as provided by GWA PR&R.

## 7.0 Document Approvals

| Role | Position | Name of Approver | Approval Signature | Date Approved |
|---|---|---|---|---|
| Authors | O&M Manager, Water Distribution<br>Legal Secretary III | Vincent Pangelinan<br>Antonette Dione Gutierrez | Approval on File | On File |
| Policy Owner | Assistant General Manager for Operations (AGM-O) | Thomas A. Cruz, P.E. | Approval on File | On File |
| Final Approver | General Manager | Miguel C. Bordallo, P.E. | Page 1 | Page 1 |

By existing Guam and Federal laws, the contents of this SOP were reviewed thoroughly by its Policy Owner and was found to be:

☒ appropriate for publication on the GWA website without compromising the security of GWA's system or the public's health and safety.

☐ not appropriate for publication on the GWA website because it might jeopardize the security of GWA's system or the public's health and safety.

## 8.0 Records of Revisions

All suggestions for improvement shall be directed to the Policy Owner indicated below. The Policy Owner will consider input received, develop recommendations on how to address the suggestions and obtain authorization to make the recommended changes. Updates, revisions, corrections and waivers to this SOP shall be made in writing and be approved by the GM.

8.1. Policy Owner: Assistant General Manager of Operations

8.2. Authorization: General Manager

| Effective Date | Revision Letter | Document Authors | Description of Change |
|---|---|---|---|
| Page 1 | A | Vincent Pangelinan<br>Antonette Dione Gutierrez | Initial Release of SOP |

## 9.0 References

9.1. GWA Employee Safety Handbook.

Docusign Envelope ID: DB5D0370-09D2-410C-A688-49E7FAB21041




9.2. SOP on Electrical Safety.

9.3. GWA's Traffic Control Plan.

9.4. SOP on *Lock-out / Tag-out (Energy Hazard Control)*.

9.5. SOP GM-062, *Preventive Maintenance Scheduling & Assignment*.

9.6. SOP-1500-WP-001, *Water Outage & Road Closure Notification to the Media/Public*.

9.7. Standard Methods. 4500-Cl G. Chlorine by DPD. https://www.nemi.gov/methods/method_summary/7431/

9.8. 28 GAR §2116 (c), *Hydrant Wrenches*. https://guamwaterworks.org/Adobe%20Files/pdf28GAR001-2.pdf

9.9. Comparing Chlorine Measurement Methods. https://www.ysi.com/ysi-blog/water-blogged-blog/2023/10/comparing-chlorine-measurement-methods?utm_source=cta&utm_medium=email&utm_campaign=2023_11_Utilities+Newsletter&mkt_tok=MjQwLVVUQi0xNDYAAAGPxSL7DdUXJLsqR2O17s3BcY9tud3Rhsz0gB2f7GLZBE9rR1CJUq0QR3DxXrswfRF-Pgf_JKX6ZerM87XtvQCSsh_qU0Y_wFP56jjCFRnM0njaWQ

9.10. 40 CFR §141.65, *Maximum Residual Disinfectant Levels*. https://www.ecfr.gov/current/title-40/chapter-I/subchapter-D/part-141/subpart-G/section-141.65#p-141.65(a)

9.11. What is the Water Hammer Effect? https://www.electricsolenoidvalves.com/blog/what-is-the-water-hammer-effect/

9.12. Fire Hydrant Testing: NFPA Guidance & How To Do It. https://blog.qrfs.com/370-nfpa-guidance-on-fire-hydrant-testing/

9.13. Pitot Gauges: How Do I Calculate the PSI to GPM Conversion? https://blog.qrfs.com/240-pitot-gauges-how-do-i-calculate-the-psi-to-gpm-conversion/#:~:text=In%20other%20words%2C%20if%20your,rate%20of%20flow%3A%202%2C273.4%20GPM

9.14. WSRB Guide to Hydrant Flow Testing. https://www1.wsrb.com/resources/hydrant-flow-testing

9.15. How to Use a Pitot Gauge for Hydrant Flow Testing. https://blog.qrfs.com/46-how-to-use-a-pitot-gauge-for-hydrant-flow-testing/

9.16. MRWA Hydrant or Pipe Flush Flow Calculator. https://moruralwater.org/water-tools-files/tool_flush.php

9.17. 28 GAR Chapter 2, Guam Waterworks Authority. https://guamwaterworks.org/Adobe%20Files/pdf28GAR001-2.pdf

Docusign Envelope ID: DB5D0370-09D2-410C-A688-49E7FAB21041



## Attachment 1: GWA Official Vehicle Pre-Departure Checklist

GUAM WATERWORKS AUTHORITY

Gloria B. Nelson Public Service Building
688 Route 15
Mangilao, Guam 96913
vpangelinan@guamwaterworks.org

**FIRE HYDRANT FLUSHING AND MAINTENANCE**
**GWA OFFICIAL VEHICLE PRE-DEPARTURE CHECKLIST**

OPERATOR 1 (DRIVER): _____
OPERATOR 2 (PASSENGER): _____
SUPERVISOR/MANAGER: _____

DATE: _____
DIVISION: _____
CONTACT NO.: _____

### VEHICLE HISTORY

**YEAR:** _____ **MAKE:** _____ **MODEL:** _____ **INS. EXP DATE:** _____
**LICENSE PLATE NO.:** _____ **REGISTRATION EXP DATE:** _____ **GAS LEVEL:** _____
**ODOMETER READING** START: _____ END: _____

| Body | Good | Fair | Poor |
|---|---|---|---|
| Hood | ☐ | ☐ | ☐ |
| Grill-Front | ☐ | ☐ | ☐ |
| Bumper-Front | ☐ | ☐ | ☐ |
| Bumper-Rear | ☐ | ☐ | ☐ |
| Fender-Front Left | ☐ | ☐ | ☐ |
| Fender-Front Right | ☐ | ☐ | ☐ |
| Tailgate | ☐ | ☐ | ☐ |
| Door-Driver | ☐ | ☐ | ☐ |
| Door passenger | ☐ | ☐ | ☐ |
| Mirror-Driver | ☐ | ☐ | ☐ |
| Mirror-Passenger | ☐ | ☐ | ☐ |
| Wiper Blades | ☐ | ☐ | ☐ |
| Wiper Blades | ☐ | ☐ | ☐ |

| Tires | Good | Fair | Poor |
|---|---|---|---|
| Jack/Tire | ☐ | ☐ | ☐ |
| Spare Tire | ☐ | ☐ | ☐ |
| Tire Pressure | ☐ | ☐ | ☐ |

| Engine | Good | Fair | Poor |
|---|---|---|---|
| Air Filter | ☐ | ☐ | ☐ |
| Battery | ☐ | ☐ | ☐ |
| Coolant Radiator | ☐ | ☐ | ☐ |
| Cap-Radiator | ☐ | ☐ | ☐ |
| Cap-Oil | ☐ | ☐ | ☐ |

| Interior | Good | Fair | Poor |
|---|---|---|---|
| Horn | ☐ | ☐ | ☐ |
| Parking Brakes | ☐ | ☐ | ☐ |
| Interior Light | ☐ | ☐ | ☐ |
| Interior Gauges | ☐ | ☐ | ☐ |
| Air Condition | ☐ | ☐ | ☐ |
| Cleanliness | ☐ | ☐ | ☐ |
| Interior Lighting | ☐ | ☐ | ☐ |

| Lights | Good | Fair | Poor |
|---|---|---|---|
| Front Hazard | ☐ | ☐ | ☐ |
| Front Signal | ☐ | ☐ | ☐ |
| Headlamps High | ☐ | ☐ | ☐ |
| Headlamps Low | ☐ | ☐ | ☐ |
| Rear Hazards | ☐ | ☐ | ☐ |
| Rear Left Brake | ☐ | ☐ | ☐ |
| Rear Right Brake | ☐ | ☐ | ☐ |
| Rear Signal | ☐ | ☐ | ☐ |

| Glass | Good | Fair | Poor |
|---|---|---|---|
| Windshield | ☐ | ☐ | ☐ |
| Back Glass | ☐ | ☐ | ☐ |
| D Window | ☐ | ☐ | ☐ |
| PD Window | ☐ | ☐ | ☐ |

| Fluid Levels | High | Normal | Low |
|---|---|---|---|
| Oil Dipstick | ☐ | ☐ | ☐ |
| Oil | ☐ | ☐ | ☐ |
| Brake fluid | ☐ | ☐ | ☐ |
| Power Steering | ☐ | ☐ | ☐ |

| Tools & Equip | Avail. | Replace | Replenish |
|---|---|---|---|
| Safety Vest | ☐ | ☐ | ☐ |
| Hard Hat | ☐ | ☐ | ☐ |
| Safety Gloves | ☐ | ☐ | ☐ |
| Flow Meter | ☐ | ☐ | ☐ |
| Valve Wrench | ☐ | ☐ | ☐ |
| Hydrant Spanner Wrench or similar | ☐ | ☐ | ☐ |
| Hydrant Deflector or Diffuser | ☐ | ☐ | ☐ |
| Wire Brush | ☐ | ☐ | ☐ |
| Various Hand Tools | ☐ | ☐ | ☐ |
| Pressure Gauge | ☐ | ☐ | ☐ |
| Comparator Kit | ☐ | ☐ | ☐ |

**REMARKS:** _____

EMPLOYEE NAME: _____ SIGNATURE: _____ DATE: _____

SUPERVISOR/ MANAGER: _____ SIGNATURE: _____ DATE: _____

Docusign Envelope ID: DB5D0370-09D2-410C-A688-49E7FAB21041



## Attachment 2: Hydrant Inspection & Flushing Checklist

GUAM WATERWORKS AUTHORITY

Gloria B. Nelson Public Service Building
688 Route 15
Mangilao, Guam 96913
vpangelinan@guamwaterworks.org

**FIRE HYDRANT FLUSHING AND MAINTENANCE**
**HYDRANT INSPECTION & FLUSHING CHECKLIST**

### Fire Hydrant 1M

| Work Order No | Failure Description | |
|---|---|---|
| 1415946 | FIRE HYDRANT 1M | 3 |

| Division | Description & Unit Number | Start Date |
|---|---|---|
| 1520 | Hydrant - WHYD-02341 (WHYD-02341) | 02/01/2024 |

| Description | | | |
|---|---|---|---|
| Notify SCC: PM is occurring. | ○ PASS | ○ FAILED | ○ SKIP |
| Notify Ops: PM is occurring. | ○ PASS | ○ FAILED | ○ SKIP |
| Review safety procedures. | ○ PASS | ○ FAILED | ○ SKIP |
| Obtain proper PPE's. | ○ PASS | ○ FAILED | ○ SKIP |
| Check general appearance. | ○ PASS | ○ FAILED | ○ SKIP |
| Check nozzle caps & drains. | ○ PASS | ○ FAILED | ○ SKIP |
| Check seals. | ○ PASS | ○ FAILED | ○ SKIP |
| Inspect for leaks. | ○ PASS | ○ FAILED | ○ SKIP |
| Fully open hydrant | ○ PASS | ○ FAILED | ○ SKIP |
| Release air from hose cap. | ○ PASS | ○ FAILED | ○ SKIP |
| Check for leakage at joint. | ○ PASS | ○ FAILED | ○ SKIP |
| Check for leakage at seals. | ○ PASS | ○ FAILED | ○ SKIP |
| Check for leakage at packing. | ○ PASS | ○ FAILED | ○ SKIP |

Page 1 of 3

Docusign Envelope ID: DB5D0370-09D2-410C-A688-49E7FAB21041



## Attachment 2: Hydrant Inspection & Flushing Checklist (Cont.)

### Fire Hydrant 1M

| Work Order No | Failure Description | |
|---|---|---|
| 1415946 | FIRE HYDRANT 1M | 3 |

| Division | Description & Unit Number | Start Date |
|---|---|---|
| 1520 | Hydrant - WHYD-02341 (WHYD-02341) | 02/01/2024 |

| Description | | | |
|---|---|---|---|
| Check for leakage at joint. | ○ PASS | ○ FAILED | ○ SKIP |
| Check for leakage at seals. | ○ PASS | ○ FAILED | ○ SKIP |
| Check for leakage at packing. | ○ PASS | ○ FAILED | ○ SKIP |
| Check leakage in outlet cap. | ○ PASS | ○ FAILED | ○ SKIP |
| Close Hydrant. | ○ PASS | ○ FAILED | ○ SKIP |
| Observe drainage. | ○ PASS | ○ FAILED | ○ SKIP |
| Flush hydrant. | ○ PASS | ○ FAILED | ○ SKIP |
| Will flow damage area? | ○ PASS | ○ FAILED | ○ SKIP |
| Close hydrant slowly. | ○ PASS | ○ FAILED | ○ SKIP |
| Clean all nozzle heads. | ○ PASS | ○ FAILED | ○ SKIP |
| Lubricate all nozzle threads. | ○ PASS | ○ FAILED | ○ SKIP |
| Replace caps if needed. | ○ PASS | ○ FAILED | ○ SKIP |
| Tighten w/spanner wrench. | ○ PASS | ○ FAILED | ○ SKIP |

Page **2** of **3**

Docusign Envelope ID: DB5D0370-09D2-410C-A688-49E7FAB21041



## Attachment 2: Hydrant Inspection & Flushing Checklist (Cont.)

### Fire Hydrant 1M

| Work Order No | Failure Description | |
|---|---|---|
| 1415946 | FIRE HYDRANT 1M | 3 |

| Division | Description & Unit Number | Start Date |
|---|---|---|
| 1520 | Hydrant - WHYD-02341 (WHYD-02341) | 02/01/2024 |

| Description | | | |
|---|---|---|---|
| Clean all nozzle heads. | ○ PASS | ○ FAILED | ○ SKIP |
| Lubricate all nozzle threads. | ○ PASS | ○ FAILED | ○ SKIP |
| Replace caps if needed. | ○ PASS | ○ FAILED | ○ SKIP |
| Tighten w/spanner wrench. | ○ PASS | ○ FAILED | ○ SKIP |
| Lubricate stem threads. | ○ PASS | ○ FAILED | ○ SKIP |
| Clean exterior of hydrant. | ○ PASS | ○ FAILED | ○ SKIP |
| Paint if needed | ○ PASS | ○ FAILED | ○ SKIP |
| Check auxiliary valves. | ○ PASS | ○ FAILED | ○ SKIP |
| Request CM. If damage is big. | ○ PASS | ○ FAILED | ○ SKIP |
| Record PM in CMMS. | ○ PASS | ○ FAILED | ○ SKIP |
| Secure any items & Site. | ○ PASS | ○ FAILED | ○ SKIP |
| Notify SCC: PM has concluded. | ○ PASS | ○ FAILED | ○ SKIP |
| Notify Ops: PM has concluded. | ○ PASS | ○ FAILED | ○ SKIP |

SUBMIT

Page 3 of 3

Docusign Envelope ID: DB5D0370-09D2-410C-A688-49E7FAB21041



## Attachment 3: Water Loss Form

GUAM WATERWORKS AUTHORITY

Gloria B. Nelson Public Service Building
688 Route 15
Mangilao, Guam 96913
vpangelinan@guamwaterworks.org

**FIRE HYDRANT FLUSHING AND MAINTENANCE**
**WATER LOSS FORM**

### Water Loss

Work Order No | Failure Description | 2

Division | Description & Unit Number | Start Date

### Water Loss Details

Order Number (Loss Number) | Creation Date | Creation Time

Start Date | Start Time | Completion Date * | Completion Time *

Age Of Leak (days before call) | Pipe Type *

Leak Location * | Material Type *

Cause of Rupture

Pipe Diameter (in)* | Cover Depth (in)*

Pressure Before Repair (psi) | Pressure After Repair (psi)

Pipe Repaired (feet)

### Water Volume Calculation

Magnitude of Leak * | Method of Leak Rate *

Gallons Per Minute * | Gallons Per Day

Days Duration | Rate / Kgal

Village of Leak *

Page 1 of 1

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## Attachment 4: Fire Hydrant Condition Assessment

GUAM WATERWORKS AUTHORITY

Gloria B. Nelson Public Service Building
688 Route 15
Mangilao, Guam 96913
vpangelinan@guamwaterworks.org

**FIRE HYDRANT FLUSHING AND MAINTENANCE**
**FIRE HYDRANT CONDITION ASSESSMENT**

**Fire Hydrant 1M (1415962)** CUSTOMER SIGNATURE

| Work Order No | Failure Description | |
|---|---|---|
| 1415962 | FIRE HYDRANT 1M | 3 |

| Division | Description & Unit Number | Start Date |
|---|---|---|
| 1520 | Hydrant - WHYD-02357 (WHYD-02357) | 02/01/2024 |

Please enter some closing notes

| Physical Condition | Low Usage | Zero Usage |
|---|---|---|
| Low to Moderate (05) | | |

| Blue Meter Tag Installation | Vehicle Odometer | Vehicle License Number |
|---|---|---|
| | | |

| Hour Meter | Fuel Meter | Vehicle Odometer |
|---|---|---|
| | | |

| Meter Read | Meter 5 | Meter 6 |
|---|---|---|
| | | |

Name:

Technician Signature:

| Equipment Status | Change Component |
|---|---|
| Working (WK) | ☑ |

COMPLETE

Closing note cannot be empty

Page **1** of **1**

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## Attachment 5: Fire Hydrant Rating Scale

GUAM WATERWORKS AUTHORITY

Gloria B. Nelson Public Service Building
688 Route 15
Mangilao, Guam 96913
vpangelinan@guamwaterworks.org

**FIRE HYDRANT FLUSHING AND MAINTENANCE**
**FIRE HYDRANT RATING SCALE**

Fire Hydrant 1M (1415962) — CUSTOMER SIGNATURE

Work Order No: 1415962 | Failure Description: FIRE HYDRANT 1M | 3
Division: 1520 | Description & Unit Number: Hydrant - WHYD-02357 (WHYD-02357) | Start Date: 02/01/2024

Please enter some closing notes

Physical Condition: Low to Moderate (05)

- Negligible (01)
- Negligible to Low (02)
- Low to Negligible (03)
- Low (04)
- Low to Moderate (05)
- Moderate to Low (06)
- Moderate (07)
- Moderate to Severe (08)
- Severe to Moderate (09)
- Severe (10)

Low Usage | Zero Usage
Vehicle Odometer | Vehicle License Number
Fuel Meter | Vehicle Odometer
Meter 5 | Meter 6
Name:
Technician Signature:
Working (WK) | Change Component

COMPLETE
Closing note cannot be empty

Page 1 of 1

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## Attachment 6: Theoretical Discharge Through Circular Orifices Chart

GUAM WATERWORKS AUTHORITY

Gloria B. Nelson Public Service Building
688 Route 15
Mangilao, Guam 96913
vpangelinan@guamwaterworks.org

**FIRE HYDRANT FLUSHING AND MAINTENANCE**
**THEORETICAL DISCHARGE THROUGH CIRCULAR ORIFICES CHART**

**Table 4.10.1(a) Theoretical Discharge Through Circular Orifices (U.S. Gallons of Water per Minute)**

| Pilot Pressure* (psi) | Feet † | Velocity Discharge (ft/sec) | Orifice Size (in.) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 2 | 2.25 | 2.375 | 2.5 | 2.625 | 2.75 | 3 | 3.25 | 3.5 | 3.75 | 4 | 4.5 |
| 1 | 2.31 | 12.20 | 119 | 151 | 168 | 187 | 206 | 226 | 269 | 315 | 366 | 420 | 477 | 604 |
| 2 | 4.61 | 17.25 | 169 | 214 | 238 | 264 | 291 | 319 | 380 | 446 | 517 | 593 | 675 | 855 |
| 3 | 6.92 | 21.13 | 207 | 262 | 292 | 323 | 356 | 391 | 465 | 546 | 633 | 727 | 827 | 1047 |
| 4 | 9.23 | 24.39 | 239 | 302 | 337 | 373 | 411 | 451 | 537 | 630 | 731 | 839 | 955 | 1209 |
| 5 | 11.54 | 27.26 | 267 | 338 | 376 | 417 | 460 | 505 | 601 | 705†† | 817 | 938 | 1068 | 1351 |
| 6 | 13.84 | 29.87 | 292 | 370 | 412 | 457 | 504 | 553 | 658 | 772 | 895 | 1028 | 1169 | 1480 |
| 7 | 16.15 | 32.26 | 316 | 400 | 445 | 493 | 544 | 597 | 711 | 834 | 967 | 1110 | 1263 | 1599 |
| 8 | 18.46 | 34.49 | 338 | 427 | 476 | 528 | 582 | 638 | 760 | 891 | 1034 | 1187 | 1350 | 1709 |
| 9 | 20.76 | 36.58 | 358 | 453 | 505 | 560 | 617 | 677 | 806 | 946 | 1097 | 1259 | 1432 | 1813 |
| 10 | 23.07 | 38.56 | 377 | 478 | 532 | 590 | 650 | 714 | 849 | 997 | 1156 | 1327 | 1510 | 1911 |
| 11 | 25.38 | 40.45 | 396 | 501 | 558 | 619 | 682 | 748 | 891 | 1045 | 1212 | 1392 | 1583 | 2004 |
| 12 | 27.68 | 42.24 | 413 | 523 | 583 | 646 | 712 | 782 | 930 | 1092 | 1266 | 1454 | 1654 | 2093 |
| 13 | 29.99 | 43.97 | 430 | 545 | 607 | 672 | 741 | 814 | 968 | 1136 | 1318 | 1513 | 1721 | 2179 |
| 14 | 32.30 | 45.63 | 447 | 565 | 630 | 698 | 769 | 844 | 1005 | 1179 | 1368 | 1570 | 1786 | 2261 |
| 15 | 34.61 | 47.22 | 462 | 585 | 652 | 722 | 796 | 874 | 1040 | 1221 | 1416 | 1625 | 1849 | 2340 |
| 16 | 36.91 | 48.78 | 477 | 604 | 673 | 746 | 822 | 903 | 1074 | 1261 | 1462 | 1679 | 1910 | 2417 |
| 17 | 39.22 | 50.28 | 492 | 623 | 694 | 769 | 848 | 930 | 1107 | 1300 | 1507 | 1730 | 1969 | 2491 |
| 18 | 41.53 | 51.73 | 506 | 641 | 714 | 791 | 872 | 957 | 1139 | 1337 | 1551 | 1780 | 2026 | 2564 |
| 19 | 43.83 | 53.15 | 520 | 658 | 734 | 813 | 896 | 984 | 1171 | 1374 | 1593 | 1829 | 2081 | 2634 |
| 20 | 46.14 | 54.54 | 534 | 676 | 753 | 834 | 920 | 1009 | 1201 | 1410 | 1635 | 1877 | 2135 | 2702 |
| 22 | 50.75 | 57.19 | 560 | 709 | 789 | 875 | 964 | 1058 | 1260 | 1478 | 1715 | 1968 | 2239 | 2834 |
| 24 | 55.37 | 59.74 | 585 | 740 | 825 | 914 | 1007 | 1106 | 1316 | 1544 | 1791 | 2056 | 2339 | 2960 |
| 26 | 59.98 | 62.18 | 609 | 770 | 858 | 951 | 1048 | 1151 | 1369 | 1607 | 1864 | 2140 | 2434 | 3081 |
| 28 | 64.60 | 64.52 | 632 | 799 | 891 | 987 | 1088 | 1194 | 1421 | 1668 | 1934 | 2220 | 2526 | 3197 |
| 30 | 69.21 | 66.79 | 654 | 827 | 922 | 1022 | 1126 | 1236 | 1471 | 1726 | 2002 | 2298 | 2615 | 3310 |
| 32 | 73.82 | 68.98 | 675 | 855 | 952 | 1055 | 1163 | 1277 | 1519 | 1783 | 2068 | 2374 | 2701 | 3418 |
| 34 | 78.44 | 71.10 | 696 | 881 | 981 | 1087 | 1199 | 1316 | 1566 | 1838 | 2131 | 2447 | 2784 | 3523 |
| 36 | 83.05 | 73.16 | 716 | 906 | 1010 | 1119 | 1234 | 1354 | 1611 | 1891 | 2193 | 2518 | 2865 | 3626 |
| 38 | 87.67 | 75.17 | 736 | 931 | 1038 | 1150 | 1268 | 1391 | 1656 | 1943 | 2253 | 2587 | 2943 | 3725 |
| 40 | 92.28 | 77.11 | 755 | 955 | 1065 | 1180 | 1300 | 1427 | 1699 | 1993 | 2312 | 2654 | 3020 | 3822 |
| 42 | 96.89 | 79.03 | 774 | 979 | 1091 | 1209 | 1333 | 1462 | 1740 | 2043 | 2369 | 2719 | 3094 | 3916 |
| 44 | 101.51 | 80.88 | 792 | 1002 | 1116 | 1237 | 1364 | 1497 | 1781 | 2091 | 2425 | 2783 | 3167 | 4008 |
| 46 | 106.12 | 82.70 | 810 | 1025 | 1142 | 1265 | 1395 | 1531 | 1821 | 2138 | 2479 | 2846 | 3238 | 4098 |
| 48 | 110.74 | 84.48 | 827 | 1047 | 1166 | 1292 | 1425 | 1563 | 1861 | 2184 | 2533 | 2907 | 3308 | 4186 |
| 50 | 115.35 | 86.22 | 844 | 1068 | 1190 | 1319 | 1454 | 1596 | 1899 | 2229 | 2585 | 2967 | 3376 | 4273 |
| 52 | 119.96 | 87.93 | 861 | 1089 | 1214 | 1345 | 1483 | 1627 | 1937 | 2273 | 2636 | 3026 | 3443 | 4357 |
| 54 | 124.58 | 89.61 | 877 | 1110 | 1237 | 1370 | 1511 | 1658 | 1974 | 2316 | 2686 | 3084 | 3508 | 4440 |
| 56 | 129.19 | 91.20 | 893 | 1130 | 1260 | 1396 | 1539 | 1689 | 2010 | 2359 | 2735 | 3140 | 3573 | 4522 |
| 58 | 133.81 | 92.87 | 909 | 1150 | 1282 | 1420 | 1566 | 1719 | 2045 | 2400 | 2784 | 3196 | 3636 | 4602 |
| 60 | 138.42 | 94.45 | 925 | 1170 | 1304 | 1445 | 1593 | 1748 | 2080 | 2441 | 2831 | 3250 | 3698 | 4681 |
| 62 | 143.03 | 96.01 | 940 | 1189 | 1325 | 1469 | 1619 | 1777 | 2115 | 2482 | 2878 | 3304 | 3759 | 4758 |
| 64 | 147.65 | 97.55 | 955 | 1209 | 1347 | 1492 | 1645 | 1805 | 2148 | 2521 | 2924 | 3357 | 3820 | 4834 |
| 66 | 152.26 | 99.07 | 970 | 1227 | 1367 | 1515 | 1670 | 1833 | 2182 | 2561 | 2970 | 3409 | 3879 | 4909 |
| 68 | 156.88 | 100.55 | 984 | 1246 | 1388 | 1538 | 1696 | 1861 | 2215 | 2599 | 3014 | 3460 | 3937 | 4983 |
| 70 | 161.49 | 102.03 | 999 | 1264 | 1408 | 1560 | 1720 | 1888 | 2247 | 2637 | 3058 | 3511 | 3995 | 5056 |
| 72 | 166.10 | 103.47 | 1013 | 1282 | 1428 | 1583 | 1745 | 1915 | 2279 | 2674 | 3102 | 3561 | 4051 | 5127 |
| 74 | 170.72 | 104.90 | 1027 | 1300 | 1448 | 1604 | 1769 | 1941 | 2310 | 2711 | 3144 | 3610 | 4107 | 5198 |
| 76 | 175.33 | 106.30 | 1041 | 1317 | 1467 | 1626 | 1793 | 1967 | 2341 | 2748 | 3187 | 3658 | 4162 | 5268 |
| 78 | 179.95 | 107.69 | 1054 | 1334 | 1487 | 1647 | 1816 | 1993 | 2372 | 2784 | 3228 | 3706 | 4217 | 5337 |
| 80 | 184.56 | 109.08 | 1068 | 1351 | 1505 | 1668 | 1839 | 2018 | 2402 | 2819 | 3269 | 3753 | 4270 | 5405 |

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## Attachment 6: Theoretical Discharge Through Circular Orifices Chart (Cont.)

**Table 4.10.1(a) Theoretical Discharge Through Circular Orifices**
**(U.S. Gallons of Water per Minute)**

| Pilot Pressure* (psi) | Feet † | Velocity Discharge (ft/sec) | Orifice Size (in.) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 2 | 2.25 | 2.375 | 2.5 | 2.625 | 2.75 | 3 | 3.25 | 3.5 | 3.75 | 4 | 4.5 |
| 82 | 189.17 | 110.42 | 1081 | 1368 | 1524 | 1689 | 1862 | 2043 | 2432 | 2854 | 3310 | 3800 | 4323 | 5472 |
| 84 | 193.79 | 111.76 | 1094 | 1385 | 1543 | 1709 | 1885 | 2068 | 2461 | 2889 | 3350 | 3846 | 4376 | 5538 |
| 86 | 198.40 | 113.08 | 1107 | 1401 | 1561 | 1730 | 1907 | 2093 | 2491 | 2923 | 3390 | 3891 | 4428 | 5604 |
| 88 | 203.02 | 114.39 | 1120 | 1417 | 1579 | 1750 | 1929 | 2117 | 2519 | 2957 | 3429 | 3936 | 4479 | 5668 |
| 90 | 207.63 | 115.68 | 1132 | 1433 | 1597 | 1769 | 1951 | 2141 | 2548 | 2990 | 3468 | 3981 | 4529 | 5733 |
| 92 | 212.24 | 116.96 | 1145 | 1449 | 1614 | 1789 | 1972 | 2165 | 2576 | 3023 | 3506 | 4025 | 4579 | 5796 |
| 94 | 216.86 | 118.23 | 1157 | 1465 | 1632 | 1808 | 1994 | 2188 | 2604 | 3056 | 3544 | 4068 | 4629 | 5859 |
| 96 | 221.47 | 119.48 | 1169 | 1480 | 1649 | 1827 | 2015 | 2211 | 2631 | 3088 | 3582 | 4111 | 4678 | 5921 |
| 98 | 226.09 | 120.71 | 1182 | 1495 | 1666 | 1846 | 2035 | 2234 | 2659 | 3120 | 3619 | 4154 | 4726 | 5982 |
| 100 | 230.70 | 121.94 | 1194 | 1511 | 1683 | 1865 | 2056 | 2257 | 2686 | 3152 | 3655 | 4196 | 4774 | 6043 |
| 102 | 235.31 | 123.15 | 1205 | 1526 | 1700 | 1884 | 2077 | 2279 | 2712 | 3183 | 3692 | 4238 | 4822 | 6103 |
| 104 | 239.93 | 124.35 | 1217 | 1541 | 1716 | 1902 | 2097 | 2301 | 2739 | 3214 | 3728 | 4279 | 4869 | 6162 |
| 106 | 244.54 | 125.55 | 1229 | 1555 | 1733 | 1920 | 2117 | 2323 | 2765 | 3245 | 3763 | 4320 | 4916 | 6221 |
| 108 | 249.16 | 126.73 | 1240 | 1570 | 1749 | 1938 | 2137 | 2345 | 2791 | 3275 | 3799 | 4361 | 4962 | 6280 |
| 110 | 253.77 | 127.89 | 1252 | 1584 | 1765 | 1956 | 2157 | 2367 | 2817 | 3306 | 3834 | 4401 | 5007 | 6338 |
| 112 | 258.38 | 129.05 | 1263 | 1599 | 1781 | 1974 | 2176 | 2388 | 2842 | 3336 | 3869 | 4441 | 5053 | 6395 |
| 114 | 263.00 | 130.20 | 1274 | 1613 | 1797 | 1991 | 2195 | 2409 | 2867 | 3365 | 3903 | 4480 | 5098 | 6452 |
| 116 | 267.61 | 131.33 | 1286 | 1627 | 1813 | 2009 | 2215 | 2430 | 2892 | 3395 | 3937 | 4519 | 5142 | 6508 |
| 118 | 272.23 | 132.46 | 1297 | 1641 | 1828 | 2026 | 2234 | 2451 | 2917 | 3424 | 3971 | 4558 | 5186 | 6564 |
| 120 | 276.84 | 133.57 | 1308 | 1655 | 1844 | 2043 | 2252 | 2472 | 2942 | 3453 | 4004 | 4597 | 5230 | 6619 |
| 122 | 281.45 | 134.69 | 1318 | 1669 | 1859 | 2060 | 2271 | 2493 | 2966 | 3481 | 4038 | 4635 | 5273 | 6674 |
| 124 | 286.07 | 135.79 | 1329 | 1682 | 1874 | 2077 | 2290 | 2513 | 2991 | 3510 | 4070 | 4673 | 5317 | 6729 |
| 126 | 290.68 | 136.88 | 1340 | 1696 | 1889 | 2093 | 2308 | 2533 | 3015 | 3538 | 4103 | 4710 | 5359 | 6783 |
| 128 | 295.30 | 137.96 | 1350 | 1709 | 1904 | 2110 | 2326 | 2553 | 3038 | 3566 | 4136 | 4748 | 5402 | 6836 |
| 130 | 299.91 | 139.03 | 1361 | 1722 | 1919 | 2126 | 2344 | 2573 | 3062 | 3594 | 4168 | 4784 | 5444 | 6890 |
| 132 | 304.52 | 140.10 | 1371 | 1736 | 1934 | 2143 | 2362 | 2593 | 3086 | 3621 | 4200 | 4821 | 5485 | 6942 |
| 134 | 309.14 | 141.16 | 1382 | 1749 | 1948 | 2159 | 2380 | 2612 | 3109 | 3649 | 4231 | 4858 | 5527 | 6995 |
| 136 | 313.75 | 142.21 | 1392 | 1762 | 1963 | 2175 | 2398 | 2632 | 3132 | 3676 | 4263 | 4894 | 5568 | 7047 |

Notes:

(1) This table is computed from the formula $Q = 29.84cd^2\sqrt{p}$ , with c = 1.00. The theoretical discharge of seawater, as from fireboat nozzles, can be found by subtracting 1 percent from the figures in Table 4.10.2.1, or from the formula $Q = 29.84cd^2\sqrt{p}$ .

(2) Appropriate coefficient should be applied where it is read from hydrant outlet. Where more accurate results are required, a coefficient appropriate on the particular nozzle must be selected and applied to the figures of the table. The discharge from circular openings of sizes other than those in the table can readily be computed by applying the principle that quantity discharged under a given head varies as the square of the diameter of the opening.

* This pressure corresponds to velocity head.
† 1 psi = 2.307 ft of water. For pressure in bars, multiply by 0.01.

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## Attachment 7: MRWA Hydrant or Pipe Flush Flow Calculator

GUAM WATERWORKS AUTHORITY
Gloria B. Nelson Public Service Building
688 Route 15
Mangilao, Guam 96913
vpangelinan@guamwaterworks.org

**FIRE HYDRANT FLUSHING AND MAINTENANCE**
**MRWA HYDRANT OR PIPE FLUSH FLOW CALCULATOR**

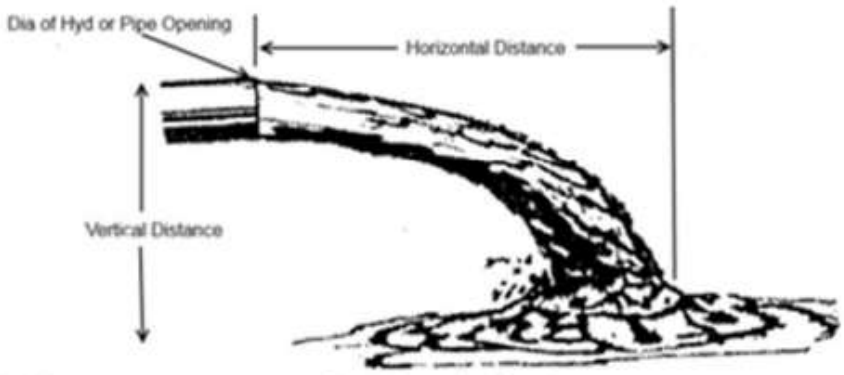
# Hydrant or Pipe Flush Flow Calculator

| | |
|---|---|
| Diameter of Hydrant Nozzle Opening or Pipe (in inches): | 0.0 |
| Horizontal Distance from the end of the Nozzle or Pipe Opening to the upper or outermost edge of the water where it hits the ground (keep ruler or yardstick level, extending out from the upper edge of the nozzle or pipe) (in inches): | 0 |
| Vertical Distance from the top rim of Nozzle or Pipe to the ground (in inches): | 0 |
| **Estimated Flow from this Hydrant or Pipe in gallons per minute (GPM) is: :** | **0.00** |

**This flow translates into the following quantities:**

**0.00 Gal / Hour** **0.00 Gal / Day**

Click Here To Close Window!
Print This Window!




* Keep tape measure level and plumb.

Page 1 of 1

Docusign Envelope ID: DB5D0370-09D2-410C-A688-49E7FAB21041



## Attachment 8: Troubleshooting Checklist for Hydrants

GUAM WATERWORKS AUTHORITY

Gloria B. Nelson Public Service Building
688 Route 15
Mangilao, Guam 96913
vpangelinan@guamwaterworks.org

**FIRE HYDRANT FLUSHING AND MAINTENANCE**
**TROUBLESHOOTING CHECKLIST FOR HYDRANTS**

| CONDITION | PROBABLE CAUSE | REMEDY |
|---|---|---|
| Debris and rubbish | 1. Missing hydrant caps.<br>2. Debris from a Main break.<br>3. Tuberculation. | 1. Place a cap.<br>2-3. Flush hydrant. |
| Cap problems | 1. Loose, ill-fitting and frozen caps.<br>2. Damaged or corroded gaskets or threads. | 1. Replace caps.<br>2. Replace gaskets and clean threads. |
| Vandalism | 1. Graffiti.<br>2. Physical damage done to the hydrant itself. | 1. Schedule paint work.<br>2. Assess and repair as needed. |
| Leaks or damaged pipes | 1. Burst pipes.<br>2. Flange or gasket leaks.<br>3. Corroded nuts and bolts. | 1. Notify SCC to request assistance from the Pressure Line Unit to repair or replace.<br>2-3. Replace parts as needed. |
| Physical obstruction | 1. Abandoned vehicle(s) or object(s).<br>2. Overgrown vegetation | 1. Notify the Manager of the obstruction for further guidance.<br>2. Notify SCC to request assistance from heavy equipment machinery to clear obstruction. |

Page 1 of 1

Docusign Envelope ID: DB5D0370-09D2-410C-A688-49E7FAB21041



## Attachment 9: Employee's Acknowledgement Receipt

GUAM WATERWORKS AUTHORITY

Gloria B. Nelson Public Service Building
688 Route 15
Mangilao, Guam 96913
vpangelinan@guamwaterworks.org

**FIRE HYDRANT FLUSHING AND MAINTENANCE**
**EMPLOYEE'S ACKNOWLEDGMENT RECEIPT**

I, the undersigned, an employee of the Guam Waterworks Authority, hereby acknowledge receipt of SOP-1500-WD-002 entitled "*Fire Hydrant Flushing and Maintenance*" this _____ day of _____, 20____.

| Employee's Name/Badge No.: | Employee's Signature: | Date: |
|---|---|---|
| | | |

Page 1 of 1