REPUBLIC OF THE PHILIPPINES

SAN PABLO CITY WATER DISTRICT

Maharlika Highway, Barangay San Gabriel, San Pablo City 4000
049 562-9955, 049 562-2751

Dedicated to all those who are committed to promoting safe and reliable water systems. May this Water Safety Plan Manual serve as a valuable resource for those who strive to ensure the provision of clean and safe water to communities, now and in the future.

The Water Safety Plan Team

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Division Manager - A, Production Division

Wilfredo M. Aligato
Team Leader, Division Manager - A , General Services Division

Engr. Eleuterio D. Amante
General Manager

Thanks to the guidance and support of the Board of Directors of San Pablo City Water District, the implementation of a comprehensive Water Safety Plan has been a resounding success. By prioritizing the safety and quality of our water supply, we have been able to ensure that our customers have access to clean and reliable water, while also meeting regulatory requirements and maintaining the integrity of our infrastructure. The commitment and leadership of our Board has been instrumental in driving this achievement, and we look forward to continuing to work together to provide the best possible service to our community.

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San Pablo City Water District

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WATER SAFETY PLAN

"MALINIS NA TUBIG SA BAWAT TAHANAN SERBISYONG AMING GAGAMPANAN"

Approved by	:	**SPCWD Board of Directors** **Board Resolution No. _______________**
Approval Date	:	**_______________________**
Copy Furnished	:	**SPCWD BOD** **Office of the General Manager** **Administrative Services Department** **Financial Management Department** **Commercial Services Department** **Technical Services Department** **Operations Department**

WATER SAFETY PLAN

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ABBREVIATIONS

AWWA	American Water Works Association
BAC	Bids and Awards Committee
BFP	Bureau of Fire Protection
COA	Commission on Audit
CREAS	Community Relations and External Affairs Section
CSC	Civil Service Commission
CSD	Commercial Services Division
DBM	Department of Budget and Management
DENR	Department of Natural Resources
DOH	Department of Health
DPWH	Department of Public Works and Highways
EWRD	Environment and Water Resources Division
FMD	Financial Management Department
GIS	Geographical Information System
GSD	General Services Division
LGU	Local Government Unit
LWUA	Local Water Utilities Administration

NEDA	National Economic Development Authority
NWRB	National Water Resources Board
OD	Operations Department
OGM	Office of the General Manager
PNSDW	Philippine National Standard for Drinking Water
PPE	Personal Protective Equipment
PWWA	Philippine Water Works Association
PSA	Philippine Statistic Authority
SOP	Standard Operating Procedure
SPCWD	San Pablo City Water District
TSD	Technical Services Department
TWG	Technical Working Group
UEPA	United States Environmental Protection Agency
WD	Water District
WEAP	Water Environment Association of the Philippines
WHO	World Health Organization
WRFO	Water Resources Facilities Operator
WSP	Water Safety Plan

Document History

This page records the changes made to the document since its inception. Every time a revision is made to the document,

Table 1. Revision History

Revision Number and Date	Sections of the Document
Rev 0. Date (07/14/2023)	Issue of first revision – all sections new
Rev 1. Date (08/16/2023)	(with LWUA 1st Assessment), Modules 4,5,6 and 8.
Rev 2. Date (02/01/2024)	(with LWUA 2nd Assessment), Modules 5.1, 5.2, 6.1, 6.2, 8.1, 8.2, 8.3

Introduction

San Pablo City in the Philippines, located 82 km southeast of Manila, is known for its economy, education, and as Laguna Province's financial center. The San Pablo City Water District provides safe drinking water to over 250,000 residents. The city covers 197 sq km, with 80 interconnected barangays and well-paved roads, making it an attractive destination for visitors and residents alike.

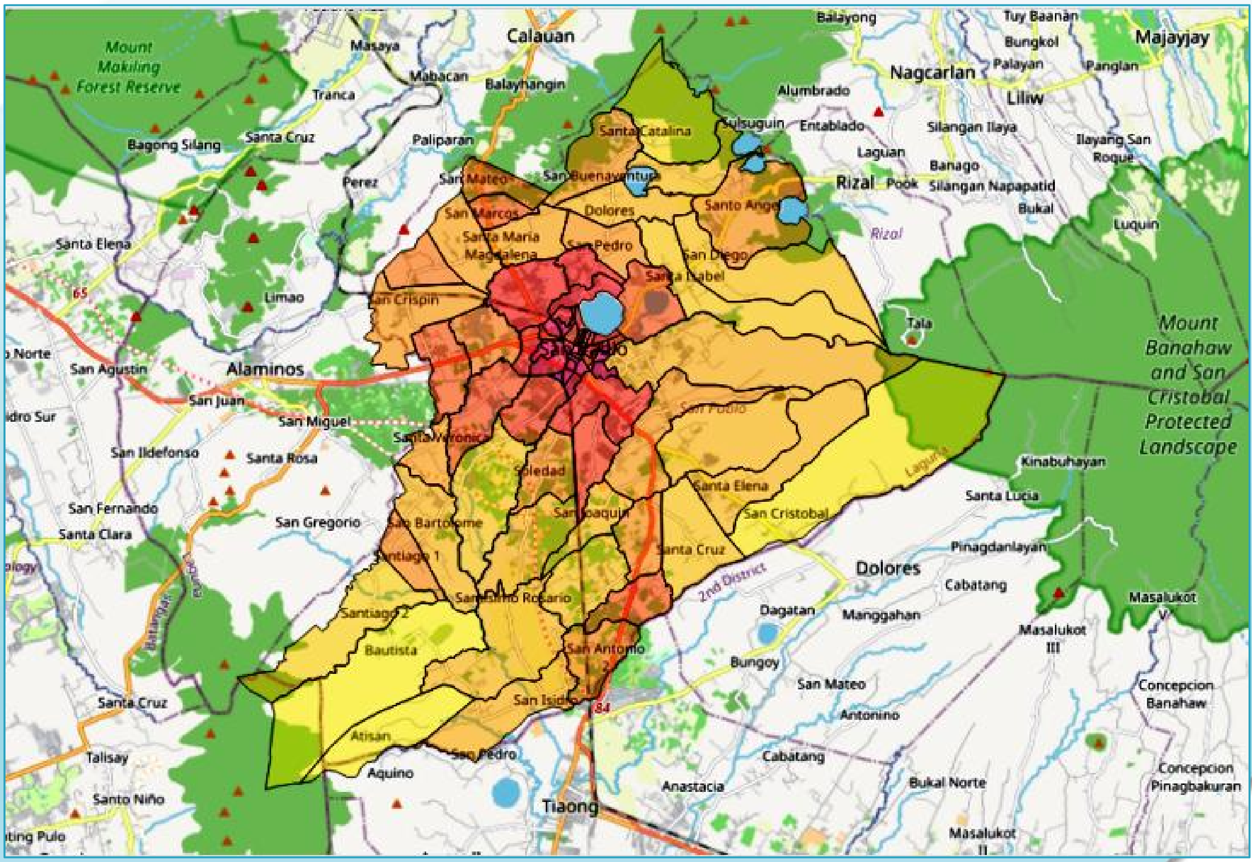


Figure 1. San Pablo City Map

The San Pablo City Water District (SPCWD) has demonstrated its commitment to providing safe and potable drinking water to the public by developing a Water Safety Plan (WSP) in 2021. The plan is based on the methodology of the World Health Organization and the Department of Health, and it provides a proactive and comprehensive risk management framework for reducing water contamination risks.

The WSP covers the entire water supply system, from the source (including watershed/catchments) to the end users. It includes the conveyance system, treatment, pumps, reservoirs, and distribution network. SPCWD has assembled a multidisciplinary team from its various operating units to assess and develop the WSP for its entire system.

The primary objective of the WSP is to ensure that the water supply is safe and potable and complies with the Philippine National Standards for Drinking Water 2017. The plan achieves this by preventing contamination of raw water sources and implementing programs to immediately resolve any contamination occurrences. It also ensures that the final water quality delivered to consumers is routinely monitored, and the water quality results meet the health-based and acceptability standards set by the Department of Health. Additionally, it aims to prevent the re-contamination of treated water during storage, distribution, and handling until the water reaches its customers.

The advantages of the WSP are numerous, including compliance with water quality targets, consistent water quality, application of best practices to ensure water safety at all times, plans in place in case of emergencies, potential savings from prevention of incidents/accidents, improvement of management assets, and customer satisfaction. To ensure the ongoing relevance and effectiveness of the plan, SPCWD will continuously update and refine the WSP to prevent waterborne diseases and reduce hazards. The WSP will provide standards and guidelines for the operational procedures of all divisions involved in production, water treatment system, transmission, distribution, water quality monitoring, maintenance and repair, and watershed management.

The San Pablo City Water District Water Safety Plan is a proactive and comprehensive framework for reducing water contamination risks and ensuring safe and potable drinking water for the concessionaires of SPCWD.

Main risks in the system

San Pablo City Water District is a water utility that provides clean and safe water to the residents of San Pablo City in the Philippines. Like all water utilities, we face various risks in the water system that can compromise the safety and quality of drinking water.

To address these risks, the San Pablo City Water District has identified and assessed the risks associated with our water system. The risks they have identified include source water contamination, treatment failure, distribution system contamination, and human factors. These risks are similar to the risks faced by other water utilities, and they can all pose a risk to public health if not properly managed.

The first risk that the San Pablo City Water District has identified is source water contamination. The source of our water supply may be contaminated with various substances, such as pathogenic microorganisms, chemicals, or other pollutants. To mitigate this risk, they regularly monitor the quality of the source water and implement measures to prevent contamination from agricultural runoff, industrial activities, sewage discharges, and natural sources.

The second risk that they have identified is treatment failure. Treatment processes such as filtration, disinfection, and chemical treatment are designed to remove or destroy contaminants from the water. However, if the treatment process fails, contaminants may remain in the water and pose a risk to public health. To address this risk, the San Pablo City Water District ensures that our treatment equipment is properly maintained, and they conduct regular testing of the water quality to ensure that the treatment process is effective.

The third risk that they have identified is distribution system contamination. Even if water leaving the treatment plant is of good quality, it can become contaminated as it travels through the distribution system. To address this risk, the San Pablo City Water District regularly inspects and maintains our distribution system, and they have implemented measures to prevent backflow and cross-connections that can lead to contamination.

The San Pablo City Water District recognizes the impact of human factors on our water system's risk. Staff training, monitoring, and maintenance protocols are in place to manage these risks effectively. Our priority is to provide high-quality and safe water to our customers, and we are committed to implementing a comprehensive approach to risk management.

Key reference materials for WSP

1) Water Safety Plan Manual, WHO (2006);
2) Water Safety Plan Manual: Step by Step Risk Management for Drinking-Water Supplies, WHO (2009);
3) Philippine National Standards for Drinking Water, DOH (2017);
4) Clean Water Act of 2004 (RA 9725);
5) Drinking Water, United States Environmental Protection Agency (UEPA);
6) American Waterworks Association (AWWA);
7) Chemical Safety of Drinking Water: Assessing Priorities for Risk Management, WHO (2007);
8) Guidelines for Drinking Water Quality 3rd edition, WHO (2008);
9) LWUA Technical Standards;
10) Safe Piped Water: Managing microbial water quality in piped distribution systems, WHO (2006);
11) DOH Administrative Order No. 2014-0027, September 04, 2014

1. The Water Safety Plan Team

The SPCWD WSP (San Pablo City Water District Water Safety Plan) team is a group of individuals from different departments with key responsibilities in the operation and maintenance of the water system. The team is responsible for providing the framework of the plan, including its implementation, and is headed by **Wilfredo M. Aligato,** who holds the position of Division Manager A – General Services Division as shown in our WSP Table of Organization on page 5. Mr. Aligato is given ample authority in the implementation of the plan, which enables him to make necessary changes to ensure that only safe water is produced.

The team is composed of representatives from key divisions, chosen for their knowledge and expertise. The team's composition is multi-disciplinary in skills, assembled from key areas involved in the day-to-day operations of the water system, such as operations, maintenance, design, production, laboratory, and technical staff. This multi-disciplinary approach ensures that the team has a broad range of knowledge and skills to draw upon when formulating the plan. Annex P (pg. 282), shows the newly reconstituted SPCWD Safety Plan Team.

Team members are expected to possess specific qualifications. They should have knowledge of the water supply system and the types of drinking water hazards that could potentially impact the quality of the water produced. Additionally, they should have the authority to implement necessary changes to ensure that only safe water is produced. This authority enables team members to take swift action to address any issues that may arise. Membership in the team is periodically reviewed, and new or replacement members are added when necessary. This approach ensures that the team remains current and effective in its efforts to ensure that only safe water is produced. The SPCWD WSP team is an essential component of the San Pablo City Water District's efforts to provide safe drinking water to its customers. The team's multi-disciplinary approach and the qualifications expected of its members enable it to address any issues that may arise quickly. Additionally, the team's periodic review ensures that it remains current and effective in its efforts to provide safe drinking water.

The recently formed SPCWD WSP team convened a series of meetings at the SPCWD Regional Training Center, as indicated in the notices of meeting in Annex Q (pg. 283 - 286) and minutes of meeting found in Annex R (pg. 287 - 288). During these meetings, the team focused on enhancing the manual and protocols, among other important topics. These discussions aimed to improve the overall operations and effectiveness of the team.

SPCWD WATER SAFETY COMMITTEE ORGANOGRAM

Figure 2. SPCWD WSP Committee
Table of Organization

1.1 WSP Team Members, Roles and Responsibilities

- Team leader drives the project and ensure focus, exercise the authority, organizational and interpersonal skills to implement the project.
- The team defines the scope and design of the WSP and identify which part of the water chain is particularly vulnerable, and the classes of the hazards to be addressed.
- The team shall explore opportunities to gather relevant knowledge and technology such as bench marking and external support from other organizations, research and international assistance programs.
- Ensure that corrective actions are fully implemented as soon as a breach in drinking water quality is detected.
- Ensure an open communication with the management and provide up-to-date information as to water quality status and program that will affect operations related to water quality and safety.
- The team shall ensure that all aspect of the WSP will be effectively implemented and keep updated to assure relevance and prompt solution in emergency situations.

Table 2. SPCWD WSP Team Members

NAME	DEPARTMENT	JOB TITLE	CONTACT NUMBER
Wilfredo M. Aligato	Administrative Services Department	Division Manager A - General Services Division	**0917 633 5278**
Jonnas Firmo C. Biscocho	Technical Services Department	Senior Water Utilities Management Officer - A	**0917 630 4302**
Ma. Jamela V. Dimapilis	Technical Services Dept	Senior Chemist	**0906 024 5054**
Mildred D. Velasco	Financial Management	Chief Corporate Accountant - B	**0919 999 0663**
Wilson M. Awayan	Operations Department	Division Manager - A Production Division	**0929 952 3435**
Hazel S. Geronimo	Technical Services Dept	Principal Engineer C	**0917 861 4293**
Arvin B. Gutierrez	Administrative Services Department	General Services Chief - B	**0928 521 6806**
Leighann Claudia F. Jones	Technical Services Dept	Laboratory Technician - C	**0965 573 8221**
Gilbert M. Velasco	Operations Department	Principal Engineer C	**0923 733 7729**
Ferdinand H. Bondad	Commercial Services Department	Supervising Customer Service Officer	**0920 360 6376**
Rodrigo A. Estalilla	Technical Services Dept	Supervising Instrument Technician	**0939 802 9226**
Jomello Angelo N. Munoz	Technical Services Dept	Senior Engineer A	**0915 3441 366**
Cherry Mae C. Cimatu	Commercial Services Department	Senior Community Relations Officer	**0998 561 7161**
Peter Gerard B. Dianquinay	Technical Services Dept	Engineering Assistant A	**0932 728 8284**

1.2 Desirable Skills Needed to Complete a WSP Team

It is important to note that a Water Safety Program (WSP) team should not only possess these skills but should also continuously develop them to ensure that they remain effective in their roles. The team members must stay up-to-date with the latest safety regulations and protocols and adapt to new challenges and emerging risks to ensure the safety of all stakeholders. Table 3 gives more descriptive meaning of expertise rating.

Moreover, it is vital to establish a robust training program to ensure that all team members possess the necessary skills and knowledge to execute their roles effectively. The training program should cover all aspects of water safety, including hazard identification, risk assessment, emergency response, and communication protocols.

A successful Water Safety Plan (WSP) requires a team of skilled and dedicated individuals who possess effective communication skills, problem-solving abilities, a thorough understanding of safety regulations and protocols, attention to detail and critical thinking skills, teamwork, and collaboration. By continuously developing these skills and establishing a robust training program, the WSP team can ensure the safety and well-being of all stakeholders, thereby creating a productive and successful workplace.

Table 3. Desirable Skills Needed to Complete a WSP Team

Descriptive Meaning of Expertise Rating								
1	Technical expertise on operation and maintenance of		**2**	Provide operational support for the WSP in terms of		**3**	Capable of communicating the WSP objectives and outcomes	
	a	Source		a	Administrative		a	Inside the WD
	b	Storage		b	Financing		b	Outside the WD
	c	Treatment		c	Technical			
	d	Distribution						
4	Understand water quality targets to be met					**9**	Other Team Members	
5	Understand the impact of proposed water quality controls on the environment						a	Resource Persons
6	Knows the regulation						b	Coordinator
7	Familiar with training and awareness programmes						c	Secretariat
8	With authority						d	Documentation Committee/Staff

Table 4. Role in WSP Team

Water Safety Plan Team Composition																				
Name	Job Title	Role in the WSP Team	Expertise																	
			1				2			3		4	5	6	7	8	9			
			a	b	c	d	a	b	c	a	b						a	b	c	d
Wilfredo M. Aligato	Division Manager A - General Services Division	Team Leader																		
Jonnas Firmo C. Biscocho	Senior Water Utilities Management Officer - A	Source Management																		
Ma. Jamela V. Dimapilis	Senior Chemist	Water Quality Verification Monitoring																		
Leighann Claudia F. Jones	Laboratory Technician - C	Water Quality Verification Monitoring																		
Arvin B. Gutierrez	General Services Chief - B	Administrative Management																		
Hazel S. Geronimo	Principal Engineer C	Design of Source Facilities																		
Mildred D. Velasco	Chief Corporate Accountant B	Financial/Budget Management																		
Wilson M. Awayan	Division Manager A - Production Division	Distribution System Management																		
Gilbert M. Velasco	Principal Engineer C	Distribution System Management																		
Ferdinand A. Bondad	Supervising Customer Service Officer	Service Connection Management																		
Rodrigo A. Estalilla Jr.	Supervising Instrument Technician	Electrical & Chlorination Maintenance																		
Jomello Angelo N. Munoz	Senior Engineer A	Secretariat / Facilities Construction Management																		
Peter Gerard B. Diangkinay	Engineering Assistant A	Secretariat / Data Monitoring																		
Cherry Mae C. Cimatu	Public Relations Assistant B	Secretariat / Customer Satisfaction																		

In SPCWD Water Safety Plan (WSP), every member is assigned specific tasks to ensure the plan's successful implementation and maintenance. This assignment of tasks serves several purposes. Firstly, it promotes accountability and ownership as each member is responsible for their designated tasks. Secondly, it enables a division of responsibilities, ensuring that all aspects of the plan are adequately addressed. Additionally, tasks are assigned based on the specialized knowledge and skills of each member, maximizing their expertise. This approach facilitates coordination and collaboration among team members, preventing duplication of efforts and ensuring effective communication. Lastly, by assigning tasks, the WSP takes a comprehensive approach, covering all necessary components such as risk assessment, monitoring, record-keeping, and emergency response planning.

Table 5. WSP Members' Tasks Description

Name / Job Title	Role in WSP	Tasks Descriptions
Wilfredo M. Aligato Division Manager A General Services Division ***wma877@gmail.com***	**Team Leader**	❖ Provide leadership and guidance to team members, fostering a collaborative and productive work environment. ❖ Oversee the development, implementation, and review of the Water Safety Plan in compliance with relevant regulations, standards, and guidelines. ❖ Coordinate with team members to ensure effective monitoring and evaluation of risk reduction measures and update risk assessments accordingly.
Jonnas Firmo C. Biscocho Senior Water Utilities Management Officer A Environment and Water Resources Division ***jonnasfirmobiscocho@gmail.com***	**Source Management**	❖ Oversee the implementation of source water monitoring programs to ensure compliance with regulatory requirements and early detection of any water quality issues. ❖ Develop and implement source protection plans, including land use regulations, buffer zones, and source water treatment strategies. ❖ Develop and implement emergency response plans specifically addressing potential source water contamination incidents or disruptions.

Ma. Jamela V. Dimapilis Senior Chemist Environment and Water Resources Division ***ma.jameladimapilis@gmail.com***	**Water Quality Verification Monitoring**	❖ Facilitate the development and implementation of risk management strategies and control measures to mitigate identified risks. ❖ Lead the team in conducting comprehensive risk assessments to identify potential hazards and vulnerabilities within the water system. ❖ Conduct advanced chemical analyses of water samples collected from various points within the water system, including source water, treatment processes, and distribution network.
Leighann Claudia F. Jones Laboratory Technician C Environment and Water Resources Division ***leighannjones0106@gmail.com***	**Water Quality Verification Monitoring**	❖ Collect water samples from various points within the water system according to established sampling protocols and schedules. ❖ Perform routine water quality tests and analyses using standard laboratory equipment and techniques. ❖ Maintain and organize laboratory records, including sample inventory, equipment logs, and maintenance schedules.
Arvin B. Gutierrez General Services Chief B General Services Division ***spcwdgsd122@gmail.com***	**Administrative Management**	❖ Manage inventory levels and procurement of materials, chemicals, spare parts, and supplies required for the operation and maintenance of the water system. ❖ Develop and enforce safety protocols and procedures to minimize occupational hazards and promote a safe working environment for employees and contractors. ❖ Coordinate with relevant departments to develop emergency response plans and ensure preparedness for incidents or disasters affecting the water system.

Engr. Hazel S. Geronimo Principal Engineer C Technical Services Department ***hazel_1stofmarch@yahoo.com***	**Design of Source Facilities**	❖ Lead the design and engineering activities for source water facilities, including intake structures, pumping stations, wells, reservoirs, and other infrastructure required for water abstraction. ❖ Develop detailed engineering designs, specifications, and drawings for source infrastructure, ensuring compliance with regulatory standards, safety guidelines, and industry best practices. ❖ Collaborate with stakeholders, including internal departments, community representatives, and government agencies, to gather input, address concerns, and incorporate feedback into the design process.
Mildred D. Velasco Chief Corporate Accountant B General Accounting Division ***mad.yinn@gmail.com***	**Financial & Budget Management**	❖ Lead the annual budgeting process, working closely with department heads to develop realistic budgets aligned with strategic objectives. ❖ Oversee the financial management activities of the water district, including budgeting, financial planning, and forecasting. ❖ Ensure compliance with accounting standards, regulatory requirements, and internal control policies within the water district.
Engr. Wilson M. Awayan Division Manager A Production Division ***awayanwilson@yahoo.com***	**Distribution System Management**	❖ Oversee the operation and maintenance of the water distribution system, including pipelines, valves, pumps, meters, and related infrastructure. ❖ Develop and implement standard operating procedures (SOPs) for routine operation and maintenance activities, ensuring compliance with regulatory requirements and best practices. ❖ Implement asset management strategies, including condition assessment, prioritized maintenance, and infrastructure replacement plans, to ensure the long-term reliability of the distribution system.

Engr. Gilbert M. Velasco Principal Engineer C Operations Department ***v_coy16@hotmail.com***	**Distribution System Management**	❖ Develop and implement strategies to manage and reduce water losses within the distribution system, including non-revenue water (NRW) and physical losses. ❖ Monitor and analyze water consumption data, flow measurements, and pressure profiles to identify areas of high water loss and prioritize leak detection and repair efforts. ❖ Implement leak detection programs and technologies, such as acoustic sensors, pressure monitoring, and data analysis tools, to identify and locate leaks efficiently.
Ferdinand A. Bondad Supervising Customer Service Officer Commercial Services Department ***ferdinandbondad@yahoo.com***	**Service Connection Management**	❖ Receive and review service connection applications from customers or developers seeking new or modified water connections. ❖ Evaluate applications for compliance with regulatory requirements, technical standards, and water district policies. ❖ Coordinate with field teams and contractors to schedule and oversee the installation of service connections, meters, and associated infrastructure.
Rodrigo A. Estalilla, Jr. Supervising Instrument Electrician Production Division	**Electrical and Chlorination Maintenance System**	❖ Supervise the maintenance, repair, and calibration activities for instrumentation systems used in water treatment, distribution, and monitoring processes. ❖ Conduct a comprehensive inspection of the electrical system components, including power supply units, control panels, circuit breakers, switches, and wiring. ❖ Maintain a comprehensive inventory of electrical and chlorination system equipment, including make, model, and installation date.

Engr. Jomello Angelo N.Munoz Senior Engineer A Technical Services Dept.	**Secretariat and Facilities Construction Management**	❖ Establish communication channels and platforms to facilitate effective information sharing among team members and external stakeholders. ❖ Develop a comprehensive project management plan for each construction project, outlining project objectives, scope, timelines, and resource allocation. ❖ Implement effective change management processes to address any modifications, variations, or scope changes during the construction projects.
Peter Gerard B. Dianquinay Engineering Assistant Environment Water Resources Division ***pgdianquinay@gmail.com***	**Secretariat and Data Monitoring**	❖ Assist in collecting relevant data related to the water supply system, including water sources, treatment processes, distribution networks, and consumer information. ❖ Compile and organize collected data in a structured manner for further analysis and evaluation. ❖ Assist in conducting data analysis to identify potential risks, vulnerabilities, and critical control points within the water supply system.
Cherry Mae C. Cimatu Public Relation Assistant B Office of the General Manager ***creas@spcwd.or.ph***	**Secretariat and Customer Satisfaction**	❖ Collaborate with the WSP team to develop a comprehensive communication strategy aimed at engaging and informing water consumers. ❖ Provide stakeholders with relevant information and resources to support their understanding and participation in the WSP and related activities. ❖ Develop educational materials, brochures, and info-graphics that explain the WSP goals, water treatment processes, and steps taken to ensure water quality.

1.3 Stakeholders' Identification and Interaction

Stakeholders play an important role in effective risk management, albeit indirectly. The Water District acknowledges that controlling potential contaminants from point and non-point sources, resulting from human activity, requires the cooperation of stakeholders through strict implementation of regulatory requirements in sanitation, sewerage, and environmental compliance. Therefore, the Water Safety Plan (WSP) strives to comply with all regulatory requirements related to effective water quality management and the protection of the environment as the source of the drinking water supply.

Recognizing consumers as its primary stakeholders, SPCWD has implemented community-based activities aimed at encouraging participation in maintaining a clean and green environment at the barangay level. These activities include information dissemination and dialogues that create open communication between the Water District and its consumers. In addition to these community-based activities, the Water District also engages with other stakeholders, such as government agencies, non-governmental organizations, and the private sector, to ensure effective risk management. Collaborative efforts are necessary to implement effective water quality management strategies, such as watershed protection, monitoring, and treatment.

Table 6. Relationships to Drinking Water Issues

[1]Suggested Types of Relationship to Drinking Water Supply Issues:	[3]Interaction Mechanism Precedes entries with "E" for existing and "P" for Proposed Point of Contact from WD/WSP Team and Stakeholder
A - Effluent Contributor (source of contamination)	
B - Regulator	
C - Source of Information / Monitoring Entity	
D - Supplier / Contractor	Examples:
E - Policy Maker / Legislator	*E - WD:PIO/SH:Farmer's Coop Head*
F - Police Authority	*P - WD:Lab Aide/SH:Sanitary Inspector*
G - Gross Concern Entity	

The WSP also recognizes the importance of building and maintaining public trust through transparency and accountability. Thus, the Water District regularly conducts public consultations and disseminates information on water quality monitoring results and other relevant updates. Overall, effective risk management requires the cooperation and involvement of stakeholders. By engaging with stakeholders and complying with regulatory requirements, the Water District is committed to providing safe and reliable drinking water to the community.

Table 7. Stakeholders' Identification and Interaction

Stakeholders					
Name	**Relationship to Drinking Water Supply Issues[1]**	**Point of Contact with WD/WSP Team[2]**	**Issues with Drinking Water Supply**	**Interaction mechanism[3]**	**Record of Interaction**
Barangay Officials	A, G	Management and Staff	Projects implementation / Water quality	Meetings	Minutes of meetings
Bulk Water Supplier	D	BOD and Management	Quality and Quantity Supplied	Reporting	Reports
Local Government Unit	F	BOD and Management	Official appointments Projects coordination	Meetings	Reports
COA	B, E	Regulatory Monitoring	Projects implementation	Audit Observation Memorandums	Reports, Memorandum Circulars
CSC	B, E	Regulatory Monitoring	Employees Qualification Standards	Reporting	Memorandum Circulars
DBM	B, E	Regulatory Monitoring	Employees Salaries, Wages and Benefits	Reporting	Memorandum Circulars
DENR	B,C, E, F	Regulatory Monitoring	Effluent Quality	Reporting	Reports
Department of Public Works and Highways	G	Project/Leak Repair coordination	Damage to Water supply system	Coordination Meeting	Minutes of meetings
DOH	B, E	Monitoring	Water Quality	Reporting	Reports and Memo Circulars
Farmers upstream of river intake	A	E - WD:PIO/ SH:Farmers' Coop Head	Pesticide runoff to river during onset of rainy season	Meeting with Farmers' Coop	Meetings of meeting Attendance sheet
Households near Pump Stations	A	Coordination Meeting	Supply Quality and Quantity	Meeting	Minutes of meetings
LWUA	B, C, E	Regulatory Monitoring	Policies, Regulations	Meetings, Conferences, Reports	Memorandum Circulars, Resolutions
Meralco/Telecom	D	Supplier/GSD	Quality of Services	Bills and Notices	Bills Payment
NWRB	B, F	Regulatory	Water Extraction	Water Application	Water extraction report
San Pablo City Health Office	B, E	Monitoring	Compliance with microbiological, physical, and chemical quality of drinking water supplied	Reporting	Monthly (Microbiological) and Yearly (Physical and Chemical) Reports
Southern Tagalog Water District Association	B, C, E	BOD, Management and Staff	Knowledge Sharing and Updates	Meetings, Conferences and others	Certificate of Appearance
Suppliers/ Contractors	D	E: SPCWD-BAC-TWG /Supplier: Officers	Quality of Products supplied	Pre-bid, Opening of bids	Minutes of meetings, letters and BID Documents

The Water Safety Plan (WSP) involves the collaboration and coordination of various stakeholders to ensure the safe and reliable supply of water to the community. We can explore the relationships and roles of the stakeholders on Table 7 (pg. 15) mentioned:

a) **Barangay Officials**: Barangay officials play a crucial role in promoting water safety and disseminating information about the WSP within their respective communities. They can facilitate awareness campaigns, encourage community participation, and serve as a bridge between the community and the San Pablo City Water District.

b) **Bulk Water Supplier**: The bulk water supplier is responsible for sourcing and supplying water to the water district. They play a significant role in maintaining the quality and quantity of water supply, adhering to the standards and requirements outlined in the WSP.

c) **Local Government Unit (LGU)**: The LGU oversees the successful implementation of the WSP within their jurisdiction. They work closely with water district, regulatory agencies, and other stakeholders to ensure compliance, allocate resources, and address any issues related to water safety.

d) **Commission on Audit (COA)**: COA is responsible for conducting audits and ensuring financial accountability in the implementation of the WSP. They provide oversight and assessment of the financial aspects of water safety initiatives and the efficient use of resources.

e) **Civil Service Commission (CSC)**: CSC establishes and monitors the guidelines for personnel management and ensures the competency and integrity of individuals involved in implementing the WSP. They may provide regulations and standards for the recruitment, training, and performance evaluation of water service personnel.

f) **Department of Budget and Management (DBM)**: DBM plays a vital role in allocating and approval of position items for Water District. They work closely with the water service providers to ensure adequate implementation of the WSP.

g) **Department of Environment and Natural Resources (DENR)**: DENR provides regulatory oversight and guidance on environmental aspects related to watershed. They enforce environmental laws and regulations, monitor water quality, and promote sustainable practices in water management.

h) **Department of Public Works and Highways (DPWH)**: DPWH is involved in the construction, maintenance, and improvement of access road infrastructure. They collaborate with water service providers to ensure the proper design and construction of water supply facilities, such as pipelines, reservoirs, and pumping stations.

i) **Department of Health (DOH)**: DOH is responsible for monitoring and promoting public health, including water quality and safety. They provide guidelines and standards for water treatment, disinfection, and distribution, ensuring that the WSP aligns with public health regulations.

j) **Farmers upstream of river intake**: Farmers play a role in ensuring the quality of water sources by practicing responsible agricultural practices. They are encouraged to minimize the use of chemicals and adopt sustainable farming methods to prevent contamination of water bodies.

k) **Households near Pump Stations**: Households near pump stations are important stakeholders as they receive direct water supply. They need to be informed about the WSP, including water safety practices, reporting mechanisms for incidents, and their role in maintaining the integrity of the water supply system.

l) **Local Water Utilities Administration (LWUA)**: LWUA provides technical assistance and guidance to water districts in implementing the WSP. They support the development and enhancement of water infrastructure, capacity building initiatives, and the improvement of service delivery to ensure water safety.

m) **Meralco/Telecom**: Meralco and telecommunication companies play a role in providing uninterrupted power supply and communication services to water service providers. Their cooperation ensures the continuous operation and monitoring of water supply systems, especially during emergencies or disruptions.

n) **National Water Resources Board (NWRB)**: NWRB is responsible for water resource management and regulation. They ensure the sustainable allocation and utilization of water resources, considering the needs of various stakeholders while maintaining water security and safety.

o) **San Pablo City Health Office**: The San Pablo City Health Office works closely with the water service providers to monitor water quality, conduct health assessments, and respond to any water-related health issues. They provide guidance and collaborate on initiatives to improve water safety.

p) **Southern Tagalog Water District Association**: The association serves as a platform for water districts in the Southern Tagalog region to share experiences, best practices, and technical knowledge related to water safety. They collaborate on regional initiatives and advocate for collective water safety efforts.

q) **Suppliers/Contractors**: Suppliers and contractors are involved in the provision of equipment, materials, and services necessary for the implementation of the WSP. They contribute to the development and maintenance of water infrastructure and systems, ensuring compliance with safety standards.

The relationships among these stakeholders in the WSP are characterized by collaboration, communication, and the sharing of responsibilities. By working together, we ensure the effective implementation of the WSP, adherence to regulatory standards, and the delivery of safe and reliable water supply to the community.

2. Water Supply System

2.1 General Information on the System

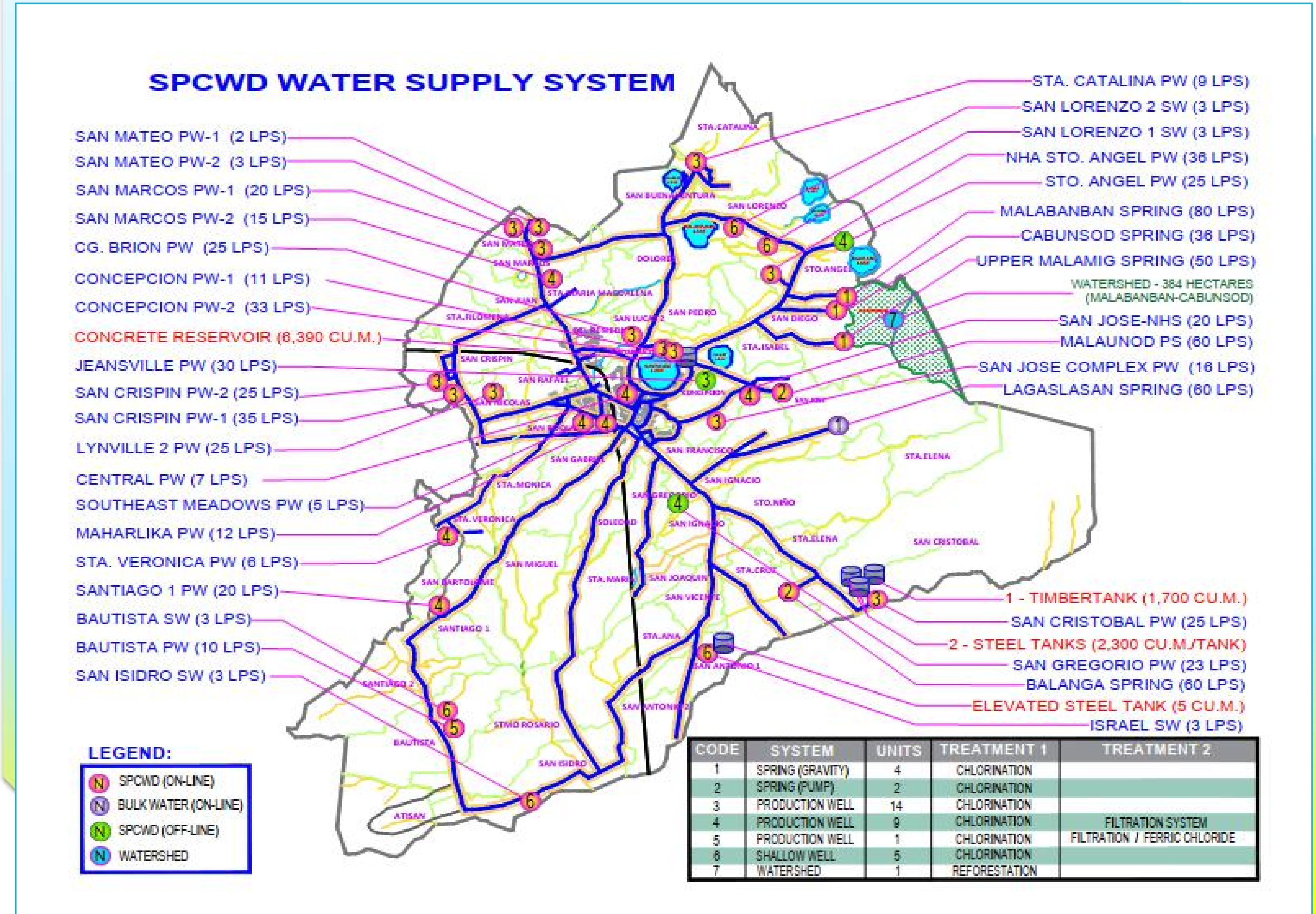
Name of Supplier:	SAN PABLO CITY WATER DISTRICT
Business Address:	Maharlika Hi-way, Brgy. San Gabriel, San Pablo City 4000
Contact No.	(049) 562 - 2751, (049) 562 - 9955
Email Address:	spcwd_ogm@yahoo.com, ogm@spcwd.org.ph
Website:	https://www.spcwd.org.ph
Contact Person	**Engr. Eleuterio D. Amante**
Location of the system	
Province	Laguna
Municipality	San Pablo City

2.2 Source of Water: Catchment and Extraction from Source

The San Pablo City Water District (SPCWD) has been supplying water to its customers through a combination of six springs and twenty-nine production wells. Together, these sources have a total monthly rated production capacity of 2,037,312 cubic meters. In response to the growing demand for water, the SPCWD has added nine new wells to its existing sources, with the latest one added in 2022. These additions have increased the district's production capacity, ensuring that customers have access to a reliable and sustainable water supply.

The SPCWD has heavily invested in infrastructure and technology to reduce instances of low water pressure. The efficient distribution system and advanced water treatment process meet or exceed national standards. Regular monitoring and testing of water sources ensure the safety and quality of the supplied water. Additionally, the SPCWD has implemented initiatives to promote water conservation and responsible usage, including awareness campaigns, education programs, and a water tariff system that encourages customers to use water responsibly. The district remains dedicated to exploring innovative solutions for long-term sustainability and providing excellent service. Recognizing the crucial role of reliable and sustainable water supply in community health and economic development, the SPCWD continues to work towards achieving this goal. Figure 3 (page 19) provides a graphical image of SPCWD Water Supply System.

Figure 3. SPCWD Water Supply System Layout



CODE	SYSTEM	UNITS	TREATMENT 1	TREATMENT 2
1	SPRING (GRAVITY)	4	CHLORINATION	
2	SPRING (PUMP)	2	CHLORINATION	
3	PRODUCTION WELL	14	CHLORINATION	
4	PRODUCTION WELL	9	CHLORINATION	FILTRATION SYSTEM
5	PRODUCTION WELL	1	CHLORINATION	FILTRATION / FERRIC CHLORIDE
6	SHALLOW WELL	5	CHLORINATION	
7	WATERSHED	1	REFORESTATION	

Table 8. Total Production (in cubic meters) in 2022.

SOURCES		Elev (m)	LOCATION (Barangay)	YEAR CONSTRUCTED	Ave. Capacity (lps)	2022 PRODUCTION (cu.m.)	Ave. Monthly Production (cu.m.)
No	Springs Sources						
01	Balanga *P	93	Sta Elena	1996	53	1,688,063	140,672
02	Cabunsod	200	Sto. Angel	1915	36	1,155,418	96,285
03	Lagaslasan-Bulk Supply	275	San Ignacio	2008	41	1,308,223	109,019
04	Malabanban	184	Sto Angel	1960	86	2,725,015	227,085
05	Upper Malamig	185	San Diego	1986	54	1,726,487	143,874
06	Malaunod *P	126	San Jose	1978	66	2,077,546	173,129
	Sub-total					10,680,752	890,064
No	Production Wells (depth_m)						
01	Bautista *F	150	Bautista	2021	11	130,169	10,847
02	Bautista SW	48	Bautista	2019	3	50,706	4,226
03	C.G. Brion	150	San Lucas	2021	21	525,026	43,752
04	Central PW *F	150	Brgy. VI-A	1998	7.5	134,602	11,217
05	Concepcion - PW1	249	Concepcion	2006	12.5	400,455	33,371
06	Concepcion - PW2	150	Concepcion	2019	31	979,828	81,652
07	Israel PW	20	San Antonio I	2001	3	95,404	7,950
08	Jeansville-Sabang	150	Concepcion	2020	29	327,832	27,319
09	Lynville 2	300	San Nicolas	2020	24	748,817	62,401
10	Maharlika PW *F	150	San Gabriel	1998	12	372,094	31,008
11	San Crispin - PW1	150	San Crispin	2014	37	1,190,220	99,185
12	San Crispin - PW2	150	San Crispin	2020	26	407,970	33,998
13	San Cristobal	150	San Cristobal	2005	28	707,910	58,993
15	San Gregorio *F	150	San Gregorio	2022	22	77,900	6,492
14	San Isidro SW *F	48	San Isidro	2019	3	27,864	2,322
16	San Jose-Complex *F	42	San Jose	2019	16	262,890	21,908
17	San Jose-NHS *F	150	San Jose	2021	20	139,811	11,651
18	San Lorenzo SW1	48	San Lorenzo	2019	3	114,068	9,506
19	San Lorenzo SW2	48	San Lorenzo	2019	3	96,537	8,045
21	San Marcos - PW2 *F	150	San Marcos	2005	14	321,736	26,811
20	San Marcos -PW1	150	San Marcos	1997	20	602,564	50,214
22	San Mateo - PW1	102	San Mateo	1996	2	63,194	5,266
23	San Mateo - PW2	96	San Mateo	2019	3	94,856	7,905
24	Santiago-1 *F	150	Santiago-1	2021	20	381,608	31,801
25	SouthEast Meadows *F	92	San Roque	2020	5	157,751	13,146
26	Sta. Catalina	12	Sta. Catalina	1976	8	197,020	16,418
27	Sta. Veronica *F	150	Sta. Veronica	2006	9	232,780	19,398
28	Sto. Angel - PW1 *F	150	Sto. Angel-Biuyan	1998	20	0	0
29	Sto. Angel - PW2	150	Sto. Angel-NHA	2020	36	946,410	78,868
	Note: *F Filtration System, *P Spring with Pump			Sub-total	785	9,788,022	815,670
35	TOTAL					20,468,77	1,705,73

A Beacon of Sustainable and Quality Water Supply

The San Pablo City Water District (SPCWD) stands as a testament to strategic foresight and commitment to excellence, with its diverse and well-thought-out water sources serving the community. Sourcing from an intricate mix of six springs and twenty-nine production wells, the SPCWD ensures that every drop supplied is not just abundant but also of the highest quality.

Diverse Sources for Reliable Supply

- **Springs:** Our springs, each with its unique history and location, play a pivotal role. The Balanga spring in Barangay Sta. Elena (1996), the century-old Cabunsod in Barangay Sto. Angel (1915), Lagaslasan-Bulk Supply in Barangay San Ignacio (2008), Malabanban in Barangay Sto. Angel (1960), Malamig in Barangay San Diego (1986), and Malaunod in Barangay San Jose (1978), together yield a robust monthly average of 890,064 cubic meters.

- **Production Wells**: The network of wells, from Bautista to Sto. Angel - PW2, each possessing unique geological and operational specifications, bolster our supply. The combined monthly contribution from these wells stands at an impressive 815,670 cubic meters, detailed comprehensively in Table 8 (pg. 20).

The synergy between the springs and wells pushes our total monthly rated production capacity to a whopping 2,037,312 cubic meters. We've judiciously expanded this capacity over time, with newer wells commissioned to cater to the burgeoning water demand in San Pablo City.

Unwavering Commitment to Water Quality

Quality is non-negotiable at SPCWD. Our water treatment methodologies are avant-garde, always staying a step ahead of national benchmarks. Constant vigilance is maintained through routine monitoring and testing, ensuring each water parameter - be it microbiological, physical, or chemical - stands up to stringent quality standards. To ensure the safety and quality of the water supplied to customers, the SPCWD has implemented an advanced water treatment process that exceeds national standards. Regular monitoring and testing of the water sources are conducted to detect any potential contamination and ensure that the water meets the required microbiological, physical, and chemical quality standards.

The SPCWD is committed to the sustainable management of its water supply and has implemented various initiatives to promote water conservation and responsible water use among its customers. These include public awareness campaigns, water conservation education programs, and the implementation of a water tariff system that encourages responsible water consumption.

Table 9. SPCWD Summary Information

SPCWD SUMMARY INFORMATION As of Dec 31, 2022				
ITEM		CAPACITY	VALUE	UNIT
Service Area			197	sq. km.
Water Sources				
Ground Water Systems		1,705,734 cu.m./ mo.	100.00	%
Spring Sources	5	781,045 cu.m./ mo.	45.79	%
Production Wells	29	815,670 cu.m./ mo.	47.82	%
Bulk Supply (Springs)	1	109,019 cu.m./ mo.	6.39	%
Total Number of Reservoirs			5	units
Concrete Tank		6,390 cu.m.	1	unit
Ground Steel Tanks		2,300 cu.m.	2	units
Timber Tanks		1,700 cu.m.	1	unit
Elevated Steel Tank		5 cu.m.	1	unit

Groundwater systems play a significant role in the SPCWD's water supply, accounting for 1,705,734 cubic meters per month, representing 100% of the total volume. Within the groundwater sources, springs contribute substantially, providing 781,045 cubic meters per month, which accounts for 45.79% of the total volume. To ensure an adequate water supply in areas where spring water is not available, the SPCWD has constructed 29 production wells. These wells yield 815,670 cubic meters per month, comprising 47.82% of the total volume. Additionally, a bulk supply from springs contributes 109,019 cubic meters per month, equivalent to 6.39% of the total volume at the above table.

The SPCWD manages its water supply through a network of reservoirs, consisting of five units in total. These reservoirs have varying capacities and are essential for maintaining a consistent water supply to the service area. The infrastructure includes a concrete tank with a capacity of 6,390 cubic meters, two ground steel tanks with capacities of 2,300 cubic meters each, a timber tank with a capacity of 1,700 cubic meters, and an elevated steel tank with a capacity of 5 cubic meters. These facilities enable the SPCWD to provide reliable water services to its constituents in San Pablo City. Regular monitoring of water levels in wells and reservoirs is conducted to ensure efficient usage and prevent over exploitation.

SPCWD recognizes the importance of meeting the growing demand for water. In line with this, the district continues to explore the feasibility of additional groundwater sources and surface water supply. By taking a proactive approach to water management and pursuing innovative solutions, the SPCWD aims to meet the needs of its constituents in a sustainable and equitable manner, securing a reliable water supply for the future.

2.2.1 Alternative Water Source

In February 2005, the San Pablo City Water District (SPCWD) initiated an extensive public information campaign to communicate its intention of securing a bulk water supply agreement with a private contractor. This comprehensive effort involved conducting presentations to various sectors, with the aim of gaining support and soliciting feedback from stakeholders.

Following a rigorous bidding process, the contract for the Lagaslasan water facility was awarded to SIG Construction and Industrial Corporation on May 31, 2006. Construction commenced on July 14 of the same year. The implementation of this project resulted in an additional 5,000 cubic meters per day of water supply from the springs by 2008. This expansion provided much-needed relief to areas experiencing low water pressure or no water conditions.

In its continued commitment to ensure a reliable and sustainable water supply, the SPCWD is actively exploring additional spring sources and considering the construction of additional production wells within its service area. Furthermore, the agency is studying the feasibility of incorporating surface water supply as a means of augmenting the existing water resources.

Through these initiatives, the SPCWD aims to strengthen its capacity to meet the increasing demand for water and address the urgent needs of communities grappling with water scarcity. The agency remains dedicated to pursuing innovative solutions and working closely with its stakeholders to ensure the long-term viability of its water supply infrastructure.

2.3 Flow Diagram

A process flow diagram is an essential tool for identifying and analyzing the water supply system from its source to the end consumer. It provides a comprehensive overview of the entire process, highlighting the various stages involved in the treatment, storage, and distribution of water. Table 10 (pg. 24) provides the process flow diagram legend to be used.

The WSP team found flow diagrams to be particularly helpful in understanding the water supply system and used them extensively during the development process. The schematic diagram presented a detailed description of the groundwater sources, treatment processes, and monitoring of critical control points. It also illustrated the storage facilities, chemical addition points, and directional arrows to indicate the flow of water through the distribution system.

Table 10. Process Flow Diagram Legend

LEGEND		
NO	DESCRIPTIONS	SYMBOL
1	CATCHMENT, STORAGE, SOURCE, FACILITY	
2	CHEMICAL PROCESS, TREATMENT	
3	OPERATION (PUMP/FILTRATION)	
4	TRANSPORT, DISTRIBUTION NETWORK	
5	CONSUMERS, CONCESSIONAIRES	
6	VERIFICATION, MONITORING	
7	CONNECTOR	
8	INTERMITTENT CONNECTOR	

In addition to the schematic diagram, the team also used maps of the watershed and distribution network as visual guides for assessing the water supply system. These maps provided valuable insights into the location and accessibility of the various components of the system, including the sources of water, treatment plants, storage tanks, and distribution pipelines.

Overall, the process flow diagram and accompanying maps were essential tools for the WSP team in developing a comprehensive understanding of the water supply system. They helped to identify potential hazards and vulnerabilities and inform decisions on risk management strategies and improvement plans. By using these tools, the team was able to ensure the provision of safe and reliable drinking water to the community.

SPCWD Four (4) Major Category Systems

1) **Spring Sources by Gravity**: This method involves utilizing spring sources where the water flows naturally through gravity. The water is collected and directed to the desired location without the need for any additional pumping equipment. It is a simple and cost-effective method that relies on the natural flow of the spring. One advantage of this method is its simplicity. Since no additional pumping equipment is required, the operating costs are significantly reduced, making it an economical choice, especially for rural or remote areas where access to electricity or fuel may be limited. Moreover, the reliance on gravity ensures a continuous and uninterrupted flow of water, making it a reliable source even during power outages or mechanical failures.

Table 11. Spring Sources by Gravity

a)	Cabunsod Spring Source	b)	Malabanban-Lubigan Spring Source
c)	Upper Malamig Spring	d)	Lagaslasan Spring

2) **Spring Sources with Pump**: In this approach, spring sources are utilized, but a pump is employed to facilitate the movement of water to the desired location. The pump helps increase the water pressure and flow rate, allowing for efficient distribution to different areas. This method is commonly used when the natural gravity flow is insufficient or when water needs to be transported over long distances. Additionally, the pump's ability to boost the pressure ensures that water reaches higher elevations or can be used for applications that require a certain level of pressure, such as firefighting or industrial processes.

Table 12. Spring Sources with Pumps

a)	Balanga Pumping Station
b)	Malaunod Pumping Station

3) **Production Wells with Filtration**: Production wells involve drilling into underground aquifers to extract water. In this method, the water is pumped from the well and passes through a filtration system to remove impurities and ensure its quality. Filtration helps remove particles, sediment, and other contaminants, providing clean and safe water for consumption. One significant advantage of this approach is the ability to tap into

underground water reservoirs that are naturally replenished over time. Unlike surface water sources that can be affected by weather conditions and seasonal variations, production wells draw from groundwater reserves, which are generally more stable and resilient.

Table 13. Productions Wells with Filtration System

a) Bautista PW	b) Central PW	c) Maharlika PW
d) San Gregorio PW	e) San Marcos PW-2	f) San Jose Complex PW
g) San Jose NHS PW	h) Sta. Veronica PW	i) Santiago 1 PW
j) SouthEast Meadows PW	k) Sto. Angel PW-1	

4) **Production Wells with no Filtration**: This method also involves extracting water from production wells, but without employing a filtration system. The water is pumped directly from the well and distributed without any additional treatment except chlorination. It is important to note that this method should only be used when the water from the well is already of suitable quality and does not require further filtration or treatment.

Table 14. Production Wells with no Filtration

a) Bautista SW	b) San Isidro PW	c) Lynville 2 PW
d) Concepcion PW-2	e) Jeansville PW	f) San Lorenzo SW-1
g) San Crispin PW-1	h) San Crispin PW-2	i) San Mateo PW-1
j) San Lorenzo SW-2	k) San Marcos PW-1	l) Sto Angel NHA PW
m) San Mateo PW-2	n) Sta. Catalina	
o) CG Brion PW	p) Concepcion PW-1	

By utilizing these different water source options and understanding their characteristics, water supply can be established in an effective and efficient manner. It is crucial to assess the specific requirements, water quality, and infrastructure needs to determine the most suitable method for each situation.

For detailed process flow descriptions of each system, refer to Annex E (pg. 84 - 118), which includes graphical system flow diagrams in Annex A (pg. 76 - 77). Annex C (pg. 82) provides process flow diagrams specifically for filtration, along with an isometric view of the system in Annex D (pg. 83). These comprehensive resources offer valuable insights into the operations of the systems, enabling a better understanding of their functionality and processes. Make use of these references to gain a deeper understanding of the system components and their interconnections.

2.4 Treatment Processes

The District produces drinking water from spring sources and deep wells. The water taken from spring sources and some deep wells is generally consistent in quality and requires less intensive treatment. They undergo disinfection treatment with Calcium Hypochlorite. Chemical feed pumps are used for chlorine dosing.

Some deep wells have water quality problems like high turbidity, Hydrogen sulfide Odor, Colour, high Iron and Manganese and presence of Arsenic. The treatment processes are Oxidation, Coagulation, Filtration and Chlorination.

a) **Disinfection** – the most important water treatment in a water supply system. Chlorination is the most widely used method for disinfecting water supplies. It is effective in killing bacteria, viruses, and other microorganisms that cause disease and immediate illness. Residual Chlorine continues to keep the water safe as it travels from the water source to the consumers' taps.

b) **Removal of Hydrogen sulfide, Iron and Manganese using DMI-65 filter media.** In order to begin the process of oxidation of the iron and manganese in solution DMI-65 is designed to operate in the presence of chlorine. In this process the oxidant removes electrons and is consumed in the process. DMI-65 is a catalytic media in the true meaning of the word and facilitates oxidation-precipitation–filtration and does not get consumed in the reactions. The media facilitates chemical reactions and does not explicitly remove anything. Once oxidized, the depth filtration aspect of the media removes the solids that are then periodically backwashed out of the filter vessels. A process flow diagram for filtration and an isometric view are attached on Annex D (pg. 83) and Annex E (pages 84-118).

c) **Arsenic treatment consist of co-precipitation of arsenic in flocs during coagulation and arsenic adsorption to the media.** Ferric chloride is added to the water wherein Arsenic binds to the positively charged surface of the Iron (Hydroxide) matrix. Then it is filtered in DMI-65 which is an extremely powerful silica sand based catalytic action water filtration media. Process flow diagram on page 106 for additional information.

d) **Sodium Carbonate (Soda Ash) for pH adjustment.** Sodium carbonate, also known as soda ash, is a white, crystalline compound used for pH adjustment. It raises the pH of acidic solutions by neutralizing acidity with carbonate ions. It finds applications in water treatment, chemical manufacturing, and more, but proper dosage is important to avoid overshooting the desired pH level. Process flow diagram on page 84 for details.

2.5 The SPCWD Laboratory

The laboratory is a critical component of the water safety plan, as it plays a crucial role in ensuring the safety and quality of the water supplied to consumers. The SPCWD laboratory has been granted a Certificate of Accreditation by the Department of Health through the Health Facilities and Services Regulatory Bureau last July 26, 2022, with accreditation number 4A-012-2224-LW-2, attached as Annex S (pg. 289). The laboratory's service capability is categorized as Category A - Microbiological, and it has been accredited for six types of tests, which are:

1) **Multiple Tube Fermentation Technique (MTFT)**
2) **Thermotolerant Coliform Test**
3) **Colilert**
4) **Gram Stain**
5) **IMViC Tests**
6) **Heterotrophic Plate Count**

Figure 4. SPCWD Laboratory

Multiple Tube Fermentation Technique (MTFT): MTFT is a microbiological test used to determine the presence of coliform bacteria in water. The technique involves inoculating a series of tubes containing a specific culture medium with a water sample and incubating them at a specific temperature. The gas production in the tubes indicates the presence of coliform bacteria in the water sample. The MTFT is a commonly used method to assess the microbial quality of drinking water.

Thermotolerant Coliform Test: The thermotolerant coliform test is a microbiological test used to detect the presence of fecal contamination in water. The test involves filtering the water sample through a membrane filter and then incubating the filter on a selective medium at a specific temperature. The growth of colonies on the medium indicates the presence of fecal contamination in the water sample.

Colilert: Colilert is a commercial water testing kit that detects the presence of coliform bacteria and E. coli in water. The kit contains a specific culture medium and a substrate that releases a fluorescent compound when metabolized by coliform bacteria and E. coli. The fluorescence is then measured using a fluorometer, and the results are expressed in Most Probable Number (MPN) per 100 mL of water.

Gram Stain: The Gram stain is a microbiological staining technique used to differentiate bacterial species based on the differences in their cell wall composition. The technique involves staining bacterial cells with crystal violet, iodine, and a decolorizing agent, followed by a counterstain. Gram-positive bacteria retain the crystal violet stain and appear purple, while gram-negative bacteria lose the crystal violet stain and appear pink.

IMViC Tests: The IMViC tests are a group of four biochemical tests used to differentiate between members of the Enterobacteriaceae family of bacteria. The tests include Indole test, Methyl Red test, Voges-Proskauer test, and Citrate test. The tests are named after the first letter of each test and are used to identify specific metabolic pathways and enzymatic activities in the bacteria.

Heterotrophic Plate Count: The Heterotrophic Plate Count (HPC) is a microbiological test used to estimate the number of viable bacteria in a water sample. The test involves spreading a water sample on an agar plate and incubating it at a specific temperature. The number of colonies that grow on the plate is then counted, and the results are expressed in colony-forming units (CFU) per mL of water. The HPC is a commonly used method to assess the microbiological quality of drinking water.

The laboratory is responsible for testing the quality of the water being supplied and detecting any potential contaminants that may pose a health risk to consumers. It collects water samples from various points in the water distribution system and analyzes them to determine if the water is safe to drink. The laboratory also monitors the quality of the water supply on an ongoing basis to ensure that it remains safe and free from contaminants.

In addition to its primary function of water sampling and testing, the laboratory is responsible for identifying any detected contaminants and determining their source. It provides information to water treatment plant operators to help them optimize their treatment processes to remove or reduce contaminants. Furthermore, the laboratory may conduct research and development activities to identify new methods for testing water quality and improve water treatment processes.

The SPCWD laboratory's accreditation by the Department of Health underscores its commitment to ensuring the safety and quality of the water being supplied to consumers. By providing accurate and reliable testing services, the laboratory plays a vital role in maintaining the public's trust in the safety of the water supply.

2.6 The Distribution System

The San Pablo City Water District (SPCWD) built an expansive transmission and distribution network that covers approximately 399,615 meters. This network comprises pipelines with diameters ranging from 50mm to 450mm, constructed using various materials such as Centrifugal Cast Iron (CCI), Asbestos Cement (AC), Steel, and Polyvinyl Chloride (PVC). The use of different materials offers numerous benefits such as durability, corrosion resistance, and cost-effectiveness, making it possible for the network to cater to various applications efficiently.

With its extensive network, the SPCWD can effectively distribute water to customers across the San Pablo City area, ensuring that they have access to clean and safe water. The availability of such a diverse network ensures that the SPCWD can meet the varying water demands of different areas, making it a reliable source of water for the community it serves.

Table 15. Transmission and distribution lines categorized by material, diameter, and length.

PIPE MATERIAL		PIPE DIAMETER (mm)	LENGTH OF PIPE (Linear meter)
1	**Centrifugal Cast Iron (CCI)**	100 - 300	20,400
2	**Steel Pipe**	150 - 300	290
3	**Cement Lined and Coated Steel**	150 - 450	24,512
4	**Polyvinyl Chloride (PVC)**	50 - 200	328,791
5	**Galvanized Iron (GI)**	50 - 100	12,585
6	**Asbestos Cement Pipe (ACP)**	75 - 150	8,499
7	**High Density Poly Ethylene (HDPE)**	150 - 250	4,538
Note: As of December 2022		**TOTAL**	**399,615**

The table provided earlier will require periodic updates as the San Pedro City Water District (SPCWD) continues to replace and rehabilitate Asbestos Cement (AC) pipes in its network. Over the last few months, the district has undertaken several replacement projects to improve the overall efficiency and safety of its pipeline infrastructure. Moreover, SPCWD has initiated several expansion projects in the last two years, and as a result, transmission lines have been installed in 79 out of 80 barangays in the region.

As new pipe technologies become available, SPCWD is considering all options to further enhance the efficiency and safety of its supply delivery. The district understands the importance of pipeline materials in ensuring water quality and is committed to selecting materials that align with its core values of sustainability and customer satisfaction.

In recent times, SPCWD has completed phase one of its Geographical Information System (GIS) project. This system digitized the district's old and new pipelines, service connections, valves, hydrants, and septic locations. By leveraging GIS technology, SPCWD can access vital field information with ease, accuracy, and speed. This development is a significant milestone in the district's quest to improve its operational efficiency and provide better services to its customers.

2.6.1 Storage After Treatment

The main storage of the water supply system is Sampaloc Reservoir, a circular single cell reinforced concrete reservoir on the side of Sampaloc Lake. It has a storage capacity of 6,390 cu. m. and a ground elevation of 146 m. Four mains from Cabunsod, Malamig, Malaunod, Malabanban / Lubigan (the last two springs are transferred through a single main) and Concepcion Production Well feed the reservoir.

Table 16. SPCWD Reservoir and Tanks

No	Name	Location	Qty	Size (cu.m.)	Total Volume (cu.m.)
1	**Sampaloc Reservoir**	Brgy. Concepcion	1	6,390	6,390
2	**Timber Tank**	Brgy. San Cristobal	1	1,700	1,700
3	**Ground Steel Tanks**	Brgy. San Cristobal	2	2,300	4,600
4	**Israel Elevated Steel Tank**	Israel Village, Brgy. San Antonio	1	5	5
				Total	**12,695**

In 1996, the San Pablo City Water District undertook the construction of two timber reservoirs in Brgy. San Cristobal, each with a capacity of 1,700 cubic meters. Presently, only one of these reservoirs remains operational, reinforced with an outer cable wire and an inner plastic lining. To address the increasing demand for water, the district acquired two ground steel tanks in 2015, boasting a capacity of 2,300 cubic meters each. These tanks are supplied by the Balanga Pumping Station and have significantly enhanced the system's storage capability. They play a vital role in ensuring a consistent and dependable supply of clean water to the expanding population in the area. With the addition of these new facilities, the San Pablo City Water District is now better equipped to meet the water requirements of its customers and provide them with reliable and high-quality water services. These infrastructure improvements mark a milestone in the district's commitment to meeting the growing water demands of the community and promoting a sustainable water supply.

2.7 Customers' Practices

As of December 2022, the total number of active service connections was 47,717. The chart below presents the growth of service connections from the initial year of operation of the water district. Historically 93.4% of the total service connections fall under the domestic or residential category. Government, Commercial and Industrial service connections comprise the rest.

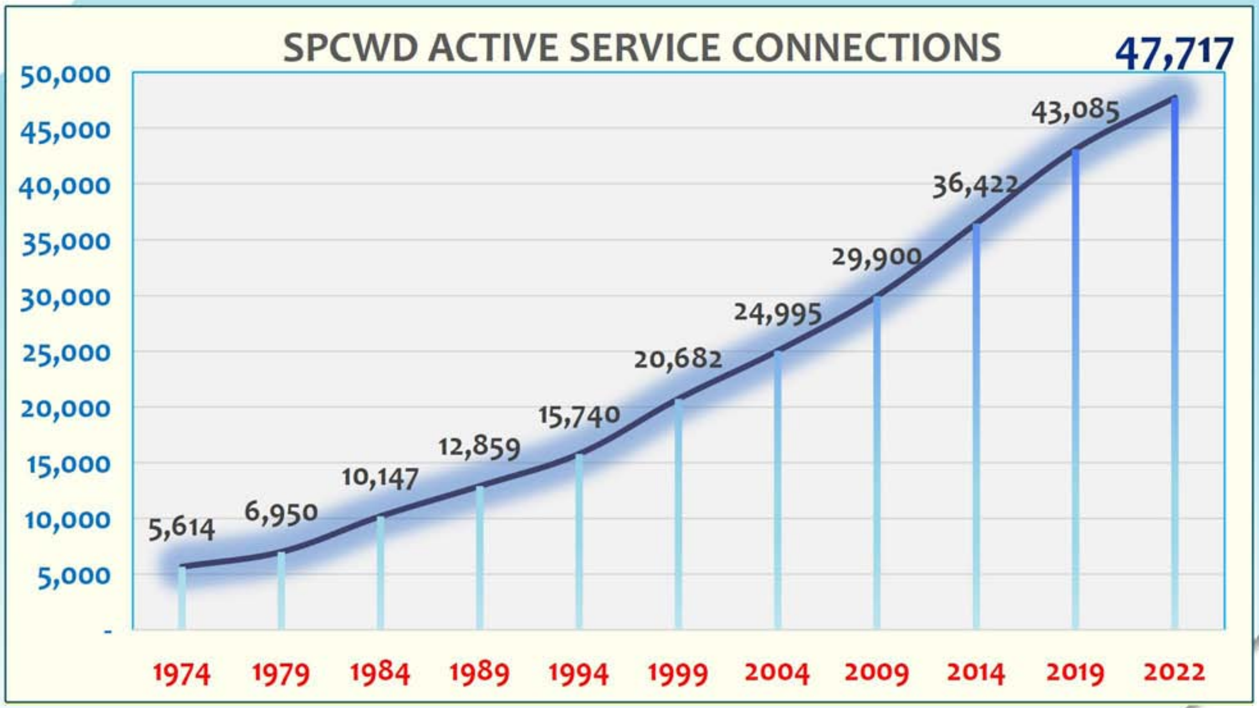


Figure 5. Active Service Connections

The 2022 LGU census recorded 322,489 people in San Pablo City. SPCWD provides water services to 79 out of 80 barangays, serving 83.18% of the community with 47,717 active connections as shown in Annex U (pg. 293). Estimated at around 238,585 people were served based on PSA's average of 5 members per household. The remaining barangay needs access to water, prompting the need to expand services to achieve universal access to clean and safe water, critical for sustainable development and improving quality of life.

However, it's important to note that this estimate is based on a simple formula and assumes an even distribution of household sizes across the service area. In reality, there may be variations in household size and water consumption patterns among households, which can affect the accuracy of the estimate. Additionally, other factors such as changes in population density, migration, and water availability may also influence the actual number of people served by the SPCWD.

The Table below presents a detailed breakdown of the service connections provided by the District as of December 2022. It provides information on the number of connections, consumption rates, and categories for each connection type.

Table 17. Service Connections by Category

SERVICE CONNECTIONS BY CATEGORY AS OF DECEMBER 2022					
Category		Number	Percentage	Ave. Consumption	Consumption
1	**Domestic**	44,568	93.4%	22.78	1,015,259
2	**Commercial**	1,453	3.05%	44.42	64,542
3	**Commercial A**	739	1.55%	22.72	16,790
4	**Commercial B**	546	1.14%	25.64	13,999
5	**Commercial C**	26	0.05%	39.36	1,023
6	**Industrial**	43	0.09%	109.65	4,715
7	**Government**	323	0.68%	92.28	29,806
8	**Free Water**	16	0.03%	70.25	1,124
9	**Bulk**	3	0.01%	2,054.33	6,163
Total		**47,717**	**100%**	**2,481.43**	**1,153,423**

The data shows that the majority of service connections, at 93.4%, are intended for domestic use, while commercial, industrial, and government connections make up the remaining percentage. Interestingly, bulk connections, which represent only 0.01% of the total connections, have the highest average consumption rate at 2,054.33, highlighting the high water usage in that category. The average consumption rate varies across the categories, with industrial connections having the highest average consumption rate at 109.65. The free water connections have the second-highest average consumption rate, indicating that despite their low percentage of the total connections, they still have a significant impact on the overall water consumption. These findings can help the District to better allocate resources and tailor our service provision to meet the specific needs of each category. By analyzing the patterns and trends in service connections and consumption, the District can identify areas that require attention, such as optimizing water delivery and treatment systems, providing more education on water conservation practices, and implementing more efficient billing and pricing systems.

Table 17 (pg. 33) provides essential insights into the District's service connections, helping the District to better understand our customer base, optimize our resources, and improve our overall service delivery.

2.8 Water Quality Required

Interpreting raw water data is crucial in ensuring that the water supply delivered to consumers is safe for consumption. Water quality targets serve as a guide for interpreting raw water data, and they are usually based on mandatory parameters set by PNSDW 2017. In the case of the San Pablo City Water District (SPCWD), the team has implemented water quality targets that are even more stringent than regulatory standards. This approach ensures that the source water quality is monitored closely, and early detection of any issues can be quickly addressed.

Table 18. SPCWD Water Quality Target

Target Water Quality		
Microbial	**PNSDW 2017 Limit**	**SPCWD WQ TARGET**
1. Total Coliform	<1.1 MPN	<1.1 MPN
2. Fecal Coliform	< 1.1 MPN	<1.1 MPN
3. Heterotrophic Plate Count	< 500 cfu/ml	< 500 cfu/ml
Physical		
1. Odor	No objectionable Odor	No objectionable Odor
2. Taste	No objectionable Taste	No objectionable Taste
3. Color (Apparent)	10 CU	10 CU
4. Turbidity	5 NTU	5 NTU
Chemical (*EPA Standard)		
1. pH	6.5 - 8.5	6.5 - 8.5
2. Total Dissolved Solids	600 mg/L	600 mg/L
3. Arsenic	0.01 mg/L	0.01 mg/L
4. Nitrate	50 mg/L	50 mg/L
5. Cadmium	0.003 mg/L	0.003 mg/L
6. Lead	0.01 mg/l	0.01 mg/l
7. Chloride	250 mg/L	250 mg/L
8. Sulfate	250 mg/L	250 mg/L
9. Iron	1.0 mg/L	0.1 mg/L*
10. Manganese	0.4 mg/l	0.1 mg/l*
11. Residual Disinfectant	must be ≥ 0.3 but < 1.5 mg/L	must be ≥ 0.5 but < 1.0 mg/L

Having more stringent water quality targets allows for a better understanding of the source water quality during normal operations and when it is under stress, approaching out of specification. This provides the necessary information to take the appropriate measures for source-based mitigation, avoiding any potential water quality incidents. The capacity to use water quality data as an early warning system is essential for SPCWD as it helps prevent internal and external water quality incidents that could harm consumers and damage the reputation of the district. Adhering to the water quality targets and monitoring the source water quality requires a robust water quality management system. SPCWD implements a rigorous water quality monitoring program to ensure that the water supply is safe for consumption. The program includes the collection of samples from various locations, which are then analyzed in accredited laboratories.

To ensure that the customers of SPCWD receive clean and safe water, it is essential to establish and maintain stringent water quality targets. This involves monitoring the quality of the source water and implementing a rigorous water quality monitoring program. Table 18 (pg. 34) provides a comprehensive list of the water quality targets that SPCWD aims to achieve for its clients and customers.

2.9 Delivery Point, Intended User of Water and Intended Uses

Prior to the implementation of the Water Safety Plan (WSP), it is crucial to determine and document the intended uses and users of the water supplied by the District. This information plays a vital role in the hazard analysis process, which helps determine the potential hazards that the water may pose to the consumers. Understanding the population served and any specific characteristics that may increase vulnerability to waterborne diseases is essential in ensuring the safety of the water supply.

The water supplied by the District must meet the product and customer specification requirements outlined by the Philippine National Standards for Drinking Water (PNSDW) and SPCWD Water Quality Targets. Compliance with these standards is necessary to ensure that the water is safe and of the highest quality for consumption.

Documenting the intended uses and users of the water supplied by the District before implementing the WSP, coupled with compliance with PNSDW and SPCWD standards, ensures that the water is safe and of the highest quality for consumption, ultimately protecting the health of the consumers.

Table 19. Intended Uses and Users of the SPCWD Water Supply

Intended Users and Uses of the Water Supply	
Intended Users	The District is responsible for supplying water to the general public, commercial establishments, and industries. However, it is important to note that the water provided is not tailored to the specific needs of individuals who are significantly immuno-compromised or industries with specialized water quality requirements. Therefore, we advise these groups to take additional measures to treat the water at the point of use. We prioritize safe water for all consumers but recognize some may have unique needs. Those with special water quality requirements should seek expert advice on point-of-use treatment options to ensure their water meets their standards. By being proactive, consumers can address their specific water quality needs. We're committed to supporting these groups by providing necessary resources to maintain water quality.
Intended Uses	SPCWD supplies water that is intended for general consumption, including drinking and food preparation. However, it is important to note that the water is not limited to these purposes only. It can also be used for other domestic purposes, such as bathing, washing, and cleaning, as well as for commercial and industrial use. We understand that water quality requirements may vary depending on the intended use. As such, we continuously monitor and treat our water supply to ensure it meets the appropriate standards and guidelines for all its intended uses. We also provide information and advice on the appropriate treatment measures for consumers who have specific water quality needs. We recognize the importance of safe and high-quality water for the well-being of individuals and the success of businesses. That is why we are committed to ensuring that our water supply meets the diverse needs of our customers. We encourage consumers to be mindful of the intended use of water and seek expert advice when necessary to ensure that they are using the appropriate treatment measures to maintain its quality.

2.10 Current Delivered Water Quality

Water is an essential resource that plays a critical role in sustaining life. As such, it is essential to ensure that the water we consume is safe and free from contaminants that could pose a threat to human health. In the case of water systems, the quality of the water must be monitored at all stages of the treatment process, from the raw water source to the final distribution to consumers.

The assessment of the current water quality of raw, treated, and delivered water is a crucial aspect of the system description. It is necessary to determine the presence of any contaminants or pollutants that may be present in the water and to ensure that the water meets the standards set by the Philippine National Standards for Drinking Water (PNSDW).

Water quality testing and review of monitoring records show that Physical and Chemical parameters of treated water in all the sources were within the standard limits. This indicates that the treatment processes used in the water systems are effective in removing contaminants and ensuring that the water is safe for consumption. Radiological tests conducted on all operational sources starting in 2015 also passed the PNSDW standard, further confirming the safety of the water being supplied.

The implementation of a Water Safety Plan (WSP) has further enhanced the quality of the water being supplied. Microbiological monitoring shows that the tests conducted on the water after treatment, in distribution lines, and finally at consumers' taps were all within the standard. This means that the water being supplied is free from harmful bacteria and other microorganisms that could pose a threat to human health. Water systems with filtration are also monitored weekly for the following parameters: pH, residual chlorine, turbidity, color, iron, and manganese. The results of these tests show that all the parameters are within the PNSDW standard and water quality targets. This means that the water being supplied is not only safe for consumption but also meets the standards set for aesthetics, such as color and turbidity.

The assessment of the current water quality of raw, treated, and delivered water as shown Table 20 (pg. 38) being supplied by SPCWD is safe and meets the standards set by the PNSDW. The implementation of a Water Safety Plan has further enhanced the quality of the water being supplied by ensuring that it is free from harmful bacteria and other microorganisms. The regular monitoring of water systems with filtration also ensures that the water supplied is not only safe but also aesthetically pleasing.

Table 20. Water Quality Monitoring of All Sources

SAN PABLO CITY WATER DISTRICT LABORATORY

WATER QUALITY MONITORING RESULT OF ALL THE SOURCES FOR THE MONTH OF DECEMBER 2022

	SOURCES	Raw Water (monthly)							Treated Water								
		Bacteriological		Physical/Chemical					Bacteriological (weekly)			Physical/Chemical (monthly)					
		TCT <1.1 MPN	FCT <1.1 MPN	Turbidity 5 NTU	Apparent Color 10 CU	pH 6.5- 8.5	Iron 1.0 mg/L	Manganese 0.4 mg/L	TCT (no. of samples) <1.1	FCT (no. of samples) <1.1	HPC <500 CFU/ml	Res. Cl ≥ 0.3 - <1.0	Turbidity 1 NTU	Apparent Color 10 CU	pH 6.5 - 8.0	Iron 0.3 mg/L	Manganese 0.1 mg/L
	Springs								PASSED / FAILED	PASSED / FAILED	PASSED / FAILED						
1	Cabunsod	Passed	Passed	0.16	< 10	7.16 @ 25.2	< 0.05	< 0.01	PASSED	PASSED	PASSED	0.55	0.05	<10	7.06 @ 24.8	< 0.05	< 0.01
2	Malabanban	Failed	Passed	0.15	<10	6.73 @ 25.4	< 0.05	< 0.01	PASSED	PASSED	PASSED	1.0	0.02	<10	7.03 @ 24.8	< 0.05	< 0.01
3	Upper Malamig	Passed	Passed	0.40	<10	6.73 @ 25.4	0.05	0.00	PASSED	PASSED	PASSED	0.4	0.89	<10	7.02 @ 25.2	< 0.05	< 0.01
4	Malaunod	Passed	Passed	0.00	<10	6.65 @ 25.4	0.05	0.00	PASSED	PASSED	PASSED	0.7	0.07	<10	6.90 @ 26.8	< 0.05	< 0.01
5	Balanga	Passed	Passed	0.34	<10	6.63 @ 25.4	0.05	0.00	PASSED	PASSED	PASSED	1.0	0.05	<10	6.85 @ 25.7	< 0.05	< 0.01
6	Lagaslasan	Passed	Passed	0.22	<10	6.40 @ 25.7	0.05	0.00	PASSED	PASSED	PASSED	0.5	0.15	<10	6.64 @ 26.0	< 0.05	< 0.01
	Deepwell w/ no filtration																
1	San Mateo 1 DW	Passed	Passed	0.05	<10	6.99 @ 25.7	< 0.05	< 0.01	PASSED	PASSED	PASSED	0.54	0.14	<10	6.79 @ 26.9	< 0.05	< 0.01
2	San Mateo 2 DW	Passed	Passed	0.05	<10	6.99 @ 26.9	0.05	0.00	PASSED	PASSED	PASSED	0.6	0.13	<10	6.82 @ 26.7	0.05	< 0.01
3	San Marcos 1 DW	Passed	Passed	0.09	<10	7.10 @ 25.8	0.26	0.07	PASSED	PASSED	PASSED	0.66	0.30	<10	6.85 @ 27.0	0.27	0.07
4	Concepcion 1 DW	Passed	Passed	0.71	<10	6.71 @ 25.1	0.10	0.03	PASSED	PASSED	PASSED	0.84	0.13	<10	6.90 @ 24.9	0.1	0.01
5	Concepcion 2 DW	Passed	Passed	1.28	<10	6.79 @ 25.1	0.40	< 0.01	PASSED	PASSED	PASSED	0.6	0.82	<10	6.88 @ 25.1	0.5	0.00
6	Sta. Catalina DW	Passed	Passed	0.69	<10	7.27 @ 25.6	0.91	<0.01	PASSED	PASSED	PASSED	0.87	0.31	<10	7.01 @ 22.1	0.91	< 0.01
7	Israel DW	Passed	Passed	0.15	<10	7.25 @ 26.0	0.01	0.00	PASSED	PASSED	PASSED	0.53	0.54	<10	6.75 @ 25.4	< 0.05	0.00
8	San Crispin 1 DW	Passed	Passed	0.10	<10	7.03 @ 26.0	0.01	0.00	PASSED	PASSED	PASSED	0.7	0.04	<10	6.92 @ 27.2	< 0.05	0.00
9	San Crispin 2 DW	Passed	Passed	0.13	<10	6.96 @ 25.8	< 0.05	0.00	PASSED	PASSED	PASSED	0.5	0.19	<10	6.89 @ 27.2	< 0.05	0.00
10	San Cristobal DW	Passed	Passed	0.5	< 10	6.79 @ 25.5	0.01	0.00	PASSED	PASSED	PASSED	0.86	0.56	<10	6.91 @ 25.6	< 0.05	0.00
11	Jeansville DW*	Passed	Passed	0.29	<10	6.85 @ 25.5	< 0.30	0.00	PASSED	PASSED	PASSED	0.66	0.18	<10	6.89 @ 27.4	< 0.30	0.00
12	Lynville DW	Passed	Passed	0.10	<10	7.03 @ 25.6	< 0.10	< 0.20	PASSED	PASSED	PASSED	0.53	0.08	<10	6.80 @ 26.7	0.13	< 0.1
13	C.G. Brion	Passed	Passed	0.28	<10	7.11 @ 25.3	0.07	0.00	PASSED	PASSED	PASSED	0.53	0.07	<10	6.92 @ 24.8	0.07	0.00
14	NHA-Sto. Angel DW	Passed	Passed	0.10	<10	6.91 @ 25.3	< 0.05	0.00	PASSED	PASSED	PASSED	1.0	0.03	<10	6.78 @ 24.3	< 0.05	0.00
	Deepwell w/ filtration											**Weekly Average**					
1	Maharlika	Passed	Passed	2.03	>10	7.43 @ 26.0	0.67	0.5	PASSED	PASSED	PASSED	0.83	0.19	<10	7.24 @ 25.9	0.07	0.00
2	San Marcos 2 DW	Passed	Passed	6.34	>10	7.19 @ 25.7	1.03	0.58	PASSED	PASSED	PASSED	0.56	0.28	<10	7.06 @ 25.6	0.39	0.10
3	Central DW	Passed	Passed	0.75	< 10	7.25 @ 25.7	0.32	0.2	PASSED	PASSED	PASSED	0.5	0.24	<10	7.22 @ 25.1	0.21	0.18
4	Sta. Veronica DW	Passed	Passed	0.13	< 10	7.01 @ 25.8	0.00	0.93	PASSED	PASSED	PASSED	0.54	0.12	<10	6.86 @ 25.0	0.02	0.10
5	Southeast Meadows	Passed	Passed	0.90	<10	7.24 @ 25.7	0.22	0.00	PASSED	PASSED	PASSED	0.50	0.11	<10	6.76 @ 25.9	0.01	0.00
6	San Jose NHS DW**	Passed	Passed	6.48	>10	7.28 @ 26.3	1.07	0.38	PASSED	PASSED	PASSED	0.57	0.21	<10	7.04 @ 25.7	0.09	0.26
7	Bautista DW	Failed	Passed	0.13	<10	6.78 @ 25.3	0.33	0.21	PASSED	PASSED	PASSED	0.5	0.05	<10	6.69 @ 25.0	0.00	0.00
8	Santiago 1	Passed	Passed	7.70	>10	6.98 @ 24.7	1.28	0.82	PASSED	PASSED	PASSED	0.7	0.04	<10	7.17 @ 26.0	0.01	0.00
	Shallow wells																
1	San Lorenzo 1	Passed	Passed	0.01	< 10	7.02 @ 27.1	0.02	0.00	Passed	Passed	Passed	0.5	0.05	<10	6.58 @ 25.4	0.02	0.00
2	San Lorenzo 2	Passed	Passed	0.67	< 10	6.70 @ 26.6	< 0.2	< 0.2	Passed	Passed	Passed	0.5	0.62	<10	6.69 @ 25.4	< 0.2	< 0.2
	Total 30 sources																

Legend: TCT - Total Coliform Test, FCT - Fecal Coliform test

HPC - Heterotrophic Plate Count; F- Failed, P-Passed

Not within the PNSDW standard

* From August monitoring

** From November monitoring

2.11 The Malabanban-Cabunsod Watershed

The Malabanban-Cabunsod watershed with a total area of 384.21 hectares (Figure 6) is a vital water source for the people of San Pablo City, and its protection is of utmost importance to the San Pablo City Water District (SPCWD). With a long history of providing water to the community, the district understands the significance of establishing and maintaining forest vegetation in the watershed for its long-term sustainability.

In 1999, President Joseph E. Estrada proclaimed Malabanban as a Watershed Forest Reserve, elevating its status from previously being classified as alienable and disposable land. This proclamation, supported by Section 6, which prohibits illegal activities within the watershed, emphasizes the commitment to follow existing forest laws and regulations.

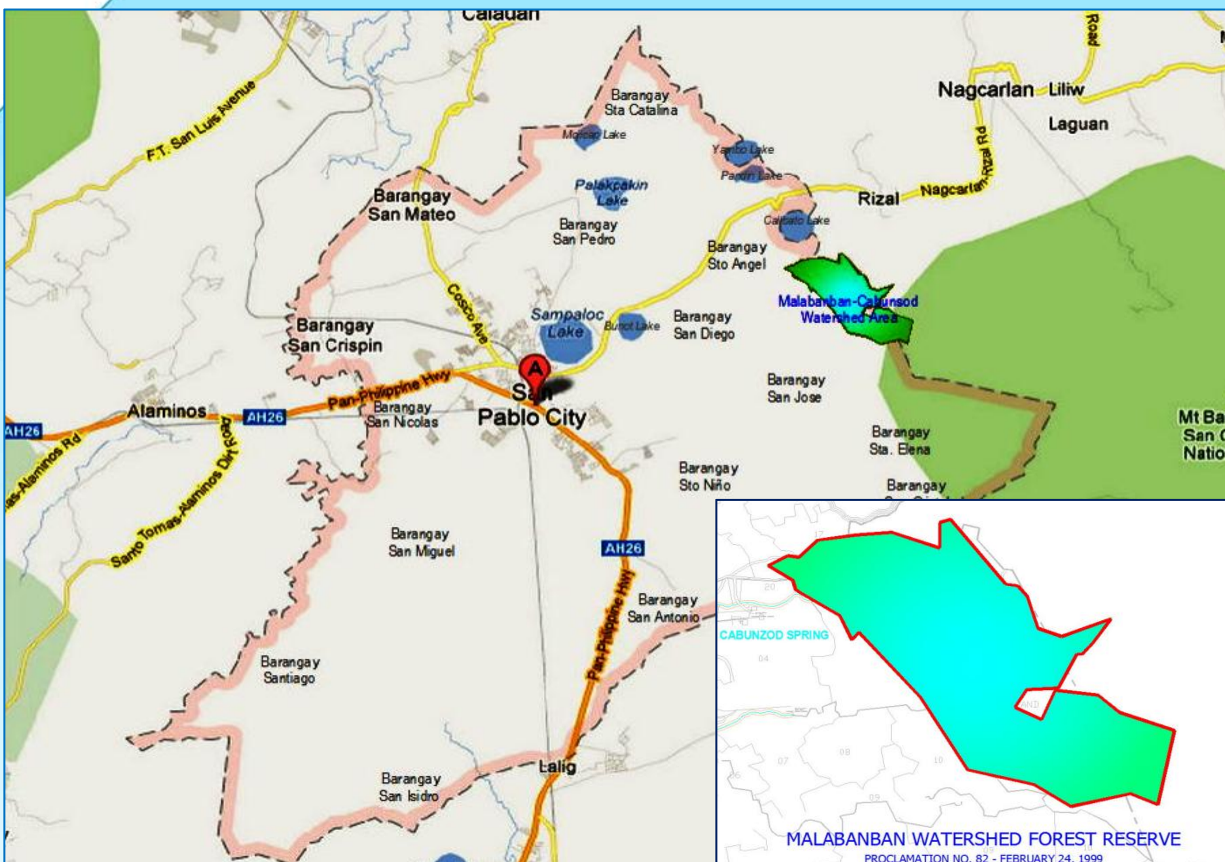


Figure 6. SPC Map and Watershed Area

The SPCWD is dedicated to safeguarding the integrity of the watershed and securing a reliable water supply as most of our spring sources are located adjacent to it. Challenges such as low water flow during the summer and the protection of barren and rocky areas require focused efforts. Mitigating deforestation and preventing illegal activities are crucial steps in preserving water quality and quantity. To ensure a reliable and high-quality water supply, proper management practices must be implemented. This includes prioritizing forest and soil conservation, promoting proper waste disposal, and regulating human activities within the watershed. Reforestation and afforestation initiatives contribute to increased water-holding capacity. The proximity of the watershed to active volcanoes adds another layer of concern. Effective management, collaboration among stakeholders, careful planning, and continuous monitoring are necessary to maintain a healthy and resilient ecosystem.

The watershed's importance in a water safety plan cannot be understated. It directly impacts water quality and availability. Protecting the watershed from contamination, monitoring water quality, and engaging stakeholders are essential elements. Preparedness for natural disasters and educating the public about the watershed's significance promote responsible behaviors and ensure long-term sustainability.

By integrating watershed management principles into a water safety plan, the community can safeguard its drinking water supply and preserve this valuable natural resource for future generations. Here are some steps that were taken that integrated watershed management principles into a water safety plan:

a) **Assess Watershed**: Evaluate the watershed's condition, including land use, pollutants, hydrology, and ecology. Identify priority areas for action.

b) **Form Management Team**: Create a collaborative team of stakeholders to coordinate and implement watershed management activities.

c) **Develop Protection Plan**: Create a comprehensive plan with goals, strategies, and measures to prevent pollution, manage land use, and promote sustainability.

d) **Implement Best Practices**: Adopt appropriate practices like erosion control, reforestation, and storm water management.

e) **Enforce Regulations**: Ensure effective enforcement of watershed protection regulations and address illegal activities.

f) **Engage and Educate**: Educate the community on watershed importance and encourage responsible behavior through outreach and education initiatives.

g) **Monitor Water Quality**: Establish a monitoring program to assess water quality and environmental indicators.

h) **Collaborate with Stakeholders**: Foster partnerships with neighboring communities, NGOs, - and academic institutions and others for enhanced watershed protection.

i) **Review and Adapt**: Regularly review and update the protection plan, evaluate strategies, and make necessary adjustments.

By following these steps, SPCWD can effectively integrate watershed management principles into our water safety plan, ensuring the long-term protection and sustainability of the watershed and its valuable water resources.

3. Hazard and Hazardous Events Identification and Risk Assessments

The SPCWD WSP provides a comprehensive analysis of hazards, their potential impact, existing control measures, and their effectiveness. The goal of this hazard identification process is to assess the risks associated with the water supply system and provide corrective actions to mitigate these risks. This discussion breaks down the key aspects from the presented table into more details in Annex I (pg. 123 - 135):

1. Sources of Hazards

- Livestock and Human Activity: Human and animal presence near water sources could introduce pollutants. Although there are control measures like perimeter fencing and screening inlets, residual risk remains due to potential breach points or unauthorized access.

- Seepage & Stormwater Runoff: Human settlements, agricultural practices, and runoff can introduce contaminants into water sources. Although measures like catchment fencing and regular inspection are in place, changes in land use or extreme weather events can still pose risks.

- Rubbish Dumping & Stormwater Runoff: Dumped trash can introduce both macro and microscopic contaminants. It's essential to maintain cleanliness around water sources and invest in community education.

- Naturally Occurring Elements: Elements like Manganese, Iron, Arsenic, and Hydrogen Sulfide could be problematic. Existing water treatment processes might not always be effective, demanding facility upgrades and improved filtration techniques.

- Infrastructure Vulnerabilities: Boreholes in permeable soils, seepage from septic tanks, damaged well casing, and contaminated water intake can compromise water quality. Regular inspections, design reviews, and facility maintenance are crucial.

2. Treatment Hazards

Filtration and Disinfection: The presence of naturally occurring elements and the risk of under-dosing or over-dosing with disinfectants pose challenges. Ensuring proper treatment, regular equipment maintenance, and backup systems are paramount.

- Operator Training: The proficiency and expertise of operators stand central to preserving water quality. Lack of comprehensive training can lead to operational lapses, endangering the treatment process. Hence, continual training initiatives are pivotal to ensure they are abreast with the latest safety standards and technological advancements.

- Access Control: To safeguard against unauthorized intrusions and possible malicious acts, it is imperative to bolster security protocols. Ensuring fortified access controls and vigilant monitoring around treatment facilities mitigates potential sabotage risks, ensuring the uninterrupted and safe delivery of water services.

3. Distribution Hazards

- Infrastructure Integrity: The structural integrity of the distribution system is paramount. Any breaches in pipes, reservoirs, or storage tanks can serve as gateways for pollutants, jeopardizing water quality. Hence, adopting rigorous inspection schedules, coupled with meticulous maintenance routines and stringent hygiene standards during repair endeavors, becomes indispensable.
- Water Stagnation and Flow: The configuration of the distribution network may inadvertently create dead-ends or pockets of irregular flow, fostering water stagnation. This can be detrimental to water quality. To combat this, it's imperative to strategize and implement routine flushing procedures, alongside ensuring consistent flow rates throughout the network.
- External Threats: Water supply systems remain susceptible to a plethora of external threats, ranging from intentional sabotage, unforeseen natural calamities, to unsanctioned interferences. A multi-pronged approach, integrating vigilant monitoring, exhaustive periodic inspections, and fostering community vigilance, acts as a robust defense mechanism to curtail these potential hazards.

4. Consumer-Related Hazards

- Household Infrastructure: Poor quality household plumbing or stagnation due to infrequent use can impact water quality at the point of consumption. Consumer education and ensuring quality materials in plumbing can address this.

- Backflows and Cross Connections: There's a risk of contamination from backflows or connections to other water sources. Education, inspections, and implementing non-return valves can mitigate this.

Annex I (pg. 123 - 135) underscores the complexity of ensuring safe water from source to tap. It's a continuous process involving infrastructure maintenance, community education, regular inspections, and swift response to emerging threats.

The comprehensive nature of this hazard analysis is commendable. It is an essential step in proactive risk management for water supply systems. Ensuring all stakeholders – from water supply agencies to consumers – are informed and play their part is crucial in guaranteeing water safety.

Table 21. Risk Factor Matrix and Priority Level

Risk Factor Matrix		Severity / Consequence				
		Insignificant No Impact / Not detectable Rating 1	Minor Complaints Impact Rating 2	Moderate Aesthetic Impact Rating 3	Major Regulatory Impact Rating 4	Catastrophic Public Health Impact Rating 5
Likelihood / Frequency	Almost Certain Once a Day Rating 5	5	10	15	20	25
	Likely Once a Week Rating 4	4	8	12	16	20
	Moderate Once a Month Rating 3	3	6	9	12	15
	Unlikely Once a Year Rating 2	2	4	6	8	10
	Rare Once every Five Years Rating 1	1	2	3	4	5
Risk Score			<6	6-9	10-15	>15
Risk Rating			Low	Medium	High	Very High

Priority Level		Risk Score	Action Level
Level	Type		
1	High	15-25	Requires Immediate Control measures
2	Moderate	6-14	Requires determination of additional control measures
3	Low	1-5	Should be documented and revisited in the future

The risk factor matrix in Table 21 (pg. 43) is a tool commonly used in risk management, especially in industries where there's a need to quantify and prioritize risks. This matrix combines the likelihood of an event occurring with the severity of the consequences if it does happen. By multiplying these two factors, you can determine the overall risk score.

Let's delve into each element:

1) Severity/Consequence;

This axis rates the impact of a risk, if it should manifest:

- **Insignificant (Rating 1)**: No discernible impact or only a negligible one.
- **Minor (Rating 2)**: Leads to complaints or minor disruptions but not causing any long-term damage.
- **Moderate (Rating 3)**: Causes aesthetic or superficial damage, perhaps to the reputation or appearance of drinking water.
- **Major (Rating 4)**: There are regulatory implications. This could lead to fines, sanctions, or a need to alter the way the operation or distribution is done.
- **Catastrophic (Rating 5)**: Affects public health, potentially causing injury, illness, or even death.

2) Likelihood/Frequency;

This axis rates the probability of a risk manifesting:

- **Almost Certain (Rating 5)**: Expected to occur frequently, such as daily.
- **Likely (Rating 4)** : Occurs regularly but not daily, like weekly.
- **Moderate (Rating 3)** : Occurs occasionally, such as monthly.
- **Unlikely (Rating 2)** : Infrequent occurrence, like once a year.
- **Rare (Rating 1)** : Very infrequent, like once every five years.

3) Risk Score Calculation;

For each potential risk, you'd multiply the Severity rating by the Likelihood rating. The resulting number is your Risk Score.

4) Risk Rating;

Based on the calculated Risk Score, the risk can be classified into categories:

- **Low** : Scores less than 6.
- **Medium** : Scores between 6 to 9.
- **High** : Scores between 10 to 15.
- **Very High** : Scores above 15.

Importance and Usage;

SPCWD-WSP used the matrix as a visual tool that helps in prioritizing risks. Those with the highest combination of severity and likelihood should be addressed first. It also helps in allocating resources. For instance, risks in the "Very High" category may need more resources or immediate corrective actions, whereas those in the "Low" category might be accepted or monitored passively.

By providing a visual representation, this matrix can be used in presentations to stakeholders or during strategy sessions, ensuring everyone understands the most pressing risks and the reasoning behind certain risk management decisions.

It should be noted, however, that while this matrix provides a quantifiable approach, risk management also involves human judgment, industry-specific knowledge, and sometimes even intuition based on experience.

4. Control Measures, Validation, Risk Reassessment and Prioritization

Understanding SPCWD's Control Measures, Their Validation, and Risk Management

The San Pablo City Water District (SPCWD) believes that safeguarding the city's water supply is paramount. To ensure this, the district adopts prioritized and validated control measures, a meticulous approach aimed at ensuring every drop of water reaching its residents is pure and safe.

1) Risk from Natural Contaminants

The presence of naturally occurring elements such as Manganese, Iron, Arsenic, and Hydrogen Sulfide in water sources is a recognized challenge. The SPCWD uses water treatment facilities to combat this. Although these facilities can address specific water quality issues, there have been instances where the treated water did not meet the desired standards, necessitating the suspension of water source operations. A suggested corrective action is the upgrade of the Water Treatment Facility to ensure efficient treatment of color, odor, and these elements.

2) Intrusion Challenges

Water sources, forming the lifeline of the San Pablo City Water District, are susceptible to contamination threats. The risks range from the seepage of polluted water into the intake box overflow pipe to contaminants breaching the system through exposed manholes or air vent screens. However, through vigilant repair, proactive maintenance, and meticulous facility inspections, these challenges have been substantially mitigated. Maintaining the system's integrity by ensuring frequent cleaning, installing robust protective screens, and consistently achieving negative contamination test results stands as our relentless pursuit.

3) Complexities in the Treatment Process

Navigating the complexities of water treatment presents a significant challenge. The system grapples with challenges such as malfunctioning chlorinators, inaccuracies in chemical preparation resulting in sub-optimal dosing, and diminished filtration efficiency owing to system wear or design limitations. Addressing these issues requires a multifaceted approach: diligent maintenance, precise equipment calibration, enhanced training modules for operators, and refining the existing operational procedures stand paramount in ensuring the highest water quality standards.

4) Distribution Network Challenges

Delivering water from the treatment (filtration/sources) plants to the taps of consumers is a journey fraught with numerous vulnerabilities. As the water travels this vast network, it encounters various potential pitfalls: the risk of pathogenic intrusion during a main break and subsequent repair, decreased system pressure when a supply source faces an outage, and possible contamination threats during the commissioning of new mains. Moreover, the aging infrastructure and external construction activities further exacerbate these challenges. To combat these risks, a multi-pronged strategy is adopted. Ensuring consistent positive water pressure, intensifying regular system monitoring, instituting comprehensive leak detection programs, and fostering robust coordination with external agencies during pipe installations or repairs become imperative. Through these enhanced measures, the goal is to ensure a safe and uninterrupted supply of water to every household.

5) Upholding Safe Protocols

While infrastructure and treatment processes are pivotal, the human element is equally crucial in ensuring water safety. The potential knowledge gaps or lapses among operators might endanger the quality of water. To counteract this, we've emphasized ongoing training initiatives. Furthermore, fostering robust communication channels with external agencies and ensuring expert oversight during excavation activities minimizes the risk of unintentional damage to pipelines.

Traversing the complex water journey, from its pristine sources to the faucets of San Pablo City's inhabitants, presents an intricate web of challenges. At every phase, the San Pablo City Water District (SPCWD) meticulously identifies potential risks, establishing stringent control measures to ensure the utmost safety. Beyond simply identifying risks, the District goes an extra mile by continually validating and refining these measures as summarized in Annex J (pg. 136 - 141). This comprehensive approach ensures that even as challenges evolve, the system adapts.

The ultimate objective remains unwavering: to guarantee that every drop reaching the residents is pure and uncontaminated. By intertwining rigorous monitoring with proactive strategies, the SPCWD not only addresses present concerns but also fortifies itself against future uncertainties, guaranteeing consistent access to clean, potable water for its community.

5. Improvement Plan

As communities grow and evolve, so too must the infrastructure that serves them. The Improvement/Upgrade Plan recently proposed by the Water Safety Committee highlights our commitment to continuous excellence and foresight in maintaining water quality and delivery. Here's a deeper dive into the strategic steps on the Proposed Control Measures we are taking:

1) Ensuring Optimal Chlorine Levels

A challenge that has been prominently noted is maintaining the right amount of residual chlorine in the water supply. This isn't just about complying with standards; it's about health. By sticking to the set-point of 0.5 mg/L and less than 1.0 mg/L for residual chlorine across all sources, the WSP ensures water safety. But adherence to this standard isn't enough. The further focus on monitoring levels at the nearest and farthest taps, combined with operator training, ensures consistent chlorine levels throughout the network. With an ongoing implementation budget of P5,126,000, the emphasis is on operator competency and strict standard operating procedures.

2) Maintenance of Essential Equipment

Recognizing the vital role of equipment, the WSP mandates regular cleaning of nozzles and chemical feed pumps. There's a realization that a clogged chlorinator nozzle could lead to sub-optimal chlorine levels. With P225,750 set aside, the focus is on both scheduled equipment maintenance and ensuring continuous chlorination even during maintenance breaks.

3) Enhancing Water Treatment Systems

Dirty water complaints, often arising from soluble Iron and Manganese, point to the need for improved treatment facilities. An impressive P4,950,000 has been channeled towards ensuring that the treatment processes are not just functional but also effective and efficient. This also caters to challenges like Arsenic reduction and overcomes the limitations of old systems and design constraints.

4) Investing in Operator Training

Machinery and systems are only as good as the people managing them. Recognizing this, there's an emphasis on continuous training for operators. Spanning from 2022-2023 with an investment of P321,774.36, the focus is clear: ensuring operators understand the critical nature of their roles and are proficient in Water Safety Plan (WSP) procedures.

Operational Improvements:

- To prevent contamination due to unexpected soil and pathogen ingress during repairs, accurate monitoring of gate valve locations is pivotal. The WSP Committee is ensuring that any modifications post-completion are updated in the As-Built Plan. This meticulous approach aids in faster repairs and potential service interruptions.

- Consistent water pressure is a sign of a healthy water distribution system. By investing in pressure recorders and gauges, the committee ensures that even if one water supply source fails, the overall system pressure remains unaffected.

- With contamination risks looming from inadequately disinfected new mains, the committee recommends increasing flushing and disinfection frequency. By adjusting chlorine doses and planning sectional flushing, areas with frequent complaints will receive additional attention.

- The regular leak detection activity is an essential preventative measure. By upgrading the leak detection equipment and factoring in overtime for the detection team, the WSP committee is being both proactive and reactive in addressing distribution network leakages.

- Lastly, the community doesn't operate in a vacuum. Other agencies might inadvertently damage pipes, leading to contamination. By setting aside a P2M annual budget, the WSP Committee aims to coordinate closely with other agencies, ensuring seamless operations and quick resolutions to potential challenges.

In essence, this plan underscores the San Pablo City Water District's commitment to ensuring that every household receives not just water but clean, safe water consistently. Through strategic investments, training, and collaborations, they are set to elevate water management to new heights. Detailed information can be found Annex K (pg. 142 - 150).

6. Monitoring of Control Measures

The San Pablo City Water District (SPCWD) is dedicated to providing safe drinking water to the residents of San Pablo City. To achieve this goal, we have implemented a robust Water Safety Plan (WSP) that incorporates operational monitoring and corrective action procedures. These procedures are essential for maintaining water quality and ensuring public health.

The WSP's emphasis on effective monitoring of our control measures exemplifies a commitment to both quality and safety. Each control measure is meticulously defined with parameters set for every possible variable, from process steps to corrective actions. Here's a comprehensive analysis:

1) Optimal Chlorine Management

To ensure water safety and health, chlorine levels are continuously monitored. Emphasis is placed on maintaining the critical limit of >0.5 mg/L but <1.0 mg/L. Monitoring the stock solution before injection provides a real-time assessment, and this is conducted using digital chlorine analyzers. Should the levels veer off the set standards, the operator-on-duty is expected to adjust the dosage and report any discrepancies to the supervisor. Furthermore, the weekly assessment of heterotrophic plate count (HPC) and E.coli indicators aids in ensuring that water is free from bacterial contamination.

2) Equipment Maintenance

Recognizing the pivotal role of equipment in water treatment, a strict regimen of cleaning nozzle/chemical feed pumps is emphasized. This is backed by thrice-daily chlorine residual checks at source sampling points, ensuring that equipment maintenance doesn't compromise water quality.

3) Enhanced Water Treatment Processes

The installation of advanced treatment facilities aims at achieving several quality standards. Parameters like odor, color, and concentrations of Iron, Manganese, and Arsenic are rigorously checked. Any non-conformities, once identified, prompt immediate action, ensuring that water safety isn't compromised.

4) Continual Training for Operators

Operators are the frontline warriors in ensuring water quality. Their training isn't just about operating machinery but understanding the entire ecosystem. Regular audits assess our competencies, and any gaps identified are addressed through seminars, webinars, and workshops.

5) Pressure Management and Infrastructure Rehabilitation

Pressure management is crucial in maintaining service efficiency. An innovative approach of installing District Metered Areas (DMAs) combined with the replacement of old pipes ensures that service interruptions, if any, are localized and quickly addressed.

6) Pressure Consistency

With a focus on zero downtime, the health of generator sets is monitored. Scheduled servicing ensures that any pressure dips due to power failures are avoided.

7) Flushing and Disinfection Frequency

Increasing the frequency of flushing and disinfection minimizes contamination risks. Laboratory tests guide this process, and any issues identified are quickly acted upon, ensuring that chlorine dosing and flushing activities are optimized.

8) Leak Detection and Management

The plan stresses regular leak detection activities. Visual inspections combined with advanced leak detection monitoring help identify potential areas of concern. Should any leaks or deteriorations be identified, immediate repair or replacement actions are initiated.

9) Coordinating with External Entities

Infrastructure networks often intersect with other services. Regular coordination with external agencies minimizes accidental damages to the water network. Visual inspections, often conducted in conjunction with contractor representatives, help in quick identification and repair of damaged pipes.

In essence, the WSP's control measures are a blend of technology, human expertise, and proactive coordination. Each measure underscores the importance of not just delivering water but ensuring its consistent quality and safety. Through meticulous monitoring and swift corrective actions, the WSP is gearing up for a future where every drop delivered is a testament to our commitment to excellence. More details are tabled in Annex L (pg. 151 - 171).

7. Verification of Effectiveness of WSP

7.1 Verification Monitoring Programme

At the heart of every robust water distribution system is a stringent compliance monitoring program. The San Pablo City Water District (SPCWD) has consistently underscored its commitment to delivering water of impeccable quality to its residents. As a testament to this dedication, we've established an exhaustive compliance monitoring system that ensures the water we supply aligns with both national and international benchmarks.

Water Quality Verification

- **Total Coliform and Fecal Coliform Testing;**

  A significant health indicator, the presence of coliform and fecal coliform bacteria can indicate contamination. The weekly sampling and analysis of both sources and consumer taps enable timely detection of any microbial contamination. In case of unusual results, there's a predefined protocol for positive TC/FC results, ensuring immediate corrective action.

- **Heterotrophic Plate Count (HPC);**

  HPC provides an estimate of the total bacterial population in the water. Weekly and monthly tests are conducted at sources and consumer taps, respectively. A high HPC count triggers a protocol to address the root cause and rectify it.

- **Residual Chlorine;**

  Chlorine's presence in water at specific concentrations is crucial for disinfection. The daily, weekly, and monthly checks, ranging from treated water sources to consumer taps, ensure optimal chlorine levels, guarding against microbial contamination.

- **Physical & Chemical Parameters Testing;**

  Regular checks for pH, color, and turbidity provide insights into the overall aesthetic quality of water and its chemical balance. Monthly testing and an established protocol for anomalies ensure quick rectifications.

- **Iron and Manganese Tests;**

  Certain sources might have high levels of Iron and Manganese. Regular tests ensure that water treatment effectively removes or reduces these elements to acceptable levels.

- **Mandatory Physical and Chemical parameters (PNSDW 2017):**

  Annual comprehensive tests, often outsourced, ascertain water quality in line with the Philippine National Standards for Drinking Water (PNSDW 2017).

7.2 Internal and External Auditing

Audit of Records

San Pablo City Water District's audit of records is a rigorous examination of the documentation and procedures associated with our Water Safety Plan. This audit ensures compliance, transparency, and the effective implementation of measures designed to guarantee water quality and safety for the city's inhabitants. Through this process, potential areas of improvement are identified, fortifying the district's commitment to public health and safety implemented the following:

- **Equipment Calibration Verification;**

  Calibration of equipment at water sources remains paramount to the San Pablo City Water District. By ensuring the precision of these tools, the district guarantees accurate data collection and peak operational performance. To maintain this accuracy, internal audits, though unscheduled, are rigorously conducted at a minimum frequency of biannually.

- **Laboratory Equipment Calibration;**

  Accuracy in water analysis is contingent upon meticulously calibrated laboratory instruments. The district underscores the importance of this by mandating annual calibration checks. These systematic evaluations, combined with strict adherence to calibration protocols, guarantee the veracity of every test result.

- **Record Verification;**

  San Pablo City Water District commits to transparency and efficiency through its operational audits. These audits, conducted on varying scales from daily to monthly, scrutinize records pertinent to pressure metrics, water level readings, chlorine residuals, among other operational parameters. This rigorous verification process ensures that operations run seamlessly and any potential issues are swiftly identified and addressed.

❖ **Leak Detection;**

San Pablo City Water District undertakes systematic leak detection procedures as part of its commitment to sustainability and efficient service delivery. By identifying and addressing leaks early, the district not only conserves valuable water resources but also ensures the longevity and reliability of the entire water distribution system

❖ **Regulatory Compliance:**

To uphold the highest standards of water quality and safety, San Pablo City Water District undergoes a comprehensive external audit by the Department of Health every three years. This rigorous assessment ensures the laboratory's adherence to prevailing regulations and prompts enhancements in protocols and procedures, further solidifying the district's dedication to public health.

7.2 Consumer Satisfaction

Consumer satisfaction

Consumer satisfaction is a crucial aspect of effective water supply management. It is important for water providers to understand and respond to consumer complaints regarding taste, color, or odor, as such complaints may indicate potential safety issues. However, it is also important to recognize that water that is technically safe may be rejected by consumers if it does not meet their aesthetic preferences. This may lead to consumers resorting to alternative, potentially unsafe water sources, thereby compromising public health.

To address these concerns, SPCWD needs to strike a balance between ensuring the safety of our water supply and meeting consumer expectations. This may involve taking steps to improve water quality, such as introducing treatment processes or using alternative water sources. It may also involve educating the public about the factors that influence water quality and how to recognize signs of contamination.

San Pablo City Water District
CUSTOMER COMPLAINTS FORM

Name :____ Date _______________

Contact No: ____

Location (Include land mark) :____

____

Reason for Complaint: ____

____

____

____

____

Signature of Complainant

CSD 030-0

Figure 7. Customer Complaints Form

Ultimately, ensuring consumer satisfaction with water supply is vital for maintaining public health and promoting trust in water providers. By actively engaging with consumers and addressing their concerns, SPCWD can ensure that they are meeting the needs of our communities while also providing safe and reliable water. The customer complaints form in Figure 7 is to provide a standardized way for customers to submit complaints or feedback about a product, service, or experience they have had with a company. This form will help the company collect important information about the complaint, investigate the issue, and work towards a resolution that satisfies the customer. The customer complaints form will be made available to all customers of the SPCWD who wish to submit a complaint or feedback about their experience.

The WSP team must continually review the needs of the monitoring program in light of newly identified risks that may contaminate drinking-water supplies. Changes to monitoring results outside of normal ranges from regular inspections and/or monitoring are an indication that risks may have changed. The WSP team need to review the situation, modify the WSP and implement improvements. Annex M (pg. 172 - 174) verifies and monitors programme.

Customers have multiple avenues to interact with the San Pablo City Water District (SPCWD) and voice their concerns. They can reach out to SPCWD through various channels, including:

i. **Telephone**: Customers can contact SPCWD directly by dialing the telephone numbers (049) 562-9955 and (049) 562-2751 for Main Office, (049) 502-8221 for Laboratory and (049) 547-0593 for Repair and Maintenance. These numbers provide a direct line of communication for customers to discuss their grievances and seek assistance.

ii. **Website**: SPCWD has an official website, accessible at https://www.spcwd.org.ph. The website, Annex X (pg. 296) serves as a comprehensive platform that provides information about the services offered by SPCWD, billing details, water conservation tips, and updates on ongoing projects. Customers can utilize the website to submit their complaints, access important forms, and stay informed about the latest news and announcements from SPCWD.

iii. **Facebook page**: SPCWD maintains an official Facebook page named "San Pablo City Water District", Annex V (pg. 294). This page acts as an interactive platform where customers can engage with SPCWD and share their concerns. Through the Facebook page, customers can send direct messages, post comments, or leave reviews, allowing SPCWD to promptly address their issues and provide necessary support. The page, Annex W (pg. 295) also serves as a valuable resource for customers to stay updated on important information, events, and initiatives undertaken by SPCWD.

iv. **Email address:** Customers can send an email to the designated email address of SPCWD's customer service department. This information can be found on SPCWD official website or at creas@spcwd.org.ph and ogm@spcwd.org.ph.

v. **Courier Services**: Customers can use courier services, such as LBC, JRS, or any local postal services, to send their documents, inquiries, or complaints to SPCWD. The exact address is San Pablo City Water District, Maharlika Highway, Barangay San Gabriel, San Pablo City 4000.

vi. **Complaint Window**: The complaint window at the SPCWD main office at Commercial Services Department serves as an essential point of contact for customers who prefer face-to-face communication or have complex concerns that require in-depth discussion. It provides a convenient and personal avenue for customers to express their grievances and receive real-time assistance from SPCWD staff.

By offering these diverse channels, SPCWD ensures that customers have convenient and accessible means to interact and communicate their grievances effectively. These platforms enable customers to engage directly with SPCWD, fostering transparency, trust, and an improved overall customer experience.

The San Pablo City Water District (SPCWD) prioritizes efficient resolution of customer concerns through the use of an internal messenger chat group. When customer information or complaints are received, the appropriate department or division is identified, and the details are promptly shared in the chat group. This enables real-time communication, updates, task assignment, and information exchange among employees involved in the resolution process.

The internal chat group serves as a collaborative platform where employees can discuss the customer's concerns, share insights, and coordinate their efforts effectively as shown on Annex Z (pg. 298). By utilizing this platform, SPCWD ensures that issues are addressed promptly, allowing for quicker responses and proactive steps to resolve the concerns raised by customers.

Additionally, the internal chat group promotes knowledge sharing and learning within the organization. Employees can exchange experiences, best practices, and suggestions to improve customer service and identify any systemic issues that require attention. This fosters a culture of continuous improvement and innovation, contributing to the overall enhancement of customer satisfaction.

Furthermore, the chat group enables SPCWD to track the progress of each customer complaint or concern. Updates can be shared, ensuring transparency and accountability throughout the resolution process. This systematic approach ensures that customer issues are not overlooked or left unaddressed, and that all concerns are handled with the utmost professionalism and efficiency.

By leveraging the internal messenger chat group, SPCWD demonstrates its commitment to effective and streamlined complaint resolution. The platform facilitates internal communication, coordination, and collaboration, ultimately resulting in improved customer experiences and a stronger relationship between SPCWD and its customers.

8. Management Procedures

The Pivotal Role of Standard Operating Procedures in Comprehensive Water Management

At the heart of a proficiently managed water supply system lie the Standard Operating Procedures (SOPs). These pivotal documents emerge as the beacon, offering meticulously detailed and unambiguous directives that ensure the continuous, optimal functioning and oversight of the water supply network. Their prominence stems not only from safeguarding the system's integrity but also from reinforcing its dependability and maintaining an unparalleled standard of water delivery.

Each SOP is crafted as a comprehensive guide, illuminating the path for routine operations. These directives ensure that every step of the process, from source to tap, is executed with a blend of precision and efficiency. They systematically allocate and detail responsibilities for a spectrum of tasks - from rigorous water quality assessments and punctual maintenance undertakings to the art of delivering exceptional customer service. When these procedures are religiously followed, they guarantee the water system's seamless and optimal operation, day in and day out.

Beyond the scope of day-to-day operations, SOPs exhibit their resilience by including robust corrective measures. These measures spring into action when operational monitoring reveals metrics that veer off established benchmarks. This vigilant, proactive approach is the shield that ensures anomalies or potential threats are swiftly addressed, thus certifying that every drop of water delivered adheres to the zenith of quality standards.

Supplementing these are the formidable emergency management protocols encompassed within SOPs. These are the contingency blueprints, ever ready for any curveballs, be they unpredictable natural events or unforeseen technical hiccups. From risk identification and mitigation to streamlined stakeholder communication and contingency plan deployments, these protocols offer a systematic recovery roadmap. They ensure that, even in times of crisis, the system remains resilient, aiming for the swiftest possible reinstatement of standard operations.

In totality, SOPs, with their depth and breadth, provide the robust foundation upon which the edifice of a reliable and efficient water supply system stands, always committed to delivering the purest, safest water to its community.

8.1 Standard Operating Procedure for Normal Operation

The development and implementation of management procedures are the responsibility of the Water Safety Plan (WSP) team. This team ensures that the procedures are comprehensive, up to date, and aligned with relevant regulations and industry best practices. Regular review and updating cycles are essential to ensure that the procedures remain relevant and effective in the ever-changing operating environment.

The compiled management procedures, including the SOPs and emergency management procedures, are listed in Table 23 (pg. 66-70) and complete processes are found on Annex N (pg. 175-262). These procedures provide a detailed guide for operating and managing the water supply system, covering a wide range of activities and scenarios. It is crucial for all personnel involved in the water supply system to be familiar with and adhere to these procedures to maintain the safety, reliability, and quality of the water supply.

8.2 Corrective Actions for Major Incidents

At the San Pablo City Water District, our mission has always been to provide our community with a consistent and pure supply of water. Yet, even as we strive for excellence, we recognize that no system is free from challenges. From potential contaminations to the natural aging of our infrastructure, from nature's unpredictable forces to emerging technological threats, our water supply can encounter various incidents. It's essential for us, as a dedicated service to San Pablo City, to be proactive, informed, and always in dialogue with our community. As we explore these major incidents, we emphasize our unwavering commitment to ensuring that every resident of San Pablo City can trust in the water that flows from their taps, today and always.

Here's a combined list of possible major incidents in our water supply systems along with their respective corrective actions, full procedures are written in Annex O (pg. 263 - 281):

1. Resolving the Cause and Effect Contaminated of Water

Water contamination manifests in multiple forms, from the intrusion of hazardous microbes like harmful bacteria and viruses to the infiltration of chemical pollutants such as industrial effluents or agricultural residues. While the origins and categories of contaminants differ, their potential to jeopardize public health is consistently alarming. Hence, our response to any signs of contamination is both immediate and strategic.

2. Rehabilitation of Infrastructure Failures

Our water supply system, a vast and intricate network comprising pipelines, advanced treatment facilities, reservoirs, and numerous other essential components, stands as a testament to modern engineering. Intriguingly, some of our pipelines date back to the 1970s or even earlier. Yet, even such long-standing and robust systems are not immune to challenges. Failures, whether resulting from the inevitable wear and tear of infrastructure, unforeseen external interferences, or sudden, unpredictable incidents, are real possibilities. Understanding the critical nature of our water supply, irrespective of the cause of these disruptions, we recognize the undeniable need for a prompt, efficient, and effective response.

3. Water Shortages Mitigation

In a time defined by shifting climate trends and rapidly escalating urban expansion, water shortages have taken center stage as a critical concern for numerous communities around the globe. These shortages, stemming from factors such as extended drought periods, unsustainable extraction practices, or surging population demands, not only present immediate challenges but also signify long-term threats. It's imperative to address water scarcity with solutions that are both immediate in alleviating present challenges and sustainable for future generations, safeguarding the well-being and prosperity of the population.

4. Terrorist Attacks or Sabotage Response

Given the fundamental significance and critical nature of water supply systems, they are often in the crosshairs for potential terrorist activities or calculated acts of sabotage. Interrupting these vital lifelines can result not only in dire health repercussions but also ripple into profound socio-economic disturbances for the community at large. In the face of such threats, it's imperative to have a multi-faceted strategy. This involves both swift, decisive reactions in crisis moments and the implementation of thorough, long-term preventative and security measures to deter and detect future vulnerabilities.

5. Equipment Malfunction Repair

Modern water supply systems are underpinned by an array of advanced equipment, encompassing everything from high-powered water pumps to intricate treatment plant apparatuses. Although meticulously engineered for durability and consistent performance, factors such as prolonged usage, the inevitable march of time, or unforeseen complications can result in operational failures. Such setbacks can not only interrupt the continuous flow of water but also endanger its purity and safety standards. Hence, it becomes paramount to diagnose and rectify equipment malfunctions with both urgency and precision, ensuring the system's integrity and the community's well-being.

6. Response on Natural Disasters

In the face of nature's unpredictability, events like earthquakes, hurricanes, floods, and droughts emerge as formidable adversaries to our water supply systems. The immediate fallout of such calamities can result in severe service outages and infrastructure damage. Beyond these immediate concerns, the lasting impact of these events can reshape the very landscape of water distribution, forcing us to reconsider traditional sourcing methods. In light of these challenges, it becomes imperative not just to react swiftly in the moment but also to adopt a proactive, adaptive approach, ensuring our systems are resilient against future disruptions (pg. 276).

7. Cyber Attacks Response

In today's digitally connected age, the infrastructure governing our vital water supply isn't just physical, but digital as well. While technology has ushered in efficiencies and capabilities previously unimaginable, it has also opened doors to a new kind of threat: cyber attacks. These malicious intrusions, be they by independent hackers or organized groups, can disrupt operations, compromise data, and potentially harm the water supply (pg. 278).

8.3 Response Plan for Emergency

The San Pablo City Water District (SPCWD) prioritizes the health and safety of its consumers. Our Incident Response Plan is meticulously crafted to address unforeseen events, ensuring swift and strategic reactions to potential public health risks. Recognizing the paramount importance of delivering safe water, our objective is the immediate restoration of water services during any incident.

Should there be any doubt regarding the quality and safety of our water under any circumstances, our protocol mandates immediate notification to our consumers. This may involve the issuance of a drinking water advisory or, if necessary, the provisioning of an alternative water source.

SPCWD's emergency plans have been refined over the years, incorporating crucial recommendations. These include guidelines on household water treatment and safe storage, ensuring that in times of crisis, our consumers have access to safe drinking water. Alongside adhering to these stringent internal procedures, we always maintain open communication with relevant authorities, ensuring that we remain updated on best practices related to household water treatment and storage.

This collaborative approach guarantees that we can tailor the most effective and locally-relevant solutions for San Pablo City residents during emergencies.

Objective:

To outline a robust strategy ensuring timely, efficient, and effective response to emergencies, thereby guaranteeing the consistent provision of safe water services to San Pablo City residents. The objective also emphasizes minimizing the impact of emergencies on the water supply and maintaining public trust in SPCWD's capabilities.

Responsibility:

- **Emergency Response Team (ERT)**: This dedicated team (TSD/ASD/WSP/OD) is in charge of orchestrating the entire emergency response, from assessment to resolution.
- **Community Relations and External Affairs Section (CREAS):** Responsible for disseminating accurate information to the public and stakeholders, and managing communication channels.
- **Technical and Operations Departments:** Accountable for the on-ground response, infrastructure repairs, and restoring the system's functionality.
- **Support and Logistics Team**: Ensures all necessary resources, tools, and equipment are available and mobilized for the response effort.
- **Training and Development Section**: Ensures periodic training for all personnel on emergency response protocols.

Table 22. Emergency Response Team

EMERGENCY RESPONSE TEAM			
Function	Person in Charge	Position	Contact Info
Incident Commander	**Jonnas Firmo C. Biscocho**	Acting Division Manager, EWRD	**0917 630 4302**
Team Communication	**Wilfredo M. Aligato**	Division Manager, GSD	**0917 633 5278**

Scene Supervisor	**Engr. Wilson M. Awayan**	Division Manager, Production Division	**0929 952 3435**
Route Guide	**Arvin B. Gutierrez**	General Services Chief – B	**0928 521 6806**
Public Information Team (CREAS)	**Cherry Mae C. Cimatu**	Senior Community Relations Officer	**0998 561 7161**
Operational Response (TSD)	**Jonnas Firmo C. Biscocho**	Acting Division Manager EWRD	**0917 630 4302**
Operational Response (OD)	**Engr. Wilson M. Awayan**	Division Manager, Production Division	**0929 952 3435**
Support and Logistics Team	**Arvin B. Gutierrez**	General Services Chief – B	**0928 521 6806**
Budget Support	**Mildred D. Velasco**	Chief Corporate Accountant	**0919 999 0663**
Training and Development	**Mervin M. Quijano**	Training and Development Officer	**(049) 562 9955**

Plan:

To anticipate, manage, and overcome potential challenges posed by emergencies, thereby ensuring an uninterrupted water supply, restoring normalcy in the shortest possible time, and upholding the reputation of the SPCWD.

Scope:

The plan addresses a variety of potential emergencies that might disrupt the SPCWD water supply, such as:

- Natural disasters (e.g., earthquakes, floods)
- Technical failures or cyber attacks
- Water contamination
- Physical infrastructure damage
- Civil unrest or sabotage

It encompasses all SPCWD personnel, infrastructure, and the wider community that depends on its services.

Procedures:

1) Activation of Emergency Response:

- ❖ Instantly activate the ERT upon receiving an alert about a potential emergency.
- ❖ Assess the severity and nature of the emergency, categorizing it accordingly.

2) Communication Strategy:

- ❖ Launch the emergency communication protocol, notifying internal teams and external stakeholders.
- ❖ Use various channels like social media, local radio, and SMS to alert the public, providing clear guidelines and safety measures.

3) Operational Response:

- ❖ Depending on the emergency type, initiate necessary operational adjustments, such as shutting down parts of the system, using backup facilities, or adjusting water distribution priorities.
- ❖ Mobilize technical teams to the affected areas for on-ground interventions.

4) Resource Mobilization:

- ❖ The logistics team should ensure the quick provision of essential tools, equipment, and manpower required for the response.
- ❖ Coordinate with external agencies for any additional support or resources.
- ❖ In case of suppliers' information, please refer to the information below:

Water Meters

CONSTECH ASIA CORP.
James Xie, General Manager
Bayaya St. Brgy. Bungad, Quezon City
0919-994-5688/0917-878-1512
(02) 8962-2398

Chlorine Powder

ASYANA MULTICHEM CORP.
Katrina Nicole Guzman, Account Manager
Dagohoy St., Brgy 77 Caloocan City, Manila
0925-714-0503
(02) 8363-0380/ (02) 8365-2364

Pipes and Fittings

KIAN SENG TRADING
James Uy, Owner
Don Placiado St., Vesco Subd.
San Pablo Laguna
(049) 562-0387

Submersible Pumps and Motors

ANDRITECH INDUSTRIAL SALES CO.
Nelson D. Rabadon, General Manager
B46 L7 King Henry St., Kingspoint Subd.
Bagbag Novaliches Quezon City
0933-4332724

Generator Sets and Air Compressors

JANGLO TRADING AND CONSTRUCTION
Fermin Lebrudo, General Manager
9298 J.M Loyola St., Brgy. Maduya, Carmona Cavite
0945-5826659/ 09335163985

Cement and Aggregates

SAN PABLO CITI ENTERPRISE CORP.
Leila Miranda, Manager
Maharlika Highway, San Pablo City
049-562-0024

5) Public Safety Measures:
   - ❖ Depending on the situation, distribute safety kits, portable water, or guidelines to the affected public.
   - ❖ Establish temporary help centers or hotline if required.

Health Information Center

Dr. James Lee Ho
City Health Officer
San Pablo City Laguna
(049) 576 9119

Bureau of Fire Protection R4A San Pablo City

SFO3 Lorelyn B Meflores
Chief Admin
San Pablo Laguna
562-7654/ 572-3868
09995784943

6) Restoration & Recovery:
   - ❖ After the immediate threat is managed, focus on restoring regular operations.
   - ❖ Repair damaged infrastructure, conduct water quality tests, and closely monitor system performance.
7) Post-Emergency Review:
   - ❖ Convene a review meeting involving all key departments to assess the response's effectiveness.
   - ❖ Document lessons learned, challenges faced, and areas of improvement.
   - ❖ Update emergency protocols based on feedback and experiences.
8) Continuous Training:
   - ❖ Regularly update emergency response training programs and conduct drills simulating potential emergency scenarios.

By adopting and regularly updating this emergency response plan, SPCWD commits to the safety and well-being of San Pablo City residents, ensuring that they always have access to clean and safe water, even in adverse situations.

Table 23. Standard Operating Procedures

Standard Operating Procedures					
Category	**Sub-Category**	**SOP Title**	**Pg**	**Cross Referred To (Dept/Section/ WSP-SOP Code)**	**Main User of SOP**
Normal Condition SOPs					
Water Sample	Sampling	A. Microbiological Sampling Procedure	175	TSD /Lab/WSP-SOP01	Laboratory/ Sampler
		B. Physical and Chemical Sampling Procedure	176	TSD /Lab /WSP-SOP02	
Dosing procedure		C. Chlorine Solution Preparation	177	TSD/EWRD/WSP-SOP01	EWRD/WRFO
Laboratory Analysis	Microbiological Analysis	D. Standard Operating Procedure for Total Coliform Analysis	180	TSD /Lab /WSP-SOP03	Laboratory/ Medical Technician
		E. Standard Operating Procedure for Heterotrophic Plate Count Analysis	186	TSD /Lab /WSP-SOP04	
		F. Standard Operating Procedure for Fecal Coliform Analysis	191	TSD /Lab /WSP-SOP05	
		G. SOP for Test Method for Enzyme Substrate Test (Presence-Absence)	197	TSD /Lab /WSP-SOP06	
		H. Standard Operating Procedure for Gram Staining	199	TSD /Lab /WSP-SOP07	
		I. Standard Operating Procedure for IMVIC TEST	202	TSD /Lab /WSP-SOP08	
Equipment and Facility Maintenance	Pumps and Motors	J. Maintenance of Chemical Feed Pumps or Chlorinators	207	TSD/EWRD/WSP-SOP02	EWRD/WRFO
Water System Facility	Distribution Lines	K. Installation of Small Distribution Line	208	OD/WSP-SOP01	OD/Pipeline and Appurtenances

		L. Installation of New Service Connection Tap at Distribution Line	210	OD/WSP-SOP02	Team
		M. Pipe Laying Installation	211	OD/WSP-SOP03	
		N. Pipeline Interconnection Procedure	213	OD/WSP-SOP04	
		O. Hydro Testing Procedure	214	OD/WSP-SOP05	
		P. Disinfection, Flushing and Turn Over	215	OD/WSP-SOP06	
Water Connection	Water Meter	Q. Replacement of Water Meter (Change Meter)	216	CSD/WSP-SOP01	OD/Disconnection and Reconnection Team
		R. Reconnection of Water Meter	217	CSD/WSP-SOP02	
	Water Connection	S. Rehabilitation of Service Connection	218	CSD/WSP-SOP03	
	Distribution Lines	T. Repair of Mainline Leakages	221	OD/WSP-SOP06	OD/Maintenance and Rehabilitation Team
		U. Repair of Service Connection Leaks	223	OD/WSP-SOP07	OD/Maintenance and Rehabilitation Team
	Water Connection	V. Storage and Handling of Materials and Supplies for Water Connection	224	AD/GSD/WSP-SOP01	OD/Maintenance and Rehabilitation Team
Customer Service Procedure	Service Connection	W. Notice of Disconnection Procedure	226	CSD/WSP-SOP04	CSD/Water Meter Inspector
		X. Reconnection Inspection Procedure	227	CSD/WSP-SOP05	CSD/Water Meter Inspector

		Y. New Service Connection Application	228	CSD/WSP-SOP06	CSD/Water Meter Inspector
Equipment and Facility Maintenance	Water Tanks	Z. Reservoir and Water Tanks Cleaning Procedure	229	TSD/EWRD/WSP-SOP03	EWRD/WRFO
	Filtration System	AA. Filtration Media Replacement Procedure	230	TSD/EWRD/WSP-SOP04	
		AB. Replacement Pump and Motor of Production Well	232	TSD/EWRD/WSP-SOP05	
Calibration of Equipment	Water Meters	AC. Repair and Calibration of Water Meters Procedure	233	OD/WSP-SOP08	OD/Rehabilitation and Maintenance Team
Water System Facility		AD. Determine Water Pressure at Transmission and Distribution Lines	234	OD/WSP-SOP09	
Calibration of Equipment	Laboratory Equipment	AE. Calibration of Laboratory Equipment	235	TSD /Lab /WSP-SOP09	Laboratory Supervisor
Drilling of New Sources	Production Wells	AF. Drilling a Production Well Procedure	238	TSD/EWRD/WSP-SOP06	EWRD/Division Manager
Disinfection Procedure		AG. Elimination of Dirty / Contaminated Water from Distribution Lines	239	OD/WSP-SOP10	OD/Rehabilitation and Maintenance Team
Calibration of Equipment	Pump and Motors	AH. Repair and Calibrate Chlorinator Pump Procedure	240	TSD/EWRD/WSP-SOP07	EWRD/WRFO
Disinfection Procedure	Water Source	AI. Cleanliness on Water Sources Procedure	241	TSD/EWRD/WSP-SOP08	
Equipment and Facility Maintenance	Pump and Motors	AJ. Repair and Maintenance of Pump and Motor	242	TSD/EWRD/WSP-SOP09	
	Bunkhouse	AK. Repair and Maintenance of Damaged Bunkhouse	243	TSD/EWRD/WSP-SOP10	

	Pipelines	AL. Leak Detection Procedure	244	OD/WSP-SOP11	OD/ Rehabilitation and Maintenance Team
	Electrical Supply	AM. Repair and Maintenance of Generator Set Procedure	245	TSD/EWRD/WSP-SOP11	EWRD/ Maintenance Team
		AN. Transferring Power Source in case of Meralco power outage Procedure	247	TSD/EWRD/WSP-SOP12	
Delivery of Supply Procedure	Supply	AO. Fuel / Diesel Delivery for Generator at Water Sources	248	TSD/EWRD/WSP-SOP13	
		AP. Chlorine Powder Supply Delivery to Water Sources	249	TSD/EWRD/WSP-SOP14	
Water System Facility	Water Network	AQ. Installation of Air Release Valves	250	OD/WSP-SOP12	OD/ Rehabilitation and Maintenance Team
	Water Network	AR. Repair and Maintenance of Fire Hydrant	251	OD/WSP-SOP13	OD/ Rehabilitation and Maintenance Team
Disinfection	Residual Chlorine Test	AS. Chlorine Residual Test at Water Sources	253	TSD/EWRD/WSP-SOP15	EWRD/WRFO
Water System Facility	Water Network	AT. Repair and Maintenance of Pipe Bridge Crossing	254	OD/WSP-SOP14	OD/ Rehabilitation and Maintenance Team
	Electrical Supply	AU. Repair and Maintenance of Electrical System	256	TSD/EWRD/WSP-SOP16	OD/ Rehabilitation and Maintenance Team
Customer Service Procedure		AV. Addressing Customer Complaints Procedure	257	CSD/WSP-SOP07	CSD/Customer Service Representative
Water System Facility		AW. Reduction of Non-Revenue Water	259	TSD/EWRD/WSP-SOP17	EWRD/Division Manager

Budgeting		AX. Budgeting Procedure for Water Safety Plan	261	FMD/WSP-SOP01	FMD/Budget Officer
Incident Condition SOPs (Major Corrective Actions					
Water Supply	Emergency Response	AY. Resolving the Cause and Effect of Contaminated Water	265	TSD/ERT/WSP-SOP01	TSD/ERT
Equipment and Facility	Emergency Response	AZ. Rehabilitation of Infrastructure Failures	267	OD/ERT/WSP-SOP02	OD/ERT
Equipment and Facility	Emergency Response	BA. Water Shortages Mitigation	269	OD/ERT/WSP-SOP03	OD/ERT
Facility operations overview	General Information	BB. Terrorist Attacks or Sabotage Response	272	ASD/ERT/WSP-SOP04	ASD/ERT
Equipment and Facility	Emergency Response	BC. Equipment Malfunction Repair	274	TSD/ERT/WSP-SOP05	TSD/ERT
Equipment and Facility	Emergency Response	BD. Response on Natural Disasters	276	OD/ERT/WSP-SOP06	OD/ERT
Facility operations overview	General Information	BE. Cyber Attacks Response	278	ICTS/ERT/WSP-SOP07	ICTS/ERT
Emergency Procedure SOP					
Facility operations		BF. Emergency Response Plan and Procedure	280	ERT/TSD/OD/WSP-SOP01	ERT/SPCWD

9. Supporting Programs

Ensuring the safety of drinking water is a fundamental responsibility of governments and water service providers. A comprehensive approach to water safety must go beyond treating and monitoring the water itself. Supporting activities are an essential component of this approach, as we address factors that may indirectly impact water quality, but are crucial to maintaining a safe and hygienic water supply.

One crucial supporting activity is training and education programs for water treatment staff. Properly trained staff can operate and maintain equipment effectively, reducing the risk of equipment failures and other emergencies. Regular equipment maintenance and calibration are also essential to prevent issues and ensure that the water treatment process is functioning optimally. Good management practices are another vital component of supporting activities. Codes of good operating, management, and hygienic practices help to establish clear guidelines for staff and ensure that everyone involved in the water treatment process is aware of their responsibilities and obligations. Standard operating procedures or system operating rules can help to streamline processes and minimize the risk of errors or oversights. All of these supporting activities should be documented in a Water Safety Plan (WSP), which serves as a comprehensive guide for ensuring the safety of drinking water. A well-designed WSP includes an inventory of all equipment and materials used in the water treatment process, clear procedures for maintaining and testing these components, and outlined roles and responsibilities for staff members. A short list is on Table 23 (pg. 66-70).

Effective communication is also critical. Water service providers should inform customers of any issues or concerns related to water quality and provide guidance on how to address them. Communication channels should be established to allow customers to report any problems or concerns they may have. Inadequate infrastructure or limited resources can pose significant challenges to ensuring water safety. In these cases, effective management and supporting activities are even more critical. By incorporating good management practices and clear operating procedures, organizations can help to minimize risks and ensure that our water supply is safe, reliable, and of high quality.

Supporting activities are essential to ensuring the safety of drinking water. They play a critical role in maintaining the integrity of the water treatment process, preventing potential hazards from entering the supply, and ensuring that water quality is maintained. By focusing on proper management, training, education, and communication, organizations can help to safeguard public health and ensure that everyone has access to safe and clean drinking water.

Table 24. Supporting Programs

ACTIVITY	PURPOSE	PROGRAM	FUNDING SOURCE	Target Date	PARTICIPANTS
Training and Awareness	To ensure that the organization, personnel and its concessionaires understand water safety plan and the influence of their actions	WSP General Awareness Program for all employees	CREAS Budget	Monthly 2023-28	All SPCWD Employees
		WSP Orientation for new member of the WSP Team	SPCWD Training Budget	September 2023	New WSP Team member
		Trainings for Water Facility Operators on Chlorine preparation, dosing, residual Chlorine monitoring, water quality	SPCWD Training Budget	Annual (May 2023)	Water Facilities Operators
		Trainings for selected employees on emergency preparedness and response (Disaster Risk Reduction)	SPCWD Training Budget	Annual (June 2023)	Members of SPCWD DRRMC
Calibration	To ensure that the instruments and equipment used in monitoring is accurate and precise	Laboratory instruments and equipment	R&M Budget	Annual 2023-28	With Laboratory staff
		Process instruments: Flow meters, data loggers, pressure gauges, level sensors	R&M Budget	Annual 2023-28	With Supervisors
		Chlorine Dosing Equipment	R&M Budget	Quarterly 2023-28	With Supervisors and Operators
		Water Meters and Gate Valves	R&M Budget	Daily / Bi-Annual	Division Managers and Supervisors
Preventive Maintenance of Equipment and Instruments	To prevent unnecessary malfunctions in the process; storages and assets are in good working conditions	Reservoir and Tank Cleaning	R&M Budget	Annual 2023-28	Water Facilities operators
		Cleaning of Raw water and Clear water tanks (Backwash)	R&M Budget	Daily 2023-28	Water Facilities operators
		Electro-mechanical facility of water treatment plants, deepwell stations	R&M Budget	Monthly 2023-28	Electro-mechanical staff
		Preventive maintenance for chlorinators	R&M Budget	Monthly 2023-28	Water Facilities operators
Hygiene and Sanitation	To ensure Occupational Safety and Health of the employees and to prevent water contamination	Occupational Health and Safety and Water Quality Monitoring	GSD Budget	Annual 2023-2028	Water Facilities operators, Pump Repair section, Plumbers, Laboratory Staff, WSP
Customer Complaint Protocol	To ensure that the customers are aware of the quality and safety of the water they are drinking	Customer Service Program; Complaints Training	CREAS / CSD Budget	Annual 2023 - 2028	Customer care employees, SPCWD employees doing frontline services
Materials and Chemicals Specification	To control chemical hazards from materials and chemicals used in water treatment, storage cleaning and laboratory activities	Material Safety Data Sheet (MSDS)	GSD Budget	Every Other Year 2023, 2025, 2027	End Users, Purchasing Section, Bids and Awards Committee

10. Periodic Review of WSP

The results of the verification exercise should be used to evaluate and review the water safety plan to see whether the field assessments identified need modifications. This requires analysis of the verification data to see if there are any deficiencies in the WSP. If verification shows that microbial contamination is detected despite the presence of control measures within their critical limits, this immediately indicates that control measures have been identified incorrectly, the critical limits are inappropriate or the control measures are insufficient. Internal or third party (independent) verification is recommended for the development of institutional relationships.

During the review, the following questions should be addressed:

- How well is the WSP working?
- Were the necessary management plans undertaken adequate?
- If not, which areas require improvement to provide long-term sustainability of the WSP?

The WSP shall be reviewed:

- Annually or every month of August.
- After an incident.
- After any significant change to the water supply.
- In response to finding a weakness in the plan.
- Additional information regarding the system is received that might warrant a revised risk level for that system.

The team will meet periodically to review the WSP and to learn from experiences and new procedures. The WSP will also be reviewed whenever there are significant changes in or around the water supply. The review process is essential to overall implementation and provides the basis from which future assessments can be made.

To review the plan, the WSP team will consider the following:

- Review and include any new activities or changes in the catchment area, abstraction, treatment, storage, distribution and consumer components of the water supply, as applicable.

- Review the improvement schedule. This will need to be updated as improvements are completed. New information or resources may mean changing the order of priority for the improvements.
- Review the roles and responsibilities and standard operating procedures. Have the roles and responsibilities of management or staff changed since last review? Have there been personnel changes since the last review? Have there been any changes in system operation, maintenance, inspection and monitoring processes and procedures?
- Review available water quality data and any completed sanitary inspection forms. Are control measures working as planned? Does the risk assessment need to be updated based on these results?

11. Revision of WSP following an Incident

After an incident, emergency or near-miss, the WSP must be reviewed. The cause of the incident will be determined and then revisions to the WSP made. Below are examples of incidents which can occur in a water system.

- **E. Coli / pathogen detection in the distribution.** When an incident involves E. Coli or pathogen detection in the distribution, it signifies a potential breach in the system's barriers to contamination. The WSP must be reviewed to identify the source of the contamination, assess the effectiveness of existing control measures, and introduce additional measures to prevent future incidents. This may involve enhancing disinfection processes, improving monitoring protocols, or implementing more rigorous maintenance procedures.
- **Contamination during high rainfall/ flooding.** Contamination incidents during periods of high rainfall or flooding require a thorough examination of vulnerability points within the water system. The WSP should be revised to address these vulnerabilities, such as strengthening infrastructure resilience, implementing robust flood mitigation measures, and enhancing monitoring during extreme weather events. Additionally, contingency plans should be reviewed and updated to facilitate a swift response in case of future flooding incidents.
- **Security breach at closed storages.** A security breach at closed storages demands a review of security protocols and access controls. The WSP should be revised to enhance security measures, such as installing surveillance systems, implementing restricted access measures,

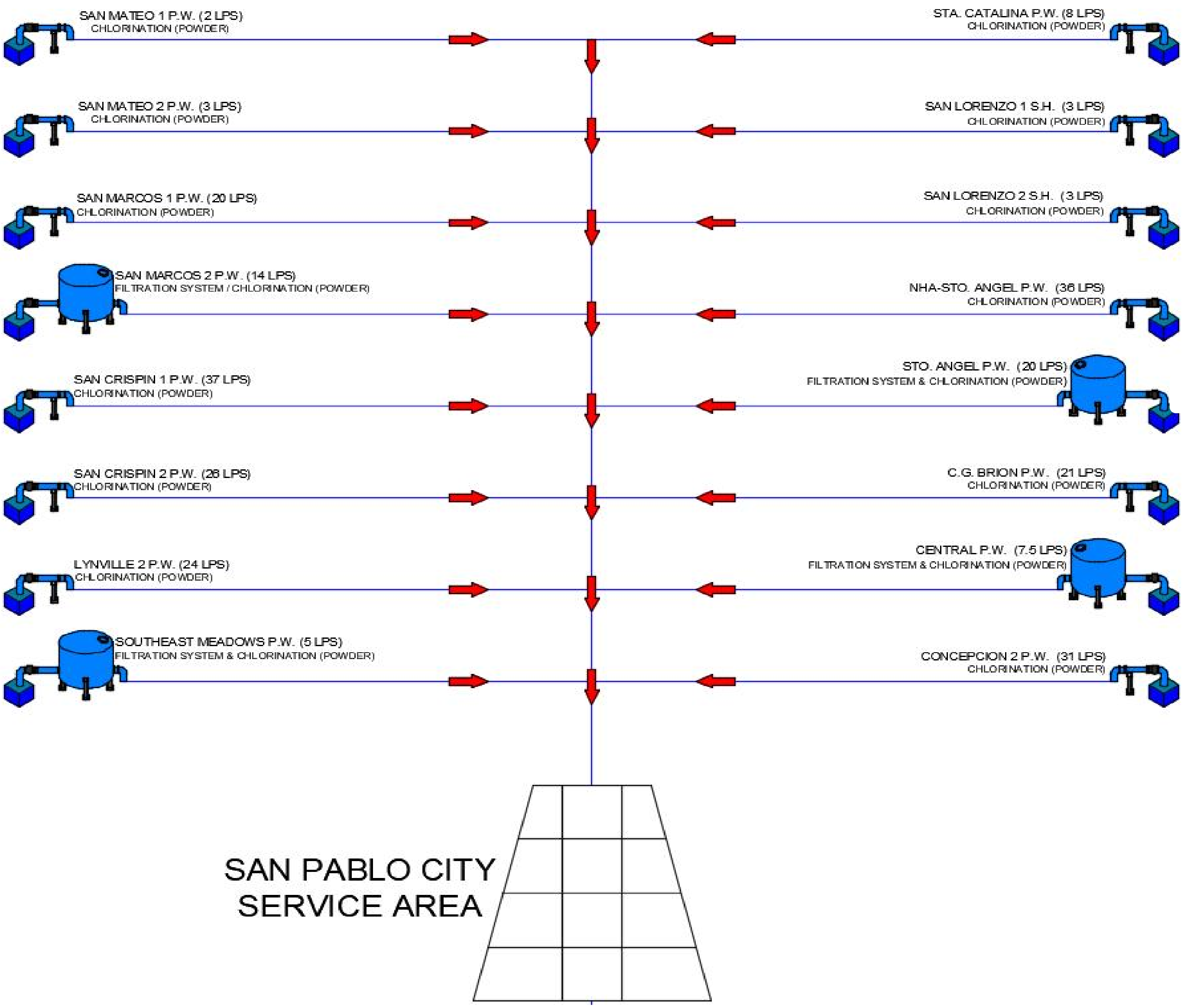
and conducting regular security audits. By addressing security vulnerabilities, the WSP ensures the protection of the water supply from intentional contamination or tampering.

- **Extended disinfection / Treatment failures.** Extended disinfection or treatment failures highlight the need to reassess treatment processes and their reliability. The WSP revision should focus on strengthening treatment systems, improving maintenance procedures, and implementing redundant treatment measures to minimize the risk of extended failures. Additionally, alternative disinfection methods can be explored to ensure continuous disinfection during unforeseen circumstances.
- **Confirmed cross contamination or backflow event.** Confirmed cross contamination or backflow events necessitate a comprehensive review of the water system's design and cross-connection control measures. The WSP should be updated to enhance cross-connection prevention strategies, such as implementing backflow prevention devices, conducting regular inspections, and providing educational outreach to consumers. These measures reduce the risk of cross-contamination incidents and protect the integrity of the water supply.

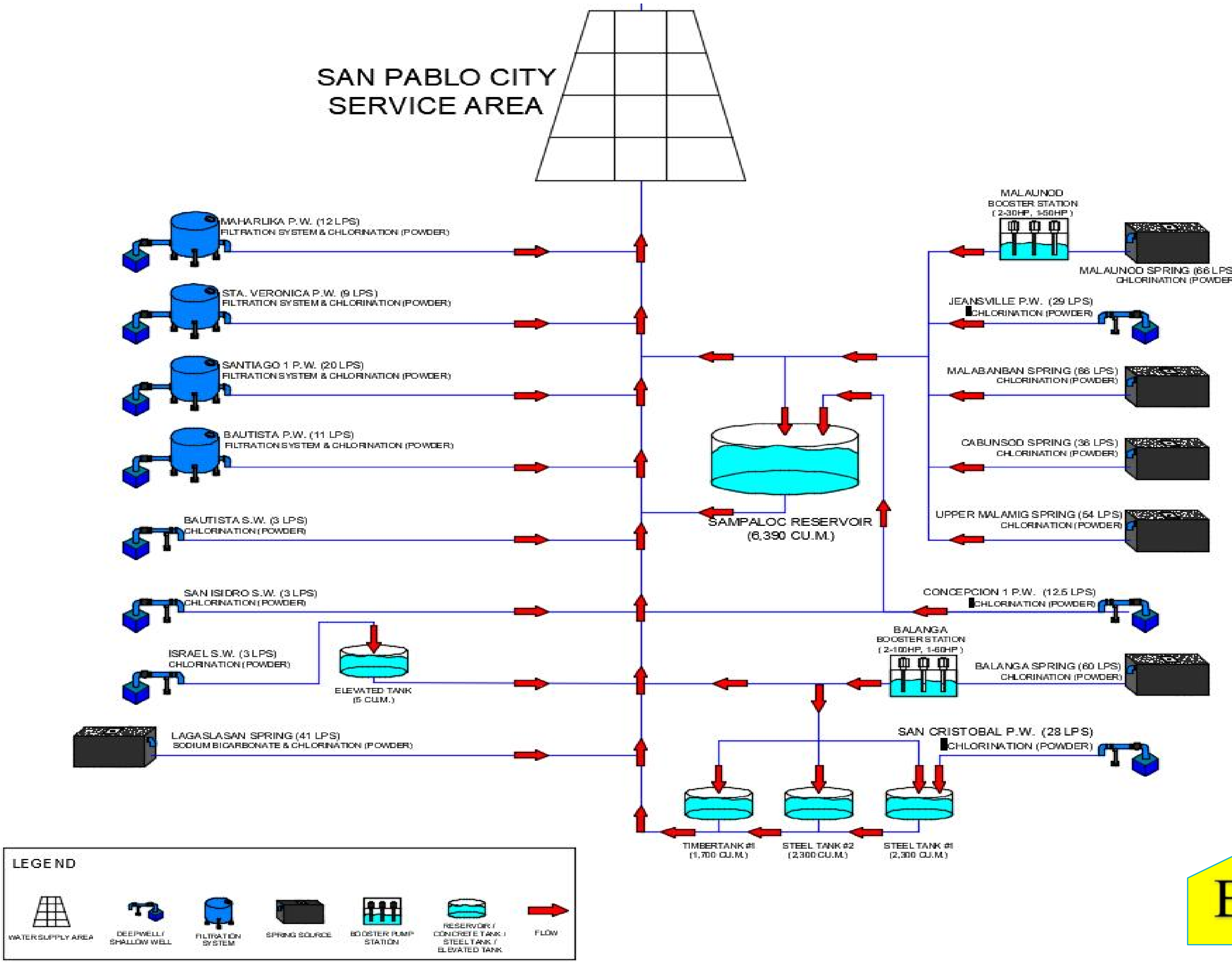
To ensure the continual safety of our water supply, we prioritize regular reviews of the Water Safety Plan (WSP) following any incidents, emergencies, or near-miss situations, irrespective of the identification of new hazards. These comprehensive evaluations are crucial for minimizing the likelihood of future incidents and assessing the effectiveness of our response strategies. Despite the inherent challenges in investigating events and assigning accountability after an incident, our commitment to WSP reviews remains unwavering. By leveraging these valuable experiences, we strengthen our ability to protect public health and ensure the delivery of clean and safe drinking water to our community. Our dedication to this process exemplifies our unwavering commitment to prioritizing the well-being of our customers.

By promptly revising the WSP following incidents, we demonstrate our commitment to continuous improvement and the provision of safe drinking water to our community. The revised plan incorporates the lessons learned from past incidents, mitigates risks, and reinforces our dedication to maintaining the highest standards of water safety.

ANNEX A - System Flow Diagram

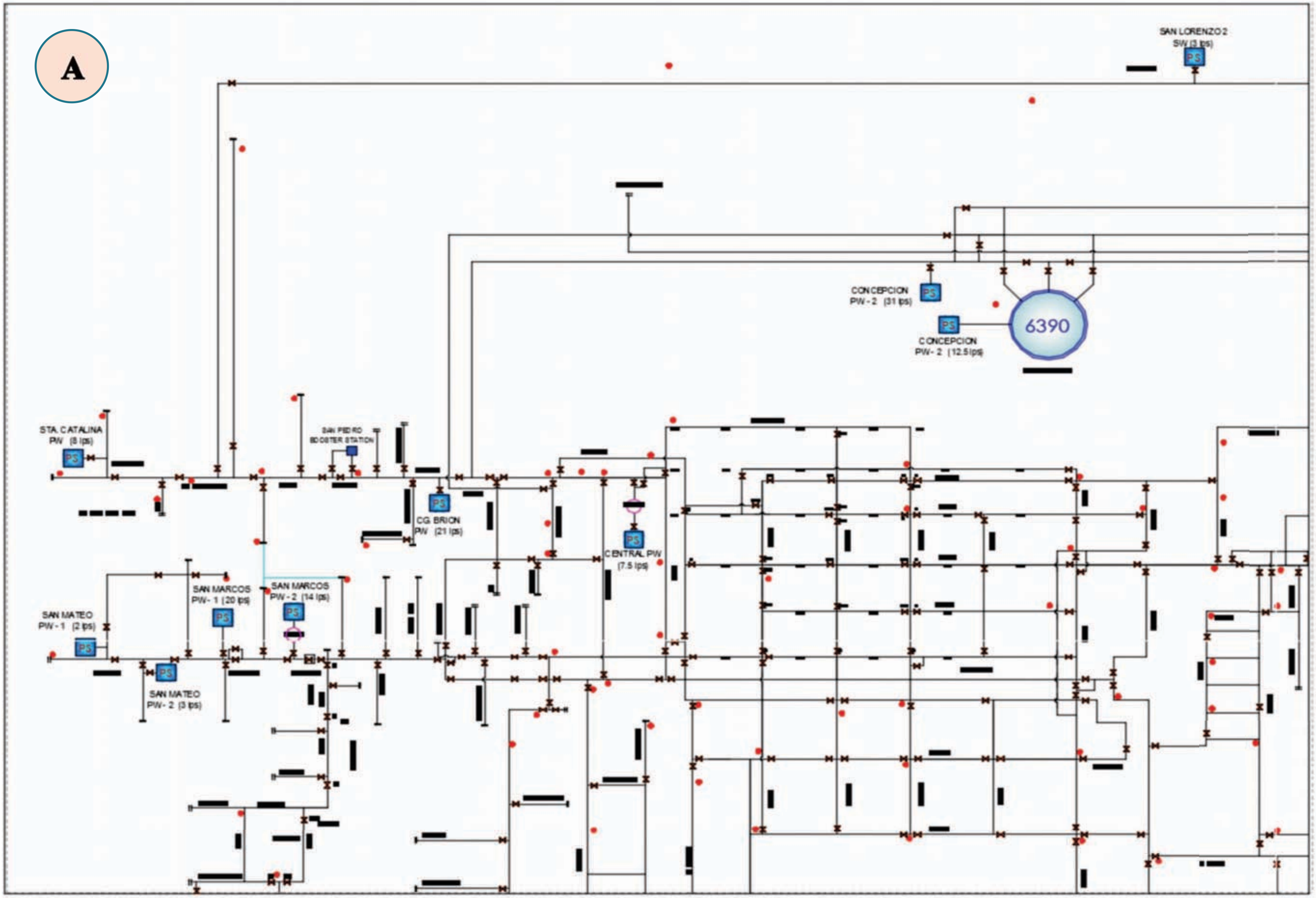


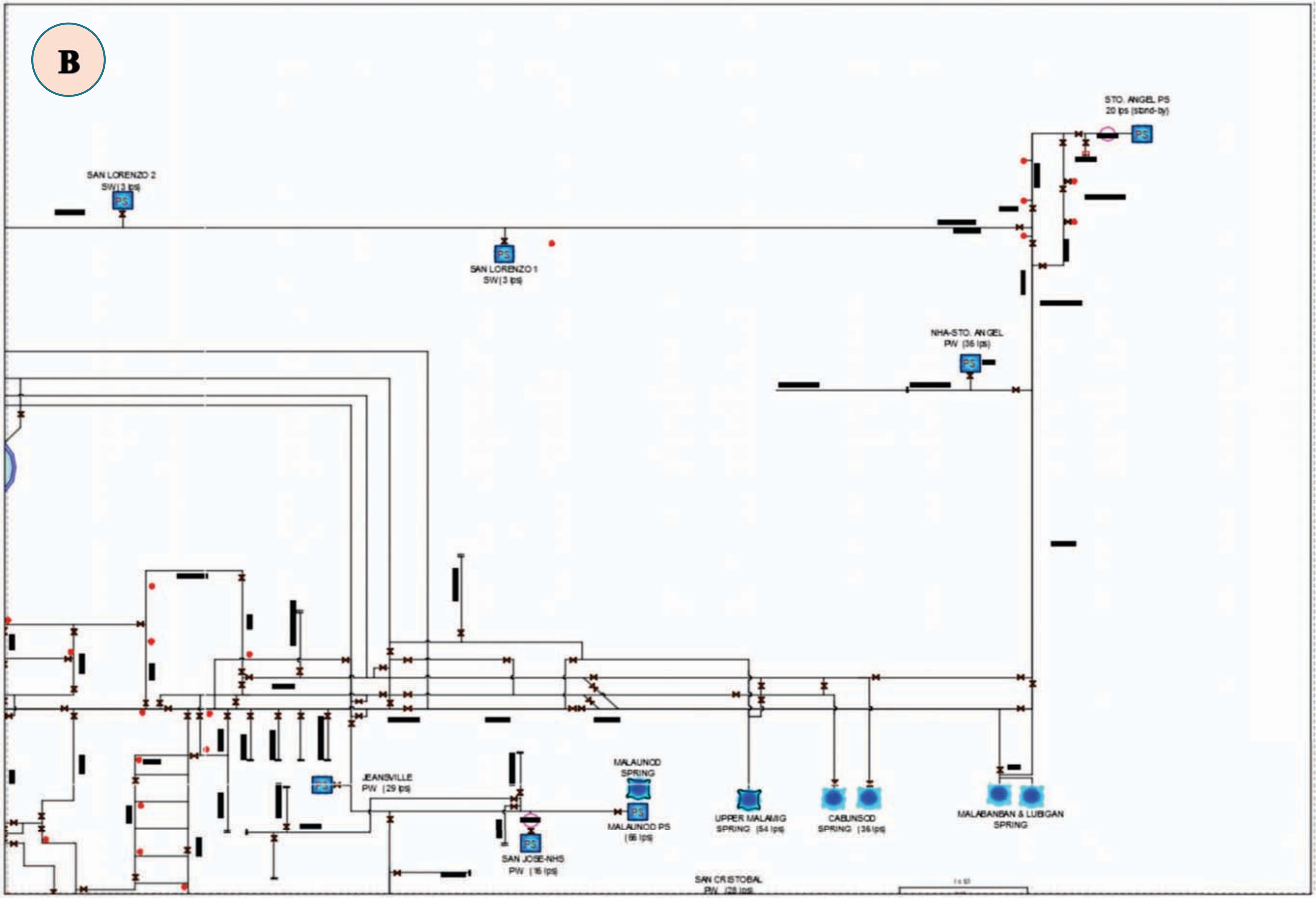
A

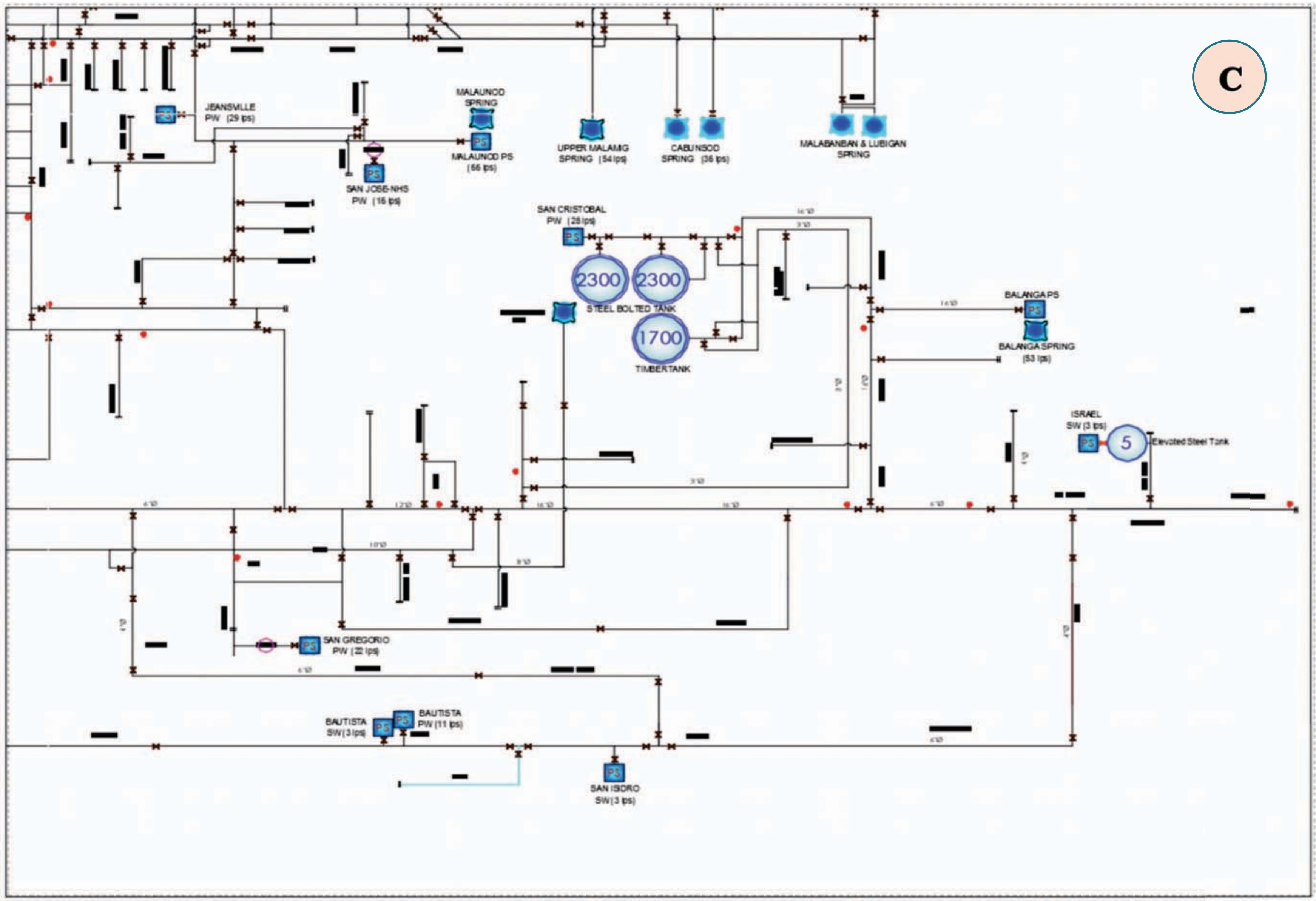

SAN PABLO CITY
SERVICE AREA
MAHARLIKA P.W. (12 LPS)
FILTRATION SYSTEM & CHLORINATION (POWDER)
STA. VERONICA P.W. (9 LPS)
FILTRATION SYSTEM & CHLORINATION (POWDER)
SANTIAGO 1 P.W. (20 LPS)
FILTRATION SYSTEM & CHLORINATION (POWDER)
BAUTISTA P.W. (11 LPS)
FILTRATION SYSTEM & CHLORINATION (POWDER)
BAUTISTA S.W. (3 LPS)
CHLORINATION (POWDER)
SAN ISIDRO S.W. (3 LPS)
CHLORINATION (POWDER)
ISRAEL S.W. (3 LPS)
CHLORINATION (POWDER)
ELEVATED TANK
(5 CU.M.)
LAGASLASAN SPRING (41 LPS)
SODIUM BICARBONATE & CHLORINATION (POWDER)
MALAUNOD
BOOSTER STATION
(2-30HP, 1-50HP)
MALAUNOD SPRING (66 LPS)
CHLORINATION (POWDER)
JEANSVILLE P.W. (29 LPS)
CHLORINATION (POWDER)
MALABANBAN SPRING (86 LPS)
CHLORINATION (POWDER)
CABUNSOD SPRING (36 LPS)
CHLORINATION (POWDER)
UPPER MALAMIG SPRING (54 LPS)
CHLORINATION (POWDER)
SAMPALOC RESERVOIR
(6,390 CU.M.)
CONCEPCION 1 P.W. (12.5 LPS)
CHLORINATION (POWDER)
BALANGA
BOOSTER STATION
(2-100HP, 1-60HP)
BALANGA SPRING (60 LPS)
CHLORINATION (POWDER)
SAN CRISTOBAL P.W. (28 LPS)
CHLORINATION (POWDER)
TIMBERTANK #1
(1,700 CU.M.)
STEEL TANK #2
(2,300 CU.M.)
STEEL TANK #1
(2,300 CU.M.)
LEGEND
WATER SUPPLY AREA
DEEPWELL / SHALLOW WELL
FILTRATION SYSTEM
SPRING SOURCE
BOOSTER PUMP STATION
RESERVOIR / CONCRETE TANK / STEEL TANK / ELEVATED TANK
FLOW

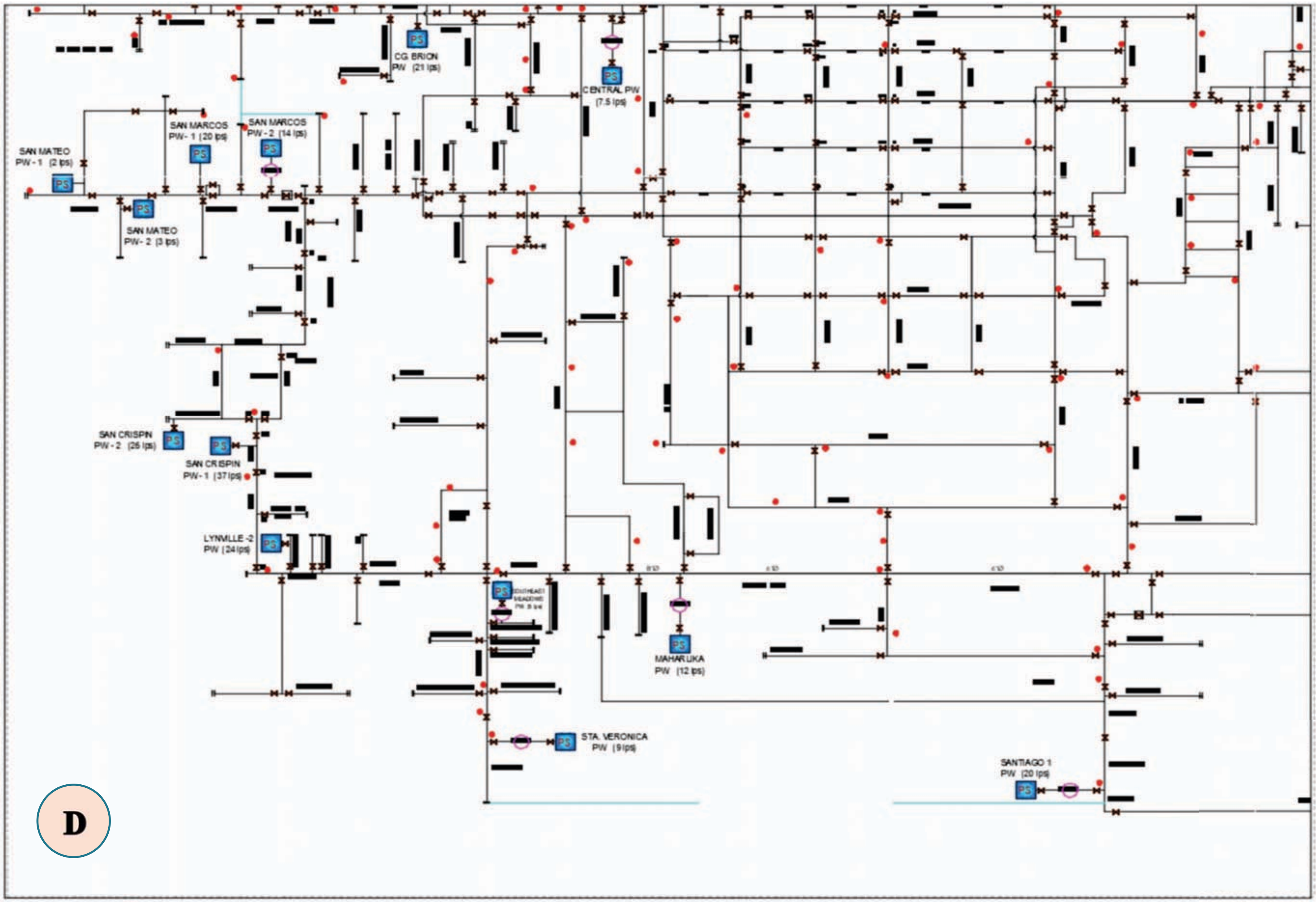
B

ANNEX B - Water Supply System

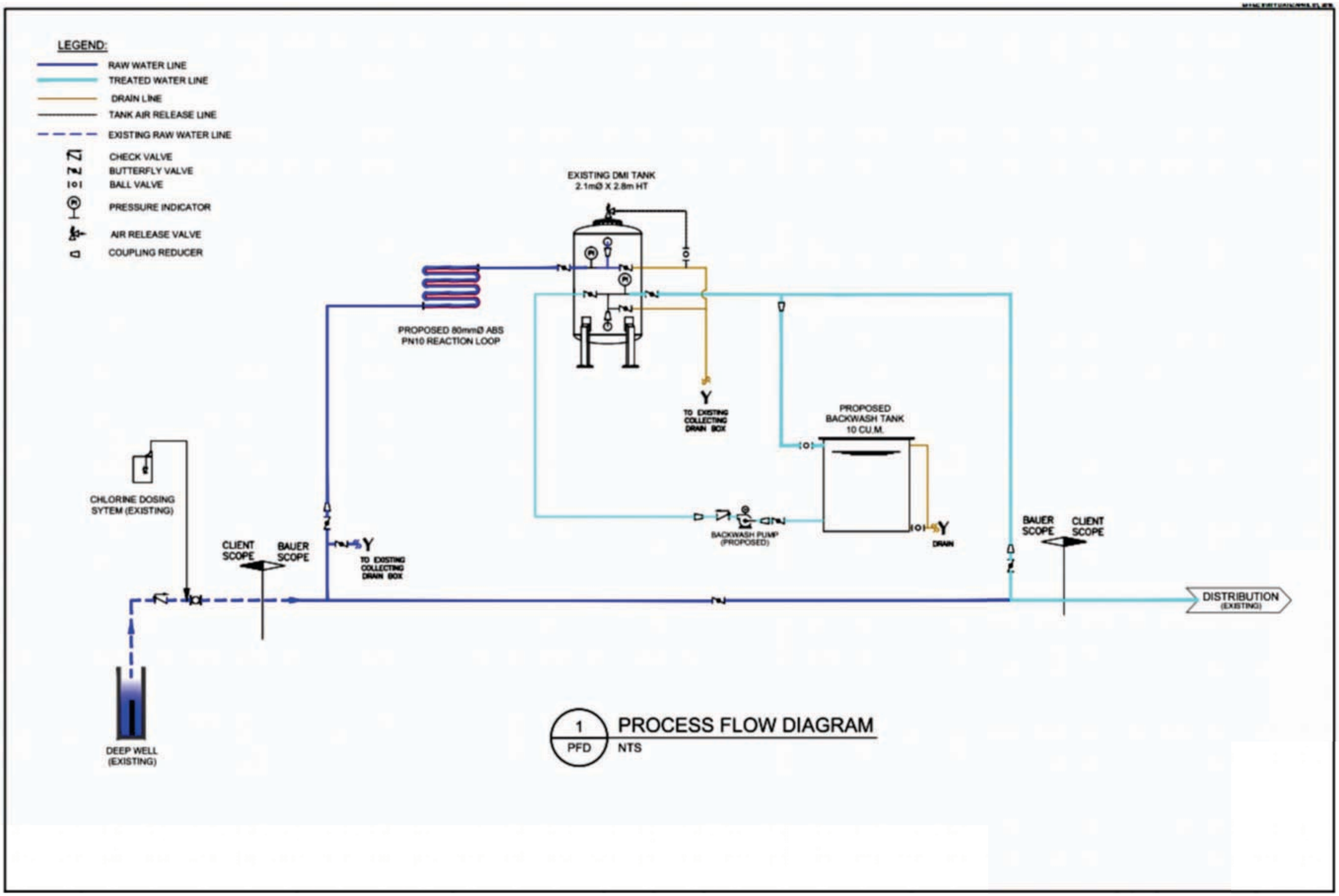



B
STO. ANGEL PS
20 lps (stand-by)
SAN LORENZO 2
SW (3 lps)
SAN LORENZO 1
SW (3 lps)
NHA-STO. ANGEL
PW (36 lps)
JEANSVILLE
PW (29 lps)
MALAUNOD
SPRING
MALAUNOD PS
SAN JOSE-NHS
PW (16 lps)
UPPER MALAMIG
SPRING (54 lps)
CABUNSOD
SPRING (36 lps)
MALABANBAN & LUBIGAN
SPRING
SAN CRISTOBAL
PW

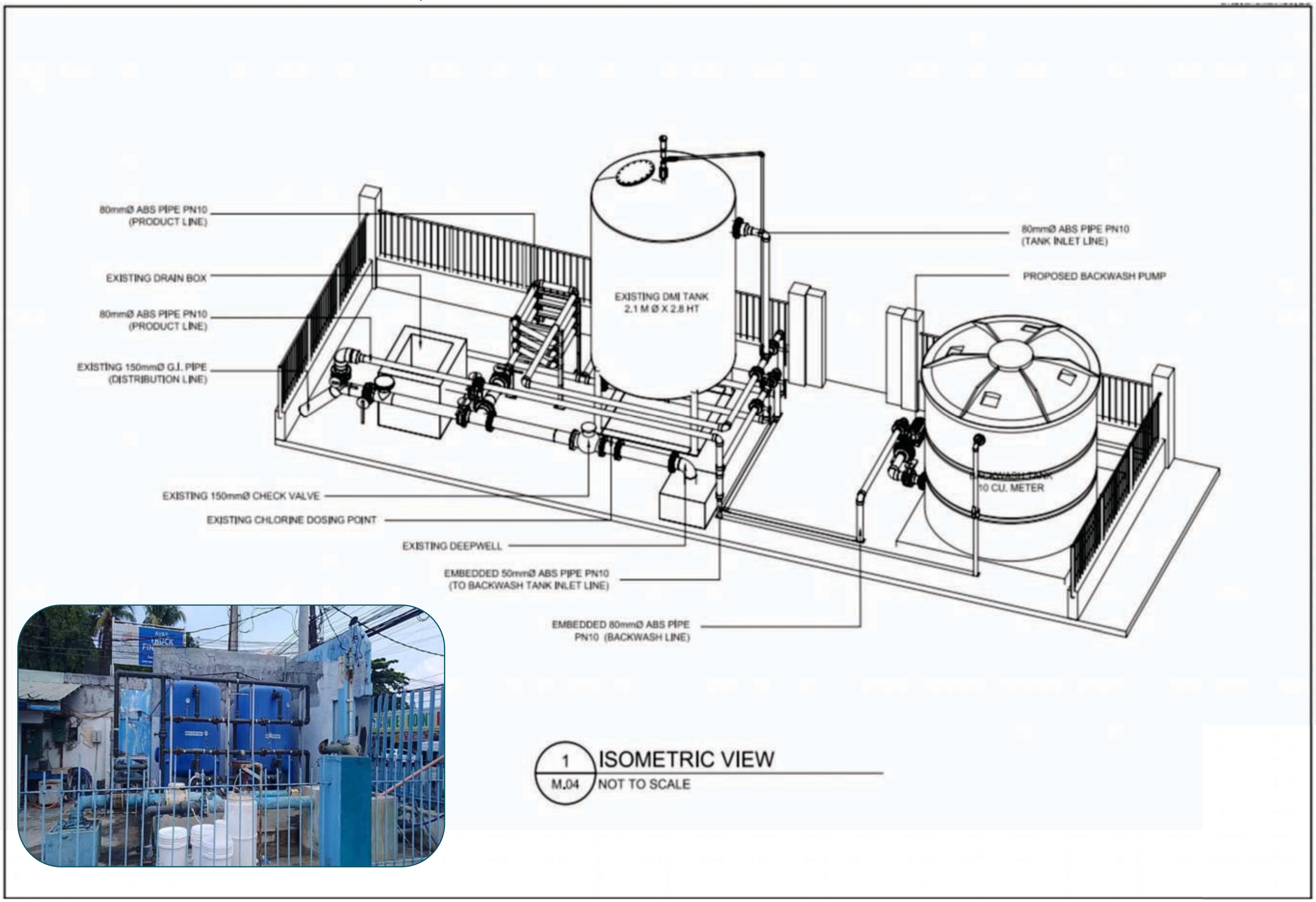

C
JEANSVILLE
PW (29 lps)
MALAUNOD
SPRING
MALAUNOD PS
(56 lps)
SAN JOSE-NHS
PW (16 lps)
UPPER MALAMIG
SPRING (54 lps)
CABUNSOD
SPRING (36 lps)
MALABANBAN & LUBIGAN
SPRING
SAN CRISTOBAL
PW (28 lps)
2300
2300
STEEL BOLTED TANK
1700
TIMBER TANK
BALANGA PS
BALANGA SPRING
(53 lps)
ISRAEL
SW (3 lps)
5
Elevated Steel Tank
SAN GREGORIO
PW (22 lps)
BAUTISTA
SW (3 lps)
BAUTISTA
PW (11 lps)
SAN ISIDRO
SW (3 lps)


SAN MATEO
PW - 1 (2 lps)
SAN MARCOS
PW - 1 (20 lps)
SAN MARCOS
PW - 2 (14 lps)
CG BRION
PW (21 lps)
CENTRAL PW
(7.5 lps)
SAN MATEO
PW - 2 (3 lps)
SAN CRISPIN
PW - 2 (26 lps)
SAN CRISPIN
PW - 1 (37 lps)
LYNVILLE -2
PW (24 lps)
MAHARLIKA
PW (12 lps)
STA. VERONICA
PW (9 lps)
SANTIAGO 1
PW (20 lps)
D

ANNEX C - Process Flow Diagram for Filtration



ANNEX D - Isometric View of Filtration System



ANNEX E - Process Flow Diagrams of Water Sources

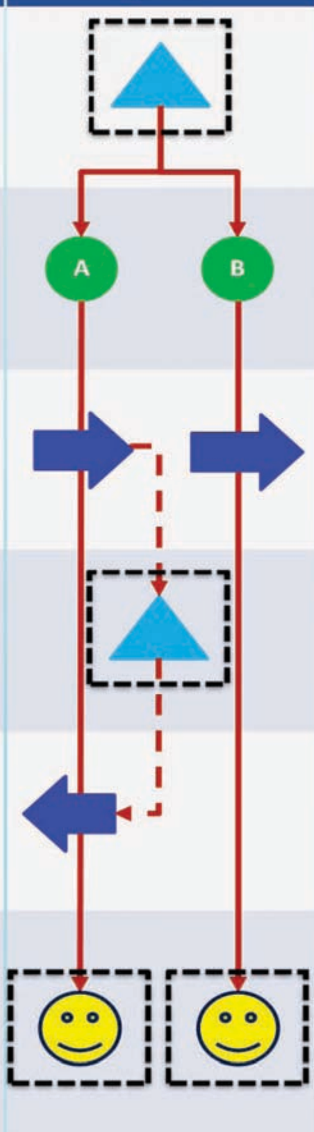
The **Malaunod Pumping Station** is one of the initial phase one projects funded by LWUA for San Pablo City's water source. It is equipped with three 30-horsepower Vertical Turbine pumps to deliver clean water to the city. With great overflow during abundance of its discharge.

PROCESS FLOW DIAGRAM OF MALAUNOD SPRING

Process Step	Symbol	Description	Dept/Div. Responsible
Catchment		Malaunod Spring Brgy. San Jose, SPC 126 m. elev, 66 lps Water Quality Analysis	Technical Services Department, Environment and Water Resources Division
Operation		Malaunod Pumping Station (Pump and Motor Operation) 3-30hp-Vertical pumps	Environment and Water Resources Division, Water Facilities Pump Operator
Treatment		Disinfection Chlorine application (Calcium Hypochlorite)	Environment and Water Resources Division, Water Facilities Pump Operator
Transport		Transmission Line 300mmØ Steel Pipe	Operations Department, Rehabilitation and Maintenance Division
Storage		Sampaloc Reservoir - concrete 6,390 cu.m. @ 146 m Elev. Filling from 9pm-5am	Enviroment and Water Resources Division Water Facilities Pump Operator Laboratory Section
Transport		Distribution Network 450mmØ, 300mmØ, 250mmØ, 200mmØ, 150mmØ, 100mmØ, 50mmØ & 20mmØ-25mmØ service pipelines	Operations Department, Rehabilitation and Maintenance Division
Consumers		Service areas: (Brgy. Concepcion, San Lucas 1, Part of San Jose, City Proper-Mabini Extension, Rizal Avenue, Cosico Avenue, P. Alcantara St, Lopez Jaena, Burgos St, Paulino St., Public market, etc.) Random sampling of water quality at concessionaires.	Laboratory Section, Production Division, Customer Service Division

Cabunsod Spring, the original water source for San Pablo City, was constructed in 1915 by the Malvar Water Works. It has provided uninterrupted service for 100 years and was recently rehabilitated in 2015. Located near the Malabanban-Cabunsod Protected Area, it remains a vital resource for the city.

PROCESS FLOW DIAGRAM OF
CABUNSOD SPRING

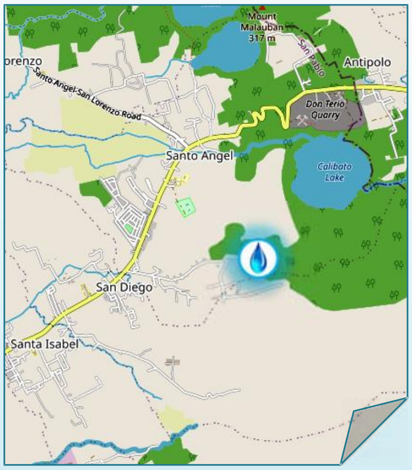


Process Step	Symbol		Dept/Div. Responsible
Catchment		Cabunsod Spring Brgy. San Diego, SPC 200 m. elev, 36 lps Water quality analysis	Technical Services Department, Environment and Water Resources Division
Treatment		Disinfection Chlorine application (Calcium Hypochlorite)	Environment and Water Resources Division, Water Facilities Pump Operator
Transport		Distribution Network A. 200mmØ CCI B. 200mmØ CCI	Operations Department, Rehabilitation and Maintenance Division
Storage		Sampaloc Reservoir-concrete 6,390 cu.m., 146m elev 9pm-5am Filling time	Environment and Water Resources Division, Water Facilities Pump Operator, Laboratory Section
Transport		Distribution Network A. 200mmØ B. 200mmØ 50mmØ, 20-25mmØ service pipelines	Operations Department, Rehabilitation and Maintenance Division
Consumers		Service areas: (Brgy. San Diego, Sta. Isabel, Concepcion, Schetelig Ave, Efarca Subd, Gomez St, Lopez Jaena St.) Random sampling for water quality analysis at concessionaires.	Laboratory Section, Production Division, Customer Service Division

Constructed in 1986 through LWUA funding, the **Upper Malamig Spring** has consistently supplied water to the city without being threatened by El Nino. Following its 2016 rehabilitation, it stands poised to meet the constituents' water requirements more effectively than ever before.

PROCESS FLOW DIAGRAM OF
UPPER MALAMIG SPRING

Process Step	Symbol	Description	Dept/Div. Responsible
Catchment		Upper Malamig Spring 3-Sources, Elev. 185m, 54 lps Brgy. San Diego, SPC Water Quality Analysis	Technical Services Department, Environment and Water Resources Division
Transport		Transmission Line 300mm Ø Steel Pipe	Technical Services Department, Environment and Water Resources Division
Facility		Central Collection Box	Technical Services Department, Environment and Water Resources Division
Treatment		Disinfection Chlorine application (Calcium Hypochlorite)	Environment and Water Resources Division, Water Facilities Pump Operator
Transport		Distribution Network (200mmØ, 150mmØ, 100mmØ, 25mmØ & 20mmØ service pipe lines)	Operations Department, Rehabilitation and Maintenance Division
Storage		Sampaloc Reservoir - concrete 6,390 cu.m. @ 146 m Elev. Filling from 9pm-5am	Enviroment and Water Resources Division Water Facilities Pump Operator
Transport		Distribution Network (300mmØ, 200mmØ, 150mmØ, 100mmØ, 75mmØ, 50mmØ, 25mmØ & 20mmØ service pipe lines)	Operations Department, Rehabilitation and Maintenance Division
Consumers		Service Areas : (Brgy. San Diego, Sta. Isabel, Concepcion, San Lucas 1, City Proper) Random sampling for water quality at concessionaires.	Laboratory Section, Production Division, Customer Service Division



The historic **Malabanban-Lubigan Spring**, established in the 1960s, provides San Pablo City with crystal clear water. Flowing naturally in Barangay Sto. Angel, it remains nestled near the picturesque Malabanban-Cabunsod Protected area, ensuring a sustainable and reliable water supply for the city's residents.

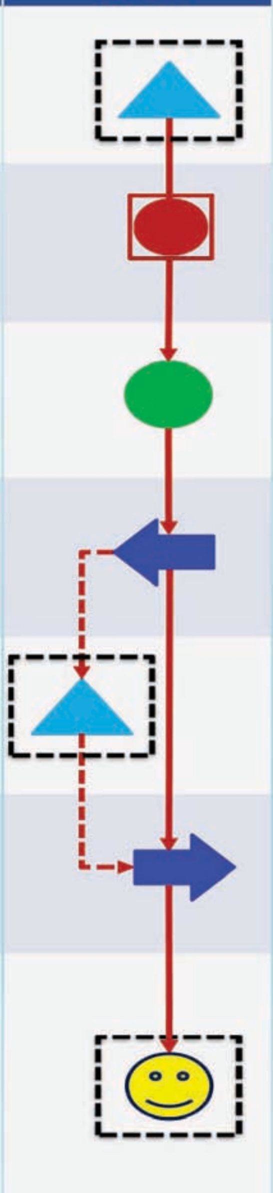
PROCESS FLOW DIAGRAM OF

MALABANBAN-LUBIGAN SPRING

Process Step	Symbol	Description	Dept/Div. Responsible
Catchment		Malabanban-Lubigan Spring Brgy. Sto. Angel, SPC 184 m. elev., 86 lps Water Quality Analysis	Technical Services Department, Environment and Water Resources Division, Laboratory Section
Treatment	A B	Disinfection Chlorine application A. Calcium Hypochlorite B. Calcium Hypochlorite	Environment and Water Resources Division, Water Facilities Pump Operator
Transport		Distribution Network A. 350mmØ B. 150mmØ, 150mmØ, 100mmØ, 75mmØ, 50mmØ 50mmØ, 25mmØ & 20mmØ service pipe lines)	Operations Department, Rehabilitation and Maintenance Division
Storage		Sampaloc Reservoir - concrete 6,390 cu.m. @ 146 m Elev.	Environment and Water Resources Division, Water Facilities Pump Operator, Laboratory Section
Consumers		Service Areas: (Brgy. Sto. Angel-Malabanban, Balagtas Blvd, Villongo Subd, Vesco Subd, City proper-Malvar St, Barleta St, T.Azucena St, Del Pilar St, M. Brion St, Bonifacio St, Zamora St.) Random sampling for water quality on concessionaires.	Laboratory Section, Production Division, Customer Service Division

The commissioning of the **Balanga Pumping Station** in 1996 came as a significant relief for the city, as it addressed the issue of dwindling water quality supply. This pumping station played a vital role in distributing water to the three adjacent barangays, namely Sta. Elena, San Cristobal, and Sto. Nino, which are centrally located. The Balanga Pumping Station boasts a commendable volume of water supply.

PROCESS FLOW DIAGRAM OF BALANGA SPRING

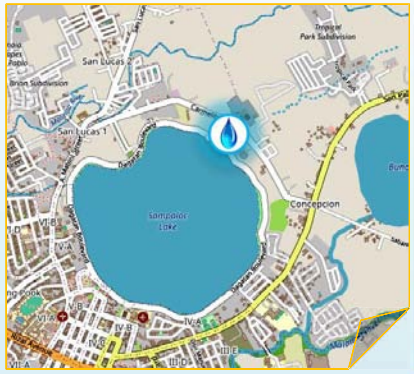


Process Step	Symbol	Description	Dept/Div. Responsible
Catchment		Balanga Spring Brgy. Sta. Elena, SPC 93 m. elev., 53 lps Water Quality Analysis	Technical Services Department, Environment and Water Resources Division, Laboratory Section
Operation		Balanga Pumping Station (Pump and Motor Operation) 3-100hp-Vertical pumps	Environment and Water Resources Division, Water Facilities Pump Operator
Treatment		Disinfection Chlorine application (Calcium Hypochlorite)	Environment and Water Resources Division, Water Facilities Pump Operator
Transport		Transmission Line 400mmØ Steel Pipe	Operations Department, Rehabilitation and Maintenance Division
Storage		2-Steel Tanks, 2000 cu.m. each 1-Timber Tank, 2500 cu.m. @ 160 m Elev. Filling from 9pm-5am	Enviroment and Water Resources Division, Water Facilities Pump Operator, Laboratory Section
Transport		Distribution Network: 400mmØ, 200mmØ, 150mmØ, 100mmØ, 75mmØ 50mmØ & 20mmØ-25mmØ service pipelines	Operations Department, Rehabilitation and Maintenance Division
Consumers		Service areas: (Brgy. San Cristobal, Sta. Elena, Sto. Niño, San Ignacio, San Vicente, Sta. Ana, San Antonio 1&2, San Francisco, Sta. Cruz, San Isidro, Santisimo Rosario, & Parts of the City-Calabia Avenue.) Random sampling of water quality at concessionaires.	Laboratory Section, Production Division, Customer Service Division

In 2008, the **Lagaslasan Spring Source** was commissioned as a significant milestone in water supply infrastructure. This project, initiated by SIG, aimed to provide a substantial bulk supply of water to meet the growing demands of the consumers. Notably, Lagaslan Spring Source holds the distinction of being one of the highest in elevation among the water sources in the San Pablo City.

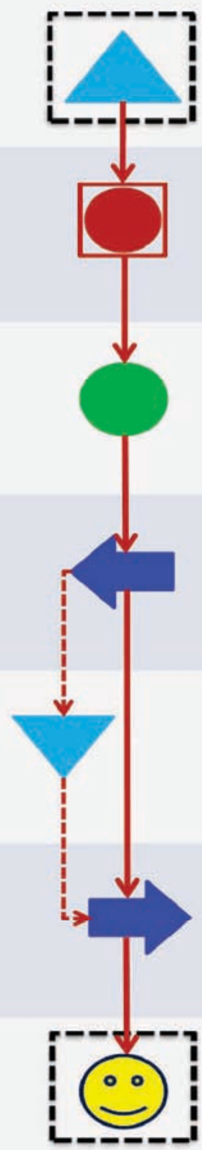
PROCESS FLOW DIAGRAM OF LAGASLASAN SPRING

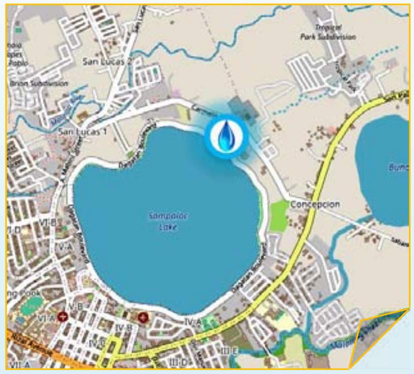
Process Step	Symbol	Description	Dept/Div. Responsible
Catchment		Lagaslasan Spring Elev. 275m Brgy. San Jose, SPC Water Quality Analysis	Bulk Supplier (SIG)
Transport		Transmission Line 200mm Ø Steel Pipe	Bulk Supplier (SIG)
Facility		Treatment Facility Brgy. San Ignacio	Bulk Supplier (SIG)
Treatment		pH adjustment (Addition of Sodium Carbonate)	Bulk Supplier (SIG), Water Facilities Pump Operator
Treatment		Disinfection Addition of Chlorine (Calcium Hypochlorite)	Bulk Supplier (SIG), Water Facilities Pump Operator
Transport		Distribution Network (200mmØ, 150mmØ, 100mmØ, 25mmØ & 20mmØ service pipe lines)	Operations Department, Rehabilitation and Maintenance Division
Consumers		Sampling Stub & Service Areas (Manhattan Village, San Gabriel, San Miguel, San Bartolome, Santiago 1), Random sampling for water quality on concessionaires.	Laboratory Section, Construction Division, Customer Service Division



The construction of **Concepcion PW-1** was successfully completed in 2006. This production well served as a valuable addition to the water infrastructure of the San Pablo City Water District (SPCWD). Notably, Concepcion PW boasted exceptional water quality. The discharge from the well was directed into the nearby Sampaloc reservoir, ensuring a reliable supply for the community.

PROCESS FLOW DIAGRAM OF CONCEPCION PRODUCTION WELL - 1

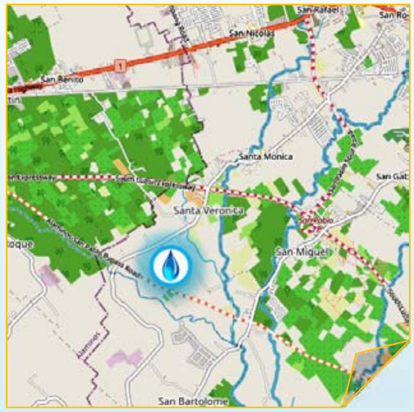
Process Step	Symbol	Description	Dept/Div. Responsible
Catchment		Concepcion Production Well-1 Brgy. Concepcion, SPC 249 m. depth, 12.5 lps 200-150mmØ Stainless Steel casing, 100mmØ-Riser pipes) Water Quality analysis	Technical Services Department, Environment and Water Resources Division
Operation		Pump and Motor Operation (30hp-submersible pump & motor)	Environment and Water Resources Division, Water Facilities Pump Operator
Treatment		Disinfection Chlorine application (Calcium Hypochlorite)	Water Facilities Pump Operator Laboratory Section
Transport		Distribution Network 150mmØ - Steel pipe	Operations Department, Rehabilitation and Maintenance Division
Storage Facility		Sampaloc Reservoir - concrete 6,390 cu.m. An option to discharge at the reservoir if needed.	Water Facilities Pump Operator
Transport		Distribution Network 150mmØ, 100mmØ, 75mmØ & 50mmØ, 20mmØ - 25mmØ service pipe lines.	Operations Department, Rehabilitation and Maintenance Division
Consumers		Service Areas: (Brgy. San Lucas 2 - Gawad Kalinga, and Mabini Extension) Random testing of water quality on concessionaires.	Laboratory Section, Production Division, Customer Service Division



In 2019, **Concepcion PW-2** was constructed, enabling direct distribution of clear water to nearby barangays. The completion coincided with the acute water scarcity experienced by San Pablo City residents, bringing much-needed relief. Minimal chlorine disinfection ensured that the water was safe for consumption.

PROCESS FLOW DIAGRAM OF CONCEPCION PRODUCTION WELL - 2

Process Step	Symbol	Description	Dept/Div. Responsible
Catchment		Concepcion Production Well - 2 Brgy. Concepcion, SPC 150 m. depth, 31 lps (200mmØ casing with stainless steel screen, 100mmØ-Riser pipes) Water Quality analysis	Technical Services Department, Environment and Water Resources Division
Operation		Pump and Motor Operation (50hp motor & submersible pump)	Environment and Water Resources Division, Water Facilities Pump Operator
Treatment		Disinfection Chlorine Gas application	Water Facilities Pump Operator Laboratory Section
Transport		Distribution Network 150mmØ - Steel pipe	Operations Department, Rehabilitation and Maintenance Division
Storage Facility		Sampaloc Reservoir-Concrete 6,390 cu.m. An option to discharge at the reservoir if needed.	Water Facilities Pump Operator
Transport		Distribution Network 200mmØ, 150mmØ, 200mmØ, 100mmØ, 75mmØ & 20mmØ - 25mmØ service pipe lines.	Operations Department, Rehabilitation and Maintenance Division
Consumers		Service Areas: (Brgy. San Lucas 1 & Brgy. San Lucas 2) Random testing of water quality at concessionaires.	Laboratory Section, Production Division, Customer Service Division



In 2006, the **Sta. Veronica Production Well** (PW) was constructed with the aim of providing a reliable water supply to the entire barangay. While the well has been successful in meeting the water demand, it has become evident that the water quality needs to be improved to comply with the national standards for safe and clean drinking water.

PROCESS FLOW DIAGRAM OF STA. VERONICA PRODUCTION WELL

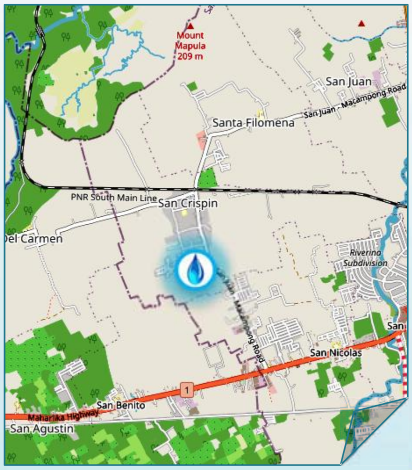
Process Step	Symbol	Description	Dept/Div. Responsible
Catchment		Sta. Veronica Production Well (200mmØ casing with stainless steel screen, 100mmØ-Riser pipes, 150m-Depth, 9 Lps) Water Quality Analysis	Technical Services Department, Environment and Water Resources Division
Operation		Pump and Motor Operation (30hp motor & submersible pump)	Environment and Water Resources Division, Water Facilities Pump Operator
Treatment		Disinfection Chlorine application (Calcium Hypochlorite)	Water Facilities Pump Operator
Treatment		Rapid Sand Filtration Water quality analysis after filtration.	Water Facilities Pump Operator
Transport		Distribution Network (150mmØ Transmission line, 100mmØ, 75mmØ, 50mmØ, 25mmØ & 20mmØ service pipe lines)	Operations Department, Rehabilitation and Maintenance Division
Consumers		Service Areas (Brgy. Sta. Veronica, Part of Sta. Monica, Part of San Bartolome) Random sampling for water quality at concessionaires.	Laboratory Section, Production Division, Customer Service Division

The **Maharlika Production Well**, constructed in 1998, has undergone various filtration systems over the years to improve its water quality. Finally, in 2020, a perfect filtration system was installed, ensuring that the water complies with the Philippine National Standard for Drinking Water 2017.

PROCESS FLOW DIAGRAM OF

MAHARLIKA PRODUCTION WELL

Process Step	Symbol	Description	Dept/Div. Responsible
Catchment		Maharlika Production Well (200mmØ casing with stainless steel screen, 100mmØ-Riser pipes, 150m Depth, 12 lps) Water Quality Analysis	Technical Services Department, Environment and Water Resources Division
Operation		Pump and Motor Operation (30hp-submersible pump & motor)	Environment and Water Resources Division, Water Facilities Pump Operator
Treatment		Disinfection Addition of Chlorine (Calcium Hypochlorite)	Water Facilities Pump Operator
Treatment		Rapid Sand Filtration Water quality analysis after filtration	Water Facilities Pump Operator, Laboratory Section
Transport		Distribution Network (100mmØ, 200mmØ, 150mmØ & 20mmØ - 25mmØ service pipe lines)	Operations Department, Rehabilitation and Maintenance Division
Consumers		Service Areas: (Brgy. San Gabriel, San Roque, San Rafael, Maharlika Highway) Radom sampling for water quality at concessionaires.	Laboratory Section, Production Division, Customer Service Division

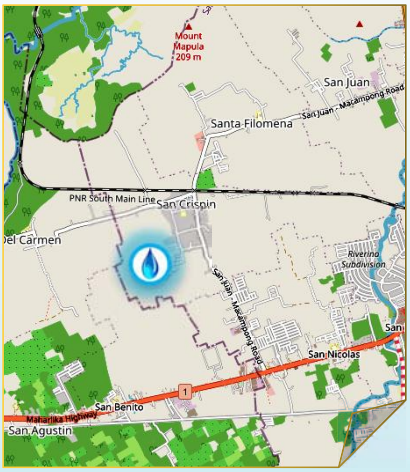


The first production well was initially constructed using PVC casing. In 2014, **San Crispin PW-1** was commissioned, and it featured a 50-horsepower pump and motor. The well provided crystal clear water to the nearby barangays, eliminating the need for filtration. The water quality was deemed perfect for everyday consumption after standard disinfection using chlorine.

PROCESS FLOW DIAGRAM OF

SAN CRISPIN PRODUCTION WELL - 1

Process Step	Symbol	Description	Dept/Div. Responsible
Catchment		San Crispin Production Well - 1 (200mmØ casing with PVC pipe screen, 100mmØ-Riser pipes, 150m Depth, 37 lps) Water Quality Analysis	Technical Services Department, Environment and Water Resources Division, Laboratory Section
Operation		Pump and Motor Operation (50hp motor & submersible pump)	Environment and Water Resources Division, Water Facilities Pump Operator
Treatment		Disinfection Chlorine application (Calcium Hypochlorite)	Water Facilities Pump Operator
Transport		Distribution Network (200mmØ, 150mmØ, 100mmØ 25mmØ & 20mmØ service pipe lines)	Operations Department, Rehabilitation and Maintenance Division
Consumers		Service Areas: (Brgy. San Crispin, Sta. Felomina, Part of San Nicolas) Random sampling for water quality at concessionaires.	Laboratory Section, Production Division, Customer Service Division



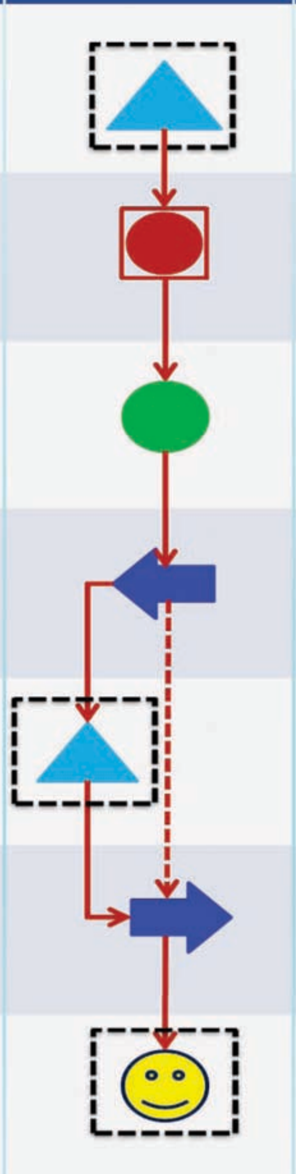
In 2020, another production well was constructed in Barangay San Crispin to meet the increasing demand for quality water. However, to ensure proper water pressure and distribution, improvements to the pipelines were necessary in the adjacent barangays of Sta. Felomina and San Juan. Recognizing the need to accommodate the water pressure from **San Crispin PW-2**, the pipeline infrastructure in the two neighboring barangays underwent enhancements.

PROCESS FLOW DIAGRAM OF
SAN CRISPIN PRODUCTION WELL - 2

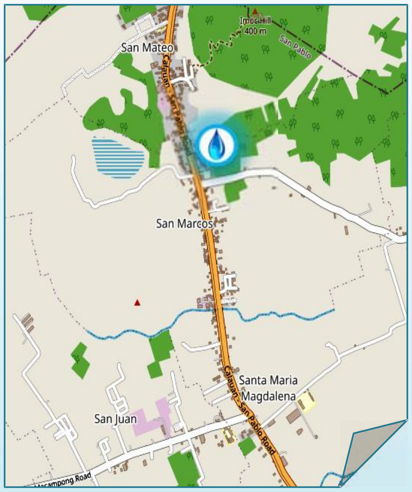
Process Step	Symbol	Description	Dept/Div. Responsible
Catchment		San Crispin Production Well - 2 (200mmØ casing with stainless steel screen, 100mmØ-Riser pipes, 150m Depth, 26 lps) Water Quality Analysis	Technical Services Department, Environment and Water Resources Division, Laboratory Section
Operation		Pump and Motor Operation (50hp-submersible pump & motor)	Environment and Water Resources Division, Water Facilities Pump Operator
Treatment		Disinfection Chlorine application (Calcium Hypochlorite)	Water Facilities Pump Operator
Transport		Distribution Network (200mmØ, 150mmØ, 100mmØ, 75mmØ, 50mmØ & 25mmØ - 20mmØ service pipe lines)	Operations Department, Rehabilitation and Maintenance Division
Consumers		Service Areas: (Brgy. San Crispin, Sta. Felomina, San Juan, Part of San Nicolas) Random sampling for water quality at concessionaires.	Laboratory Section, Production Division, Customer Service Division

In response to the ever-growing demand for quality water, the **San Cristobal PW** was constructed in 2005. The purpose of this new production well was to augment the existing water supply and ensure an adequate and reliable source of water for the community. The well was strategically built on a vacant space within the area where the timber tank and bolted tanks were built.

PROCESS FLOW DIAGRAM OF SAN CRISTOBAL PRODUCTION WELL

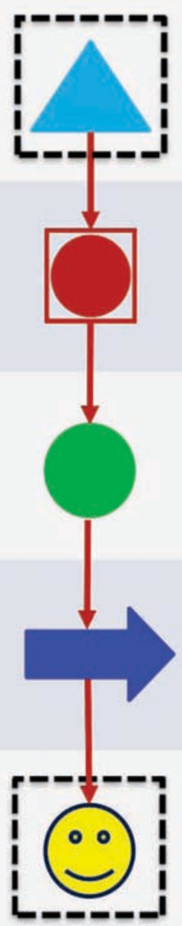


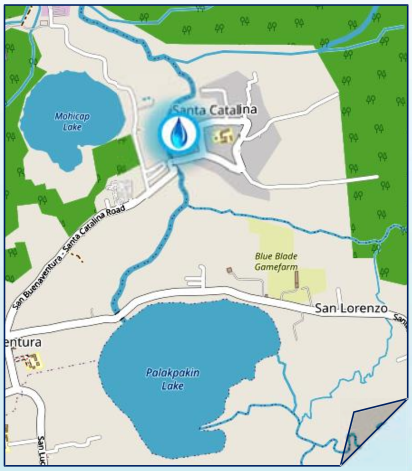
Process Step	Symbol	Description	Dept/Div. Responsible
Catchment		San Cristobal Production Well Brgy. San Cristobal, SPC 150 m. depth, 28 lps (200mmØ stainless steel casing, 100mmØ-Riser pipes) Water Quality analysis	Technical Services Department, Environment and Water Resources Division
Operation		Pump and Motor Operation (30hp-submersible pump & motor)	Environment and Water Resources Division, Water Facilities Pump Operator
Treatment		Disinfection Chlorine application (Calcium Hypochlorite)	Water Facilities Pump Operator, Laboratory Section
Transport		Distribution Network 150mmØ - Steel pipe	Operations Department, Rehabilitation and Maintenance Division
Storage Facility		Steel Bolted Tank 2, 2,300 cu.m. @ 160 m Elev.	Environment and Water Resources Division, Water Facilities Pump Operator, Laboratory Section
Transport		Distribution Network 150mmØ, 400mmØ, 100mmØ, 75mmØ, 50mmØ, 20mmØ - 25mmØ service pipe lines.	Operations Department, Rehabilitation and Maintenance Division
Consumers		Service Area: (Brgy. San Cristobal, Sta. Elena and Sto. Nino) Random testing of water quality at concessionaires.	Laboratory Section, Production Division, Customer Service Division



San Marcos PW-1 is one of the few production wells that were built in 1998 to address the adverse impacts of the El Nino phenomenon. Located within the premises of San Marcos Elementary School, the construction of the well was made possible through a generous donation of land. SPCWD shows its commitment to ensuring a safe and accessible water supply for both the school and the surrounding consumers.

PROCESS FLOW DIAGRAM OF
SAN MARCOS PRODUCTION WELL - 1

	Symbol	Description	Dept/Div. Responsible
Catchment		San Marcos Prod Well-1 (200mmØ casing with stainless steel screen, 100mmØ-Riser pipes, 150m Depth, 20 lps) Water Quality Analysis	Technical Services Department, Environment and Water Resources Division
Operation		Pump and Motor Operation (50hp-submersible pump & motor)	Environment and Water Resources Division, Water Facilities Pump Operator
Treatment		Disinfection Chlorine application (Calcium Hypochlorite)	Water Facilities Pump Operator
Transport		Distribution Network (200mmØ, 150mmØ, 100mmØ, 75mmØ, 50mmØ, 25mmØ & 20mmØ service pipe lines)	Operations Department, Rehabilitation and Maintenance Division
Consumers		Service Areas (Brgy. San Marcos, San Mateo, Sta Ma. Magdalena and Dolores) Random sampling for water quality.	Laboratory Section, Production Division, Customer Service Division



Sta. Catalina Production Well, transferred to the Water district by the barangay, was restored in 1976. It serves as a reliable water source in the city's distant region, meeting the Philippine National Standard for Drinking Water. Chlorine is necessary for disinfection, ensuring its suitability for residents' everyday needs. It plays a crucial role in promoting the overall health and well-being of the barangay's residents by providing them with safe and clean water for their daily activities.

PROCESS FLOW DIAGRAM OF STA. CATALINA PRODUCTION WELL

Process Step	Symbol	Description	Dept/Div. Responsible
Catchment		Sta Catalina Production Well (150mmØ casing with stainless steel screen, 75mmØ-Riser pipes, 8 lps) Water Quality Analysis	Technical Services Department, Environment and Water Resources Division
Operation		Pump and Motor Operation (15hp-submersible pump & motor)	Environment and Water Resources Division, Water Facilities Pump Operator
Treatment		Disinfection Chlorine application (Calcium Hypochlorite)	Water Facilities Pump Operator
Transport		Distribution Network 100mmØ, 25mmØ & 20mmØ service pipe lines	Operations Department, Rehabilitation and Maintenance Division
Consumers		Service Areas: (Brgy. Sta. Catalina, Part of San Buenaventura) Random sampling for water quality at concessionaires.	Laboratory Section, Production Division, Customer Service Division

San Marcos PW-2 was constructed in 2005 with the primary aim of augmenting the supply of quality water to Barangays San Marcos, Sta. Maria Magdalena, and San Juan. However, to ensure compliance with the latest edition of the Philippine National Standard for Drinking Water, the installation of a Rapid San Filtration System became necessary.

PROCESS FLOW DIAGRAM OF
SAN MARCOS PRODUCTION WELL - 2

Process Step	Symbol	Description	Dept/Div. Responsible
Catchment		San Marcos Production Well - 2 (200mmØ casing with stainless steel screen, 100mmØ-Riser pipes, 150m-Depth, 14 lps) Water Quality Analysis	Technical Services Department, Environment and Water Resources Division
Operation		Pump and Motor Operation (30hp motor & submersible pump)	Environment and Water Resources Division, Water Facilities Pump Operator
Treatment		Disinfection Chlorine application (Calcium Hypochlorite)	Water Facilities Pump Operator
Filtration		Rapid Sand Filtration (Gravel and Silica Sand), Water quality analysis after filtration.	Water Facilities Pump Operator
Transport		Distribution Network (200mmØ Transmission line,100mmØ, 75mmØ, 50mmØ, 25mmØ & 20mmØ service pipe lines)	Operations Department, Rehabilitation and Maintenance Division
Consumers		Service Areas (Part of Brgy. San Marcos and Sta. Maria Magdalena) Random sampling for water quality at concessionaires.	Laboratory Section, Production Division, Customer Service Division

The **San Jose PW** facility at SPCWD Complex Area was constructed in 2019 as a crucial response to the prevalent water scarcity issues faced during that time. While the volume of water produced by the facility is commendable, there is room for improvement in terms of water quality, specifically in the area of filtration and the reduction of elevated levels of iron and manganese minerals.

PROCESS FLOW DIAGRAM OF

SAN JOSE-COMPLEX PRODUCTION WELL

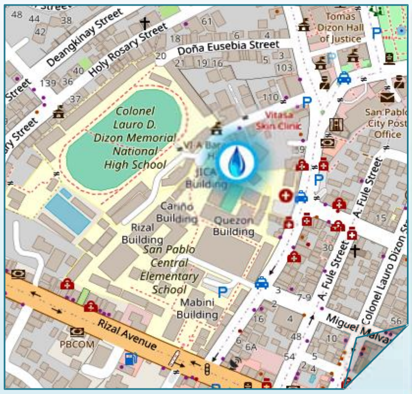
Process Step	Symbol	Description	Dept/Div. Responsible
Catchment		San Jose Production Well Brgy. San Jose, SPC 42 m. depth, 21 lps (200mmØ casing with stainless steel screen) Water Quality Analysis	Technical Services Department, Environment and Water Resources Division
Operation		Pump and Motor Operation (30hp-submersible pump & motor) *Stand-by (No Operation)	Environment and Water Resources Division, Water Facilities Pump Operator
Treatment		Disinfection Addition of Chlorine (Calcium Hypochlorite)	Water Facilities Pump Operator
Treatment		Rapid Sand Filtration Water quality analysis after filtration	Water Facilities Pump Operator, Laboratory Section
Transport		Distribution Network (150mmØ, 100mmØ, 75mmØ & 50mmØ 20mmØ - 25mmØ service pipe lines)	Operations Department, Rehabilitation and Maintenance Division
Consumers		Service Areas: (Part of San Francisco-Calihan (Medex Subd., Maharlika Village, Part of San Jose - Paseo De San Pablo, Amante Drive) Radom sampling for water quality at concessionaires.	Laboratory Section, Production Division, Customer Service Division

Built in 2021, the San Jose National High School Production Well (**San Jose NHS PW**) was constructed to meet the increasing water demands of newly developed subdivisions within the barangay. The primary objective of this initiative is to augment the existing water supply and ensure a reliable source for the growing community.

PROCESS FLOW DIAGRAM OF

SAN JOSE-NHS PRODUCTION WELL

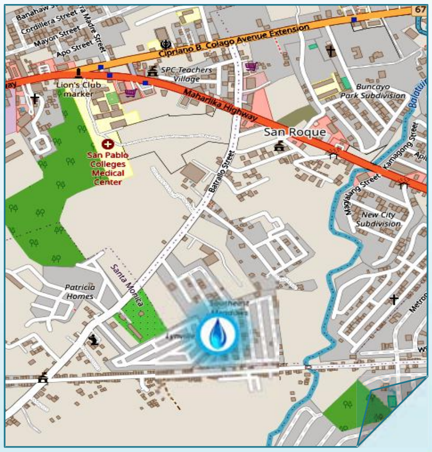
Process Step	Symbol	Description	Dept/Div. Responsible
Catchment		San Jose-NHS Production Well (200mmØ casing with stainless steel screen, 150m Depth, 16 lps) Water Quality Analysis	Technical Services Department, Environment and Water Resources Division
Operation		Pump and Motor Operation (30hp-submersible pump & motor) *Stand-by (No Operation)	Environment and Water Resources Division, Water Facilities Pump Operator
Treatment		Disinfection Addition of Chlorine (Calcium Hypochlorite)	Water Facilities Pump Operator
Treatment		Rapid Sand Filtration Water quality analysis after filtration	Water Facilities Pump Operator, Laboratory Section
Transport		Distribution Network (150mmØ, 100mmØ, 75mmØ & 50mmØ 20mmØ - 25mmØ service pipe lines)	Operations Department, Rehabilitation and Maintenance Division
Consumers		Service Areas: (Brgy. San Jose-Malamig (Starville, Aranville, Oreta Subd.,Hillsdale Subd. Nha-San Jose Subd., Munting Paraiso) Radom sampling for water quality at concessionaires.	Laboratory Section, Production Division, Customer Service Division



In response to the severe impacts of the El Nino Phenomenon in the late 1990s, the **Central Production Well** (Central PW) was constructed in 1998 within the premises of the Central Elementary School. The purpose of this initiative was to provide a reliable water source. The Central PW requires additional filtration measures to adequately meet the needs and expectations of consumers.

PROCESS FLOW DIAGRAM OF CENTRAL PRODUCTION WELL

Process Step	Symbol	Description	Dept/Div. Responsible
Catchment		Central Production Well (200mmØ casing with stainless steel screen, 100mmØ-Riser pipes, 150m Depth, 7.5 lps) Water Quality Analysis	Technical Services Department, Environment and Water Resources Division
Operation		Pump and Motor Operation (30hp-submersible pump & motor)	Environment and Water Resources Division, Water Facilities Pump Operator
Treatment		Disinfection Addition of Chlorine (Calcium Hypochlorite)	Water Facilities Pump Operator
Treatment		Rapid Sand Filtration (Manganese Green Sand), Chlorine residual monitoring after filtration	Water Facilities Pump Operator
Treatment		Disinfection (Ultra-Violet Light)	Water Facilities Pump Operator
Transport		Distribution Network (100mmØ, 200mmØ, 150mmØ & 20mmØ - 25mmØ service pipe lines)	Operations Department, Rehabilitation and Maintenance Division
Consumers		Service Areas: (Brgy. VI-A, V-A, V-C, V-D), Trece Martirez St, Zamora St, Bonifacio St, Zulueta St, Lopez Jaena St.) Radom sampling for water quality at concessionaires.	Laboratory Section, Production Division, Customer Service Division



For years, the SouthEast Meadows Subdivision has been grappling with recurring issues of low water pressure and even water scarcity. In response, a space was offered in 2020 to construct the **Southeast Meadows Production Well** within the subdivision. However it was evident that the water quality requires further improvement to meet the expectations and satisfaction.

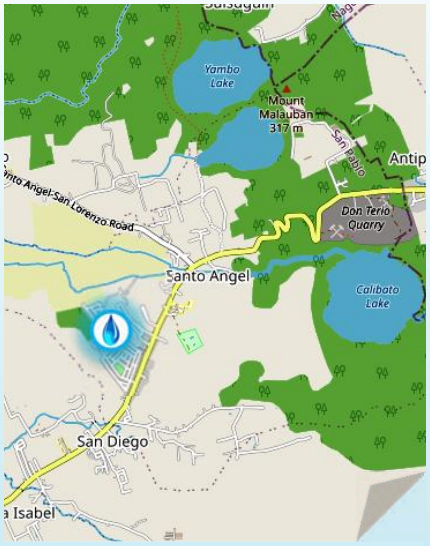
PROCESS FLOW DIAGRAM OF SOUTH-EAST MEADOWS PRODUCTION WELL

Process Step	Symbol	Description	Dept/Div. Responsible
Catchment		South-East Meadows Prod. Well (200mmØ casing with stainless steel screen, 5 lps) Water Quality Analysis	Technical Services Department, Environment and Water Resources Division
Operation		Pump and Motor Operation (10hp-submersible pump & motor)	Environment and Water Resources Division, Water Facilities Pump Operator
Treatment		Disinfection Addition of Chlorine (Calcium Hypochlorite)	Water Facilities Pump Operator
Treatment		Rapid Sand Filtration Water quality analysis after filtration	Water Facilities Pump Operator, Laboratory Section
Transport		Distribution Network (150mmØ, 100mmØ, 75mmØ, 50mmØ & 25mmØ - 20mmØ service pipe lines)	Operations Department, Rehabilitation and Maintenance Division
Consumers		Service Areas: (SouthEast Meadows Subdiviion, Part of San Roque and Part of Sta Monica.) Radom sampling for water quality at concessionaires.	Laboratory Section, Production Division, Customer Service Division

The **CG Brion Production Well** (CG Brion PW) was purposefully constructed in 2021 to address the water supply needs of the CG Brion Subdivision and the surrounding barangays. This well stands out as one of the rare instances where filtration is not required, thanks to its exceptional water quality and ample volume, making it an efficient and reliable source of water distribution.

PROCESS FLOW DIAGRAM OF
CG BRION PRODUCTION WELL

Process Step	Symbol	Description	Dept/Div. Responsible
Catchment		CG. Brion Production Well (200mmØ casing with stainless steel screen, 150m Depth, 21 lps) Water Quality Analysis	Technical Services Department, Environment and Water Resources Division, Laboratory Section
Operation		Pump and Motor Operation (30hp-submersible pump & motor)	Environment and Water Resources Division, Water Facilities Pump Operator
Treatment		Disinfection Chlorine application (Calcium Hypochlorite)	Water Facilities Pump Operator
Transport		Distribution Network (200mmØ, 150mmØ, 100mmØ, 75mmØ, 50mmØ & 25mmØ - 20mmØ service pipe lines)	Operations Department, Rehabilitation and Maintenance Division
Consumers		Service Areas: (Brgy. San Lucas 1, Brgy. San Lucas 2, Brgy. San Pedro, Brgy. Dolores & San Buenaventura) Random sampling for water quality at concessionaires.	Laboratory Section, Production Division, Customer Service Division



In response to the prevailing water scarcity in 2020, the **NHA - Sto. Angel Production Well** (NHA-Sto. Angel PW) was constructed as an essential solution to supplement the insufficient supply of spring water for our current consumers. The local barangay generously offered a vacant area within the NHA for the development of this additional water source. Fortunately, the NHA-Sto. Angel PW boasts excellent water quality, requiring only minimal chlorine injection for disinfection, and is readily available for the consumers' needs.

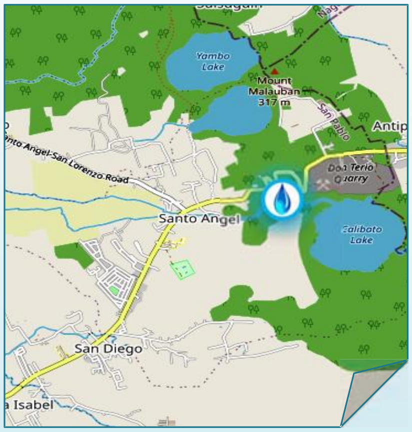
PROCESS FLOW DIAGRAM OF NHA-STO. ANGEL PRODUCTION WELL

Process Step	Symbol	Description	Dept/Div. Responsible
Catchment		NHA-Sto. Angel Production Well (200mmØ casing with stainless steel screen, 100mmØ-Riser pipes, 150m Depth, 36 lps) Water Quality Analysis	Technical Services Department, Environment and Water Resources Division, Laboratory Section
Operation		Pump and Motor Operation (50hp-submersible pump & motor)	Environment and Water Resources Division, Water Facilities Pump Operator
Treatment		Disinfection Chlorine application (Calcium Hypochlorite)	Water Facilities Pump Operator
Transport		Distribution Network (200mmØ, 150mmØ, 100mmØ, 75mmØ, 50mmØ & 25mmØ - 20mmØ service pipe lines)	Operations Department, Rehabilitation and Maintenance Division
Consumers		Service Areas: (Brgy. Sto. Angel, San Lorenzo) Random sampling for water quality at concessionaires.	Laboratory Section, Production Division, Customer Service Division

Constructed in a donated lot within the Jeansville Subdivision, the **Jeansville Production Well** has become a valuable asset to the community. It has an exceptional water quality and a remarkable volume of supply. In 2020, during a severe water scarcity crisis that affected the entire city of San Pablo, the Jeansville Production Well played a pivotal role in meeting the heightened demand for water.

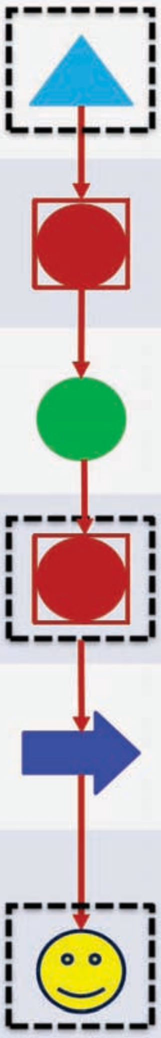
PROCESS FLOW DIAGRAM OF JEANSVILLE PRODUCTION WELL

Process Step	Symbol	Description	Dept/Div. Responsible
Catchment		Jeansville Production Well (250mmØ casing with stainless steel screen, 100mmØ-Riser pipes, 150m Depth, 29 lps) Water Quality Analysis	Technical Services Department, Environment and Water Resources Division, Laboratory Section
Operation		Pump and Motor Operation (50hp-submersible pump & motor)	Environment and Water Resources Division, Water Facilities Pump Operator
Treatment		Disinfection Chlorine application (Calcium Hypochlorite)	Water Facilities Pump Operator
Transport		Distribution Network (300mm, 150mmØ, 100mmØ, 75mmØ, 50mmØ & 25mmØ - 20mmØ service pipe lines)	Operations Department, Rehabilitation and Maintenance Division
Consumers		Service areas: (Brgy. Concepcion, San Lucas 1 City Proper-Mabini Extension, Rizal Avenue, Cosico Avenue, P. Alcantara St, Lopez Jaena, Burgos St, Paulino St., Public market, etc.) Random sampling of water quality at concessionaires.	Laboratory Section, Production Division, Customer Service Division



Sto. Angel PW-1, one of the early production wells constructed in late 1998, boasts a plentiful water supply. However, the water quality presents challenges as it is tainted with elevated levels of iron, manganese, and hydrogen sulfide. To effectively address this issue and ensure the delivery of clean and safe water, the implementation of a comprehensive filtration system is necessary.

PROCESS FLOW DIAGRAM OF STO. ANGEL PRODUCTION WELL

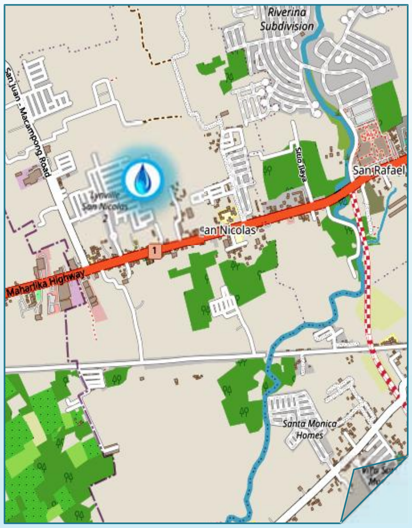


Process Step	Symbol	Description	Dept/Div. Responsible
Catchment		Sto. Angel Production Well (250mmØ casing with stainless steel screen, 100mmØ-Riser pipes, 150m-Depth, 20 lps) Water Quality Analysis	Technical Services Department, Environment and Water Resources Division, Laboratory Section
Operation		Pump and Motor Operation (30hp-submersible pump & motor) *Stand-by (No Operation)	Environment and Water Resources Division, Water Facilities Pump Operator
Treatment		Disinfection Chlorine application (Calcium HypoChlorite)	Environment and Water Resources Division, Water Facilities Pump Operator
Operation		Rapid Sand Filtration Water quality analysis after filtration.	Environment and Water Resources Division, Water Facilities Pump Operator, Laboratory Section
Transport		Distribution Network 150mmØ, 100mmØ, 75mmØ, 50mmØ & 20mmØ-25mmØ service pipelines	Operations Department, Rehabilitation and Maintenance Division
Consumers		Service areas: (Brgy. Sto. Angel, San Lorenzo, San Buenaventura, Dolores) Random sampling of water quality at concessionaires.	Laboratory Section, Production Division, Customer Service Division

San Gregorio PW is a recently constructed production well in 2022, strategically located within the San Gregorio subdivision. The establishment of this well was a crucial step towards mitigating the water crisis in the area, ensuring a sustainable solution for the community's water needs. However, during the evaluation process, it was identified that the water quality required additional filtration measures to meet the desired standards.

PROCESS FLOW DIAGRAM OF
SAN GREGORIO PRODUCTION WELL

Process Step	Symbol	Description	Dept/Div. Responsible
Catchment		San Gregorio Production Well (200mmØ casing with stainless steel screen, 150m Depth, 22 lps) Water Quality Analysis	Technical Services Department, Environment and Water Resources Division
Operation		Pump and Motor Operation (30hp-submersible pump & motor) *Stand-by (No Operation)	Environment and Water Resources Division, Water Facilities Pump Operator
Treatment		Disinfection Addition of Chlorine (Calcium Hypochlorite)	Water Facilities Pump Operator
Treatment		Rapid Sand Filtration Water quality analysis after filtration	Water Facilities Pump Operator, Laboratory Section
Transport		Distribution Network (100mmØ, 75mmØ, 50mmØ & 20mmØ - 25mmØ service pipe lines)	Operations Department, Rehabilitation and Maintenance Division
Consumers		Service Areas: (Brgy. San Gregorio, Brgy. San Joaquin, Brgy. San Francisco (Farconville) Radom sampling for water quality at concessionaires.	Laboratory Section, Production Division, Customer Service Division



The construction of **Lynville 2 Production Well** (Lynville 2 PW) by the Lynville 2 Developer and its subsequent turnover to the San Pablo City Water District in 2020 marked a significant milestone in ensuring reliable water supply for the residents. The well boasts a substantial volume of water and consistently delivers exceptional water quality, requiring minimal chlorine disinfection. It has become a vital source of water for the residents of the subdivision, providing them with a dependable and safe water resource.

PROCESS FLOW DIAGRAM OF LYNVILLE 2 PRODUCTION WELL

Process Step	Symbol	Description	Dept/Div. Responsible
Catchment		Lynville-2 Production Well (200mmØ casing with stainless steel screen, 300m Depth, 24 lps) Water Quality Analysis	Technical Services Department, Environment and Water Resources Division, Laboratory Section
Operation		Pump and Motor Operation (30hp-submersible pump & motor)	Environment and Water Resources Division, Water Facilities Pump Operator
Treatment		Disinfection Chlorine application (Calcium Hypochlorite)	Water Facilities Pump Operator
Transport		Distribution Network (200mmØ, 150mmØ, 100mmØ, 75mmØ, 50mmØ & 25mmØ - 20mmØ service pipe lines)	Operations Department, Rehabilitation and Maintenance Division
Consumers		Service Areas: (Brgy. San Nicolas, Brgy. San Rafael) Random sampling for water quality at concessionaires.	Laboratory Section, Production Division, Customer Service Division

Bautista SW, constructed during the water crisis in 2019, has proven to be a valuable and dependable water source that the Local Government Unit (LGU) has subsequently entrusted to the Water District. This source not only exhibits good water quality but also maintains a sufficient discharge capacity. Recognizing its reliability and positive attributes, the Water District has retained Bautista SW to serve as an augmentation source during peak hours of water consumption.

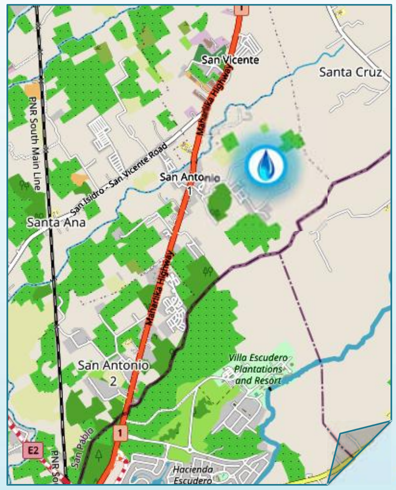
PROCESS FLOW DIAGRAM OF BAUTISTA SHALLOW WELL

Process Step	Symbol	Description	Dept/Div. Responsible
Catchment		Bautista Shallow Well Brgy. Bautista, SPC 48 m. depth, 3 lps (100mmØ-Casing, 50mmØ-Riser pipes) Water Quality Analysis	Technical Services Department, Environment and Water Resources Division, Laboratory Section
Operation		Pump and Motor Operation (5hp-submersible pump & motor)	Environment and Water Resources Division, Water Facilities Pump Operator
Treatment		Disinfection Chlorine application (Calcium Hypochlorite)	Water Facilities Pump Operator
Transport		Distribution Network (150mmØ, 100mmØ, 75mmØ, 50mmØ & 25mmØ - 20mmØ service pipe lines)	Operations Department, Rehabilitation and Maintenance Division
Consumers		Service Areas: (Brgy. Bautista, Part of San Isidro and Santisimo Rosario) Radom sampling for water quality at concessionaires.	Laboratory Section, Production Division, Customer Service Division

In 2021, the construction of **Bautista PW** addressed the long-standing issue of inconsistent water pressure in the remote area, ranging from no water to low pressure. However, the water quality required improvement, leading to the implementation of filtration to meet the standard. Furthermore, the presence of arsenic in the water was detected, prompting the addition of ferric chloride for treatment prior to filtration.

PROCESS FLOW DIAGRAM OF BAUTISTA PRODUCTION WELL

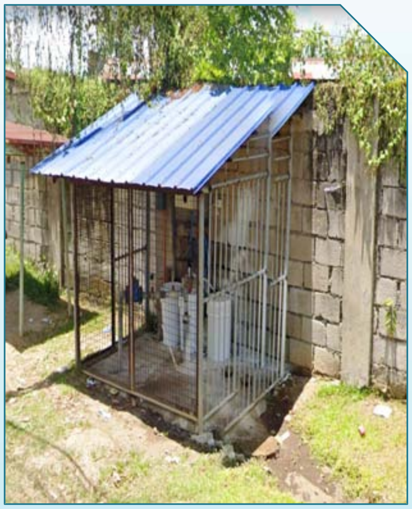
Process Step	Symbol	Description	Dept/Div. Responsible
Catchment		Bautista Production Well Brgy. Bautista, SPC 150 m. depth, 11 lps (200mmØ casing with stainless steel screen) Water Quality Analysis	Technical Services Department, Environment and Water Resources Division
Operation		Pump and Motor Operation (30hp-submersible pump & motor)	Environment and Water Resources Division, Water Facilities Pump Operator
Treatment		Disinfection Addition of Chlorine (Calcium Hypochlorite)	Water Facilities Pump Operator
Treatment		Arsenic Treatment Addition of Ferric Chloride	Water Facilities Pump Operator
Treatment		Rapid Sand Filtration Water quality analysis after filtration	Water Facilities Pump Operator, Laboratory Section
Transport		Distribution Network (150mmØ, 100mmØ, 75mmØ, 50mmØ & 25mmØ - 20mmØ service pipe lines)	Operations Department, Rehabilitation and Maintenance Division
Consumers		Service Areas: (Brgy. Bautista, Brgy. San Isidro, Brgy. Santisimo Rosario) Radom sampling for water quality at concessionaires.	Laboratory Section, Production Division, Customer Service Division

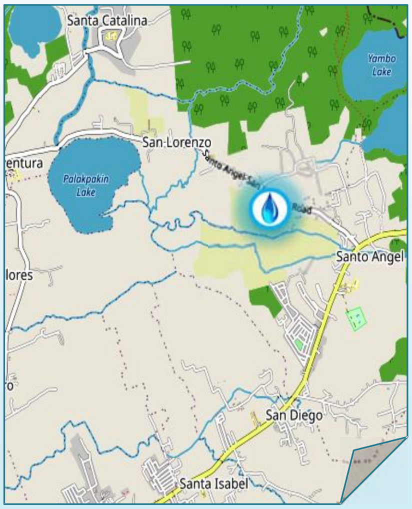


Israel PW is one of several production wells that were handed over to the Water District in 2001. Located in Israel Village, a subdivision within Barangay San Antonio 1, the well plays a crucial role in supplying water to the local residents and surrounding areas. Complementing its functionality, an elevated tank with a capacity of 5 cubic meters was constructed alongside the well. This integrated infrastructure ensures a consistent and reliable water supply for the community.

PROCESS FLOW DIAGRAM OF ISRAEL SHALLOW WELL

Process Step	Symbol	Description	Dept/Div. Responsible
Catchment		Israel Shallow Well (100mmØ-Casing, 50mmØ-Riser pipes, 20m-Depth, 3-Lps) Water Quality Analysis	Technical Services Department, Environment and Water Resources Division
Operation		Pump and Motor Operation (5hp motor & submersible pump)	Environment and Water Resources Division, Water Facilities Pump Operator
Treatment		Disinpection Chlorine Application (Calcium Hypochlorite)	Water Facilities Pump Operator Laboratory Section
Storage Facility		Elevated Steel Water Tank 5 cu.m. - 15m high	Environment and Water Resources Division, Water Facilities Pump Operator, Laboratory Section
Transport		Distribution Network 50mmØ, 75mmØ & 20mmØ - 25mmØ service pipe lines.	Operations Department, Rehabilitation and Maintenance Division
Consumers		Service Area (Israel Subdivision) Random testing of water quality at concessionaires.	Laboratory Section, Production Division, Customer Service Division

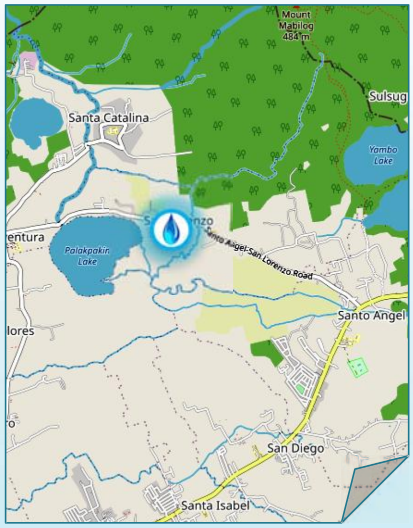




San Lorenzo SW-1 was strategically constructed by the LGU in response to the prevailing water crisis in 2019 and earlier, with the aim of providing substantial assistance to the Water District. It stands as one among several shallow wells situated within the distribution area of the SPCWD, which were retained by the Water District owing to its exceptional water quality and commendable volume discharge.

PROCESS FLOW DIAGRAM OF
SAN LORENZO SHALLOW WELL - 1

Process Step	Symbol	Description	Dept/Div. Responsible
Catchment		San Lorenzo 1 Shallow Well (100mmØ-Casing, 50mmØ-Riser pipes, 48m-Depth, 3-Lps) Water Quality Analysis	Technical Services Department, Environment and Water Resources Division, Laboratory Section
Operation		Pump and Motor Operation (5hp-submersible pump & motor)	Environment and Water Resources Division, Water Facilities Pump Operator
Treatment		Disinfection Chlorine application (Calcium Hypochlorite)	Water Facilities Pump Operator
Transport		Distribution Network 150mmØ, 100mmØ, 75mmØ, 50mmØ & 20mmØ-25mmØ service pipelines	Operations Department, Rehabilitation and Maintenance Division
Consumers		Service Areas: (Brgy. San Lorenzo, Part of San Buenaventura) Random sampling for water quality at concessionaires.	Laboratory Section, Production Division, Customer Service Division



In response to the prevailing water crisis in 2019, an initial shallow well was installed at Barangay San Lorenzo to alleviate the situation. However, recognizing the need for further water supply augmentation, **San Lorenzo SW-2** was commissioned. This additional well played a crucial role in bolstering the water supply in the area during the crisis. San Lorenzo SW-2 offers exceptional water quality, meeting the required standards for safe consumption.

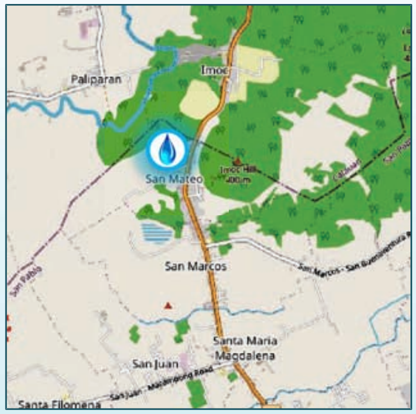
PROCESS FLOW DIAGRAM OF SAN LORENZO SHALLOW WELL - 2

Process Step	Symbol	Description	Dept/Div. Responsible
Catchment		San Lorenzo 2 Shallow Well (100mmØ-Casing, 50mmØ-Riser pipes, 48m-Depth, 3-Lps) Water Quality Analysis	Technical Services Department, Environment and Water Resources Division, Laboratory Section
Operation		Pump and Motor Operation (5hp-submersible pump & motor)	Environment and Water Resources Division, Water Facilities Pump Operator
Treatment		Disinfection Chlorine application (Calcium Hypochlorite)	Water Facilities Pump Operator
Transport		Distribution Network 150mmØ, 100mmØ, 75mmØ, 50mmØ & 20mmØ-25mmØ service pipelines	Operations Department, Rehabilitation and Maintenance Division
Consumers		Service Areas: (Brgy. San Lorenzo, Part of San Buenaventura) Random sampling for water quality at concessionaires.	Laboratory Section, Production Division, Customer Service Division

In 1996, the **San Mateo PW-1** production well underwent rehabilitation with the purpose of partially supplying Barangay San Mateo with water. Previously, the water was pumped into four 5 cu.m. tanks that have recently been decommissioned. The quality of the water is excellent, requiring only minimal disinfection before it is directly supplied to the nearby residents.

PROCESS FLOW DIAGRAM OF
SAN MATEO PRODUCTION WELL - 1

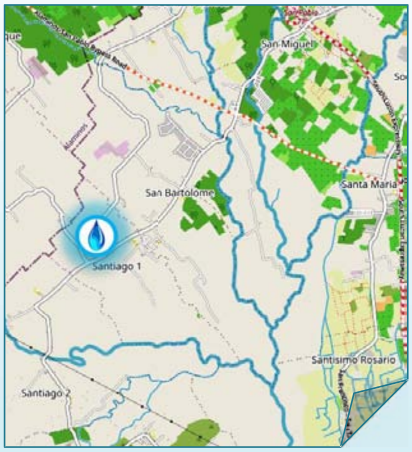
Process Step	Symbol	Description	Dept/Div. Responsible
Catchment		San Mateo Production Well - 1 Brgy. San Mateo, SPC 102 m. depth, 2 lps (150mmØ casing with stainless steel screen, 50mmØ-Riser pipes) Water Quality Analysis	Technical Services Department, Environment and Water Resources Division
Operation		Pump and Motor Operation (5hp-submersible pump & motor)	Environment and Water Resources Division, Water Facilities Pump Operator
Treatment		Disinfection Chlorine application (Calcium Hypochlorite)	Water Facilities Pump Operator
Transport		Distribution Network 200mmØ, 50mmØ 20mmØ - 25mmØ service pipe lines.	Operations Department, Rehabilitation and Maintenance Division
Consumers		Service Area: (Brgy. San Mateo) Random testing of water quality at concessionaires.	Laboratory Section, Production Division, Customer Service Division



In 2019, an additional water source called **San Mateo PW-2** was constructed to meet the needs of the consumers in Barangay San Mateo. Located approximately 50 meters from production well number one, this source provides water of the same high quality. Only minimal chlorination is required before distributing the water to the same area, ensuring sufficiency and

PROCESS FLOW DIAGRAM OF SAN MATEO PRODUCTION WELL - 2

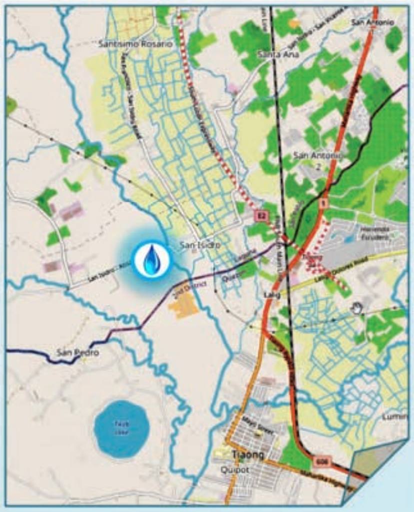
Process Step	Symbol	Description	Dept/Div. Responsible
Catchment		San Mateo Production Well - 2 Brgy. San Mateo, SPC 96 m. depth, 3 lps (200mmØ casing with stainless steel screen, 100mmØ-Riser pipes) Water Quality Analysis	Technical Services Department, Environment and Water Resources Division
Operation		Pump and Motor Operation (20hp-submersible pump & motor)	Environment and Water Resources Division, Water Facilities Pump Operator
Treatment		Disinfection Chlorine application (Calcium Hypochlorite)	Water Facilities Pump Operator
Transport		Distribution Network (200mmØ, 100mmØ & 75mmØ 25mmØ - 20mmØ service pipe lines)	Operations Department, Rehabilitation and Maintenance Division
Consumers		Service Area: (Part of Brgy. San Mateo) Random testing of water quality at concessionaires.	Laboratory Section, Production Division, Customer Service Division



In the years leading up to 2021, Barangay Santiago-1 experienced a severe water crisis, which prompted the commissioning of **Santiago-1 PW** as a solution. While the volume of water provided by Santiago-1 PW was sufficient, there were concerns regarding the water quality, necessitating the implementation of a filtration system to ensure the water's potability.

PROCESS FLOW DIAGRAM OF
SANTIAGO 1 PRODUCTION WELL

Process Step	Symbol	Description	Dept/Div. Responsible
Catchment		Santiago 1 Production Well (200mmØ casing with stainless steel screen, 150m Depth, 20 lps) Water Quality Analysis	Technical Services Department, Environment and Water Resources Division
Operation		Pump and Motor Operation (30hp-submersible pump & motor)	Environment and Water Resources Division, Water Facilities Pump Operator
Treatment		Disinfection Addition of Chlorine (Calcium Hypochlorite)	Water Facilities Pump Operator
Treatment		Rapid Sand Filtration Water quality analysis after filtration	Water Facilities Pump Operator, Laboratory Section
Transport		Distribution Network (150mmØ, 100mmØ, 75mmØ, 50mmØ & 25mmØ - 20mmØ service pipe lines)	Operations Department, Rehabilitation and Maintenance Division
Consumers		Service Areas: (Brgy. San Miguel, Brgy. San Bartolome, Brgy. Santiago 1, Brgy. Santiago 2, Portion of Brgy. Bautista) Radom sampling for water quality at concessionaires.	Laboratory Section, Production Division, Customer Service Division



In 2019, the **San Isidro Shallow Well** was constructed, providing immediate relief to the residents of San Isidro and nearby areas in terms of their water quality requirements. The local government unit (LGU) handed over the shallow well site to the Water District. Notably, the San Isidro Shallow Well stands out among the few shallow wells due to its exceptional water quality.

PROCESS FLOW DIAGRAM OF SAN ISIDRO SHALLOW WELL

Process Step	Symbol	Description	Dept/Div. Responsible
Catchment		San Isidro Shallow Well (100mmØ-Casing, 50mmØ-Riser pipes, 48m-Depth, 3-Lps) Water Quality Analysis	Technical Services Department, Environment and Water Resources Division, Laboratory Section
Operation		Pump and Motor Operation (5hp-submersible pump & motor)	Environment and Water Resources Division, Water Facilities Pump Operator
Treatment		Disinfection Chlorine application (Calcium Hypochlorite)	Water Facilities Pump Operator
Transport		Distribution Network (150mmØ, 100mmØ, 75mmØ, 50mmØ & 25mmØ - 20mmØ service pipe lines)	Operations Department, Rehabilitation and Maintenance Division
Consumers		Service Areas: (Brgy. San Isidro, Part of Santisimo Rosario) Radom sampling for water quality at concessionaires.	Laboratory Section, Production Division, Customer Service Division

ANNEX F - Microbiological Analysis of Water Sources

Monthly Microbiological Analysis of Water Samples
For the month of DECEMBER 2022
Method: Multiple Tube Fermentation Technique

No.	Sampling Points	No.of Samples Taken	Results of Analysis		Remarks	Average Chlorine Residual
			Total Coliform	Fecal Coliform		
			PNSDW Std - <1.1 MPN	PNSDW Std - <1.1 MPN		
Production Well						
1	**Bautista Production Well**	2	<1.1	<1.1	PASSED	0.63
2	**Central Production Well**	3	<1.1	<1.1	PASSED	0.54
3	**CG Brion Production Well**	3	<1.1	<1.1	PASSED	0.56
4	**Concepcion Production Well 1**	3	<1.1	<1.1	PASSED	0.88
5	**Concepcion Production Well 2**	3	<1.1	<1.1	PASSED	0.68
6	**Israel Production Well**	3	<1.1	<1.1	PASSED	0.38
7	**Lynville Production Well**	2	<1.1	<1.1	PASSED	1.00
8	**Maharlika Production Well**	3	<1.1	<1.1	PASSED	0.70
9	**NHA - Sto. Angel Production Well**	3	<1.1	<1.1	PASSED	0.92
10	**San Crispin Production Well 1**	2	<1.1	<1.1	PASSED	0.76
11	**San Crispin Production Well 2**	2	<1.1	<1.1	PASSED	0.97
12	**San Cristobal Production Well**	3	<1.1	<1.1	PASSED	0.64
13	**San Lorenzo Production Well 1**	2	<1.1	<1.1	PASSED	0.36
14	**San Lorenzo Production Well 2**	2	<1.1	<1.1	PASSED	0.36
15	**San Marcos Production Well 1**	2	<1.1	<1.1	PASSED	0.81
16	**San Marcos Production Well 2**	2	<1.1	<1.1	PASSED	0.95
17	**San Mateo Production Well 1**	2	<1.1	<1.1	PASSED	0.47
18	**San Mateo Production Well 2**	2	<1.1	<1.1	PASSED	0.67
19	**Santiago 1 Production Well**	2	<1.1	<1.1	PASSED	0.54
20	**South East Meadows Prod. Well**	2	<1.1	<1.1	PASSED	0.57
21	**Sta. Catalina Production Well**	2	<1.1	<1.1	PASSED	0.87
22	**Sta. Veronica Production Well**	2	<1.1	<1.1	PASSED	0.56
Reservoir						
23	**Sampaloc Reservoir**	3	<1.1	<1.1	PASSED	0.63
Spring Source						
24	**Cabunsod A Spring**	3	<1.1	<1.1	PASSED	1.50
25	**Cabunsod B Spring**	3	<1.1	<1.1	PASSED	0.59
26	**Malabanban 6" Spring**	3	<1.1	<1.1	PASSED	0.55
27	**Malabanban 12" Spring**	3	<1.1	<1.1	PASSED	0.61
28	**Malaunod Spring**	2	<1.1	<1.1	PASSED	0.80
29	**Upper Malamig Spring**	3	<1.1	<1.1	PASSED	1.10
30	**Balanga Spring**	3	<1.1	<1.1	PASSED	0.52
31	**Lagaslasan Spring**	3	<1.1	<1.1	PASSED	0.35
	Total Number of Samples	**78**				
××NOTHING FOLLOWS××						
	Remarks: All samples passed the PNSDW Standard for Total and Fecal Coliform Bacteria					
	Reference : Philippine National Standard for Drinking Water 2017 (PNSDW 2017)					
	PNSDW Standard Limit: Total Coliform - <1.1 MPN					
	Fecal Coliform - <1.1 MPN					
	Note: Results are based on the samples taken					

ANNEX G - Physical and Chemical Analysis of Water Sources

Name of Pumping Station		Parameters Tested													
		SOURCES									RESIDENCES				
		Color	pH	TDS	Nitrates	As	Fe	Mn	Pb	Cd	Color	pH	Turbidity	Pb	Cd
		10 CU	6.5-8.5	600 mg/L	50 mg/L	0.01 mg/L	1.0 mg/L	0.4 mg/L	0.01 mg/L	0.003 mg/L	10 CU	6.5-8.5	5 NTU	0.01 mg/L	0.003 mg/L
Spring															
1	**Upper Malamig**	3	6.97	96	0.6	<0.005					3	6.87	0.4	< 0.005	< 0.001
2	**Lubigan**	3	7.00	121	0.2	<0.005					3	7.06	0.20	< 0.005	< 0.001
3	**Cabunsod**	3	7.08	116	0.2	<0.005					3	6.97	0.25	< 0.005	< 0.001
4	**Malabanban**	3	7.12	120	0.1	0.005					3	6.91	0.10	< 0.005	< 0.001
5	**Malaunod**	3	7	143	1.1	<0.005					3	6.72	0.25	< 0.005	< 0.001
6	**Balanga**	< 3	6.67	241	4.1	<0.005					<3	6.63	0.15	< 0.005	< 0.001
7	**Lagaslasan (Bulk)**	< 3	6.38	158	3.7	<0.005					<3	6.10	0.50	< 0.005	< 0.001
Deepwell without Filtration															
8	**San Marcos PW-1**	3	6.93	240	1.4	<0.005					3	6.87	0.30	< 0.005	< 0.001
9	**San Mateo PW-1**	<3	7.06	259	17	<0.005					<3	6.83	0.15	< 0.005	< 0.001
10	**San Mateo PW-2**	3	6.99	257	12	<0.005					<3	6.97	0.55	< 0.005	< 0.001
11	**San Crispin PW-1**	<3	6.81	223	2.3	<0.005					<3	6.76	0.25	< 0.005	< 0.001
12	**San Crispin PW-2**	<3	6.72	237	2.3	<0.005					<3	6.79	0.30	< 0.005	< 0.001
13	**Concepcion PW-1**	<3	6.81	178	2.3	<0.005					<3	7.06	0.10	< 0.005	< 0.001
14	**Concepcion PW-2**	<3	6.96	111	1.1	<0.005					<3	6.96	0.20	< 0.005	< 0.001
15	**NHA-Sto. Angel**	3	6.83	220	1.5	<0.005					3	6.83	0.25	< 0.005	< 0.001
16	**Jeansville**														
17	**CG Brion**	5	6.98	193	0.4	<0.005					5	7.04	0.40	< 0.005	< 0.001
18	**Lynville 2**	5	7.13	210	0.6	<0.005					3	7.07	0.25	< 0.005	< 0.001
19	**Israel**	<3	6.8	279	5.4	<0.005					<3	6.88	0.20	< 0.005	< 0.001
20	**San Cristobal**	<3	6.82	508	<0.006	<0.005					<3	6.82	0.20	< 0.005	< 0.001
21	**Sta. Catalina**	10	7.22	240	<0.006	<0.005					10	7.06	1.40	< 0.005	< 0.001
Deepwell with Filtration															
22	**Maharlika**	3	7.04	620	<0.006	<0.005	0.006	<0.003			3	7.09	0.03	< 0.005	< 0.001
23	**San Marcos PW-2**	5	7.03	261	0.06	<0.005		0.4			5	7.07	0.50	< 0.005	< 0.001
24	**Southeast Meadows**	<3	6.78	286	7.9	<0.005	<0.005				<3	6.61	0.20	< 0.005	< 0.001
25	**Central**	3	7.16	287	0.3	<0.005					3	7.24	0.60	< 0.005	< 0.001
26	**Sta. Veronica**	5	6.93	347	<0.006	<0.005					<3	6.79	0.15	< 0.005	< 0.001
27	**Santiago 1**	<3	6.89	298	<0.006	<0.005	0.005	<0.003			<3	7.30	0.15	< 0.005	< 0.001
28	**San Jose NHS**	8	7.0	400	<0.006	<0.005	0.06	0.08	<0.005	<0.001					
29	**Bautista**	3	7.0	301	<0.005	<0.005	0.06	0.008	<0.005	<0.001					
Shallow well															
30	**San Lorenzo SW-1**	3	6.8	157	1.2	<0.008					3	6.5	0.35	<0.005	<0.001
31	**San Lorenzo SW-2**	8	6.52	177	1.9	<0.005					8	6.5	0.7	< 0.005	< 0.001

ANNEX H - Treatment Chemicals, Impurities and By-Product

Treatment Chemicals

Disinfectant/ Disinfectant Additive	Other Function	Available Commercial Strength	Maximum Dosage in Water (mg/L)	Arsenic (As)	Cadmium (Cd)	Chromium (Cr)	Lead (Pb)	Mercury (Hg)	Selenium (Se)	Chloroethylene (CCl_4)	Trihalomethane (THM)	Extractable Ether
Calcium Hypochlorite [Ca $(OCl)_2$]	Removal of Iron and Manganese; taste & odor control, Hydrogen Sulfide	70%	1.5					I*			B*	

** At maximum dosage level specified, it has no known contribution that adversely affect the potability of drinking water* ***I - Impurity*** ***B - By-product***

pH Adjustment	Available Commercial Strength	Maximum Dosage in Water (mg/L)	Arsenic (As)	Cadmium (Cd)	Chromium (Cr)	Lead (Pb)	Mercury (Hg)	Selenium (Se)	Silver (Ag)	Fluoride (F)
Sodium Hydroxide,	50-73%						√			
Caustic Soda (NaOH)										
Sodium Carbonate,	58.48%			√		√				
Soda Ash, (Na_2CO_3)	NaO									

Filtration Media	Form	Process Provided	Impurities						
			Arsenic (As)	Cadmium (Cd)	Chromium (Cr)	Lead (Pb)	Mercury (Hg)	Selenium (Se)	Silver (Ag)
Manganese Greensand	Granular	Processed media for Iron, Manganese, and hydrogen Sulfide removal							
Manganese Dioxide AD-26 (Sta. Veronica)	Granular	Media for Iron, Manganese, and hydrogen Sulfide removal							
DMI - 65 - silica sand based filtration media	Granular	Media for Iron, Manganese, and hydrogen Sulfide removal							
Katalox - Light	Granular	Media for Iron, Manganese, and hydrogen Sulfide removal							
Activated Carbon	Granular or Powder	Adsorption for removal of: color, odor, and soluble substances	√		√	√	√		√

Coagulant	Chemical Formula	Function	Available Commercial Strength	Arsenic (As)	Cadmium (Cd)	Chromium (Cr)	Lead (Pb)	Mercury (Hg)	Selenium (Se)	Silver (Ag)
Ferric Chloride	$FeCl_3$	Coagulant of Arsenic	30%	•	•	•	•	•	•	•

ANNEX I – Hazards and Hazards Identification

HAZARDS AND HAZARDS IDENTIFICATION											
Risk Ref	Hazard	Hazardous event (source of hazard)	Raw Risk			Existing Control Measure	Effectiveness of existing control measure	Residual Risk		
			Likelihood	Severity	Score			Likelihood	Score	Priority
SOURCES (S)										
S1	P	Livestock and human activity at water source.	2	3	6	Construction of perimeter fence/gate of catchment areas; Screens at water supply inlet points.	Limited access of unauthorized person at the source; Catchment sanitary surveys show no contamination due to livestock /human activity.	1	3	L
	M		2	5	10			1	5	L
S2	P	Seepage of contaminants or pathogens from human settlements in catchment areas and pumping stations.	3	3	9	Fencing of catchment and pumping stations; facility inspection.	Regular microbiological test of treated water show negative results for Coliform.	1	3	L
	M		3	5	15			1	5	L
S3	P	Storm water runoff carrying contaminants.	3	3	9	Flood mitigation or retardation; sediment traps.	Water quality reports showed less microbiological contamination.	1	3	L
	C		3	4	12			1	4	L
	M		3	5	15			1	5	L
S4	P	Rubbish dumping in source water.	2	3	6	Perimeter fencing/gate; Availability of bins or rubbish collection; customer education and awareness program; signage.	Sanitary inspection records show no contamination.	1	3	L
	C		2	4	8			1	4	L
	M		2	5	10			1	5	L

HAZARDS AND HAZARDS IDENTIFICATION										
Risk Ref	Hazard	Hazardous event (source of hazard)	Raw Risk			Existing Control Measure	Effectiveness of existing control measure	Residual Risk		
			Likelihood	Severity	Score			Likelihood	Score	Priority
S5	P	Agricultural practices may lead to contamination by toxic chemicals like pesticides, spillage of diesel and petroleum products.	1	3	3	Catchment management plan to control current activity; community awareness; Monitoring presence of pesticides.	Sanitary inspection records show no contamination.	1	3	L
	C		1	4	4			1	4	L
S6	P	Runoff from animal farms to source water.	2	3	6	Controlled grazing in the catchment; fencing of catchment areas.	Regular microbiological test of treated water show negative results for Coliform.	1	3	L
	M		2	5	10			1	5	L
S7	P	Interrupted water/no water due to pump breakdown.	2	3	6	Standby pumps; regular maintenance of pumps.	Lessen water interruption and repair of pumps.	1	3	L
	C		2	4	8			1	4	L
	M		2	5	10			1	5	L
S8	P	Water may contain naturally occurring Manganese, Iron, Arsenic and Hydrogen Sulfide.	5	3	15	Allot budget for water treatment system.	Water quality reports show that some water quality issues were addressed by filtration system. However, with others still fail with the standard, the source has to stop the operation.	3	9	M
	C		5	4	20			3	12	M
S9	P	Shallow boreholes in highly permeable soils or fractured rock aquifers are vulnerable to contamination.	2	3	6	Facility inspection.	Sanitary inspection records show no contamination.	1	3	L
	M		3	5	15			1	5	L

HAZARDS AND HAZARDS IDENTIFICATION										
Risk Ref	Hazard	Hazardous event (source of hazard)	Raw Risk			Existing Control Measure	Effectiveness of existing control measure	Residual Risk		
			Likelihood	Severity	Score			Likelihood	Score	Priority
S10	P	Seepage of leachate from septic tanks of nearby houses near well sources.	3	3	9	Check well design if there is cement grout **if present**: conduct regular inspection of well casing for integrity **if absent**: seepage will be addressed at treatment.	Presence of seepage from septic tanks would normally produce odor on water; no foul odor recorder over the years. Water analysis does not indicate any sign of seepage.	1	2	L
	M		3	5	15			1	5	L
S11	P	Intrusion of dirty water through damage well casing.	2	3	6	Facility inspection.	Regular microbiological and physical tests show negative results.	1	3	L
	C		2	4	8			1	4	L
	M		2	5	10			1	5	L
S12	P	Intrusion of contaminated water in the intake box overflow pipe.	3	3	9	Repair of overflow/Facility inspection.	Regular microbiological and physical tests show negative results.	1	6	M
	M		3	5	15			2	10	M
S13	P	Inadequate well-head protection and unhygienic practices.	3	3	9	Fencing of catchment and pumping stations; facility inspection and maintenance.	Limited access on source of unauthorized personnel.	1	3	L
	M		3	5	15			1	5	L
S14	P	Changes in raw water quality can occur due to heavy rains.	2	3	6	Monitor Raw water quality for physical and microbiological changes and adjust treatment.	Record of WQ monitoring of raw water show microbiological contamination due to heavy rains.	1	3	L
	C		2	3	6			1	5	L
	M		2	5	10			1	5	L
S15	C	High levels of natural organic matter in source water will cause disinfection-by-product with Chlorine(DBP formation).	2	4	8	Controlled grazing in the catchment; fencing of catchment areas.	Water analysis show no DBP formation.	1	4	L

HAZARDS AND HAZARDS IDENTIFICATION											
Risk Ref	Hazard	Hazardous event (source of hazard)	Raw Risk			Existing Control Measure	Effectiveness of existing control measure	Residual Risk		
			Likelihood	Severity	Score			Likelihood	Score	Priority
S16	P	Recreational Activities near the source.	3	3	9	Restrict activities where required. Ensure toilets with sewer management and rubbish bins are available.	Limited activities near sources; No contamination occurred in the sources as a result of recreational activities.	1	3	L
	C		3	4	12			1	4	L
	M		3	5	15			1	5	L
S17	P	Vandalism or sabotage may pollute the water.	1	3	3	Secure fence, lock gates, protect spring and pumps.	Record of Physical inspection show that there was no vandalism or sabotage.	1	3	L
	C		1	3	3			1	3	L
	M		1	5	5			1	5	L
S18	P	Intrusion of contaminants and small animals in open manholes and screen for air vent.	4	3	12	Repair of manholes and installation of screen; Facility inspection.	Limited access of contaminants/small animals.	3	9	M
	M		4	5	20			3	15	H
S19	P	Damage of well casing and screen due to wear and tear acts of nature e.g. typhoon, earthquakes (turbidity or microbial contamination).	1	3	3	Facility inspection and repair as the need arises.	Return in good condition.	1	3	L
	M		1	5	5			1	5	L
S20	P	Cracking and flaking of paints and accumulation of rusts inside and outside of elevated water tank steel shell (all active elevated tanks).	2	3	6	Water tank inspection; Stripping of damage paint and repainting with non-toxic paint.	Prevented the continuous occurrence of paint flaking and accumulation of rust.	1	3	L
	C		2	4	8			1	4	L
	M		2	5	10			1	5	L

HAZARDS AND HAZARDS IDENTIFICATION										
Risk Ref	Hazard	Hazardous event (source of hazard)	Raw Risk			Existing Control Measure	Effectiveness of existing control measure	Residual Risk		
			Likelihood	Severity	Score			Likelihood	Score	Priority
S21	P	Accumulation of sediments and chemical residues inside the inner wall of the tank (all active elevated tanks including ground reservoir).	2	3	6	Water tank/reservoir inspection and interior cleaning and scraping of sediments and practices building up at the tank wall.	Free from harmful bacteria and elimination of the presence of the fine sediment and residues.	1	3	L
	M		2	5	10			1	5	L
TREATMENT (T)										
T1	P	Water may contain naturally occurring Manganese, Iron, Arsenic and Hydrogen Sulfide.	5	3	15	Setting-up water treatment such as but not limited to filtration	Water quality reports show that some water quality issues were addressed by filtration system. However, with others still fail with the standard, the source has to stop the operation.	3	9	M
	C		5	4	20			3	12	M
T2	P	Defective chlorinator and chemical feed pump resulting to no chlorination.	4	3	12	Regular maintenance and calibration of equipment; Availability of back-up system.	Regular maintenance and calibration of equipment not strictly followed.	3	9	M
	M		4	5	20			2	10	M
T3	P	Under dosing of Chlorine disinfectant/oxidant due to improper chemical preparation.	4	3	12	Strict compliance to Standard Procedure for chemical preparation and dosing; monitor Chlorine Residual.	Low chlorine residual to no chlorine still observed in some sources.	3	9	M
	M		4	5	20			3	15	H

HAZARDS AND HAZARDS IDENTIFICATION										
Risk Ref	Hazard	Hazardous event (source of hazard)	Raw Risk			Existing Control Measure	Effectiveness of existing control measure	Residual Risk		
			Likelihood	Severity	Score			Likelihood	Score	Priority
T4	**P**	Under dosing of Chlorine disinfectant/oxidant due to clogging of Chlorinator nozzle/chemical feed pump.	4	3	12	Regular/periodic cleaning of nozzle/chemical feed pump; use of back-up chlorinator during periods of maintenance.	Lesser clogging of nozzles of chlorinators and feed pumps.	3	9	M
	M		4	5	20			3	15	H
T5	M	Residual Chlorine not maintained through network.	4	5	20	Set -point designed to achieve Residual Chlorine standard at consumers' taps; monitor residual Chlorine in nearest and farthest taps.	Record of Residual Chlorine monitoring in the distribution lines show that some selected sites have residual below the required dosage.	3	15	H
T6	M	Less effective disinfection due to elevated turbidity.	3	5	15	Improve clarification and filtration processes Monitor turbidity and Chlorine residual.	Turbidity is within the standard for effective disinfection.	1	5	L
T7	P	Improper filtration media.	2	3	6	Purchase media suited for the design of filtration.	Iron and Manganese results are within the water quality targets.	1	3	L
	C		2	3	6			1	3	L
T8	P	Infrequent backwashing causing ineffective filtration.	4	3	12	Conduct process optimization study on the number of backwash needed.	Proper backwashing leads to effective filtration.	1	3	L
	C		4	3	12			1	3	L
T9	P	Ineffective filtration due to mechanical failure.	2	3	6	Replacement of defective parts and units.	Regular maintenance of filtration resulted in good water quality.	1	3	L
	C		2	3	6			1	3	L

HAZARDS AND HAZARDS IDENTIFICATION										
Risk Ref	Hazard	Hazardous event (source of hazard)	Raw Risk			Existing Control Measure	Effectiveness of existing control measure	Residual Risk		
			Likelihood	Severity	Score			Likelihood	Score	Priority
T10	P	Failure to oxidize and filter highly soluble Iron and Manganese in treated water causes dirty water complaints.	5	3	15	Performance management /analysis; process controllability; choice and depth of media determined from extensive study.	Process proving is being conducted.	3	9	M
T11	P	Media loss during backwash resulting in reduction of efficiency due to inadequate filter media depth.	3	3	9	Regular inspection and replenishment of media.	Reports show that media loss resulted inefficiency of the filtration system.	1	3	L
	M		3	5	15			1	5	L
T12	P	Improper maintenance of filtration leading to loss of water quality.	3	3	9	Proper bed expansion; Media agitation by air or mechanical washers.	Regular maintenance of filtration resulted in good water quality.	1	3	L
	M		3	5	15			1	5	L
T13	P	Ineffective filtration and backwashing due to age of system and design limitation.	4	3	12	Validate treatment process and install improvement/upgrade plan for the facilities that are validated to be inefficient or no longer functioning; alternative treatment.	Allotted budget for the improvement / upgrade plan for the facilities.	3	9	L
	C		4	3	12			3	9	L
	M		4	5	20			2	10	M
T14	P	Blocked filters causing inadequate particle removal.	3	3	9	Proper bed expansion; Media agitation by air or mechanical washers (Back Washing).	Regular maintenance of filtration resulted in good water quality.	1	3	L
	M		3	5	15			1	5	L

HAZARDS AND HAZARDS IDENTIFICATION										
Risk Ref	Hazard	Hazardous event (source of hazard)	Raw Risk			Existing Control Measure	Effectiveness of existing control measure	Residual Risk		
			Likelihood	Severity	Score			Likelihood	Score	Priority
T15	P	Interrupted treatment due to power outage.	2	3	6	Standby power generators.	Routine testing of power supply shows it works when power is lost.	1	3	L
	C		2	3	6			1	3	L
	M		2	5	10			1	5	L
T16	P	Failure of pumps.	3	2	9	Back-up pumps.	Records show that water samples are negative from microbiological contamination.	2	4	L
	C		3	2	9			2	4	L
	M		3	3	15			2	6	L
T17	P	Contamination due to wrong chemicals and materials supplied and dosed.	1	3	3	Strict purchasing policy and procedure; Laboratory analysis certificate from supplier.	No record of wrong chemicals purchased.	1	3	L
	C		1	3	3			1	3	L
	M		1	5	5			1	5	L
T18	P	Treatment chemicals may be of poor quality compromising effectiveness of treatment.	1	3	3	Include in purchasing policy and procedure the requirement of proof/certification of purity of the product supplied ; monitor treated water.	Procurement records show that chemicals purchased are of good quality.	1	3	L
	C		1	3	3			1	3	L
	M		1	5	5			1	5	L
T19	P	Chemical supply runs out so treatment effectively stops.	2	3	6	Maintain sufficient chemical stocks.	Record shows sufficient supply available and good stock rotation.	1	3	L
	C		2	3	6			1	3	L
	M		2	5	10			1	5	L
T20	P	Insufficiently Trained Operators.	3	3	9	Ensure that treatment source operators are trained and meet established competency standards; use of skilled and trained operators.	New operators has to undergo trainings and refresher trainings for the existing operators.	2	6	M
	C		3	3	9			2	6	M
	M		3	5	15			2	10	M

T21	P	Unwarranted entry in the treatment facility.	3	3	9	Secured fence, locked premises; Regular inspection.	Record show no unwarranted entry in the facility.	1	3	L
	C		3	3	9			1	3	L
	M		3	5	15			1	5	L
	DISTRIBUTION (D) - Storage									
D1	P	Microbial contamination of service reservoir from animal/ bird droppings washed into storages through open inspection hatches or faults.	3	3	9	Inspection covers remain in place; Maintain residual chlorine within the tank; Regular cleaning , inspection and maintenance of storage tanks.	No record of bacterial contamination in service reservoirs / tanks.	1	3	L
	M		3	5	15			1	5	L
D2	P	High chlorine levels may enter the distribution system if there is poor mixing after disinfection of storages.	3	3	9	Adequate mixing of storages, monitoring of residual chlorine.	Chlorine residual in reservoirs and tanks are within the standards.	1	3	L
	M		3	5	15			1	5	L
D3	M	Increased microbial activity due to loss of Chlorine as a result of long retention time in reservoir.	3	5	15	Minimize stagnation. Maintain an effective disinfectant residual.	Chlorine residual in reservoirs and tanks are within the standards.	1	5	L
D4	P	Scaling and formation of biofilm on the walls.	3	4	12	Monitor to detect areas of quality degradation. Maintain an effective chlorine residual and periodic flushing of FH and Pipelines.	Periodic Flushing of FH and Pipelines remove accumulated biofilm and other contaminants.	1	4	L
	M		3	5	15			1	4	L

HAZARDS AND HAZARDS IDENTIFICATION										
Risk Ref	Hazard	Hazardous event (source of hazard)	Raw Risk			Existing Control Measure	Effectiveness of existing control measure	Residual Risk		
			Likelihood	Severity	Score			Likelihood	Score	Priority
D5	P	Accumulation of particles in the reservoir floor.	3	3	9	Annual tank preventive maintenance program. Flush and clean tanks regularly.	Annual tank preventive maintenance program cleans and flush particles from the reservoirs.	1	3	L
	M		3	5	15			1	5	L
D6	P	Resuspension of sediments containing slimes and odor producing microorganisms.	3	4	12	Inspect regularly and clean when necessary. Maintain an effective chlorine residual	Regular cleaning and maintaining of chlorine residual prevents the growth of microorganisms and odor.	1	3	L
	M		3	5	15			1	3	L
D7	P	Accumulated rust particles in elevated water tank.	2	3	6	Inspect regularly and clean when necessary.	Regular cleaning and maintenance of water tanks prevents rust.	1	3	L
	C		2	3	6			1	3	L
	M		2	5	10			1	5	L
D8	P	Ingress of pathogens and soil during a main break and repair.	3	3	9	Flushing of water mains in the area affected by the shutdown. Disinfection of water main prior to turning on the supply.	Water quality complaints still observe during main break and repair.	2	6	M
	C		3	3	9			2	6	M
	M		3	5	15			2	10	M
D9	P	Dead-end mains and low water flows can to lead stagnant water and loss of residual chlorine causing unacceptable odors.	3	3	9	Minimize dead ends in water pipes. Investigate ways to increase flow through section of the pipe. Regular flushing.	Installation of BOV on dead-ends mains, and pressure management in low pressure areas.	2	6	M
	M		3	5	15			2	10	M
D10	P	Poor hygiene in repair works.	3	3	9	Follow hygiene procedure for repair works in distribution main	Lesser contamination or water quality complaints observed.	1	3	L
	M		3	5	15			1	5	L
D11	P	Low system pressure if one supply source is out of service.	3	3	9	Maintain positive distribution water pressure. Regular pressure monitoring.	Regular monitoring of pressure to maintain pressure.	2	6	M
	C		3	3	9			2	6	M
	M		3	5	15			2	10	M

HAZARDS AND HAZARDS IDENTIFICATION										
			Raw Risk					Residual Risk		
Risk Ref	**Hazard**	**Hazardous event (source of hazard)**	**Likelihood**	**Severity**	**Score**	**Existing Control Measure**	**Effectiveness of existing control measure**	**Likelihood**	**Score**	**Priority**
D12	**P**	Illegal connections could lead to cross-contamination.	2	4	8	Regular inspection.	Monitoring & inspection of concessionaires with unusual consumption.	1	2	L
	M		2	5	10			1	2	L
D13	**P**	Inadequate disinfection or flushing before commissioning of new mains may result in contamination.	3	3	9	Establish standard procedures for commissioning new mains, including disinfection and flushing. Store new pipes and fittings with openings sealed.	Hydro & Water testing show unfavorable results.	2	6	M
	M		3	5	15			2	10	M
D14	**P**	Cross connection or backflow can contaminate water supply system.	3	3	9	Institute a cross-connection program. Install backflow prevention devices.	Received lesser report of backflow.	1	3	L
	M		3	5	15			1	5	L
D15	**P**	Unsuitable coatings and materials can leach chemicals or support bacterial growth.	1	3	3	Use only materials approved for use in drinking water.	Prevented the continuous occurrence of paint flaking and accumulation of rust.	1	3	L
	M		1	5	5			1	5	L
D16	**P**	Changes in flow or increased concentration of chlorine disinfectant can cause sloughing and re-suspension of biofilms.	3	3	9	Flush mains before changes in flow and adjust concentrations of chlorine to required level.	Frequent water sample and flushing on site to eliminate sloughing.	1	3	L
D17	**P**	Leakages within the distribution network.	3	3	9	Leak detection program.	Can locate existing leaks underground.	2	6	M
	C		3	3	9			2	6	M
	M		3	5	15			2	10	M

HAZARDS AND HAZARDS IDENTIFICATION										
Risk Ref	Hazard	Hazardous event (source of hazard)	Raw Risk			Existing Control Measure	Effectiveness of existing control measure	Residual Risk		
			Likelihood	Severity	Score			Likelihood	Score	Priority
D18	**P**	Water interruption due to no power supply.	2	4	8	Standby generator. Inform the public.	Decreased frequency of shut down and water supply interruption, continuous water supply.	1	3	L
D19	**C**	Accidental chemical spillage along distribution line in considerable volume.	1	4	4	Emergency Standard Operating Procedure to ensure quick response.	No contamination due to chemical spillage.	1	4	L
D20	**P**	Intrusion of contaminants due to poor quality of materials used in turned over subdivisions.	1	4	4	Replacement with quality materials and flushing to prevent contaminants to multiply.	No intrusion of contaminants due to poor quality materials.	1	4	L
	M		1	5	5			1	5	L
D21	**P**	Sabotage and natural disaster.	1	3	3	Ensure that potential accessible components of distribution systems are kept secured and are locked.	Minimized the number of repair of distribution lines aftermath of natural disaster.	1	3	L
	C		1	3	3			1	3	L
	M		1	5	5			1	5	L
D22	**P**	Contaminants enter through busted pipes accidentally damaged by other agencies.	3	3	9	Assign a technical personnel aware of the exact location of buried pipes to act as guide of excavators.	Minimized the number of pipes being damaged.	2	6	M
	M		3	5	15			2	10	M

	CONSUMERS (C)									
HAZARDS AND HAZARDS IDENTIFICATION										
			Raw Risk					Residual Risk		
Risk Ref	Hazard	Hazardous event (source of hazard)	Likelihood	Severity	Score	Existing Control Measure	Effectiveness of existing control measure	Likelihood	Score	Priority
C1	P	Colored water as a result of iron and manganese precipitation.	4	3	12	Water treatment process optimization including chemical dosing, filter backwashing, flow rate.	Water quality complaints show that brownish to black water is still observed in areas supplied by sources with iron and manganese.	2	6	M
	C		4	3	12			2	6	M
	M		4	5	20			2	10	M
C2	P	Contamination by backflow due to unauthorized/illegal connection.	2	3	6	Site inspections and remove illegal connections.	Inspections and removal of illegal connections prevent possible backflow of pressure.	2	6	L
	C		2	3	6			2	6	L
	M		2	5	10			2	10	M
C3	P	Backflow from faulty meters or household plumbing devices or water storages (i.e. rainwater tanks, swimming pools, garden ponds).	2	3	6	Site inspections; all meters have non-return valves.	No complaints received as a result of backflow from faulty meters.	1	3	L
	C		2	3	6			1	3	L
	M		2	5	10			1	5	L
C4	P	Poor quality of household plumbing can leach chemicals that have health impacts or cause color, tastes and odors.	2	3	6	Educate consumers and plumbers about safe plumbing materials and installations.	No complaints of color, odor and taste due to in-house plumbing.	1	3	L
	C		2	4	8			1	4	L
C5	P	Stagnation can occur where water is held in pipework which is infrequently used.	3	3	9	Education and awareness Regular flushing.	Regular flushing of FH in the water system will clean up contaminants.	1	3	L
	M		3	5	15			1	5	L
C6	P	Cross connection with private water supplier and chemical storage tanks.	2	3	6	Education and awareness.	Regular communication with the private water supplier.	1	3	L
	C		2	4	8			1	4	L
	M		2	5	10			1	5	L

ANNEX J - Prioritized and Validated Control Measures

PRIORITIZED AND VALIDATED CONTROL MEASURES													
Risk Ref	Hazard	Hazardous event (source of hazard)	Raw Risk			Existing Control Measure	Effectiveness of existing control measure	Residual Risk			Proposed Control Measure	Validation	PCM Ref
			Likelihood	Severity	Score			Likelihood	Score	Priority			
S8	P	Water may contain naturally occurring Manganese, Iron, Arsenic and Hydrogen Sulfide.	5	3	15	Installation of water treatment facility with filtration system	Water quality reports show that some water quality issues of arsenic and hydrogen sulfide were not addressed by filtration system alone.	3	9	M	Upgrade Water Treatment Facility for effective treatment.	Not exceeded with the PNSDW standard.	PCM 1
	C		5	4	20			3	12	M			
S12	P	Intrusion of contaminated water in the intake box overflow pipe.	3	3	9	Fenced the catchment area above the spring from animals and humans to prevent contamination.	Some microbial analysis of spring sources shows microbial contamination with coliform	2	6	M	Spring box cleaning; Educational awareness to the local community and pump operators of the correct maintenance of the spring inlet and system and in the rationale for the protection of the source.	Consistency in negative results of water samples.	PCM 2
	M		3	5	15			2	10	M			

S18	**P**	Intrusion of contaminants and small animals in open manholes and screen for air vent.	4	3	12	Repair of manholes and installation of screen; Facility inspection.	Limited access of contaminants/small animals.	3	9	M	Report the necessary repair of manholes immediately; Install rigid and durable screen.	Consistency in negative results in microbial and physical analysis of water samples.	**PCM 3**
	M		4	5	20			3	15	H			
T2	**P**	Defective chlorinator and chemical feed pump resulting to no chlorination.	4	3	12	Regular maintenance and calibration of equipment; Availability of back-up system	Regular maintenance and calibration of equipment not strictly followed.	3	9	M	Prepare a calibration schedule for the equipment use at the source.	Calibration certificate of the equipment.	**PCM 4**
	M		4	5	20			3	15	H			
T3	P	Underdosing of Chlorine disinfectant/oxidant due to improper chemical preparation	4	3	12	Strict compliance to Standard Procedure for chemical preparation and dosing; monitor Chlorine Residual	Low chlorine residual to no chlorine still observed in some sources	3	9	M	Adjust Chlorine point dose to achieve ≥0.5 mg/L but < 1.5 mg/L residual chlorine; Regular monitoring of residual chlorine; Training program for operators.	Microbiological water quality data has proven that ≥ 0.5 mg/L is sufficient to provide a ≥ 0.3 residual in the service area. Above 1.5 mg/L (leaving the source) there will be numerous complaints near the source and possible formation of DBPs	**PCM 5**
	M		4	5	20			3	15	H			
T4	P	Underdosing of Chlorine disinfectant/oxidant due to clogging of Chlorinator nozzle/chemical feed pump	4	3	12	Regular/periodic cleaning of nozzle/chemical feed pump; use of back-up chlorinator during periods of maintenance	Lesser clogging of nozzles of chlorinators and feed pumps	3	9	M	Strictly follow regular cleaning of nozzle/chemical feed pump; regularly check residual chlorine	Maintenance of the equipment has been recorded in logbook	**PCM 6**
	M		4	5	20			3	15	H			

T5	M	Residual Chlorine not maintained through network	4	5	20	Set -point designed to achieve Residual Chlorine standard at consumers' taps; monitor residual Chlorine in nearest and farthest taps	Record of Residual Chlorine monitoring in the distribution lines show that some selected sites have residual below the required dosage	4	20	H	Strictly follow set-point for residual chlorine in all the sources to meet the standard of ≥ 0.5 mg/L but < 1.0 mg/L leaving treatment works; Monitor Residual Chlorine nearest and farthest taps from the source	Residual chlorine is being monitored by the laboratory personnel weekly daily by the pump operators. Records can be shown in their respective logbooks.	**PCM 7**
T10	P	Failure to oxidize and filter highly soluble Iron and Manganese in treated water causes dirty water complaints	5	3	15	Performance management/analysis; process controllability; choice and depth of media determined from extensive study	Process proving is being conducted	3	9	M	Install An effective and efficient water treatment	Complete test of parameters for microbiological, physical and chemical quality of water	**PCM 8**
T13	P	Ineffective filtration and backwashing due to age of system and design limitation	4	3	12	Validate treatment process and install improvement/upgrade plan for the facilities that are validated to be inefficient or no longer functioning; alternative treatment	Alloted budget for the improvement/upgrade plan for the facilities	3	9	L	Install An effective and efficient water treatment	Complete test of parameters for microbiological, physical and chemical quality of water	**PCM 9**
	C		4	3	12			3	9	L			
	M		4	5	20			2	10	M			
T20	P	Insufficiently Trained Operators	3	3	9	Ensure that treatment source operators are	Some operators are not well trained leading to loss or ineffective treatment	3	9	M	Continuous training of the operators for operation and	Well trained and competent operators	**PCM 10**

	C		3	3	9	trained and meet established competency standards; use of skilled and trained operators		3	9	M	maintenance of sources; WSP training	ensure effective water treatment	
	M		3	5	15			3	15	H			
D8	P	Ingress of pathogens and soil during a main break and repair	3	3	9	Flushing of water mains in the area affected by the shutdown. Disinfection of water main prior to turning on the supply.	Water quality complaints observed during mainbreak and repair	3	9	M	Pressure Management and Installation of DMAs Rehabilitation of old and deteriorated Asbestos and GI Pipes.	Customer complaints and reports	**PCM 11**
	C		3	3	9			3	9	M			
	M		3	5	15			3	15	H			
D11	P	Low system pressure if one supply source is out of service	3	3	9	Maintain positive distribution water pressure. Regular pressure monitoring.	Less complaints received on water interruption.	3	9	M	Pressure Management - Valving and Installation of Data Loggers	Maintain pressure monitoring within service area	**PCM 12**
	C		3	3	9			3	9	M			
	M		3	5	15			3	15	H			

D13	P	Inadequate disinfection or flushing before commissioning of new mains may result in contamination	3	3	9	Establish standard procedures for commissioning new mains, including disinfection and flushing. Store new pipes and fittings with openings sealed.	Hydro & Water testing show unfavorable results.	3	9	M	Revision of standard procedures for commissioning new mains, including hydro testing, disinfection and flushing. Inspection of materials before installation.	Positive Result of Hydro & Water Sample Testing	**PCM 13**
	M		3	5	15			3	15	H			
D17	P	Leakages within the distribution network	3	3	9	Leak detection program	Can locate existing leaks underground	2	6	M	Rehabilitation of aging pipe lines in distribution network.	Customer complaints and reports	**PCM 14**
	C		3	3	9			2	6	M			
	M		3	5	15			2	10	M			
D22	P	Contaminants enter through busted pipes accidentally damaged by other agencies	3	3	9	Assign a technical personnel aware of the exact location of buried pipes to act as guide of excavators.	Minimized the number of pipes being damaged	3	9	M	Coordinate with the concerned agency or company before any execution of works is undertaken.	Coordinated activities will prevent damages to existing pipelines	**PCM 15**
	M		3	5	15			3	15	H			

C1	P	Complaints received regarding colored water as a result of iron and manganese precipitation.	4	3	12	Complaints are reported to concerned division to conduct water treatment process optimization including chemical dosing, filter backwashing, flow rate	Water quality complaints show that brownish to black water is still observed in areas supplied by sources with iron and manganese.	2	6	M	Pump operators must strictly follow the standard operating procedures for sources with filtration system.	Customer complaints and reports	**PCM 16**
	C		4	3	12			2	6	M			
	M		4	5	20			2	10	M			

ANNEX K - Improvement and Upgrade Plan

IMPROVEMENT/ UPGRADE PLAN							
PCM Ref	**Action (Proposed Control Measure)**	**Arising from (Hazardous Event)**	**Identified specific improvement plan**	**Accountabilities**	**Due**	**Cost**	**Status**
PCM1	Upgrade Water Treatment Facility for effective treatment	Water may contain naturally occurring Manganese, Iron, Arsenic, and Hydrogen Sulfide	1. Refer to the manual/SOP that provided by the contractor to help increase processing efficiency and overall quality of the installation. Ensure thorough understanding of maintenance and operating requirements.	Operator -on- duty	2022	P4,950,000	Completed
			2. Assessment of Plant Performance - Evaluate the performance of the water treatment plant through regular analyze water samples to monitor treatment effectiveness and adjust the process as needed.	Laboratory Supervisor			
			3. Personnel Involvement - Train the operator on duty of basic repairs and inspections. EWRD Division Manager oversees the entire process.	EWRD Division Manager			

PCM2	Spring box cleaning; Educational awareness on the local community and pump operators to the correct maintenance of the spring inlet and system and in the rationale for the protection of the catchment areas.	Intrusion of contaminated water in the intake box overflow pipe	1. Inspection and Source identification - Identify potential entry points or vulnerabilities; Determine the source of contamination and possible nearby land use, industrial activities, or agricultural practices.	EWRD Division Manager	2023		Completed
			2. Barriers & Maintenance - Install physical barriers and conduct regular cleaning and maintain these barriers to ensure their effectiveness.		1st Quarter of 2024	Extracted from P390,000.00 budget of Source and Infrastructure Improvement	On-Going Implementation
			3. Monitoring & Alarm - Implement real-time monitoring systems and set alarms to alert operators when contamination exceeded acceptable limits; Perform shutting down if contamination is detected.	Operator -on-duty			On-Going Implementation
			4. Community awareness - Inform the nearby community about their responsible safeguarding on water quality to prevent contamination incidents.	Public Information Officer			On-Going Implementation

PCM3	Report the necessary repair of manholes; Install rigid and durable screen	Intrusion of contaminants and small animals in open manholes and screen for air vent	1. Manhole Security & Maintenance - Seal and lock manholes to prevent unauthorized access. Report the crucial incidents; Conduct regular cleaning of any accumulated debris or blockages.	Operator -on- duty			On-going implementation
			2. Air vent Screens - Install fine mesh screens over air vents to prevent debris, insects, and small animals from entering while allowing airflow.	Production and Maintenance Division Manager	Upon receipt of the report	P100,000.00 or depends on the accessed damaged	Budgeted
			3. Rodent and Pest Control - Seal manhole with durable materials; Place bait stations near manholes to discourage rodents from approaching.				
PCM4	Prepare a calibration schedule for the equipment use at the source	Defective chlorinator and chemical feed pump resulting to no chlorination	1. Immediate Assessment of the Chlorinator - Inspect thoroughly if possible for repair or replacement.	Operator -on- duty			On-going
			2. Chemical feed pump evaluation - Assess the chemical feed pump's performance and calibrate as schedule to prevent issues and defects.	EWRD Division Manager	As schedule	P100,000	Budgeted
			3. Backup System - Purchasing and installing backup chemical feed pump.		2022	P200,000	Completed

PCM5	Adjust Chlorine point dose to achieve ≥0.5 mg/L but < 1.5 mg/L residual chlorine; Regular monitoring of residual chlorine; Training program for operators	Residual Chlorine not maintained through network; Underdosing of Chlorine disinfectant/oxidant due to improper preparation of Chlorine solution	1. Network Monitoring and Sampling - Increase the frequency of water sampling at various points within the distribution network to measure residual chlorine level. 2. Strictly follow the SOP for addressing sudden chlorine level drops.	Laboratory Supervisor			On-Going Implementation
			3. Operator Training and Awareness - Train operators on proper chlorine handling, dosing, and safety protocols;	Training & Development Officer	Annually	P100,000.00	
PCM6	Strictly follow regular cleaning of nozzle/chemical feed pump; regularly check residual chlorine	Underdosing of Chlorine disinfectant/oxidant due to clogging of Chlorinator nozzle/chemical feed pump	1. Nozzle and Pump Inspection and Assessment - Inspect for any visible clogs, blockages, or damages. Consider cleaning or replacement after the assessment of the malfunctioning components.	Operator-on-duty			On-Going Implementation
			2. Regular Maintenance Schedule - Regularly perform the maintenance schedule for both the chlorinator and chemical feed pump and keep essential spare parts on hand to minimize downtime.	Operator-on-duty	June 2024	P225,750	Budgeted
			3. Monitoring & Adjustment - Instruct operators to monitor residual chlorine level regularly and adjust dosing rates based on water quality variations.	EWRD Division Manager			On-Going Implementation

PCM7	Strictly follow set-point for residual chlorine in all the sources to meet the standard of ≥ 0.5 mg/L but < 1.0 mg/L leaving treatment works; Monitor Residual Chlorine nearest and farthest taps from the source	Residual Chlorine not maintained through network	1. Network Monitoring and Sampling - Increase the frequency of water sampling at various points within the distribution network to measure residual chlorine level.	Laboratory Supervisor			On-Going Implementation
			2. Strictly follow the SOP for addressing sudden chlorine level drops	Operator-on-duty			On-Going Implementation
PCM 8/ PCM 9	Performance Management and process controllability of water treatment	Failure to oxidize and filter highly soluble Iron and Manganese in treated water causes dirty water complaints	1. Monitoring & Testing - Install real-time sensors that can detect any deviations from the desired levels. 2. Hydraulic design optimization - Ensure optimal flow rates through filters to maximize contact time for oxidation and filtration.	EWRD Division Manager	2022	P 4,950,000	Completed
		Failure to remove or reduce Arsenic in a safe level					
		Ineffective filtration and backwashing due to age of system and design limitation	3. Regularly backwash filters to remove accumulated particles.	Operator-on-duty			On-going implementation

PCM 10	Continuous training of the operators for operation and maintenance of sources ; WSP training	Insufficiently Trained Operators	1. Process documentation - Strengthen the implementation of the existing documents, update system operations manual with accurate information, and simplified flow diagrams and peer-to-peer knowledge sharing.	EWRD Division Manager			Updating of the documents as necessary
			2. SOPs - Follow SOPs for troubleshooting guides for operators.	Operator -on- duty			On-going implementation
			3. Simulator Training - Simulate real-world scenarios to enhance practical skills; Develop targeted training programs close to needs assessments to ensure high-level performance and consistent operations.	Training & Development Officer	Annually	P100,000.00	On-Going Implementation
PCM 11	Pressure Management and Installation of DMAs Rehabilitation of old and deteriorated Asbestos and GI Pipes.	Ingress of pathogens and soil during a main break and repair	1. DMA Formation and Pressure Management Techniques - Divide the distribution network into smaller zones to enable pressure management and facilitate leak detection and control; Install pressure reducing valves strategically within the network to reduce pipe stress and leakage.	Production Maintenance Division Manager	December 2023	P3,000,000.00	Completed

			2. Rehabilitation methods of AC and GI pipes - Applying a protective layer inside the existing pipe to restore structural integrity and prevent corrosion; Pipe bursting the old pipe; Grouting or filling voids and sealing leaks in the pipes.				
PCM 12	Pressure Management - Valving and Installation of Data Loggers	Low system pressure if one water supply source is out of service(power supply)	Installation of pressure and flow data loggers - Deploy at import and export points at each identified DMA. Critical points within a DMA are equipped with pressure loggers.	Production and Maintenance Division Manager	Within 2024	Extracted from P3M approved budget of Distribution Lines Improvement	For preparation of program of works
PCM 13	Revision of standard procedures for commissioning new mains, including hydro testing, disinfection and flushing. Inspection of materials before installation.	Inadequate disinfection or flushing before commissioning of new mains may result in contamination	1. Hydrostatic testing 2. Disinfection plan - Before the construction begins, the disinfection plan should be done (including the application of disinfection material, location of the injection points, flushing points, order of sampling, procedure for final connections) 3. Material inspection - Inspect all materials before installation to ensure they meet quality standards and are suitable for the intended use. 4. Flushing - Thoroughly flush the new main before testing and disinfection.	Production and Maintenance Division Manager	Within 2024	Extracted from P3M approved budget of Distribution Lines Improvement	For preparation of program of works

PCM 14	Rehabilitation of aging pipe lines in distribution network	Leakages within the distribution network	1. Upgrade Leak detection instrument at the distribution network. 2. Rehabilitation strategies - Leaking fixing to implement a fixed reduction rate in water losses throughout the entire network and pipe cleaning at a rate of at least 1% of the total network length per year.	Production and Maintenance Division Manager	Within 2024	Overtime pay for leak detection team (to be identified) (From the budget)	Preparation of Program of Works
PCM 15	Coordinate with the concerned agency or company before any execution of works is undertaken.	Contaminants enter through busted pipes accidentally damaged by other agencies	1. Condition Assessment and Inspection - Regularly assess the condition of water distribution pipes. Prioritize inspection in areas where accidental damage is more likely.	Production and Maintenance Team	**December** 2023		Completed
			2. Immediate repair of busted pipes - Collaborate with relevant agencies to expedite repairs. Follow the response protocol for repairing damaged pipes.			P200,000	
			3. Cross-Contamination Prevention - Isolate damaged sections. Monitor pressure to detect sudden drops that may lead to contamination.				

PCM 16	Pump operators must strictly follow the standard operating procedures for sources with filtration system.	Complaints regarding colored water as a result of iron and manganese precipitation	1. Review and update SOPs.	EWRD Division Manager	2023	-	Completed the review and update of the SOPs.
			2. Training - Conduct comprehensive training sessions for pump operators on SOPs. Ensure they understand the procedures thoroughly.	Training & Development Officer		P100,00.00	Completed
			3. Normal Operations - Perform the pre-start checks of the pumps. Continuously monitor pump performance during start-up. Ensure that pump parameters are within specified limits from the SOPs during the operating hours.	Operator-on-duty			On-going implementation

ANNEX L - Monitoring of Control Measures in the Improvement / Upgrade Plan

MONITORING OF CONTROL MEASURES IN THE IMPROVEMENT/UPGRADE PLAN								
Risk Ref	**Process Step: Control Measure**	**Critical limit**	**What**	**Where**	**When**	**How**	**Who**	**Corrective action**
S1	Construction of perimeter fence/gate of catchment areas; Screens at water supply inlet points.	Signs of screen deterioration and damaged/ missing padlock.	Condition of screen and padlocks	Source	Daily	Monitoring by visual inspection	Operator -on-duty	Operator to undertake immediately: • If limit breached: Inform EWRD Division Manager to endorse the repair/ replacement of defective screen and padlocks to the maintenance team.
S2	Fencing of catchment and pumping stations; facility inspection.	Visible signs of rust, corrosion, or physical damage; Loose or sagging sections compromise security and aesthetic; Instances of trespassing; Evidence of vandalism.	Condition of fencing materials	Source	Daily	Monitoring by visual inspection	Operator -on-duty	Operator to undertake immediately: • If limit breached: Inform EWRD Division Manager to endorse securing loose parts and reinforce weak areas to the maintenance team.

S3	Flood mitigation or retardation; sediment traps.	Sediment transfer even during small floods.	Condition of flood and sediment traps	Source	Daily	Monitoring by visual inspection	Operator -on-duty	Operator to undertake immediately: • If limit breached: Inform EWRD Division Manager to endorse repair/replace damage components to the maintenance team.
S4	Perimeter fencing/gate; Availability of bins or rubbish collection; customer education and awareness program; signage	Visible signs of rust, corrosion, or physical damage; Evidence of vandalism; Dumped wastes	Condition of fencing materials and waste bins at the source	Source	Daily	Monitoring by visual inspection	Operator -on-duty	Operator to undertake immediately the cleanup and disposal of hazardous materials properly around the area: • If limit breached: Inform EWRD Division Manager to endorse installation of signages discouraging dumping around the facility.
S5	Catchment management plan to control current activity; Community awareness: Coordination with land owners/farmer s and encourage	Changes in water clarity, color or sedimentation, presence of viable precipitates	Water quality	Sampling point	As needed	Water Analysis	Laboratory personnel	Laboratory personnel undertake immediately water quality test to determine the extent of contamination: • If limit breached: Inform GM and EWRD Division Manager to endorse Public Information Officer to advise the affected consumers until return

	them to have fertilizers and pesticides management.							to its normal operations.
S6	Controlled grazing in the catchment; fencing of catchment areas	Visible signs of rust, corrosion, or physical damage; Loose or sagging sections compromise security and aesthetic; Instances of trespassing; Animal manures	Condition of fencing materials	Source	Daily	Monitoring by visual inspection	Operator -on-duty	Operator to undertake immediately: • If limit breached: Inform EWRD Division Manager to endorse installation hardened fencing and Install signages that disallow grazing of animals near the source to the maintenance team.
S7	Standby pumps; regular maintenance of pumps	Provision of at least 1 set spare unit	Chlorinator and feed pump condition	Chlorine Storage Room	Monthly	Inventory	GSD (Storeroom keeper)	Storeroom keeper to undertake immediately: • If limit breached: Inform EWRD Division Manager to request for additional chlorinator to serve as spare unit.

S8/S9	Installation of water treatment facility	Passed SPCWD and PNSDW standards	Water Quality	Source	Once a week/ source	Water Analysis	Laboratory personnel	Laboratory personnel to undertake immediately: • If limit breached: Inform EWRD Division Manager of the test report to follow SOP for troubleshooting from the manual.
S10	Check well design if there is cement grout if present: conduct regular inspection of well casing for integrity if absent: seepage will be addressed at treatment	No objectionable odor	Water supply	Well sources	Once a week/ source	Monitoring by visual inspection	Operator -on-duty	Operator to undertake immediately: • If limit breached: Inform EWRD Division Manager to endorse immediate repair of well casing to the maintenance team
S11	Facility inspection	Visible signs of rust, corrosion, or physical damage; Loose or sagging sections	Condition of water source facility's fencing and	Sources	Daily	Monitoring by visual inspection	Operator -on-duty	Operator to undertake immediately: • If limit breached: Inform EWRD Division

S12	Fenced the catchment area above the spring from animals and humans to prevent contamination.	compromise security and aesthetic; Instances of trespassing; Animal manures	catchment					Manager to endorse repair/replace damage components to the maintenance team.
S13	Fencing of catchment and pumping stations; facility inspection and maintenance							
S14	Adjust treatment as needed	Changes in water clarity, color or sedimentation, presence of visible precipitates	Water quality	Sampling point	Once a week or as needed	Water Analysis	Laboratory personnel	Laboratory personnel to undertake immediately conduct water quality tests to determine the extent of contamination: • If limit breached: Inform EWRD Division Manager of the test report to adjust treatment based on the results.

S15	Controlled grazing in the catchment; fencing of catchment areas	Loose or sagging sections compromise security and aesthetic; Instances of trespassing; Animal manures	Condition of water source facility's fencing and catchment	Sources	Daily	Monitoring by visual inspection	Operator -on-duty	Operator to undertake immediately: • If limit breached: Inform EWRD Division Manager to endorse repair/replace damage components to the maintenance team.
S16	Restrict human activities near the source. Ensure toilets with sewer management and rubbish bins are available.	Instances of trespassing; Evidence of vandalism; Waste materials	Cleanliness of the surroundings	Sources	Daily	Monitoring by visual inspection	Operator -on-duty	Operator to undertake immediately: • If limit breached: Inform EWRD Division Manager to endorse installation of signs that disallow unauthorized person to enter and waste dumping.
S17	Secure fence, lock gates, protect spring and pumps	Signs of screen deterioration and damaged/ missing padlock	Condition of fence and locks	Sources	Daily	Monitoring by visual inspection	Operator -on-duty	Operator to undertake immediately: • If limit breached: Inform EWRD Division Manager to endorse repair/replace damage components to the maintenance team.

S18	Repair of manholes and installation of screen. Regular facility inspection.	Signs of manhole and screen deterioration and damaged.	Condition of manholes and screen for air vent	Source	Once a week/ source	Monitoring by visual inspection	Operator -on-duty	Operator to undertake immediately: • If limit breached: Inform EWRD Division Manager to endorse immediate repair of manholes and screen to the maintenance team.
S19	Facility inspection and repair as the need arises	Signs of screen deterioration and damaged	Condition of catchment	Sources	Daily	Monitoring by visual inspection	Operator -on-duty	Operator to undertake immediately: • If limit breached: Inform EWRD Division Manager to endorse repair/replace damage components to the maintenance team.
S20	Stripping of damage paint and repainting with non-toxic paint	Accumulation of rust	Active elevated tanks	Source	Every 6 months	Monitoring by visual inspection	Operator -on-duty	Operator to undertake immediately: • If limit breached: Inform EWRD Division Manager to advice operator-on-duty to conduct repainting of tanks.

S21	Water tank/ reservoir inspection and interior cleaning and scraping of sediments and practices building up at the tank wall	Accumulation of of sediments and chemical residues inside the inner wall	Water tanks/ reservoir	Source	Monthly	Monitoring by visual inspection	Operator -on-duty	Operator to undertake immediately: • If limit breached: Inform EWRD Division Manager to advise isolation of water tanks/ reservoir until the maintenance is completed
T1	Installation of water treatment facility with filtration system	Colored water, precipitates or unpleasant odor	Water quality	Sampling point	Once a week	Water Analysis	Laboratory personnel	Laboratory personnel to undertake immediately conduct water quality tests to determine the extent of contamination: • If limit breached: Inform EWRD Division Manager of the test report to adjust treatment based on the results.
T2	Regular maintenance and calibration of equipment; Availability of back-up system	Low/High level to no chlorine	Chlorine dosage	Chlorine Fed Pump	Daily	Residual chlorine testing	Operator -on-duty	Operator to undertake immediately: • If limit breached: Inform EWRD Division Manager to advise operator-on-duty to perform troubleshooting procedures

T3	Strictly follow set-point for residual chlorine in all the sources to meet the standard of ≥ 0.5 mg/L but < 1.0 mg/L leaving treatment works; Monitor Residual Chlorine nearest and farthest taps from the source; Trainings for the operator	>0.5 mg/L but <1.0 mg/L	Chlorine dosage	stock solution	Prior to injection	Digital Chlorine analyzer	Operator -on-duty	Operator to undertake immediately: • If limit breached: Inform EWRD Division Manager to advise operator-on-duty to adjust the chlorine dosage.
			Chlorine Residual	Source Sampling Point	3 times /day	Digital Chlorine analyzer	Operator -on-duty	
		0 HPC	Microbiologic al parameters	Source Sampling Point	Once a week	Laboratory Analysis	Laboratory personnel	Laboratory personnel to undertake immediately conduct water quality tests to determine the extent of contamination: • If limit breached: Inform EWRD Division Manager of the test result.
		negative E.coli						
T4	Strictly follow regular cleaning of nozzle/chemic al feed pump; use of back-up chlorinator during periods of maintenance	>0.5 mg/L but <1.0 mg/L	Chlorine Residual	Source Sampling Point	at least 3 times /day	Digital Chlorine analyzer	Operator -on-duty	Operator to undertake immediately: • If limit breached: Inform EWRD Division Manager to advise operator-on-duty to check and clean the nozzle.

T5	Set -point designed to achieve Residual Chlorine standard at consumers' taps; monitor residual Chlorine in nearest and farthest taps.	Low to no chlorine detected	Chlorine Residual	Distribution lines	Daily	Digital Chlorine analyzer	Laboratory personnel	Laboratory personnel to undertake immediately conduct chlorine residual test from the distribution lines: • If limit breached: Inform EWRD Division Manager to inform the operator-on-duty to adjust the chlorine level from the source.
T6	Improve clarification and filtration process. Monitor turbidity.	1 NTU	Turbidity	Source Sampling Point	Once a week	Laboratory Analysis	Laboratory personnel	Laboratory personnel to undertake immediately conduct turbidity test from the source. • If limit breached: Inform EWRD Division Manager to inform the operator to conduct flushing.
T7	Purchase media suited for the design of filtration	Colored water, precipitates or unpleasant odor	Filter Media	Source Sampling Point	Once a week	Laboratory Analysis	Laboratory personnel	Laboratory personnel to undertake immediately conduct water analysis • If limit breached: Inform EWRD Division Manager to inspect the condition of the filter media if needs to replace or regenerate.

T8	Conduct process optimization study on the number of backwash needed	Dirty water; Presence of precipitates	Water quality	Source	Daily	Optimized backwashing	Operator -on-duty	Operator to undertake immediately: • If limit breached: Inform EWRD Division Manager to advise operator-on-duty to the conduct optimized backwashing.
T9	Replacement of defective parts and units	Changes in water quality;Dirty water	Water quality	Source	Daily	Mechanical inspection	Operator -on- duty	Operator to undertake immediately: • If limit breached: Inform EWRD Division Manager to advise operator-on-duty conduct the pre-start up checking of the machines
T10	Performance management/analysis; process controllability; choice and depth of media determined from extensive study	Colored water, precipitates or unpleasant odor	Water quality	Filtration system	Monthly	Monthly Preventive Maintenance	Operator -on- duty	Operator to undertake immediately: • If limit breached: Inform EWRD Division Manager to advise operator-on-duty regularly perform the preventive and basic maintenance of the filtration system.
T11	Regular inspection and replenishment of media							
T12	Proper bed expansion; Media agitation by air							

	or mechanical washers							
T13	Validate treatment process and install improvement/ upgrade plan for the facilities that are validated to be inefficient or no longer functioning; alternative treatment	Passed SPCWD and PNSDW standards	Water quality	Source	Once a week	Laboratory Analysis	Laboratory personnel	Laboratory personnel to undertake immediately conduct water analysis • If limit breached: Inform EWRD Division Manager to advise the operator to isolate the water source until rehabilitation is completed.
T15	Standby power generators	Complaints regarding water interruption	Water supply	Source	During power outage	Actual report of operator-on-duty	EWRD Division Manager	EWRD Division Manager to undertake immediately. • If limit breached: Inform GM and Public Information Officer to advise the concessionaires of water interruption.
T18	Include in purchasing policy and procedure the requirement of proof/certification of purity of the product supplied.	Absence of certificate of analysis	Chemical supply	Procurement	During bidding	Review on technical specifications	BAC-TWG/ End User	BAC-TWG/ End user to undertake immediately. • If limit breached: Inform the procurement to look for another supplier.

T19	Maintain sufficient chemical stock	50% of requirement for 3 months	Chemical supply	Stock room	Monthly	Inventory	GSD	GSD (Storeroom keeper) to undertake immediately. • If limit breached: Inform the EWRD Division Manager to purchase request.
T20	Ensure that treatment source operators are trained and meet established competency standards; use of skilled and trained operators	Ineffective performance of the system	Water supply	Source	Daily	Conduct audit of operators to assess their knowledge of operation	EWRD Division Manager	EWRD Division Manager to undertake immediately. • If limit breached: Inform the EWRD Division Manager to request seminars/ Webinars and workshops for the operators.
T21	Secured fence, locked premises; Regular inspection	Loose or sagging sections compromise security and aesthetic; Instances of trespassing;	Condition of water source facility's fencing and catchment	Sources	Daily	Monitoring by visual inspection	Operator -on-duty	Operator to undertake immediately: • If limit breached: Inform EWRD Division Manager to advise maintenance team for repair/replace damage components.

D1	Inspection covers remain in place; Maintain residual chlorine within the tank; Regular cleaning , inspection and maintenance of storage tanks.	Dirty water; Presence of precipitates.	Condition of water tanks	Storage tanks	Monthly	Monitoring by visual inspection	Operator -on-duty	Operator to undertake immediately: • If limit breached: Inform EWRD Division Manager to advise maintenance team to perform the schedule of cleaning regularly.
D2	Adequate mixing of storages, monitoring of residual chlorine.	High/Low residual chlorine level	Chlorine Residual	Stored water	Daily	Digital Chlorine analyzer	Operator -on-duty	Operator to undertake immediately: • If limit breached: Inform EWRD Division Manager to advise operator- on-duty to fill in the storage tanks with enough level of water to maintain the consistency of chlorine residual level and clean the tanks regularly.
D3	Minimize stagnation. Maintain an effective disinfectant residual.							

D4	Monitoring to detect areas of water quality degradation. Periodic flushing of fire hydrants and pipelines	Complaints regarding water quality issues	Water supply	Distribution lines	Monthly/ Upon received of complaints	Laboratory Analysis	Laboratory personnel	Laboratory personnel to undertake immediately conduct water analysis • If limit breached: Inform EWRD Division Manager to advise the Production Division Manager to conduct flushing of fire hydrants and pipelines based on the test result.
D5	Annual tank preventive maintenance program. Flush and clean tanks regularly.	Visible rust, precipitate, dirty water	Storage tanks	Water facility	Monthly	Regular preventive maintenance	Operator -on-duty	Operator to undertake immediately: • If limit breached: Inform EWRD Division Manager to advise the operator to perform the schedule of cleaning.
D6	Inspect regularly and clean when necessary. Maintain an effective chlorine residual							
D7	Inspect regularly and clean when necessary.							

D8	Flushing of water mains in the area affected by the shutdown. Disinfection of water main prior to turning on the supply.	Dirty water	Water quality	Source and Distribution lines	As needed	Flushing	Operator-on-duty and Rehab and Maintenance Team	Operator-on-duty and Rehab and Maintenance Team to undertake immediately: • If limit breached: Inform EWRD Division Manager to advise laboratory personnel to conduct water analysis after flushing.
D9	Minimize dead ends in water pipes. Investigate ways to increase flow through section of the pipe. Regular flushing.	Low pressure; No chlorine	Water supply and water quality	Distribution lines	As needed	Flushing/ Disinfection	Operator-on-duty and Rehab and Maintenance Team	Operator-on-duty and Rehab and Maintenance Team to undertake immediately: • If limit breached: Inform EWRD Division Manager to advise laboratory personnel to conduct water analysis after flushing.
D10	Follow hygiene procedure for repair works in distribution main	Low pressure to no water	Water supply	Distribution lines	As needed	Repair of works	Rehab and Maintenance Team	Rehab and Maintenance Team to undertake immediately: • If limit breached: Inform Production Division Manager to advise the team to follow the SOP for repair works.

D11/ D12	Pressure Management - Valving and Installation of Data Loggers Regular inspection	No downtime	Genset is fully serviceable	Area of low pressure	Service every 500 running hours	Prepare regular preventive maintenance	Production Division Manager	Production Division Manager to undertake immediately: • If limit breached: Inform the Maintenance Team to perform scheduled maintenance
D13	Revision of standard procedures for commissioning new mains, including hydro testing, disinfection and flushing. Inspection of materials before installation.	No repeat complaints	No. of days between flushing and length of disinfection	Area of new mains	During scheduled of commissioning	Laboratory test results	Laboratory personnel	Laboratory personnel to undertake water analysis immediately: • If limit breached: Inform the EWRD Division Manager to advise Production Division Manager of implementation of flushing activities & dosing of chlorine.
D14	Institute a cross-connection program. Install backflow prevention devices.	Detection of backflow	Water supply	Area of cross connection	As scheduled	Backflow testing	Production Division Manager	Production Division Manager to undertake immediately: • If limit breached: Inform the Rehab Team to perform the frequency of backflow testing.
D15	Use only materials approved for use in drinking water.	Bacterial growth	Water quality	Repaired/ Newly install water lines	As installation is scheduled	Laboratory Analysis	Laboratory personnel	Laboratory personnel to undertake water analysis immediately: • If limit breached: Inform the EWRD Division Manager of the test result.

D16	Flush mains before changes in flow and adjust concentrations of chlorine to required level.	suspension of biofilms	Water quality	Main lines	Weekly	Laboratory Analysis	Laboratory personnel	Laboratory personnel to undertake water analysis immediately: • If limit breached: Inform the EWRD Division Manager of the test result.
D17	Leak detection program;Conduct regular leak detection activity	Sign of leaks and deterioration	Pressure monitoring	Area of service interruption	Weekly	Visual inspection/leak detection monitoring	Pipelines, Appurtenances & Maintenance Team	Pipelines, Appurtenances & Maintenance Team to undertake immediately: • If limit breached: Inform the Production Division Manager to advise the team to perform repair /replace of deteriorated pipes.
D18	Standby generator. Inform the public.	Power interruption	Water pressure	Area of service interruption	As power interruption arise	Water pressure teat gauge	Pipelines, Appurtenances & Maintenance Team	Pipelines, Appurtenances & Maintenance Team to undertake immediately: • If limit breached: Inform the Production Division Manager and GM to advise the Public Information Officer to release a public announcement.

D19	Emergency Standard Operating Procedure to ensure quick response	Chemical/oil spill	Pipelines	Area of repair distribution lines	As emergency arise	Visual inspection	Pipelines, Appurtenances & Maintenance Team	Pipelines, Appurtenances & Maintenance Team to undertake immediately: • If limit breached: Inform the Production Division Manager to advise the laboratory to conduct water analysis to determine for any chemical contamination.
D20	Replacement with quality materials and flushing to prevent contaminants to multiply.	Dirty water	Water quality	Damage pipelines	As emergency arise	Water Analysis	Laboratory personnel	Laboratory personnel to undertake water analysis immediately: • If limit breached: Inform the EWRD Division Manager of the test result.
D21	Ensure that potential accessible components of distribution systems are kept secured and are locked.	Loose or sagging sections compromise security and aesthetic; Instances of trespassing; Animal manures	Condition of catchment's facility	Water Source facility	Daily	Visual Inspection	Operator-on-duty	Operator-on-duty to undertake immediately: • If limit breached: Inform EWRD Division Manager to maintenance team for repair damaged components.

D22	Assign a technical personnel aware of the exact location of buried pipes to act as guide of excavators./ Coordinate with the concerned agency or company before any execution of works is undertaken.	Sign of leaks and deterioration; Water interruption.	Construction activities	Along pipe network of the District	Weekly	Visual inspection with the contractor's representative	Pipelines, Appurtenances & Maintenance Division	Pipelines, Appurtenances & Maintenance Team to undertake immediately: • If limit breached: Inform the Production Division Manager to the team to implement SOP on repair of damaged pipes.
C1	Pump operators must strictly follow the standard operating procedures for sources with filtration system.	Water quality passed PNSDW standards; No complaints received	Efficiency of the filtration system	Water source	Daily	Regular maintenance	Operator-on-duty	Operator to undertake immediately: • If limit breached: Inform the EWRD Division Manager to advise isolation of the water source until the maintenance is completed.
C2	Site inspections and removal of illegal connection	Complaints regarding backflow of pressure	Water pressure	Distribution lines	Every inspection schedule/ Upon receive of complaint	Visual inspection/ Checking of faulty meters	Meter Inspector	Meter Inspector to undertake immediately: • If limit breached: Inform the Commercial Division Manager to inspector to immediate removal of illegal connections.

C3	Site inspections; all meters have non-return valves	Backflow water	Water supply	Households/ Commercial establishments	Every inspection schedule/ Upon receive of complaint	Visual inspection/ Checking of faulty meters	Meter Inspector	Meter Inspector to undertake immediately: • If limit breached: Inform the Commercial Division Manager to inspector to immediate replace of faulty meters.
C4	Educate consumers and plumbers about safe plumbing materials and installations	Colored water, precipitates or unpleasant odor	Water quality	Households/ Commercial establishments	Upon receipt of complaint	Water analysis/ Public information	Laboratory personnel/ Public information officer	Laboratory personnel to undertake water analysis immediately: • If limit breached: Inform the EWRD Division Manager of the test result to inform the complainant through public information officer.
C5	Education and awareness Regular flushing of fire hydrants in the water system to remove contaminants	Colored water, precipitates or unpleasant odor	Water quality	Households/ Commercial establishments	Upon receipt of complaint	Water analysis/ Public information	Laboratory personnel/ Public information officer	Laboratory personnel to undertake water analysis immediately: • If limit breached: Inform the EWRD Division Manager of the test result to inform the complainant through public information officer.
C6	Education and awareness	Complaints received	Water supply	Area of cross connection	Upon receipt of complaint	Inspection of the area	Meter Inspector	Meter Inspector to undertake immediately: • If limit breached: Inform the Commercial Division Manager to inspector to investigate the complaint.

ANNEX M - Verification Monitoring Programme

Verification Monitoring Programme							
Verification Activity	**Location of Activity**	**Type of Activity**	**Frequency of activity**	**Analyst**	**Recipient of Analysis Result***	**Action on unusual/ failing result**	**3rd-Party Recipient of Results**
Water Quality							
Total Coliform and Fecal Coliform	Sources - Treated Water	Sampling/ Water analysis	Weekly	Medical Technologist	Laboratory Supervisor	Protocol for positive TC/FC results	GM, BOD, LWUA, City Health Office
	Consumer's taps - randomly selected per designed sampling plan						
Heterotrophic Plate Count	Sources - Treated Water	Sampling/ Water analysis	Weekly	Medical Technologist	Laboratory Supervisor	Protocol for High HPC results	GM, BOD, LWUA, City Health Office
	Consumer's taps randomly selected per designed sampling plan		Monthly				
Residual Chlorine	Treated Water - Sources	Sampling/ Water analysis	Daily	Pump/ Source Tenders	Water Resource Management Supervisor/ Laboratory Supervisor	Protocol for high, low and no residual Chlorine	GM, BOD, LWUA, City Health Office
			Weekly	Lab Sampler			
	Consumers Taps		Monthly				
Physical & Chemical Parameters (pH, Color,Turbidity)	Water Sources - Raw and Treated water	Sampling/ Water analysis	Monthly	Chemist	Laboratory Supervisor	Protocol for non-conforming parameters	Water Resources Supervisor and Div Manager
Iron and Manganese Tests	Raw water from sources with Iron and Manganese	Sampling/ Water analysis	Monthly	Chemist	Laboratory Supervisor	Protocol for non-conforming parameters	Water Resources Supervisor and Div Manager
	Treated Water from sources with Filtration		Weekly				
Mandatory Physical and Chemical parameters (PNSDW 2017)	Water sources, Water Treatment Works, Consumer's taps	Sampling	Annually	Outsourced in other laboratories	Laboratory Supervisor	Protocol for non-conforming parameters	GM, LWUA, City Health Office

Verification Activity	Location of Activity	Type of Activity	Frequency of activity	Auditor	Recipient of Audit Result*	Action on areas for improvement	3rd-Party Recipient of Results
Audit of Records							
Verification of equipment calibration	Water Sources	Internal audit	Unscheduled at least twice a year	As appointed by WSP Team	Water Resources Supervisor	Protocol for calibration of the equipment at the source	EWRD WSP Team
Verification of Calibration of Laboratory Instruments and Equipment	SPCWD Laboratory	Calibration of instruments and equipment	Annual	As appointed by WSP Team	Laboratory Section Supervisor	Protocol for calibration of the equipment and instruments in the laboratory	Laboratory Section EWRD WSP Team
Verification of records: Pressure, Water level, Volumetric Flow, Residual Chlorine	Water Sources	Operations Audit	Daily	As appointed by WSP Team	EWRD Division	Standard Operating Procedures for verification of pressure, water level, chlorine residual.	EWRD WSP Team
Verification of records: Pressure, Air release valves, Valves, Hydrants/Blow- offs Maintenance Job order	Distribution System	Operations Audit	Monthly	As appointed by WSP Team	Operations Division	Standard operating procedures for verification of pressure, air release valves, Hydrants/BO maintenance.	Operations Dept WSP Team
Leak Detection	Pipeline Network	Maintenance	3 times a week/ as needed	As appointed by WSP Team	Operations Division	SOP for Leak Detection.	Operations WSP Team
Regulatory compliance	SPCWD Laboratory	External Audit	Every 3 years	DOH assessment team	Laboratory Section Supervisor	Additional laboratory capabilities (Physical/Chemical capabilities)	Laboratory Section WSP Team

Verification Activity	Location of Activity	Type of Activity	Frequency of activity	Analyst	Recipient of Analysis Result*	Action on areas for improvement	3rd-Party Recipient of Results
Customer Satisfaction							
Customer Feedback	Payment/Collection Office; Customer Service	Survey	Annual	Customer Service Officer / Commercial Services Dept.	Customer Service Section	Acknowledge and resolve customer feedback	GM, Concerned Units
Customer Complaints	Customer Service	Social Media	As received	Customer Service Officer	Customer Service Section	Notify concerned Departments	GM, Concerned Units

A. Microbiological Sampling Procedure

Purpose: To provide a documented standard procedure for the collection, handling, storage, and transport of water samples.

Scope: This procedure will cover collection, handling, storage, and transport of water samples to the laboratory.

Timeliness: The entire process from sample collection to obtaining results may take approximately 1 to 3 days. However, expedited processing may be possible for urgent samples or if the laboratory has the capacity to prioritize testing.

Procedures:

To collect a sample from the tap or pump outlet:

1. Use sterilized bottles (clear, glass, 110mL) from the laboratory. The container should be kept unopened and away from contamination until it is required for filling.
2. Select a tap that is supply water from a service pipe directly connected with the main.
3. Remove from the tap any attachments such as filters, aerators, or screens that may cause splashing.
4. Turn on the tap or let at maximum flow rate and let the water flow for 2 to 3 minutes to clean the service lines. If tap cleanliness is questionable, choose another tap.
5. Disinfect the faucet by spraying 70% Isopropyl Alcohol before sampling.
6. Let water run for additional 2 to 3 minutes after treatment. Do not sample from leaking taps that allow water to flow over the outside of the tap.
7. Open the sterilized sampling bottle. Hold the cap with the protective paper cover facing downward to avoid contamination.
8. Fill the bottle, avoid touching the mouth of the bottle to the tap during filling. Fill the bottle up to the shoulder or leave at least 2.5 cm air space to facilitate mixing by shaking prior to analysis.
9. Tightly screw the cap together with the protective paper cover on the bottle. Secure cover with string.
10. Record the date and time of sampling, name of collector, water sampling laboratory code in the record book.

Note: Samples should be placed in a cooler immediately after collection. If using wet ice to maintain temperature, it is best to contain the ice in plastic zipper locking bags so as to not contaminate the sample with the melting ice. For HPC analysis, maintain samples at < 8 ^{o}C. samples exceeding 8 hours from collection to analysis shall be rejected. For Coliform analysis, samples exceeding 24 hours from the time of collection shall be rejected.

B. Physical and Chemical Sampling Procedure

Purpose: To provide a documented standard procedure for the collection, handling, storage, and transport of water samples

Scope: This procedure will cover collection, handling, storage, and transport of water samples to the laboratory

Timeliness: The entire process of collecting, handling, and transporting a water sample can be completed within 10-20 minutes. However, it's important to account for potential variations based on specific situations.

Procedures:

1. Use clean plastic bottle to collect water samples.
   1.1 For specific parameter or analyte, collect at least 500mL water sample.
2. Rinse the container several times with the water to be sampled before taking the sample.
3. Remove all the attachments (like filter and screen) from the sampling point.
4. Record the location and procedure used for each sample taken.
   4.1 From a tap - Take samples as close as possible to the source of supply. Let the water run long enough to flush the system. Fill sample containers slowly with a gentle stream to avoid turbulence and air bubbles.
   4.2 From a well - Let the pump run long enough to draw fresh groundwater into the system. Collect a sample from a tap near the well.
5. When removing cap, do not put cap face down or in pocket. Do not allow inside a cap, inside of container or bottles threads to be touched by any object.
6. Fill the sample bottle to within approximately 1 inch of the bottle top.
7. Screw cap on securely.
8. Label the sampling bottle as to source, date and time of collection.
9. Deliver samples to the laboratory within the same day if possible. If samples cannot reach the laboratory within 6 hours, samples should be placed in cooler immediately after collection. Samples exceeding 24 hours from the time of collection to analysis shall be rejected.

C. Chlorine Solution Preparation

Purpose: The purpose of preparing a chlorine solution is to provide a disinfectant solution that can effectively kill harmful bacteria, viruses, and other pathogens present in water, surfaces, or objects.

Timeliness: 3-5 minutes. Calculating the weight of calcium hypochlorite powder using the provided formula can be done within a few minutes under ideal circumstances.

SOP 1: **How to determine the weight of Calcium Hypochlorite powder required to prepare a chlorine liquid solution**

Training Required:

a. Awareness of safe handling of chlorine

b. Training in this SOPs

Important Safety Note:

a. Ensure gloves, overalls, face shield and dust mask are worn when handling powder chlorine.

b. Ensure the area is well ventilated to prevent build up of fumes.

Calculation for determining the weight of powder required

The following calculation describes how to prepare a chlorine liquid solution from a 70% active chlorine powder:

$$\textbf{Powder Required (g)} = \frac{\text{1000 x Volume of chlorine liquid required(L) x Desired liquid Chlorine concentration(\%)}}{\text{Active chlorine concentration in chlorine powder (\%)}}$$

Volume of chlorine liquid required: 1 L
Desired liquid chlorine concentration: 1%
Active chlorine concentration in the calcium hypochlorite powder: 70%

$$\textbf{Powder Required (g)} = \frac{1000 \quad x\,1\,Lx\;\;1\,\%}{70\;\;\%}$$

Powder Required (g) = 14 g of calcium hypochlorite powder required per 1 L of water

So, for example, if you wish to make a 10 L batch of 1% chlorine liquid solution, you will require 140 g of calcium hypochlorite powder (that is, 10L x 14 g).

This 1% chlorine liquid solution may now be used in determining the **chlorine dose rate**

SOP 2: How to prepare a batch of chlorine liquid from Chlorine powder

Timeliness: 30 minutes: If referring to SOP 1 for calculations or encountering minor difficulties during the process. Important note: This is an estimate, and the actual time may vary depending on the specific circumstances. The 24-hour settling time is not included in the active preparation timeframe.

Procedures:

1) Use SOP1 to determine the weight of chlorine powder required per liter of water.
2) Measure the desired volume of clean water and add to a suitably sized, chlorine resistant, mixing container.
3) Measure the required weight of chlorine powder.
4) Add the chlorine powder to the water slowly.
   - Always add the chlorine powder to the water (never water to the chlorine powder).
5) Use an appropriate mixing tool (for example, a portable mechanical agitator may be used as a power drill with a mixing head) to gently mix the solution until most of the powder has dissolved (minimum of 5 minutes mixing time).
   - Some of the powder will not completely dissolve – this is normal.
6) Once mixed, the solution should be allowed to settle for up to 24 hours before use.
   - This will allow undissolved material to settle to the bottom of the receptacle (this material may block the chlorine dose pump, if not removed);
   - Once settled, carefully transfer the chlorine liquid solution to a clean chlorine resistant container, taking care not to disturb the settled sediment.
7) The liquid chlorine solution is now ready to be used.

Important storage information

To minimize the rate and extent of chlorine decomposition in the chlorine powder and liquid, always:

a) Store in a cool, dry, well ventilated place;
b) Store away from direct sunlight and excessive humidity and temperatures;
c) Store in chlorine resistant containers (for example, light resistant plastic [poly vinyl Chloride; high density polyethylene], glass, cement); and
d) Keep all storage containers fully sealed when not in use.

SOP 3: How to calculate chlorine dose

Timeliness: Calculating the chlorine dose using the formula can be done within a few minutes under ideal circumstances. However, it's important to consider the individual's familiarity and available resources when estimating the actual time needed.

Procedures:

To determine the required chlorine dose rate in milliliters per hour (mL/h), use the following equation:

$$\textbf{Chlorine dose rate mL/h} = \frac{\text{Required chlorine dose (mg/L) x Flow (m}^3\text{/h}}{\text{Chlorine liquid concentration (\%)} \div 100}$$

For example, if our required dose is 2 mg/L, the plant flow rate in this example is 100 m^3/h and the concentration of active chlorine in the chlorine liquid solution is 1%, then:

$$\textbf{Chlorine dose rate mL/h} = \frac{2mg/Lx100m^3/h}{1\% \div 100}$$

= 20,000 mL/h (or approximately 333 mL/minute)

Important notes when adjusting the chlorine dose

a) Always adjust dose in a stepwise fashion, that is, gradual adjustments (little by little)
b) Do not make large adjustments all at once or you risk over/under dosing.
c) Always consider the time taken for newly dosed water to flow through (or turn over) in the tank or pipe before additional adjustments are made.
d) Always increase chlorine monitoring following changes in the chlorine dose to ensure the dose has been optimized and under-or–over-dosing is not occurring.
e) Adjustments to the chlorine dose may be required following the use of a fresh chlorine batch, due to batch variation with regards to the strength of the new chlorine liquid solution.

D. Standard Operating Procedure for Total Coliform Analysis

1.0 Objective

To establish a documented standard procedure for the analysis of drinking water using Multiple Tube Fermentation method .

2.0 Scope

The procedure shall be limited only to the analysis of total coliform bacteria in water using a conventional microbiological method, known as Multiple Tube Fermentation method.

3.0 Timeliness:

Taking into account the minimum incubation times, the entire Total Coliform Analysis can take at least 3-5 days to complete. However, depending on specific protocols, additional confirmation tests, and unforeseen delays, the actual time can be longer.

4.0 Definition Of Terms

4.1 Lauryl Sulphate Broth (Lauryl Tryptose Broth) - is used for the detection of coliform bacteria in water. It can also be used for the presumptive detection of coliform bacteria in water,effluent or sewage.

4.2 Brilliant Green Bile Broth 2% - is widely used medium for the detection of coliform bacteria in water and waste water. It is also recommended for the presumptive detection and confirmation of coliform bacteria in water,effluent or sewage.

4.3 Total Coliform - members of the facultative anaerobic, gram-negative, nonspore-forming, rod-shaped bacteria that ferment lactose which results to gas formation within 48 hours at 35˚C.

5.0 Reference Documents

5.1 Standard Method for Examination of Water and Waste water 2017

5.2 Philippine National Standard for Drinking Water 2017

6.0 Responsibility And Authority

6.1 The Laboratory Section shall be responsible for the following:

6.1.1 Responsible in preparation of culture media

6.1.2 Ensure quality standard and safety throughout the procedure.

6.1.3 Check the reliability of results and shall see to it that the procedures carried out are within the scope and within quality standards.

7.0 Equipment, Supplies And Materials

7.1 Equipment:

7.1.1 Top Loading Balance
7.1.2 pH Meter
7.1.3 Autoclave
7.1.4 Biological Safety Cabinet
7.1.5 Incubator set at 35˚C
7.1.6 Water bath set at 44.5˚C

7.2 Materials/Supplies

7.2.1 Lauryl Sulfate Broth
7.2.2 Brilliant Green Lactose Broth 2%
7.2.3 Pipetor
7.2.4 Test tubes
7.2.5 Durham Tubes
7.2.6 Control Cultures

8.0 Media Preparation

8.1 **Lauryl Sulfate Broth**

8.1.1 Switch ON top loading balance.

8.1.2 Weigh beaker and record weight.

8.1.3 Add weight of beaker and desired weight of media or press “TARE” button on the balance.

8.1.4 Weigh media up to 71.2 grams (for double strength) or 106.8 grams (for triple strength).

8.1.5 Remove the beaker.

8.1.6 Dissolve 1000 mL of distilled water. Mix the media with a stirring rod. Heat to dissolve completely using a magnetic stirrer with a hotplate until a complete solution is obtained.

8.1.7 Place Durham tubes in an inverted position in test tubes.

8.1.8 Dispense 10 mL each into test tubes.

8.1.9 Cover tubes with test tube caps and place in a wire basket and cover with brown paper.

8.1.10 Place sterility tape on the brown paper.

8.1.11 Sterilized for 121 ˚C, 15 minutes at 15 lbs. Pressure.

8.1.12 Cool down the autoclave.

8.1.13 Remove the wire basket and cool at room temperature.

8.1.14 Get the final pH of the finished media and record. pH= 6.8± 0.2.

8.1.15 Store media in dry and ambient temperature.

Table 25. Preparation of Lauryl Sulfate Broth - Total Coliform Analysis

Inoculum (mL)	Amount of Medium in Tube (mL)	Volume of Medium + Inoculum (mL)	Dehydrated LSB required (g/L)
1	10 or more	11 or more	35.6
10	10	20	71.2
10	20	30	53.4
20	10	30	106.8
100	50	150	106.8
100	35	135	137.1
100	20	120	213.6

Triple Strength Double Strength

8.2 **Brilliant Green Lactose Broth 2%**

8.2.1 Switch ON top loading balance.

8.2.2 Weigh beaker and record weight.

8.2.3 Add weight of beaker and desired weight of media or press “TARE” button on the balance.

8.2.4 Weigh media up to 40.0 grams.

8.2.5 Remove the beaker.

8.2.6 Dissolve 1000mL of distilled water. Mix the media with a stirring rod. Heat to dissolve completely using a magnetic stirrer with a hotplate until a complete solution is obtained.

8.2.7 Place Durham tubes in an inverted position in test tubes.

8.2.8 Dispense 10 mL each into test tubes.

8.2.9 Cover tubes with test tube caps and place in a wire basket and cover with brown paper.

8.2.10 Place sterility tape on the brown paper.

8.2.11 Sterilized for 121 ˚C, 15 minutes at 15 lbs. Pressure.

8.2.12 Cool down the autoclave.

8.2.13 Remove the wire basket and cool at room temperature.

8.2.14 Get the final pH of the finished media and record. pH= 6.8± 0.2.

8.2.15 Store media in dry and ambient temperature.

9.0 Sterility Test

9.1 1-2 % per batch of prepared culture media is used for sterility test.

9.2 Culture media is incubated at 35˚C within 24 to 48 hours.

9.3 Observe for any bacterial growth on the media.

9.4 Presence of bacterial growth indicated that the culture media is non-sterile.

10.0 Productivity Test

10.1 1-2 % per batch of prepared culture media is used for productivity test.

10.2 Aseptically pipette out 10 mL of the distilled water into each sterilized culture media.

10.3 Culture media is incubated at 35˚C within 24 to 48 hours.

10.4 Observe for any bacterial growth on the media.

10.5 Presence of bacterial growth indicated that the culture media is non-sterile.

11.0 Procedure Details

11.1 Shake the water sample in the bottle vigorously prior to inoculation of the test medium to allow dispersion of bacteria all throughout the sample.

11.2 Aseptically pipette out 10 mL of the sample into each sterilized test tubes containing 10 mL of double strength concentration of Lauryl Sulfate Broth (LSB) with inverted Durham tubes or Aseptically pipette out 20 mL of the sample into each sterilized test tubes containing 10 mL of triple strength concentration of LSB with inverted Durham tubes.

11.3 Shake the tubes gently after inoculation to disperse the sample uniformly throughout the medium.

11.4 Incubate the seeded media at 35˚C for 24-48 hours.

11.5 After incubation at 24 hours and 48 hours, observe and note the number of tubes that show acid production (change in color/ turbidity) and gas effervescence (a bubble formation inside the Durham tube). Tubes with noted acid and gas production are considered "presumptive positive" growths of coliforms. Cultures not exhibiting production of both acid and gas after 48 hours are considered negative for coliform bacteria.

11.6 Record all the number of positive tubes observed after both the 24 h and 48 h incubation periods.

11.7 Transfer the growth from each positive presumptive tube into tubes containing BGB broth using a sterile wooden applicator.

11.8 Disinfect used applicator sticks using chlorine solution prior to disposal.

11.9 Place the inoculated BGB tubes in the incubator set at 35 ± 0.5˚C for 24 ± 2 hours.

11.10 Record all the number of positive tubes observed after the 24 hour period.

11.11 Calculate the Most Probable Number (MPN) value based on the number of positive BGB tubes showing evidence of formation of gas inside the inverted Durham tubes. Failure to produce gas bubbles indicates a negative result. Use the MPN Index Table in calculating the MPN value.

Table 26. MPN Table for Triple Strength - Total Coliform Analysis

No. of tubes giving Positive Reaction out of 5 (20 mL each)	MPN Index/100 mL	95 % Confidence Limit	
		Lower	Upper
0	<1.1	---	3.5
1	1.1	0.051	5.4
2	2.6	0.40	8.4
3	4.6	1.0	13
4	8.0	2.1	23
5	>8.0	3.4	---

Table 27. MPN Table for Double Strength - Total Coliform Analysis

No. of tubes giving Positive Reaction out of 10 (10 mL each)	MPN Index/100 mL	95 % Confidence Limit	
		Lower	Upper
0	<1.1	---	3.0
1	1.1	0.03	5.9
2	2.2	0.26	8.1
3	3.6	0.69	10.6
4	5.1	1.3	13.4
5	6.9	2.1	16.8
6	9.2	3.1	21.1
7	12.0	4.3	27.1
8	16.1	5.9	36.8
9	23.0	8.1	59.5
10	>23.0	13.5	Infinite

12.0 Method Verification

12.1 To confirm that the media and laboratory procedures and equipment procedure appropriate responses. Analyze at least one positive source sample, for samples with a history of heavy growth without gas in presumptive-phase tubes, carry the tubes through the confirmed phase to check for false negative responses for coliform bacteria.

13.0 Quality Control

13.1 With sterile 10 mL pipette, inoculate 20 mL of positive control (E. aerogenes), negative control (S. aureus) and blank control each into a tube of Lauryl Sulfate Broth or Brilliant Green Lactose Broth.

13.2 Shake gently to distribute the sample uniformly throughout the medium.

13.3 Incubate the tubes at 35.0 ± 0.5˚C for 24 to 48 hours.

13.4 After incubation of 24 hours examine and note each tube for the presence of gas. If present, gas can be seen in the durham tube.

13.5 If no gas has developed, re-incubate tubes for further 24-hour period.

13.6 Log results in raw data sheet and quality control log book.

14.0 Reports

Table 28. Total Coliform Analysis Report Types

Reports	Frequency	Responsible
Water Quality Monitoring Report	Weekly	Analyst
Microbiological Analysis of Special Project	As per request	Analyst
Microbiological Analysis of Water Sample	As per request	Analyst

15.0 Performance Indicators

15.1 Results of analysis shall meet the PNSDW

E. Standard Operating Procedure for Heterotrophic Plate Count Analysis

1.0 Objective

To establish a documented standard procedure for the analysis of drinking water using pour plate method .

2.0 Scope

The procedure shall be limited only to the analysis of heterotrophic plate counts in water using conventional microbiological method, known as Pour Plate method.

3.0 Timeliness

The entire process of conducting HPC analysis using the pour plate method, from sample collection to reporting, can take approximately 2 to 4 days, depending on the specific circumstances and workload.

4.0 Definition Of Terms

4.1 Heterotrophic Plate Count - provides the estimated number of viable microorganisms in the water sample and used to indicate general biological condition of drinking water as a consequence of insufficient treatment process.

4.2 Heterotrophic Bacteria - a broad group of bacteria that includes pathogens, non pathogens and opportunistic bacteria.

4.3 Plate Count Agar (Standard Methods Agar) - recommended for the determination of plate counts of microorganisms in food, water, waste water and also from clinical samples.

5.0 Reference Documents

5.1 Standard Method for Examination of Water and Waste water 2017

5.2 Philippine National Standard for Drinking Water 2017

6.0 Responsibility And Authority

6.1 The Laboratory Section shall be responsible for the following:

6.1.1 Responsible for the preparation of culture media.

6.1.2 Ensure quality standard and safety throughout the procedure.

5.1.2 Check the reliability of results and shall see to it that the procedures carried out are within the scope and within quality standards.

7.0 Equipment, supplies and materials

7.1 **Equipment:**

7.1.1 Top Loading Balance
7.1.2 Autoclave
7.1.3 Biological Safety Cabinet
7.1.4 Incubator set at 35˚C
7.1.5 Water bath set at 44.5˚C
7.1.6 Colony Counter

7.2 **Materials/Supplies**

7.2.1 Plate Count Agar
7.2.2 Sterile Petri dish
7.2.3 Pipetor
7.2.4 Control Cultures

8.0 Media Preparation

8.1 Switch ON top loading balance.

8.2 Weigh beaker and record weight.

8.3 Add weight of beaker and desired weight of media or press “TARE” button on the balance.

8.4 Weigh media up to 11.75 grams.

8.5 Remove the beaker.

8.6 Dissolve 500mL of distilled water. Mix the media with a stirring rod. Heat to dissolve completely using a magnetic stirrer with a hotplate until a complete solution is obtained.

8.7 Dispense 10mL each into test tubes.

8.8 Cover tubes with test tube caps and place in a wire basket and cover with brown paper.

8.9 Place sterility tape on the brown paper.

8.10 Sterilized for 15 minutes at 15 lbs. Pressure.

8.11 Cool down the autoclave.

8.12 Remove the wire basket and cool at room temperature.

8.13 Get the final pH of the finished media and record. pH= 7.0± 0.2.

8.14 Store media in dry and ambient temperature.

9.0 Sterility Test

9.1 1-2 % per batch of prepared culture media is used for sterility test.

9.2 Check sterility of medium and dilution water blanks by pouring control plates for each series.

9.3 Prepare additional controls to determine contamination of plates, pipets and room air.

9.4 Culture media is incubated at 35˚C within 24 to 48 hours.

9.5 Observe for any bacterial growth on the media.

9.6 Presence of bacterial growth indicated that the culture media is non-sterile.

10.0 Procedure Details

10.1 Disinfect working area with 70% Isopropyl alcohol.

10.2 Mark each sterile petri dish with the sample number and prepare at least a duplicate plate for each sample.

10.3 Maintain the melted PCA in a water bath tempered to 45 - 50˚C until ready to pour into the sterile plates.

10.4 Mix each sample bottle by rapidly making about 25 complete up-and-down or back-and-forth movements.

10.5 Aseptically transfer 1 mL of water sample into the sterile petri dish in duplicate.

10.6 Pour approximately 15 mL of tempered molten PCA into the plates. Avoid pouring the molten medium directly onto the inoculum and avoid spilling the medium on the outside of the petri dish or on the inside of the plate lid when pouring.

10.7 Swirl plates gently in rotating motion five times (clockwise and counterclockwise evenly), then allow agar to solidify within 10 minutes on a level surface.

10.8 Incubate the plates in an upside down position at 35˚C for 48 hours.

10.9 Count the colonies in each plate after the incubation period. If counting has to be delayed, refrigerate the plates at 5˚C, but count the plates at least within 24 hours. Count the number of distinct colonies on the agar surface and within the agar itself. Consider plates having 30 to 300 colonies in determining the plate count.

10.10 Compute the Colony Forming Units per mL of sample (CFU/mL) using the formula:

$$\frac{CFU}{mL} = \frac{Average\ No.of\ Colonies \times Dilution\ Factor}{Volume\ Plated\ or\ Aliquot}$$

10.11 Record all sample results as well as results of sterility controls for each test run.

11.0 Interpretation And Reporting

11.1 Results are obtained by averaging the number of colonies on all plates from the same undiluted or diluted sample volume and multiplying by a dilution.

11.2 Results should be rounded off to two significant digits to avoid creating false precision.

11.3 For 3-digit results, raise the middle digit if the last digit is 5 or greater. Retain the middle digit if the last digit is 4 or smaller. The last digit will be zero. For example, 143 will become 140; 255 will become 260. Two digit numbers require no rounding off.

11.4 Spreaders are colonies of bacteria that grow in such a way that they appear to be "spread" across the plate.

11.5 If spreaders are encountered on the plates selected, count colonies on representative portions only when the colonies are well-distributed in spreader-free areas, and the area covered by the spreaders does not exceed ½ of the plate area.

11.6 If plates have excessive spreader growth, report as "spreaders".

11.7 When plates are uncountable because of missed dilution or accidental dropping, or contamination, or the control plates indicate that the medium or other material or lab ware was contaminated, report it as "laboratory accident".

11.8 If plates from all dilutions of any sample have no colonies present, report the count as "< 1 CFU/ mL". If there are more than 300 colonies present, compute using the following situation and report as "Estimated CFU/mL)":

11.8.1 If there are fewer than 10 colonies/cm^2; count colonies in 13 squares of the colony counter that represent colony distribution. Select 7 consecutive squares across the plate (horizontally) and 6 vertical consecutive squares. Multiply the sum of the numbers of colonies in the 13 selected square centimeters by 5 to compute the estimated colonies per plate if the plate area is 65 cm^2.

11.8.2 If there are more than 10 colonies/cm^2; count 4 representative squares, take the average count/cm^2 then multiply by the appropriate factor, 57 for disposable plastic plates and 65 for glass plates, to compute for the estimated colonies per plate.

11.8.3 If counts on crowded plates exceeded 100 colonies/cm^2; report results as greater than 6500 (>6500) divided by the smallest sample volume plated for glass plates or >5700 divided by the smallest sample volume plated for plastic plates. Report as "Estimated CFU/mL"

12.0 Reports

Table 29. Heterotrophic Plate Count Analysis Report Types

Reports	Frequency	Responsible
Water Quality Monitoring Report	Weekly	Analyst
Microbiological Analysis of Water Sample	As per request	Analyst

13.0 Performance Indicators

13.1 Results of analysis shall meet the PNSDW

F. Standard Operating Procedure for Fecal Coliform Analysis

1.0 Objective

To establish a documented standard procedure for the analysis of drinking water using Multiple Tube Fermentation method .

2.0 Scope

The procedure shall be limited only to the analysis of fecal coliform bacteria in water using a conventional microbiological method, known as Multiple Tube Fermentation method.

3.0 Timeliness

The entire process of conducting Fecal Coliform Analysis using the Multiple Tube Fermentation method, from sample collection to reporting, can take approximately 2 to 4 days, depending on the specific circumstances and workload.

4.0 Definition Of Terms

4.1 Lauryl Sulphate Broth (Lauryl Tryptose Broth) - is used for the detection of coliform bacteria in water. It can also be used for the presumptive detection of coliform bacteria in water,effluent or sewage.

4.2 EC medium - is a widely used medium for the detection of coliform bacteria in water and wastewater. It is also recommended for the selective enumeration of presumptive *Escherichia coli* by MPN technique from water samples.

4.3 Fecal Coliform - bacteria belong to the group of total Coliform but are differentiated through laboratory examinations using an elevated temperature of 44.5˚C.

5.0 Reference Documents

5.1 Standard Method for Examination of Water and Waste water 2017

5.2 Philippine National Standard for Drinking Water 2017

6.0 Responsibility And Authority

6.1 The Laboratory Section shall be responsible for the following:

6.1.1 Responsible for the preparation of culture media.

6.1.2 Ensure quality standard and safety throughout the procedure.

6.1.3 Check the reliability of results and shall see to it that the procedures carried out are within the scope and within quality standards.

7.0 Equipment, Supplies And Materials

7.1 Equipment:

7.1.1 Top Loading Balance
7.1.2 pH Meter
7.1.3 Autoclave
7.1.4 Biological Safety Cabinet
7.1.5 Incubator set at 35˚C
7.1.6 Water bath set at 44.5˚C

7.2 Materials/Supplies

7.2.1 Lauryl Sulfate Broth
7.2.2 EC Medium
7.2.3 Pipetor
7.2.4 Test tubes
7.2.5 Durham Tubes
7.2.6 Control Cultures

8.0 Media Preparation

8.1 Lauryl Sulfate Broth

8.1.1 Switch ON top loading balance.

8.1.2 Weigh beaker and record weight.

8.1.3 Add weight of beaker and desired weight of media or press “TARE” button on the balance.

8.1.4 Weigh media up to 71.2 grams (for double strength) or 106.8 grams (for triple strength).

8.1.5 Remove the beaker.

8.1.6 Dissolve 1000 mL of distilled water. Mix the media with stirring a rod. Heat to dissolve completely using a magnetic stirrer with a hotplate until a complete solution is obtained.

8.1.7 Place Durham tubes in an inverted position in test tubes.

8.1.8 Dispense 10 mL each into test tubes.

8.1.9 Cover tubes with test tube caps and place in a wire basket and cover with brown paper.

8.1.10 Place sterility tape on the brown paper.

8.1.11 Sterilized for 121 ˚C 15 minutes at 15 lbs. Pressure.

8.1.12 Cool down the autoclave.

8.1.13 Remove the wire basket and cool at room temperature.

8.1.14 Get the final pH of the finished media and record. pH= 6.8± 0.2.

8.1.15 Store media in dry and ambient temperature.

Table 30. Preparation of Lauryl Sulfate Broth - Fecal Coliform Analysis

Inoculum (mL)	Amount of Medium in Tube (mL)	Volume of Medium + Inoculum (mL)	Dehydrated LSB required (g/L)
1	10 or more	11 or more	35.6
10	10	20	71.2
10	20	30	53.4
20	10	30	106.8
100	50	150	106.8
100	35	135	137.1
100	20	120	213.6

Triple Strength   Double Strength

8.2 EC Broth

8.2.1 Switch ON top loading balance.

8.2.2 Weigh beaker and record weight.

8.2.3 Add weight of beaker and desired weight of media or press "TARE" button on the balance.

8.2.4 Weigh media up to 37.0 grams.

8.2.5 Remove the beaker.

8.2.6 Dissolve 1000mL of distilled water. Mix the media with a stirring rod. Heat to dissolve completely using a magnetic stirrer with a hotplate until a complete solution is obtained.

8.2.7 Place Durham tubes in an inverted position in test tubes.

8.2.8 Dispense 10 mL each into test tubes.

8.2.9 Cover tubes with test tube caps and place in a wire basket and cover with brown paper.

8.2.10 Place sterility tape on the brown paper.

8.2.11 Sterilized for 121 ˚C, 15 minutes at 15 lbs. Pressure.

8.2.12 Cool down the autoclave.

8.2.13 Remove the wire basket and cool at room temperature.

8.2.14 Get the final pH of the finished media and record. pH= 6.9± 0.2.

8.2.15 Store media in dry and ambient temperature.

9.0 Sterility Test

9.1 1-2 % per batch of prepared culture media is used for sterility test.

9.2 Culture media is incubated at 35˚C within 24 to 48 hours.

9.3 Observe for any bacterial growth on the media.

9.4 Presence of bacterial growth indicated that the culture media is non-sterile.

10.0 Productivity Test

10.1 1-2 % per batch of prepared culture media is used for productivity test.
10.2 Aseptically pipette out 10 mL of the distilled water into each sterilized culture media.
10.3 Culture media is incubated at 35˚C within 24 to 48 hours.
10.4 Observe for any bacterial growth on the media.
10.5 Presence of bacterial growth indicated that the culture media is non-sterile.

11.0 Procedure Details

11.1 Shake the water sample in the bottle vigorously prior to inoculation of the test medium to allow dispersion of bacteria all throughout the sample.

11.2 Aseptically pipette out 10 mL of the sample into each sterilized test tubes containing 10 mL of double strength concentration of Lauryl Sulfate Broth (LSB) with inverted Durham tubes or Aseptically pipette out 20 mL of the sample into each sterilized test tubes containing 10 mL of triple strength concentration of LSB with inverted Durham tubes.

11.3 Shake the tubes gently after inoculation to disperse the sample uniformly throughout the medium.

11.4 Incubate the seeded media at 35˚C for 24-48 hours.

11.5 After incubation at 24 hours and 48 hours, observe and note the number of tubes that show acid production (change in color/ turbidity) and gas effervescence (a bubble formation inside the Durham tube). Tubes with noted acid and gas production are considered “presumptive positive” growths of coliforms. Cultures not exhibiting production of both acid and gas after 48 hours are considered negative for coliform bacteria.

11.6 Record all the number of positive tubes observed after both the 24 h and 48 h incubation periods.

11.7 Transfer the growth from each positive presumptive tube into tubes containing EC broth using a sterile wooden applicator.

11.8 Disinfect used applicator sticks using chlorine solution prior to disposal.

11.9 Place the inoculated EC tubes in a water bath set at 44.5 ± 0.2˚C for 24 ± 2 hours.

11.10 Record all the number of positive tubes observed after the 24 hour period.

11.11 Calculate the Most Probable Number (MPN) value based on the number of positive EC tubes showing evidence of formation of gas inside the inverted Durham tubes. Failure to produce gas bubbles indicates a negative result. Use the MPN Index Table in calculating the MPN value.

Table 31. MPN Table for Triple Strength - Fecal Coliform Analysis

No. of tubes giving Positive Reaction out of 5 (20 mL each)	MPN Index/100 mL	95 % Confidence Limit	
		Lower	Upper
0	<1.1	---	3.5
1	1.1	0.051	5.4
2	2.6	0.40	8.4
3	4.6	1.0	13
4	8.0	2.1	23
5	>8.0	3.4	---

Table 32. MPN Table for Double Strength - Fecal Coliform Analysis

No. of tubes giving Positive Reaction out of 10 (10 mL each)	MPN Index/100 mL	95 % Confidence Limit	
		Lower	Upper
0	<1.1	---	3.0
1	1.1	0.03	5.9
2	2.2	0.26	8.1
3	3.6	0.69	10.6
4	5.1	1.3	13.4
5	6.9	2.1	16.8
6	9.2	3.1	21.1
7	12.0	4.3	27.1
8	16.1	5.9	36.8
9	23.0	8.1	59.5
10	>23.0	13.5	Infinite

12.0 Method Verification

12.1 To confirm that the media and laboratory procedures and equipment procedure appropriate responses. Analyze at least one positive source sample, for samples with a history of heavy growth without gas in presumptive-phase tubes, carry the tubes through the confirmed phase to check for false negative responses for coliform bacteria.

13.0 Quality Control

13.1 With sterile 10 mL pipette, inoculate 20 mL of positive control (E. coli), negative control (S. aureus) and blank control each into a tube of Lauryl Sulfate Broth or EC Broth.

13.2 Shake gently to distribute the sample uniformly throughout the medium.

13.3 Incubate the tubes at 35.0 ± 0.5˚C for 24 to 48 hours.

13.4 After incubation of 24 hours examine and note each tube for the presence of gas. If present gas can be seen in the durham tube.

13.5 If no gas has developed, re-incubate tubes for further 24-hour period.

13.6 Log results in raw data sheet and quality control log book.

14.0 Reports

Table 33. Fecal Coliform Analysis Report Types

Reports	Frequency	Responsible
Water Quality Monitoring Report	Weekly	Analyst
Microbiological Analysis of Special Project	As per request	Analyst
Microbiological Analysis of Water Sample	As per request	Analyst

15.0 Performance Indicators

15.1 Results of analysis shall meet the PNSDW 2017

G. SOP for Test Method for Enzyme Substrate Test (Presence-Absence)

1.0 Objective

To establish a documented standard procedure for the analysis of drinking water using Enzyme Substrate Coliform Test.

2.0 Scope

This procedure will cover the analysis of water sample/s up to interpretation

3.0 Timeliness

The entire process of conducting the Enzyme Substrate Test (Presence-Absence), from sample collection to result interpretation and reporting, can take approximately 2 to 3 days, depending on the specific circumstances and workload.

4.0 Definition Of Terms

4.1 Enzyme Substrate Test – utilizes hydrolyzable substrates for the simultaneous detection of total coliform bacteria and *Escherichia coli* enzyme.

4.2 Philippine National Standard for Drinking Water (PNSDW) - prescribe the standards and procedures on drinking water quality to protect public/consumer's health.

5.0 Reference Documents

5.1 Standard Method for Examination of Water and Wastewater 2017

5.2 Philippine National Standard for Drinking Water 2017

6.0 Responsibility And Authority

6.1 The Laboratory Section shall be responsible for the following:

5.1.1 Ensure quality standard and safety throughout the procedure.

5.1.2 Check the reliability of results and shall see to it that the procedures carried out are within the scope and within quality standards.

7.0 Equipment, Supplies And Materials

7.1 Equipment:

7.1.1 Biological Safety Cabinet

7.1.2 Incubator set at 35˚C

7.1.3 UV Lamp 365 nm

7.2 **Materials/Supplies**

7.2.1 Chromogenic substrate reagent (ONPG & MUG)

7.2.2 Sterile, transparent, non-fluorescent 100mL bottle

7.2.3 Control Cultures

8.0 Procedure Details

8.1 Mix samples thoroughly by mixing 25 completely up and down or back and forth for 7 seconds.

8.2 Separate carefully one Snap Pack from the strip taking care not to accidentally open adjacent packs.

8.3 Tap the Snap Pack to ensure that all the reagent powder is in the bottom part of the pack.

8.4 Aseptically add the substrate reagent into the water sample, cap vessel and mix until reagent is completely dissolved.

8.5 Incubate at 35˚C for 18 hours.

8.6 Read the results after 18 hours. Observe for the color change in the sample. For a sample that turned yellow, view in the UV lamp for fluorescence. Use a comparator for reference.

Table 34. Color Comparator Test Method for Enzyme Results

Color	Result
Less yellow than the comparator	Negative for Total Coliform and *Escherichia coli*
Yellow equal or greater than comparator	Positive for Total Coliform
Yellow and fluorescence equal or greater than comparator	Positive for *Escherichia coli*

9.0 Reports

Table 35. Test Method for Enzyme Substrate Test Report Types

Reports	Frequency	Responsible
Water Quality Monitoring Report	Weekly	Analyst
Microbiological Analysis of Special Project	As per request	Analyst
Microbiological Analysis of Water Sample	As per request	Analyst

10.0 Performance Indicators

10.1 Results of analysis shall meet the PNSDW 2017

H. Standard Operating Procedure for Gram Staining

1.0 Objective

To differentiate between two major categories of bacteria : gram-positive and gram-negative.

2.0 Scope

This procedure is intended as a standard test for identification of gram-positive and gram-negative.

3.0 Timeliness

The entire process of conducting Gram Staining, from sample preparation to result interpretation and reporting, can take approximately 3 to 6 hours, depending on the specific circumstances and workload.

4.0 Definition Of Terms

Gram stain - the most useful and widely employed differential stain in bacteriology.

5.0 Reference Documents

5.1 National Public Health Laboratory

5.2 Manual of Clinical Microbiology, Chapin, KC, Lauderdale, T., ASM Press, 2003, Washington, DC. Chapter: Reagents, Stains and Media.

6.0 Responsibility And Authority

6.1 The Laboratory Section shall be responsible for the following:

6.1.1 Ensure quality standard and safety throughout the procedure.

6.1.2 Check the reliability of results and shall see to it that the procedures carried out are within the scope and within quality standards.

7.0 Precautions

7.1.1 Aseptic technique and standard precaution for handling microbial cultures.

7.1.2 Crystal violet, safranin and iodine can cause irritation to the eyes , respiratory and skin

8.0 Equipment, Supplies, Materials And Reagent

8.1 **Equipment:**

8.1.1 Light microscope
8.1.2 Bacteincenerator/ Alcohol lamp

8.2 **Materials/Supplies**

8.2.1 Glass slides
8.2.2 Squirt bottle
8.2.3 Inoculating loops
8.2.4 Staining rack
8.2.5 Oil immersion
8.2.6 Bacterial cultures including E. coli and S. aureus as controls

8.3 **Reagent**

8.3.1 Crystal Violet
8.3.2 Gram's Iodine
8.3.3 95% ethanol/acetone
8.3.4 Safranin

9.0 Procedure Details

8.1 Prepare heat-fixed smears of cultures provided

9.1.1 With a wax pencil mark the reference number of the bacterial culture in the far left corner a clean glass slide.
9.1.2 Place a drop of water in the center of a clean glass slides
9.1.3 With inoculating loop, aseptically pick up a very small amount of culture and mix into the drop of water.
9.1.4 Spread this of out of 1/2 inch area
9.1.5 Allow the slide to air dry or place on a slide warmer
9.1.6 Pass the slide through a alcohol lamp flame three times to heat-fix the bacteria

9.2 Staining Procedure

9.2.1 Flood dried slide with crystal violet and let stand one minute
9.2.2 Rinse with tap water and drain off excess water
9.2.3 Flood slide with gram's iodine and let stand for one minute
9.2.4 Rinse with tap water and drain off excess water
9.2.5 Decolorize with 95% ethyl alcohol/acetone until most of the crystal violet is removed in thin areas (length of decolorizing time depends on thickness of smear)

9.2.6 Rinse with tap water and drain off excess water

9.2.7 Counterstain with safranin for 10 seconds

9.2.8 Rinse with tap water and drain off excess water

9.2.9 Place on slide warmer until dry or blot gently on paper towel

9.3 Examination

9.3.1 Place a drop of immersion oil on the slide

9.3.2 Examine using oil immersion (100x) objective

9.3.3 Focus using coarse and fine adjustment knobs until objects are in focus

10.0 Results Interpretations And Reporting

10.1 Results Interpretation of results:

Blue organisms – Gram Positive **Red organisms – Gram Negative**

10.2 Reporting of results

10.2.1 Describe organisms by their Gram reaction (Gram Positive - blue, Gram negative – red) and their microscopic morphology and arrangement (e.g. cocci in pairs, chains, clusters; bacilli, small, large, filamentous, yeasts). For example: “Gram positive cocci in chains”

10.2.2 Record the findings

11.0 Limitations

11.1.1 The length of time of the decolorizing step (ethanol/acetate) is critical. Thin smears require less time than thick smears. Too much decolorizing will render everything on the slide red; not enough decolorizing will render everything on the slide blue

11.1.2 Gram positive organisms, especially bacilli, from cultures that are not fresh (>48 hrs.) may not retain the crystal violet and stain red

11.1.3 Some species of bacteria are described as “Gram variable” and may stain blue or red or show both colors.

12.0 Clean Up

12.1 Used staining liquid should be discarded in the liquid waste chemical containers

12.2 Gram smears should be discarded in the autoclave bin

I. Standard Operating Procedure for IMVIC TEST

1.0 Objective

To help determine the identities of certain species of Gram negative bacilli (Enterobacteriaceae)

2.0 Scope

Differentiation of coliforms, i.e. bacteria of the genera Escherichia and Enterobacter, into species and varieties.

3.0 Timeliness

The entire process of differentiating species of Gram-negative bacilli within the Enterobacteriaceae family can take approximately 2 to 5 days, considering the time required for sample preparation, biochemical testing, data analysis, interpretation, and reporting.

4.0 Definition Of Terms

I - Indole
M - methyl red
Vi - Voges- proskauer
C - Citrate

5.0 Responsibility And Authority

5.1 The Laboratory Section shall be responsible for the following:

5.1.1 Ensure quality standard and safety throughout the procedure.

5.1.2 Check the reliability of results and shall see to it that the procedures carried out are within the scope and within quality standards.

6.0 Equipment, Supplies And Material

6.1 Materials

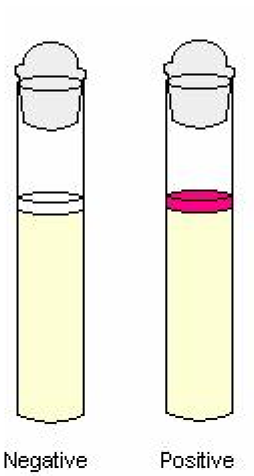
6.1.1 Tryptone broth
6.1.2 MR-VP broth
6.1.3 Simmon's Citrate slants
6.1.4 Empty 13x100 mm test tubes
6.1.5 Kovac's reagent (dropper bottles)
6.1.6 Methyl Red (dropper bottles)
6.1.7 5% alpha-napthol (dropper bottles) -- 5 per class
6.1.8 40% KOH (dropper bottles) -- 5 per class
6.1.9 Plastic droppers or Pasteur pipettes

7.0 Test And Procedure

INDOLE TEST:

Principle: Some bacteria can produce indole from amino acid tryptophan using the enzyme typtophanase

$$\text{Trytophan} \xrightarrow[\text{H}_2\text{O}]{\text{trytophanase}} \text{Indole + pyruvic acid + NH}_3$$



Production of indole is detected using Ehrlich’s reagent or Kovac’s reagent. Indole reacts with the aldehyde in the reagent to give a red color. An alcoholic layer concentrates the red color as a ring at the top

Figure 8. Indole Test

Procedure:

1) Bacterium to be tested is inoculated in peptone water, which contains amino acid tryptophan and incubated overnight at 37oC.Prepare 1% tryptophan broth .
2) Incubate one set of test tube with test organism and maintain one set as negative control without inoculation. Inoculate one set of test tube with E.coli use as positive control.
3) Following incubation few drops of Kovac’s reagent are added. Shake gently.
4) Kovac’s reagent consists of para-dimethyl aminobenzaldehyde 10 gm, isoamyl alcohol 150gm and con. HCl 50 ml
5) Allow the tubes to stand for 2 min. so that the reagent comes to the top and then compare test culture with the control tubes.
6) Ehrlich’s reagent is more sensitive in detecting indole production in anerobes and non-fermenters.

Observation:- Formation of a red or pink coloured ring at the top is taken as positive.

Example: Escherichia coli: Positive; Klebsiella pneumoniae: Negative

METHYL RED (MR) TEST:

Principle: This is to detect the ability of an organism to produce and maintain stable acid end products from glucose fermentation. Some bacteria produce large amounts of acids from glucose fermentation that they overcome the buffering action of the system. Methyl Red is a pH indicator, which remains red in color at a pH of 4.4 or less.

Glucose → Pyruvic acid → Mixed acid fermentation (pH 4.4)
↓
Red color with methyl indicator

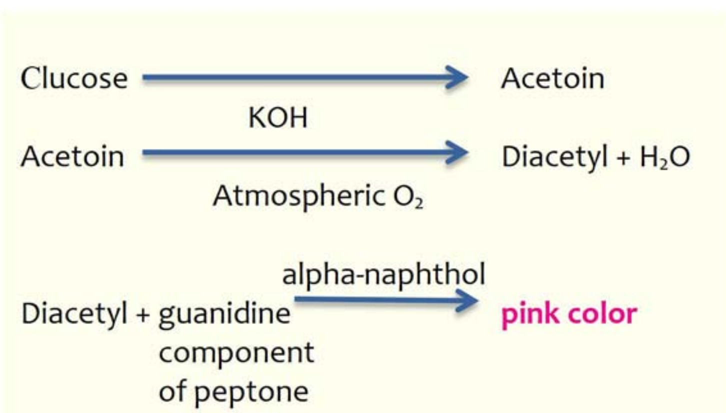
Procedure:

1. The bacterium to be tested in inoculated into glucose phosphate broth, which contains glucose and a phosphate buffer and incubated at 37°C for 48 hours.
2. Over the 48 hours the mixed-acid producing organism must produce sufficient acid to overcome the phosphate buffer and remain acid.
3. The pH of the medium is tested by the addition of 5 drops of MR reagent.
4. Development of red color is taken as positive. MR negative organism produce yellow color.

Example: Eschericihia coli: Positive; Klebsiella pneumoniae: Negative

VOGES PROSKAUER (VP) TEST:

Principle: While MR test is useful in detecting mixed acid producers, VP test detects butylene glycol producers Acetyl-methyl carbinol (acetoin) is an intermediate in the production of butylene glycol. In this test two reagents, 40% KOH and alpha-naphthol are added to test broth after incubation and exposed to atmospheric oxygen. If acetoin is present, it is oxidized in the presence of air and KOH to diacetyl. Diacetyl then reacts with guanidine components of peptone, in the presence of alpha- naphthol to produce red color. Role of alpha-naphthol is that of a catalyst and a color intensifier



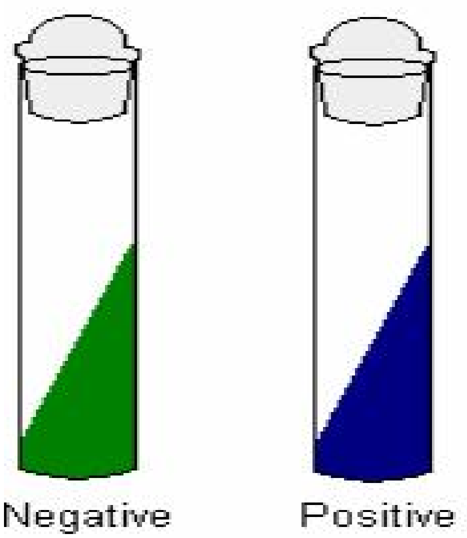
Procedure:

1. Bacterium to be tested is inoculated into glucose phosphate broth and incubated for at least 48 hours.
2. 0.6 ml of alpha-naphthol is added to the test broth and shaken. 0.2 ml of 40% KOH is added to the broth and shaken. The tube is allowed to stand for 15 minutes. Appearance of red color is taken as a positive test.
3. The negative tubes must be held for one hour, since maximum color development occurs within one hour after addition of reagents.

Examples: Escherichia coli: Negative; Klebsiella pneumoniae: Positive

Citrate Utilization Test:

Principle: This test detects the ability of an organism to utilize citrate as the sole source of carbon and energy. Bacteria are inoculated on a medium containing sodium citrate and a pH indicator bromothymol blue. The medium also contains inorganic ammonium salts, which is utilized as sole source of nitrogen.



$$\text{Citrate} \longrightarrow \text{Oxaloacetate} + \text{Acetate}$$

$$\text{Oxaloacetate} \longrightarrow \text{Pyruvate} + CO_2$$

$$CO_2 + Na + H_2O \longrightarrow Na_2CO_3$$

Utilization of citrate involves the enzyme citritase, which breaks down citrate to oxaloacetate and acetate. Oxaloacetate is further broken down to pyruvate and CO_2. Production of Na_2CO_3 as well as NH_3 from utilization of sodium citrate and ammonium salt respectively results in alkaline pH. This results in change of medium's color from green to blue.

Figure 9. Citrate Utilization Test

Procedure:

1. Bacterial colonies are picked up from a straight wire and inoculated into slope of Simmon's citrate agar and incubated overnight at 37 °C.
2. If the organism has the ability to utilize citrate, the medium changes its color from green to blue.

Observation- If colour of the medium change to blue it is citrate Positive E.coli is citrate Positive.

Examples: Escherichia coli: Negative; Klebsiella pneumoniae: Positive

8.0 Reports

Table 36. IMVIC Test Report Types

S. No	Test Name	Positive result	Negative Result
1.	**Indole Test**	color changes pink to red (“cherry-red ring”)	no color change occurs
2.	**Methyl Red test**	a stable red color develops	a yellow color develops
3.	**Voges Proskauer Test**	a pink-red color develops	a yellow color develops
4.	**Citrate Test**	develops blue color from green	No color change

9.0 Performance Indicators

9.1 Results of analysis shall meet the PNSDW 2017

J. Maintenance of Chemical Feed Pumps or Chlorinators

Purpose: The purpose of maintaining chemical feed pumps or chlorinators is to ensure they function reliably and efficiently, preventing unexpected downtime,minimizing repair costs, extending equipment lifespan, and complying with regulatory standards for water treatment to ensure safe and consistent water quality.

Scope: The scope of maintenance for chemical feed pumps or chlorinators includes inspections, cleaning, calibration, parts replacement, testing, and training. Clogging at points where solution flow is restricted is the most frequent problem encountered in using chemical feed pumps. This is due to the presence of insoluble particles. This is commonly encountered if the water is fairly hard or contains iron or manganese.

Responsibility: Pump Operator/Maintenance Team, Technical Services Department

Timeliness: The Daily maintenance typically takes around 15 to 30 minutes per pump, while the more extensive maintenance every six months allows for a thorough inspection and refurbishment of the equipment, may take several hours to complete, depending on the extent of inspection, cleaning, and parts replacement needed .

1) Daily Maintenance Procedure:

a) Unplug chemical feed pumps from electric source before starting maintenance.
b) Flush vital parts of the chemical feed pumps with clear water.
c) Remove strainer, flush and clean it using a stiff, vegetable-fiber brush.
d) Flush out chlorine solution lines with fresh water to prevent residual chlorine buildup.
e) Schedule maintenance during pump rest periods to avoid disruption of the disinfection process.

2) Every Six Months Maintenance Procedure:

a) Install a temporary chemical feed pump as a backup option to the existing disinfection equipment.
b) Perform a thorough inspection of the chlorinator, remove any deposits by brushing and rinsing, and identify any worn or damaged parts that need replacement.
c) Replace any worn or damaged parts to ensure proper function.
d) Lubricate the parts and reassemble the chlorinator.
e) Document the maintenance performed and any issues encountered during the inspection, which can be used to inform future maintenance schedules and identify any recurring issues.

K. Installation of Small Distribution Line

Purpose: Installing small distribution lines is to provide a reliable means of delivering essential utilities such as water to homes, businesses, and facilities. This can connect individual properties to larger distribution networks or distribute resources within a localized area. These lines aim to minimize leakage and pressure drops while maximizing flow rate and operational efficiency, ensuring a consistent supply of resources to customers and improving the safety and reliability of the distribution system.

Scope: Installing small distribution lines involves planning, designing, and constructing pipelines to deliver utilities to homes and businesses. The process includes assessing infrastructure, selecting materials, obtaining permits, and ensuring safety. Excavation and installation of new infrastructure may be required, and coordination with local authorities and property owners is necessary.

Timeliness: The entire process of planning, designing, obtaining permits, and constructing small distribution lines can take several months to complete. It's essential to allocate sufficient time and resources for each phase to ensure the project is completed efficiently and in compliance with regulations and safety standards.

Table 37. Installation of Small Distribution Line Materials, Tools and Equipment

Materials Needed	Tools and Equipment Used:
a) Bolts and Nuts	a) Adjustable Wrench
b) Brass Gate Valve	b) Boring Machine
c) CI Split Tee	c) Chisel
d) Flange Adaptor	d) Compressor with Jack Hammer
e) G.I. Coupling	e) Cutting Machine (concrete road)
f) G.I. Elbow 90°	f) Dewatering Pump
g) G.I. Pipe	g) Digging Bar
h) G.I. Plug	h) Hacksaw Blade
i) G.I. Tee	i) Jack Hammer (Concrete Road)
j) Gate Valve	j) Mallet
k) Gravel 3/4”	k) Pipe Wrench
l) PVC Pipes	l) Portable Compactor
m) Sand S1	m) Service Vehicle
n) Seal Tape (Teflon)	n) Shovel
o) Valve Box Cover	o) Welding Machine

Responsibility: Production Division, Operations Department : (049) 547 - 0593

Procedures:

1) Issue Job Order/Billed Order and secure materials from the General Services Division, ensuring compliance with SPCWD standards.
2) Mobilize tools, equipment, manpower, and signages to the site for safe and efficient work execution.
3) Excavate trench with proper depth, width, and slope to ensure stable and reliable installation of the new pipeline.
4) Install split tee and gate valve according to SPCWD specifications on the body of the pipe.
5) Tap mainline using tapping machine until water flows out and flush out any cuttings.
6) Close gate valve and connect PVC Pipe with flange adaptor, ensuring proper alignment and sealing.
7) Lay PVC Pipe at a minimum depth of 40cm with sand bedding to protect against damage and provide support.
8) Backfill the area with new materials, compacting each layer for stable support and dispose of excavated materials properly.
9) Install Fire hydrant/BOV at the end of the distribution line, ensuring proper location and orientation.
10) Open gate valve at the mainline and fire hydrant/BOV and flush water until clear.
11) Inject powder chlorine at the fire hydrant/BOV for disinfection and comply with SPCWD standards.
12) Install concrete pad at the base of fire hydrant and valve box cover for protection and stability.
13) Paint newly installed fire hydrant/BOV with SPCWD-approved colors for easy identification.
14) Restore the concrete pavement affected during excavation to its original condition, complying with SPCWD standards.

L. Installation of New Service Connection Tap at Distribution Line

Purpose: The installation of a new service connection tap at a distribution line is to provide a reliable and efficient means of connecting individual properties or buildings to a larger network of essential utilities, such as water. This involves tapping into the existing distribution line, installing a new service connection tap, and connecting the service line to the property or building.

Scope: Involves identifying the location for the tap, excavating the area, and installing a new tapping sleeve and valve. A service line is then connected to the sleeve and extended to the property or building, ensuring proper depth and protection. The process may also include flushing the new connection and disinfecting the service line.

Timeliness: The entire process of installing a new service connection tap at a distribution line can typically be completed within a 3 hours to a 5 hours, depending on the specific requirements and conditions of the project site. It's essential to adhere to safety protocols, regulatory requirements, and industry best practices throughout the installation process.

Responsibility: Tapping Team, Operations Department

Procedures:

1) Dispatch job orders for tapping and mobilize necessary manpower, tools, and equipment with safety signages.
2) Excavate trench for mainline tapping at the required depth, install a saddle clamp and corporation cock on the pipe body.
3) Tap the mainline using a tapping machine and allow water to flow out to flush out cuttings.
4) Connect the P.E. Tube, lay it at a minimum depth of 40 cm with a protective layer of sand bedding under and over the tube for service lines.
5) Backfill the excavated area with new materials and dispose of the excavated material properly.
6) Install GI pipe for the meter stand, at least 40 cm above the ground and install a concrete pad on the meter base for stability.
7) Install the new water meter and flush out water until clear.
8) Advise the concessionaire to conduct flushing of water inside their house until clear.
9) Restore the concrete pavement affected during excavation.
10) Obtain approval from the concessionaire and have them sign the Job Order for confirmation.

M. Pipe Laying Installation

Purpose: The installation of pipes involves the laying of pipelines or other conduits to transport essential resources, such as water, from one location to another.The purpose is to provide a reliable and efficient means of water supply delivery, ensuring that customers have access to a consistent supply of resources while also improving the overall safety and sustainability of the infrastructure.

Scope: Pipe laying installation involves planning, designing, and constructing pipelines for resource delivery, using suitable materials and equipment, excavation and preparation of the site, laying and joining pipes, and compliance testing and inspection.

Timeliness: The entire process of pipe laying installation can take several weeks or months to complete, with the actual timeline depending on project-specific factors. It's essential to adhere to safety protocols, environmental regulations, and quality standards throughout the installation process to ensure the reliability and sustainability of the pipeline infrastructure.

Responsibility: Production Division, Operations Department : (049) 547 - 0593

Table 38. Pipe Laying Installation Materials, Tools and Equipment Needed

Materials	Tools & Equipment
a) Bolts and nuts	a) Air compressor with Jackhammer
b) Cement	b) Boom Truck
c) Chalk stone	c) Concrete Cutter
d) Chlorine Powder	d) Cutting outfit
e) Flange Adaptor	e) Dewatering Pump
f) Gasoline/Diesel	f) Digging ba
g) Hacksaw blade	g) Generator/Welding Machine
h) Hard Coal tar	h) Hacksaw
i) Nails and Coco Lumber	i) Measuring tape
j) New filling materials	j) Pipe cutter
k) Oxygen and Acetylene	k) Service vehicle
l) Paint brush	l) Shovel
m) Plywood	m) Signages
n) PVC Pipes	n) Vise Grip
o) Red Oxide	o) Wrenches
p) Rope	

q) Rubber gaskets	
r) Sand and gravel	
s) Split Tee	
t) Steel Plates	
u) Welding rods	

Procedures:

1) Coordinate with local officials to facilitate the implementation of the water project.
2) Prepare the site and gather all necessary materials and equipment for the construction.
3) Mobilize all materials, equipment, tools, and manpower needed to ensure smooth execution of the project.
4) Ensure that pipes stored on site are properly covered and fitted with end caps to prevent contamination.
5) Ensure that the construction crew is equipped with the prescribed safety gear such as safety glasses, safety vest, and safety shoes to prevent accidents and injuries.
6) Install safety signages in prominent locations to warn people of the construction work and potential hazards.
7) Perform excavation works, clean the inside of the pipes prior to laying, and backfill with new materials to restore the site. Restore the site to its original state.
8) Cover openings in the pipeline with empty sacks when work stops for the day.
9) Complete all pipe joints in the trench before stopping work.
10) If water accumulates in the trench, keep the plug in place until the area is free of standing water and mud that may enter the pipe.
11) Handle sealing materials or gaskets in a way that avoids contamination.
12) Use suitable lubricants for the sealing gaskets that are safe for use in potable water.
13) Clean-up and demobilization.
14) Documentation and submission of accomplishment report.

N. Pipeline Interconnection Procedure

Purpose: Pipeline interconnection aims to create a reliable and efficient means of transporting water between pipelines, using specialized fittings and equipment to connect water systems and maintain optimal flow rates. This improves the overall efficiency, reliability, and safety of water conveyance.

Scope: The scope of pipeline interconnection includes selecting appropriate fittings, excavation and preparation of the area, installation of equipment, testing, and monitoring to improve efficiency, reliability, and safety of resource transportation.

Timeliness: Considering the minimum durations, the entire Pipeline Interconnection Procedure can take 1 to 3 days to complete. This is a broad estimate, and the actual time can vary significantly based on several factors.

Responsibility: Production Division, Operations Department : (049) 547 - 0593

Procedures:

1) Prepare complete plan and materials estimates duly approved by SPCWD Authority and other requirements.
2) Notify the Community Relations & External Affairs Section (CREAS) of the water supply interruption and provide them with the press release for dissemination to the public.
3) Prepare the site for the interconnection works by clearing any obstructions and ensuring that the area is safe for construction activities.
4) Mobilize all the necessary materials, equipment, tools, and manpower required for the interconnection works. Ensure that the construction crew is equipped with the necessary safety gear, such as safety glasses, safety vests, and safety shoes, to prevent accidents and injuries.
5) Install safety signages in prominent locations to warn people of the construction work and potential hazards.
6) Close the valve to isolate the area where the interconnection work will take place. Drain the remaining water in the isolated pipeline network to ensure that it is safe to proceed with the interconnection works.
7) Clean all fittings and pipes that will be used for the interconnection to ensure a secure and leak-free connection. Perform the interconnection works following the prescribed procedures and protocols.
8) Open the isolation valves slowly to restore the normal supply of water, while ensuring that there are no leaks or other issues.
9) Backfill the excavation with new filling materials to restore the site to its original state.
10) Clean-up, demobilization, documentation and submission of accomplishment report.
11) Notify CREAS of the successful completion of the interconnection works, and ensure that all relevant documentation is provided for their records.

O. Hydro Testing Procedure

Purpose: Hydro testing is done to ensure the safe operation of pressure equipment by identifying defects and weaknesses through pressurizing above normal range. It minimizes the risk of accidents, environmental damage, and downtime, and ensures compliance with industry regulations and standards.

Scope: The scope of hydro testing involves preparing and pressurizing pressure equipment, monitoring for defects and leaks, and using specialized equipment and testing areas. The goal is to identify and mitigate weaknesses and ensure safe and effective equipment function within design parameters.

Timeliness: The entire Hydro Testing Procedure can take 2 to 10 days to complete. However, the actual time can vary significantly.

Responsibility : Engineering Division, Technical Services Department : (049) 547 - 0593

Procedures:

1) Prepare complete plan and materials estimates duly approved by SPCWD Authority and other requirements.
2) Conduct a visual inspection of the pipeline or equipment to be tested, looking for any visible damage or defects.
3) Fill the pipeline or equipment with water, removing all air pockets and ensuring that the water is clean and free of debris.
4) Raise the pressure inside the pipeline or equipment gradually to the desired level, up to a maximum pressure of 150 psi.
5) Hold the pressure steady for a duration of two (2) hours and monitor for any leaks or pressure drops.
6) If the allowable leakage limit is not met, identify and locate any leaks, and fix them accordingly. Repeat the hydro testing procedure until the allowable leakage limit is achieved.
7) Clean and demobilization.
8) Documentation and submission of accomplishment report.

P. Disinfection, Flushing and Turn Over

Purpose: The purpose of disinfection, flushing, and turnover is to ensure the safety and quality of the water supply by removing any potential sources of contamination or harmful substances. This process involves the use of chlorine disinfectants and flushing of water systems to remove any sediments, debris, or stagnant water that may have accumulated during construction or maintenance.

Scope: The scope of Disinfection, Flushing, and Turnover includes the process of cleaning and sanitizing a water system after installation, repair, or maintenance. This involves removing debris, flushing the system with clean water, disinfecting the pipes and fixtures with appropriate chemicals, and turning over the system to ensure adequate water quality and safety.

Timeliness: Considering minimum durations, the entire Disinfection, Flushing, and Turnover process can take 5 to 9 days to complete. However, the actual time can vary significantly depending on several factors.

Responsibility: Engineering Division, Technical Services Department : (049) 547 - 0593

Procedures:

1) Develop a comprehensive plan: Create a detailed plan outlining the scope, expected outcomes, risks, and contingency measures. Specify materials, equipment, and personnel responsibilities.
2) Inspect and repair: Thoroughly inspect the water system for leaks or damages. Repair identified issues before disinfection.
3) Develop a disinfection plan: Determine the appropriate chlorine dosage and contact time for effective disinfection based on system size and complexity.
4) Pre-flush: Remove debris and sediment by conducting a pre-flush to prepare the system for disinfection.
5) Monitor chlorine levels: Continuously monitor and record chlorine levels throughout the disinfection process. Adjust dosage if needed to maintain desired concentration.
6) Post-flush: After disinfection, perform a post-flush to eliminate residual chlorine and debris from the system.
7) Conduct quality testing: Collect water samples from multiple points in the system and conduct quality testing to ensure compliance with standards.
8) System turnover: Once water quality is confirmed, transition the system for regular use. Monitor regularly to maintain water safety.
9) Documentation and submission of accomplishment report.

Q. Replacement of Water Meter (Change Meter)

Purpose: Replacing a water meter is to ensure accurate measurement of water usage for billing and resource management. Over time, meters can become less accurate, leading to potential financial losses. Replacing them enables fair billing and improved efficiency through enhanced features.

Scope: Replacement of water meters involves assessing the existing meter, selecting a new one, installing it safely, and testing for proper functionality. Coordination with the customer is required, and brief water service interruption may occur. The goal is to ensure accurate billing and efficient resource management.

Timeliness: The entire Water Meter Replacement process can take 1-2 days to complete. However, the actual time can vary significantly from the issuance of change meter job order.

Responsibility: Production Division, Operations Department & Commercial Services Dept.

Table 39. Replacement of Water Meter materials, tools and equipment

Materials	Tools and Equipment
a) Bolts and Nuts	a) Adjustable Wrenches
b) Flange Type Water Meter	b) Pipe Wrenches
c) Gasket	c) Service Vehicle
d) New Water Meter with Gasket	d) Vise Grip
e) Rubber	
f) Teflon Tape	

Procedures:

1) Notify the concessionaire / customer in advance of the water meter replacement.
2) Turn off the control valve to the property to prevent any water flow during the replacement process.
3) Record the cut-off reading, brand, and serial number of the old water meter in the job order for future reference.
4) Remove the old water meter and install the new one, ensuring that it is installed horizontally for accurate measurement of water flow.
5) Record the initial reading, brand, and serial number of the new water meter for tracking purposes.
6) Conduct a final inspection to verify that the new water meter is functioning properly and has been installed correctly.
7) Open the control valve to restore water supply to the property.
8) Documentation and submission of change meter report.

R. Reconnection of Water Meter

Purpose: Re-connecting a water meter is to restore water supply to a property that has previously been disconnected. This is typically done after payment of any outstanding bills or fees, or when a property changes ownership. The re-connection of the water meter ensures that the property has access to a reliable water supply, which is essential for daily living and commercial activities.

Scope: Re-connecting a water meter includes physical re-connection of the meter to the property's plumbing system and ensuring that the water supply is functioning correctly. This may involve verifying that the water pressure and flow rate are adequate, as well as testing for any leaks or other issues that may impact the supply.

Timeliness: The entire Reconnection of Water Meter process can take 2-5 days to complete. However, the actual time can vary significantly depending on several factors.

Responsibility: Production Division, Operations Department

Table 40. Reconnection of Water Meter Materials, Tools and Equipment

Materials	Tools and Equipment
a) Bolts and Nuts	a) Adjustable Wrench
b) New Water Meter	b) Pipe Wrench
c) Teflon Tape	c) Service Vehicle
d) Water Meter Gasket	d) Vise Grip

Procedures:

1) Notify the concessionaire / customer in advance of the re-connection of the water meter.
2) Turn off the control valve to the property to prevent any water flow during the installation process.
3) Record the cut-off reading, brand, and serial number of the old water meter in the job order for future reference.
4) Install the new water meter, ensuring that it is installed horizontally to accurately measure the water flow.
5) Record the initial reading, brand, and serial number of the new water meter for tracking purposes.
6) Conduct a final inspection to verify that the new water meter is functioning properly.
7) Open the control valve to restore water supply to the property.
8) Documentation and submission of Water Meter Relocation Report.

S. Rehabilitation of Service Connection

Purpose: The rehabilitation of service connection involves addressing issues such as overloaded stub outs, old and overloaded service connections, service lines affected by road works, and low water pressure or no water supply. The purpose of this rehabilitation is to ensure efficient, reliable, and safe water supply, reducing the risk of water wastage, contamination, and health risks.

Scope: It involves repair, replacement, and upgrading of existing infrastructure and implementation of new processes to improve the water supply system.

Timeliness: The entire process of pipeline interconnection can take several days to months to complete, with the actual timeline depending on project-specific factors. It's essential to adhere to safety protocols, environmental regulations, and quality standards throughout the interconnection process to ensure the reliability and safety of the water transportation system.

Responsibility: Pipelines and Appurtenances Maintenance Division, Operations Department

The procedure on rehabilitation of service connection applies to the following conditions:

1) Overloaded Stub out
2) Old and Overloaded Service Connection
3) Service lines affected due to road concreting, road widening and construction of drainage canal.
4) Service lines affected by low pressure to no water condition.

Table 41. Rehabilitation of Service Connection materials, tools and equipment

Materials Needed:	Tools and Equipment Needed:
a) Ball Corporation Cock w/ Lock wing	a) Air Compressor
b) CS TO CS	b) Boring Machine
c) G.I. Cross Tee	c) Chisel
d) G.I. Nipple	d) Cutting Machine for concrete road
e) G.I. Plug	e) Dewatering Pump
f) G.I. Tee	f) Digging Bar
g) G.I.Tee Reducer	g) Hacksaw w/ Blade
h) GI Elbow Reducer	h) Jack Hammer for concrete road
i) GI Elbow x 90°	i) Mallet
j) GI Pipes	j) Pipe Wrench

k) Gravel at least 3/4”	k) Portable Compactor
l) IP Coupling	l) Service Vehicle
m) PE Tube ISO	m) Shovel
n) Portland Cement	n) Tapping Machine
o) Saddle Clamp	o) Welding Machine
p) Sand S1	
q) Seal Tape Teflon	
r) Water Meter	

Procedures: (A. Installation of Meter Stub-out)

1) Conduct site inspection and seek cooperation with the affected concessionaires or barangay officials in the area.
2) Gather the following data:
   a) The nature of the complaint, including any relevant details about the issue affecting the water supply system.
   b) The number of affected service connection lines to determine the scale of the problem.
   c) The pressure at the affected service lines to identify the severity of the issue.
   d) The location of existing mainlines in the area for possible tapping points.
   e) The pressure at the mainline to determine if it is sufficient to meet the needs of the community.
   f) The proposed location of the meter stub out on the property and the definition of road right-of-ways to ensure proper installation.
   g) The distance of the proposed stub out to the existing mainline, which should be no more than 25 linear meters from the distribution line.
   h) The definition of the road right-of-way and the road's location to avoid disruptions and ensure proper planning.
   i) Any excavation permits needed to comply with regulations and ensure public safety.
   j) The materials needed for the rehabilitation process to ensure effective and efficient execution.
3) Dispatch job orders to assign responsibilities to team members.
4) Withdraw necessary materials from the General Services Division.
5) Mobilize manpower, tools, equipment, and signages to the work site.
6) Excavate a trench for the mainline tapping while adhering to the defined road right-of-ways.
7) Install a saddle clamp on the pipe's body, followed by a ball corporation cock valve with a lock wing.
8) Tap the tapping machine, and bore the mainline to allow water to flow out.
9) Allow water to flow to flush out the cuttings.
10) Close the corporation cock valve and connect the P.E. Tube.

11) Lay the P.E. Tube at a minimum depth of 40cm and ensure that service lines have a protective layer of sand bedding under and over the tube.
12) Backfill the excavated area using new materials, haul excavated materials out of the work site, and dispose of them properly.
13) Install a meter stub out stand at a minimum depth of 40cm.
14) Flush water until it is clear.
3) Re-install the water meter.
4) Restore any concrete pavement affected during the excavation process.

Procedures: (B. Transfer of Service Connection to Stub Out)

1) Before starting the transfer process, the concessionaire should be notified of the transfer and informed of the expected timeline and any potential disruptions to their water service.
2) Conduct a site assessment to identify any potential risks or hazards that may impact the transfer process.
3) Prepare the site by marking out the area where the pipeline will be laid, securing the area, and ensuring that all necessary permits and approvals are in place.
4) Excavate and lay the pipeline after the meter at a minimum depth of 40cm, ensuring that the pipeline is properly supported and protected.
5) Connect the newly laid pipeline to the concessionaire's in-house service line, ensuring that all connections are properly sealed and secured.
6) Install the water meter to the newly installed stub out according to standard, ensuring that it is properly calibrated and functioning correctly.
7) Test the flow of water at the concessionaire's house to ensure that the connection is working properly and that there are no leaks or other issues.
8) After the transfer is complete, restore any concrete pavement affected during excavation and install a concrete pad on the stub out base after rehabilitation to ensure it is properly supported.
9) Document the process: Submit a comprehensive report that documents the entire transfer process, including any issues encountered, actions taken, and recommendations for future improvements.

Note:
By following these steps, the transfer process will be more efficient and effective, reducing the risk of disruptions or safety hazards and ensuring that the transfer is completed smoothly and safely.

T. Repair of Mainline Leakages

Purpose: This is essential to prevent water loss, maintain water pressure and quality, and avoid any safety hazards or property damage that may result from a leak. Repairing mainline leakages also helps to ensure the sustainability of the water supply system and conserve precious water resources.

Scope: Repairing mainline leakages includes identifying the location and cause of the leak, excavating the area surrounding the leak, repairing the damaged section of the pipe, and conducting a final inspection to verify that the repair has been successful.

Timeliness: The entire process of repairing mainline leakages can typically take from one to several days to complete, with the actual timeline depending on the specific circumstances of each repair job. It's essential to prioritize timely repairs to minimize water loss, maintain water quality, and ensure the integrity of the water supply system.

Responsibility: Pipelines and Appurtenances Maintenance Division, Operations Department

Table 42. Repair of Mainline Leakages materials, tools and equipment

Materials:	Tools and Equipment:
a) Cement	a) Air compressor with Jackhammer
b) Flange Adaptor	b) Concrete cutter
c) Welding rods	c) Concrete Mixer
d) Rubber gaskets	d) Cutting outfit
e) Steel Plates	e) Dewatering Pump
f) New filling material	f) Digging bar
g) Repair Clamps	g) Generator/Welding Machine
h) Bolts and nuts	h) Hacksaw
i) Sand and gravel	i) Pipe cutter
j) Oxygen and Acetylene	j) Pipes Wrenches
	k) Service vehicle
	l) Shovel
	m) Signages
	n) Vise grip

Procedures:

1) Conduct initial assessment: Before starting any repair work, conduct a thorough on-site assessment to determine the extent of the damage and identify the necessary materials and equipment needed for the repair.

2) Notify the public thru CREAS: Ensure that a Public Service Announcement is issued by the concerned authorities, including details on the affected area and duration of repair, to minimize inconvenience to the public.

3) Secure the work site: Secure the work site by isolating the affected area and mobilizing all necessary equipment, materials, signage, and lighting to ensure the safety of workers and the public.

4) Repair the leak: Excavate the area with the leak and clean the affected pipe, then fix the leak, check fittings, and tighten bolts.

5) Perform leak test: Perform a thorough leak test by opening isolated valves and checking for any leaks. If no leak is detected, proceed with the next step.

6) Backfill and compact: Apply sand bedding and backfill the excavated area with 150mm layer-by-layer compaction to ensure that the repair site is properly supported and stabilized.

7) Test water quality: Flush fire hydrants/BOVs and collect water samples for quality testing to ensure that the water supply is safe for consumption.

8) Notify relevant parties: Inform CREAS, Pumping Station/Pump Operators, and Department Managers of the completed repair to ensure that everyone is aware of the status of the repair work.

9) Restore the area: Restore the area as necessary by removing any temporary structures or signs, filling any gaps or holes, and ensuring that the area is clean and safe for public use.

10) Documentation and submission of Repair Maintenance Report.

By following these steps, the repair work can be completed efficiently and effectively, minimizing disruptions to the public and ensuring the safety of workers and the public.

U. Repair of Service Connection Leaks

Purpose: The purpose of the Repair of Water Service Connection Leaks is to identify, assess, and resolve leaks in water service connections within a specific water supply system. The primary objective is to restore the integrity of the connections, minimize water losses, prevent infrastructure damage, and ensure the continuous and efficient delivery of water to consumers.

Scope: The scope of the Repair of Water Service Connection Leaks includes identifying and detecting leaks in water service connections, assessing their severity and impact, developing a repair plan, implementing necessary repairs such as pipe replacement or joint repair, ensuring quality assurance through post-repair testing, maintaining comprehensive documentation, and considering preventive measures to minimize future leaks and ensure efficient water delivery within the specified system.

Timeliness: Considering minimum durations, the entire Repair of Service Connection Leaks process can take 1 to 2 days to complete. However, the actual time can vary significantly depending on several factors.

Responsibility: Pipelines and Appurtenances Maintenance Division, Operations Department

Table 43. Service Connection Leaks materials, tools and equipment

Materials	Tools & Equipment Needed
a) Bolts and Nuts	a) Air Compressor and Jackhammer
b) Cement	b) Concrete Cutter
c) New Filling Materials	c) Cutting Outfit
d) Oxygene and Acetylene	d) Dewatering Pump
e) Pipes	e) Digging Bar
f) Repair Clamps	f) Generator/Welding Machine
g) Rubber Gaskets	g) Hacksaw
h) Sand and Gravel	h) Pipe Cutter
i) Steel Plates	i) Service Vehicle
j) Universal Adaptor	j) Shovel
k) Welding rods	k) Signages
	l) Vise Grip
	m) Wrenches

A. Repair at Tapping Point

Procedures:

1) Assess the tapping point: Evaluate the pipe size and type to determine needed materials and equipment.
2) Notify the public: Issue a public announcement through appropriate channels (CREAS), informing about the repair work, affected area, and expected duration.
3) Mobilize equipment and materials: Gather and prepare all necessary resources for the repair.
4) Isolate the area: Implement safety measures to isolate the affected area, ensuring worker and public safety.
5) Excavate the area: Dig around the tapping point to expose the leaking pipe, removing soil and debris for inspection and repair.
6) Repair the leak: Apply suitable repair techniques, replacing or fixing the damaged pipe section to establish a secure, leak-free connection.
7) Restore the area: Return the area to its original state by backfilling with appropriate materials, proper compaction, and flushing if required.
8) Documentation and submission of Repair and Maintenance Report.

B. Service Connection Line Repair

Procedures:

1) Assess pipe size and type on-site for proper repair materials mobilization.
2) Mobilize necessary materials, equipment, signage, and lighting to the repair site.
3) Install safety signage to notify of ongoing repair work.
4) Excavate area around affected pipe for access.
5) Dewater trench and clean leaking pipe.
6) Fix leakage, check fittings for security against further leaks.
7) Perform pressure test to verify successful repair and no additional leaks.
8) Apply sand bedding for additional pipe support if needed.
9) Backfill area, compacting each layer to prevent settling and pipe damage.
10) Restore area and inform concessionaire/complainant of completed repair work.
11) Documentation and submission of Repair and Maintenance Report.

V. Storage and Handling of Materials and Supplies for Water Connection

Purpose: Proper storage and handling of materials and supplies for water connection prevents contamination, ensures compliance with regulations, and minimizes the risk of system damage. This helps to maintain the quality and efficiency of the water supply system, ensuring safe and reliable access to clean water for all users.

Scope: Proper storage and handling of materials and supplies for water connection involves storing, transporting, and handling materials and supplies in a manner that prevents contamination, damage, and non-compliance.

Timeliness: The storage and handling of materials and supplies for water connection is an ongoing process that requires careful planning, organization, and maintenance to ensure the availability, quality, and safety of materials when needed for water connection projects.

Responsibility: Property Officer and Storekeeper, General Services Division

Procedures:

1) Store water connection materials in a clean and dry area to maintain their integrity and prevent contamination.
2) Organize fitting materials based on size, type, and purpose, and pack them securely to ensure their preservation.
3) Store disinfectant chemicals with toxic substances, like battery solutions and fuel, separately in a designated area, away from water connection materials.
4) Properly handle and dispose of waste materials containing toxic substances, ensuring they are kept separate from water connection materials.
5) Protect pipes from sunlight and potential damage by utilizing end caps and ensuring they are not directly exposed.
6) Maintain cleanliness both inside and outside the storage area to prevent the accumulation of debris and dust, preserving the quality of the materials.
7) Regularly inspect and rotate stored materials to ensure proper inventory management and identify any potential issues or replacements needed.
8) Documentation and submission of Monthly Inventory Report.

W. Notice of Disconnection Procedure

Purpose: To inform customers of an impending water service termination due to non-payment, unauthorized usage, or safety concerns. The notice typically outlines the date of disconnection and provides information on how to avoid disconnection, including payment options and ways to resolve any outstanding issues.

Scope: It involves providing customers with the date of disconnection, instructions on how to avoid disconnection, and options for resolving outstanding issues.

Timeliness: The Notice of Disconnection Procedure aims to provide customers with sufficient notice and opportunities to address any issues before water service termination occurs, ensuring fairness and compliance with regulatory requirements.

Responsibility: Meter Readers, Commercial Services Department

1) Commercial Services Department serves notice for disconnection to customers with delinquent account 3 months and up.
2) Customer Pays the Account.

    a) If full payment or pays partial with 2 months in arrears or less, customer pays directly to teller.
    b) If partial payment with total due amount of more than 2 months in arrears:
        - Customer arranges partial payment and executes promissory note.
        - Customer accounts division extend implementation of disconnection.

Failure to pay on any succeeding payment scheme as executed in the promissory note, customer accounts division shall implement disconnection of water connection (note: the executed promissory note serves as a disconnection notice).

    c) If no payment is made or partial payment with total due amount of more than 2 months in arrears without promissory note, implement disconnection of water connection within 48 hours of receipt of notice.

3) Documentation and submission of Disconnection Report.

X. Reconnection Inspection Procedure

Purpose: Conducting a reconnection inspection in water services is to ensure that the reconnection of the water supply to a property or premises is safe, compliant with regulations, and functioning properly. The inspection is necessary to identify any potential hazards or issues with the reconnected water supply, such as leaks, contamination, or inadequate pressure, that could pose a health or safety risk to occupants of the property or the wider community.

Scope: Reconnecting water services can occur after a period of disconnection, such as during construction work, repairs, changes in ownership or non-payment of bill. The inspection also ensures that the water supply is properly metered, and any outstanding charges for water use are accounted for.

Timeliness: Reconnection Inspection Procedure depends on various factors such as the nature of the disconnection, the urgency of reconnection, and regulatory requirements, usually one day. The procedure aims to ensure that water services are safely and efficiently restored to properties while complying with regulations and maintaining the integrity of the water supply system.

Responsibility: Inspector, Commercial Services Department

Procedures:

1) Retrieve and review applicant's relevant previous data.
2) Conduct site inspection and gather/confirm the following data:
    a) Conduct a thorough site inspection to locate the house and/or meter accurately.
    b) Determine the nearest meter stub out for a possible reconnection point.
    c) Accurately classify the service connection to ensure the correct reconnection procedure.
    d) Ensure all materials required for the reconnection meet SPCWD standards to ensure quality workmanship.
3) The applicant proceeds to SPCWD for payment.
4) Documentation and Monthly Collection Report.

Y. New Service Connection Application

Purpose: To request the installation of a new water supply to a specific location. The application typically includes the customer's name, address, and contact information, as well as details on the requested service, such as the size and type of service, the location of the service, and any necessary permits or fees. The application should be complete, accurate, and comply with relevant regulations and procedures to ensure a timely and efficient installation process.

Scope: This includes the type and size of service required, the location of the service, and any necessary permits or fees. The application should be complete and accurate to ensure a timely and efficient installation process. Additionally, it must comply with relevant regulations and procedures.

Timeliness: The timeliness for processing a New Service Connection Application varies depending on several factors, including the complexity of the request, existing workload, regulatory requirements, and administrative processes. SPCWD provides enough time to entertain applicants and explain to them the necessary requirements and schedule.

Responsibility: Customer Service Assistant, Commercial Services Department

Procedures:

1) Receive a completed New Service Application Form, along with all required documents and payment for application and inspection fees.
2) Schedule and conduct a thorough inspection and investigation of the installation location for the new service connection.
3) Assess the necessary materials and create a detailed sketch of the proposed location for the new service connection.
4) Obtain official approval for the installation of the new service connection and ensure all associated charges, including materials and labor, are paid.
5) Schedule and execute the installation of the new service connection, ensuring adherence to safety protocols and quality standards.
6) Documentation and submission of New Service Connection Report.

Z. Reservoir and Water Tanks Cleaning Procedure

Purpose: In general, the cleaning process should be carried out on a regular basis to ensure that the water supply remains safe and clean. This may involve cleaning the reservoirs every few years or more frequently if there are concerns about water quality or contamination.

Scope: The cleaning process described above is a standard procedure for cleaning drinking water reservoirs. The scope of the cleaning process will depend on the size of the reservoir, the type of contamination present, and the specific regulations and guidelines that apply in the local area.

Timeliness: The timeliness of cleaning reservoirs and water tanks is essential to ensure the continued safety and quality of the water supply. Regular cleaning and maintenance help prevent contamination, ensure compliance with regulations, and maintain operational efficiency. One to two days or as schedule.

Responsibility: Maintenance Team, Environment and Water Resources Division, Technical Services Department

Procedures:

1) Notify the Management and Concessionaires: Before initiating the cleaning process, inform the relevant water authority about the plan for cleaning the reservoir. This is important to ensure the safety of the water supply and to avoid any potential contamination.
2) Drain the Reservoir/Tanks: The first step is to drain the reservoir completely. The water should be pumped out and disposed of safely, following local regulations.
3) Remove Debris: Once the reservoir is empty, remove any debris, such as leaves, sticks, and other organic matter, from the bottom and sides of the reservoir.
4) Scrub the Reservoir: Use a stiff-bristled brush to scrub the inside of the reservoir thoroughly. Pay particular attention to areas that are difficult to reach, such as corners and crevices.
5) Rinse the Reservoir: Rinse the reservoir thoroughly with clean water to remove any remaining debris and cleaning solution.
6) Disinfect the Reservoir: Use a disinfectant or chlorine solution to kill any remaining bacteria or viruses. Follow the instructions provided by the disinfectant manufacturer to ensure that the correct amount of disinfectant is used.
7) Fill the Reservoir: Once the disinfectant has been applied, fill the reservoir with clean water. This water should be tested before it is released into the distribution system to ensure that it is safe to drink.
8) Test the Water Quality: After the reservoir is refilled, test the water quality to ensure that it meets local and national drinking water standards. This includes testing for bacteria, viruses, and other contaminants.
9) Documentation and Maintenance Report.

AA. Filtration Media Replacement Procedure

Purpose: The purpose of the filtration media replacement procedure is to ensure that the filtration system is working effectively and producing high-quality water. By replacing the old media with new, clean media, the procedure helps to remove contaminants and maintain the flow rate of the system, ensuring that the water is safe for consumption.

Scope: The scope of the filtration media replacement procedure is to replace old media with new to optimize the filtration system's performance and produce high-quality water. It includes draining, cleaning, installing new media, reassembling, starting up, and testing the system.

Timeliness: Typically, the procedure can take several hours to complete, including draining the system, cleaning the filtration components, installing new media, reassembling the system, starting it up, and conducting thorough testing to verify its performance. However, the exact duration may vary based on the specific conditions and requirements of each filtration system. It is essential to adhere to the established timeline to minimize downtime and ensure uninterrupted access to high-quality water for consumption.

Responsibility: Service Provider and Maintenance Team and Environment and Water Resources Division, Technical Services Department

Procedures:

1) Shut Down the Filtration System: Before replacing the filtration media, the filtration system must be shut down. This will involve turning off any valves that control the flow of water to the system and disconnecting any electrical connections.
2) Drain the Filter: Once the filtration system has been shut down, the filter must be drained of any water that may still be present. This can be done by opening the drain valve located at the bottom of the filter.
3) Remove the Old Media: The old filtration media must be removed from the filter. This may involve unscrewing any bolts or clamps that are holding the media in place and carefully removing it from the filter housing.
4) Clean the Filter: With the old media removed, the filter should be thoroughly cleaned to remove any debris or contaminants that may be present. This can be done using a soft-bristled brush and clean water.
5) Install the New Media: The new filtration media should be carefully installed in the filter housing, following the manufacturer's instructions. It is important to ensure that the media

is installed correctly and securely, so that it does not move or become dislodged during operation.

6) Reassemble the Filter: Once the new media is installed, the filter can be reassembled. This may involve replacing any bolts or clamps that were removed during the disassembly process and reconnecting any electrical connections.
7) Start Up the Filtration System: With the filter reassembled, the filtration system can be started up again. This will involve turning the valves back on and reconnecting any electrical connections.
8) Test the Filtration System: Finally, the filtration system should be tested to ensure that it is working correctly. This may involve testing the flow rate, checking for leaks, and monitoring the quality of the water that is being produced.
9) Documentation and Accomplishment Report.

It is important to follow the manufacturer's instructions when replacing the filtration media, as different types of media may require different procedures or equipment. It is also important to ensure that the replacement media is compatible with the existing system and that it meets the required specifications for water quality and flow rate.

In general, the media replacement process should be carried out by trained professionals who have the necessary expertise and equipment to carry out the work safely and effectively. This may involve contracting with a specialized filtration company or working with a team of water treatment professionals.

AB. Replacement Pump and Motor of Production Well

Purpose: The purpose of this procedure is to replace the production well pump and motor to ensure a continuous and reliable water supply. It aims to maintain the well's performance, increase the well's lifespan, and prevent water supply interruptions.

Scope: The scope of this procedure includes the removal of the old well pump and motor, installation of the new pump and motor, and testing the system to ensure proper operation. The procedure covers all safety precautions, disassembly, reassembly, and testing steps required to replace the pump and motor in production wells.

Timeliness: Completing this procedure depends on several factors, including the size and depth of the well, the complexity of the pump and motor replacement, and any specific conditions or challenges encountered during the process. Typically, the procedure can take several hours to a few days to complete. It involves various steps such as safely removing the old pump and motor, installing the new equipment, testing the system to ensure proper functionality, and conducting any necessary adjustments or troubleshooting.

Responsibility: Maintenance Team - Environment and Water Resources Division, Technical Services Department

Procedures:

1) Prepare the Work Area: Ensure that the area around the well is clear and free from debris. Turn off the power supply and secure the wellhead to prevent unauthorized access.
2) Remove the Old Pump and Motor: Disconnect the electrical wiring and plumbing connections. Remove the pump and motor from the well using specialized lifting equipment.
3) Inspect the Well and Components: Inspect the well casing, pipe, and any other components for damage or corrosion. Replace any damaged components.
4) Install the New Pump and Motor: Carefully lower the new pump and motor into the well, making sure it is centered and level. Attach the electrical and plumbing connections following the manufacturer's instructions.
5) Reassemble the Wellhead: Replace any gaskets or seals as necessary, and reassemble the wellhead. Tighten all bolts and connections to the manufacturer's specifications.
6) Test the System: Turn on the power supply and test the new pump and motor for proper operation. Check the water pressure, flow rate, and electrical current draw. Observe the system for any leaks or abnormalities.
7) Complete the Documentation: Record all installation and testing procedures, including any measurements or readings taken during testing. Store all documentation in a safe and accessible location.

It is important to note that these procedures should be performed by qualified professionals with the necessary training, tools, and experience to ensure a safe and successful replacement of the production well pump and motor.

AC. Repair and Calibration of Water Meters Procedure

Purpose: This is to repair and calibrate water meters to ensure accurate measurement of water consumption. It aims to identify and correct any meter malfunctions, prevent over billing or under billing, and ensure the efficient use of water resources.

Scope: The scope includes the identification of faulty water meters, removal of the meter from the service line, repair or replacement of the meter components, and calibration of the meter to ensure accurate measurement. The procedure covers all necessary safety precautions, disassembly, repair, reassembly, and testing steps required to repair and calibrate water meters.

Timeliness: The Repair and Calibration of Water Meters Procedure typically takes a few hours to several days, depending on factors like the number of meters, extent of damage, and parts availability. It involves identifying faults, removing meters, repairing or replacing components, and calibrating for accuracy. Efficient planning and access to parts can expedite the process, but thoroughness is essential to ensure accurate water measurement.

Responsibility: Supervising Instrument Technician, Operations Department

Procedure:

1) Visual Inspection of Water Meters: The first step is to visually inspect the water meter to ensure that it is not damaged and is functioning properly. Any physical damage or wear and tear on the water meter will be noted for repair or replacement.
2) Set-Up Water Meters to Test Bench: The water meter will then be set up on the test bench, which is a controlled environment where the accuracy of the water meter can be tested.
3) Record Initial Reading of Water Meters: The initial reading of the water meter will be recorded. A circulating pump will be run to attain 100 liters of water volume.
4) Record Final Reading of Water Meters: The final reading of the water meter will be recorded after the water has circulated.
5) Calculate Accuracy: The accuracy of the water meter will be calculated by subtracting the final reading from the initial reading. If the accuracy is outside the desired range of 98% to 102%, the water meter will be adjusted at the regulator.
6) Repeat Calibration: The calibration and testing process (steps 3 to 5) will be repeated until the desired accuracy is achieved.
7) Repair and Maintenance: Any damaged or worn components of the water meter will be repaired or replaced as necessary to ensure its accurate measurement of water consumption.
8) Final Testing: After calibration and repair, the water meter will undergo final testing to ensure that it is functioning accurately and within the desired range.
9) Documentation: All test results and maintenance activities will be documented for future reference and to ensure compliance with regulatory requirements.

AD. Determine Water Pressure at Transmission and Distribution Lines

Purpose: The purpose of this procedure is to determine the water pressure on transmission and distribution lines to ensure adequate water pressure and supply to customers.

Scope: This procedure applies to all transmission and distribution lines used to transport water to customers. The determination of water pressure will be conducted by trained SPCWD personnel using appropriate tools and equipment.

Timeliness: The determination of water pressure at transmission and distribution lines typically takes a few hours to a few days to complete, depending on the size and complexity of the water network. Trained personnel will conduct measurements using specialized tools and equipment to ensure accurate results. Efficient execution of the procedure is essential to maintain optimal water pressure and supply to customers.

Responsibility: Pipelines and Appurtenances Maintenance Division, Operations Department

Procedures:

1) Visual Inspection and Line Pressure Check: Upon receiving low-pressure complaints, a visual inspection will be conducted, and line pressure in the area will be checked to identify any potential causes of low water pressure.
2) Pressure Zoning: If no busted pipes are found, pressure zoning will be conducted for every 100 meters to 500 meters before and after the reported low-pressure area using portable pressure gauge or pressure data recorder logger to determine the location of any pressure drops or fluctuations.
3) Leak Detection: If any leaks are suspected, leak detection equipment will be used to locate any leaks on the transmission or distribution line. If leaks are found, immediate repair will follow.
4) Line Pressure Check: After any necessary repairs are made, line pressure in the area will be checked again to evaluate if equal pressure is attained. Analyze the pressure data to identify any trends or anomalies that may indicate issues with the water distribution system. Compare the readings with the required pressure levels and identify any areas that may require adjustments or maintenance.
5) Valving: Valving may be considered to neutralize and balance line pressure in the area if necessary. This may involve adjusting valves on the transmission or distribution line to ensure that adequate water pressure is maintained throughout the area.
6) Documentation: All test results and maintenance activities will be documented for future reference and to ensure compliance with regulatory requirements.
7) Follow-up: After the determination of water pressure is completed, follow-up inspections and checks may be conducted periodically to ensure that water pressure is maintained at an adequate level to meet customer demand.

AE. Calibration of Laboratory Equipment

Purpose: This procedure is to calibrate laboratory equipment used in water district testing to ensure accurate and precise measurements. It aims to ensure the reliability of laboratory results, prevent errors or inaccuracies in data, and maintain compliance with regulatory requirements.

Scope: Includes the identification of laboratory equipment requiring calibration, verification of equipment performance, adjustment of equipment settings, and recording of calibration data. The procedure covers all necessary safety precautions, equipment, and techniques required to calibrate laboratory equipment in a water district.

Timeliness: Calibrating laboratory equipment in the water district typically takes several hours to complete, depending on the number and complexity of the instruments involved. Trained personnel will systematically verify and adjust equipment settings, ensuring accurate and reliable measurements. Efficient execution of the procedure is crucial to maintaining the integrity of laboratory results and regulatory compliance.

Responsibility: Instrument Technician and Laboratory Section,
Environment and Water Resources Division

Table 44. Laboratory Equipment Calibration and Maintenance Schedule

Equipment	Maintenance and Calibration Requirements	Frequency
Balances	1. Linearity, zero point, and accuracy (using standard weights) 2. Clean 3. Service	Daily/ Each use Daily/Each use Annually
Volumetric glassware	1. Accuracy, precision (pipettes/burettes) 2. Clean and/or sterilize	Depends on use Each use
Electrode/meter system, including pH	1. Electrode drift or reduce response 2. Fixed point and slope checks using standard solution 3. Clean electrode	Daily/Each use
Temperature controlled equipment (refrigerators, incubators, etc.)	1. Periodic calibration of temperature sensing system using appropriate standard thermometer 2. Thermal stability 3. Heating/cooling rates and cycles 4. Ability to achieve and sustain pressure or vacuum 5. Monitor temperature 6. Clean and disinfect internal surfaces	Annually Annually Annually Annually Daily Weekly

Microscope	1. Revolving power 2. Graticule calibration (for length calibration) 3. Clean 4. Full maintenance 5. Check alignment	Annually Annually Daily/Each use Annually Daily/Each use
Sterilizing oven	1. Establish stability/uniformity 2. Monitor temperature	Initially and after repair Each use
Autoclave	1. Establish characteristics for typical load/cycle 2. Monitor temperature/time (with spore vials or strips) 3. Visual checks of gasket, clean/drain chamber 4. Full service 5. Safety check of pressure vessel	Initially and after repair Each use (and weekly) Each use Annually Annually
Fume Hood	1. Airflow Verification 2. Sash Alignment 3. Baffle Adjustment 4. Exhaust Systemd	Annually Annually Annually Annually
Safety cabinet	1. Establish performance 2. Particle count monitoring 3. Air flow monitoring 4. Full service and mechanical check	Initially and after repair Weekly Monthly Annually
Media dispenser	1. Volume dispensed 2. Decontaminate, clean and sterilize as appropriate	Daily/each use/each adjustment
Pipettors/Pipettes	1. Accuracy and precision of volume dispensed 2. Clean	Regularly (taking account of the frequency and nature of use) Each use
Colony counter	1. Check against manual number counted	Monthly
Spectrophotometers (UV/Vis)	1. Overall system check: Wavelength (accuracy, precision, stability), source stability, detector performance (resolution, sensitivity, linearity, accuracy, precision) signal-to-nose (mass, ppm, wavelength frequency, absorbance, transmittance, bandwidth, intensity) 2. System response (blank, standard, control) 3. Clean	Annually Daily/Each use As recommended in the manual

Procedures:

1) Procedures must be performed by qualified professionals with the necessary expertise, training, and tools to ensure accurate and safe calibration of laboratory equipment used in water district testing.

2) Identify Equipment for Calibration: Identify the laboratory equipment, such as pH meters and turbidity meters, requiring calibration.
3) Verify Equipment Performance: Conduct a preliminary check to ensure the equipment is clean, undamaged, and in good working condition.
4) Prepare Calibration Standards: Follow manufacturer instructions and regulatory requirements to prepare traceable calibration standards.
5) Adjust Equipment Settings: Set the equipment parameters to match the calibration standards, including zero or span settings.
6) Perform Calibration: Calibrate the equipment using prepared standards, recording readings and comparing them to expected values.
7) Adjust Equipment if Needed: Make necessary adjustments if readings deviate from expected values.
8) Document Calibration Data: Record calibration details, including date, standards used, readings, adjustments, and the qualified professional responsible.
9) Store Calibration Records: Keep all records in a secure and accessible location for future reference.

AF. Drilling a Production Well Procedure

Purpose: The purpose of this procedure is to drill a production well to ensure a reliable and sustainable source of water for the water district. It aims to provide a safe and efficient water supply by drilling a well that meets the required specifications and standards.

Scope: The scope of this procedure includes the identification of suitable drilling locations, preparation of drilling equipment, drilling the well, and installation of the production equipment. The procedure covers all necessary safety precautions, equipment, and techniques required to drill a production well.

Timeliness: Drilling a production well involves several stages, typically spanning several weeks to months, depending on factors such as geological conditions and the depth of the well. The process begins with site selection and preparation, followed by drilling operations, casing installation, and well completion. Efficient execution of the procedure is essential to ensure timely completion while adhering to safety and quality standards.

Responsibility: Contractor and Technical Services Department

Procedures:

1) Procedures must be performed by qualified professionals with the necessary training, tools, and experience to ensure a safe and successful drilling of a production well.
2) Identify Suitable Drilling Locations: Select drilling locations based on geological and hydro-geological data, considering contamination sources, infrastructure, and accessibility.
3) Prepare Drilling Equipment: Clean, maintain, and set up drilling equipment according to manufacturer instructions and regulatory requirements.
4) Drill the Well: Execute the drilling plan, monitoring progress and adjusting parameters as needed.
5) Collect Soil and Rock Samples: Gather and label soil and rock samples at regular intervals for analysis.
6) Install Production Equipment: Follow manufacturer instructions and regulations to install well screens, pumps, and piping.
7) Conduct Pumping Tests: Perform tests to determine well yield and drawdown, record data for optimization purposes.
8) Disinfect the Well: Employ approved disinfectants and procedures to disinfect the well.
9) Document Drilling Data: Record drilling details, including dates, well depth, samples obtained, pumping test results, and disinfection procedures. Store documents securely.

AG. Elimination of Dirty / Contaminated Water from Distribution Lines

Purpose: The purpose of this procedure is to eliminate dirty/contaminated water from the distribution line to concessionaires. It aims to improve the quality of water supplied to concessionaires by removing sediment, debris, and other contaminants that may accumulate on the distribution line.

Scope: The scope of this procedure includes identifying the areas where the distribution line is contaminated, flushing the line with water to remove sediment and debris, and taking necessary precautions to ensure the safety of the workers performing the task.

Timeliness: The timeliness for the elimination of dirty or contaminated water from distribution lines can vary depending on factors such as the extent of contamination, the length of the distribution lines, and the efficiency of the flushing process. However, a typical timeframe for completing this procedure may range from a few hours to a few days, depending on the complexity of the task and the resources available. It is essential to prioritize prompt action to minimize any potential risks to water quality and ensure timely restoration of clean water supply to concessionaires.

Responsibility: Maintenance Team - Operations Department

Procedures:

1) Identify the Contaminated Areas: Identify the areas where the distribution line is contaminated by conducting regular water quality testing and observing any complaints from concessionaires.
2) Prepare the Equipment: Prepare the necessary equipment, such as flushing valves, hoses, and pumps, and ensure that all equipment is clean, in good working condition, and well-maintained.
3) Isolate the Section of the Distribution Line: Isolate the section of the distribution line that needs to be cleaned by closing valves on either end of the section.
4) Flush the Line: Open the flushing valves and flush the line with a high volume of water to remove sediment, debris, and other contaminants. Direct the flow of water away from the concessionaires.
5) Collect and Dispose of Discharged Water: Collect and dispose of the discharged water in an approved manner, such as by pumping it to a treatment plant or a holding pond.
6) Conduct Water Quality Testing: Conduct water quality testing after flushing the line to ensure that the water meets the required standards.
7) Open the Valves: Once the water quality testing has been completed and the water meets the required standards, open the valves and allow the water to flow to the concessionaires.
8) Document the Cleaning Process: Document the cleaning process, including the date, location, equipment used, water quality testing results, and any observations or issues encountered during the process.

AH. Repair and Calibrate Chlorinator Pump Procedure — TSD/EWRD/WSP-SOP07

Purpose: The purpose of this procedure is to repair and calibrate the chlorinator pump used in the water treatment process. It aims to ensure that the pump is functioning properly and delivering the correct amount of chlorine to the water to achieve the required disinfection levels.

Scope: The scope of this procedure includes inspecting the chlorinator pump, identifying any faults, repairing and replacing faulty parts, and calibrating the pump to ensure accurate and consistent delivery of chlorine.

Timeliness: The timeliness for repairing and calibrating a chlorinator pump can vary depending on factors such as the extent of damage or malfunction, the availability of replacement parts, and the complexity of the calibration process. Typically, this procedure may take anywhere from a few hours to a full day to complete, depending on the specific circumstances and the expertise of the personnel involved. It's essential to prioritize swift action to minimize downtime and ensure the continued effectiveness of the water treatment process.

Responsibility: Environment and Water Resources Division / TSD

Procedures:

1) Inspect the Chlorinator Pump: Inspect the chlorinator pump for any visible signs of damage, such as leaks, cracks, or worn-out parts.
2) Identify Faulty Parts: Identify any faulty parts, such as valves, tubing, or fittings, that may be affecting the performance of the pump.
3) Repair and Replace Faulty Parts: Repair or replace any faulty parts that are identified during the inspection. Follow the manufacturer's instructions or seek expert advice if necessary.
4) Clean the Pump: Clean the chlorinator pump and its components thoroughly using appropriate cleaning agents to remove any debris or buildup that may affect its performance.
5) Calibrate the Pump: Calibrate the pump to ensure that it is delivering the correct amount of chlorine to the water. Use a calibrated flowmeter and chemical test kit to check the chlorine level and adjust the pump's settings if necessary.
6) Test the Pump: Test the chlorinator pump by running it for a set period and monitor its performance to ensure that it is functioning properly.
7) Document the Repair and Calibration Process: Document all repair and calibration activities undertaken, including the date, equipment used, parts replaced, and any issues encountered during the process.

It is important to note that these procedures should be performed by qualified professionals with the necessary training, tools, and experience to ensure a safe and successful repair and calibration of the chlorinator pump.

AI. Cleanliness on Water Sources Procedure — TSD/EWRD/WSPSOP08

Purpose: The purpose of this procedure is to ensure that the sources of water and the pump-house or bunkhouse are kept clean and free from contamination. It aims to prevent the spread of disease, maintain the quality of water supplied to consumers, and prolong the lifespan of the equipment used in the water treatment process.

Scope: The scope of this procedure includes identifying the sources of water, such as wells or surface water bodies, and the pump-house or bunkhouse, inspecting them for cleanliness, and taking necessary measures to maintain their cleanliness.

Timeliness: The timeliness for ensuring cleanliness on water sources and pump-houses involves regular inspections and cleaning schedules. Typically, this procedure should be conducted at regular intervals, such as weekly or monthly, depending on the level of contamination risk and regulatory requirements. Each cleaning session may take several hours to complete, including inspection, cleaning, and disinfection processes. Therefore, the timeliness for this procedure depends on the frequency of inspections and the efficiency of the cleaning process, ensuring that water sources and pump-houses remain clean and free from contamination.

Responsibility: Water Facilities Operators,
Environment and Water Resources Division, TSD

Procedures:

1) Identify the Sources of Water: Identify the sources of water, such as wells or surface water bodies, and the pump-house or bunkhouse that require cleaning and maintenance.
2) Inspect the Sources: Inspect the sources for any visible signs of contamination, such as debris, sediment, or algae growth. Check the water quality and quantity regularly.
3) Clean the Sources: Clean the sources thoroughly using appropriate cleaning agents, such as chlorine or hydrogen peroxide, to remove any debris, sediment, or algae growth.
4) Maintain Cleanliness of the Sources: Take necessary measures to maintain the cleanliness of the sources, such as installing covers or screens to prevent debris from entering, regular maintenance of pumps or motors, etc.
5) Inspect the Pump-house/Bunkhouse: Inspect the pump-house or bunkhouse for any visible signs of contamination, such as dust, debris, or pests. Check for any damage to the walls, roofs, or doors.
6) Clean the Pump-house/Bunkhouse: Clean the pump-house or bunkhouse thoroughly using appropriate cleaning agents to remove any dust, debris, or pests.
7) Maintain Cleanliness of the Pump-house/Bunkhouse: Take necessary measures to maintain the cleanliness of the pump-house or bunkhouse, such as regular cleaning schedules, pest control, etc.
8) Document the Cleaning and Maintenance Process: Document all cleaning and maintenance activities undertaken, including the date, equipment used, cleaning agents used, and any issues encountered during the process.

AJ. Repair and Maintenance of Pump and Motor

Purpose: The purpose of this procedure is to repair the pump and motor used in the water sources. It aims to ensure that the pump and motor are functioning properly and delivering water to the treatment plant or distribution network.

Scope: The scope of this procedure includes identifying the type of pump and motor used in the water source, inspecting them for any visible signs of damage, repairing or replacing faulty parts, and testing the equipment to ensure that it is functioning properly.

Timeliness: The timeliness for the repair and maintenance of pumps and motors depends on the severity of the issue and the criticality of the water source's operation. Generally, any repairs should be conducted promptly upon detection of issues to minimize downtime and prevent disruptions to water supply. For routine maintenance, a schedule should be established based on manufacturer recommendations and historical performance data, typically ranging from monthly to annually. Each repair or maintenance session may take several hours to complete, including diagnosis, repair/replacement of parts, and testing. Therefore, timeliness involves ensuring that repairs are conducted promptly and maintenance activities are scheduled and carried out regularly to keep the water sources operational and reliable.

Responsibility: Outsource Contractor and Environment and Water Resources Division, Technical Services Department

Procedures:

1) Identify the Type of Pump and Motor: Identify the type of pump and motor used in the water source, such as a centrifugal pump or submersible pump, and the size and capacity of the motor.
2) Inspect the Pump and Motor: Inspect the pump and motor for any visible signs of damage, such as leaks, corrosion, or worn-out parts. Check the electrical connections and control systems.
3) Identify Faulty Parts: Identify any faulty parts, such as impellers, bearings, or seals, that may be affecting the performance of the pump and motor.
4) Repair and Replace Faulty Parts: Repair or replace any faulty parts that are identified during the inspection. Follow the manufacturer's instructions or seek expert advice if necessary.
5) Test the Equipment: Test the pump and motor to ensure that they are functioning properly. Measure the flow rate, pressure, and electrical current to ensure that they are within the required specifications.
6) Document the Repair Process: Document all repair activities undertaken, including the date, equipment used, parts replaced, and any issues encountered during the process.

It is important to note that these procedures should be performed by qualified professionals with the necessary training, tools, and experience to ensure a safe and successful repair of the pump and motor. Proper personal protective equipment (PPE) must be used during the repair process to prevent injuries or accidents.

AK. Repair and Maintenance of Damaged Bunkhouse

Purpose: The purpose of this procedure is to repair a damaged pump-house or bunkhouse in water sources. It aims to ensure that the structure is safe, functional, and able to protect the equipment and personnel working in the area.

Scope: The scope of this procedure includes identifying the damage to the pump-house or bunkhouse, assessing the extent of the damage, planning the repair process, and executing the repair activities. It also includes ensuring that safety measures are in place throughout the repair process.

Timeliness: The timeliness for repairing a damaged bunkhouse varies based on severity, with critical repairs prioritized for immediate action. Repair steps include assessment, planning, material procurement, and execution, aiming for efficiency while maintaining safety. Depending on damage extent, repairs may range from days to weeks.

Responsibility: Engineering and Planning, Environment and Water Resources Division
Technical Services Department

Procedures:

1) Identify the Damage: Identify the extent and type of damage to the pump-house or bunkhouse, such as cracks, leaks, or structural damage.
2) Assess the Extent of the Damage: Assess the extent of the damage to determine the repair requirements and prioritize the repairs based on safety concerns and equipment protection.
3) Plan the Repair Process: Develop a repair plan that includes the materials and equipment needed, the safety measures required, and the repair activities.
4) Execute the Repair Activities: Execute the repair activities according to the plan. Repair any structural damage, replace any damaged materials, and fix any leaks or other issues. Ensure that safety measures, such as fall protection and proper ventilation, are in place throughout the repair process.
5) Test the Repaired Structure: Test the repaired structure to ensure that it is safe, functional, and able to protect the equipment and personnel working in the area.
6) Document the Repair Process: Document all repair activities undertaken, including the date, materials and equipment used, and any issues encountered during the process.

It is important to note that these procedures should be performed by qualified professionals with the necessary training, tools, and experience to ensure a safe and successful repair of the pump-house or bunkhouse. Proper personal protective equipment (PPE) must be used during the repair process to prevent injuries or accidents.

AL. Leak Detection Procedure

Purpose: The purpose of this procedure is to detect leaks on water lines and report them to the water district for immediate repair. It aims to prevent water loss, damage to infrastructure and property, and ensure that water supply is uninterrupted.

Scope: The scope of this procedure includes identifying the location of the leak, assessing its severity, and reporting it to the water district for immediate repair. It also includes implementing temporary measures to mitigate the damage while waiting for the repair crew to arrive.

Timeliness: The timeliness for leak detection depends on factors like leak size and location. Upon detection, immediate reporting to the water district is crucial for prompt repair, minimizing water loss and infrastructure damage. Temporary measures may be implemented until repairs are completed. Timeliness can range from hours for critical leaks to days for less severe ones.

Responsibility: Pipelines and Appurtenances Maintenance Division, Operations Department

Procedures:

1) Identify the Location of the Leak: Identify the location of the leak using leak detection equipment or by visual inspection of the water line. Check for any signs of water damage, such as water puddles, wet soil, or decreased water pressure.
2) Assess the Severity of the Leak: Assess the severity of the leak based on the amount of water flowing and the potential impact on infrastructure and property.
3) Report the Leak to the Water District: Report the leak to the water district immediately, providing information on the location, severity, and any other relevant details, such as whether the leak is affecting any critical facilities, such as hospitals or schools.
4) Implement Temporary Measures: Implement temporary measures to mitigate the damage, such as shutting off the water supply to the affected area or diverting the flow of water. Notify any affected customers of the temporary water service interruption.
5) Monitor the Leak: Monitor the leak to ensure that it does not worsen and that the temporary measures are effective.
6) Verify Immediate Repair: Ensure that the water district has received the report and that the repair crew is dispatched immediately to repair the leak.
7) Document the Leak: Document all leak detection and reporting activities undertaken, including the date, location, severity, and any temporary measures implemented.

It is important to note that these procedures should be performed by qualified professionals with the necessary training, tools, and experience to ensure a safe and successful leak detection and reporting process. Proper personal protective equipment (PPE) must be used during the process to prevent injuries or accidents.

AM. Repair and Maintenance of Generator Set Procedure

Purpose: The purpose of this document is to outline the procedures for the repair and maintenance of generator sets. The generator sets are critical pieces of equipment that provide backup power in the event of a power outage or when there is a need for portable power. Proper maintenance and repair procedures are necessary to ensure the reliable operation of these generator sets.

Scope: This document covers the repair and maintenance of generator sets, including both routine maintenance and major repairs. The generator sets covered by this document may be used for emergency backup power or as a primary power source in remote or off-grid locations. The procedures outlined in this document are applicable to generator sets powered by diesel, gasoline, or natural gas.

Timeliness: The timeliness for repairing and maintaining generator sets depends on factors like the nature of the issue and the availability of replacement parts. Routine maintenance tasks may be performed regularly, such as monthly or quarterly, to prevent breakdowns. For urgent repairs, response time should be swift to minimize downtime. Timeliness can range from immediate action for critical failures to scheduled maintenance within days or weeks for routine tasks.

Responsibility: Auto-Mechanic, GSD and Environment and Water Resources Division

Procedures:

❖ **Routine maintenance:**

Regular maintenance is essential to keep generator sets in good working condition. The following procedures should be performed on a regular basis:

a) Check and change oil: Generator sets require regular oil changes to ensure proper lubrication of the engine. The oil should be changed every 100-200 hours of operation or as recommended by the manufacturer.

b) Check and replace filters: The air, fuel, and oil filters should be checked and replaced as needed to ensure proper engine performance.

c) Inspect and replace belts: Generator sets use belts to drive the generator and other components. These belts should be inspected regularly for signs of wear and replaced as needed.

d) Test batteries: Generator sets rely on batteries to start the engine. These batteries should be tested regularly and replaced as needed.

❖ **Major repairs:**

In the event of a major repair, the following procedures should be followed:

a) Shut down the generator: Before beginning any repair work, the generator should be shut down and disconnected from any power source.

b) Diagnose the problem: The problem should be diagnosed to determine the extent of the repair needed.

c) Obtain necessary parts and tools: Any necessary parts and tools should be obtained before beginning the repair work.

d) Repair the generator: The repair work should be carried out according to the manufacturer's specifications.

e) Test the generator: After the repair work is complete, the generator should be tested to ensure that it is functioning properly.

Safety procedures:

When working on generator sets, it is important to follow appropriate safety procedures to prevent accidents or injuries. The following safety procedures should be followed:

a) Wear appropriate personal protective equipment, such as gloves and eye protection.

b) Follow lockout/tagout procedures to ensure that the generator is not accidentally started.

c) Keep the work area clean and free of clutter.

d) Never work on a generator set that is still running or has not been properly shut down.

e) Follow all other applicable safety procedures as outlined in the manufacturer's instructions or by local regulations.

f) Documentation and submission of Accomplishment Report.

Note:

By following these procedures for the repair and maintenance of generator sets, you can ensure that your equipment is always in good working condition and ready to provide reliable backup power when needed. Regular maintenance and proper repairs can help extend the life of your generator set and prevent costly downtime.

AN. Transferring Power Source in case of Meralco power outage Procedure

Purpose: The purpose of this is to outline the procedures for transferring power source in case of Meralco power outage. The procedures will help ensure that critical equipment and systems remain operational during a power outage, minimizing disruption to water supply operations.

Scope: This covers the transfer of power source in case of Meralco power outage in commercial and industrial settings. The procedures outlined in this document are applicable to backup power systems such as generators, batteries, and UPS systems.

Timeliness: The timeliness for transferring power source in case of a Meralco power outage depends on the urgency of the situation and the criticality of the equipment involved. In emergency situations, such as during a power outage, immediate action is necessary to minimize disruptions to water supply operations. Therefore, the transfer of power source should be executed promptly upon detection of the outage. Delays should be minimized to ensure continuity of operations and prevent any adverse impacts on the water supply system.

Responsibility: Water Sources Facilities Operator / EWRD

Procedures:

1) Assess the power outage: Evaluate the cause and estimated duration of the power outage to determine the appropriate generator set to use.
2) Activate the generator set: Start and activate the generator set according to the manufacturer's instructions and safety protocols.
3) Transfer the load: Switch the load from the main power source to the generator set using circuit breakers or a transfer switch.
4) Monitor the generator set: Continuously monitor the generator set to ensure it is supplying sufficient power to critical equipment and systems. Adjust settings if necessary.
5) Restore power: Once the main power is restored, switch the load back to the main power source, reversing the transfer process.
6) Test the generator set: After power is restored, conduct tests to ensure the generator set's proper functioning and readiness for future outages.
7) Keep record on the incident and inform immediate supervisor of the power situation.

AO. Fuel / Diesel Delivery for Generator at Water Sources

Purpose: The purpose of this document is to outline the procedures for delivering fuel or diesel to generators in water sources. This will ensure that generators located in remote or off-grid areas, such as water sources, have a reliable supply of fuel to operate.

Scope: This document covers the delivery of fuel or diesel to generators in water sources, such as lakes, rivers, or dams. The procedures outlined in this document are applicable to all types of generators powered by fuel or diesel.

Timeliness: The timeliness for fuel or diesel delivery to generators at water sources should be prompt to ensure uninterrupted operation of the generators, especially during periods of high demand or emergencies. Ideally, fuel delivery should occur before the generator's fuel levels become critically low to prevent disruptions to water supply operations. Delays in fuel delivery could lead to downtime, affecting the reliability of the water supply system. Therefore, efficient scheduling and timely execution of fuel deliveries are essential to maintain operational continuity.

Responsibility: Fuel Delivery Team, Environment and Water Resources Division, TSD

Procedures:

1) Assess the location: Evaluate the accessibility, proximity to fuel depot, and any safety or environmental considerations at the generator location.
2) Choose the delivery method: Select the appropriate method for delivering fuel or diesel based on the location assessment. This may involve using fuel drums transported by truck or other suitable means.
3) Ensure safety: Prioritize safety by following all necessary procedures. Use personal protective equipment, ground fuel tanks and containers, and adhere to relevant regulations and guidelines.
4) Load and secure the fuel: Get approved Fuel Requisition Slip and load the fuel or diesel onto the delivery vehicle from fuel station, ensuring proper securing of fuel tanks and containers.
5) Transport the fuel: Safely transport the fuel to the generator location, ensuring proper anchoring and securing if using a fuel barge.
6) Unload the fuel: Carefully unload the fuel or diesel at the generator location, taking precautions to prevent spills or leaks.
7) Refuel the generator: Refuel the generator using the delivered fuel or diesel, following the manufacturer's instructions and ensuring proper ventilation of fuel tanks.
8) Monitor fuel level: Keep track of the fuel level in the generator and schedule additional deliveries as needed to maintain a reliable fuel supply.

AP. Chlorine Powder Supply Delivery to Water Sources

Purpose: The purpose of this document is to outline the procedures for delivering chlorine powder or chlorine gas to water treatment facilities for the purpose of disinfecting water sources. This will help ensure that the water is safe for human consumption and meets the required standards for water quality.

Scope: This document covers the delivery of chlorine powder to water treatment facilities, including municipal water treatment plants and private water sources. The procedures outlined in this document are applicable to all types of water treatment facilities.

Timeliness: The timeliness for delivering chlorine powder to water treatment facilities is crucial for maintaining water safety and quality. Ideally, deliveries should be scheduled in advance to ensure a continuous supply of chlorine for disinfection purposes. Delays in chlorine powder delivery could result in insufficient disinfection levels, compromising water quality and potentially posing health risks to consumers.

Responsibility: Delivery Team, Environment and Water Resources Division

Procedures:

1) Handling:
- Trained personnel handle the chlorine powder with care, wearing appropriate personal protective equipment (PPE) such as gloves and goggles.
- They use suitable equipment, such as scoops or measuring devices, to transfer the chlorine powder from storage containers to the treatment facility.

2) Transportation to Water Treatment Facility:
- The chlorine powder is transported to the water treatment facility using designated vehicles equipped with secure containers or packaging to prevent spills or leaks during transit.
- Drivers adhere to safe driving practices and follow prescribed routes to minimize risks during transportation.

3) Delivery to Water Treatment Facility:
- Upon arrival at the water treatment facility, the chlorine powder is unloaded and transferred to the designated storage area within the facility.
- Personnel responsible for handling chlorine at the treatment facility receive and verify the delivery against the accompanying documentation.

4) Documentation:
- All relevant documentation, including delivery receipts, invoices, and inspection reports, is filed and maintained for record-keeping purposes.
- Any discrepancies or issues identified during the delivery process are documented and reported to the appropriate personnel for resolution.

5) Safety Measures:
- Safety protocols and procedures are strictly followed throughout the delivery process to minimize the risk of accidents, spills, or exposure to chlorine powder.
- Emergency response procedures are in place, and personnel are trained to handle any unforeseen incidents or emergencies effectively.

By following this procedure, the safe and timely delivery of chlorine powder to water treatment facilities is ensured, contributing to the continued provision of clean and safe drinking water to the community.

AQ. Installation of Air Release Valves

Purpose: This is to establish guidelines for the installation of air release valves in water distribution systems for the water district. The installation of air release valves aims to improve the efficiency and safety of the water distribution system by releasing trapped air, reducing system pressure, and minimizing the risk of water hammer.

Scope: This document applies to all water district employees and contractors responsible for installing air release valves in the water distribution system. The procedures outlined in this document apply to the installation of air release valves in both new and existing water distribution systems.

Timeliness For the installation of air release valves in the water distribution system, the process involves initial planning and site assessment lasting 1-2 weeks, followed by procurement of materials within 1-2 weeks. Subsequently, sites are prepared over 1-2 days per site to ensure safety measures. Valve installation takes place over 1-2 days per valve, followed by connection to the system within the same timeframe. Testing and commissioning occur over 1-2 days, with ongoing documentation of the installation process and generation of reports to maintain efficiency and enhance water distribution system performance.

Responsibility: Pipelines and Appurtenances Maintenance Division, Operations Department

Procedures:

1) Develop a detailed plan and design to ensure proper selection, sizing, and placement of air release valves. Include a review of system layout, hydraulic characteristics, and operating conditions.
2) Select air release valves based on system pressure, flow rate, and expected air volume. Ensure compatibility with existing pipeline material and compliance with industry standards.
3) Install air release valves at high points in the system for efficient air release. Use proper techniques for installation, including appropriate valve orientation and torque specifications.
4) Test and commission air release valves after installation. Conduct a thorough inspection, pressure test, and monitor performance over time.
5) Regularly maintain and inspect air release valves to prevent downtime and damage to the system. Promptly address any issues.
6) Document installation, testing, and maintenance activities related to air release valves in detail to facilitate future maintenance and repair activities.

AR. Repair and Maintenance of Fire Hydrant OD/WSP-SOP13

Purpose: The purpose of this document is to establish guidelines and procedures for the repair and maintenance of fire hydrants. It aims to ensure the proper functioning and reliability of fire hydrants, which are critical components of the fire protection system. Regular maintenance and prompt repair of fire hydrants are essential for the safety and effectiveness of firefighting operations.

Scope: This document applies to all personnel involved in the repair and maintenance of fire hydrants, including maintenance teams, technicians, and relevant stakeholders. It covers the inspection, testing, repair, and routine maintenance of fire hydrants within the designated area.

Timeliness: Timeliness is essential in the repair and maintenance of fire hydrants to ensure their functionality during emergencies. Delays in addressing issues can jeopardize firefighting operations and public safety. Therefore, adherence to established repair and maintenance procedures is crucial to promptly address any issues and maintain the reliability of fire hydrants.

Responsibility: Pipelines and Appurtenances Maintenance Division, Operations Department

Procedures:

1) Inspection and Testing:

   a) Regular Inspections: Conduct routine inspections of fire hydrants to identify any visible signs of damage, deterioration, or malfunction. This includes checking for leaking valves, damaged components, proper signage, and accessibility.

   b) Flow Testing: Perform periodic flow tests to assess the water supply capacity and pressure of the fire hydrant. Ensure that the flow rate meets the specified standards and record the test results for future reference.

2) Repair and Maintenance:

   a) Prompt Response: Address repair requests or reported issues with fire hydrants promptly to minimize downtime and ensure their operational readiness.

   b) Component Replacement: Replace damaged or malfunctioning components of the fire hydrant, such as valves, stems, caps, gaskets, or hydrant heads, using appropriate tools and equipment.

c) Valve Exercising: Regularly exercise and lubricate the valves of fire hydrants to prevent seizing and ensure smooth operation.

d) Flushing and Cleaning: Conduct periodic flushing and cleaning of fire hydrants to remove sediment, debris, and potential obstructions from the water supply line.

e) Painting and Marking: Maintain the visibility of fire hydrants by repainting them as necessary and ensuring that proper markings, such as reflective bands or color-coded caps, are in place.

3) Documentation and Reporting:

a) Maintenance Records: Keep detailed records of all maintenance and repair activities performed on fire hydrants. This includes documenting the date, nature of the work, replacement parts used, and any specific observations or recommendations.

b) Reporting: Provide timely reports to relevant stakeholders, such as the fire department or water utility, regarding the status of fire hydrant repairs, maintenance schedules, and any outstanding issues that require attention.

4) Training and Education:

a) Training Programs: Provide training and education programs to maintenance personnel on fire hydrant repair and maintenance procedures, safety protocols, and the proper use of tools and equipment.

b) Knowledge Transfer: Promote knowledge sharing and collaboration among maintenance teams to enhance skills and expertise in fire hydrant repair and maintenance.

Regular and proactive repair and maintenance of fire hydrants are essential for ensuring their optimal functionality and readiness during firefighting operations. This document serves as a reference for personnel involved in fire hydrant repair and maintenance activities, outlining the procedures and responsibilities necessary to maintain a reliable and effective fire protection system.

AS. Chlorine Residual Test at Water Sources

Purpose: To ensure that the chlorine residual in drinking water is within the range of 0.3 ppm to 1.5 ppm, which is the recommended level for safe and effective disinfection.

Scope: This procedure applies to all drinking water systems that use chlorine for disinfection.

Timeliness: Integrating hourly testing into the chlorine residual procedure at water sources ensures timely monitoring of disinfection levels. By conducting tests every hour, adjustments can be promptly made to maintain chlorine levels within the recommended range of 0.3 ppm to 1.5 ppm. This proactive approach enhances timeliness, ensuring continuous adherence to safety standards and water quality regulations.

Responsibility: Water Resource Facilities Operator
Laboratory Section
Environment and Water Resources Division

Procedures:

1) Collect a representative sample of the water to be tested from the water source.
2) Use a digital chlorine analyzer to measure the chlorine residual in the sample.
3) Check the residual chlorine. It must be within the the desired range of 0.3 ppm to 1.5 ppm. If the chlorine residual is outside this range, proceed to step 4.
4) Adjust the chlorinator or feed pump to increase or decrease the chlorine dosage as needed to achieve the desired residual.
5) Retest the water to confirm that the chlorine residual is within the desired range.
6) Record the results of the test, including the date, time, location, and chlorine residual level.
7) If the chlorine residual remains outside the desired range, investigate the cause and take appropriate corrective action.

By following these procedures, water systems can ensure that the drinking water is properly disinfected and meets the required safety standards.

AT. Repair and Maintenance of Pipe Bridge Crossing

Purpose: The purpose of the Pipe Bridge Crossing Repair and Maintenance in the Water Safety Plan is to ensure the integrity, functionality, and safety of pipe bridge crossings within the water distribution system. This includes identifying and addressing any damages, leaks, or potential risks associated with the pipe bridge crossings to maintain a reliable and secure water supply.

Scope: The scope of the Pipe Bridge Crossing Repair and Maintenance includes all pipe bridge crossings within the water distribution system. This encompasses the inspection, assessment, repair, and ongoing maintenance activities necessary to ensure the structural integrity and optimal performance of the pipe bridge crossings.

Timeliness: The timeliness for pipe bridge repair and maintenance involves several steps. Initial inspection takes 1-2 days, followed by 1-2 days for repair planning. Repair execution varies from 3 to 7 days based on complexity. Ongoing maintenance is scheduled every 3-6 months to uphold structural integrity and performance.

Responsibility: Pipelines and Appurtenances Maintenance Division, Operations Department

Procedures:

1) Inspection and Assessment:

- ❖ Regularly inspect all pipe bridge crossings to identify any signs of damage, deterioration, or potential risks.
- ❖ Assess the condition and structural integrity of the pipe bridge crossings using appropriate inspection techniques and tools.
- ❖ Evaluate the impact of any identified issues on the overall water distribution system and water safety.

2) Damage and Leak Repair:

- ❖ Promptly address any identified damages or leaks in the pipe bridge crossings to prevent further deterioration and potential water loss.
- ❖ Implement suitable repair techniques based on the type and extent of damage, ensuring adherence to industry standards and regulations.

- Conduct necessary repairs using appropriate materials, equipment, and techniques to restore the functionality and safety of the pipe bridge crossings.

3) Risk Mitigation:

- Identify and assess potential risks associated with the pipe bridge crossings, such as structural instability, environmental factors, or external interferences.
- Develop and implement risk mitigation strategies to minimize the likelihood and impact of risks on the pipe bridge crossings.
- Regularly monitor and evaluate the effectiveness of risk mitigation measures and make adjustments as needed.

4) Ongoing Maintenance:

- Establish a preventive maintenance program for regular inspection, cleaning, and maintenance activities of the pipe bridge crossings.
- Schedule routine maintenance tasks, such as cleaning debris, clearing vegetation, and inspecting support structures.
- Conduct necessary maintenance activities to ensure the long-term performance and safety of the pipe bridge crossings.

5) Documentation and Reporting:

- Maintain detailed records of inspection findings, repair activities, maintenance schedules, and any relevant documentation related to pipe bridge crossings.
- Generate reports on the condition of the pipe bridge crossings, highlighting any significant findings, repairs, or maintenance actions taken.
- Provide regular updates to relevant stakeholders, such as water utility management, regulatory bodies, and maintenance personnel, regarding the repair and maintenance activities.

By implementing the Pipe Bridge Crossing Repair and Maintenance procedures, water utilities can ensure the reliability, safety, and efficient functioning of pipe bridge crossings, ultimately contributing to the overall water safety and uninterrupted water supply for consumers.

AU. Repair and Maintenance of Electrical System

Purpose: The purpose of checking and maintenance of the electrical system of water sources is to ensure the safe and efficient operation of the electrical equipment that is used to pump and distribute water. Regular checking and maintenance will help prevent breakdowns and reduce the risk of electrical hazards.

Scope: The scope of this procedure covers the checking and maintenance of the electrical system of water sources, including electrical motors, control panels, switch-gear, transformers, and other electrical equipment used in the pumping and distribution of water.

Timeliness: Timeliness is essential in conducting repairs and maintenance on the electrical system of water sources to ensure the safe and efficient operation of equipment. Regular checks and maintenance procedures should be scheduled at intervals conducive to preventing breakdowns and minimizing the risk of electrical hazards. Prompt response to any detected issues or potential risks is crucial to maintaining uninterrupted water supply and preventing system failures.

Responsibility: Maintenance Team, Environment and Water Resources Division

Procedures:

1) Visual Inspection - Conduct a visual inspection of the electrical equipment used in the water source to check for any signs of damage, wear, or corrosion.
2) Electrical Testing - Test all electrical equipment using a multi-meter or other appropriate electrical testing equipment to check for proper functioning and electrical continuity.
3) Check Electrical Connections - Check all electrical connections for loose or corroded connections, and tighten or replace as necessary.
4) Check Fuses and Circuit Breakers - Check fuses and circuit breakers for proper rating and replace if needed.
5) Lubrication - Check all moving parts and bearings and lubricate them as necessary to ensure proper functioning.
6) Check Control Panels - Check control panels for proper functioning, cleanliness, and any signs of wear or damage. Clean or replace components as necessary.
7) Check for Overheating - Check for overheating of electrical components by feeling for hot spots or using an infrared thermometer. Investigate and correct any overheating problems immediately.
8) Cleaning - Clean all electrical equipment, enclosures, and wiring to remove any dirt, dust, or debris that may affect their operation.
9) Record Keeping - Maintain a record of all electrical inspections, tests, repairs, and replacements made to the electrical equipment of water sources.

AV. Addressing Customer Complaints Procedure

Purpose: The purpose of addressing customer complaints for a water district is to ensure prompt resolution of issues related to water quality, pressure, billing, and customer service. It demonstrates a commitment to customer satisfaction and enables identification of areas for improvement to increase trust, retention, and revenue.

Scope: The scope includes receiving, investigating, and responding to complaints related to water quality, pressure, billing, and customer service, and implementing corrective actions to increase satisfaction and retention.

Timeliness: Addressing customer complaints involves several timely steps. Upon receiving a complaint, it should be acknowledged within 24 hours. Investigation and resolution vary but aim to be completed within 3-5 business days. Follow-up with the customer should occur promptly after resolution. Overall, the goal is to address complaints swiftly and effectively to maintain customer satisfaction.

Responsibility:

1) All personnel receiving a complaint shall record the complaint on the Complaint Record Form (CSD-030-0).
2) CREAS (Community Relations and External Affairs Section under Customer Services Division is responsible in filing and forwarding each complaint to responsible teams, maintaining a file listing designated for complaints.
3) CREAS shall perform necessary investigation, subsequently redirecting the complaint to the head of concerned department.
4) Head of responsible department shall review and ensure that complaints are appropriately handled, investigated and appropriate measures are taken in respect of the complaint regarding the service provided to prevent recurrences.
5) A summary of action taken shall be furnished and handed over to CREAS for filing.

Procedures:

4.1 Complaints may be received from internal or external source and as verbal feedback or written feedback. Verbal feedback may be received in person or via telephone conversation. Written complaints may be received in the form of letters, e-mails, chats, comments from social media pages, etc.

Complaints received through the following channels are catered by CREAS under the Customer Services Division of the Commercial Department

Inbound calls:	(049) 562-9955
Email:	creas@spcwd.org.ph
Official Website:	www.spcwd.org.ph

Social Media (Facebook): San Pablo City Water District
Through courier: San Pablo City Water District, Brgy. San Gabriel Maharlika Highway, San Pablo City 4000

All complaints shall be recorded using the Customer Complaint Form (CSD-030-0).
4.2 Once the complaint is received, it is to be recorded in the Complaint Monitoring sheet and shall be sent to concerned department for immediate settlement/resolution of the complaint. The following key information is to be obtained at the time of the initial customer interaction:

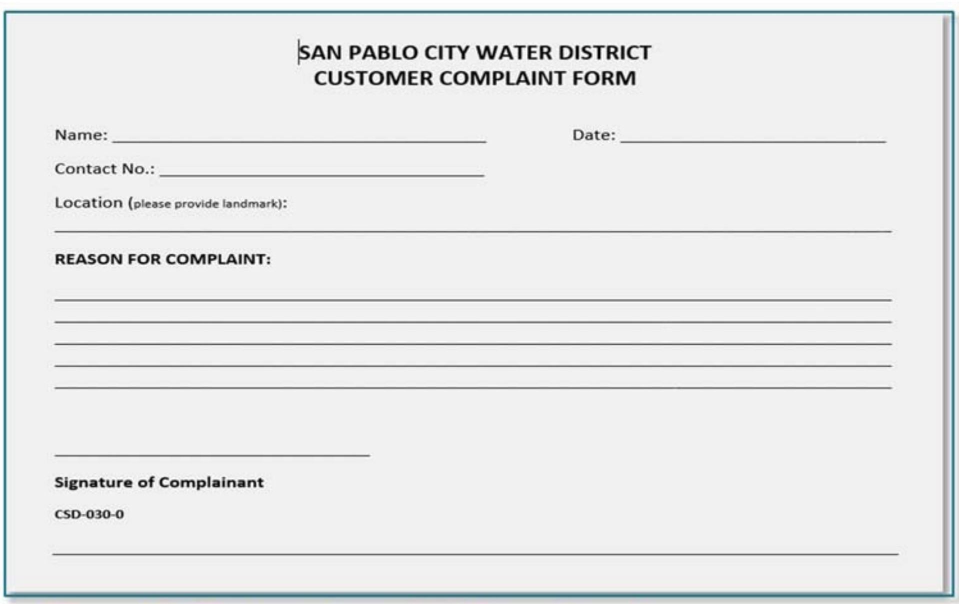
a) Date
b) Complainant's name / SPCWD Account name
c) Address
d) Phone number
e) Nature/reasons for complaint
f) Complainant's signature

If there is insufficient data, additional information from the originating source shall be requested.

4.3 Head of responsible department should then proceed to handling the complaint. If complaint is resolved within 24 hours, it shall be marked closed. If it is not resolved due to any complexity, it shall be accelerated and consulted to the General Manager for appropriate measures to be taken for its immediate settlement.

4.4 Any action taken as a result of the complaint shall be forwarded to CREAS for recording in the Complaint Monitoring Sheet / List.

4.5 All complaints shall be reviewed as part of the annual customer service review to determine whether there are specific or recurring problems that may require attention.


SAN PABLO CITY WATER DISTRICT
CUSTOMER COMPLAINT FORM

Name: ______________________ Date: ______________

Contact No.: ______________________

Location (please provide landmark):

____

REASON FOR COMPLAINT:

____
____
____
____
____

____

Signature of Complainant

CSD-030-0

Figure 10. Customer Complaint Form Sample

AW. Reduction of Non-Revenue Water

Purpose: The purpose of this strategy is to outline a comprehensive approach for reducing non-revenue water (NRW) for the Water Service Provider (WSP). By implementing effective measures and procedures, the WSP aims to minimize water losses, optimize revenue generation, and enhance operational efficiency.

Timeliness: The strategy for reducing non-revenue water (NRW) involves timely implementation to achieve its objectives. Initial assessment and planning should be completed within a few months, followed by swift implementation of identified measures. Continuous monitoring and adjustments are essential, with progress reports issued regularly to track performance. The overall goal is to achieve significant reductions in NRW within a reasonable timeframe, typically over several years.

Responsibility: Operations Department / TSD / WSP

Scope: The NRW reduction strategy encompasses the following:

1) **Leakage Management:**
   a) Identification and prioritization of high-leakage areas.
   b) Regular leak detection surveys and maintenance activities.
   c) Prompt repair of leaks and rehabilitation of aging infrastructure.
   d) Implementation of pressure management systems to minimize leakage.

2) **Metering and Billing:**
   a) Installation of accurate and tamper-proof meters across the network.
   b) Regular meter reading and validation to ensure billing accuracy.
   c) Investigation and resolution of customer complaints related to billing discrepancies.
   d) Implementation of advanced metering infrastructure (AMI) for real-time monitoring and data analysis.

3) **Infrastructure Management:**
   a) Asset management practices to assess the condition and lifespan of infrastructure components.
   b) Development of a comprehensive maintenance schedule for pipelines, valves, and reservoirs.
   c) Prioritization of infrastructure upgrades based on criticality and potential impact on NRW reduction.
   d) Integration of technology solutions for remote monitoring and control of infrastructure.

4) Customer Engagement and Education:

a) Awareness campaigns to educate customers about the importance of water conservation.
b) Provision of customer portals and mobile applications for consumption monitoring and leak reporting.
c) Regular communication and engagement with customers regarding NRW reduction initiatives.
d) Collaboration with local communities and stakeholders to promote responsible water usage.

Procedures:

To implement the NRW reduction strategy effectively, the following procedures will be followed:

1) Conduct an Initial Assessment:

a) Evaluate the existing NRW levels and identify key contributing factors.
b) Analyze historical data, metering records, and customer complaints to assess the magnitude of the problem.
c) Perform hydraulic modeling and water balance analysis to identify areas of concern.

2) Develop an Action Plan:

a) Set specific and measurable targets for NRW reduction.
b) Define roles and responsibilities of stakeholders involved in the implementation.
c) Allocate necessary resources, including budget and skilled personnel.
d) Establish a timeline with milestones and key performance indicators (KPIs).

3) Implement and Monitor:

a) Execute the NRW reduction initiatives as per the action plan.
b) Monitor and evaluate the effectiveness of measures implemented.
c) Regularly update and maintain a database of NRW-related information.
d) Conduct periodic audits and performance reviews to track progress.

4) Continuous Improvement:

a) Analyze data and performance indicators to identify areas for further improvement.
b) Explore innovative technologies and best practices in NRW management.
c) Seek feedback from customers and stakeholders for process refinement.
d) Continuously train and educate staff on NRW reduction techniques and methodologies.

AX. Budgeting Procedure for Water Safety Plan

Purpose: The purpose of this document is to establish a clear framework for budgeting equipment, tools, vehicles, and chemicals for the Water Safe Plan (WSP) based on a priority list. This budgeting process aims to ensure efficient allocation of resources, prioritize critical needs, and support the effective implementation of WSP programmes.

Scope: The scope of this budgeting process encompasses the identification, estimation, and allocation of financial resources required for procuring equipment, tools, vehicles, and chemicals necessary for WSP. The process will consider the priority list of items based on their criticality and immediate impact on program objectives.

Timeliness: The budgeting procedure for the Water Safety Plan (WSP) involves identifying necessary resources, estimating financial needs, and allocating budgets promptly based on priority lists. This process ensures efficient allocation of resources for procurement and timely implementation of WSP initiatives, typically completed within a few weeks.

Responsibility: Water Safety Plan Team
Technical Services Department
Operations Department

Procedures:

1) **Identify Priority List:**
   - ❖ Review the priority list of equipment, tools, vehicles, and chemicals based on the specific needs and requirements of the WSP programmes.
   - ❖ Prioritize the items on the list based on their urgency, impact on project outcomes, and available budgetary resources.
2) **Conduct Needs Assessment:**
   - ❖ Assess the specific equipment, tools, vehicles, and chemicals required for each project based on technical specifications, project plans, and stakeholder input.
   - ❖ Determine the quantity, quality, and specifications of the items needed to fulfill project requirements.
3) **Estimate Costs:**
   - ❖ Gather price quotations, catalogues, or engage with suppliers to obtain cost estimates for the identified items.

- ❖ Consider the cost of procurement, transportation, installation, maintenance, and any associated training or support services.

4) Develop Budget:

- ❖ Prepare a comprehensive budget that includes all the identified items, their associated costs, and any additional expenses related to procurement and utilization.
- ❖ Allocate budgetary resources based on the priority ranking of the items, giving higher priority to critical and immediate needs.

5) Seek Approvals:

- ❖ Present the budget proposal to relevant stakeholders, including program managers, finance departments, and decision-makers.
- ❖ Provide necessary justifications and highlight the importance of each item in achieving program goals and outcomes.

6) Monitor and Review:

- ❖ Regularly monitor budget utilization and compare it against the approved budget to ensure adherence and identify any deviations.
- ❖ Conduct periodic reviews to assess the effectiveness of the budgeting process and make necessary adjustments or relocations based on changing needs or priorities.

7) Procurement and Implementation:

- ❖ Initiate the procurement process for approved items in accordance with organizational policies and procedures.
- ❖ Coordinate with the procurement team to ensure timely acquisition, delivery, and installation of the equipment, tools, vehicles, and chemicals.
- ❖ Monitor the implementation progress and address any challenges or issues that arise during the procurement and utilization phases.

ANNEX O. Management Procedures for Major Incidents and Corrective Actions

In response to major incidents within the San Pablo City Water District (SPCWD), comprehensive management procedures and corrective actions have been established to swiftly address and mitigate the impact of such events. These procedures encompass a range of protocols designed to ensure effective incident management, including immediate response, thorough assessment, and decisive action planning. By swiftly implementing these procedures, the SPCWD aims to minimize disruptions to water services, safeguard infrastructure, and prioritize the safety and well-being of residents and personnel.

1. Key Personnel:

Table 45. Emergency Response Team - Major Incident

Emergency Response Team (ERT)			
Function	**Person in charge**	**Position**	**Contact Details**
Incident Commander	**Jonnas Firmo C. Biscocho**	Acting Division Manager EWRD	0917 630 4302
Communication Commander	**Wilfredo M. Aligato**	Division Manager, GSD	0917 633 5278
Scene Supervisor	**Engr. Wilson M. Awayan**	Division Manager, Production	0920 952 3435
Route Guide	**Arvin B. Gutierrez**	General Services Chief - B	0928 521 6806
Public Information Team (CREAS)	**Cherry Mae C. Cimatu**	Senior Community Relations Officer	0998 561 7161
Operational Response Technical Services Dept	**Jonnas Firmo C. Biscocho**	Acting Division Manager EWRD	0917 630 4302
Operational Response Operations Dept	**Engr. Wilson M. Awayan**	Division Manager, Production Division	0929 952 3435
Water Collection and Analysis	**Ma. Jamela V. Dimapilis**	OIC-Laboratory Supervisor	0906 024 5054
Support and Logistics Team	**Arvin B. Gutierrez**	General Services Chief – B	0928 521 6806
Training and Development	**Mervin M. Quijano**	Training and Development Officer	(049) 562 9955
Information and Communication Technology	**Marnie U. Garbo**	IT Specialist	(049) 562 9955 Loc 117
Water Safety Plan Committee	**Wilfredo M. Aligato**	WSP Team Leader	0917 633 5278

2. Backup Equipment:

a) The General Services Store Room serves as a critical hub for storing backup equipment, including spare pumps, filters, and pipelines and fittings, ensuring readiness for any unforeseen operational disruptions.

b) Regular inspections and proactive maintenance protocols are diligently carried out to sustain the reliability and functionality of backup equipment, minimizing downtime during emergencies.

c) Team members receive specialized training to swiftly transition to backup equipment when necessary, fostering a culture of preparedness and resilience in response to operational challenges.

3. Logistic and Technical Information:

a) The EWRD Division Manager oversees a comprehensive repository of technical data, meticulously documenting vital information on water sources, treatment processes, and monitoring parameters, facilitating informed decision-making and system optimization.

b) Concurrently, the General Services Chief manages logistical data, including transportation routes, evacuation plans, and access points, ensuring efficient resource allocation and strategic response capabilities in emergency scenarios.

4. Standard Operating Procedures (SOPs):

a) Guided by the WSP Team Leader, the development and maintenance of robust Standard Operating Procedures (SOPs) are prioritized, serving as foundational guidelines for operational consistency and regulatory compliance.

b) Regular review and refinement of SOPs occur annually to incorporate industry best practices and regulatory updates, promoting continuous improvement and adaptability in response to evolving operational requirements.

c) During deviations from standard procedures, SOPs provide clear directives, empowering team members to execute timely and effective responses, safeguarding operational integrity and service reliability.

AY. Resolving the Cause and Effect of Contaminated Water

Purpose: The purpose of this procedure is to establish a comprehensive framework for the San Pablo City Water District (SPCWD) to address potential contamination threats to its water supply system. This aims to ensure the uninterrupted provision of potable water to the city's residents, protect essential infrastructure, and maintain public trust in the SPCWD's capacity to deliver safe water.

Scope: This procedure encompasses all elements and operations of the SPCWD water supply system, including water sources, treatment plants, storage facilities, pipelines, distribution points, and related personnel. It outlines steps for prevention, detection, response, and recovery in the event of water contamination.

Timeliness: The procedure swiftly addresses potential water contamination threats in the San Pablo City Water District (SPCWD) system, ensuring rapid response to safeguard public health and essential infrastructure. It encompasses all system elements and operations, focusing on immediate prevention, detection, response, and recovery measures. Typically completed within hours to days, it prioritizes swift action to mitigate risks and restore water quality, reflecting the urgency of the situation.

Responsibility:

1) The Emergency Response Team is responsible for immediate detection and response to the incident. They shall:

    - ❖ Activate contamination detection systems in the water supply infrastructure.
    - ❖ Halt operations and isolate the affected section of the water supply system.
    - ❖ Notify local authorities, health departments, and relevant stakeholders.
    - ❖ Initiate public advisories to inform residents about the situation and provide guidelines (e.g., boiling water before consumption).

2) The Laboratory Supervisor is responsible for identification & assessment of contamination through water analysis. He shall:

    - ❖ Collect water samples from multiple points to ascertain the type and extent of contamination.
    - ❖ Engage certified laboratories for detailed water quality analysis.
    - ❖ Determine the potential source or cause of contamination.

3) The EWRD Division Manager is responsible to provide a disinfected containment as backup storage. He shall:

    - ❖ Utilize specialized water treatment processes to neutralize or remove contaminants.

- Cleanse and disinfect storage and distribution systems, ensuring no residual contaminants.
- Utilize backup water sources, if available, to maintain supply during the treatment phase.

4) The Public Information Officer is responsible to provide a public announcement about the incident. He shall:
   - Regularly update the public regarding the status of the contamination and actions being taken.
   - Offer clear guidelines for safe water use, and provide alternatives if possible, such as water distribution points.
   - Address concerns through community engagement sessions and public help lines.

5) The Production Division Manager is responsible for recovery & restoration of the damaged components. He shall:
   - Evaluate the need for infrastructure upgrades or modifications to prevent recurrence.
   - Monitor the treated water consistently to ensure that it meets all safety standards.
   - Gradually reinstate regular operations once the water quality is certified safe.

6) The WSP Team Leader is responsible for post-incident review. He shall:
   - Convene a committee to analyze the contamination incident, assess responses, and identify gaps.
   - Implement recommendations to enhance the system's resilience against future contamination threats.
   - Engage with experts and consultants to gain insights and adopt best practices.

Corrective Action Procedures:

1. Immediately detect and response to the incident.
2. Isolate affected section from the entire system.
3. Notify the affected concessionaires.
4. Conduct multiple collection of water sample for analysis to determine the extent of contamination and the potential cause of contamination.
5. Provide disinfected water containers to serve as the water storage to support the low pressure in some areas.
6. Immediately repair the damaged infrastructures or components.
7. Gradually reinstate regular operations once the water quality is certified safe.
8. Conduct a post-incident review to prevent recurrence of the same incident.

By meticulously following this procedure, the SPCWD aims to safeguard its water supply system from contamination threats, thereby ensuring the health and well-being of the San Pablo City community.

AZ. Rehabilitation of Infrastructure Failures

Purpose: The purpose of this procedure is to provide clear guidelines for the San Pablo City Water District (SPCWD) to prevent, identify, and rectify infrastructure failures in its water supply system. This is essential to ensure consistent water delivery, maintain the system's operational efficiency, and uphold the trust of the San Pablo City residents.

Scope: This procedure covers all infrastructural components of the SPCWD water supply system, from source extraction sites, treatment facilities, storage tanks, to distribution pipelines, and pumping stations. It is binding on all employees, contractors, and partners involved with the water system's operation and maintenance.

Timeliness: Given the urgency of maintaining water supply reliability and public trust, addressing infrastructure failures under this procedure typically occurs swiftly, with resolution efforts initiated within hours of detection. Timeliness is crucial, ensuring minimal disruption to water services and rapid restoration of infrastructure functionality to meet the needs of San Pablo City residents.

Responsibility:

1) The Emergency Response Team is responsible for immediate detection and response to the incident. They shall:
    - ❖ Activate system monitoring tools to quickly identify the site and nature of the failure.
    - ❖ Isolate the affected infrastructure component to prevent further damage or service disruption.
    - ❖ Mobilize emergency response teams to assess and address the situation.

2) The Operations Department Manager shall is responsible for the evaluation and assessment of the impact of the incident. He shall:
    - ❖ Determine the extent of the damage and its implications on the water supply.
    - ❖ Evaluate potential risks to public health and safety, such as contamination due to pipe breaches.
    - ❖ Estimate the timeframe for repairs or replacements.

3) The Rehabilitation and Maintenance Division is responsible for the repair & rectification. He shall:
    - ❖ Engage specialized teams or contractors to perform repairs or replacements.

- ❖ Conduct rigorous quality checks after repair to ensure the infrastructure's functionality and safety.
- ❖ Restore normal operations gradually after confirming system integrity.

4) The Public Information Officer is responsible to provide a public announcement about the incident. He shall:
   - ❖ Keep the public informed about repair progress and expected timelines for service restoration.
   - ❖ Address public concerns and inquiries through dedicated communication channels.

5) The WSP Team Leader is responsible for post-incident review. He shall:
   - ❖ Review the incident to identify root causes and understand failure mechanisms.
   - ❖ Assess the effectiveness of the response and identify areas of improvement.
   - ❖ Propose upgrades or preventive measures to minimize the likelihood of similar failures.

Corrective Action Procedures:

1. Immediately detect and response to the incident.
2. Evaluate and assess the extent of the damage and its implications.
3. Issue public advisories about disruptions and alternate arrangements.
4. Operate the back-up water sources or provide water rationing to the affected area.
5. Perform repairs or replacements as soon as possible.
6. Conduct quality check after the repair.
7. Restore normal operations gradually.
8. Review the incident and assess the effectiveness of the response.
9. Implement infrastructure upgrades if possible.

By adhering to this procedure, SPCWD aims to proactively manage infrastructure failures, ensuring minimal service disruption and maintaining the water system's overall reliability for San Pablo City residents.

BA. Water Shortages Mitigation

Purpose: The purpose of this procedure is to guide the San Pablo City Water District (SPCWD) in preventing, identifying, and managing water shortages to ensure consistent and sustainable water provision to the city's residents. Recognizing the vital importance of water, this procedure underscores our commitment to maintaining an uninterrupted supply, even under challenging circumstances.

Scope: This procedure addresses all facets of the SPCWD water supply system, from water source management, storage capacities, distribution mechanisms, to demand management. It's applicable to all SPCWD staff, contractors, and any associated stakeholders involved in water provision and management.

Timeliness: Timeliness is paramount, with efforts focused on promptly identifying the root causes of shortages, implementing mitigation measures, and communicating effectively with stakeholders. In urgent cases, resolution efforts should be initiated within hours to minimize the impact on residents and maintain public trust in the SPCWD's ability to provide reliable water services.

Responsibility:

1) The Emergency Response Team is responsible for early detection & monitoring: They shall:

   - ❖ Use hydrological monitoring tools to assess water levels in source reservoirs and underground aquifers.
   - ❖ Monitor usage patterns and compare them against available reserves, forecasting potential shortages.

2) The Public Information Officer is responsible for promoting campaigns with regards to water conservation. He shall:

   - ❖ Initiate public awareness campaigns encouraging water conservation.
   - ❖ If necessary, introduce temporary usage restrictions, like limiting non-essential water use (e.g., garden watering, car washing).
   - ❖ Regularly inform the public about the water situation, urging adherence to conservation measures.
   - ❖ Provide a platform (e.g., helpline, website) for queries, updates, and feedback.

3) The EWRD Division Manager is responsible for operational adjustments in water distribution and supply augmentation. He shall:

- ❖ Prioritize water distribution to critical facilities like hospitals and emergency services.
- ❖ Adjust pump timings and storage releases to optimize available supplies.
- ❖ Explore activating secondary or backup water sources, if available.Investigate the feasibility of short-term solutions such as water rationing or activating dormant wells.
- ❖ Investigate the feasibility of short-term solutions such as water rationing or activating dormant wells.
- ❖ Initiate rainwater harvesting measures at public facilities and encourage their adoption in residential areas.

4) The Management is responsible to formulate a Long-term Measures and update the existing policy and strategies.

- ❖ Explore new water sources, including groundwater extraction or partnership arrangements with neighboring water entities.
- ❖ Invest in infrastructure that enhances water storage capacity, such as new reservoirs or expanding existing ones.
- ❖ Promote the use of water-efficient appliances and fixtures within the city.
- ❖ Encourage landscape practices that reduce water demand, like xeriscaping.
- ❖ Develop a comprehensive drought management plan detailing measures at various stages of water scarcity.
- ❖ Collaborate with environmental experts (LWUA, PAWD) to understand and address factors affecting local water availability.
- ❖ Continuously review and adjust water tariffs to encourage responsible consumption.

5) The WSP Team Leader is responsible to the continuous review of the existing corrective actions. He shall:

- ❖ Post-incident, analyze response measures for efficiency and effectiveness.
- ❖ Offer training sessions for SPCWD staff on innovative water-saving techniques and technologies.
- ❖ Engage the community in regular conservation workshops and feedback sessions.

Corrective Action Procedures:

1. Immediately detect and response to the incident.
2. Evaluate and assess the extent of the water shortages.

3. Issue public advisories about about the water situation, urging adherence to conservation measures and alternate arrangements.
4. Operate the back-up water sources or provide water rationing to the affected area.
5. Perform operational adjustments in water distribution and supply augmentation
6. Review the incident and assess the effectiveness of the response and plan for long-term measures in case of the same situation happen.

By meticulously adhering to this procedure, the SPCWD seeks to effectively manage water shortages, ensuring that San Pablo City residents always have access to this vital resource, even during challenging times.

BB. Terrorist Attack or Sabotage Response

Purpose: The purpose of this procedure is to outline measures and protocols specific to San Pablo City Water District (SPCWD) for addressing potential threats of terrorist attacks or sabotage to its water supply system. It aims to ensure the continuous provision of safe and clean water to the city's inhabitants, protect vital infrastructure, and safeguard the well-being of all associated personnel.

Scope: This procedure applies to all components and operations of the SPCWD water supply system, including water sources, treatment facilities, storage reservoirs, distribution networks, information systems, and personnel. It encompasses preventive, reactive, and recovery measures and is binding on all employees, contractors, vendors, and partners involved in any capacity with the SPCWD water system.

Timeliness: This procedure outlines SPCWD's response to potential terrorist attacks or sabotage on its water supply system. Timeliness is critical. Immediate action is required to detect and mitigate threats, minimizing disruptions and safeguarding public health and infrastructure integrity.

Responsibility: SPCWD / Water Safety Committee / Emergency Response Team

1) The Emergency Response Team is responsible for immediate detection and response. They shall:
    - ❖ Activate the water district's Water Safety Plan team.
    - ❖ Isolate and secure affected areas or components of the water supply system.
    - ❖ Notify city officials, emergency services, and pertinent regulatory bodies.
    - ❖ Establish a central communication hub to manage information dissemination and coordinate response actions.

2) The EWRD Division Manager and The Operation Department Manager are responsible for ensuring the water quality and water supply of the system. They shall:

    - ❖ Assess the immediate implications of the threat or incident on the water quality and distribution.
    - ❖ Implement emergency water treatment protocols if contamination is suspected.
    - ❖ Divert water flows if specific sections of the system are compromised.
    - ❖ Mobilize alternative water sources or distribution methods, if available, to ensure continued supply.

3) The Public Information officer is responsible to contact law enforcing body for investigation. He shall:
    - ❖ Collaborate closely with law enforcement and intelligence agencies (NBI) to determine the nature, source, and extent of the threat.

- Document and preserve any evidence, while ensuring the continuity of essential operations.
- Evaluate the vulnerability of other assets in the water supply system.

4) The Production Division Manager is responsible for recovery process. He shall:

- Implement a systematic plan (shop drawings and estimates) for the restoration of affected components of the water system.
- Regularly update the public and relevant stakeholders on recovery efforts and water safety status.
- Avail external technical assistance or consultancy if needed to expedite the restoration process.
- Ensure psychological support or counseling for affected staff and stakeholders.

5) The WSP Team is responsible for the review and reinforcement after the incident. He shall:

- Convene a post-incident review committee to identify lapses and areas of improvement.
- Strengthen security measures, incorporating latest technologies and best practices, focusing especially on vulnerable points in the system.
- Reevaluate and update emergency response and communication plans based on the lessons learned.
- The Emergency Response Team is responsible for strengthening the preparedness of the agency on this kind of situation. They shall:
- Invest in continuous monitoring and surveillance of the entire water supply system.
- Conduct regular security drills and simulations, ensuring staff is prepared for various threat scenarios.
- Collaborate with national and or international agencies to stay updated on emerging threats and response techniques.

Corrective Action Procedure

1. Immediately detect and response to the incident.
2. Evaluate and assess the extent the immediate implications of the threat or incident on the water quality and distribution.
3. Implement emergency water treatment protocols if contamination is suspected.
4. Divert water flows if specific sections of the system are compromised. Operate the back-up water sources or provide water rationing to the affected area.
5. Contact law enforcing body for investigation, if necessary.
6. Implement a systematic plan (shop drawings and estimates) for the restoration of affected components of the water system.
7. Review the incident and assess the effectiveness of the response and plan.

Given the critical nature of water supply systems, it's paramount that SPCWD's procedures for addressing terrorist attacks or sabotage are robust, adaptable, and regularly updated to counter evolving threats.

BC. Equipment Malfunction Repair

Purpose: The purpose of this procedure is to ensure that the San Pablo City Water District (SPCWD) has a systematic and efficient approach to address equipment malfunctions within its water supply system. Ensuring reliable functionality of all equipment is critical to maintaining an uninterrupted water supply to the city's residents.

Scope: This procedure applies to all equipment and machinery used in the SPCWD water supply system, encompassing water extraction, treatment, storage, and distribution. It is relevant to all employees, technicians, contractors, and vendors involved in the operation, maintenance, and repair of said equipment.

Timeliness: Timeliness is crucial in addressing equipment malfunctions. Immediate action upon detection is necessary to minimize disruptions to the water supply system and ensure uninterrupted service to residents. Delays in response can lead to prolonged downtime, affecting water availability and public trust in the SPCWD's ability to provide reliable service. Therefore, timely identification, diagnosis, and resolution of equipment malfunctions are paramount to maintaining operational efficiency and customer satisfaction.

Responsibility: TSD / Water Safety Committee / Emergency Response Team

1. The General Services Chief is responsible for detection & reporting of the malfunction equipment and immediate response. He shall:

   ❖ Use integrated (Property Management) monitoring systems to identify equipment abnormalities.

   ❖ Ensure a clear reporting channel for employees to communicate any observed malfunctions.

   ❖ Isolate the malfunctioning equipment to prevent further system disruptions or potential hazards.

   ❖ Deploy a technical response team to assess and address the malfunction on-site.

   ❖ Utilize backup equipment, if available, to maintain system operations.

2. The Maintenance Team is responsible for equipment investigation & diagnosis. They shall:

   ❖ Determine the root cause of the malfunction, considering aspects such as wear and tear, external factors, or operational errors.

   ❖ Engage external experts or consultants (suppliers) if an in-house team cannot determine the cause.

- ❖ Carry out necessary repairs based on the diagnosis, ensuring adherence to safety protocols.
- ❖ If equipment cannot be repaired, initiate procedures for its replacement, ensuring the new equipment meets specified standards.
- ❖ Post-repair/replacement, perform comprehensive testing to validate equipment functionality.

3. The Public Information Officer is responsible to inform the affected consumers. He shall:

- ❖ Keep the public informed about the situation and expected resolutions, if the malfunction affects water supply or quality
- ❖ Offer guidelines on water use, if necessary, until the equipment is fully operational.

Corrective Action Procedures:

1. Detect and report the malfunction equipment to the GSD.
2. Utilize back-up until the equipment investigation and diagnosis is done.
3. Carry out necessary repair or replacement based on the diagnosis.
4. Contact external contractor is an in-house team cannot resolve the issue.
5. Inform the public if the malfunction affects the water supply or water quality.
6. Evaluate the root cause and implement the preventive measures.

By rigorously following this procedure, SPCWD aims to minimize the impact of equipment malfunctions on water supply operations, ensuring the consistent delivery of safe and clean water to San Pablo City residents.

BD. Response on Natural Disasters

Purpose: The primary objective of this procedure is to outline a robust and proactive approach for the San Pablo City Water District (SPCWD) in the face of natural disasters. Given the critical nature of water supply in the aftermath of disasters, it is imperative to ensure that the city's water supply system is resilient, and the services can be restored swiftly to aid recovery efforts.

Scope: This procedure encompasses every aspect of the SPCWD water supply system, including source reservoirs, treatment facilities, storage tanks, distribution networks, and the broader operational infrastructure. It covers a range of natural disasters, including but not limited to, earthquakes, typhoons, floods, and landslides, and is applicable to all employees, contractors, and emergency response teams linked with SPCWD.

Timeliness: Timeliness in responding to natural disasters is crucial for the San Pablo City Water District (SPCWD) to ensure the continuity of water supply and aid in post-disaster recovery efforts. Prompt action is necessary to assess damages, prioritize repairs, and restore services swiftly. Therefore, efforts must be initiated immediately following the occurrence of a natural disaster, with a focus on rapid assessment, coordination with emergency response teams, and implementation of contingency plans. The goal is to minimize disruptions and ensure the timely restoration of water services to affected areas, thereby supporting the community's resilience and recovery.

Responsibility: SPCWD / Water Safety Committee / Emergency Response Team

1. The emergency Response Team is responsible for immediate response. They shall:

    - ❖ Activate emergency command centers to coordinate disaster response.
    - ❖ Evaluate initial damage and shut down affected parts of the system to prevent further damage.
    - ❖ Inform local authorities and the general public about service disruptions and safety precautions.
    - ❖ Deploy teams to conduct on-ground assessments of damages across the water supply chain.
    - ❖ Source emergency equipment and resources required for rapid response operations.

2. The Public Information Officer Is responsible for updating the consumers. He shall:
   - ❖ Provide regular updates to the public about service restoration, safe water use, and storage methods.
   - ❖ Collaborate with other civic agencies to ensure effective dissemination of vital information.
3. The Production Division is responsible for repair and restoration. He shall:
   - ❖ Prioritize repair and restoration based on criticality (e.g., fixing main pipelines before minor branches).
   - ❖ Use temporary solutions, such as mobile water treatment units and water trucks, to supply essentials to affected areas.
   - ❖ Ensure quality checks are done post-repairs to ascertain water safety.
4. The General Services Chief is responsible to conduct training & drills for calamity preparedness. He shall:
   - ❖ Organize periodic disaster response drills for employees and associated personnel to familiarize them with emergency protocols.
   - ❖ Partner with disaster management agencies to train teams in specialized disaster response techniques.
5. The WSP Team is responsible for the pos-incident review. They shall:
   - ❖ After every major disaster event, conduct a detailed review to analyze the response's effectiveness and identify areas for improvement.
   - ❖ Update disaster response plans based on real-time learnings to ensure better preparedness for future incidents.

Corrective Action Procedures:

1. Detect the damage and immediately respond.
2. Inform the public about the situation of the affected part of the water system.
3. Prioritize repair and restoration based on criticality
4. Ensure quality checks are done post-repairs to ascertain water safety.
5. Organize periodic disaster response drills for employees and associated personnel to familiarize them with emergency protocols.
6. Conduct a post-incident assessment.

Through the rigorous application of this procedure, SPCWD aims to fortify San Pablo City's water supply system against natural disasters, ensuring rapid recovery and the well-being of its residents during such critical times.

BE. Cyber Attacks Response

Purpose: To provide a clear and actionable framework for the San Pablo City Water District (SPCWD) to protect its digital assets, infrastructure controls, and information systems from cyber attacks. In an era of growing digital dependency, safeguarding our systems against malicious cyber threats is of paramount importance to ensure uninterrupted water services and maintain the trust of San Pablo City residents.

Scope: This procedure applies to all digital and IT infrastructure, systems, databases, communication networks, and software applications linked with the SPCWD water supply system. It encompasses both preventive measures and responsive actions to cyber threats and is applicable to all IT staff, contractors, and any personnel with access to the system's digital components.

Timeliness: Timeliness is crucial in responding to cyber attacks to protect the San Pablo City Water District's (SPCWD) digital assets and ensure continuous water services. Immediate action upon detection or suspicion of an attack involves rapid assessment, containment, and mitigation measures to minimize the impact, restore system functionality, and prevent further breaches. This requires prompt initiation of efforts, real-time monitoring, incident response protocols, and collaboration with cybersecurity experts for effective threat resolution.

Responsibility: SPCWD / Water Safety Committee / Emergency Response Team

1. The Information Technology Specialist is responsible to formulate a proactive defense against cyber attacks and immediately response to the threat. He shall:

    - ❖ Implement state-of-the-art firewalls and intrusion detection systems.
    - ❖ Regularly update and patch software, operating systems, and applications to rectify vulnerabilities.
    - ❖ Encrypt sensitive data and employ multi-factor authentication for critical systems.
    - ❖ Continuously monitor network traffic for unusual activities or potential breaches.
    - ❖ Set up real-time alerts for suspicious activities, ensuring quick response.
    - ❖ If a cyber threat or breach is detected, isolate affected systems to contain the threat.
    - ❖ Initiate system backups or switch to redundant systems to maintain operational continuity.
    - ❖ Engage cyber security experts for threat neutralization.

2. The Public Information Office is responsible for communicating to the public. He shall:

   - Inform stakeholders, especially if personal data or service delivery is affected.
   - Provide clear guidelines on steps the public should take, such as password changes or monitoring for suspicious activities.
   - Collaborate with cybersecurity professionals (NBI) to understand the breach's nature, extent, and source.

3. The EWRD Division Manager and Production Division Officer are responsible for the system Restoration & Upgrades. They shall:

   - Clean and restore affected systems using backups.
   - After the threat is neutralized, assess and implement additional security measures to prevent future occurrences.

4. The Training and Development Officer is responsible for:

   - Regularly train all personnel on cyber hygiene, recognizing phishing attempts, and safe online behaviors.
   - Conduct simulated cyber attacks to test and improve organizational readiness.

5. The WSP Team is responsible for the Review & Continuous Improvement:

   - Post-incident, analyze the effectiveness of the response and identify areas for improvement.
   - Stay updated with global cybersecurity trends and threats, ensuring that the organization's cyber defenses evolve accordingly.
   - Collaborate with other utilities, cybersecurity agencies, and experts to share intelligence and best practices.

By meticulously adhering to this procedure, SPCWD aims to fortify its digital assets against cyber threats, ensuring the integrity, availability, and confidentiality of San Pablo City's water supply system in an increasingly digitalized world.

BF. Emergency Response Plan and Procedure

Purpose: The purpose of the Emergency Response Plan (ERP) and Procedure for the San Pablo City Water District (SPCWD) is to establish a comprehensive framework for effectively managing and responding to emergency situations that may impact the water supply system. The ERP aims to safeguard public health, protect critical infrastructure, and minimize disruptions to water services during emergencies, such as natural disasters, infrastructure failures, or security incidents.

Scope: This Emergency Response Plan applies to all aspects of the SPCWD water supply system, including water sources, treatment facilities, distribution networks, and associated infrastructure. It encompasses a range of emergency scenarios, including but not limited to, earthquakes, floods, power outages, chemical spills, and cyber attacks. The plan outlines protocols for emergency preparedness, response, and recovery, involving coordination among SPCWD personnel, emergency responders, government agencies, and other stakeholders.

Responsibility: Emergency Response Team - SPCWD

Key Components of the Emergency Response Plan:

1) **Emergency Preparedness:** This entails conducting thorough risk assessments at least annually, formulating robust emergency response protocols, and establishing clear communication channels. Regular training sessions and drills are organized to maintain a state of readiness among SPCWD personnel and stakeholders, ensuring swift and effective responses during emergencies.

2) **Emergency Response:** When an emergency occurs, designated personnel promptly activate the ERP and execute response actions following predefined protocols. These actions may involve implementing contingency measures, mobilizing resources, and collaborating with external agencies as necessary to address the situation effectively.

3) **Communication and Coordination**: Clear communication channels are established to disseminate information, coordinate response efforts, and provide updates to relevant parties, including customers, regulatory agencies, and the public. Regular communication ensures transparency and fosters public trust in the SPCWD's emergency response capabilities.

4) **Resource Management:** The ERP outlines procedures for resource allocation and management during emergencies, including personnel, equipment, supplies, and external support services. Adequate resources are mobilized to address immediate needs and facilitate recovery efforts.

5) **Emergency Recovery:** Once the immediate threat has been mitigated, the focus shifts to recovery and restoration activities. This includes assessing damage, repairing infrastructure, restoring services, and implementing measures to prevent future emergencies.

This Emergency Response Plan and Procedure for the San Pablo City Water District is designed to address a wide range of potential emergencies and ensure the continuity of water services. It outlines protocols for emergency preparedness, response, and recovery, emphasizing communication, coordination, and resource management. Through regular training, drills, and collaboration with stakeholders, the SPCWD aims to maintain readiness and effectively manage emergencies to safeguard public health and critical infrastructure.

ANNEX P - Reconstitution of SPCWD Water Safety Plan Team

REPUBLIC OF THE PHILIPPINES
SAN PABLO CITY WATER DISTRICT
Maharlika Highway, San Gabriel, San Pablo City
Tel. Nos. 5627568 to 70 Fax (049) 5622751

BOARD RESOLUTION NO. 018
Series of 2023

APPROVING THE RECONSTITUTION OF THE SAN PABLO CITY WATER DISTRICT WATER SAFETY PLAN TEAM (WSPT) FOR CY 2023-2025

RESOLVED, To approve the Reconstitution of the San Pablo City Water District Water Safety Plan Team (WSPT) for CY 2023-2025 due to attrition caused by retirement and separation from office of some of the previous members, to wit:

NAME	DEPARTMENT	ROLE
WILFREDO M. ALIGATO	ASD/General Services Division	Team Leader
JONNAS FIRMO C. BISCOCHO	TSD/Water Resource Management Section	Source Management
JAMELA V. DIMAPILIS	TSD/Laboratory Section	Water Quality Verification Monitoring
HAZEL S. GERONIMO	TSD/Engineering Division	Design of Resource Facilities
RODRIGO A. ESTALILLA	OD/Production Division	Electrical & Chlorination Monitoring
LEIGHANN CLAUDIA F. JONES	TSD/Laboratory Section	Filtration & Chlorination Monitoring
WILSON M. AWAYAN	OD/Production Division	Distribution System Management
GILBERT M. VELASCO	OD/Sewerage & Sanitation Section	Distribution System Management
FERDINAND H. BONDAD	CSD/CSD	Service Connection Management
MILDRED C. VELASCO	FMD/General Accounting Division	Financial/Budget Management
ARVIN B. GUTIERREZ	ASD/General Services Division	Administrative Management
CHERRY MAE C. CIMATU	CSD/CREAS	Secretariat
PETER GERALD B. DIANQUINAY	TSD/Engineering Division	Secretariat
JOMELLO ENGELO N. MUÑOZ	TSD/Engineering Division	Secretariat

Approved by unanimous vote

I hereby certify that a resolution of the foregoing tenor was duly passed at the meeting of the Board of Directors of the San Pablo City Water District held 01 February 2023 at SPCWD Board Room, a quorum being then present and voting.

ENGR. ELEUTERIO D. AMANTE
Secretary

CERTIFIED TRUE AND CORRECT:

BRIGIDA B. ALICAN
Chairman

BALBINO A. ESCUETA
Vice-Chairman

RONNIE S. SANTIAGO
Member

ANNEX Q - Notice of Meeting

SAN PABLO CITY WATER DISTRICT
San Pablo City

NOTICE OF MEETING

TO : **Water Safety Plan Team Members**

FROM : **Water Safety Plan Team Leader**

Date : **February 06, 2023**

Please be advised that there will be a meeting of the re-organized SPCWD Water Safety Plan Team on February 10, 2023, Friday at 9am until 12pm at the SPCWD Regional Training Center. Your attendance is highly expected.

Wilfredo M. Aligato
Team Leader

Noted by:

Arch. Mario A. Bondad
Acting General Manager

Team Members

Jonnas Firmo C. Biscocho
Jamela V. Dimapilis
Hazel S. Geronimo
Rodrigo A. Estalilla
Leighann Claudia F. Jones
Wilson M. Awayan
Gilbert M. Velasco
Ferdinand H. Bondad
Arvin B. Gutierrez
Cherry Mae C. Cimatu
Peter Gerald B. Diangkinay
Jomello Angelo N. Muñoz
Mildred C. Velasco

SAN PABLO CITY WATER DISTRICT
San Pablo City

NOTICE OF MEETING

TO : Water Safety Plan Team Members

FROM : Water Safety Plan Team Leader

Date : February 27, 2023

Please be advised that there will be a meeting of the SPCWD Water Safety Plan Team on March 03, 2017, Friday at 9:00 AM until 12 PM at the SPCWD Regional Training Center. Your attendance is highly expected.

Agenda:

1. Review and Assessment of Updates of the Water Safety Plan
2. Assignment of Revision Tasks Identified in the Review and Assessment
3. Setting of Target Date of Completion of Water Safety Plan
4. Other Matters

Wilfredo M. Aligato
Team Leader

Noted by:

2/27/23

Engr. Eleuterio D. Amante
General Manager

Team Members

Jonnas Firmo C. Biscocho
Jamela V. Dimapilis
Hazel S. Geronimo
Rodrigo A. Estalilla
Leighann Claudia F. Jones
Wilson M. Awayan
Gilbert M. Velasco
Mildred C. Velasco
Ferdinand H. Bondad
Arvin B. Gutierrez
Cherry Mae C. Cimatu
Peter Gerald B. Diangkinay
Jomello Angelo N. Muñoz

SAN PABLO CITY WATER DISTRICT
San Pablo City

NOTICE OF MEETING

TO : **Water Safety Plan Team Members**

FROM : **Water Safety Plan Team Leader**

Date : **March 15, 2023**

Please be advised that there will be a meeting of the SPCWD Water Safety Plan Team on March 20, 2023, Monday at 11:00 AM until 2 PM at the SPCWD Regional Training Center. Your attendance is highly expected.

Wilfredo M. Aligato
Team Leader

Noted by:
3/15/23

Engr. Eleuterio D. Amante
General Manager

Team Members

Jonnas Firmo C. Biscocho
Jamela V. Dimapilis
Hazel S. Geronimo
Rodrigo A. Estalilla
Leighann Claudia F. Jones
Wilson M. Awayan
Gilbert M. Velasco
Mildred C. Velasco
Ferdinand H. Bondad
Arvin B. Gutierrez
Cherry Mae C. Cimatu
Peter Gerald B. Diangkinay
Jomello Angelo N. Muñoz

SAN PABLO CITY WATER DISTRICT
San Pablo City

NOTICE OF MEETING

TO	:	**Water Safety Plan Team Members**
FROM	:	**Water Safety Plan Team Leader**
Date	:	**March 28, 2023**

Please be advised that there will be a meeting of the SPCWD Water Safety Plan Team on April 04, 2023, Tuesday at 11:00 AM until 2 PM at the SPCWD Regional Training Center. Your attendance is highly expected.

Wilfredo M. Aligato
Team Leader

Noted by:

3/28/23

Engr. Eleuterio D. Amante
General Manager

Team Members

Jonnas Firmo C. Biscocho
Jamela V. Dimapilis
Hazel S. Geronimo
Rodrigo A. Estalilla
Leighann Claudia F. Jones
Wilson M. Awayan
Gilbert M. Velasco
Mildred C. Velasco
Ferdinand H. Bondad
Arvin B. Gutierrez
Cherry Mae C. Cimatu
Peter Gerald B. Diangkinay
Jomello Angelo N. Muñoz

WATER SAFETY PLAN COMMITTEE MTG.
SAN PABLO CITY WATER DISTRICT
APRIL 04, 2023, 11AM

IN ATTENDANCE:

MR. WILFREDO M. ALIGATO,	Team Leader
MR. JONNAS FIRMO C. BISCOCHO,	Source Management
MS. JAMELA V. DIMAPILIS,	Water Quality Verification Monitoring
MR. RODRIGO A. ESTALILLA,	Electrical & Chlorination Maintenance
MS. LEIGHANN CLAUDIA F. JONES,	Filtration & Chlorination Monitoring
ENGR. WILSON M. AWAYAN,	Distribution System Management
ENGR. GILBERT M. VELASCO,	Distribution System Management
MR. FERDINAND A. BONDAND,	Service Connection Management
MS. MILDRED C. VELASCO,	Financial/Budget Management
MR. ARVIN B. GUTIERREZ,	Administrative Management
MS. CHERRY MAE CIMATU,	Secretariat
MR. PETER GERALD B. DIANQUINAY,	Secretariat
MR. JOMELLO ANGELO N. MUÑOZ,	Secretariat

AGENDA POINTS	ACTION PLANS	RESPONSIBLE DIVISION / PERSON
REVISIONS / UPDATING OF WSP PLAN	▪ Include Malabanban / Upper Malamig Spring Source in the schematic diagram so that every spring source is included ▪ Production wells must also be incorporated (some PWs may be placed in clusters instead)	TSD (Engr. Hazel)
	▪ SPCWD Committee organogram – changes ▪ Engr. Hazel not included in the chart / *(Water Sources & Storage)* ▪ Peter Gerald Dianquinay – Gerald should be Gerard ▪ Insert middle initials (Peter Gerard **B.** Dianquinay; Ferdinand **A.** Bondad; Jonnas Firmo **C.** Biscocho; Jomello Angelo **N.** Muñoz	Mr. Aligato Secretariat
	▪ SPCWD Water Supply System	TSD / Mr. Dianquinay (already updated)
	▪ Process Flow Diagram (narrative)	Mr. Aligato
	▪ Submit SOPs per division	ALL concerned divisions

	▪ Insert matrix (water quality compliance)	Laboratory (already forwarded; to edit format)
	▪ 2.11 Persistent Problems (might be better not to include as this will only result to further investigation / review)	Laboratory / Mr. Aligato
	▪ Change customer population based on city population survey instead of NSO (pattern with submitted PBB/LWUA report)	Mr. Ferdie Bondad/ Cherry Cimatu
PROBLEM TO BE ADDRESSED Lagaslasan Spring Source (presence of air)	▪ Mr. Arvin Gutierrez suggested to issue demand letter to SIG, stating the problem so that we can have a response re. the matter ▪ SPCWD may also help SIG by providing staff that will aid in repairing the concern	Legal Counsel TSD / Operations
Others	▪ Recommence meeting once all other revisions are finalized. (to be proofread and reviewed for final updates. Once approved by the committee, submission and for approval of GM)	ALL team members

Prepared by:

Cherry Mae C. Cimatu
SCRO, CSD-CREAS

ANNEX S - DOH Certificate of Accreditation

Republic of the Philippines
DEPARTMENT OF HEALTH
HEALTH FACILITIES AND SERVICES REGULATORY BUREAU

CERTIFICATE OF ACCREDITATION

Owner	: San Pablo City Water District
Name of Facility	: **SAN PABLO CITY WATER DISTRICT LABORATORY**
Type of Facility	: Laboratory for Drinking Water Analysis
Location	: SPCWD Complex, Brgy. San Jose, San Pablo City Laguna
Accreditation Number	: 4A-012-2224-LW-2
Validity of Accreditation	: 26 July 2022 – 31 December 2024
Service Capability	: Category A. Microbiological

1. MTFT – Multiple Tube Fermentation Technique
2. Thermotolerant Coliform Test
3. Colilert
4. Gram Stain
5. IMViC Tests
6. Heterotrophic Plate Count

By Authority of the Secretary of Health:

ATTY. NICOLAS B. LUTERO III, CESO III
Director IV

This accreditation is renewable every three (3) years and subject to suspension or revocation if the facility is found violating AO 2020-0031 and related issuances.

ANNEX T. Actual San Pablo City Population Number 2022

CITY POPULATION OFFICE
2022 ACTUAL NUMBER OF POPULATION

BARANGAY	2019 CPO POPULATION	2020 CPO POPULATION	2021 CPO POPULATION	2022 CPO POPULATION	MALE	FEMALE	FAMILIES	HOUSE HOLD	HOUSE HOLD SIZE	POPULATION DENSITY	LAND AREA /Has.
1. Atisan	1362	1330	1389	1368	703	665	413	346	3.95	8.31	164.63
2. Sta. Ana	2748	2805	2985	3075	1565	1510	861	833	3.69	8.51	361.20
3. Sto. Angel	8084	9649	9601	9704	4828	4876	2899	2416	4.02	16.20	599.07
4. San Antonio I	6273	6628	6663	6,855	3378	3477	3688	1484	4.62	29.01	236.30
5. San Antonio II	4023	4264	4401	4857	2442	2415	1193	1151	4.22	17.90	271.30
6. Bagong Bayan	6160	6180	7265	7039	3487	3552	2714	1620	4.35	142.78	49.30
7. Bagong Pook	2084	2419	2262	2304	1172	1132	664	520	4.43	210.41	10.95
8. San Bartolome	4759	3977	4067	4085	2062	2023	1085	922	4.43	9.94	410.98
9. Bautista	2795	2845	2894	3080	1529	1551	1049	755	4.08	4.45	691.61
10. San Buenaventura	4301	4242	4301	4501	2134	2367	1399	1059	4.25	11.51	390.95
11. Sta. Catalina	2702	2446	2769	2797	1404	1393	781	687	4.07	4.74	590.56
12. Concepcion	10045	10233	10390	10662	5207	5455	3076	2282	4.67	28.87	369.30
13.San Crispin	4351	4333	6606	6606	3110	3496	1700	1611	4.10	18.31	360.86
14.San Cristobal	6075	6358	6406	6416	3192	3224	1485	1246	5.15	3.31	1939.58
15. Sto. Cristo	4154	4033	3859	3876	1932	1944	947	798	4.86	299.07	12.96
16. Sta. Cruz	2710	2794	2950	2890	1204	1686	827	772	3.74	6.55	441.39
17. San Diego	5561	6013	6053	5292	2567	2725	1436	1460	3.62	6.64	796.98
18. Dolores	3204	3468	3498	3514	1860	1654	806	785	4.48	10.40	337.77
19. Sta. Elena	5120	5331	5487	5527	2833	2694	1471	1184	4.67	9.57	577.42
20. Sta. Filomena	3678	3840	3988	4182	2148	2034	1021	870	4.81	15.08	277.24
21. San Francisco	18411	18651	21386	19887	8059	11828	5650	5021	3.96	69.39	286.59
22. San Gabriel	8695	9587	10067	10154	5991	4163	5707	2115	4.80	35.51	285.98
23.San Gregorio	6337	8225	11189	11583	5797	5786	3222	2927	3.96	46.60	248.58
24. San Ignacio	6601	6679	7510	7023	3809	3214	1791	1594	4.41	10.91	643.75
25. Sta. Isabel	3788	4013	4045	4060	2075	1985	1320	910	4.46	8.09	501.67
26. San Isidro	4058	5291	4527	4652	2368	2284	1264	1119	4.16	6.72	691.84
27. San Joaquin	1564	1702	1741	1756	879	877	569	451	3.89	10.17	172.58
28. San Jose	8288	8520	8737	9313	4640	4673	3934	2961	3.15	10.74	867.25
29. San Juan	3878	4079	4144	4050	2000	2050	1145	946	4.28	15.60	259.64
30. San Lorenzo	2025	2115	2178	2199	1119	1080	650	571	3.85	5.22	421.47

BARANGAY	2019 CPO POPULATION	2020 CPO POPULATION	2021 CPO POPULATION	2022 CPO POPULATION	MALE	FEMALE	FAMILIES	HOUSE HOLD	HOUSE HOLD SIZE	POPULATION DENSITY	LAND AREA /Has.
31. San Lucas I	6617	6780	6835	6855	3272	3583	5022	1813	3.78	111.66	61.39
32. San Lucas II	6416	6456	6786	6796	3219	3577	2276	1859	3.66	56.28	120.75
33. San Marcos	3260	3502	3592	3601	1587	2014	848	693	5.20	16.74	215.12
34. Sta. Maria	3667	4076	4362	4470	2205	2265	1208	1059	4.22	12.85	347.82
35. Sta. Ma. Magdalena	2710	2717	2574	2635	1276	1359	780	732	3.60	10.67	246.99
36. San Mateo	3233	3333	3349	3401	1741	1660	1041	746	4.56	22.88	148.62
37. San Miguel	3613	3863	3876	4034	2023	2011	1054	951	4.24	8.45	477.36
38. Sta. Monica	8994	9300	10774	10818	5620	5198	2989	2604	4.15	38.77	279.04
39. San Nicolas	5644	6527	7167	7291	3628	3663	2148	2015	3.62	28.34	257.29
40. Sto. Niño	5241	5339	5569	5591	2753	2838	1689	1457	3.84	7.36	759.71
41. San Pedro	2802	2899	3044	3094	1486	1608	1070	763	4.06	15.24	203.03
42. San Rafael	3891	3745	3818	4143	2001	2142	1065	1065	3.89	18.34	225.96
43. Del Remedio	19380	20595	21599	21420	10821	10599	5799	5246	4.08	75.21	284.79
44. San Roque	3528	4406	4451	4469	2173	2296	997	967	4.62	67.28	66.42
45. Stmo. Rosario	5328	5306	5634	5692	2853	2839	1634	1416	4.02	7.18	792.53
46. Santiago I	2570	2591	2643	2672	1352	1320	695	620	4.31	11.42	233.96
47. Santiago II	3350	3608	3857	3895	1975	1920	1004	890	4.38	5.54	703.20
48. Soledad	3260	3788	4176	4239	2145	2094	1154	942	4.50	13.33	317.94
49. Sta. Veronica	1940	2085	2142	2246	1165	1081	645	565	3.98	10.45	214.92
50. San Vicente	3885	4009	4102	4092	2139	1953	1144	851	4.81	18.58	220.19
51. Brgy. I-A	588	788	735	749	362	387	222	182	4.12	55.48	13.50
52. Brgy. I-B	4062	4162	4162	4262	2105	2157	2942	1320	3.23	154.53	27.58
53. Brgy. II-A	3178	3291	3109	3262	1609	1653	844	679	4.80	739.68	4.41
54. Brgy. II-B	2485	2532	2523	2498	1230	1268	859	562	4.44	297.74	8.39
55. Brgy. II-C	1163	1293	1283	1362	700	662	385	277	4.92	179.68	7.58
56. Brgy. II-D	1138	1371	1202	1230	605	625	339	315	3.90	308.27	3.99
57. Brgy. II-E	2355	2234	2367	2329	1146	1183	688	540	4.31	205.02	11.36
58. Brgy. II-F	2068	2131	2288	2185	1095	1090	628	530	4.12	140.33	15.57
59. Brgy. III-A	173	173	177	178	74	104	53	53	3.36	29.82	5.97
60. Brgy. III-B	1055	1004	1077	1107	536	571	303	227	4.88	124.80	8.87

BARANGAY	2019 CPO POPULATION	2020 CPO POPULATION	2021 CPO POPULATION	2022 CPO POPULATION	MALE	FEMALE	FAMILIES	HOUSE HOLD	HOUSE HOLD SIZE	POPULATION DENSITY	LAND AREA /Has.
61. Brgy. III-C	2657	2731	2843	2548	1217	1331	686	582	4.38	242.21	10.52
62. Brgy. III-D	1301	1334	1471	1478	666	812	442	308	4.80	191.70	7.71
63. Brgy. III-E	655	630	632	663	331	332	181	176	3.77	47.80	13.87
64. Brgy. III-F	296	296	290	290	155	135	90	60	4.83	102.47	2.83
65. Brgy. IV-A	782	816	789	865	405	460	278	210	4.12	21.62	40.01
66. Brgy. IV-B	463	463	463	348	160	188	155	160	2.18	73.42	4.74
67. Brgy. IV-C	622	772	760	798	393	405	292	182	4.38	72.48	11.01
68. Brgy. V-A	533	502	533	533	257	276	165	133	4.01	17.80	29.94
69. Brgy. V-B	475	471	399	413	175	238	109	100	4.13	83.94	4.92
70. Brgy. V-C	422	414	400	410	193	217	126	94	4.36	153.56	2.67
71. Brgy. V-D	498	495	396	465	211	254	119	91	5.11	184.52	2.52
72. Brgy. VI-A	551	605	578	605	287	318	166	150	2.33	50.76	11.92
73. Brgy. VI-B	1025	1055	1100	1100	521	579	265	260	4.23	174.33	6.31
74. Brgy. VI-D	1913	1913	1938	2025	1040	985	527	621	3.26	109.46	18.50
75. Brgy.VI-E	2899	2879	3455	3455	1725	1730	1147	782	4.42	223.77	15.44
76. Brgy. VII-A	2118	2118	2083	1379	669	710	381	324	4.26	170.25	8.10
77. Brgy. VII-B	616	618	624	626	295	331	212	154	4.06	131.24	4.77
78. Brgy. VII-C	350	350	350	80	63	17	71	71	1.1267606	32.92	2.43
79. Brgy. VII-D	127	127	127	127	60	67	22	25	5.08	103.25	1.23
80. Brgy. VII-E	353	355	358	358	195	163	54	32	11.19	115.86	3.09
Grand Total	**290,084**	**304,898**	**322,220**	322,489	**159,408**	**163,081**	**101780**	**77870**	**4.14**	**16.32**	**19756.48**

Prepared by:

J. Liwag

JAMES MICHAEL R. LIWAG, RN, MPA
Administrative Officer II

Noted by:

mtderiquito

MYLENE T. DERIQUITO, RN, MPA
City Population Officer

ANNEX U - Certification on the Total Number of Households served by SPCWD 2022

REPUBLIC OF THE PHILIPPINES
SAN PABLO CITY WATER DISTRICT
Maharlika Highway, San Gabriel, San Pablo City
Tel. No. (049) 562-9955

CERTIFICATION

This is to certify that approximately 83.18% of the total number of households within the coverage of San Pablo City Water District have access to potable water as of December 31, 2022 computed as follows:

Total number of Households within the coverage area	-	64,224
Total number of service connections	-	47,717
% of Household with access to potable water	-	74.3%
% of Communal users	-	8.88%

Communal Users are those concessionaires with access to potable water but has no Service Connections

Issued this 20th day of April 2023.

MARIA VICTORIA D. AFRICA
Acting Division Manager A
Costumers Account Division

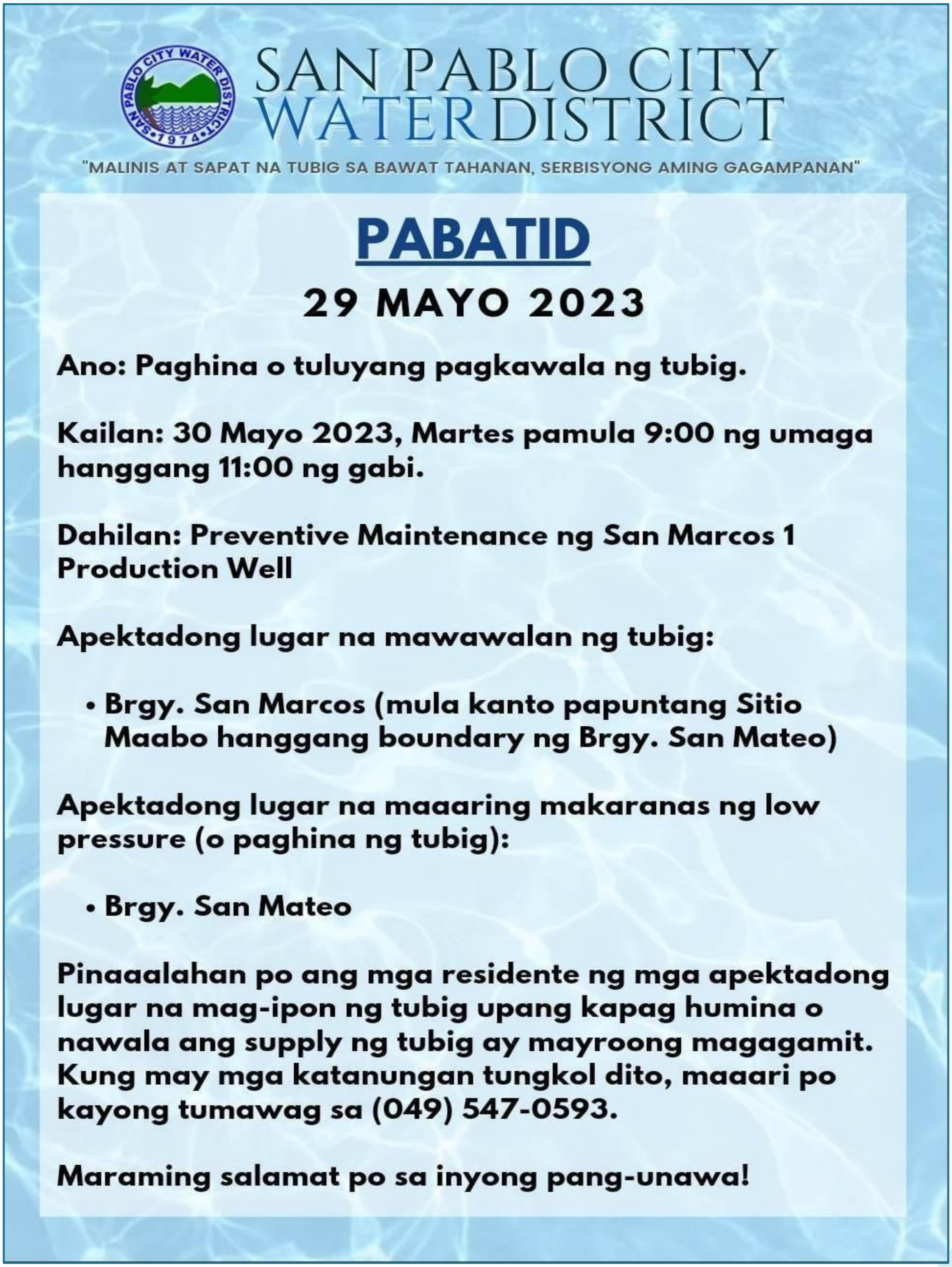
Noted by:

ENGR. ELEUTERIO D. AMANTE
General Manager A

5/22/23

ANNEX V - SPCWD Official FaceBook Page

ANNEX W - SPCWD FaceBook Page Sample Post



SAN PABLO CITY WATER DISTRICT

"MALINIS AT SAPAT NA TUBIG SA BAWAT TAHANAN, SERBISYONG AMING GAGAMPANAN"

PABATID

29 MAYO 2023

Ano: Paghina o tuluyang pagkawala ng tubig.

Kailan: 30 Mayo 2023, Martes pamula 9:00 ng umaga hanggang 11:00 ng gabi.

Dahilan: Preventive Maintenance ng San Marcos 1 Production Well

Apektadong lugar na mawawalan ng tubig:

- **Brgy. San Marcos (mula kanto papuntang Sitio Maabo hanggang boundary ng Brgy. San Mateo)**

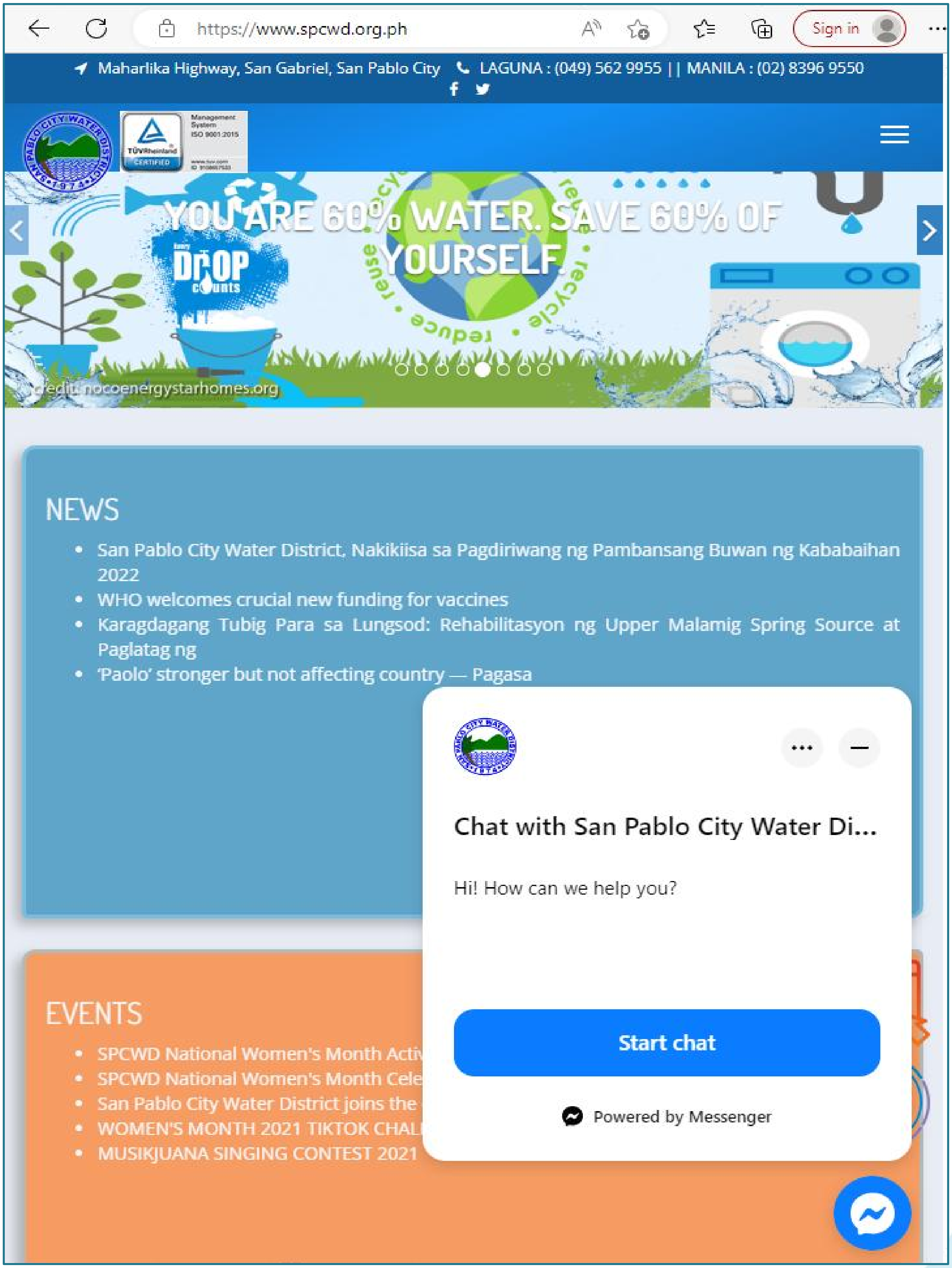
Apektadong lugar na maaaring makaranas ng low pressure (o paghina ng tubig):

- **Brgy. San Mateo**

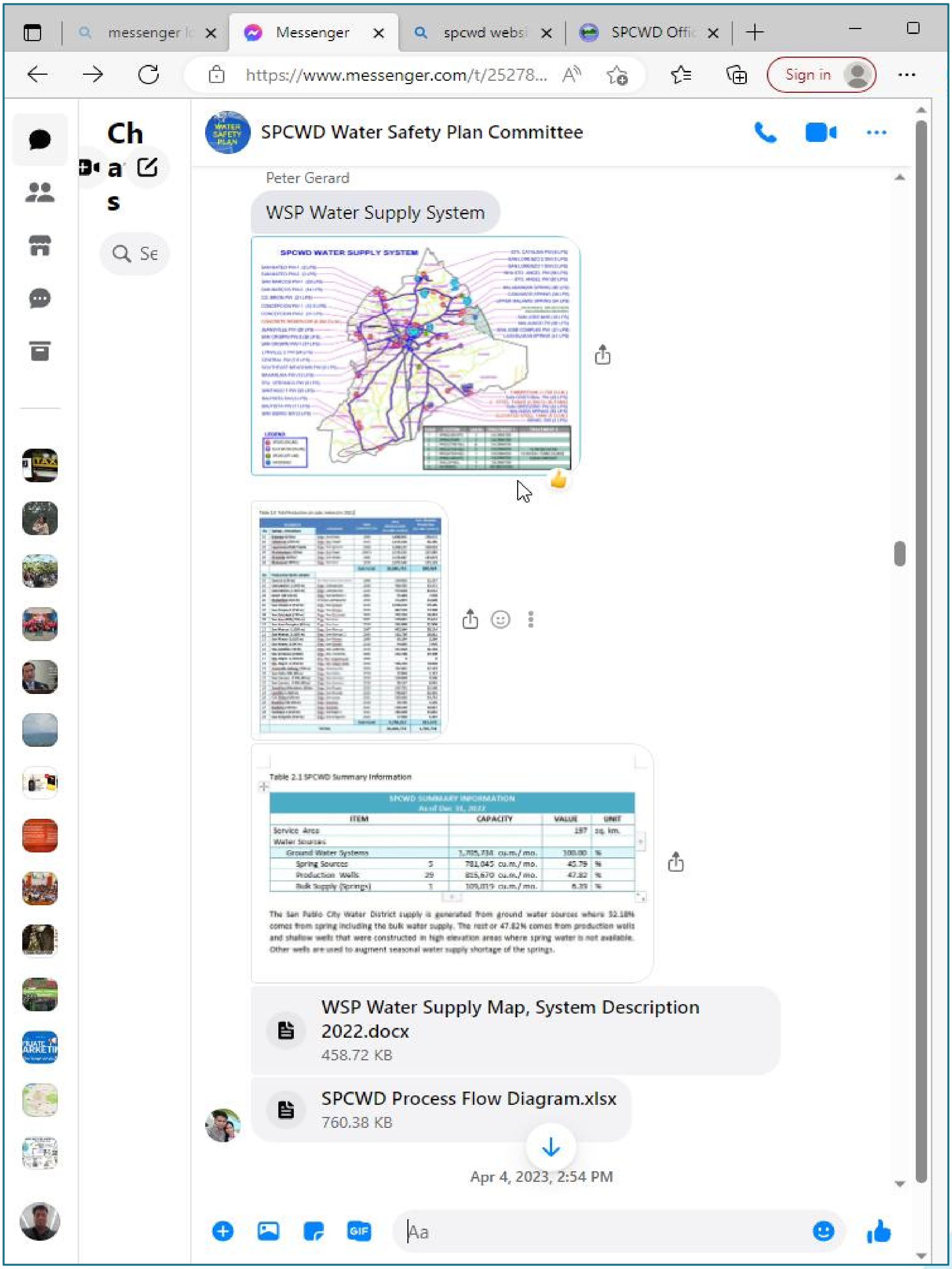
Pinaaalahan po ang mga residente ng mga apektadong lugar na mag-ipon ng tubig upang kapag humina o nawala ang supply ng tubig ay mayroong magagamit. Kung may mga katanungan tungkol dito, maaari po kayong tumawag sa (049) 547-0593.

Maraming salamat po sa inyong pang-unawa!

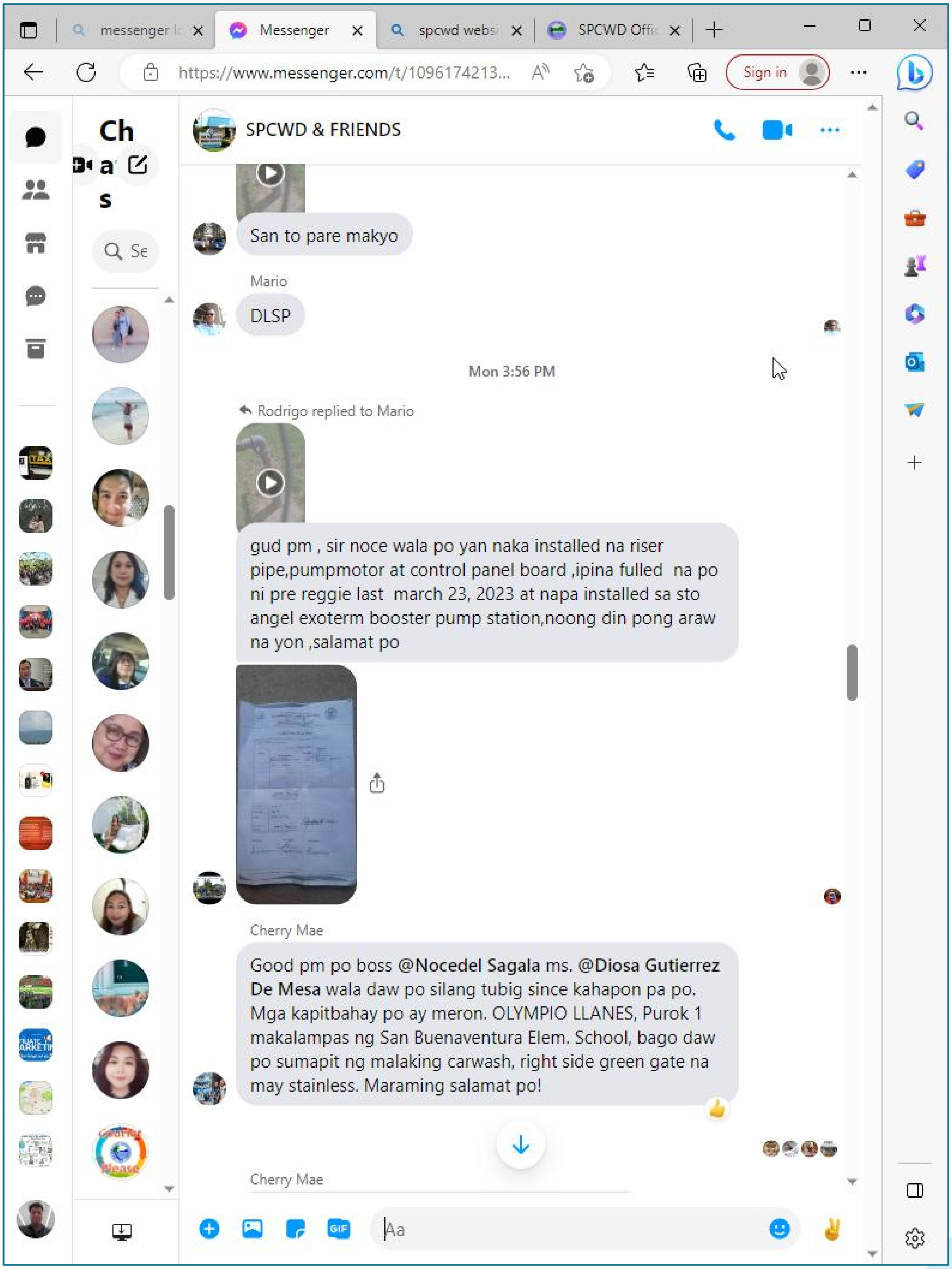
ANNEX X - SPCWD Official Website



ANNEX Y - SPCWD WSP Chat Group



ANNEX Z - SPCWD Internal Chat Group



ANNEX AA - SPCWD Phone Directory

SAN PABLO CITY WATER DISCTRICT
SAN PABLO CITY
PHONE DIRECTORY

LOCAL NUMBE	LOCATION	CODE	OUTGOING CALL PERMISSION
101	LOBBY	OPERATOR	LAGUNA
103	COMMERCIAL SERVICES DEPARTMENT - BILLING	CSD BILLING	LAGUNA
104	COMMERCIAL SERVICES DEPARTMENT - NEW SERVICE	CSD NEW SERVICE	LAGUNA
105	COMMERCIAL SERVICES DEPARTMENT - CUSTOMER	CSD CUSTOMER	LAGUNA
106	COMMERCIAL SERVICES DEPARTMENT - COMPLAIN	CSD COMPLAIN	LAGUNA
107	COMMERCIAL SERVICES DEPARTMENT - CREAS	CSD CREAS	LAGUNA
108	COMMERCIAL SERVICES DEPARTMENT - MANAGER	CSD MANAGER	MANILA
109	TREASURY AND BUDGET DIVISION	TBD	LAGUNA
110	FINANCE DEPARTMENT - MAIN	AFD MAIN	MANILA
111	FINANCE DEPARTMENT - ACCOUNTS	AFD ACCOUNTING	LAGUNA
112	OFFICE OF THE GENERAL MANAGER - SECRETARY	OGM SEC	LAGUNA
113	OFFICE OF THE GENERAL MANAGER - GM	GM	MANILA
114	OFFICE OF THE BOARD OF DIRECTORS	OBD SEC	LAGUNA
115	OFFICE OF THE BOARD OF DIRECTORS	OBD	MANILA
116	LEGAL OFFICE	LEGAL	LAGUNA
117	ICTS - DEVELOPMENT	ICTS DEV	LAGUNA
118	ICTS - SERVER ROOM	ICTS SERVER	MANILA
119	INTERNAL AUDIT SECTION	AUDIT	LAGUNA
120	RTC	RTC	LAGUNA
121	CONFERENCE ROOM	CONF RM	LAGUNA
122	ADMINISTRATIVE DEPARTMENT - HR	AGD HR	LAGUNA
123	ADMINISTRATIVE DEPARTMENT - MANAGER	AGD MANAGER	MANILA
124	PURCHASING SECTION	PRS	LAGUNA
125	PURCHASING SECTION - SUPERVISOR	PRS SUPERVISOR	MANILA
126	GENERAL SERVICES DIVISION	GSD STORE RM	LAGUNA
127	GENERAL SERVICES DIVISION	GSD	MANILA
128	BIDS AND AWARDS COMMITTEE	BAC	LAGUNA
129	GUARD HOUSE	GUARD	LAGUNA

LAGUNA LINE: (049) 562 - 9955
MANILA LINE: (02) 8396 - 9550
FAX NUMBER: (049) 562 - 2751
COMPLEX: (049) 547 - 0593
LABORATORY: (049) 502 - 8221
BRANCH: (049) 508 - 3070

ANNEX AB - Definition of Terms

Term	Definition
Audit	An audit of a Water Safety Plan (WSP) is a review and evaluation of the implementation, effectiveness, and ongoing management of the plan. The purpose of an audit is to identify any deficiencies or areas for improvement in the WSP, and to ensure that the plan is meeting its intended goals of providing safe and reliable drinking water to consumers.
Autoclave	An autoclave is a piece of laboratory equipment used to sterilize equipment and supplies by subjecting them to high pressure and temperature. It is a sealed chamber that uses steam to kill bacteria, viruses, and other microorganisms that may be present on the surfaces of instruments or supplies.
Backflow	Flow of water in a pipe or line in a direction opposite to the normal flow; often associated with back siphonage or the flow of possibly contaminated water into a potable water system
Backwash	The upflow or counter-current flow of water through a filter, lifting the mineral bed and flushing away to drain the particles of foreign matter that have been filtered from the water supply during the service cycle.
Biological Safety Cabinet	A Biological Safety Cabinet (BSC), also known as a biosafety cabinet or microbiological safety cabinet, is an enclosed laboratory workspace designed to provide protection for the user, the environment, and the samples being handled.
Brilliant Green Lactose Broth	Brilliant Green Lactose Broth is a type of selective and differential culture medium commonly used in microbiology to detect and enumerate fecal coliforms, particularly Escherichia coli (E. coli).
Catchment	Drainage basin/ watershed – a discreet area of land that has a common drainage system. A catchment includes both water bodies that convey the water and the land surface from which water drains into these bodies.
Centrifugally Cast Iron (CCI)	Centrifugally Cast Iron (CCI) pipes are a type of pipe made from cast iron using the centrifugal casting process. This manufacturing process involves pouring molten iron into a rapidly rotating cylindrical mold, allowing the iron to solidify under the force of centrifugal force. CCI pipes are known for their durability, strength, and resistance to corrosion, making them a popular choice for water supply and drainage systems.
Chlorine	A halogen element, a heavy, greenish-yellow, incombustible, water soluble, poisonous gas that is highly irritating to the respiratory organs; used for water purification, bleach making, etc.

Chlorination Disinfection of water by using Chlorine, whereby chlorine is added to the water for the purpose of killing bacteria, by means of a chlorinator or feed pump.

Chlorine Residual when a sufficient dosage of chlorine is applied to water, microorganisms of sanitary significance are destroyed and there is a reaction on all oxidizable matter. After all these reactions have taken place, at the end of a specified contact time there remains a certain minute quantity of chlorine in the water.

Coagulant A substance that triggers formation of a soft, semisolid mass in water, to which constituent to be removed are attracted and/or trapped by adhesion; often the constituent become heavy enough to settle out.

Coagulation is a water treatment process that promotes aggregation of small particles into larger particles that can be subsequently removed by sedimentation and/or filtration.

Color Color is an important parameter to consider in a Water Safety Plan (WSP) because it can affect the aesthetic quality of water and impact consumer satisfaction. Color in water is typically caused by the presence of dissolved organic compounds, such as humic and fulvic acids, or by suspended particles such as clay or other sediment.

Compliance Adherence to set water quality / operational requirements. Refers to the degree to which the plan adheres to applicable laws, regulations, standards, and guidelines related to the safety and quality of drinking water.

Contaminant Contaminants are substances that can make water unsafe or unsuitable for human consumption. Examples of contaminants that may be present in drinking water include bacteria, viruses, protozoa, chemical pollutants, and physical particles such as sediment or rust. A Water Safety Plan (WSP) is a comprehensive approach to managing the risks associated with potential contaminants in the water supply.

Control The state wherein correct procedures are being followed and criteria are being met.

Control Measure Any action and activity that can be used to prevent, eliminate or reduce to an acceptable level any water safety hazard

Control Point A step at which control can be applied to prevent, eliminate or reduce the risks of a water safety hazard.

Corrective Action Any action to be taken when the results of monitoring at the control point indicate a loss of control.

Critical Limit	In a Water Safety Plan (WSP), a critical limit is a measurable value or parameter that must be maintained within acceptable limits to ensure the safety and quality of drinking water. Critical limits are established based on risk assessment and are used to identify when corrective actions are needed to manage risks and ensure that the water supply is safe for consumption.
Disinfection	Disinfection is the process of destroying or removing harmful microorganisms from water by using chemical, physical, or biological agents. The most commonly used disinfectants in water treatment include chlorine, chloramines, ozone, ultraviolet (UV) light, and hydrogen peroxide.
Durham Tube	A Durham tube is a small, inverted glass vial or test tube that is used in microbiology to detect gas production by microorganisms during fermentation. The tube is filled with a liquid growth medium, such as glucose broth, and is then inverted and placed in a larger tube or flask that also contains the same growth medium.
Enterobacter	Enterobacter is a genus of gram-negative bacteria that belongs to the family Enterobacteriaceae. This genus contains numerous species of bacteria that are found in diverse environments, including soil, water, and the intestines of humans and other animals. Some species of Enterobacter can also cause infections in humans, particularly in individuals with weakened immune systems or those who have undergone invasive medical procedures.
Escherichia coli (E. coli)	Escherichia coli, commonly abbreviated as E. coli, is a Gram-negative, facultative anaerobic, rod-shaped bacterium that is commonly found in the lower intestine of warm-blooded organisms, including humans. While most strains of E. coli are harmless and even beneficial to their hosts, some strains can cause illness, such as food poisoning, urinary tract infections, and neonatal meningitis. E. coli is a commonly studied model organism in microbiology and genetics, and has contributed significantly to the understanding of gene regulation, DNA replication, and protein synthesis.
Facultative Anaerobic Bacteria	Facultative anaerobic bacteria are microorganisms that can survive and grow in both aerobic (oxygen-rich) and anaerobic (oxygen-poor) environments. These bacteria are capable of carrying out cellular respiration in the presence of oxygen, but can also switch to fermentation or anaerobic respiration in the absence of oxygen.
Fecal Coliform	Is an anaerobic, rod-shaped, gram-negative, non-sporulatingbacterium.When levels are high there may be an elevated risk of waterborne gastroenteritis.
Filter	A device used to clean water by removing iron, silt, taste, odor, color, etc., before it is fed into the softener or supply lines of the consumer.
Filter Media	A media filter is a type of filter that uses a bed of *sand*, peat, shredded tires, foam, crushed glass, geo-textile fabric, crushed granite or other material to

	filter water for drinking, swimming pools, aquaculture, irrigation, storm water management and other applications.
Filtration	A process of treating water by means of oxidation of iron and manganese content on water by using Chlorine and simple aeration, and then passing through a manganese greensand filter media before distribution.
Floc	A flocculent mass formed in a fluid through precipitation or aggregation of suspended particles.
Fulvic acids	Fulvic acids are a group of organic acids that are formed during the decomposition of plant and animal matter in soil. They are a type of humic substance, which also includes humic acids and humin. Fulvic acids are soluble in water and have a yellow to dark brown color.
Groundwater	Water that occurs below the surface of the Earth, where it occupies spaces in soils or geologic strata.
Hazard	Any agent (physical, chemical, biological or radiological) that can cause harm to public health
Hazard Analysis	The process of collecting and evaluating information on hazards and conditions leading to their presence to decide which are significant for water safety and therefore should be addressed in the WSP.
Hazardous Event	is an incident or occurrence that poses a threat to the safety and quality of drinking water. Hazardous events can be caused by a range of factors, including natural disasters, technological accidents, intentional acts, or human error.
Heterotrophic Plate Count (HPC)	Is a procedure used to estimate the number of live heterotrophic bacteria that are present in a water sample. A sample of water is put on a plate that contains nutrients that the bacteria need to survive and grow.
Inorganic Substances	Inorganic substances are compounds that do not contain carbon and can be found in water sources. These substances can enter water sources from a variety of sources, including natural geological formations, agricultural runoff, and industrial discharges. Some inorganic substances can be harmful to human health, such as heavy metals like lead, arsenic, and mercury.
Implementation	Implementation is a critical step in the Water Safety Plan (WSP) process. It involves putting the plan into action by implementing the measures and procedures that have been developed to manage the risks associated with potential hazards in the water supply.

Incident/ Near-miss Where loss of control has led to a public health risk. An incident or near-miss is an unexpected event or circumstance that has the potential to impact the safety and quality of the water supply. An incident refers to an actual event that has caused harm or damage to the water supply, while a near-miss refers to an event that could have resulted in harm or damage, but did not.

Indole Indole is a heterocyclic organic compound with a bicyclic structure consisting of a six-membered benzene ring fused to a five-membered nitrogen-containing pyrrole ring. It has a molecular formula of C8H7N and a molecular weight of 117.15 g/mol. Indole is a colorless to pale yellow solid that is soluble in organic solvents like ethanol and chloroform.

Incubator An incubator is a piece of laboratory equipment used to grow and maintain microbiological cultures or cell cultures. It is a temperature-controlled device that provides a stable and controlled environment for the growth of cells or microorganisms.

Lauryl Sulphate Broth Lauryl Sulphate Broth (LSB) is a microbiological culture medium commonly used for the detection and enumeration of coliform bacteria in water, food, and dairy products. It contains sodium lauryl sulphate, which is a selective agent that inhibits the growth of non-coliform bacteria and encourages the growth of coliforms.

Microorganism Any organism too small to be viewed by the unaided eye, as bacteria, protozoa, and some fungi & algae.

Monitor The act of conducting a planned sequence of observations or measurements of control parameters to assess whether a control point is under control or whether the water meets quality criteria.

Multi-barrier Approach The concept of using more than one type of barrier or control measure in a water supply system (from catchment through abstraction, treatment, storage and distribution to the consumer) to minimize risks to the safety of the water supply.

Nephelometric Turbidity Unit (NTU) The standard unit of measurement used to measure turbidity in water. It makes use of a light scattering effect of fine suspended particles in a light beam.

Nonspore-forming Nonspore-forming refers to bacterial species that do not form spores. Spore-forming bacteria, on the other hand, have the ability to form a tough, protective outer layer called a spore when they are exposed to unfavorable conditions such as lack of nutrients or high temperatures. The spore allows the bacteria to survive in a dormant state until more favorable conditions return.

Parts per million (ppm)	A common basis for reporting the results of water and wastewater analysis, indicating the number of parts by weight of water or other solvent. One ppm equal to 1 milligram per liter.
Petri Dish	A petri dish is a shallow, cylindrical glass or plastic container with a lid, used for culturing and observing microorganisms, cells, and tissues in a laboratory setting. Petri dishes are commonly used in microbiology, molecular biology, and cell culture applications, and are used to grow and study bacteria, fungi, viruses, and other microorganisms.
Polyvinyl Chloride (PVC)	Polyvinyl chloride (PVC) is a synthetic plastic polymer that is widely used in construction, plumbing, and electrical industries. It is a thermoplastic material, which means it can be melted and molded into different shapes and sizes. PVC pipes are a popular choice for plumbing systems because they are lightweight, durable, and resistant to corrosion and chemical damage.
Operational Monitoring	The act of conducting a planned sequence of observations or measurements of control parameters to assess whether a control measure is operating within the design specifications.
Organic Substances	Organic substances are carbon-based compounds that can be found in water sources. They can enter water sources from a variety of sources, including industrial discharges, agricultural runoff, and sewage treatment plants. Some of these substances can be harmful to human health, including pesticides, herbicides, and polycyclic aromatic hydrocarbons (PAHs).
Pathogen	An infectious agent (colloquially known as a *germ*) – a microorganism, in the widest sense such as a virus, bacterium, prion, or fungus, that causes disease in its host. The host may be an animal, human, a plant, or even another microorganism.
pH meter	A pH meter is a scientific instrument used to measure the acidity or alkalinity of a solution. The pH meter measures the concentration of hydrogen ions in the solution and gives a numerical value that represents the pH of the solution. pH is a measure of the hydrogen ion concentration in a solution and is expressed on a scale from 0 to 14, with 0 being the most acidic, 7 being neutral, and 14 being the most alkaline.
Pipettor	A pipettor, also known as a pipette or micropipette, is a laboratory instrument used for transferring small volumes of liquid accurately and precisely. It is commonly used in chemistry, biology, and medical laboratories for various applications such as sample preparation, measuring reagents, and dispensing liquids.
Point of Use	Point of consumption. Point-of-use (POU) is an important component of a Water Safety Plan (WSP). It refers to the point where water is consumed or used by an individual or household. Examples of POU devices include faucets, water filters, and water dispensers.

Polycyclic Aromatic Hydrocarbons (PAHs)	Polycyclic aromatic hydrocarbons (PAHs) are a group of organic compounds that are formed from the incomplete combustion of fossil fuels, wood, and other organic materials. They are characterized by the presence of multiple fused aromatic rings, which give them unique chemical and physical properties. PAHs are ubiquitous in the environment and can be found in air, soil, water, and various organic materials. Some PAHs are known to be carcinogenic, and exposure to them has been linked to various health effects, including respiratory and cardiovascular diseases, as well as developmental and reproductive disorders.
Process Step	A point, procedure, operation or stage in the water supply chain including raw materials, from primary production to final exposure.
Production Well	A water source where extraction of water is by means of submersible pump and motor.
Raw Water	Water as it comes from the source (well, lake, reservoir, river) or untreated water.
Reservoir	A reservoir is a large body of water container that is used to store water for human consumption, irrigation, or other purposes. In a Water Safety Plan (WSP), a reservoir can be a critical component of the water supply system, as it can impact the quality and safety of the water that is supplied to consumers.
Risk Score	The score assigned to a hazard based on the hazard analysis process. A Risk Score in a Water Safety Plan (WSP) is a quantitative measure of the level of risk associated with a specific hazard or hazard event in the water supply system. The Risk Score is determined by considering both the likelihood of the hazard occurring and the potential consequences or impacts of the hazard on public health and the environment.
Safranin	Safranin is a biological stain that is commonly used in microscopy and histology to color various biological specimens. It is a basic dye, meaning it has a positive charge and is attracted to negatively charged structures in cells and tissues. Safranin is commonly used to stain cell nuclei, as well as connective tissues such as cartilage and collagen. It is particularly useful in staining plant cells, as it stains lignified cell walls and makes them more visible under the microscope.
Spring	A water spring is a natural source of water that emerges from the ground, often from underground aquifers. It occurs where the water table intersects the surface of the earth and forms a visible flow of water.
Stakeholders	Individuals or organizations that are influenced by, or influential to, the water supply. Stakeholders in a Water Safety Plan (WSP) are individuals, groups, or organizations that have a direct or indirect interest in the safety and quality of

	the water supply. They may be affected by the water supply system, or they may have an impact on the system's performance. It is important to identify and engage stakeholders in the WSP process to ensure that their interests are taken into account and that the plan is effective in managing risks and protecting public health.
Sterilized	Sterilized refers to a state in which all viable microorganisms, including bacteria, viruses, and fungi, have been killed or removed from a material or environment. Sterilization is a process that involves the use of physical or chemical agents, such as heat, radiation, or chemical disinfectants, to achieve this state of complete microbial destruction.
Supporting programs/supporting requirements	The foundation activities required to ensure safe water including training, raw material specifications and general good water management practices. These programs can be just as important as control points in controlling water quality risks but where application tends to cover long time-frames and/or broader organizational or geographic areas. Includes general organizational supporting programs as well as specific programs targeted to particular risks.
Top-Loading Balance	A top-loading balance is a laboratory instrument used to measure the mass of an object with a high degree of accuracy. It consists of a weighing pan located at the top of the balance, which is attached to a spring or electronic sensor that measures the weight of the object placed on the pan.
Total Coliform	Refers to any rod-shapes, non-spore-forming gram negative bacteria capable of growth in the presence of bile sales, or other surface-active agents with similar growth-inhibiting.
Total Dissolve Solids	Total Dissolved Solids (TDS) is a measure of the amount of inorganic and organic substances that are dissolved in water, including minerals, salts, and other substances. TDS is an important parameter to consider in a Water Safety Plan (WSP) because it can affect the taste, odor, and appearance of water, as well as its suitability for various uses.
Turbidity	Turbidity is the cloudiness or haziness of a liquid caused by the presence of suspended particles, such as clay, silt, and organic matter. In a Water Safety Plan (WSP), turbidity is an important parameter to consider as it can be an indicator of the quality of the water and the effectiveness of the treatment process.
Upgrade	An upgrade in a Water Safety Plan (WSP) refers to changes or improvements made to the plan to ensure that it remains effective in managing risks and ensuring the safety and quality of the water supply. WSP upgrades may be necessary due to changes in the water supply system, advancements in technology or scientific knowledge, or changes in regulations or standards.

Validation	Investigative activity to identify the effectiveness of control measure. It provides the evidence that elements of the WSP can effectively meet the water quality targets.
Verification	The application of methods, procedures, tests and other evaluation to determine compliance with the WSP. Verification confirms that the water quality targets are being met and that the system as a whole is operating safely and the WSP is functioning effectively.
Water Bath	A water bath is a piece of laboratory equipment that is used for heating substances or maintaining a constant temperature of samples that are immersed in a water-filled container.
Waterborne Diseases	Diseases caused by pathogenic microorganisms that most commonly are transmitted in contaminated fresh water. Infection commonly results during bathing, washing, drinking, in the preparation of food, or the consumption of food thus infected.
Water Safety Plan (WSP)	A comprehensive risk assessment and risk management approach that encompasses all steps in water supply, from catchment to consumer.

THE WATER SAFETY PLAN

Water, the source of life we need,
A precious gift, a vital deed.
To keep it clean and free from harm,
We must have a water safety plan.

A plan to keep our water pure,
To protect it now and forevermore.
From contaminants that may come,
And keep it safe, our number one.

With regulations in place,
We'll ensure a safe water space.
And with the help of all,
We'll keep our water standing tall.

Community engagement we'll seek,
To educate and help the weak.
With information, dialogues, and more,
We'll keep our water pure for evermore.

So let us join in this noble cause,
And help our water stay applause.
For safe water is our right,
And with our plan, it'll shine so bright.