



# WATER SAFETY PLAN

*Revision No. 0.0 dated May 15, 2017*



**BINMALEY  
WATER  
DISTRICT**



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

| <b>Revision Number</b> | <b>Date</b> | <b>Which section/s of the document was/were revised?</b> |
|------------------------|-------------|--|
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Water Safety Plan of Binmaley Water District

Document Revision : Binmaley WD Water Safety Plan Revision 0.0, dated May 15, 2017 Final



## **I. INTRODUCTION AND WSP TEAM FORMATION**

### **1.1 Background**

Guided by its vision, mission & core values, **BINMALEY WATER DISTRICT** (BIWAD) establish its Water Safety Plan to ensure that the quality of supplied water is safe and meets the health based standards even in emergency cases.

Water Safety Plan focuses on monitoring the safety of water from its source to the concessionaires' household. This Water Safety Plan comprises the protection of the water sources, water treatment plant, pumps and reservoirs, and the distribution network from risk that will endanger the quality of water being delivered to the concessionaires. The WSP intends to guarantee that safe drinking water is available to its customers at all times through a sound water supply practice. This is achieved by:

- a) ensuring that the final quality of water delivered to the consuming public are routinely monitored and water quality results meet the established health-based standards set by DOH.
- b) preventing the contamination of the source of the raw water and provision of programs to immediately resolve occurrences of contamination.

The Water Safety Plan is described as a systematic procedure and comprehensive plan formulated to:

- a) ensure that the desired water quality is met at all times at every stage of its operation
- b) identify parties who will be responsible to undertake the above tasks
- c) identify all the hazards and hazardous events which may impair the quality of water and affect the operation

- d) develop programs that will prevent the occurrence of such events and improve the system
- e) prepare plans to manage the impacts of such events
- f) implement control and monitoring program to assess effectiveness of the plan
- g) keep accurate record and document the procedures and their outcome
- h) subject the plan to continuous improvement

The adoption of the Water Safety Plan and the associated commitment of the Binmaley Water District to the approach translate to a number of benefits. The major benefits of developing and implementing a Water Safety Plan include the systematic and detailed assessment of its processes and prioritization of hazards in all its operations and facilities, the establishment of operational barriers to control hazardous events and the availability of contingency and mitigating measures to cushion the impact of these events. The WSP also provides an organized and structured system to minimize the chances of failure to its services caused by oversight, lapses on management or operational decisions and identifies parties responsible for such. This process ensure the consistency of the quality of water supplied to BIWAD's customers and provide contingency plans to respond to system failures and unforeseeable hazardous events and accidents, which may result in the impairment of its operation.

On the overall, the advantages of the Water Safety Plan can be summarized as follows:

- a) compliance with water quality targets
- b) application of best practices to secure water safety
- c) consistent water quality and safety
- d) plans are in place to prevent crisis scenario from water quality impairment
- e) potential savings from avoidance of incidents and accidents
- f) improvement in asset management
- g) ensure customer satisfaction



## 1.2 VISION, MISSION & CORE VALUES

**Vision :** Binmaley Water District shall become the premier self-sufficient provider of reliable and affordable water service in the Province of Pangasinan.

**Mission :** Partnering with the Local Government for Binmaley's progress, the Binmaley Water District provides safe, potable and high quality water in a responsive manner and at the most economical cost to its concessionaires.

**Quality Policy:** We strive to serve our clients with quality service, constantly consider the interest of our stakeholders and advocate continual improvement. To this end, the Officers and Employees of the Binmaley Water District are committed to:

- Provide quality service to our clients by delivering adequate, safe, potable and affordable water on a 24/7 basis;
- Serve promptly, professionally and courteously;
- Comply with applicable local and international standard; and
- Communicating with clients and other interested parties to poster understanding.

**Core Values:** Integrity, Professionalism, Accountability, Independence and Initiative.

## 1.3 STRUCTURE AND COMPOSITION OF WSP TEAM:

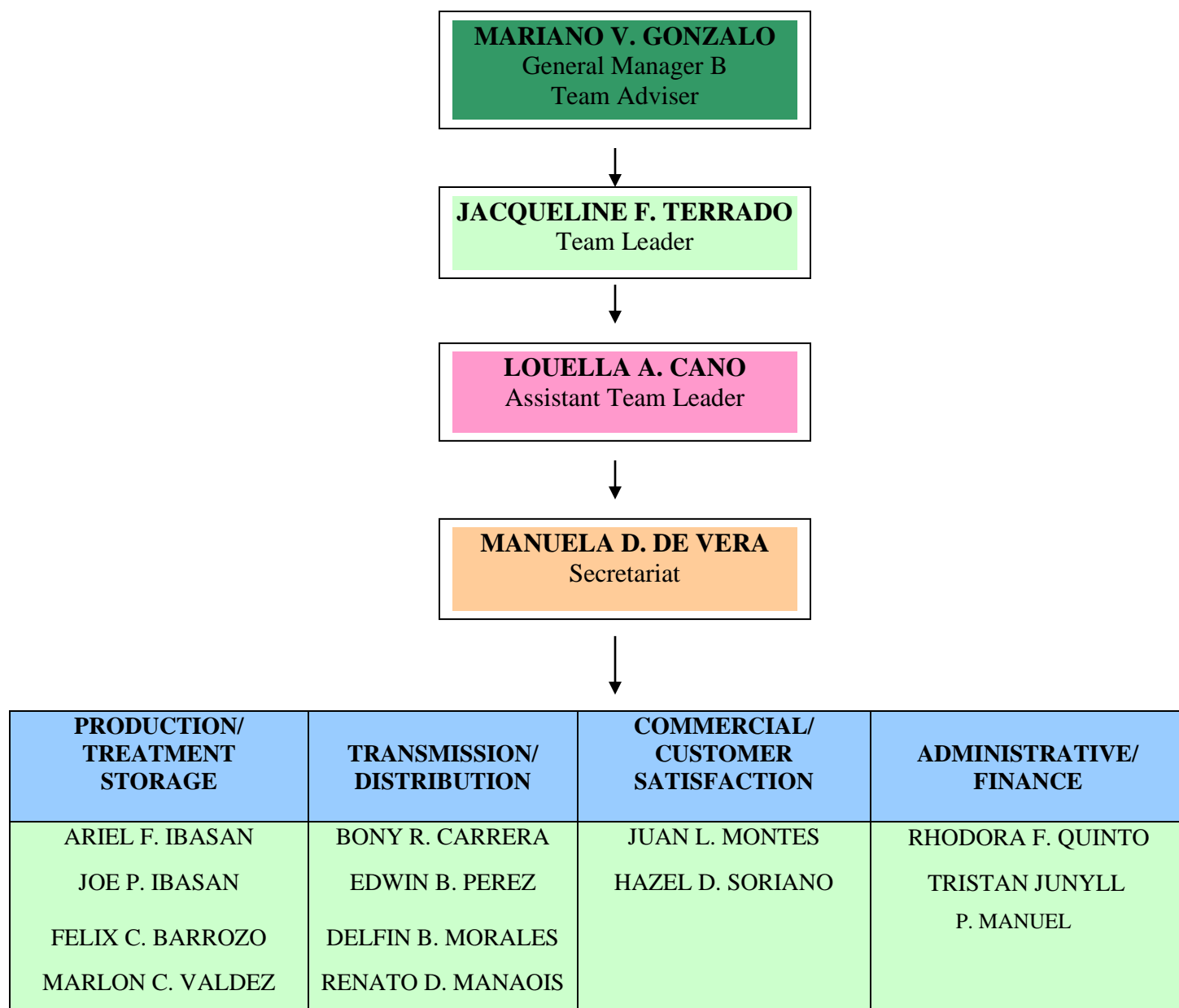
As mandated by the Department of Health's Administrative Order No. 2014-0027 which declares the development and implementation of the Water Safety Plan (WSP) by all drinking-water service providers and as required by the Local Water Utilities Administration Memorandum Circular No. 010-14, the Board of Directors and Management of the Binmaley Water District showed their support for the formulation of the Water Safety Plan Team through Board Resolution No. 04 dated March 19, 2015, attached as Annex D.

The Water Safety Plan Team of the Binmaley Water District was formed thru Office memorandum 2015-03 (Annex C) and composed of diverse and experienced technical personnel from every facet of the water system. Every key divisions and sections are well represented to address all concerns, from the production, maintenance, administrative, finance and commercial. All will be working together, hand in hand for the development and implementation of the identified approach that is connected to the safety of water supplied by the water district.

**Table 1. SKILLS REQUIRED FOR WSP TEAM**

|   |   |                |
|---|---|----------------|
| 1 | Technical expertise on operation and maintenance of                         |                |
|   | a   | Source         |
|   | b   | Storage        |
|   | c   | Treatment      |
|   | d   | Distribution   |
| 2 | Provide operational support for the WSP in terms of                         |                |
|   | a   | Administrative |
|   | b   | Finance        |
|   | c   | Commercial     |
| 3 | Capable of communicating the WSP objectives & outcomes                      |                |
|   | a   | Inside the WD  |
|   | b   | Outside the WD |
| 4 | Understand water quality targets to be met                                  |                |
| 5 | Understand the impact of proposed water quality controls on the environment |                |
| 6 | Familiar with training and awareness program                                |                |

Figure 1. **WSP ORGANOGRAM**



**Table 2. WATER SAFETY PLAN TEAM COMPOSITION**

| Name                     | Job Title   | Role In the WSP Team                   | Contact Details | Expertise |   |   |   |   |   |   |   |   |   |   |   |
|--------------------------|---|--|-----------------|-----------|---|---|---|---|---|---|---|---|---|---|---|
|                          |   |  |                 | 1         |   |   |   | 2 |   |   | 3 |   | 4 | 5 | 6 |
|                          |   |  |                 | a         | b | c | d | a | b | c | a | b |   |   |   |
| Mariano V. Gonzalo       | General Manager   | Team Adviser                           | 09177501269     | x         | x | x | x | x | x | x | x | x | x | x | x |
| Jacqueline F. Terrado    | Division Manager B – Commercial   | Team Leader                            | 09196794411     |           |   |   |   |   |   | x | x | x | x | x | x |
| Louella A.. Cano         | OIC- Operations & Technical Services Division & Senior Corporate Accountant A | Assistant Team Leader                  | 09435585547     |           |   |   |   | x | x |   | x | x |   |   | x |
| Manuela D. De Vera       | Division Manager B-Admin. & Finance   | Secretariat                            | 09158520488     |           |   |   |   | x | x |   | x | x |   |   | x |
| Ariel F. Ibasan          | Plant/Electrician Mechanic B  | Groundwater & Treatment Storage        | 09169339454     | x         | x | x | x |   |   |   |   |   | x | x |   |
| Joe P. Ibasan            | Water Resources Facilities Operator A   | Groundwater & Treatment Storage        | 09228955285     | x         | x | x | x |   |   |   |   |   | x | x |   |
| Felix C. Barrozo         | Water Resources Facilities Operator A   | Groundwater & Maintenance              | 09336028797     | x         | x | x | x |   |   |   |   |   |   |   |   |
| Marlon C. Valdez         | Water Resources Facilities Operator B   | Groundwater & Treatment Storage        | 09276123649     | x         | x | x | x |   |   |   |   |   | x | x |   |
| Bony R. Carrera          | Water/Sewerage Maintenance Foreman  | Transmission/ Distribution Maintenance | 09152187828     | x         | x | x | x |   |   |   |   |   | x | x |   |
| Edwin B. Perez           | Senior Water/Sew. Maintenance Man A   | Transmission/ Distribution Maintenance | 09163663597     |           | x |   | x |   |   |   |   |   |   |   |   |
| Delfin B. Morales        | Senior Water/Sew. Maintenance Man A   | Transmission/ Distribution Maintenance | 09480648169     |           | x |   | x |   |   |   |   |   |   |   |   |
| Renato D. Manaois        | Senior Water/Sew. Maintenance Man A   | Transmission/ Distribution Maintenance | none            |           | x |   | x |   |   |   |   |   |   |   |   |
| Juan L. Montes           | Senior Water/Sew. Maintenance Man A   | Commercial/ Customer Service           | 09165230723     |           |   |   |   |   |   | x |   |   |   |   |   |
| Hazel D. Soriano         | Utilities/Customer Service Asst. C  | Commercial/ Customer Service           | 09778373169     |           |   |   |   |   |   | x |   |   |   |   |   |
| Rhodora F. Quinto        | Cashier A   | Admin/ Finance                         | 09158077414     |           |   |   |   | x | x |   |   |   |   |   |   |
| Tristan Junyll P. Manuel | Administrative Service Aide   | Admin/ Finance                         | 09675419462     |           |   |   |   | x | x |   |   |   |   |   |   |

### **1.7 Duties and Responsibilities of WSP Team:**

1. The Team Leader should drive the project and ensure focus and must use her interpersonal skills to ensure project implementation and to explore external support, that includes benchmarking or partnering with other organizations and other sources of aid and information.
2. The Team must discuss, determine, and define the water supply system, its stakeholders, the hazards of each part of water supply system, the control measures both existing and proposed, the improvement plan to minimize if not eliminate hazardous events.
3. The Team is responsible in monitoring the effectiveness of the WSP and ensures that corrective actions are fully implemented.
4. The Team is responsible of the verification process by conducting several verification activities to ensure that the WSP is effectively implemented to deal with water quality issues and to ensure an open communication with the management and its stakeholders on activities that will affect the quality of water.

**Stakeholders** play a vital role in developing the water safety plan because they have a big impact and influence to the quality of safe drinking water delivered to the concessionaires.

**Table 3 : WSP STAKEHOLDERS**

| STAKE HOLDER                                  | RELATIONSHIP TO DRINKING WATER SUPPLY ISSUES | ISSUES WITH DRINKING WATER SUPPLY  | POINT OF CONTACT WITH WSP TEAM      | INTER-ACTION MECHANISM  | RECORD OF INTER-ACTION                                  |
|---|--|--|-------------------------------------|---|---|
| Local Water Utilities Administration          | Regulatory                                   | Water quality  | Submission of Water Quality Report  | Reporting   | Monthly Report  |
| National Water Resources Board                | Regulatory                                   | Drinking & water extraction authority  | Water permit & water quality report | Communication   | Reports/ documents required                             |
| Department of Environment & Natural Resources | Environment protection authority             | Environment aspects for construction & future management programs  | Regulatory monitoring               | Communication/ Meetings   | Permits/ Reports/ documents required                    |
| Department of Health<br><br>Rural Health Unit | Regulatory                                   | Compliance with PNSDW<br><br>Compliance with Sanitary Code of the Philippines  | Water quality                       | Water samples collection and analysis especially during emergencies           | Laboratory test results<br><br>Permits & certifications |
| Accredited Laboratory Testing Centers         |  | Compliance with PNSDW<br><br>Provide speedy laboratory test results of water samples submitted for various parameters (physical, chemical) & absence or presence of E Coli (bacteriological) for sound and efficient management decision | Laboratory Technician / RMT         | Proper handling of water samples for accurate and reliable laboratory results | Laboratory test results                                 |
| Philippine National Police                    | Police authority                             | Water quality  | Safety of facilities                | Reporting   | Reports   |

|  |                  |  |   |   |   |
|--|------------------|--|---|---|---|
| Department of Public Works and Highways                | Regulatory       | <p>Provide information on project implementation that may cause damage to water pipelines</p> <p>Provide necessary permits to BIWAD for speedy repair/restoration/rehabilitation works of leakages &amp; pipelines</p>   | Project/rehabilitation/ leak repair / restoration activities coordination | Letter of Request/ Communication                            | Communication/ requests letters/ permit |
| Local Government Unit / Engineering's Office/ Barangay | Regulatory       | <p>Provide information on project implementation that may cause damage to water pipelines</p> <p>Provide necessary permits to BIWAD for speedy repair/restoration/rehabilitation works of leakages &amp; pipelines</p> <p>Proper coordination with BIWAD prior to permit/certification issuances specially construction of structures near BIWAD deep wells and treatment facilities</p> | Project/rehabilitation activities coordination                            | Communication/ documentary requirements/ Letter of Requests | Reports/ documents required/ permit     |
| Central Pangasinan Electric Cooperative (CENPELCO)     | Energy supply    | Water quality/ intermittent supply   | Power interruption coordination   | Reporting   | Notice of power interruption            |
| Suppliers  | Industry Partner | Materials/ supplies provided met the standard specifications & delivery period is within the specified period to avoid interruption of district's operation and in the operation of treatment plants and other facilities.   | BAC Chairman / Company Sales Consultant or Representative                 | Request for Quotation/                                      | Procurement documents                   |



## II. SYSTEM DESCRIPTION

### 2.1 GENERAL INFORMATION

**BINMALEY WATER DISTRICT** was formed on August 5, 1978 through Resolution No. 40, s. 1978 passed by the Sangguniang Bayan of Binmaley. Its operation started on October 5, 1979 upon issuance of the Conditional Certificate of Conformance No. 097 by the Local Water Utilities Administration (LWUA) pursuant to the provisions of Presidential Decree No. 198 as amended by PD Nos. 768 and 1479, otherwise known as the Provincial Utilities Act of 1973.

**BINMALEY WATER DISTRICT** is responsible for acquiring, installing, improving, maintaining and operating water supply and distribution systems for domestic and municipal uses for residents and lands within the boundaries of the district, and conducting such other functions and operations incidental to water resource development, utilization and disposal.

**BINMALEY WATER DISTRICT** is a Government-Owned and Controlled Corporation and is an autonomous unit politically and economically independent from the local government. On July 13, 2016, the Local Water utilities Administration issued Certificate of Category for the Binmaley Water District as Category “B” Water District effective July a, 2016 in compliance with the guidelines provided for in the DBM approved Revised Local Water District manual on Categorization, Re-categorization and Other Related matters (LWD-MaCRO).

As of December 31, 2018, the Water District has eight wells (Table 6) catering 100% of the total barangays of the Municipality of Binmaley and some barangays of nearby municipalities and cities (as shown in Table 4) with a total of 11,839 active service connections on a 24/7 service. The district is also a beneficiary of two (2) water treatment plants from the Japanese Government through

Japan International Cooperation Agency (JICA). The said facilities are serving a total population of 71,034 with clean, clear, potable and affordable water.

At present, there are thirty-three (33) hardworking employees, 33 all of which are regular , under the stewardship of **Engr. Mariano V. Gonzalo** as the General Manager and whose overall management and supervision earned for the district an outstanding performance awards. With the assistance and support of the Board of Directors, functioning as Policy Makers, and with the cooperation of the Staff, the **BINMALEY WATER DISTRICT**, diligently and efficiently performs its mission to be of service to the people of Binmaley.

**Table 4. AREAS OF OPERATION:**

| MUNICIPALITY OF BINMALEY |                 |                      |
|--------------------------|-----------------|----------------------|
| 1. Amancoro              | 12. Camaley     | 23. Pallas           |
| 2. Balagan               | 13. Canaoalan   | 24. Papagueyan       |
| 3. Balogo                | 14. Dulag       | 25. Parayao          |
| 4. Basing                | 15. Dupo        | 26. Poblacion        |
| 5. Baybay Polong         | 16. Gayaman     | 27. Pototan          |
| 6. Baybay Lopez          | 17. Linoc       | 28. Sabangan         |
| 7. Biec                  | 18. Lomboy      | 29. Salapingao       |
| 8. Buenlag               | 19. Malindong   | 30. San Isidro Norte |
| 9. Calit                 | 20. Manat       | 31. San Isidro Sur   |
| 10. Caloocan Norte       | 21. Nagpalangan | 32. Sta. Rosa        |
| 11. Caloocan Sur         | 22. Naguilayan  | 33. Tombor           |

| MUNICIPALITY OF LINGAYEN | CITY OF SAN CARLOS |
|--------------------------|--------------------|
| 1. Dulag                 | 1. Parayao         |
| 2. Basing                | 2. xxx             |

**Table 5. Approved Water Rates by LWUA on April 27, 2011 per BOT Res. No. 69, s.2011**

| <b>Concessionaires'<br/>Classification</b> | <b>Meter<br/>Size</b> | <b>No. of<br/>Connections</b> | <b>Minimum<br/>Charge</b> | <b>COMMODITY CHARGES</b> |                     |                     |                        |
|--|-----------------------|-------------------------------|---------------------------|--------------------------|---------------------|---------------------|------------------------|
|  |                       |                               |                           | <b><u>11-20</u></b>      | <b><u>21-30</u></b> | <b><u>31-40</u></b> | <b><u>41 above</u></b> |
| Domestic/<br>Government                    | ½"                    | 10,688                        | P 185.00                  | P20.40                   | P 23.35             | P 27.25             | P 32.10                |
| Domestic/<br>Government                    | ¾"                    | 9                             | 296.00                    | 20.40                    | 23.35               | 27.25               | 32.10                  |
| Domestic/<br>Government                    | 1"                    | 5                             | 592.00                    | 20.40                    | 23.35               | 27.25               | 32.10                  |
| Semi-Commercial                            | ½"                    | 128                           | 277.50                    | 30.60                    | 35.00               | 40.85               | 48.15                  |
| Commercial                                 | ½"                    | 65                            | 370.00                    | 40.80                    | 46.70               | 54.50               | 64.20                  |
| Commercial                                 | ¾"                    | 3                             | 592.00                    | 40.80                    | 46.70               | 54.50               | 64.20                  |
| Commercial                                 | 1"                    | 1                             | 1,184.00                  | 40.80                    | 46.70               | 54.50               | 64.20                  |
| Commercial                                 | 1 ½"                  | 1                             | 2,960.00                  | 40.80                    | 46.70               | 54.50               | 64.20                  |
| Commercial                                 | 2"                    | 1                             | 7,400.00                  | 40.80                    | 46.70               | 54.50               | 64.20                  |
| Wholesale                                  | 3"                    | 1                             | 925.00                    | 18.50                    | 18.50               | 18.50               | 18.50                  |

## 2.4 SOURCES DESCRIPTION:

**Binmaley Water District** gets its source mainly from groundwater. It has eight (8) deep wells with depth ranging from 199M- 250M and rated capacity of 173 to 1,555 cubic meters/ day with two (2) Water Treatment Plants located at Barangays Caloocan Sur and Biec for the improvement of water quality .

| <u>WATER TREATMENT PLANTS</u>                  | <u>Year Constructed</u> |
|--|-------------------------|
| <i>❖ Constructed under the grant from JICA</i> |                         |
| 1. Biec Water Treatment Plant                  | 2003                    |
| 2. Caloocan Sur Water Treatment Plant          | 2003                    |

| <u>DEEPWELLS</u>                 |      |
|----------------------------------|------|
| 1. Nagpalangan (abandoned)       | 1994 |
| 2. Amancoro Pump Station         | 2001 |
| 3. Tombor                        | 2001 |
| 4. Caloocan Sur                  | 2004 |
| 5. Biec                          | 2004 |
| 6. Naguilayan Pump Station       | 2007 |
| 7. San Isidro Norte Pump Station | 2010 |
| 8. Gayaman Pump Station          | 2010 |
| 9. Basing Pump Station           | 2012 |

**Table 6. SOURCES LOCATION**

| <b>Source #</b> | <b>Deep well</b>           | <b>Production Capacity</b> | <b>Operating Schedule</b> | <b>Capacity m3/day</b> |
|-----------------|----------------------------|----------------------------|---------------------------|------------------------|
| 1               | Nagpalangan<br>(abandoned) | 2 lps                      | 24 hours                  | 172.80 m3/day          |
| 2               | Amancoro                   | 6 lps                      | 16.5 hours                | 367.20 m3/day          |
| 3               | Tombor                     | 13 lps                     | 21.5 hours                | 1,123.20 m3/day        |
| 4               | Caloocan Sur               | 17 lps                     | 17.5 hours                | 1,468.80 m3/day        |
| 5               | Biec                       | 18 lps                     | 18.5 hours                | 1,555.20 m3/day        |
| 6               | Naguilayan                 | 17 lps                     | 23 hours                  | 1,468.80 m3/day        |
| 7               | San Isidro                 | 16 lps                     | 17.5 hours                | 1,382.40 m3/day        |
| 8               | Gayaman                    | 10 lps                     | 21.5 hours                | 864.00 m3/day          |
| 9               | Basing                     | 8 lps                      | 20.5 hours                | 691.20 m3/day          |



#### **2.4.a DEEPWELLS/PUMP STATIONS :**

##### **1. NAGPALANGAN PUMP STATION:**

Nagpalangan System was previously owned by the barangay and was turned-over to the Binmaley Water District in 1995. The Nagpalangan deep well was drilled to an approximate depth of 130M with a casing diameter of 100mm. The well is equipped with submersible deep well (Model SP7) coupled to a submersible motor 2HP with a capacity of 2lps. The well has a Static Water Level of 7M and Pumping Water Level of 9M. Pumping operation is automatic through the use of water level control installed in the elevated tank.



Figure 3. NAGPALANGAN PUMP STATION



## **2. AMANCORO PUMP STATION:**

The Amancoro deep well was constructed in 2001 thru the ADB-loan project. The well depth is 199M with a casing diameter of 350mm x 200mm spiral welded pipes. The well is equipped with submersible deep well pump coupled to a submersible motor 15HP with a capacity of 6 lps. The well is operating from 4:30Am to 9:00PM. The pumping station has a chlorinator for disinfection and a 50KVA generator set as standby power supply in case of power failure.



Figure 4. AMANCORO PUMP STATION

### 3. TOMBOR PUMP STATION:

Tombor deep well was drilled in 2003 thru the ADB loan project. The well depth is 201M with a casing diameter of 350mm x 200mm spiral welded pipes. The well is equipped with submersible deep well pump (Model SP46-4) coupled to a submersible motor 15HP with a capacity of 13 lps. The well is operating from 1:00AM to 10:30PM. The well has Static Water Level of 16M and Pumping Water Level of 30.30M. The pumping station has a chlorinator for disinfection and 45KVA generator set as standby power supply in case of power failure.



Figure 5. TOMBOR PUMP STATION



#### 4. NAGUILAYAN PUMP STATION

Naguilayan deep well was drilled in 2007 to a depth of 249M with casing diameter of 350mm x 200mm spiral welded pipes. The well is equipped with submersible deep well pump (Model SP77-3A) coupled to a submersible motor 20HP with a capacity of 17 lps. The well is operating from 1:00AM to 12:00 midnight. The well has Static Water Level of 8.12M and Pumping Water Level of 19.5M. The pumping station has a chlorinator for disinfection and 60KVA generator set as standby power supply in case of power failure.



Figure 6. NAGUILAYAN PUMP STATION

## 5. SAN ISIDRO PUMP STATION:

San Isidro deep well was drilled in 2010 to a depth of 208M with a casing diameter of 350mm x 200mm spiral welded pipes. The well is equipped with submersible deep well pump coupled to a submersible motor 7.5HP with a capacity of 16 lps. The well is operating from 4:00AM to 09:30PM. The well has Static Water Level of 8.5M and Pumping Water Level of 13.1. The pumping station has a chlorinator for disinfection and 45KVA generator set as standby power supply in case of power failure. Inside the compound is a Fiber-Glass Reinforced Ground Reservoir with a capacity of 300 cubic meters.



Figure 7. SAN ISIDRO PUMP STATION



## 6. GAYAMAN PUMP STATION

Gayaman deep well was drilled in 2010 to a depth of 196M with casing diameter of 350mm x 200mm spiral welded pipes. The well is equipped with submersible deep well pump coupled to a submersible motor 20HP with a capacity of 10 lps. The well is operating from 1:00AM to 10:30PM. The well has Static Water Level of 18.5M and Pumping Water Level of 31.5M. The pumping station has a chlorinator for disinfection and 77KVA generator set as standby power supply in case of power failure.

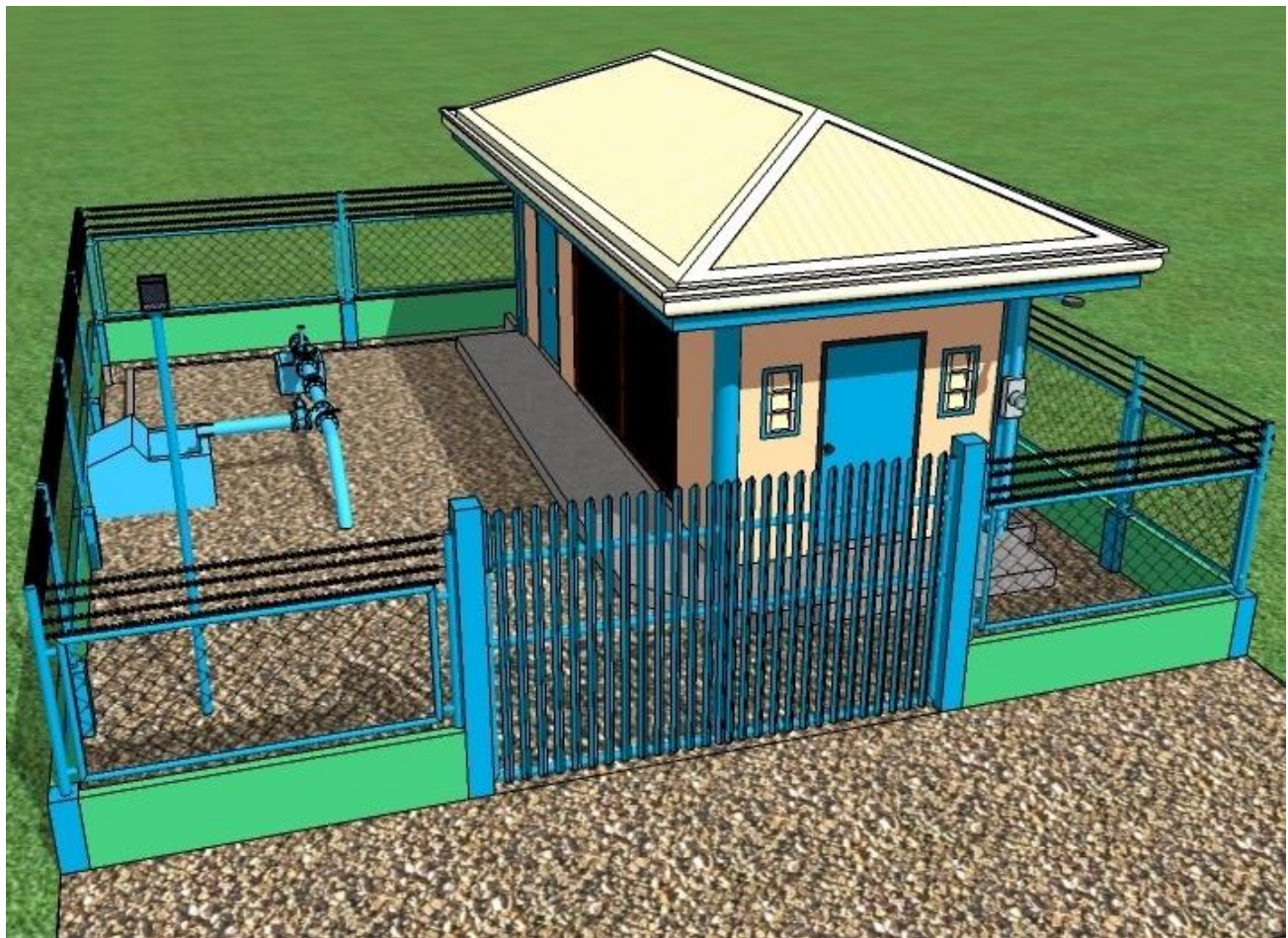


Figure 8 . GAYAMAN PUMP STATION

## 7. BASING PUMP STATION

Basing deep well was drilled in 2012 to a depth of 200M with casing diameter of 350mm x 200mm spiral welded pipes. The well is equipped with submersible deep well pump (Vanssan Model 150-5) coupled to a submersible motor 10HP with a capacity of 8 lps. The well is operating from 3:00AM to 11:30PM. The well has Static Water Level of 9.5M and Pumping Water Level of 13.8M. The pumping station has a chlorinator for disinfection and a 50KVA generator set as standby power supply in case of power failure.



Figure 9. BASING PUMP STATION

**8. Caloocan Sur Deepwell & Water Treatment Plant** was drilled in 2004 to a depth of 250M with a casing diameter of 350mm x 200mm spiral welded pipe. The well is equipped with a submersible deep well pump (Model SP60-3) coupled to a submersible motor 15HP with a capacity of 17 lps. The well is operating from 4:30AM to 10:00PM. The well has Static Water Level of 11.5M and Pumping water Level of 16.3M.

**9. Biec Deepwell & Water Treatment Plant** was drilled in 1998 to a depth of 209M with a casing diameter of 350mm x 250mm spiral welded pipes. The well is equipped with a submersible deep well pump (Model SP220-6) coupled to a submersible motor with a capacity of 18 lps. The well is operating from 4:30AM to 11:00PM. The well has Static Water Level of 10M and Pumping Water Level of 13.6M.



## **2.4.b WATER TREATMENT PROCESSES:**

The water quality of Binmaley has yellowish color and odor because of organic matters that is present in the groundwater source. Caloocan Sur and Biec Water Treatment Plants were constructed in 2003. These two treatment plants employ the following processes: Aeration-Slow/Rapid Mixing-Coagulation/Flocculation-Sedimentation and Filtration.

Each treatment plant (Caloocan Sur and Biec Water Treatment Plants) has 12 facilities and discussed in detail as follows:

### **1. DEEPWELL**

The deep well is the source of Raw Water. The Deep Well Pump discharge raw water to the Aeration Tower.

Caloocan Sur deep well was drilled in 2004 to a depth of 250M with casing diameter 350mm x 200mm spiral welded pipes. The well is equipped with a submersible deep well pump (Model SP60-3) coupled to a submersible motor 15HP with a capacity of 17lps. The well is operating from 4:30AM to 10:00PM. The well has Static Water Level of 11.5M and Pumping Water Level of 16.3M.

Biec (Fabia) deep well was drilled in 1998 to a depth of 209M with casing diameter of 350mm x 200mm spiral welded pipes. The well is equipped with a submersible deep well pump (Model SP220-6) coupled to a submersible motor with a capacity of 18lps. The well is operating from 4:30AM to 11:00PM. The well has Static Water Level of 10M and Pumping Water Level of 13.6M.

## **2. AERATION TOWER**

Aeration is the first process of water treatment and brings water and air in close contact in order to remove the odor and oxidizes dissolved metals such as iron, manganese and hydrogen sulfide usually present in groundwater.

The iron content present in groundwater is oxidized and extracted by spraying the raw water in the aeration tower. The aeration nozzle sprays the raw water; retention time is about 90-100 minutes as designed.

## **3. MIXING BASIN**

The aerated raw water will flow to the mixing basin. In the mixing basin, flocculants are added and stir with the rapid mixer. Retention time is about 1.5 minutes as designed.

**POLY ALUMINUM CHLORIDE (PAC)** - this chemical is used as flocculating agent. It promotes flocculation by causing colloids and other suspended particles in liquids to aggregate, forming a floc. Flocculants are used in water treatment processes to improve the sedimentation or filterability of small particles.

## **4. FLOCCULATION BASIN**

In the Flocculation Basin stir slowly the water from Mixing Basin to allow flocs to develop. The retention time is about 30 minutes as designed. Baffled plates are installed to facilitate coagulation and are facilitated by flocculation process which is slow mixing of coagulated raw water that allows particles to gather to form larger, heavier particles called “floc” which will be settled at the bottom.

## 5. SEDIMENTATION BASIN

Precipitate fully grown-up flocs. The retention time is about 100 minutes as designed. At the entrance and exit to the sedimentation basin, flow uniforming walls are installed to attain uniform inflow and outflow of water.

## 6. ALUM SOLUTION DOSING FACILITY

It is the facility that flocculates the oxidized and extracted iron content of the aeration tower and alum is injected into the front-part of mixing basin to execute settling removal within the sedimentation basin. The alum solution tank stores the dissolved alum and the alum solution mixer dissolves the alum.

## 7. CHLORINE SOLUTION DOSING FACILITY

It is the facility that injects chlorine as disinfectant. There are three points for injection and the purposes of the injection point are as follows:

- Front-part of mixing basin - remove algae in mixing basin, flocculation basin and sedimentation basin.
- Back-part of sedimentation basin - remove algae in filtration basin
- Back-part of filtration basin – use for disinfection

**SODIUM HYPOCHLORITE** - is a chemical compound with the formula  $\text{NaClO}$ . It is composed of a sodium cation ( $\text{Na}^+$ ) and a hypochlorite anion ( $\text{ClO}^-$ ). It may also be viewed as the sodium salt of hypochlorous acid. When dissolved in water, it is commonly known as bleach or liquid bleach. Sodium Hypochlorite is used as oxidizing agent during the pre-chlorination stage and as disinfectant for microbial contamination in the intermediate and post-chlorination stage.

## **8. FILTRATION BASIN**

Water that is treated in the sedimentation basin or aeration tower is filtered as treated water. The sand filter is a filter media for filtration to remove turbidity from raw water. It is necessary to wash when the level of water in filtration basin goes high at the operation. Gravel supports filter sand. There are four layers and the particle size become bigger downward. Filtered water is stored to the Treated Water Reservoir.

## **9. DRAINAGE BASIN**

Receive the wastewater when filtration basin is washed. Once received, supernatant water is sent back to the mixing basin as recycling water. It has a capacity of one time washing of the filtration basin.

## **10. TREATED WATER RESERVOIR (TWR)**

Once treated, water coming from the filtration basin enters the treated water distribution network and is directly sent to the Treated Water Reservoir (TWR). The retention time is eight hours as designed. The transmission pump supplies water from treated water reservoir to the distribution line.

## **11. SLUDGE BED**

The sludge bed receives the sludge that settled in the sedimentation basin and the sun dries it while draining the supernatant water.













## **12. DRAINAGE PIT**

Receives the drain from each basin and discharge outside by drain pump

**Table 7. PROCESS FLOW LEGEND:**

| PROCESS/STEP                   | SYMBOL  | DESCRIPTION   |
|--------------------------------|---|---|
| Source                         |    | Deep wells  |
| Treatment/<br>Chemical Process |    | Aeration, Chlorination, Mixing,<br>Flocculating, Sedimentation, Filtration  |
| Transport                      |    | <ol style="list-style-type: none"> <li>1. Raw water from deepwell to Aeration Tower.</li> <li>2. Water from Sedimentation Basin to Filtration Basin.</li> <li>3. Treated Water from Filtration Basin to Treated Water Reservoir.</li> </ol>   |
| Storage                        |  | <ol style="list-style-type: none"> <li>1. 500 cubic meters Concrete Ground Treated Water Reservoirs (Biec and Caloocan Sur Water Treatment Plants)</li> <li>2. 300 cubic meters Fiber-Glass Reinforced Polyester Ground Reservoir (San Isidro)</li> <li>3. 190 cubic meters Reinforced Elevated Concrete Reservoir (Poblacion)</li> <li>4. 100 cubic meters Elevated Steel Tank (Papagueyan)</li> <li>5. 10 cubic meters Elevated Steel Tank (Nagpalangan)</li> </ol> |
| Transport                      |  | <ol style="list-style-type: none"> <li>1. Treated Water Reservoir to Distribution Line.</li> <li>2. Chlorinated Water from Pump house to Distribution Line.</li> </ol>  |
| Inspection                     |  | Random sampling for chlorine residual and Water Quality analyses within the distribution system.  |

**Table 8. PROCESS FLOW DIAGRAM - BIEC & CALOOCAN SUR WATER TREATMENT PLANTS**

| Description                                | Step  | Responsible Unit                                 |
|--|---|--|
| Raw water from Caloocan Sur deep well      |    | Production Unit-Pump Operator                    |
| Transport to Aeration Tower                |    | Production Unit-Pump Operator                    |
| Aerated Water                              |    | Production Unit-Pump Operator                    |
| Transport to Mixing Basin                  |    | Production Unit-Pump Operator                    |
| Injection of PAC and Sodium Hypochlorite   |    | Production Unit-Pump Operator                    |
| Coagulation-Flocculation and Sedimentation |  | Production Unit-Pump Operator                    |
| Transport to Filtration Basin              |  | Production Unit-Pump Operator                    |
| Filtration                                 |  | Production Unit-Pump Operator                    |
| Transport to Treated Water Reservoir       |  | Production Unit-Pump Operator                    |
| Treated Water Reservoir                    |  | Production Unit-Pump Operator                    |
| Transport to Distribution Line             |  | Construction Unit-Water/Sewerage Maintenance Men |
| Concessioner                               |  | Construction Unit-Water/Sewerage Maintenance Men |

## 2.5 Transmission and Distribution

Binmaley Water District has a total pipeline network of 127,186 linear meters which are interconnected traversing the service coverage area. It is composed of Asbestos Concrete Pipes, Cast Iron Pipes, Un-plasticized Polyvinyl Chloride Pipes and Polyethylene Tubing.

**Table 9 :     LENGTH OF TRANSMISSION/DISTRIBUTION LINES**

| <b><u>Diameter</u></b> | <b><u>Materials Type</u></b> | <b><u>Length (m)</u></b> |
|------------------------|------------------------------|--------------------------|
| 200mm                  | Asbestos Concrete Pipe       | 500m                     |
| 200mm                  | UPVC Pipe                    | 700m                     |
| 150mm                  | UPVC Pipe                    | 7,200m                   |
| 150mm                  | Cast Iron Pipe               | 800m                     |
| 100mm                  | UPVC Pipe                    | 25,900m                  |
| 100mm                  | Asbestos Concrete Pipe       | 1,500m                   |
| 100mm                  | Cast Iron Pipe               | 1,600m                   |
| 75mm                   | UPVC Pipe                    | 46,025m                  |
| 75mm                   | Asbestos Concrete Pipe       | 600m                     |
| 50mm                   | UPVC Pipe                    | 24,570m                  |
| 40mm                   | Polyethylene Tubing          | 3,808m                   |
| 32mm                   | Polyethylene Tubing          | 13,983m                  |



## 2.6 Storage Facilities

1. Caloocan Sur Treated Water Concrete Ground Reservoir has a capacity of 500 cubic meters of treated water. It was constructed in 2003.
2. Biec Treated Water Concrete Ground Reservoir has a capacity of 500 cubic meters of treated water. It was constructed in 2003.
3. Poblacion Elevated Reinforced Concrete Reservoir with a capacity of approximately 190 cubic meters and an overflow elevation of 15.6m above It was constructed in 1960.
4. Nagpalangan Elevated Steel Tank has an existing capacity 6.9 cubic meters constructed in 1994 beside its pumping station. The bottom elevation of the tank is 14.40m above ground level and an overflow elevation of 16.60m above ground level.
5. Papagueyan Elevated Steel Tank has a capacity of 100 cubic meters constructed in 2003.
6. San Isidro Fiber-Glass Reinforced Polyester Ground Reservoir has an existing capacity of 300 cubic meters and was constructed in 2010 with fill and draw system using a booster pump to pump out water into distribution lines.

## **2.7 Intended users and uses of water:**

The water supplied by the Binmaley Water district is primarily intended for general domestic use and consumption such as drinking, personal hygiene, foodstuff preparation, washing of clothes, utensils and other human activities that utilize water.

The intended consumers do not include those who are significantly immuno-compromised or industries with special water quality needs. It should be noted that the water is not recommended for use for hospital products, medical procedures and pharmaceuticals requiring special purification process. And these are advised to provide additional points-of-use treatment.

The water is not also safe for use with freshwater aquarium fish species, amphibians and other sensitive domesticated animals that may be intoxicated by the chlorine present in the water.

## **2.8 Water Quality Targets & Commitment:**

Water supplied by the **Binmaley Water District** should comply with the Philippine National Standards for Drinking Water both for microbiological quality and physical-chemical quality.

Microbiological Testing is conducted monthly. Water samples are collected from the Water District's sources (9 deep well) and from concessionaires' tap. These water samples are submitted for analysis at DOH accredited testing centers. The parameters monitored are Total Coliform, Fecal Coliform and Heterotrophic Plate Count.

Physical Chemical analysis is conducted once a year. Water samples are collected from the Water District's sources and these are submitted to DOH accredited testing center for analysis. There are 13 parameters being monitored and these includes Turbidity (NTU), Apparent Color, pH, Total Dissolved Solids, Sulfate, Nitrate, Chloride, Benzene, Iron (Total), Manganese (Total), Arsenic, Cadmium and Lead.

### III. HAZARD IDENTIFICATION AND RISK ASSESSMENT

For each step of the validated process flow diagram, The **WSP Team** of the **Binmaley Water District** identified what could go wrong in the water supply system in terms of hazards and hazardous events. Hazards may occur or be introduced throughout the water system, from water source to distribution system including consumer premises. Identification of hazards and hazardous event were conducted through existing records, historical events, local knowledge and onsite visits that can affect the safety of water supply and establish required controlling measures in order to provide safe drinking-water. To ensure an effective risk management, the WSP Team took into consideration the need to identify all potential biological, physical and chemical hazards that could be associated with the water supply. The Team also considered specifically the unusual color of water, while there is no history of its adverse effect that had been recorded, this may still present possible potential health hazard.

In establishing the hazards to be prioritized, the WSP team used a Semi-Quantitative Risk Assessment to calculate priority score for each identified hazard. This process of identifying priority hazards is for purposes of ranking the identified hazards and to provide more focus on the most significant ones. The likelihood and severity was derived from the team's technical knowledge and expertise, historical data and relevant guidelines. **Table 10** describes the semi-quantitative risk matrix used to rate the likelihood or frequency and severity or consequence of the hazards when it occurred for calculation of the risk score. The WSP Team determined a cut-off point, which is a risk score of 5 that entails further focus and study. The small risks may be tolerable but should not be ignored.

Hazards, hazardous events control measures, residual risks and prioritization are presented in **Chapter IV, Table 11**.

Table 10 : SEMI-QUANTITATIVE RISK MATRIX (from Deere et.al. 2001) :

| Risk Factor Matrix   |   | Severity/Consequence                                     |   |   |   |   |
|----------------------|---|--|---|---|---|---|
|                      |   | Insignificant<br>No impact/Not<br>Detectable<br>Rating 1 | Minor<br>Compliance<br>Impact<br>Rating 2 | Moderate<br>Aesthetic<br>Impact<br>Rating 3 | Major<br>Regulatory<br>Impact<br>Rating 4 | Catastrophic<br>Public Health<br>Impact<br>Rating 5 |
| Likelihood/Frequency | Almost<br>Certain Once<br>a day<br>Rating 5 | 5  | 10  | 15  | 20  | 25  |
|                      | Likely Once<br>a week<br>Rating 4           | 4  | 8   | 12  | 16  | 20  |
|                      | Moderate<br>Once a<br>month<br>Rating 3     | 3  | 6   | 9   | 12  | 15  |
|                      | Unlikely<br>Once a year<br>Rating 2         | 2  | 4   | 6   | 8   | 10  |
|                      | Rare Once<br>every 5 years<br>Rating 1      | 1  | 2   | 3   | 4   | 5   |
| Risk Score           |   | < 6  |   | 6-9   | 10-15                                     | > 15  |
| Risk Rating          |   | Low  |   | Medium                                      | High                                      | Very High   |

| Ranking | Likelihood/Frequency                 | Severity/Consequence   |
|---------|--------------------------------------|--|
| 5       | <b>Almost Certain</b> - Once per day | <b>Catastrophic</b> - Potentially lethal to a large population, likely to have also very significant morbidity |
| 4       | <b>Most Likely</b> - Once per week   | <b>Major</b> - Potentially lethal to a small population, likely to have also significant morbidity             |
| 3       | <b>Likely</b> - Once per month       | <b>Moderate</b> - Potentially harmful to a large population but no mortality                                   |
| 2       | <b>Unlikely</b> - Once per year      | <b>Minor</b> - Potentially harmful to a small population but no mortality                                      |
| 1       | <b>Rare</b> - Once every five years  | <b>Insignificant</b> - Negligible impact in terms of severity of disease or numbers of people affected.        |

#### **IV- DETERMINE AND VALIDATE CONTROL MEASURES, REASSESS AND PRIORITIZE THE RISKS**

After identification of potential risks and hazards that may affect the quality of water provided to the concessionaires, the WSP Team establish control measures to address the identified possible risks. Control measures are actions, activities and processes applied to prevent or to mitigate the hazards from occurring. In many instances, there are already existing control measures. In such case, they should be validated to demonstrate their effectiveness as control measures. Each control measure was therefore validated by the team to verify its efficacy, based on records, data gathered and on site assessment.

Reassessment of risk was conducted taking into account the effectiveness of each of the controls. The reduction in the risk rating achieved by each control is an indication of its effectiveness.

The WSP team was also able to prioritize the risks based on the likelihood and severity of occurrence of the identified hazardous event. High priority risks (risk rating from medium to very high) may require system modifications or upgrades. Low priority risks on the other hand, can be mitigated by adhering to good working practices and observing standard operating procedures.

**Table 11** shows the determination of hazards, hazardous events, assessment of risks and validation of control measures, residual risks and prioritization from catchment to distribution system including consumer premises.

**Table 11 : HAZARDS, CONTROL MEASURES AND RISKS:**

**A. CALOOCAN SUR AND BIEC WATER TREATMENT PLANT**

| PROCESS STEP                 | HAZARDOUS EVENT   | RAW RISK |            |          |       |             | EXISTING RISK CONTROL   | VALIDATION  | RESIDUAL RISK |          |       |             | PROPOSED CONTROL MEASURES  |
|------------------------------|---|----------|------------|----------|-------|-------------|---|---|---------------|----------|-------|-------------|--|
|                              |   | HAZARD   | LIKELIHOOD | SEVERITY | SCORE | RISK RATING |   |   | LIKELIHOOD    | SEVERITY | SCORE | Risk Rating |  |
| <b>Water Treatment Plant</b> | Entry of animals,& unauthorized persons which could lead to contamination, sabotage & vandalism | C        | 5          | 4        | 20    | VH          | Water treatment plants are secured with perimeter fence         | No incidence of sabotage nor vandalism & no presence of contamination | 2             | 4        | 8     | L           | Procurement of security services and installation of CCTV cameras  |
|                              | Yellowish color of water  | P        | 2          | 3        | 6     | M           | Water treatment processes                                       | Water color is reduced by 50-75%                                      | 1             | 3        | 3     | L           |  |
|                              | Electro-mechanical equipment breakdown  | M        | 3          | 5        | 15    | H           | Regular preventive maintenance of electro-mechanical equipment. | No history of major breakdown of equipment.                           | 2             | 5        | 10    | H           | Training of employees on trouble shooting  |
|                              | Breakdown of generator sets   | P        | 2          | 3        | 6     | M           | Regular preventive maintenance of generator sets                | Less in cidents of breakdown and repairs                              | 2             | 3        | 6     | M           | Training of employees on trouble shooting & immediate repair or replacement of generator set, if necessary |

|                                   |   |          |          |          |           |          |  |   |          |          |           |          |   |
|-----------------------------------|---|----------|----------|----------|-----------|----------|--|---|----------|----------|-----------|----------|---|
| <b>Aeration</b>                   | <b>Malfunction of aeration nozzle sprays</b>  | <b>P</b> | <b>2</b> | <b>3</b> | <b>6</b>  | <b>M</b> | Regular preventive maintenance of nozzle sprays  | Remove odor and dissolved metals such as iron, manganese & hydrogen sulfide | <b>1</b> | <b>3</b> | <b>3</b>  | <b>L</b> |   |
| <b>Mixing</b>                     | <b>Breakdown of chlorinator</b>   | <b>C</b> | <b>2</b> | <b>3</b> | <b>6</b>  | <b>M</b> | Weekly inspection of chemical mixing equipment   | Effective and efficient mixing of flocculants                               | <b>1</b> | <b>3</b> | <b>3</b>  | <b>L</b> |   |
|                                   | <b>Breakdown of chlorinator</b>   | <b>M</b> | <b>3</b> | <b>5</b> | <b>15</b> | <b>H</b> | Regular preventive maintenance of chlorinator  | Incidence of repair and breakdown was reduced                               | <b>2</b> | <b>5</b> | <b>10</b> | <b>H</b> | Purchase of additional chlorinator for standby purposes     |
| <b>Coagulation / Flocculation</b> | <b>Failure and incorrect dosage of poly aluminum chloride &amp; sodium hypochlorite</b> | <b>M</b> | <b>3</b> | <b>5</b> | <b>15</b> | <b>H</b> | Follow the standard procedures in chemical dosing  | Effective & efficient removal of yellowish color and other suspended solids | <b>2</b> | <b>5</b> | <b>10</b> | <b>H</b> | Competency training of Water Resources Facilities Operators |
| <b>Sedimentation</b>              | <b>Formation of algae at sedimentation</b>  | <b>P</b> | <b>5</b> | <b>2</b> | <b>10</b> | <b>H</b> | Regular cleaning/ maintenance and increase dosage of chlorine from time to time (shocking) | Prevent formation of algae  | <b>2</b> | <b>2</b> | <b>4</b>  | <b>L</b> |   |
| <b>Filtration</b>                 | <b>Entry of insects, bird droppings, floating leaves, etc.</b>                          | <b>M</b> | <b>3</b> | <b>5</b> | <b>15</b> | <b>H</b> | Installation of vent cover screens and regular pruning of nearby branches of trees         | It will limit entry of insects, birds, etc.                                 | <b>2</b> | <b>5</b> | <b>10</b> | <b>H</b> | Regular inspection of vent cover screens                    |
|                                   | <b>Poor performance/ not operating well of filters</b>                                  | <b>P</b> | <b>2</b> | <b>2</b> | <b>4</b>  | <b>L</b> | Regular preventive maintenance of filters  | It will reduce formation of solid particles                                 | <b>2</b> | <b>2</b> | <b>4</b>  | <b>L</b> |   |

## B. GROUNDWATER

| PROCESS STEP            | HAZARDOUS EVENT  | RAW RISK |            |          |       |             | EXISTING RISK CONTROL   | VALIDATION  | RESIDUAL RISK |          |       |             | PROPOSED CONTROL MEASURES                             |
|-------------------------|--|----------|------------|----------|-------|-------------|---|---|---------------|----------|-------|-------------|---|
|                         |  | HAZARD   | LIKELIHOOD | SEVERITY | SCORE | RISK RATING |   |   | LIKELIHOOD    | SEVERITY | SCORE | Risk Rating |   |
| Well/<br>Catch-<br>ment | Entry of animals and unauthorized persons that would lead to contamination, sabotage and vandalism | C        | 5          | 4        | 20    | VH          | Pump stations are secured with perimeter fence  | Entry of unauthorized persons are strictly prohibited         | 2             | 4        | 8     | M           | Installation of CCTV cameras                          |
|                         | Yellowish color of water   | P        | 5          | 3        | 15    | H           | Continuous disinfection   | Physical/chemical analysis<br>Monitoring of chlorine residual | 3             | 3        | 9     | M           | Procurement of water treatment/ filtration facilities |
|                         | Salt intrusion   | C        | 2          | 4        | 8     | H           | Minimize/regulate pumping capacity<br>Installation of cement grout in all deepwell construction | Physical/chemical analysis<br>No customer complaint           | 2             | 4        | 8     | M           | Cement grouting to all deepwell construction          |
|                         | Sand pumping due to power fluctuation  | P        | 3          | 3        | 9     | M           | Minimize/regulate pumping capacity and coordination with the electric provider                  | Minimize customer complaint                                   | 2             | 3        | 6     | M           | Procurement of additional communication devices       |



|  |   |   |   |   |    |   |  |  |   |   |   |   |  |
|--|---|---|---|---|----|---|--|--|---|---|---|---|--|
|  | Breakdown of generator  | P | 2 | 4 | 8  | M | Regular inspection and maintenance of generator set  | Reduce breakdown and minimize incidents of repair      | 2 | 4 | 8 | M | Training of employees on trouble shooting<br><br>Replacement of gen set if necessary |
|  | Intrusion of contaminants due to heavy rainfall/ flood                    | M | 3 | 5 | 15 | H | Construction of pump station one meter elevation above natural ground level  | Prevent entry of contaminated water                    | 1 | 5 | 5 | L |  |
|  | Intrusion of contaminants from improper garbage disposal of nearby houses | M | 3 | 5 | 15 | H | Coordination with the LGU/ Barangay Officials for strict implementation of proper garbage disposal   | Bacteriological test results<br><br>No contamination   | 1 | 5 | 5 | L |  |
|  | Seepage of leachate from septic tanks of nearby houses                    | M | 3 | 5 | 15 | H | Strict implementation on the construction and use of standard septic tanks and all deep wells have blank casing and forced cement grouting | Bacteriological test results and prevent contamination | 1 | 5 | 5 | L |  |
|  | Intrusion of spilled stand by gasoline due to heavy rainfall/ flood       | C | 2 | 4 | 8  | M | Pump station is one meter elevated above natural ground level<br><br>Proper storage of standby gasoline                                    | Physical/ chemical analysis                            | 1 | 4 | 4 | L |  |

|                      |   |   |   |   |    |   |  |  |   |   |    |   |   |
|----------------------|---|---|---|---|----|---|--|--|---|---|----|---|---|
| <b>Dis-infection</b> | Failure of disinfection due to breakdown of chlorinator   | M | 3 | 5 | 15 | H | Regular maintenance of chlorinator   | Bacteriological test results                               | 2 | 5 | 10 | H | Procurement of additional stand by chlorinator                              |
|                      | Clogging of chlorinator injector  | M | 3 | 5 | 15 | H | Daily inspection and maintenance of chlorinator injector   | Prevent clogging and prolonged use of chlorinator injector | 2 | 5 | 10 | H | Procurement of additional chlorinator injector as spare in case of clogging |
|                      | Inadequate or failure of chemical dosing due to lack or non-availability of chlorine  | M | 3 | 5 | 15 | H | Regular monitoring of chlorine stock   | Prevent contamination                                      | 2 | 5 | 10 | H | Establish re-order point on chlorine level                                  |
| <b>Reservoir</b>     | Intrusion of contaminants such as birds, insects, leaves, etc. due to damaged/unsecured vent covers on all reservoir openings | M | 3 | 5 | 15 | H | Secure vent covers of all reservoir openings   | Physical/chemical and bacteriological analysis             | 2 | 5 | 10 | H | Regular inspection by the assigned personnel                                |
|                      | Damaged elevated and ground water tank  | C | 2 | 4 | 8  | M | Compliance on the standard structural design.<br><br>Periodic inspection and maintenance on the elevated and groundwater tanks | Prevent damage of property                                 | 1 | 4 | 4  | L |   |

## C. DISTRIBUTION

| PROCESS STEP | HAZARDOUS EVENT  | RAW RISK |            |          |       |             | EXISTING RISK CONTROL  | VALIDATION  | RESIDUAL RISK |          |       |             | PROPOSED CONTROL MEASURES                                     |
|--------------|--|----------|------------|----------|-------|-------------|--|---|---------------|----------|-------|-------------|---|
|              |  | HAZARD   | LIKELIHOOD | SEVERITY | SCORE | RISK RATING |  |   | LIKELIHOOD    | SEVERITY | SCORE | Risk Rating |   |
| Storage      | Open/unsecured/easily access to the reservoir  | P        | 5          | 3        | 15    | H           | Installation of security perimeter fence on the storage facilities                                       | Prevent entry of animals and unauthorized persons | 2             | 3        | 6     | M           | Installation of CCTV cameras                                  |
|              | Damage facility due to natural calamities like earthquake, typhoon, etc.                     | C        | 2          | 5        | 10    | H           | Compliance to the structural design standards and periodic inspection and maintenance on the structures. | Prevent damage to property                        | 1             | 5        | 5     | L           |   |
|              | Intrusion of contaminants in reservoir due to unsecured vent cover or service facility entry | C        | 5          | 3        | 15    | H           | Secure vent covers on reservoir openings   | Prevent entry of insects, bird droppings, etc.    | 2             | 3        | 6     | M           | Regular monitoring/inspection by the assigned employee        |
| Transmission | Intrusion of contaminants due to pipeline leakages   | M        | 3          | 5        | 15    | H           | Regular inspection of water pipelines  | Customer complaints and reports                   | 2             | 5        | 10    | H           | Procurement of additional materials for immediate replacement |
|              | Intrusion of contaminants due to power interruption  | M        | 3          | 5        | 15    | H           | Standby generator set  |   | 2             | 5        | 10    | H           | Regular preventive maintenance of generator set               |

|                   |   |   |   |   |    |   |   |  |   |   |    |   |  |
|-------------------|---|---|---|---|----|---|---|--|---|---|----|---|--|
|                   | Intrusion of contaminants due to sub-standard materials, dilapidated materials and improper installation of pipelines | M | 2 | 5 | 10 | H | Rehabilitation of old pipelines   | Customer's service request reports                               | 2 | 5 | 10 | H | Continuous rehabilitation or replacement of dilapidated pipes                                  |
|                   | Intrusion of contaminants due to low pressure/insufficient supply of water  | M | 3 | 5 | 15 | H | Additional installation of new distribution lines to the areas affected by low pressure | Customer complaints  | 2 | 5 | 10 | H | Additional construction of two production wells that could provide water for the next 5 years. |
|                   | Irregular schedule of flushing of pipelines   | M | 3 | 5 | 15 | H | Regular schedule of flushing of pipelines and hydrants                                  | Minimize silt, sludge and sand at distribution and service lines | 2 | 5 | 10 | H | Training of employees and complete documentation of flushing conducted                         |
|                   | Sludge formation  | P | 2 | 3 | 6  | M | Regular schedule of flushing of pipelines and hydrants                                  | Minimize silt, sludge and sand at distribution and service lines | 2 | 3 | 6  | M |  |
| Consumer Premises | Intrusion of contaminants due to sub-standard materials and improper installation of service lines                    | M | 3 | 5 | 15 | H | Strict compliance to Water District's standard  | Minimize contamination   | 2 | 5 | 10 | H | Information campaign and close coordination with the barangay officials                        |

|  |  |          |          |          |           |          |   |   |          |          |           |          |   |
|--|--|----------|----------|----------|-----------|----------|---|---|----------|----------|-----------|----------|---|
|  | <b>Intrusion of contaminants due to illegal connections/ tapping</b> | <b>M</b> | <b>3</b> | <b>5</b> | <b>15</b> | <b>H</b> | Monthly monitoring & inspection of concessionaires with unusual consumption and information dissemination thru broadcast media. | Minimal report received for illegal connections           | <b>2</b> | <b>5</b> | <b>10</b> | <b>H</b> | Information campaign and close coordination with the barangay officials |
|  | <b>Contamination of water supply due to several surface water</b>    | <b>M</b> | <b>3</b> | <b>5</b> | <b>15</b> | <b>H</b> | Information dissemination on the possibility of intrusion of microbial contaminants   | Minimize customer's complaints                            | <b>2</b> | <b>5</b> | <b>10</b> | <b>H</b> | Information campaign and close coordination with the barangay officials |
|  | <b>Backflow of customer's overhead tank due to low pressure</b>      | <b>M</b> | <b>2</b> | <b>5</b> | <b>10</b> | <b>H</b> | Installation of check valves  | Reversed reading in the water meter/ negative consumption | <b>2</b> | <b>5</b> | <b>10</b> | <b>H</b> | Regular inspection of water service connection                          |
|  | <b>Pipeline leakages</b>   | <b>M</b> | <b>3</b> | <b>5</b> | <b>15</b> | <b>H</b> | Replacement of service lines  | Bacteriological test<br><br>Prevent contamination         | <b>2</b> | <b>5</b> | <b>10</b> | <b>H</b> | Replacement of dilapidated and sub-standard materials                   |

## V- IMPROVEMENT/UPGRADE PLAN

The WSP team crafted an improvement plan or upgrade plan for each of the identified significant risks with no known applicable control measure. These improvement measures are applicable as well for other less significant risk.

Each identified specific improvement/upgrade plan is delegated to particular officer or division of the **Binmaley Water District**. A specified time scale is to be followed in the implementation of each plan, depending on whether the improvement/upgrade plan involves short, medium or long-term program. Moreover, implementation of these specific improvement/upgrade plans must be monitored and observed to ensure that the improvements undertaken are effective.

The **Binmaley Water District** will allocate funds to defray expenditures relative to the implementation of these improvement plans.



**Table 12 : IMPROVEMENT AND UPGRADE PLAN:**

**A. CALOOCAN SUR & BIEC TREATMENT PLANTS**

| HAZARDOUS<br>EVENT  | ACTION TO<br>BE TAKEN  | ARISING<br>FROM   | IDENTIFIED<br>SPECIFIC<br>IMPROVE-<br>MENT<br>PLAN  | ACCOUNT-<br>ABILITIES | DUE  | STATUS         |
|---|--|---|---|-----------------------|------|----------------|
| Entry of animals and unauthorized persons which could lead to contamination, sabotage and vandalism | Installation of security of perimeter fencing to water treatment plants, pumping stations, elevated and ground reservoir | Risk assessment indicates that easily access can lead to contamination, sabotage and vandalism                          | Installation of CCTV cameras and Procurement of security services   | Production Division   | 2018 | Planning stage |
| Electro Mechanical equipment breakdown  | Regular preventive maintenance of electro mechanical equipment, water treatment & disinfection facilities.               | Risk assessment indicates breakdown of equipment can lead to failure of disinfection.                                   | a) training of existing employees on trouble shooting<br>b) procurement of additional chlorinator as standby purposes | Production Division   | 2017 | Done           |
| Entry of insects, bird droppings, floating leaves, etc.   | Regular inspection of vent cover screens and pruning of nearby branches of trees   | Risk assessment indicates that improper or non installation of vent cover screens may lead to intrusion of contaminants | Weekly inspection of vent cover screens   | Technical Division    | 2017 | Done           |
| Failure & Incorrect dosage of Poly Aluminum Chloride and Sodium Hypochlorite                        | Follow standard procedures by the plant operators  | Risk assessment indicates failure or incorrect dosage of chemicals may lead to intrusion of contaminants                | Competency training of plant operators  | Production Division   | 2017 | Done           |

## B. GROUNDWATER:

| HAZARDOUS EVENT   | ACTION TO BE TAKEN  | ARISING FROM  | IDENTIFIED SPECIFIC IMPROVEMENT PLAN  | ACCOUNT-ABILITIES   | DUE       | STATUS         |
|---|---|---|---|---------------------|-----------|----------------|
| Entry of animals and unauthorized persons which could lead to contamination, sabotage and vandalism | Installation of security of perimeter fencing to pumping stations.                        | Risk assessment indicates that easily access can lead to contamination, sabotage and vandalism  | Installation of CCTV cameras  | Production Division | 2018      | Planning stage |
| Yellowish color of water  | Continuous disinfection   | Risk assessment indicates that yellow color of water do not comply with the parameters of Philippine National Standards for drinking water. | Procurement of water treatment/filtration facilities  | Production Division | 2018-2019 | Planning stage |
| Salt Intrusion  | Installation of cement grout to deepwell construction                                     | Risk assessment indicates that salty water is not safe for human consumption  | Cement grouting to all deepwell construction  | Production Division | 2017      | Done           |
| Breakdown of Generator set and chlorinators   | Regular preventive maintenance of Generator set and chlorinator                           | Risk assessment indicates that breakdown of gen set and chlorinator may lead to intrusion of microbial contamination                        | a) training of existing employees on trouble shooting<br>b) procurement of additional chlorinator as standby purposes | Admin. Division     | 2017      | Done           |
| Sand pumping due to power fluctuation   | Minimize/regulate pumping capacity and coordination with the electric provider (CENPELCO) | Risk assessment indicates power fluctuation leads to sand intrusion   | Procurement of additional communication devices   | Admin Division      | 2017      | Done           |

|  |                                      |   |  |                     |      |      |
|--|--------------------------------------|---|--|---------------------|------|------|
| Inadequate or failure of chemical dosing due to lack or non availability of chlorine | Regular monitoring of chlorine stock | Risk assessment indicates that lack or no chlorine dosage will lead to intrusion of microbial contamination | a) Establish reorder point of chlorine<br><br>b) Procurement of additional 15 days stock in case of delayed delivery of chlorine | Production Division | 2017 | Done |
|--|--------------------------------------|---|--|---------------------|------|------|

## B. DISTRIBUTION:

| HAZARDOUS EVENT   | ACTION TO BE TAKEN   | ARISING FROM   | IDENTIFIED SPECIFIC IMPROVE-MENT PLAN                                    | ACCOUNT-ABILITIES          | DUE       | STATUS         |
|---|--|--|--|----------------------------|-----------|----------------|
| Open/unsecured easily access to the reservoir                       | Installation of security perimeter fence on the storage facilities   | Risk assessment indicates that easily access can lead to contamination, sabotage and vandalism   | Installation of CCTV cameras and   | Admin. Division            | 2018      | Planning stage |
| Intrusion of contaminants in reservoir due to unsecured vent covers | Regular inspection/ monitoring of storage facilities   | Risk assessment indicates entry of insects, bird droppings etc. may lead to intrusion of contaminants  | Secure vent covers on reservoir openings                                 | Technical Division         | 2017      | Done           |
| Pipeline leakages   | a) Rehabilitation of old dilapidated and sub-standard pipeline.<br><br>b) coordination with the government and private entities for the construction work within the area. | Risk assessment indicates entry of contaminants due to leakages caused by vandalism and construction works of government and private agencies, sub- standard materials and improper installation of pipelines. | a) Installation of new distribution lines<br><br>b) information campaign | Admin & Technical Division | 2018-2019 | Planning Stage |

|   |   |   |  |                               |           |          |
|---|---|---|--|-------------------------------|-----------|----------|
| Insufficient supply of water or low pressure  | Additional installation of new distribution lines to the areas affected by low pressure   | Risk assessment indicates that areas with insufficient supply of water may lead to intrusion of contaminants                          | Construction of additional two (2) production well that could provide for the next five years.                                     | Admin. Division               | 2017-2018 | On going |
| Intrusion of contaminants due to illegal connections, supply of several surface water, backflow of customer's overhead tank | Regular monitoring and inspection of inactive concessionaires, unusual consumption and service connections of active concessionaires. | Risk assessment indicates that illegal connections and other supply of surface water may lead to intrusion of microbial contamination | a)Information campaign<br>b) Periodic consultative meeting with the Barangay Officials and LGU on the implementation of ordinances | Admin and Commercial Division | 2017      | Done     |

## VI : MONITORING OF CONTROL MEASURES (OPERATIONAL MONITORING)

Monitoring is carried out to check that the control measures put in place to control hazards are working. The Water safety Plan team performs operational monitoring which includes defining and validating the monitoring of the control measures and developing procedures to verify the efficacy of the control measures.

The WSP team created a monitoring plan for the whole water supply system indicating an acceptable critical/operational limit for each control, designated monitoring locations, and established a schedule for frequency of monitoring and assigned responsible party to conduct the monitoring.

**Table 13 . CONTROL MEASURES :**

| Control Measures   | Critical Limit  | What to monitor?             | When to monitor?<br>Where to monitor?   | Who will monitor?<br>How to monitor?  | Corrective Actions  |
|--|---|------------------------------|---|---|---|
| Water Treatment Plants, pumping stations and storage facilities are secured with perimeter fence.  | Signs of deformation or perimeter fence;<br><br>Missing padlocks on gates;<br><br>Reported incidents of unauthorized entry from concerned citizens. | Condition of perimeter fence | Daily monitoring, 24/7.<br><br>Biec and Caloocan Sur Water Treatment Plants, pumping stations and storage facilities. | Pump operators and designated personnel.<br><br>Visual inspection of the premises of Water Treatment Plants, pumping stations and storage facilities. | Report incidents of unauthorized entry.<br><br>Report condition of perimeter fence. |
| All disinfection facilities are subjected to regular preventive maintenance and calibration every month aside from the regular visual inspection by operators on duty. | At least 1 spare unit   | Chlorinator                  | Monthly.<br><br>Water Treatment Plants, pumping stations and Poblacion Reservoir.                                     | Pump operators.<br><br>Check if chlorinator is functioning properly.  | Request additional unit in case the spare unit is issued.                           |

|  |   |                                   |  |   |   |
|--|---|-----------------------------------|--|---|---|
| Regular delivery of chlorine supply to Water Treatment Plants. | Order is placed before the re-order point.                  | Chlorine supply                   | Daily monitoring.<br><br>Water Treatment Plants, pumping stations and Poblacion Reservoir. | Pump operators.<br><br>Visual inspection of Chlorine containers.  | Request for Chlorine delivery before it reaches the re-order point. |
| Adequate supply of Poly Aluminum Chloride.                     | Order is placed before the Re-order point.                  | PAC supply                        | Every mixing schedule.<br><br>Water Treatment Plants.                                      | Pump operators.<br><br>Monitoring by visual inspection.           | Request for PAC delivery before it reaches the re-order point.      |
| Installation of vent cover screens and padlocks for hatches.   | Signs of screen deterioration and damaged / missing padlock | Condition of screens and padlocks | Monthly monitoring.<br><br>Treated Water Reservoir and other storage facilities.           | Pump operators.<br>Monitoring by visual inspection.               | Repair and or replacement of defective screens and padlocks.        |
| Preventive maintenance of generator sets.                      | At least one gen-set as spare.                              | Generator set                     | Daily every after shift.<br><br>Water Treatment Plants and pumping stations.               | Pump operators and assigned personnel at pumping stations.        | Report if repair is necessary and replacement if beyond repair.     |
| Strict implementation of SOPs in isolation and leak repair.    | Complaints regarding water quality                          | Water Supply                      | Daily monitoring.<br><br>Faucet within the vicinity.                                       | Assigned Water/Sew. Maint. Man<br><br>Collection of water sample. | Flushing at hydrants/blow-off valves.                               |
| Rehabilitation of old and deteriorated pipes                   | Complaints regarding water quality                          | Water Supply                      | Daily monitoring.<br><br>Faucet within the vicinity.                                       | Assigned Water/Sew. Maint. Man<br><br>Collection of water sample. | Rehabilitation of deteriorated pipelines.                           |



## VII - VERIFICATION PROCEDURES

Verification provides evidence that the overall system design and operation is capable of consistently delivering water of the specified quality to meet the health-based targets. It involves three (3) activities:

- 1) Compliance monitoring – confirmation of compliance with water quality targets
- 2) Internal and external auditing of operational activities - it can have both an assessment and a compliance checking role. Frequency of audit depends on the level of confidence required by the water utility and regulatory body.
- 3) Consumer satisfaction – includes checking that consumers are satisfied with the water supplied by the district.

**Table 14 : COMPLIANCE & VERIFICATION MONITORING PROGRAM**

| <b>Verification Activity</b>      | <b>PNSDW Parameters</b>  | <b>Location of Activity</b>  | <b>Type of Activity</b>   | <b>Frequency of Activity</b> | <b>Analyst</b>                               | <b>Recipient of Analysis Result</b>                               | <b>Action on Unusual/Failing Result</b>         | <b>3<sup>rd</sup>- Party Recipient of Results</b> |
|-----------------------------------|--|--|---------------------------|------------------------------|--|---|---|---|
| <b>Physical/ Chemical Testing</b> | <b>Turbidity.<br/>Apparent color,<br/>pH,<br/>total dissolved units /<br/><br/>iron, manganese<br/>sulfate<br/>nitrate<br/>chloride<br/>benzene<br/>arsenic<br/>cadmium<br/>lead<br/>total dissolved units</b> | All water sources  | Water Quality Testing     | Once a year or as needed     | DOH Accredited Laboratory Testing Center     | OIC-Operations & Technical Services Division (Production Section) | Protocol for water parameter permissible limits | LWUA  |
| <b>Micro-biological Testing</b>   | <b>Total Coliform<br/><br/>Fecal Coliform</b>  | Consumers Tap and sources randomly Selected per Designed sampling plan | Water Quality Testing     | Once a month or as needed    | DOH Accredited Laboratory Testing Center     | Commercial Division   | Protocol for positive results                   | LWUA  |
| <b>Equipment Calibration</b>      | n/a  | Records Custodian  | Calibration & Maintenance | At least twice a year        | OIC-Operations & Technical Services Division | OIC-Operations & Technical Services Division                      |   |   |

|   |     |                     |                        |                        |  |  |  |                 |
|---|-----|---------------------|------------------------|------------------------|--|--|--|-----------------|
| Records Verification:<br>1. Pressure<br>2. Water Level<br>3. Volumetric Flow<br>4. Residual Chlorine                                      | n/a | Pump Stations       | Operations Audit Daily | Daily                  | Operations & Technical Services Division (Production Section)            | OIC-Operations & Technical Services Division |  | General Manager |
| <b>Records Verification:</b><br>1. Pressure<br>2. Air Release Valves<br>3. Valves<br>4. Hydrants/ Blow-offs<br>5. Maintenance/ Job Orders | n/a | Distribution System | Operations Audit       | Monthly or as needed   | OIC-Operations & Technical Services Division (Water Maintenance Section) | OIC-Operations & Technical Services Division |  | General Manager |
| Leak Detection  |     | Pipelines           | Maintenance            | Daily                  | OIC-Operations & Technical Services Division (Water Maintenance Section) | OIC-Operations & Technical Services Division |  |                 |
| Customer Satisfaction Survey  | n/a | Served Barangays    | Random Survey          | Quarterly or as needed | Commercial Division  | Commercial Division Head                     |  | General Manager |
| Customer Feedback   |     | Collection Office   | Random Survey          | Quarterly              | Commercial Division  | Commercial Division Head                     |  |                 |

## **7.1 External Audit Plans :**

The Binmaley Water District shall comply with the regulatory external auditing guidelines to be issued by the Department of Health (DOH) and the Local Water Utilities Administration (LWUA) .

## **VIII. MANAGEMENT PROCEDURES :**

To maintain the effectiveness and efficiency of the **Binmaley Water District** in providing safe and potable water to its concessionaires, it is important to perform regular monitoring of each process and performs necessary corrective actions for every deviation from operational limits and incident response reports and are consistently recorded, updated and readily available when the need arises. These documents were kept simple and short as much as possible and the level of detail in the procedures and work instructions is sufficient to provide assurance of operational control when performed by competent and well trained personnel.

Management procedures are clear documentation of operational procedures which describes the activities necessary to complete the tasks in accordance with industry regulations, laws or even the district's standards or procedures in providing safe drinking water to the constituents of Binmaley and its neighboring towns/cities. These procedures are documented and are periodically updated particularly in light of implementation of the improvement/upgrade plan, review of incidents, emergencies and close adversities. Regular monitoring of every process step and any necessary corrective actions taken for every deviation from operational limits, incident response reports are consistently recorded and kept for future reference.

The Binmaley Water District has two water treatment plants, Caloocan Sur WTP and Biec WTP, with rated capacity of 17 lps and 18 lps respectively. Standard operating procedures, as shown in **Annex \_\_\_\_\_** were developed for treatment procedures, maintenance of the distribution system and consumer premises to define expected and acceptable practices

The officers and employees of the Binmaley Water District aims to ensure, in emergency and disaster situations, the least possible impact on water supply and public image through an effective response that contributes to preserving the health and life of the population .

## **IX. SUPPORTING PROGRAMS:**

As of the first quarter of 2017, **Binmaley Water District** has 33 employees, 31 of whom are regular and 2 contractual employees. With Office Memorandum dated March 23, 2015, supported by Board Resolution No. 04, series 2015 and approved on March 19, 2015, the Water Safety Plan was established to ensure that the quality of water supplied by the district is safe and potable 24/7 from the catchment/source to the tap of every concessionaire's household. The district conducts regular water treatment to prevent and control water related health problems and the concessionaires can immediately consumes and use the water supplied by the district.

In order to avoid additional problems that risk the quality of drinking water, the **Binmaley Water District** implemented supporting programs that can enhance personnel's ability and understanding about their respective responsibilities and duties and make sure that the product meets the standards of safe quality drinking water. These are organization-wide activities that do not directly affect water quality but are meant to ensure that no additional source of potential hazards will come from the operating/surrounding environment, the equipment's used, the people themselves, employees and visitors alike.

Table 15 shows the types of supporting programs which will serve as the solid backbone for the implementation of this Water Safety Plan.

**Table 15 : SUPPORTING PROGRAMS :**

| Program   | Purpose  | Activity   | Target Date                       | Responsible Unit   | Target Participants   |
|---|--|--|-----------------------------------|--|---|
| <b>1. Calibration program on the following:</b>             |  |  |                                   |  |   |
| a. Chlorine Dosing Equipment                                | 1. To ensure that all equipments by the district are performing well and measures critical limit of operational parameters accurately<br><br>2.To decrease NRW | 1. Calibration & preventive maintenance of system appurtenances & equipment                    | Per approved program or as needed | Operation & Technical Services Division (Production Section)                     | Division Head with the Water Resources Facility Operators               |
| b. Process Instruments such as flow meters , pressure gauge |  |  | Per approved program or as needed | Operation & Technical Services Division (Production Section)                     | Division Head with the Water Resources Facility Operators               |
| c. Water Meters & valves                                    |  | 2.Program on replacement of 5 year old and above water meters                                  | Per approved program or as needed | Commercial & Operation & Technical Services Division (Water Maintenance Section) | Division Head with the Water Maintenance Men                            |
| Preventive Maintenance                                      | To ensure that malfunctions of important processes are prevented and ensure that all assets and equipment are in good working order or condition               | Regular check-up and monitoring and immediate repair of equipment<br><br>Cleaning of reservoir | Per approved program or as needed | Operation & Technical Services Division  | Water Resources Facilities Operators and Water/Sewerage Maintenance Men |



|  |  |   |   |   |  |
|--|--|---|---|---|--|
| Training on Hygiene and Sanitation         | To secure that all personnel who are directly responsible with the supply and delivery of safe water will practice proper hygiene and sanitation to prevent water contamination  | Water quality monitoring  | Part of regular quarterly meeting of responsible division & section | Operation & Technical Services Division and Commercial Division | Division Managers/ Water Resources Facilities Operators and Water/Sewerage Maintenance Men |
| Maintenance of Chemical Storage Facilities | To ensure that chemicals are not contaminated and are stored safely in their respective storages in order not to affect the effectiveness of the chemicals used.   | Proper storage and handling<br>Check for chemicals leakage  | On-going  | Operation & Technical Services Division (Production Section)    | Water Resources Facility Operators   |
| Training and Continuing Education          | To ensure personnel's ability and understanding on the water source protection/water treatment process and its optimization for the implementation of water safety practices.<br><br>To ensure that the entire organization and its stakeholders understand their role in the effective implementation of the water safety plan and the effect of their action on water quality. | Water Safety Plan Training<br><br>Skills and competency requirements<br><br>Equipment and process training programs   | As scheduled  | All employees concern   | All employees concern  |
| Research and Development                   | To update and develop new strategies in determining and having better understanding for the possible hazards to all the components of the water supply system and give the right solution to avoid contamination.<br><br>To upgrade and improve efficiency of operation  | Understanding potential hazards research into better indicators of contamination<br><br>Upgrading of some equipment and facilities thru new technologies<br><br>Geographic Information System | As scheduled  | Operation & Technical Division with Commercial Division         | Division Managers, Water Resources Facilities Operators, Water Maintenance Men             |
| Organizational Culture                     | To enhance team cooperation and camaraderie between the employees and the management   | Team Building<br><br>Family Day   | Once a year   | All officers and employees of BIWAD                             | All officers and employees of BIWAD  |

## **X. REVIEW AND AUDIT:**

Water Safety Plan shall be reviewed at least once a year to ensure that the procedures, plan and records are being carried out and that new risk threatening the water sources, production and distribution of safe water are regularly assessed and addressed. It also ensures that employees and stakeholders are confident in supporting the WSP approach.

Periodic review also involves the completion of factual input for management decision, determines if the district is at risk, identifies areas or opportunities for improvements, assesses individual performance, assists the employees training needs, improve communication and personnel motivation. An audit-based approach places responsibility on every unit involved to provide information regarding system performance against indicators agreed upon. Auditing has both an assessment and a compliance checking-checking role. It gathers information on the level of conformance to the quality system as indicated in the water safety plan and as the degree of compliance to regulatory requirements.

**Table 16 : WSP REVIEW PROCEDURES**

| <b>Purpose of Review</b>                             | <b>Schedule</b>  | <b>Responsible Unit</b> |
|--|--|-------------------------|
| Changes in the catchment, treatment and distribution | Any changes in the water system                                    | WSP Team                |
| Revised procedures                                   | Any changes made in the office procedures                          | WSP Team                |
| Staff changes  | Any changes in the workforce                                       | WSP Team                |
| WSP Team composition & contact number changes        | Any changes in the composition & contact number of WSP Team Member | WSP Team                |

## **XI. REVISE THE WSP FOLLOWING AN INCIDENT:**

Review of the water safety plan by the team is deemed necessary at least once a year to ensure that occurrence of hazards and issues are addressed. The development of the water safety plan decreases the number and severity of incidents, emergencies or near misses affecting or would possibly affect the quality and safety of water distributed. However, such incidents/events may still occur.

Hence in addition to the periodic review of the WSP, review and/or revision of the WSP following emergency, incident or unforeseen event irrespective of new hazards identified is very important to guarantee that the same incident/emergency will no longer recur in the future and to determine whether the response was effective or needs to be improved.

Most likely, the results of a post incident review will determine the areas for improvement of the WSP whether it is a new hazard, or a revised risk for assessment, a revision for an operating procedure or a training issue. It is important that the WSP must be revised so that changes/revisions may be reflected and incorporated in the documentation, procedures and supporting programs.

**Table 17 . INCIDENT RESPONSE PLANS**

| <b>Purpose of Review</b> | <b>Schedule</b>   | <b>Responsible Unit</b> |
|--------------------------|---|-------------------------|
| Incident                 | After fortuitous event such as typhoon, earthquake, landslide | WSP Team                |
| Near Miss                | After fortuitous event such as typhoon, earthquake, landslide | WSP Team                |

**I - DISTRIBUTION PIPELINES:**

1. Maintain positive line pressure. Negative pressure could result to intrusion of contaminants or backflow from private storage that may contaminate the system.
2. Valves should be open or shut-off gradually. Opening or shutting off a valve abruptly can cause sudden surges, reversal of flow and changes in water velocity that might produce water hammer that could stir up sediments making the water dirty and may damage valves and weaken pipe joints.
3. Implement an appropriate flushing program to clear sediments from the system. Such program should institute the regular, periodic flushing of the pipes, as well as prescribe maintenance measures for those sections of the system that are more prone to sediment build-up, such as dead-end pipes and low sections. These sediment-prone sections should be pre-identified and if needed provided with additional blow-offs and hydrants to facilitate and disinfection.

**Flushing Procedures:**

1. Isolate the water mains to be cleaned by closing the appropriate control valves.
2. Empty the water mains by opening the blow-off valve or other temporary outlet at the lower end of the pipeline. In some cases, to expedite the emptying of water mains without pumping, compressed air may be introduced at the highest point of the isolated system;
3. Inject water at high-induced velocity (1.0 meter per second or higher) until the objectionable materials are expelled.
4. As needed, disinfect the pipelines. After disinfection flush the pipeline with clean water until the chlorine-odor is hardly detectable.
5. Put pipelines back to operation.

## II - PIPELINE MAINTENANCE:

The repair on transmission, distribution and service lines are being conducted by the Binmaley Water District personnel. Excavation, pavement breaking, if any, exposing and clearing of damaged pipelines are being performed by BIWAD personnel. Once pipeline is clear, then repair will be conducted.

When leaks happened during weekends, holidays and night time, the repair will be handled by the Quick Response Team composed of the Construction Foreman and two Water Maintenance Men. Number of maintenance personnel to do the repair depends on the extent of the activity.

Immediate water interruption or reduction of water pressure prior to repair depends on the following situation:

- a) if the volume of water is too much that the leak will cause damages on the roads and properties
- b) if the location of leak is far from bodies of water containing potential contaminants
- c) if pipeline is situated in residential areas wherein there is adjacent drainage system
- d) if there are many service connections that will be affected, normally repair will be scheduled at night

In case of service line leaks, there will be no water interruption to be done. Water interruption can only be applied on bigger sizes wherein pressure cannot be contained by the maintenance personnel. Pressure will dictate if interruption is needed to repair the leak on service connections.

### **III - BACTERIOLOGICAL AND LABORATORY TESTING:**

To ensure and properly monitor the safety of water supplied by the district, bacteriological and laboratory tests are conducted monthly or as needed. These covers sample source address or where the sample is taken, date and time of collection, result of analysis and remarks. The test is conducted and analyzed by DOH accredited testing center.

**III.1 Bacteriological Test Sampling** is conducted on a monthly basis or as needed for HPC monitoring and detection of coliform organisms or E.coli.

#### **Procedures:**

1. Take sample from a tap or household faucet at random (ensure that areas covered shall be well presented).
2. Clean the tap or faucet (wipe the outlet with a clean cloth to remove dirt)
3. Turn on the tap at maximum flow rate and let the water flow for 1-2 minutes
4. Sterilize the tap for 1-minute with the flame from an ignited cotton-wool swab soaked in alcohol (denatured and/or 70% Isopropyl)
5. Carefully turn on the tap and allow 1-2 minutes at a medium flow rate prior to sampling
6. Open a sterilized bottle and immediately hold the bottle and immediately hold the bottle under the water jet and fill the bottle at least 100ml of water sample. A small air space should be left to facilitate shaking at the time of inoculation prior to analysis.

7. Cap the bottle and shall be labeled properly
  - a. Date & time of sampling
  - b. Source/point of sampling
8. Deliver water samples to nearest DOH accredited laboratory center for analysis
9. Water sample collector shall also take into consideration the following important reminders:
  - a. that the water analysis shall be done 6-hours from the time of collection
  - b. that the time of lapsing between collection and processing shall in no case exceed 24-hours
10. Upon availability of the laboratory result/s, prepare the summary Report on Microbiological Test (pre-format) , filling up all the necessary data and information and send to LWUA-Management Advisor for compliance/reference (attach laboratory results).



**III.2 Physical-Chemical Test Sampling** is conducted once a year or as needed for monitoring of the following parameters; a) physical parameters (apparent color, turbidity, pH & total dissolved solids) & b) chemical parameters (iron, manganese, sulfate, nitrate, chloride, benzene, arsenic, cadmium, lead & total dissolved solids)

**Procedures:**

1. Before water sample is collected from the tap (faucet), sufficiently flush to ensure that the sample is a representative of the supply.
2. Clean the tap or faucet (wipe the outlet with a clean cloth to remove dirt).
3. Open the bottle (1.5 liters), then capped the bottle and labeled properly : a) date & time of sampling & b) source/point of sampling
4. Deliver water samples to any DOH accredited laboratory center (government or private) for analysis.
5. Upon availability of the test result/s, send Physico-Chemical Test Results for Water to LWUA-Management Advisor for compliance/reference.

For other operating procedures adopted by the district, Operations Manual is hereto attached (*Annex B* )

Republic of the Philippines  
**BINMALEY WATER DISTRICT**  
Luna St., Binmaley, Pangasinan

Annex C

**OFFICE MEMORANDUM 2015-03**

TO : All Employees of the Binmaley Water District

FROM : **MARIANO V. GONZALO**  
General Manager

DATE : **March 23,2015**

RE : **Water Safety Plan Team Composition**

A Water Safety Plan (WSP) is the most effective way of ensuring that water supply is safe for human consumption. The primary objectives of a WSP in protecting human health and ensuring good water supply practice are the minimization of contamination of source waters, the reduction or removal of contamination through appropriate treatment processes and the prevention of contamination in the distribution network and the domestic distribution system. In order to produce a plan, a thorough assessment of water source to the consumer's tap must be carried out by the water provider.

Our agency has taken its initial step in the development of WSP by organizing and assembling the Water Safety Plan Team as follows:

| NAME                     | DIVISION  | JOB TITLE  | ROLE                     |
|--------------------------|---|--|--------------------------|
| 1. Jacqueline F. Terrado | Commercial  | Division Manager C                               | Team Leader              |
| 2. Louella A. Cano       | * Administrative & Finance<br>* Operation & Tech. Service | * Senior Corp. Accountant<br>* Officer In Charge | Assistant<br>Team Leader |
| 3. Manuela D. De Vera    | Administrative & Finance                                  | Division Manager C                               | Secretariat              |

|                           |                            |  |                               |
|---------------------------|----------------------------|--|-------------------------------|
| 4. Bony R. Carrera Sr.    | Operation & Tech. Services | Water/Sew. Maintenance Foreman         | Transmission / Distribution   |
| 5. Edwin B. Perez         | Operation & Tech. Services | Senior Water/Sew. Maintenance Man A    | Transmission / Distribution   |
| 6. Delfin B. Morales      | Operation & Tech. Services | Senior Water/Sew. Maintenance Man A    | Transmission / Distribution   |
| 7. Renato D. Manaois      | Operation & Tech. Services | Senior Water/Sew. Maintenance Man A    | Transmission / Distribution   |
| 8. Ariel F. Ibasan        | Operation & Tech. Services | Plant Equipment/ Mechanic B            | Production/ Treatment Storage |
| 9. Joe P. Ibasan          | Operation & Tech. Services | Water Resources Facilities Operator A  | Production/ Treatment Storage |
| 10. Marlon C. Valdez      | Operation & Tech. Services | Water Resources Facilities Operator A  | Production/ Treatment Storage |
| 11. Felix C. Barrozo      | Operation & Tech. Services | Senior Water/Sew. Maintenance Man A    | Production/ Treatment Storage |
| 12. Juan L. Montes        | Commercial                 | Senior Water/Sew. Maintenance Man A    | Customer Satisfaction         |
| 13. Hazel D. Soriano      | Commercial                 | Utilities/Customer Service Assistant C | Customer Satisfaction         |
| 14. Rhodora F. Quinto     | Administrative & Finance   | Cashier A                              | Administrative/ Finance       |
| 15. Maribel M. Apolinario | Administrative & Finance   | Senior Accounting Processor A          | Administrative/ Finance       |

You are hereby enjoined to support and to cooperate with whatever activity/measures in the implementation of the Water Safety Plan.

For your strict compliance.

**EXCERPT FROM THE MINUTES OF THE REGULAR MEETING  
OF THE BOARD OF DIRECTORS OF BINMALEY WATER DISTRICT  
HELD AT THE DISTRICT'S OFFICE ON MARCH 19, 2015**

*Annex D*

**Present:**

|                              |       |                 |
|------------------------------|-------|-----------------|
| Mr. Amado L. Aquino          | ----- | Chairman        |
| Mr. Juan T. Castro           | ----- | Vice-Chairman   |
| Mrs. Leonor C. Delos Angeles | ----- | Board Secretary |
| Mr. Rodolfo B. Cerezo        | ----- | Member          |
| Mrs. Anita U. Urbano         | ----- | Member          |
| Engr. Mariano V. Gonzalo     | ----- | General Manager |

**RESOLUTION NO. 04**  
Series 2015

**RESOLUTION ADOPTING THE WATER SAFETY PLAN TEAM  
COMPOSITION OF THE BINMALEY WATER DISTRICT**

**WHEREAS**, Water Safety Plan (WSP) is considered by the World Health Organization (WHO) as the most effective means of maintaining a safe supply of drinking water for human consumption and minimization of water borne diseases;

**WHEREAS**, in order to produce a plan, a thorough assessment of the water source to the consumer's tap must be carried out by the water provider whose initial step is to assemble a team who would prepare and develop the plan;

**WHEREAS**, the Binmaley Water District's WSP Team, as recommended by the management, is composed of the following:

| <u>NAME</u>              | <u>DIVISION</u>             | <u>JOB TITLE</u>                    | <u>ROLE IN THE<br/>WSP TEAM</u> |
|--------------------------|-----------------------------|-------------------------------------|---------------------------------|
| 1. Jacqueline F. Terrado | Commercial                  | Division Manager C                  | Team Leader                     |
| 2. Louella A. Cano       | * Administrative & Finance  | * Senior Corporate Accountant       | Assistant Team Leader           |
|                          | * Operation & Tech. Service | * Officer In Charge                 |                                 |
| 3. Manuela D. De Vera    | Administrative & Finance    | Division Manager C                  | Secretariat                     |
| 4. Bony R. Carrera Sr.   | Operation & Tech. Services  | Water/Sew. Maintenance Foreman      | Transmission / Distribution     |
| 5. Edwin B. Perez        | Operation & Tech. Services  | Senior Water/Sew. Maintenance Man A | Transmission / Distribution     |
| 6. Delfin B. Morales     | Operation & Tech. Services  | Senior Water/Sew. Maintenance Man A | Transmission / Distribution     |
| 7. Renato D. Manaois     | Operation & Tech. Services  | Senior Water/Sew. Maintenance Man A | Transmission / Distribution     |

|                           |                            |   |                                  |
|---------------------------|----------------------------|---|----------------------------------|
| 8. Ariel F. Ibasan        | Operation & Tech. Services | Plant Equipment/<br>Mechanic B            | Production/<br>Treatment Storage |
| 9. Joe P. Ibasan          | Operation & Tech. Services | Water Resources Facilities<br>Operator A  | Production/<br>Treatment Storage |
| 10. Marlon C. Valdez      | Operation & Tech. Services | Water Resources Facilities<br>Operator A  | Production/<br>Treatment Storage |
| 11. Felix C. Barrozo      | Operation & Tech. Services | Senior Water/Sew.<br>Maintenance Man A    | Production/<br>Treatment Storage |
| 12. Juan L. Montes        | Commercial                 | Senior Water/Sew.<br>Maintenance Man A    | Customer<br>Satisfaction         |
| 13. Hazel D. Soriano      | Commercial                 | Utilities/Customer<br>Service Assistant C | Customer<br>Satisfaction         |
| 14. Rhodora F. Quinto     | Administrative & Finance   | Cashier A                                 | Administrative/<br>Finance       |
| 15. Maribel M. Apolinario | Administrative & Finance   | Senior Accounting<br>Processor A          | Administrative/<br>Finance       |

**WHEREAS**, the development of the plan which covers all phases of the operation requires the support and cooperation of the rest of the employees;

**WHEREFORE**, on motion duly seconded;

**RESOLVED**, as it is hereby **RESOLVED**, to adopt the Water Safety Plan Team composition.

**“UNANIMOUSLY APPROVED”**

**MR. AMADO L. AQUINO**  
Chairman

**MR. JUAN T. CASTRO**  
Vice- Chairman

**MRS. LEONOR C. DELOS ANGELES**  
Board Secretary

**MR. RODOLFO B. CEREZO**  
Member

**MRS. ANITA U. URBANO**  
Member

**Alkalinity** – the quantitative capacity of an aqueous solution to neutralize an acid. Measuring alkalinity is important in determining a stream’s ability to neutralize acidic pollution from rainfall or wastewater.

**Aqueduct** – a conduit for water, one for carrying a large quantity of flowing water.

**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 thru mineral bed and flushing away the particles of foreign matter that have been filtered from the water supply during the service cycle.

**Calcium Hypochlorite** – a white, crystalline compound,  $\text{Ca(OCL)}_2$ , used as a disinfecting and bleaching agent.

**Chlorine** – a halogen element, a heavy, greenish-yellow, incombustible, water-soluble, poisonous gas that is highly irritating to the respiratory organs, obtained chiefly by electrolysis of sodium chloride brine; used for water purification, bleach making, etc.

**Chlorine Dioxide** – is a chemical compound with the formula  $\text{ClO}_2$ . It is a potent and useful oxidizing agent used in water treatment and in bleaching.

**Chlorine Residual** – when a sufficient dosage of chlorine is applied to water, micro organisms 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.

**Clarification** – is the final part of the process and allows the large flocs containing much of the suspended matter to sink to the bottom of a tank or basin, while the clear water overflows and is then further treated.

**Coagulant** – a substance that triggers formation of a soft, semi-solid 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.

**Colloid** – a dispersion of particles larger than those in true solutions and smaller than those in true suspensions.

**Contaminant** – materials not normally found in water that make the water less desirable or unfit for its intended use.

**Disinfection** - water treatment process designed to destroy disease- causing microorganism making water safe for humans to drink normally by adding chlorine, chlorine dioxide, etc.

**Effluent** – as out flowing of water from a natural body of water or from a sewage treatment facility.

**Fecal Coliform** – subgroup of coliform bacteria that has a high positive correlation with fecal contamination associated with all warm blooded animals

**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 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.

**Floc** – a flocculent mass formed in a fluid through precipitation or aggregation of suspended particles.

**Flocculation** – to form flocculent masses, as a cloud or a chemical precipitate; form aggregated or compound masses of particles. Increase the cohesion of the floc formed by coagulation

**Groundwater** – water that occurs below the surface of the earth, where it occupies spaces in soils or geologic strata.

**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.

**Microorganism** – any organism too small to be viewed by the unaided eye, as bacteria, protozoa, and some fungi and algae.

**Nephelometric Turbidity Unit (NTU)** – the standard unit of measurement used to measure turbidity in water. It make use of a light scattering effect of fine suspended particles in a light beam.

**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 equals one pound per million pounds of water.

**Polymer** – a general term for chemical composed of long chains of molecules of known electrical charge and electrical strength. These compounds aid water treatment by agglomerating (clumping together in bunches) very small particles so that they can settle out of water and/or become trapped in filters.