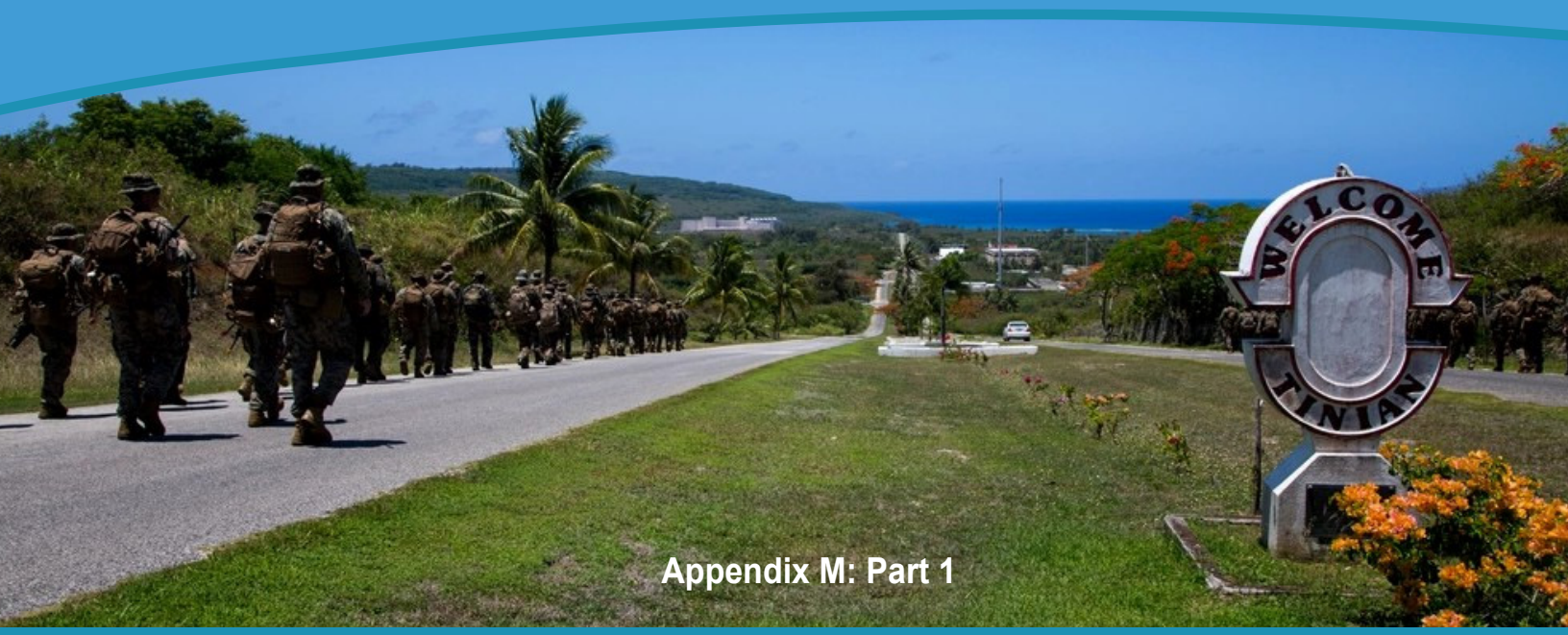
Revised Draft Environmental Impact Statement

Commonwealth of the Northern Mariana Islands Joint Military Training



Appendix M: Part 1

June 2025

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Appendix M – Part 1
Utility Studies

Potable Water Study Update

Groundwater Modeling Technical Memorandum

The appendices of this Revised Draft EIS are compliant with Section 508 of the Rehabilitation Act. This allows assistive technology to be used to obtain the available information from the document. However, accessibility is limited to a descriptive title for some graphics, figures, tables, images, and attachments. Individuals who require assistance may submit a request through the Section 508 link on the project website at CNMIJointMilitaryTrainingEIS.com

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GROUNDWATER MODELING TECHNICAL MEMORANDUM

POTABLE WATER STUDY UPDATE
IN SUPPORT OF THE
COMMONWEALTH OF THE NORTHERN MARIANA ISLANDS
JOINT MILITARY TRAINING ENVIRONMENTAL IMPACT STATEMENT

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June 2025

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1 INTRODUCTION

1.1 BACKGROUND

The islands of the Commonwealth of the Northern Mariana Islands (CNMI) are strategically located in the United States (U.S.) Department of Defense (DoD) Indo-Pacific area of operations, as shown in Figure 1. Figure 2 shows the Military Lease Area on Tinian where the U.S. military has trained for several decades.

The Proposed Action would support the ongoing and evolving training requirements of U.S. Armed Forces forward deployed to the Western Pacific, and U.S. allies and partners, specifically for distributed operations training within the Military Lease Area on Tinian. Proposed training events would include both ground and aviation training within the Military Lease Area.

Non-live-fire offensive and defensive training actions would continue to be conducted in the Military Lease Area with an increase in existing land-based training events, including both ground and aviation training, which are the same or similar to those currently being conducted on Tinian.

Live-fire training would be conducted at two ranges that would be developed within the Exclusive Military Use Area:

- **Multi-Purpose Maneuver Range.** A live-fire range occupying approximately 200 acres at the northern tip of Tinian to support platoon-size live-fire and maneuver, including three surface radar facilities.
- **Explosives Training Range.** A live-fire range on approximately 2.5 acres for the employment of demolitions and military explosives in support of offensive and defensive training events.

The following are also included in the Proposed Action to support training events:

- Establishment of 13 Landing Zones, areas cleared of vegetation to 6–8 inches, and associated access roads to conduct training events and to provide staging, bivouac, and gathering and rendezvous areas.
- Ground and aviation improvements at North Field, including establishment of a drop zone and the placement of a metal airfield surface.
- Construction and operation of a Base Camp.
- Clearance and improvements of roads within the Military Lease Area.

1.2 PURPOSE

The purpose of this study is to estimate the potable water demand and infrastructure required for the proposed CNMI Joint Military Training Environmental Impact Statement and to recommend potable water solutions to avoid significant impacts. Potable water solutions would be made part of the Proposed Action.

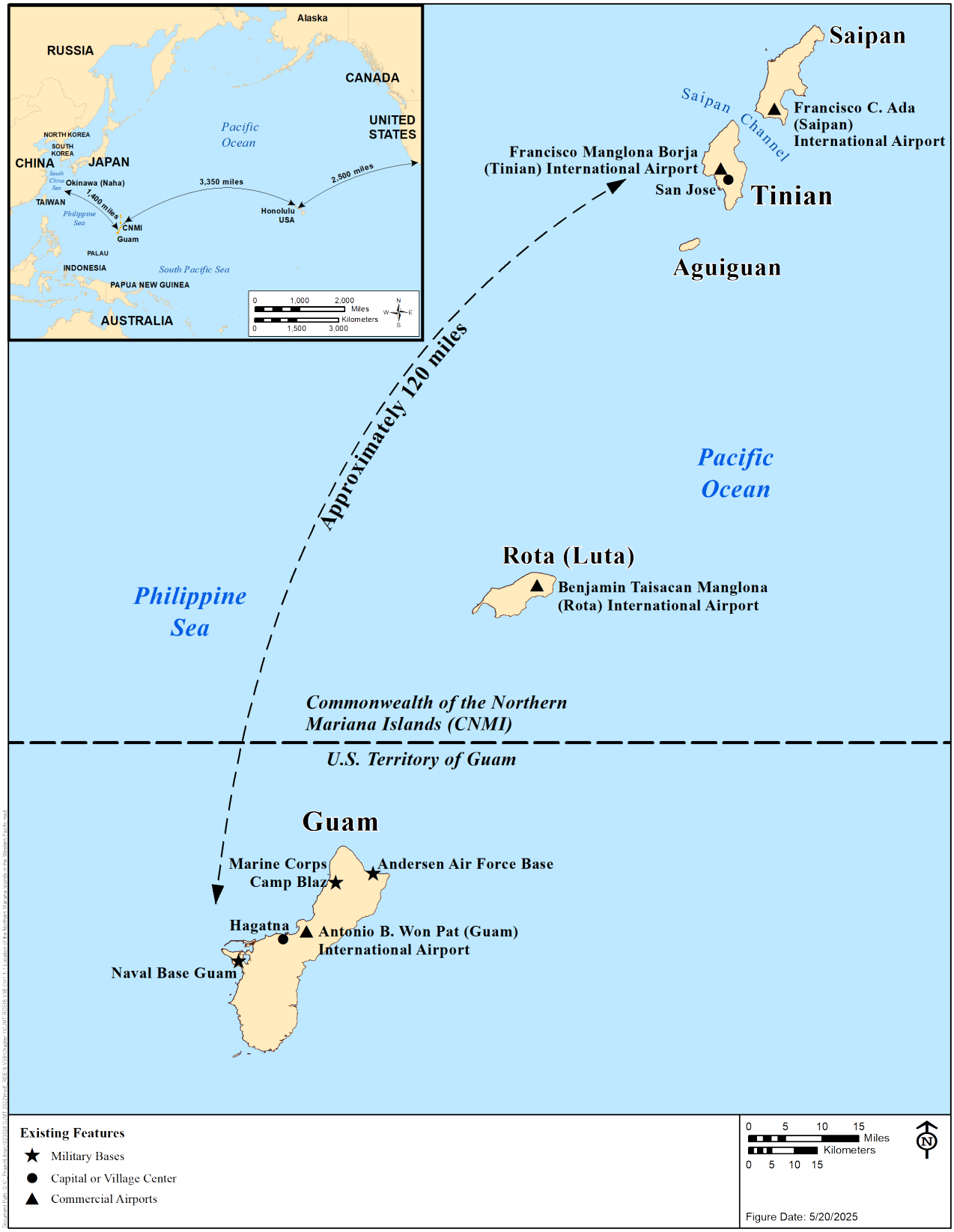

Figure 1. Island of Tinian – Location

Figure 2. Island of Tinian – Military Lease Area Boundaries

1.3 GROUNDWATER SUPPLY

Rainfall is the primary source of fresh groundwater on Tinian. The U.S. Geological Survey estimates the average annual groundwater recharge for Tinian to be approximately 30 inches per year (Gingerich 2002). This translates into approximately 62,000 acre-feet per year of recharge.

The rapid downward percolation of rainwater into porous limestone rock (Doan et al. 1960) recharges Tinian's basal freshwater aquifer. Fresh groundwater on Tinian is primarily classified as basal, which is a body of fresh groundwater that floats on saline groundwater. The portion of the basal freshwater lens that is usable for potable water, which has chloride concentrations less than 250 parts per million, is thickest south and southwest of Mount Lasso and becomes increasingly thinner approaching the coastline (Figure 3).

The groundwater table on Tinian ranges from sea level around the perimeter of the island to over 3 feet above mean sea level in the central portions of the island. Groundwater flows outward from the North Central Highland and the southeastern ridge, and generally seaward around the island (Department of the Navy [DON] 2015). Figure 3 depicts groundwater table elevation contours and the general directions of groundwater flow. Most of the fresh groundwater slowly discharges naturally from springs around the perimeter of the island and submarine coastal springs.

The basal freshwater lens underlying Tinian is the principal source of drinking water and meets the definition of an aquifer in CNMI Title 65, Chapter 65-90-010.

1.4 CNMI BUREAU OF ENVIRONMENTAL AND COASTAL QUALITY

The CNMI Bureau of Environmental and Coastal Quality is the regulatory agency responsible for permitting and enforcement of groundwater, potable water, and non-potable water. The CNMI Bureau of Environmental and Coastal Quality regulates potable water systems per CNMI Drinking Water Regulations, Chapter 65-20. Construction of new wells and operation of existing groundwater wells are subject to an annual permit that limits extraction to protect both availability and quality of groundwater. As part of the permitting process, well owners must conduct the following at each well each year, per CNMI Title 65, Chapter 140:

- Pump test
- Aquifer recovery test
- Water quality testing at a Bureau of Environmental and Coastal Quality-certified laboratory

The maximum quantity of groundwater that can be extracted each month is set by Bureau of Environmental and Coastal Quality in the permit for each well, which must be renewed each year.

1.5 COMMONWEALTH UTILITIES CORPORATION

The Commonwealth Utilities Corporation, a public utility governed by a Board of Directors appointed by the CNMI governor, owns and operates Tinian's only public potable water system. The water system on Tinian consists of approximately 33 miles of pipelines, three aboveground steel reservoirs, and approximately 800 metered service connections (Commonwealth Utilities Corporation 2015a). It is supplied by a single groundwater well (Maui Well No. 2). Figure 4 shows the physical layout of the Commonwealth Utilities Corporation water system.

Figure 3. Tinian Groundwater Wells, Elevation, and Flow Direction

Figure 4. Commonwealth Utilities Corporation Existing Potable Water System

1.5.1 Wells

Maui Well No. 2 is a Maui-style infiltration gallery, which obtains freshwater from the basal lens (Figure 5 and Figure 6) and is the sole source of potable water; there are no redundant or backup supplies. The well is located adjacent to the Marpo wetland area. Maui Well No. 2 is equipped with four 75-horsepower pumps, each capable of pumping approximately 350 gallons per minute. With one pump allowed to be out of service, the pumping capacity is 1.5 million gallons per day.

Figure 5. Maui Well No. 2 Pump House

Figure 6. Maui Well No. 2 Pump Equipment

1.5.2 Storage

The Commonwealth Utilities Corporation water system includes a total of 1.25 million gallons of storage between three existing aboveground reservoirs. Two reservoirs are located adjacent to each other in Carolinas Heights. Each reservoir has a volume of 0.50 million gallons (Figure 7 and Figure 8).

Figure 7. Carolinas Tank 1 (0.50 Million Gallons)

Figure 8. Carolinas Tank 2 (0.50 Million Gallons)

The third reservoir is located in Marpo Heights and has a capacity of 0.25 million gallons (Figure 9). In September 2024, the Marpo Tank appeared to be abandoned. It was surrounded by thick vegetation and not accessible (Figure 10). During this site visit, staff heard the sound of a

significant amount of flowing water and speculated that the tank may be overflowing (D. Cronquist, AECOM, Personal Communication, September 9, 2024).

Figure 9. Marpo Tank (0.25 Million Gallons) in 2013

Figure 10. Marpo Tank (0.25 Million Gallons) in 2024

1.5.3 Distribution System

The distribution system consists of approximately 33 miles of water pipelines that vary in diameter from 4 to 12 inches. According to the currently available draft final version of the Commonwealth Utilities Corporation drinking water and wastewater master plan for its facilities on Tinian (Commonwealth Utilities Corporation 2015a), most of the pipelines were constructed of polyvinyl chloride and are in relatively good condition (Commonwealth Utilities Corporation 2015a). Shorter lengths of pipelines were constructed using fiber-reinforced polymer polyvinyl chloride and galvanized iron.

1.6 FRANCISCO MANGLONA BORJA/TINIAN INTERNATIONAL AIRPORT

The Commonwealth Ports Authority owns and operates Francisco Manglona Borja/Tinian International Airport. The airport is a customer of the Commonwealth Utilities Corporation and receives all of its potable water from Maui Well No. 2. Downstream of the Commonwealth Utilities Corporation water meter, the Commonwealth Ports Authority operates its own water system within the airport property. This system includes a 0.2-million-gallon storage reservoir and booster pump station (Figure 11).

Figure 11. Water Tank and Booster Pump Station at Francisco Manglona Borja/Tinian International Airport

1.7 U.S. AGENCY FOR GLOBAL MEDIA

The U.S. Agency for Global Media, formerly International Broadcasting Bureau, operated radio transmitting facilities on Tinian and Saipan. The Tinian facility is not connected to the Commonwealth Utilities Corporation system. Rainwater is captured from a portion of the roof and stored in two aboveground tanks with a total capacity of 8,500 gallons (Figure 12). All water used at the facility is non-potable except for a point-of-use reverse osmosis system that treats water for potable use in the kitchen. Rainwater harvesting provides the majority of water used except during dry months. Approximately 5,000 gallons per year are purchased from Commonwealth Utilities Corporation and trucked in bulk.

Figure 12. Non-potable Water Storage Tank at U.S. Agency for Global Media Facility on Tinian

1.8 TINIAN MAYOR'S OFFICE

The Tinian Mayor's Office owns groundwater and charges a fee for the quantity of water extracted. The Tinian Mayor's Office owns and operates two non-potable water wells: M-21 and M-26 (see Figure). Neither well is connected to pipe networks. Both wells are permitted by Bureau of Environmental and Coastal Quality. The wells are described as follows:

- **Well M-21** is primarily used by the construction contractor for the U.S. Air Force's Tinian Divert Infrastructure Improvements at the Francisco Manglona Borja/Tinian International Airport. This well includes a water meter and a 40,000-gallon tank. This well was permitted in 2024 to extract no more than 1.8 million gallons per month (J. Aldieri, NAVFAC Marianas, Personal Communication, September 10, 2024).
- **Well M-26** is primarily used by cattle ranchers and is not metered. For the purposes of this report, it is assumed that the quantity of water used at this well is equal to the permitted extraction of Well M-21.

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2 EXISTING WATER SYSTEM

2.1 EXISTING WATER DEMANDS

Table 1 summarizes water production (i.e., extraction) quantities from Maui Well No. 2 as recorded by the Commonwealth Utilities Corporation at the well site. Production includes water delivered into the distribution system, which is inclusive of water billed to customers, unmetered uses, leaks, losses, and overflows.

Table 1. Commonwealth Utilities Corporation Water Production from Maui Well No. 2

Year	*Total Annual (MG)*	*Average Daily (MGD)*
2019	313	0.86
2020	312	0.85
2021	307	0.84
2022	321	0.88
2023	306	0.84
Average		**0.85**

Legend: MG = million gallons; MGD = million gallons per day.
Source: Commonwealth Utilities Corporation 2024b.

Table 2 summarizes billing records for all Commonwealth Utilities Corporation customers combined based on meter readings. All registered connections served by the Commonwealth Utilities Corporation are metered and read monthly.

Table 2. Commonwealth Utilities Corporation Billed Water Demand

Year	*Total Annual (MG)*	*Average Daily (MGD)*
2019	88	0.24
2020	77	0.21
2021	81	0.22
2022	84	0.23
2023	87	0.24
Average		**0.23**

Legend: MG = million gallons; MGD = million gallons per day.
Source: Commonwealth Utilities Corporation 2024c.

The U.S. Environmental Protection Agency has stated that the sustainable yield at Maui Well No. 2 in drought conditions is 1.0 million gallons per day. The average production at Maui Well No. 2 for the last 5 years was 0.85 million gallons per day. However, this only applies to the Maui Well No. 2 location and therefore is not an indication of the sustainable yield of all of Tinian.

2.2 WATER QUALITY AND COMPLIANCE WITH REGULATORY STANDARDS

2.2.1 National Primary Drinking Water Standards

The Bureau of Environmental and Coastal Quality has adopted the National Primary Drinking Water Standards, which establish a maximum contaminant level for various constituents in public water systems to protect human health (CNMI Drinking Water Regulations, Chapter 65-20). Compliance with these standards is mandatory and requires the Commonwealth Utilities Corporation to have analytical laboratory testing performed on the water supply. The results of

these tests are provided to the public in the form of a water quality report issued annually by the Commonwealth Utilities Corporation. The reports issued between 2012 and 2023 indicate that the Commonwealth Utilities Corporation water system meets the primary drinking water standards (Commonwealth Utilities Corporation 2013, 2014, 2015b, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024a).

Nitrogen, both nitrate and nitrite, is a common contaminant of concern in areas where wastewater is primarily treated in septic tanks and in agricultural areas. The Commonwealth Utilities Corporation reports that total nitrogen levels are below the maximum contaminant level of 10 milligrams per liter. In 2023, the concentration of total nitrogen was 4.8 milligrams per liter (Commonwealth Utilities Corporation 2024a).

2.2.2 National Secondary Drinking Water Standards

The Bureau of Environmental and Coastal Quality has also adopted the National Secondary Drinking Water Standards, which provide non-mandatory water quality standards for 15 additional contaminants (CNMI Drinking Water Regulations, Chapter 65-20). The secondary standards are established "…as guidelines to assist public water systems in managing their drinking water for aesthetic considerations, such as taste, color, and odor" (U.S. Environmental Protection Agency 2018). These contaminants are not considered a risk to public health.

As discussed previously, the freshwater basal lens floats on top of the denser seawater. The transition between freshwater and seawater is gradual, with salt content generally increasing with depth. Chloride concentration is an important secondary standard for Maui Well No. 2 because it has the potential to indicate the quantity of freshwater available at that location. The secondary maximum contaminant level for chloride is 250 milligrams per liter. Table 3 provides chloride concentrations at Maui Well No. 2 between 2012 and 2023.

Table 3. Chloride Concentrations at Maui Well No. 2

Year	*Chloride (ppm)*	
	Average	*Range*
2012	196	175–223
2013	190	172–217
2014	213	212–214
2015	213	212–214
2016	190	184–196
2017	184	184
2018	176	176
2019	146	n/a
2020	145*	n/a
2021	176*	158–176
2022	176*	158–176
2023	177*	n/a

Note: * = Value reported as highest instead of average.
Legend: ppm = part per million; n/a = not available.
Source: Commonwealth Utilities Corporation 2013, 2014, 2015b, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024a.

2.2.3 Treatment

The Commonwealth Utilities Corporation does not treat water produced at Maui Well No. 2 other than disinfection, which is accomplished using gaseous chlorine injection.

3 WATER DEMANDS FOR PROPOSED ACTION

3.1 POTABLE WATER DEMANDS WITHIN THE MILITARY LEASE AREA

The following section estimates the water demands due to the Proposed Action located within the Military Lease Area and outside the existing service area of the Commonwealth Utilities Corporation water system.

3.1.1 Design Population

The maximum number of personnel on island at any one time from the Proposed Action would be 1,070 (estimates for this study used 1,100 to be conservative) and consists of the following types:

- Up to a maximum of 1,000 military personnel participating in training.
- Between 30 and 50 permanent support personnel, who would maintain and operate the facility. It is assumed that 20 individuals would relocate to Tinian and that the on-island local workforce could fill 30 positions.
- Up to 50 construction workers, who are assumed to relocate to Tinian from off-island. Construction would occur in phases over approximately 10 to 15 years.

Dependents are not included in the estimates above based on the experience of other DoD construction projects on Tinian. Potable water used for existing military training and military construction projects is already obtained from Commonwealth Utilities Corporation and included in the existing Commonwealth Utilities Corporation water demand data.

3.1.2 Domestic Demands

Domestic demands consist of all water necessary for human consumption, bathing, laundry, food preparation, and other miscellaneous uses that are calculated on a per capita basis. Table 4 summarizes the average day domestic demands located within the Military Lease Area using Unified Facilities Criteria 3-230-03 (DoD 2020) unit demands. The maximum population value was used in these calculations from the design population discussed above.

Table 4. Average Day Domestic Demand Within the Military Lease Area Under Alternative 1

Personnel Type	*Use Category*[a]	*Unit Demand (gpcd)*	*Population*	*Demand (gpd)*
Military Personnel	Military Training Camps	50	1,000	50,000
Construction Workers (8-hour shift)	Nonresident Personnel and Civilian Employees (per 8-hour shift)	30	50	1,500
Permanent Support Personnel (8-hour shift)	Nonresident Personnel and Civilian Employees (per 8-hour shift)	30	50	1,500
			Total	**53,000**

Note: [a]Per UFC 3-230-03 Table 3-1.
Legend: gpcd = gallon per capita per day; gpd = gallon per day; UFC = United Facilities Criteria.

3.1.3 Industrial Demands: Operation

A portable vehicle wash facility is proposed to be constructed at the Base Camp. Vehicles used in the maintenance and operation of the facilities would be washed here in addition to those military vehicles transported off-island on aircraft at the airport. The wash facility is a contained concrete facility where multiple vehicles can be washed simultaneously using portable cleaning equipment. Wash water is contained during the washing cycle and recycled. Once the wash cycles are complete, wash water is pumped out and disposed of in conformance with CNMI regulations.[1]

A new central vehicle wash facility, J609 Embark Facility, was recently constructed at Naval Base Guam. This facility, although larger than the facility proposed for Tinian, provides a reliable estimate of the amount of water that would be required to clean military vehicles in a climate similar to that of Tinian. The central vehicle wash facility on Guam was designed with a demand of 4,800 gallons per day for 230 vehicles per day (DON 2023). This yields approximately 21 gallons per vehicle for a similar climate to the proposed wash facility on Tinian.

The Proposed Action includes a wash capacity for the following vehicles:

- 15 military vehicles
- 30 maintenance and operation vehicles

The maximum water demand is 945 gallons per day. Military vehicles are estimated to be transported by air 4 times per year. Maintenance and operation vehicles are estimated to be washed 3 times per month (36 times per year). This results in an average annual water demand of 23,940 gallons per year.

3.1.4 Industrial Demands: Construction

Industrial demands during construction would include concrete mixing, earthwork compaction, dust control, hydrostatic pressure testing, and cleaning. Non-potable water used for this purpose is proposed to be obtained from Well M-21.

3.1.5 Average Annual Water Demand

The previous tables provided average day demands at the peak training population, which is a maximum potential adverse effect used to size the proposed water infrastructure. Because military training may occur intermittently throughout the year, the water used annually would be significantly lower than the average daily demand.

Table 5 provides the long-term average annual water demand within the Military Lease Area by the Proposed Action under Alternative 1 after construction is complete.

[1] See the *Final Memorandum: Wastewater Analysis in Support of the CNMI Joint Military Training* for information regarding disposal of wash water.

Table 5. Average Annual Water Demands Within the Military Lease Area Under Alternative 1

Description	*Demand*	*Cycles Per Year*	*Persons x Day*	*Unit Water Demand (gpcd)*	*Demand (gallons/year)*
Large Training Group	1,000 persons × 30 days	4	120,000	50	6,000,000
Medium Training Group	250 persons × 14 days	4	14,000	50	700,000
Small Training Group	100 persons × 14 days	10	14,000	50	700,000
Permanent Support Personnel (8-hour shift)	50 persons × 365 days	1	18,250	30	547,500
Portable Vehicle Wash Facility					23,940
				Total	**7,971,440**

Note: These demands represent the maximum of the training durations and personnel per year identified in the revised draft EIS.
Legend: gpcd = gallon per capita per day.

Training tempo under Alternative 2 is 10 percent less than under Alternative 1, which would result in a proportional decrease in water use by 10 percent. As a result, the average annual water demand under Alternative 2 is 7,174,296 gallons per year.

3.2 POTABLE WATER DEMANDS OUTSIDE THE MILITARY LEASE AREA

The following section estimates the water demands due to the Proposed Action located outside the Military Lease Area. This area is within the existing service area of the Commonwealth Utilities Corporation water system. It is anticipated that the Commonwealth Utilities Corporation would meet potable water demands in this area.

3.2.1 Domestic Demands

It is anticipated that construction workers and permanent support personnel would live outside the Military Lease Area in homes, apartments, or hotels. Table 6 summarizes the additional average day domestic demands due to the Proposed Action under Alternative 1 that the Commonwealth Utilities Corporation would meet. Per capita unit demand is estimated using Unified Facilities Criteria 3-230-03 (DoD 2020).

Table 6. Average Day Domestic Demand on Commonwealth Utilities Corporation Water System Under Alternative 1

Personnel Type	*Use Category* [a]	*Unit Demand (gpcd)*	*Population*	*Demand (gpd)*
Construction Workers (24-hour)	Family Housing	125	50	6,250
Permanent Support Personnel (24-hour) [b]	Family Housing	125	20	2,500
			Total	**8,750**

Notes: [a]Per UFC 3-230-03, Table 3-1.
[b]Only personnel relocating from off-island are included here.
Legend: gpcd = gallon per capita per day; gpd = gallon per day; UFC = Unified Facilities Criteria.

3.2.2 Industrial Demands: Operation

A central vehicle wash facility is proposed to be constructed at the Port of Tinian. Military vehicles would be washed here after training is complete and prior to loading on vessels for transport off-island. The wash facility would be a contained concrete facility where multiple vehicles can be washed simultaneously using permanently mounted cleaning equipment. Wash water would be contained during the washing cycle and recycled. Once the wash cycles are complete, wash water would be pumped out and disposed of in conformance with CNMI regulations.[2] No domestic demand is proposed at the Port of Tinian as the wash facility would not have a restroom.

A new central vehicle wash facility, J609 Embark Facility, was recently constructed at Naval Base Guam. This facility, although larger than the facility proposed for Tinian, provides a reliable estimate of the amount of water that would be required to clean military vehicles in a climate similar to that of Tinian. The central vehicle wash facility on Guam was designed with a demand of 4,800 gallons per day for 230 vehicles per day (DON 2023). This yields approximately 21 gallons per vehicle for a similar climate to the proposed wash facility on Tinian.

The Proposed Action includes a wash capacity of 44 vehicles per day, which is based on 87 total vehicles for a 1,000-person training exercise and a 2-day retrograde period. The prorated industrial demand for the proposed wash facility would be 924 gallons per day.

3.2.3 Industrial Demands: Construction

Industrial demands during construction would include mixing concrete, earthwork compaction, dust control, hydrostatic pressure testing, and cleaning. Non-potable water used for this purpose is proposed to be obtained from Well M-21. No water is proposed to be purchased from the Commonwealth Utilities Corporation for construction purposes.

3.2.4 Average Annual Water Demand

The water demand by the Proposed Action is anticipated to remain consistent and not vary significantly throughout a given year. Because of this, the average annual water demand is the sum of the existing and proposed demands. Table 7 summarizes impacts of the Proposed Action under Alternative 1 on the CUC water system.

Table 7. Summary of Existing and Proposed Water Demands on Commonwealth Utilities Corporation Under Alternative 1

Category	*Average Day Demand (MGD)*
Existing CUC Production [a]	0.85
Proposed Additional Domestic Demand	0.0088
Proposed Additional Industrial Demand [b]	0.0009
Total Demand on CUC Water System	**0.86**

Notes: [a]Average of production at Maui Well No. 2 from 2019 to 2023.
[b]Assume one wash per day at the Central Vehicle Wash Facility at the Port of Tinian.
Legend: CUC = Commonwealth Utilities Corporation; MGD = million gallons per day.

As discussed in Section 2, the average day production from Maui Well No. 2 between 2019 and 2023 is 0.85 million gallons per day, which is less than the estimated aquifer drought capacity at

[2] See the *Final Memorandum: Wastewater Analysis in Support of the CNMI Joint Military Training* for information regarding disposal of wash water.

Maui Well No. 2 of 1.0 million gallons per day. The Proposed Action under Alternative 1 is estimated to increase water production at Maui Well No. 2 by 1.14 percent. The sum of existing water production and proposed water demand is approximately 0.86 million gallons per day, which results in 0.14 million gallons per day in remaining aquifer drought capacity.

The water demands on the Commonwealth Utilities Corporation are the same for both Alternative 1 and Alternative 2.

3.3 NON-POTABLE WATER DEMANDS

3.3.1 Construction Water (Well M-21)

Industrial demands during construction would include mixing concrete, earthwork compaction, dust control, hydrostatic pressure testing, and cleaning. The U.S. Air Force is currently constructing the Tinian Divert Infrastructure Improvements at the Francisco Manglona Borja/Tinian International Airport. The contractor purchases all water for that construction from the Tinian Mayor's Office at Well M-21. This well has an extraction capacity of 1.8 million gallons per month in 2024 (J. Aldieri, NAVFAC Marianas, Personal Communication, September 10, 2024), or 21.6 million gallons per year. All water used at this well is used for construction purposes.

The construction contractor is responsible for obtaining non-potable water used in construction. Construction of the Tinian Divert Infrastructure Improvements would be completed prior to starting construction of the Proposed Action. It is anticipated that the contractor for the Proposed Action would make arrangements with the Tinian Mayor's Office to use Well M-21 for construction water.

The Proposed Action is significantly smaller in size and scope than the Tinian Divert Infrastructure Improvements and would use substantially less water during construction. To be conservative, it is assumed that the same quantity of water, 21.6 million gallons per year, would be used in construction of the Proposed Action.

3.3.2 North Field Wells

Non-potable water infrastructure is proposed to be constructed at North Field for firefighting purposes. Water infrastructure at North Field is proposed to be separate from the Base Camp and would not be interconnected. Water would be used for firefighting purposes and would not be operated continuously. Based on wildland firefighting recommendations, it is estimated that the volume of non-potable water used would not exceed 800,000 gallons per year.

3.3.3 U.S. Air Force's Tinian Divert Infrastructure Improvements

The U.S. Air Force has constructed a groundwater well to supply water to the Tinian Divert Infrastructure Improvements at the Francisco Manglona Borja/Tinian International Airport. The primary purpose for this well is to provide water for fire protection purposes. It is estimated this well would use an average of 800,000 gallons per year. This project was permitted separately and is not included in the Proposed Action.

3.3.4 U.S. Air Force's North Field Rehabilitation

The U.S. Air Force is planning to rehabilitate an existing groundwater well or construct a new groundwater in North Field to supply non-potable water for construction of their North Field Rehabilitation project. The U.S. Air Force estimates they would use 12,000 gallons per day for construction, which is 4,380,000 gallons per year. This project was permitted separately and is not included in the Proposed Action.

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4 NEW WATER INFRASTRUCTURE

4.1 OPTIONS EVALUATED

The following options were evaluated to supply water in order to meet the needs of the Proposed Action within the Military Lease Area. Water demands outside the Military Lease Area are proposed to be met by the Commonwealth Utilities Corporation.

No construction activities would be conducted at the former U.S. Agency for Global Media site on Saipan and no changes to water use are proposed. Because of this, there is no impact to potable water on Saipan.

4.1.1 Option A, Connection to Commonwealth Utilities Corporation

Under Option A, a pipeline would be constructed to supply water from the Commonwealth Utilities Corporation to meet the needs of the Proposed Action within the Military Lease Area. However, this was not deemed feasible because the Commonwealth Utilities Corporation does not comply with the DoD requirements for water supply as described in Unified Facilities Criteria 3-230-01 (DoD 2020). Unified Facilities Criteria 3-230-01 incorporates the *Ten State Standards* (Great Lakes 2012), which requires a minimum of two sources of groundwater to be provided.

The Commonwealth Utilities Corporation water system on Tinian only has one source of groundwater with no redundancy and does not comply with these requirements.

4.1.2 Option B, Construct Separate Water Infrastructure

Under Option B, new water infrastructure would be constructed that would operate independently of the existing Commonwealth Utilities Corporation water system and avoid impacts to it. The Proposed Action includes construction of new water infrastructure at two different locations:

- Base Camp
- North Field

Water infrastructure at the Base Camp would consist of new groundwater wells, aboveground storage tanks, and distribution piping to meet potable water and fire protection demands. Water infrastructure at North Field would consist of new groundwater wells and aboveground storage tanks for fire protection demand only. Groundwater production from these wells would conform to extraction limitations and requirements stated in the operation permit by the Bureau of Environmental and Coastal Quality. Excess capacity could also be made available for agricultural or other uses approved by the U.S. Marine Corps (USMC).

4.1.3 Option C, Interconnection Between Water Systems

Under Option C, a pipeline would be constructed between the new water infrastructure described in Option B and the Commonwealth Utilities Corporation to provide emergency water supply. However, this was not deemed feasible because the combined system would not comply with the DoD requirements for water supply as described in Unified Facilities Criteria 3-230-01 (DoD 2020). Unified Facilities Criteria 3-230-01 incorporates the *Ten State Standards* (Great Lakes 2012), which requires the total developed groundwater source capacity to equal or exceed the design maximum day demand with the largest producing well out of service.

The groundwater wells proposed in Option B do not have sufficient capacity to meet the needs of the Commonwealth Utilities Corporation water system if the largest producing well, Maui Well No. 2, were out of service and therefore would not comply with these requirements.

4.2 BASE CAMP WATER INFRASTRUCTURE

The Proposed Action includes construction of a Base Camp at the U.S. Agency for Global Media site on Tinian. As envisioned, Administration, Range Control, and Training Support functions proposed in the Base Camp would use the existing operation and administration building, and warehouse requirements would be partially met with the existing warehouse facilities. Other previously disturbed, cleared areas within the site would accommodate other new construction needs of the proposed Base Camp.

The Proposed Action includes construction of new water infrastructure to fully support the USMC's proposed CNMI Joint Military Training and to avoid impacts on the Commonwealth Utilities Corporation water system. This proposed new water infrastructure would supply the domestic, industrial, and fire protection demands of military training activities within the Military Lease Area. This proposed new water infrastructure would comply with the Federal Safe Drinking Water Act and the CNMI Drinking Water Regulations and be operated by USMC with a CNMI-certified water operator. No connection to the Commonwealth Utilities Corporation water system is proposed. Excess capacity could also be made available for agricultural or other uses approved by USMC. The existing non-potable rainwater harvesting system may also be retained for non-potable uses.

Potable water would be supplied to the Base Camp from new groundwater wells at one of the two following locations:

- Wellfield Option A is located east of Broadway at 86th Street.
- Wellfield Option B is located between West End Drive and 8th Avenue at 86th Street.

Wellfield Option B is the preferred option to locate new groundwater wells due to its proximity to the Base Camp. Water pipelines from the well field to the Base Camp would be located in 86th Street and 8th Avenue, or along West End Drive (Figure 13). It is not feasible to construct groundwater wells closer to the former U.S. Agency for Global Media site due to the site geology.

4.2.1 Design Flow

Water demands are calculated in accordance with Unified Facilities Criteria 3-230-03, *Water Treatment* (DoD 2020). Design flow is the greater of peak hourly demand or maximum daily domestic demand plus industrial demand. Maximum daily and peak hourly demands are calculated as the product of the average daily domestic demand and the coefficient "K." The coefficient "K" for maximum daily demand is 2.25 for populations of less than 5,000 people. The coefficient "K" for peak hourly demand is 4.0 for populations of less than 5,000 people.

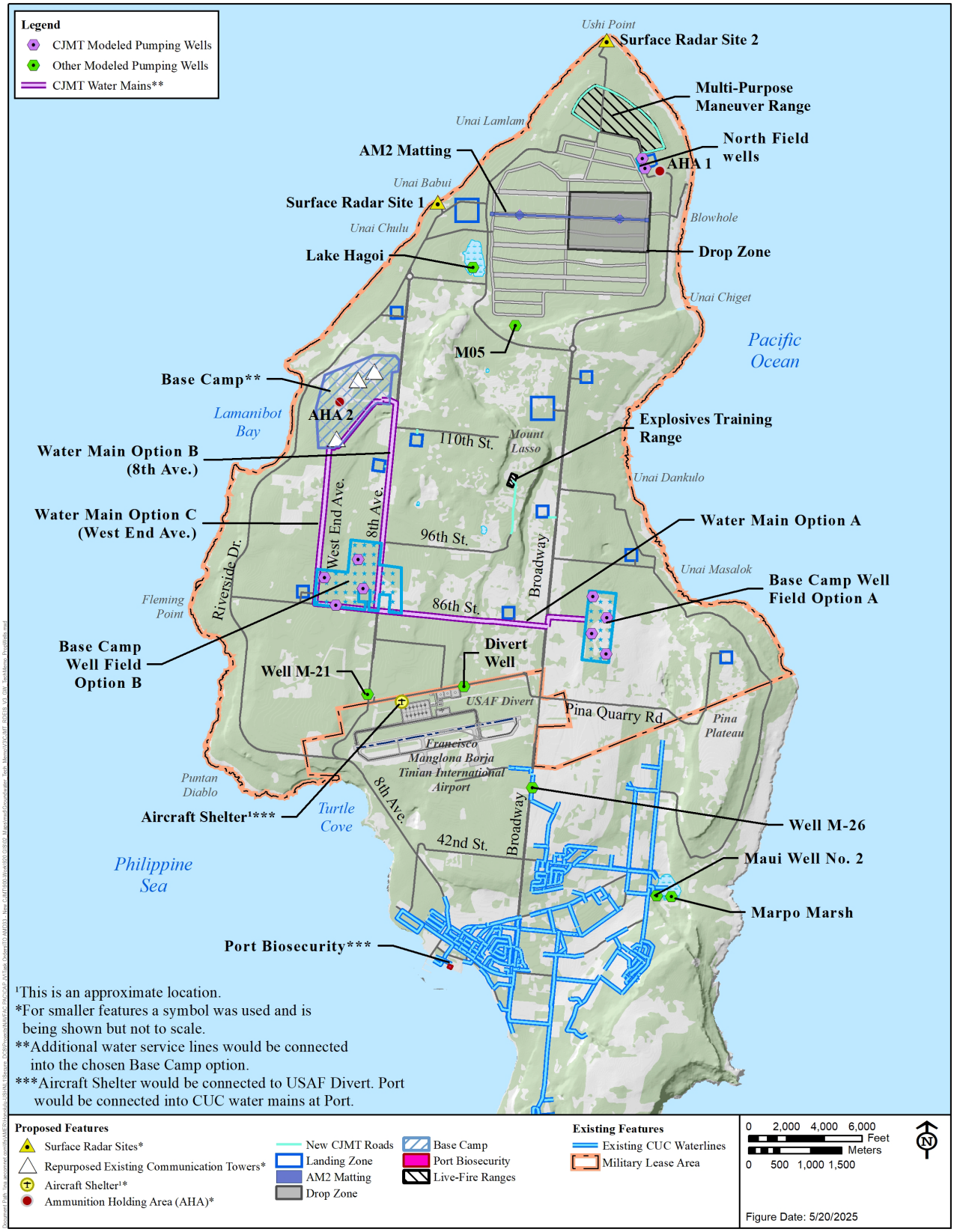

Figure 13. Water Infrastructure Included in Proposed Action

Fire demand requirements are described in Unified Facilities Criteria 3-600-01, *Fire Protection Engineering for Facilities* (DoD 2021a). The fire demand is a minimum of 1,000 gallons per minute for a 2-hour duration at 20 pounds per square inch, which is a volume of 120,000 gallons.

The design flow is then calculated as:

- Peak Hourly Demand = 53,945 gallons per day × 4.0 = 215,780 gallons per day
- Maximum Daily Demand + Fire Flow = 53,945 gallons per day × 2.25 + 120,000 gallons per day = 241,376 gallons per day

The controlling design flow is 241,376 gallons per day and the proposed water infrastructure would be designed to provide this flowrate.

4.2.2 Groundwater Wells

New groundwater wells could be constructed to operate with a capacity of 120 gallons per minute. To reduce impacts to the aquifer, a larger number of wells operating at lower flowrates is proposed. The proposed equipped pumping capacity would be limited to 60 gallons per minute, which is equal to 86,400 gallons per day. Three groundwater wells can provide 259,200 gallons per day, which would meet the design flow of 241,376 gallons per day. *Ten State Standards* (Great Lakes 2012) require a fourth, redundant well to be constructed so that design flow can be met with the largest source of water out of service. It is planned that all four wells would operate on a rotating cycle. The specific location of the wells would be determined as part of engineering design.

Construction and operation of each groundwater well would be subject to an annual permit from Bureau of Environmental and Coastal Quality. Bureau of Environmental and Coastal Quality would determine extraction limitations based on the results of pump tests, aquifer recovery tests, and water quality testing. The extraction limitations would be subject to change each year based on test results.

4.2.3 Water Treatment

Groundwater is not anticipated to require filtration or treatment, other than disinfection, based on the analytical testing results of groundwater performed in 2015 (DON 2015).

4.2.4 Storage Requirements

Water storage requirements are described in Unified Facilities Criteria 3-230-01 (DoD 2021b). The required storage is the sum of the maximum daily demand for 24 hours, which is 121,376 gallons, and fire demand of 120,000 gallons:

- Required Storage Volume = 121,376 gallons + 120,000 gallons = 241,376 gallons

One possible hypothetical tank configuration that would meet this requirement has a diameter of 40 feet and a height of 32 feet with a gross volume of 300,810 gallons and a usable volume of 253,808 gallons. To meet the required storage, two tanks are recommended so that one tank can be removed from service for maintenance and repair while the other is in operation. Additionally, Unified Facilities Criteria 3-600-01 (DoD 2021a) requires that water storage tanks be refilled within 48 hours of normal consumption and within 24 hours if normal consumption is curtailed.

4.2.5 Booster Pump Station

A booster pump station would be required downstream of the storage tanks to pressurize the water infrastructure. Per Unified Facilities Criteria 3-230-01 (DoD 2021b), pumps would be required to maintain a residual pressure of 40 pounds per square inch at average day demand and 30 pounds per square inch during design flow. Minimum residual pressure at fire hydrants must be at least 20 psi while supplying fire flow. It is recommended that the booster pumps be designed to supply both domestic and fire demands. Stand-alone fire demand pumps could fail in an emergency because they do not operate regularly.

The booster pump station and disinfection are proposed to be located inside a 1,200-square-foot pump building.

4.3 NORTH FIELD WATER INFRASTRUCTURE

Non-potable water infrastructure is proposed to be constructed at North Field for firefighting purposes. Water infrastructure at North Field is proposed to be separate from the Base Camp and not interconnected. Water infrastructure is planned to include up to two new or rehabilitated groundwater wells, two 100,000-gallon aboveground water tanks, a booster pump station, and a 1,200-square-foot pump house. The overall land disturbance for this infrastructure is anticipated to be 100 feet square (10,000 square feet) and the specific locations would be determined during engineering design.

New groundwater wells could be constructed to operate with a capacity of 120 gallons per minute. To reduce impacts to the aquifer, it is proposed to limit the equipped pumping capacity to 60 gallons per minute, which is equal to 86,400 gallons per day. Water would be used for firefighting purposes and would not be operated continuously. Based on wildland firefighting recommendations, it is estimated that the volume of non-potable water used would not exceed 800,000 gallons per year.

Construction and operation of each groundwater well would be subject to an annual permit from Bureau of Environmental and Coastal Quality. Bureau of Environmental and Coastal Quality would determine extraction limitations based on the results of pump tests, aquifer recovery tests, and water quality testing. The extraction limitations would be subject to change each year based on test results. Even though this is intended as a non-potable water, Bureau of Environmental and Coastal Quality requires that the wells be designed and constructed to potable standards.

4.4 AIRCRAFT SHELTER WATER INFRASTRUCTURE

The proposed aircraft shelter is located at the Tinian Divert Infrastructure Improvements at the Francisco Manglona Borja/Tinian International Airport. Fire protection requirements for the aircraft shelter would be met by the water system being constructed as part of the Tinian Divert Infrastructure Improvements. This water system would include a groundwater well, storage tank, and booster pump for fire protection purposes. A pipeline would be constructed from this water system to the proposed aircraft shelter. No potable water uses are proposed at the aircraft shelter. No changes in demand or usage on this water system are proposed.

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5 SUMMARY

5.1 NEW WATER INFRASTRUCTURE

The Proposed Action on Tinian includes construction of potable water infrastructure at the Base Camp that includes new groundwater wells, water storage tanks, and a pipeline distribution system to provide water for military trainees. This action, designed and managed in a manner that would avoid adversely affecting the sustainable yield of the aquifer, would avoid demands on the Commonwealth Utilities Corporation water system. The new water infrastructure would be sized in accordance with government regulations to provide a maximum day demand of 121,376 gallons per day plus fire demand of 120,000 gallons per day.

While the new water infrastructure would be sized to provide the maximum day demand and fire demand occurring simultaneously, the actual water usage during the year would be substantially less. The average annual water demand of the new water infrastructure would be 8,518,940 gallons per year under Alternative 1. The average annual water demands under Alternative 2 would be 7,174,296 gallons per year.

Non-potable water infrastructure is proposed to be constructed at North Field for firefighting purposes. Water infrastructure at North Field is proposed to be separate from the Base Camp and would not be interconnected. It is estimated that 800,000 gallons per year would be used. This demand would be the same under both Alternative 1 and Alternative 2.

Construction and operation of each groundwater well would be subject to an annual permit from Bureau of Environmental and Coastal Quality. Bureau of Environmental and Coastal Quality would determine extraction limitations based on the results of pump tests, aquifer recovery tests, and water quality testing. The extraction limitations would be subject to change each year based on test results to protect the aquifer.

5.2 COMMONWEALTH UTILITIES CORPORATION

Construction workers and permanent support personnel would reside outside the Military Lease Area and become customers of the Commonwealth Utilities Corporation. As customers, they would be responsible for paying all charges and rates adopted by the Commonwealth Utilities Corporation. The Proposed Action under Alternative 1 and Alternative 2 is estimated to increase water production at Maui Well No. 2 by 9,674 gallons per day, which is 1.14 percent. The estimated total production at Maui Well No. 2 with the Proposed Action is approximately 0.86 million gallons per day, which is below the aquifer drought capacity at Maui Well No. 2 of 1.0 million gallons per day.

5.3 GROUNDWATER IMPACTS

Impacts to groundwater availability and quality are evaluated in the Groundwater Modeling Technical Memorandum. Table 8 provides a summary of water demands evaluated in the groundwater model.

Table 8. Summary of Average Annual Water Demands on Tinian

Owner	*Facility*	*Type*	*Average Annual Water Demand [b] (gallons per year)*	*No. Wells*
Military	CJMT Base Camp	Potable	7,971,440	4
Military	CJMT North Field	Non-Potable	800,000	2
Military	U.S. Air Force North Field Rehabilitation	Non-Potable	4,380,000	1
Military	Tinian Divert Infrastructure Improvements	Potable	800,000	1
CUC	Maui Well No. 2 [a]	Potable	314,727,702	1
Tinian Mayor's Office	Well M-21 (CJMT Construction)	Non-Potable	21,600,000	1
Tinian Mayor's Office	Well M-26 (Existing Agriculture)	Non-Potable	21,600,000	1

Notes: [a]Average of production at Maui Well No. 2 from 2019 to 2023 and proposed CJMT demands on the CUC water system.
[b]Total demand for all the wells.

Legend: CJMT = Commonwealth of the Northern Mariana Islands Joint Military Training; CUC = Commonwealth Utilities Corporation; gpd = gallon per day; U.S. = United States.

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ATTACHMENT A
FEBRUARY 2016 MEETING MINUTES

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Background, Summary, and Follow-up from 03 and 04 February 2016 on Next Steps in Addressing Potable Water and Groundwater Issues on Tinian, Commonwealth of the Northern Mariana Islands (CNMI)

Meeting Locations: Commonwealth Utilities Corporation (CUC) Conference Room Saipan (03 February 2016 Meeting) and CUC Conference Room Tinian and Field (04 February 2016)

Attendees:

CNMI Bureau of Environmental and Coastal Quality (BECQ):
Captain Derek Chambers †
CUC:
James Benevente, Engineer †
John Reigel, Manager*
Winston Omar, Operator**
Environmental Protection Agency (EPA):
Carl Goldstein, Program Manager †
Mike Lee, Water Division †
John McCarroll, Pacific Islands †

Marine Corps Activity Guam:
Gunnery Sergeant Donald McClester †
Major Chris Merrill †

Marine Corps Forces Pacific (MARFORPAC), Defense Policy Review Initiative (DPRI):
Sherri Eng, Environmental †
Tim Robert, Operations †
Martha Spengler, Environmental*
Marine Corps Headquarters
Stephen Wenderoth, Legal Counsel †
Naval Facilities Engineering Command Pacific:
Brian Whitehouse, Project Manager †
Pacific Air Forces:
Mark Petersen, Project Manager †

Joint Venture TEC-AECOM (JV):
Daniel Cronquist, Engineer*
Douglas Roff, Hydrogeologist*

†=attended meetings on 03 February only * = attended meetings on 03 February and 04 February; **= attended meeting on 04 February only

Background: Two meetings were held in the CNMI the first week of February 2016 to discuss the next steps in addressing the EPA's concerns related to potable water and groundwater issues on Tinian. These meetings are a follow-on action related to the EPA's comments on the Draft CNMI Joint Military Training (CJMT) Environmental Impact Statement (EIS)/Overseas EIS (OEIS) (hereinafter referred to as the "DEIS"). The Department of Defense (DoD) released the DEIS in April 2015. After an initial review, the EPA agreed to withhold an adverse rating on the DEIS provided the DoD addresses its concerns related to the CJMT proposed action. These concerns included issues related to potable water and groundwater alternatives on Tinian. The DoD agreed to prepare a Revised DEIS (RDEIS) in order to address the EPA's and others' comments on the DEIS. Towards this end, MARFORPAC and the EPA met in December 2015 and January 2016 to discuss potable water demands, potable water production, sustainable production of groundwater aquifer sub-basins on Tinian, and potential potable water alternatives to be evaluated for possible analysis in the RDEIS.

At the DoD's request, the EPA coordinated a meeting with the CUC and BECQ in the CNMI. The purpose of the meeting on 3 February 2016 was to get the CUC's and BECQ's feedback on assumptions that went into a Water Demands Memo that the JV prepared to estimate potable water production from the CUC System and projected water demands on Tinian through 2027. In addition, the DoD wanted to discuss the sustainable production of fresh groundwater on the island, gain a better understanding of the unaccounted for water (UFW) from the CUC System, and CUC's plans and desires to address UFW and other CUC System issues. The purpose of the 4 February 2016 meeting was for the JV and DoD to meet with CUC operators and to examine key CUC infrastructure and gather data needed to further evaluate potable water and groundwater alternatives on Tinian.

I. Water Demands Memo

Background: DPRI Environmental directed the JV to prepare a Water Demands Memo that outlines the production rate of the CUC's sole freshwater production well on Tinian (Maui Well No. 2) and the various projected water demands on Tinian from the present through 2027. The Water Demands Memo was intended to address EPA comments related to the sustainable production of freshwater on the island, provide a breakdown of the CJMT construction and operation water demands and how those demands and other projected water demands could be met (i.e., potable water and groundwater options/alternatives). Toward that end, the memo memorializes the CUC's daily and annual production pumped from Maui Well No. 2 and metered potable water (i.e., assumed consumption rate of potable water) as reported by the CUC. The memo also provides estimated agricultural water demands on the island, projected CJMT water demands broken down by year of construction through operation, projected Divert water demands, projected Plumeria Resort and Tinian Ocean View Resort water demands, and anticipated water demands from induced population growth. The Water Demands Memo is a starting point in the reevaluation of potable water and groundwater options on Tinian. The DoD shared the draft Water Demands Memo with the EPA in their 14 January 2016 meeting and received feedback on assumptions made in preparing the Water Demands Memo.

Discussion Summary:

- **General Feedback on the Water Demands Memo.** The CUC and BECQ were pleased with the draft Water Demands Memo as it helped them to better understand the water demands on Tinian and the current production rates of Maui Well No. 2. Both agencies would like a copy of the Water Demands Memo once it is finalized.
- **Projected Water Demands on Tinian**
    - **Feed-back on Water Demand Assumptions.** The CUC and BECQ had few comments on the assumptions that went into the projected water demands outlined in the Water Demands Memo except for the following:
        - While they had no formal documentation or permit application, the CUC understands that the proposed Tinian Ocean View Resort intends to meet their operational water demands via reverse osmosis.
        - The CUC and BECQ had no specific knowledge of agricultural water demands on Tinian.
    - **Follow Up on Water Demands.** The JV will follow up with the Tinian Ocean View Resort developers (Alter City Group and Bridge Investment Group, respectively) to confirm that water demands are adequately represented. Plumeria Resort water demands for operation were obtained from the development's Environmental Impact Assessment (EIA). The Tinian Ocean View Resort, which has begun construction, does not have an EIA; thus, all construction and operation water demands were estimated based on descriptions available from the local newspaper. The JV will follow up with the Tinian agricultural extension agent (Lawerence Duponcheel) and with the CNMI Department of Agriculture to get a better sense of the water demands from agriculture off of the Military Lease Area (MLA).
- **Freshwater Production on Tinian**
    - **Sustainable Freshwater Production from Maui Well No. 2.** The CUC agreed with an EPA recommendation that it would be prudent to assume that the CUC sustainable production capacity from Maui Well No. 2 is 1.0 Million Gallons per Day (MGD). The CJMT DEIS had used an average sustainable production capacity of 1.26 MGD in order to assess impacts from the CJMT project, noting that production rate ranges from 1.0 MGD during dry periods to about 1.50 MGD

during wet periods. Based on the discussion, the DoD agreed to use the 1.0 MGD in its impact analysis for the RDEIS (unless further analysis of CUC extraction rates indicates another reasonable value). [Note: CUC operators on Tinian have kept hourly hydraulic head (groundwater levels) from Maui Well No. 2 since its inception along with pump rates.]

- **Sustainable Freshwater Yield on Tinian.** All agreed that the aquifer sub-basins on Tinian could accommodate the projected freshwater pumping demands outlined in the Water Demands Memo provided that the extraction of groundwater was sufficiently dispersed to avoid impacting water quality (i.e., siltation, chloride content).
  - **Maui Well No. 2 Water Quality Issues.** Presently, the CUC System pumps exclusively from the Makpo sub-basin aquifer which is thought to be hydraulically connected to the Makpo Wetland. [Note: Maui Well No. 2 is a horizontal well or "Maui-style infiltration gallery well"]. The CUC confirmed that water quality during periods of heavy rainfall coincided with increased turbidity in the well thought to be due to runoff into the wetland. In their comments on the DEIS, the EPA expressed concern that increasing pump rates to accommodate project CJMT could further affect water quality at Maui Well No. 2. In addition, the chloride content at Maui Well No. 2 is recorded at greater than 200 milligrams per liter (mg/l) which is close to the SDWA Secondary Drinking Water Level of 250 mg/l. As noted in EPA comments and discussions, CUC System customers have registered complaints about water quality/taste. All agreed that pumping from other wells either within the Makpo aquifer sub-basin or other aquifer sub-basins would be one way to avoid impacting water quality at Maui Well No. 2.
  - **Other Potential Production Wells in the Makpo Aquifer Sub-basin.** As described by the U.S. Geological Survey (*Geohydrology and Numerical Simulation of Alternative Pumping Distributions and the Effects of Drought on Ground-Water Flow System of Tinian, Commonwealth of the Northern Mariana Islands*, Gingerich et al 2002) , the CUC had two vertical wells in operation in the Makpo aquifer sub-basin into the 1990s. During the site visit on 4 February 2016, the CUC operators showed the JV and DoD the locations of these inactive wells – both of which were capped and are reportedly in marginal to poor condition. The CUC indicated that the wells were taken off-line because the CUC could not afford to continue to maintain the wells. Reportedly, there are other vertical wells that may tap into the Makpo aquifer sub-basin that may be used for agricultural or other water demands (these are described in the 2002 USGS report).
  - **Potential Freshwater Production from the Masalok Aquifer Sub-basin.** The JV explained why they believe that pumping in the MLA (i.e., primarily in the Masalok aquifer sub-basin), as proposed in the DEIS, would not likely affect the water quality and quantity in the Makpo sub-basin aquifer. The maximum CJMT projected water demands, as described in the DEIS, would be between 0.240 MGD and 0.460 MGD. Mr. Roff explained that the USGS (2002) modeled pumping in both the northern and southern portions of Tinian during drought periods and at pumping rates that are below those projected water demands described in the Water Demands Memo.

II. Impacts to Water Quality from Increased Groundwater Extraction on Tinian

Background. In their comments on the DEIS, the EPA stated that the DEIS did not adequately address the potential for saltwater intrusion on drinking water and the effects on drinking water quality. The DEIS concludes that the additional construction-period and operation-period water demands (off of the MLA) would require increased pumping from the CUC's Maui Well No. 2 and this could result in temporary increased chloride levels as a result of saltwater intrusion. The DEIS concludes that these impacts are less than significant because the limited times this

would occur and because of the size and recharge characteristics of the freshwater basal lens. The EPA believes that the information in the DEIS allows for uncertainty regarding the potential for saltwater intrusion in the aquifer. The DEIS conclusions regarding potential salinity increases were based largely on the USGS 2002 groundwater model. This steady-state groundwater flow model is based on pumping data from the late 1990's and, while it was the best available tool for predicting the possible hydrologic effects of additional groundwater withdrawals at that time, more sophisticated models currently exist. The model cannot predict the salinity distribution within the aquifer and it is not capable of predicting the quality of the water pumped from a given well. The model can simulate the location of the freshwater/saltwater interface; however, it cannot simulate local up-coning atpumped wells.

Furthermore, the EPA indicated in their comments that the DEIS does not specifically discuss the combined impacts to the aquifer, during operations, from pumping in the MLA (Masalok aquifer sub-basin) and outside the MLA (Makpo aquifer sub-basin). The EPA is concerned that the two sub-basins have a high degree of connectivity and thus pumping from one sub-basin would lower the freshwater availability in the other sub-basin. The EPA noted that groundwater withdrawal on Tinian and the potential effects it could have on Makpo Wetland are not discussed in the DEIS. Maui Well No. 2, Tinian's sole public water supply well, pumps freshwater from Makpo Wetland's basal groundwater lens. The project water demand would be between 0.033 to 0.058 MGD during the construction period. During the operation period the project water demand would be on average 0.240 MGD and maximum of 0.460 MGD. The DoD System's well field would be within the Masalok sub-watershed, with a small portion located within the Makpo sub-watershed where the CUC System well is located. The EPA believes that the two sub-watersheds are connected (i.e., share the same limestone aquifer and the two basins are connected); thus, the EPA believes that the wells and wetlands in one sub-watershed could be influenced by groundwater withdrawal from wells in the neighboring sub-watershed.

The DoD in subsequent discussions with the EPA responded that structural features, which define the Median Valley, likely result in significant conduit flow to the north and southwest of the MLA. These were not accounted for in the 2002 model.

Discussion Summary:

- **Aquifer Modelling on Tinian.** Following the discussion on the sustainable yield of freshwater on Tinian, Mr. Lee (EPA) indicated that an updated aquifer model could help address the EPA's concerns about water quality as a result of projected and proposed water extraction from the DoD, CUC, and Plumeria Resort on drinking water quality.

III. Unaccounted for Water from the CUC System on Tinian

The EPA in its comments on the DEIS recommended that UFW be targeted for improvement as it would have a beneficial impact by helping the CUC and the municipality. The EPA recommended that options for correcting the deficiencies in the CUC System should be evaluated in the RDEIS as the EPA believes that it represents a reasonable alternative that could reduce potentially significant impacts on the potable water utility (and groundwater aquifer).

Presently, the CUC pumps between 0.890 MGD to 1.32 MGD from Maui Well No. 2; however, they currently bill only 0.320 MGD. This means that approximately 0.570 MGD to 1.00 MGD is UFW lost to the environment or utilized by customers at unmetered or unregistered facilities. The CUC, in response to a Stipulated Order with the EPA, prepared a draft drinking water master plan ("Master Plan"). The Master Plan identified several potential sources of UFW including faulty water meters, over-topping of water storage tanks, leaking pipes, and unmetered/unregistered connections. At the 03 February 2016 meeting, the CUC acknowledged that they do not fully understand the quantities of UFW that can be attributed to various sources. The following provides a summary

of the various UFW sources and the CUC's general understanding and identified approach for addressing UFW from these sources:

- **Faulty Water Meters.** The CUC acknowledged that their water meters are not reliable and often undercount the amount of water delivered to service connections resulting in UFW. Often water bills are estimated based upon use when the meters were functional. Sources of inaccuracy, according to the Master Plan, include improper installation and lack of maintenance.
- **Over-Topping of Storage Tanks.** The CUC operates two aboveground water storage tanks, 0.250 million gallon (MG) and 0.500 MG in size. The 0.250 MG tank's flow control system has failed, resulting in UFW of 0.144 to 0.216 MGD according to the Master Plan. Currently the tank is operated manually and the master valve to the tank was closed during our field visit. The 0.500 MG storage tank has a telemetric connection to Maui Well No. 2 which is controls operation of the pumps; however, due to power supply irregularity, the telemetry can be unreliable and thus result in over topping of the tank. The CUC has programmed projects to replace the 0.500 MG tank and telemetry system at the tank. The CUC has not yet programmed a project to address deficiencies at the 0.250 MG tank. The Master Plan recommends that the CUC abandon the 0.250 MG tank.
- **Leaking Transmission and Distribution Pipes.** Leaking pipes are a source of UFW that are exacerbated by non-functional pressure reducing valves (PRVs) which over pressurize portions of the pipeline system. The CUC has programmed a project to replace several of the PRVs in accordance with the Master Plan recommendations. Additionally, CUC has identified pipelines for replacement including the seaport area where the proposed CJMT port operations would be located. The CUC has identified a need to perform leak detection and repair or replacement throughout Tinian – particularly areas of San Jose Village.
- **Unmetered and Unregistered Connections to the CUC System.** Neither unmetered nor unregistered connections have water meters and both contribute to UFW. The primary difference between the two is that unmetered connections are known and authorized by CUC whereas the unregistered connections are not known and are not authorized. CUC has not attempted a comprehensive review of their service area to determine occupied properties without a meter.

IV. CUC System Improvements

In their comments on the DEIS, the EPA noted that it has issued a Stipulated Order to the CUC to bring its drinking water system back into compliance with Safe Drinking Water Act (SDWA). Furthermore, the EPA noted that the CUC is in severe financial distress. In the EPA's comments, they stated that if the DoD action would place an additional financial burden on the CUC, this would be an unacceptable impact to the CUC and could compromise the public's access to drinking water. The EPA recommended that the DoD describe any improvements that the DoD would make to the CUC System in the RDEIS. These improvements could include any additional pumping capacity that would be needed to the CUC System to ensure that sufficient drinking water would be available to the public, nature and extent of CUC System improvements, and an explanation of how the DoD would support CUC in making these improvements.

- **Programmed CUC System Improvements.** The CUC provided the DoD with a list of programmed improvements (i.e., funding has been approved) to the CUC System.
    - PRV replacements. The CUC has a project in place to replace and, in some case, move several PRVs. This project will go a long way in reducing water pressure and help reduce additional pipeline failures.
    - 0.500 MG Storage Tank Replacement. The CUC has a project programmed to replace the existing 0.500 MG storage tank including the liquid control telemetry. This project will help in with the reliability of the CUC System.

- **Unprogrammed CUC System Improvements.** The CUC provided the DoD with a list of potential construction projects in order of importance that they are looking for funding to implement. They believe that one or some combination of projects from this list could be used as mitigation for DoD actions on Tinian. These improvements are not presently programmed.
    - Install altitude valve at the 0.250 MG storage tank. This improvement would reduce leakage by approximately 0.144 MGD to 0.150 MGD when the tank is in operation.
    - Replace 8-inch fiberglass-reinforced pipe (FRP) transmission/distribution line between Maui Well No. 2 and the 0.500 MG storage tank with 10-inch ductile iron pipe for resistance to pressure transients (4,620 linear feet); install dedicated polyvinyl chloride (PVC) distribution pipe from 0.500 MG tank to intersection with Maui Well No. 1 (currently off-line, inactive) (5,370 linear feet), sized to accommodate proposed DoD demand.
    - Replace 6-inch FRP distribution piping between Maui Well No. 1 intersection and the 0.250 MG tank with new PVC sized to accommodate proposed DoD demand (DoD point of connection on this pipeline) (8,270 linear feet).
    - Replace galvanized iron (GI) and cast iron piping in Makpo Valley with new 6-inch PVC (6,000 linear feet).
    - Replace 10-inch FRP distribution piping from 0.500 MGD to San Jose Village (10,720 linear feet) with new PVC, sized to accommodate increased demand.
    - Replace GI pipe to seaport with new PVC sized to accommodate proposed military seaport demand.
    - Perform leak detection and repair throughout Tinian, focus first on FRP distribution piping in San Jose Village.

V. Follow-up Actions

The DPRI provided follow-up actions to the JV following the meetings in the CNMI in order to continue to address the EPA's comments related to potable water and groundwater on Tinian. The following is a summary of those actions which will enable DPRI to have discussions with DoD leadership in Washington D.C. to discuss the potable water/groundwater alternatives/options for Tinian and the studies necessary to make these evaluations. In addition, the JV will provide DPRI with rough order of magnitude costs for the non-programmed CUC System improvements. The intent is to meet with DoD leadership in March followed by a meeting with the EPA later (the same week) in order advise them of the way forward for related to potable water/groundwater issues on Tinian.

1. **Water Demands Memo.** JV to update and finalize the Water Demands Memo to reflect refinements to the projected agricultural water demands, Tinian Ocean View Resort, updates to the CJMT as it relates to potential changes resulting from the "Day-in-the-Life" (i.e., relocation of washracks, any increases in firefighting demands), Divert (based on new information from Mark Petersen), induced growth from DoD and proposed resort development, and existing CUC metering data (i.e., does the existing metering water demand match the Tinian population plus the Tinian Dynasty tourist demands?).
2. **Unaccounted For Water.** JV to provide an outline for assessing UFW including traditional methods of how this could be achieved (e.g., water flow measurements on fire hydrants or other locations) and adaptive methods (e.g., study of the water meters). Provide pros and cons of each including the fact that the CUC has some repair and replacement projects that would change the UFW results in the future.
3. **Aquifer Model.** JV to provide an outline of the objectives of the groundwater modelling, inputs, and outputs, costs, and how this would address the EPA's recommendations.
4. **Potable Water/Groundwater Alternatives/Options to Evaluate.** The JV to provide a write up on the possible potable water/groundwater alternatives or options for possible evaluation.

- **All CUC System.** Based on the updated water demands and the 1.0 MGD water production capacity from Maui Well No. 2, is an "All CUC System" a practicable potable water/groundwater alternative for meeting CJMT demands? JV to provide a discussion of the critical vulnerabilities for an All CUC System. These could include: (1) UFW correction (15% to 25% have been discussed as optimal UFW) and what it would take to get the UFW under control and maintain it (rough costs); (2) the need for redundancy for DoD potable water system; (3) requirements for firefighting (i.e., ability to replenish the water storage tank in base camp within 48 hours in the event of a fire); (4) Groundwater Under the Direct Influence (GUDI) concerns for Maui Well No. 2 (requires back-up wells in the event water quality is not compliant); and (5) memo from Schergardus on water quality requirements for military installations; etc.
- **Potential Hybrid System Options.** JV to identify potential Hybrid System options and rough costs. These could include: (1) DEIS Option which includes a DoD System to meet most demands with improvements to CUC System to meet port improvements and personnel living on the economy (i.e., construction workers and base operations personnel); (2) Connection of a DoD System to the CUC System to allow for DoD to provide potable water in the event the CUC System has a shortfall in meeting their demands; (3) DoD System water trucked down to the port to meet port improvement demands and some improvements or pay assessment fees for personnel living on the economy.
- **All DoD System.** Preliminarily, an "All DoD System" does not appear to be a viable solution as at least some of the CJMT demands – personnel living on the economy – would need to be met by the CUC System.

- **Deadlines.** The JV was tasked to provide items 2 and 4 (UFW and Potable Water/Groundwater Options) in time for meetings with DoD leadership in early March and items 1 and 3 (Water Demands Memo and Aquifer Model) in time for the EPA meeting (mid March).

ATTACHMENT B
ADDITIONAL UNIFIED FACILITIES CRITERIA DISTRIBUTION SYSTEM REQUIREMENTS

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ADDITIONAL UNIFIED FACILITIES CRITERIA DISTRIBUTION SYSTEM REQUIREMENTS

Unified Facilities Criteria 3-230-01, *Water Storage and Distribution* (Department of Defense [DoD] 2021b):

- Design criteria should be in accordance with the following precedence:
  - State waterworks regulations
  - Utility provider's requirements
  - *Recommended Standards for Water Works*, latest edition
  - Conservation alternatives to meet current DoD conservation policies
- Minimum storage volume required is the sum of 50 percent of the average daily domestic requirements, plus any industrial demand that cannot be reduced during the fire period and the required fire demand.
- Distribution mains should be sized based on maximum hourly demand or the maximum daily demand plus the fire flow requirement, whichever is greater.
- A pipe network should be provided where flow to a single course is available from two or more directions.
- Demand projections should be based on anticipated demand not less than 5 years in the future.
- The Best Practice Documents American Water Works Association Manual M32, *Distribution Network Analysis for Water Utilities*, and Manual M31, *Distribution System Requirements for Fire Protection*, can be consulted for additional guidance.
- Velocities should range from 2–5 feet (8 meters) per second at maximum daily demand and the largest fire flow requirement.
- Minimum ground-level residual pressures at fire hydrants must be at least 40 pounds per square inch during normal flow conditions, 30 pounds per square inch during hourly maximum demand, and 20 pounds per square inch while supplying fire flow and hose-stream demand.
- Areas of excessively high or low pressures require that the system be divided into multiple pressure levels.
- Minimum pipe cover must be 2.5 feet (0.8 meter).
- When distribution is pumped from storage, transmission mains must have capacities equal to maximum day demand plus industrial demand and fire flow requirements.
- Without storage, transmission mains must meet maximum hourly demand.
- Shutoff valve spacing should not exceed 5,000 feet (1,524 meters) on long lines and 15,000 feet (5,572 meters) on loops.
- Velocities should not exceed 5 feet (1.5 meter) per second in transmission mains.

Unified Facilities Criteria 3-230-03, *Water Treatment* (DoD 2020):

- Domestic uses include drinking water, household uses, and household lawn irrigation.
  - Industrial flows include cooling, issues to ships, irrigation, swimming pools, shops, laundries, dining, processing, flushing, air conditioning, wash racks, rinse racks, and boiler makeup.

Unified Facilities Criteria 3-600-01, *Fire Protection Engineering for Facilities* (DoD 2021a):

- Additional distribution system requirements:
  - Must be sized to accommodate fire flows plus domestic and industrial for flushing demands that cannot be restricted during fires.
  - Must be looped to provide at least 50 percent of the required fire flow in case of a single break.
  - Must be able to support 150 percent of the building fire pump–rated capacity with a minimum pressure of 20 pounds per square inch at the suction side of the pump.
- Hydrant installation requirements:
  - Must be installed adjacent to paved areas, accessible to fire department apparatus.
  - Must not be closer than 3 feet (1 meter) or farther than 7 feet (2 meters) from the roadway, shoulder, or curb line.
  - Must be installed with a minimum 6-inch connection to the supply main and valves at the connection.
  - Must be in accordance with National Fire Protection Association 24, except as modified by the Unified Facilities Criteria.
- Hydrant spacing requirements:
  - All parts of the building must be within 350 feet (107 meters) of a hydrant.
  - At least one hydrant must be located within 150 feet (46 meters) of the fire department connection.
  - Hydrants protecting warehouses must be spaced a maximum of 300 feet (91 meters) apart.
  - Hydrants protecting aircraft hangars must be spaced a maximum of 300 feet (91 meters) apart with at least one hydrant at each corner of the hangar.
  - Hydrants protecting petroleum, oil, and lubricants storage and distribution facilities must be spaced a maximum of 300 feet (91 meters) apart, with a minimum of two hydrants.
  - Hydrants protecting exterior storage must be spaced at 300-foot (91-meter) maximum intervals around the perimeter.
  - Hydrant spacing must not exceed 600 feet (183 meters) for family housing developments without sprinkler protection and must not exceed 1,000 feet (305 meters) for family housing developments with sprinkler protection.