AMERICAN SAMOA POWER AUTHORITY

Water Supply – Well Drilling and Groundwater Exploration

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OUTLINE

1. American Samoa Power Authority (ASPA)
2. Water Supply in American Samoa
3. Water Supply Issues
4. Resolving Water Supply Issues
5. Siting New Groundwater Wells
6. Drilling and Groundwater Exploration
7. Aquifer Tests
8. Sustainable Yield Determination
9. Groundwater Resource Management

AMERICAN SAMOA POWER AUTHORITY

- Semi autonomous
- 380 employees
- Power generation
- Solid waste
- Wastewater services
- Water supply

Fig.1: ASPA Operations building.

WATER SUPPLY IN AMERICAN SAMOA

WATER SOURCES:

- 99% Groundwater Production Wells
- 1% Surface water – Microfiltration Plant

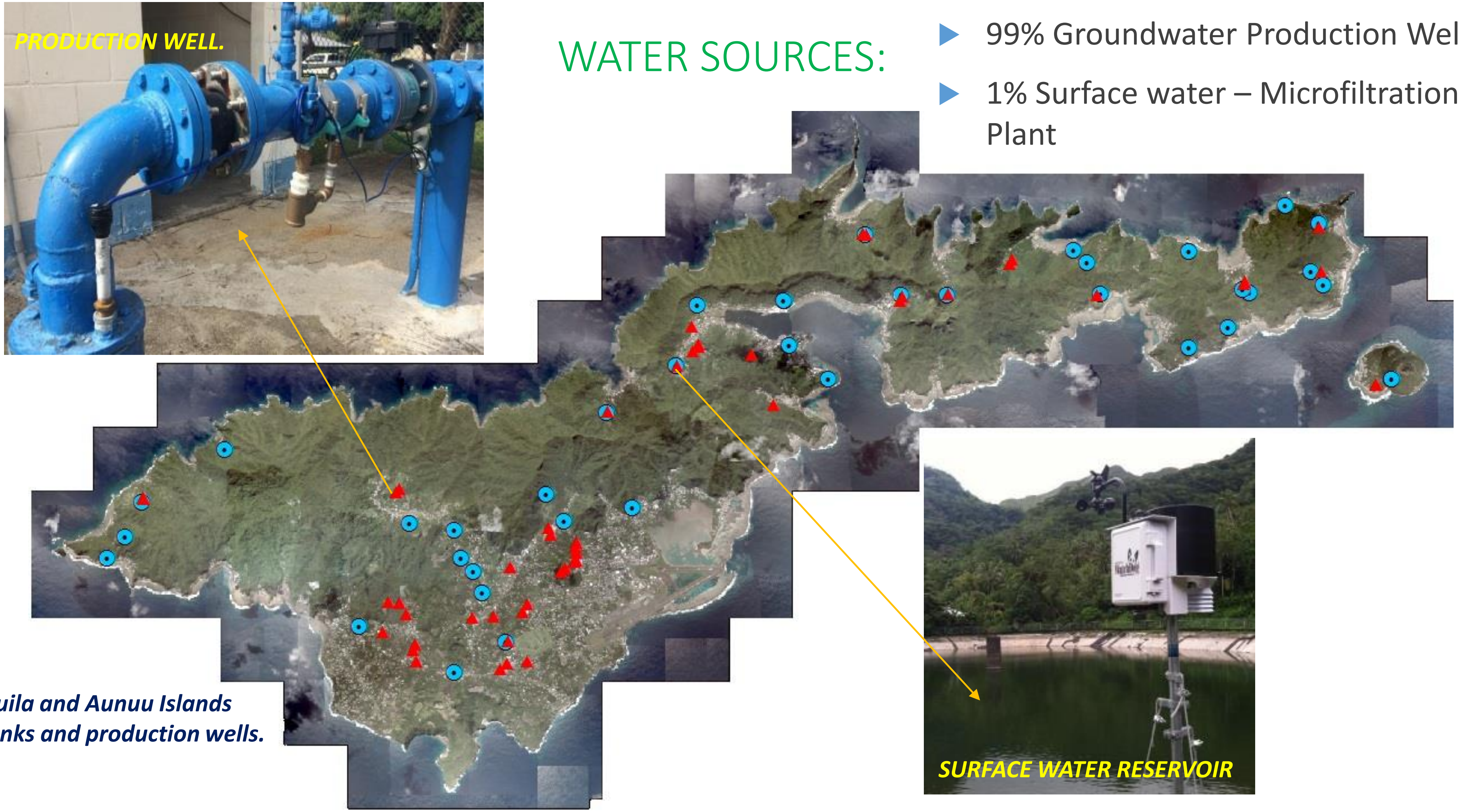


Fig.2: Map of Tutuila and Aunuu Islands showing water tanks and production wells.

WATER SUPPLY ISSUES

- High Non Revenue Water
- Aging infrastructure
- Low pressure
- Funding support $$$
- GUDI wells – Boil Water Notice (BWN)
- High chloride wells
- Diminishing yields

Fig.3: ASPA Water Operations repairing a leak.

Fig.4: Leaking pipeline - 8" AC coupling failure.

RESOLVING WATER SUPPLY ISSUES

Water Supply Issues

Solutions???

Pipeline replacement

New technologies – RO systems for high chloride sources

Rainwater harvesting

Seek funding for new water projects

New infrastructure improvement projects

Water conservation plans

Drilling for Groundwater!

WHY?

- Funding support
- Equipment and Tooling
- Experience and Technical Capacity
- Water Resource
- Exploration benefiting Science and Research

Fig.5: Drilling and well construction on site.

DRILLING AND GROUNDWATER EXPLORATION

- **Well siting:**
  - Demand
  - Geology
  - Groundwater flow paths
  - Recharge areas
  - Residential
  - Land use
  - Accessibility
  - Right of Way

Fig.6: Setting up on a new drilling site.

DRILLING AND GROUNDWATER EXPLORATION

- Drilling new wells…

Fig.7: Drilling Malaeimi Well 2.

Fig.8: Drilling a new well.

Fig.9: Casing installation.

Fig.10: Welding casings.

Fig.11: Video logging new well.

Drill to required depth → Casing installation and grout seal → Video logging → Pumping tests → Water Quality Tests (Baseline) → Connections and Permit to operate.

DRILLING AND GROUNDWATER EXPLORATION

- **SUCCESS!!!**
- New production wells.
- Low chlorides.
- Good water quality.
- Sufficient Yield.

Fig.12: Hitting static water level at Vaipito.

Fig.13: Hitting static water level at Malaeimi.

AQUIFER TESTS

- **Pumping tests:**
  1. Tidal monitoring
  2. Step Drawdown Tests
  3. Recovery Monitoring
  4. Constant Rate Test
  5. Data Analysis and Sustainable Yield Recommendations

Fig.14: Drilling and well construction at Pago Pago angled well.

SUSTAINABLE YIELD DETERMINATION

- **Step Drawdown Tests**

  Different pumping rates at specified periods of time.

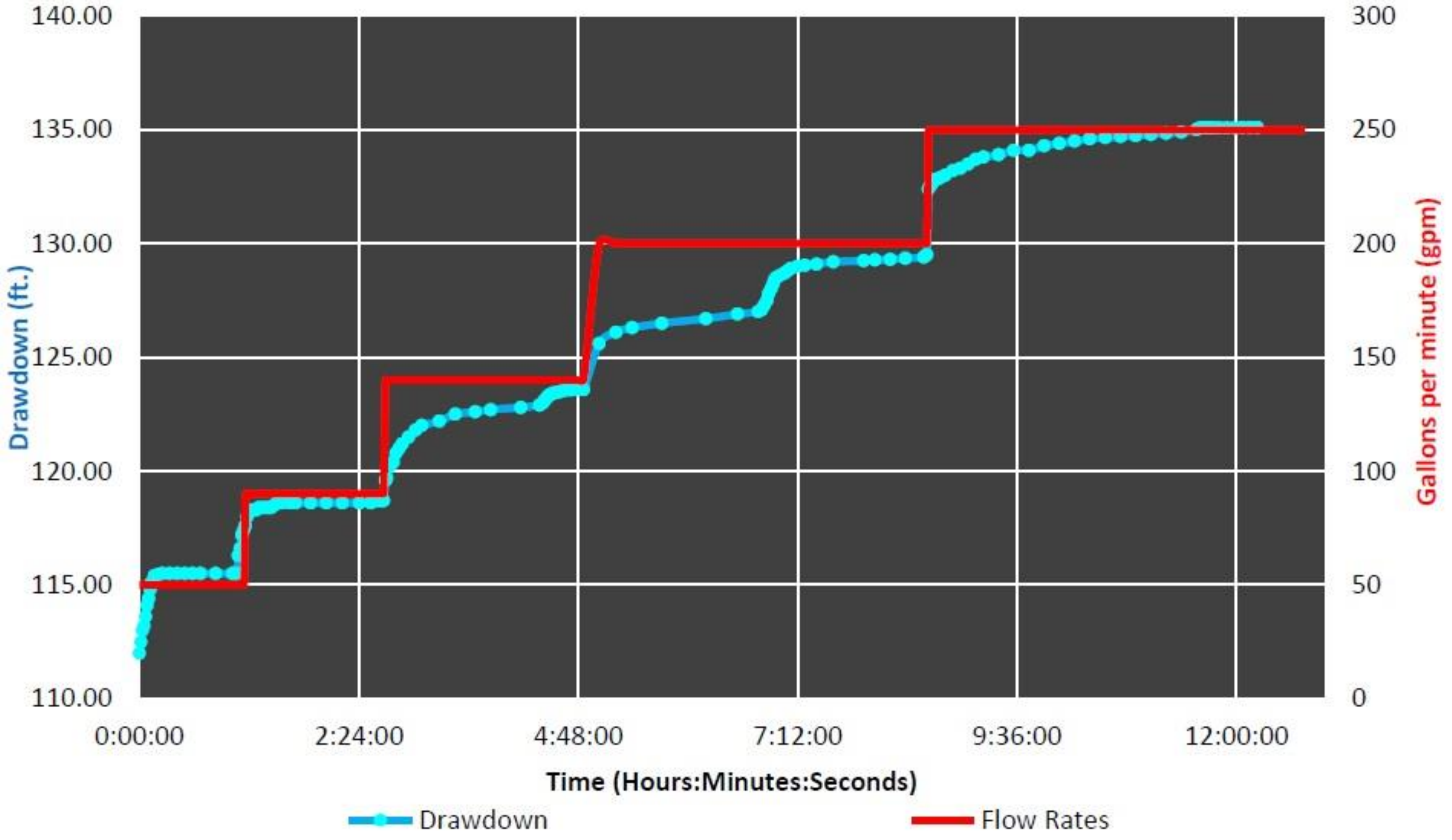


Fig.15: Step Drawdown Results for a new well in Malaeimi area, Tutuila Island.

SUSTAINABLE YIELD DETERMINATION

Well Losses:

Calculated using the Jacob Method **s = BQ + CQ²**

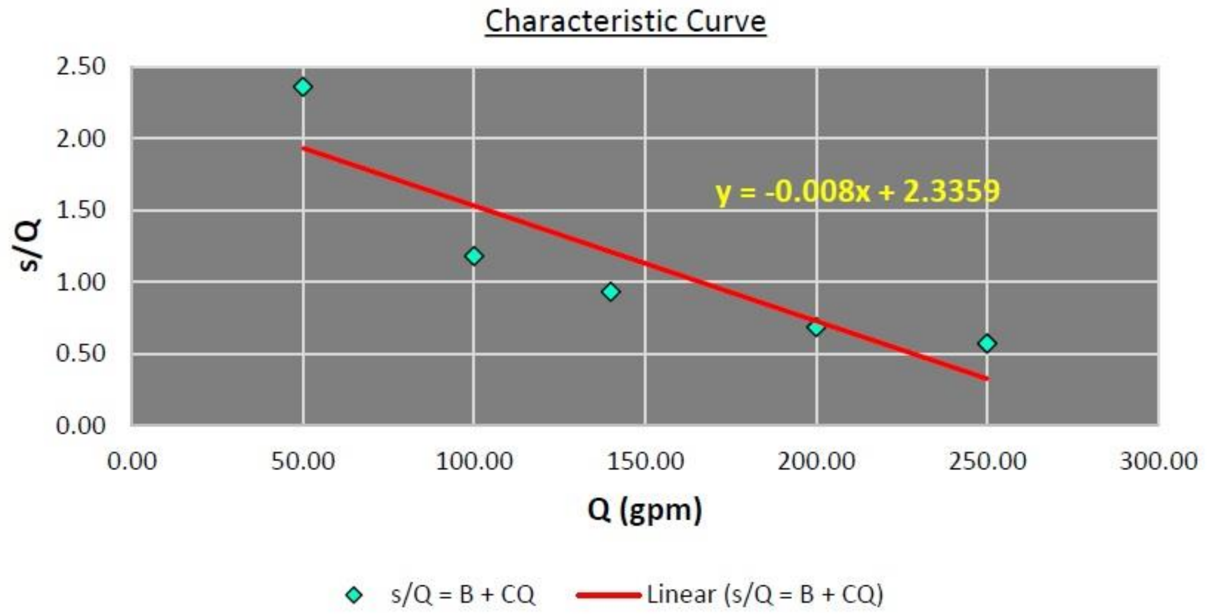
whereby,

s = Drawdown

BQ = Drawdown due to formation loss

CQ2 = Drawdown due to well losses

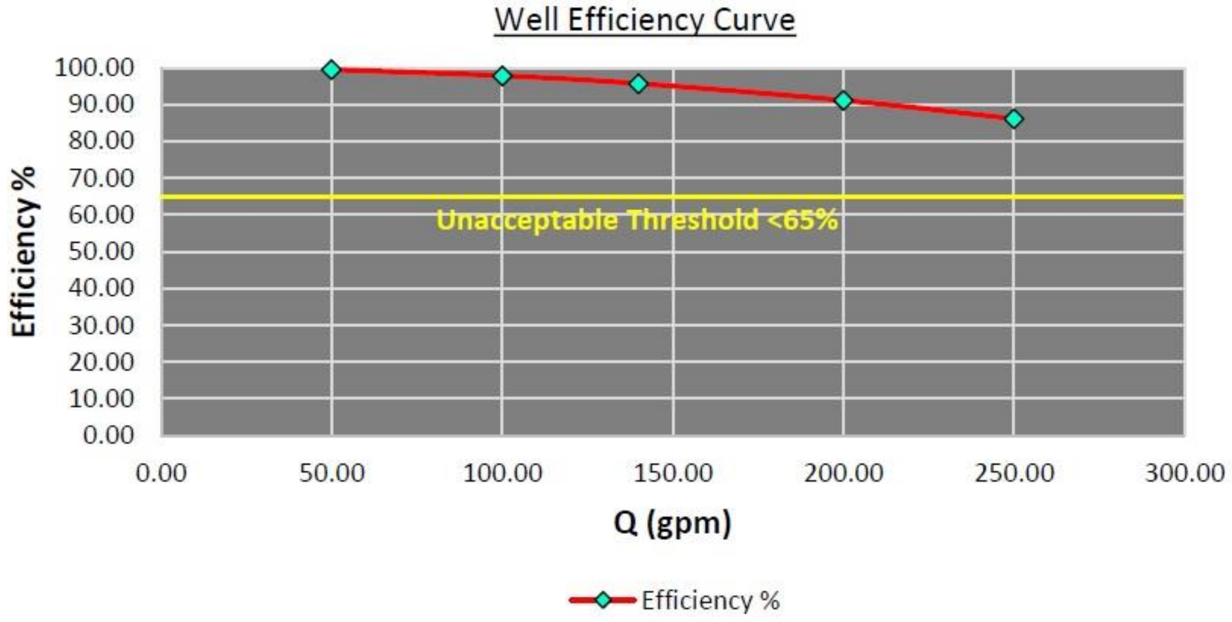
Q = Flow discharge rate (gpm)



Well Efficiency:

$$Lp = \frac{BQ}{BQ + CQ^2} x100\%$$

Well with efficiency above 65% is recommended.



SUSTAINABLE YIELD DETERMINATION

- Constant Rate Test – 24 to 36 hours.
- Maximum Drawdown – 20 ft. from SWL.
- Specific Capacity (gpm/ft of drawdown).
- Aquifer Storage.
- Transmissivity (T) – Cooper Jacob straight line method. Estimated from pumping rate and change in drawdown per log cycle.

$$T = \frac{2.3Q}{4\pi}\frac{1}{\Delta s}$$

- Hydraulic Conductivity (K) – T/b

Whereby,

b = Aquifer thickness

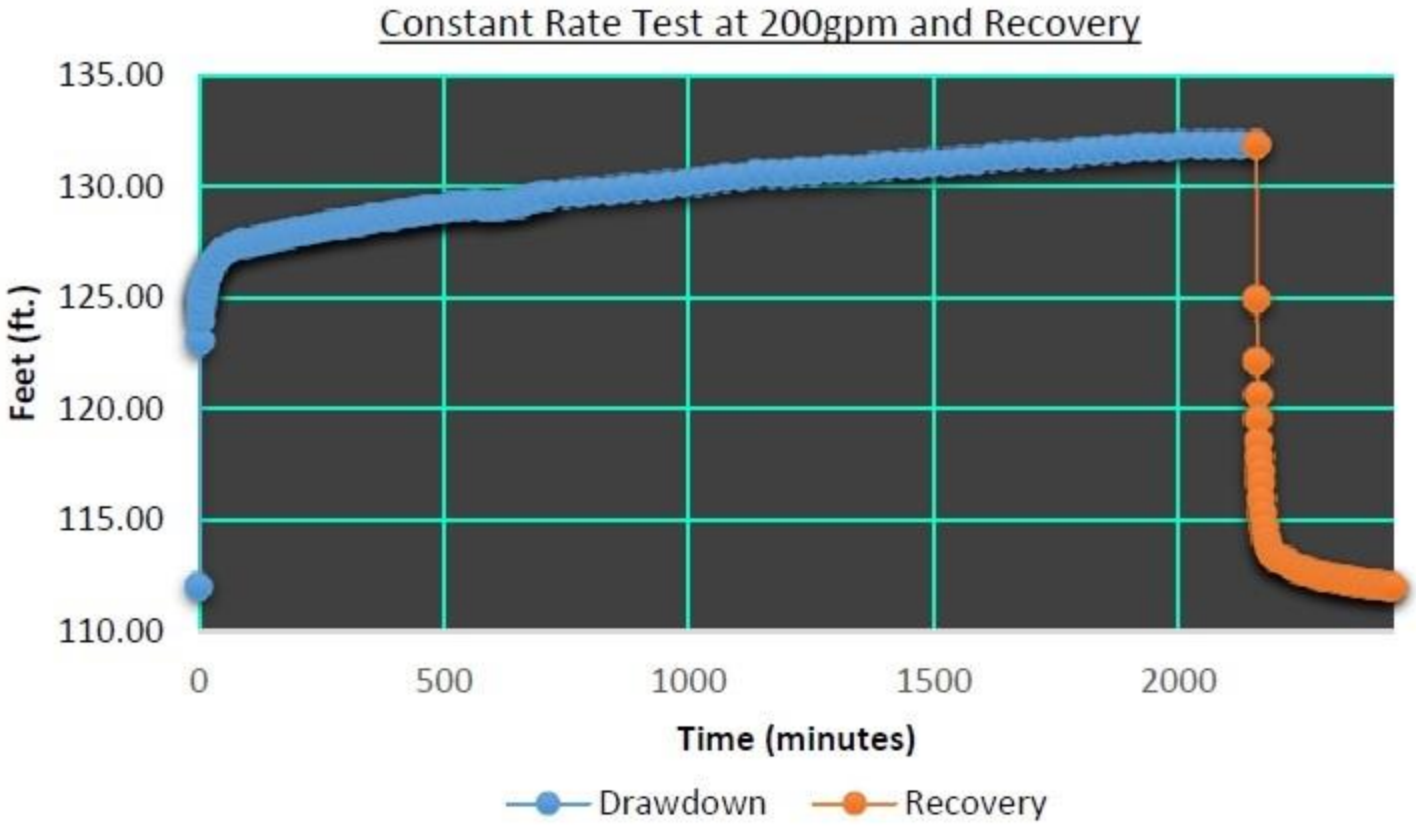


Fig.16: Constant Rate Test Results for a new well in Malaeimi area, Tutuila Island.

GROUNDWATER RESOURCE MANAGEMENT

Fig.17: ASPA-UH Weather Station.

Fig.18: Salinity profiling.

Fig.19: Chloride monitoring.

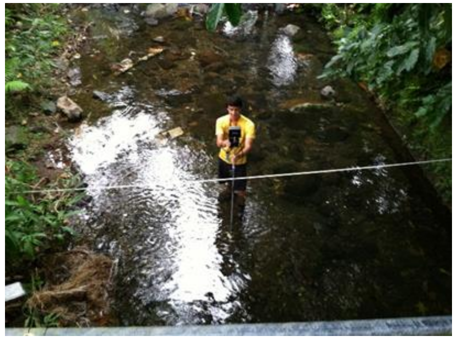


Fig.20: Discharge measurements.

- Collaboration with University of Hawaii – Water Resources Research Center (UH-WRRC) for:
  - Groundwater Research
  - Hydrology and Hydrogeological Data collection: *Rain gauges, Weather stations, Stream discharge measurements, GW levels, chlorides, drawdown measurements*
  - Numerical modeling
- Capacity Development
- Specialist support
- Protect resource → Ensure **SUSTAINABLE MANAGEMENT**!

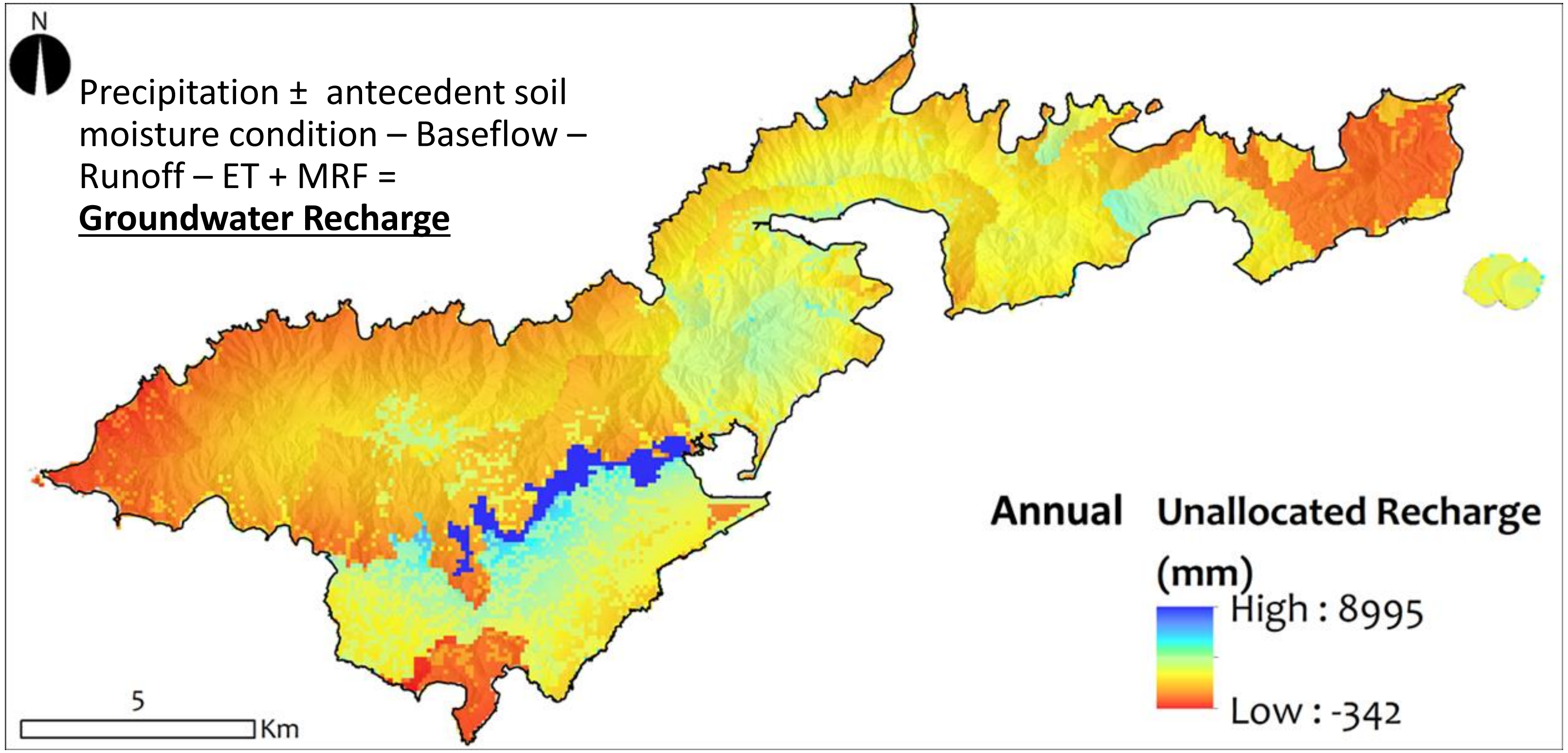


Fig.21: Groundwater recharge numerical simulation.

THANK YOU FOR YOUR ATTENTION!