

Water Usage at Forward Operating Bases

**Stephen W. Maloney
U.S. Army ERDC-CERL
Champaign, IL 61826-9005**

**2010 Environment, Energy & Sustainability
Symposium & Exhibition
14-17 June, 2010 Denver, CO**

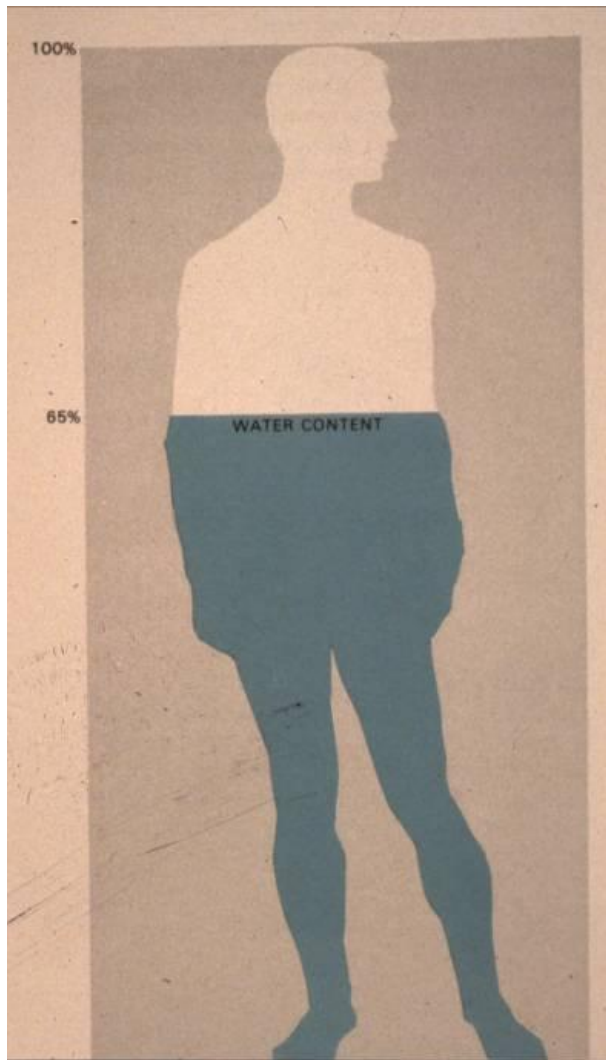


Report Documentation Page				Form Approved OMB No. 0704-0188	
Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.					
1. REPORT DATE JUN 2010		2. REPORT TYPE		3. DATES COVERED 00-00-2010 to 00-00-2010	
4. TITLE AND SUBTITLE Water Usage at Forward Operating Bases				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Army Engineer Research and Development Center, Construction Engineering Research Laboratory, Champaign, IL, 61826-9005				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution unlimited					
13. SUPPLEMENTARY NOTES Presented at the NDIA Environment, Energy Security & Sustainability (E2S2) Symposium & Exhibition held 14-17 June 2010 in Denver, CO.					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT Same as Report (SAR)	18. NUMBER OF PAGES 22	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			



Lessons learned in Iraq and Afghanistan show that water is as costly as fuel when delivered to FOBs

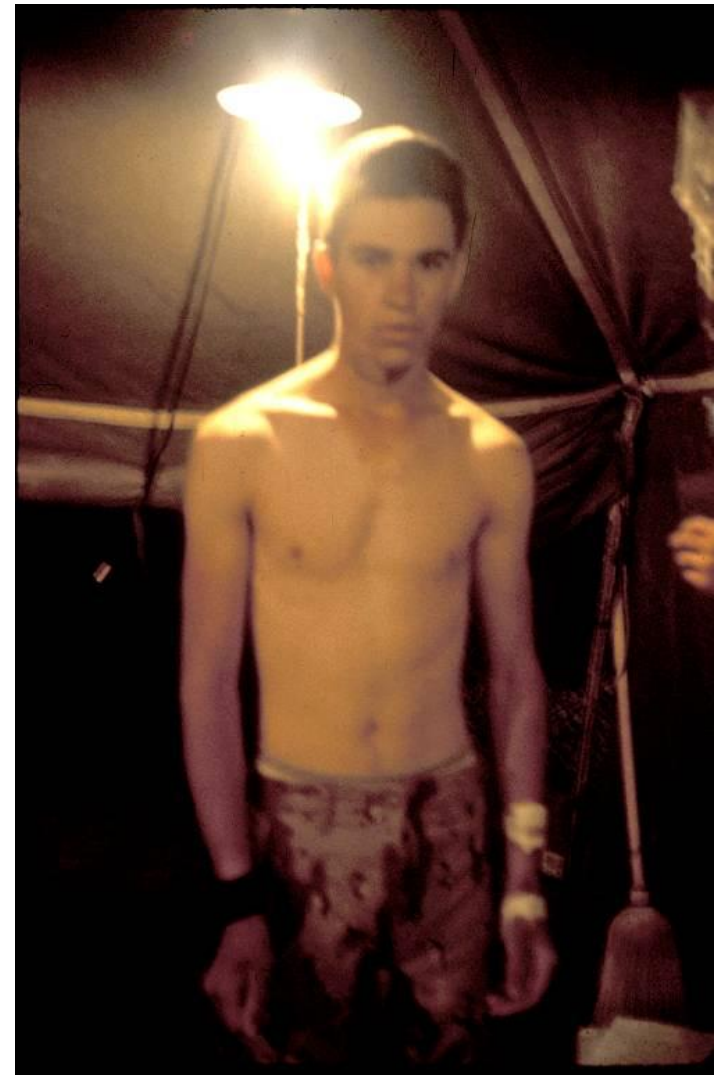




Water is just as mission critical as fuel, food and ammunition.



**US Army Corps
of Engineers**



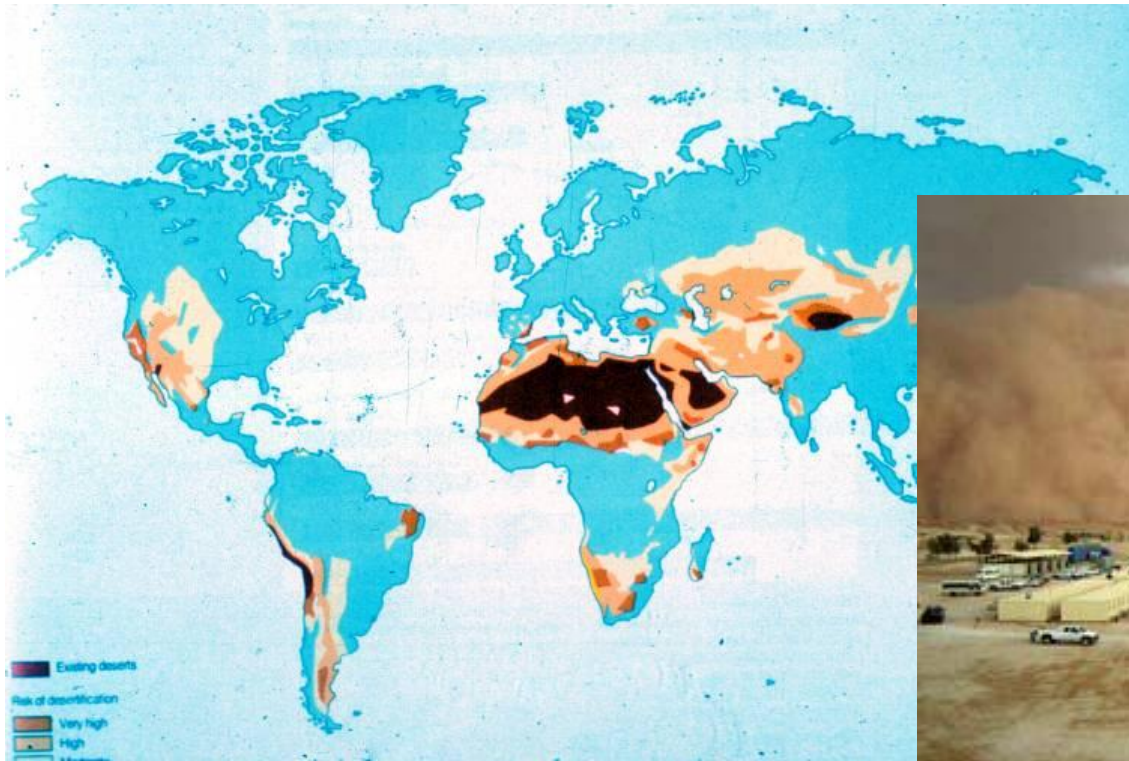
Preventable heat-related casualties

Engineer Research and Development Center



Unless one has experienced the extreme heat of soldier activities, one may not appreciate the amount of water required to cool down the body temperature. This is one example of how planning factors may not actually reflect how soldiers use water on a daily basis.





Not all arid regions are equal. Should planning factors be refined/customized to reflect differences?



The Army is learning -- by experience -- how to manage water in the oppressive and harsh desert environments. Therefore, planning will probably continue to evolve.



Goals

- **Determine water demand planning factors from literature sources**
- **Quantify actual usage at Forward Operating Bases**
 - **Three general classes:**
 - **Small outposts (Company) of up to 120 personnel**
 - **Medium size bases (Battalion) of approximately 1,000 personnel**
 - **Large bases (Brigade) above 12,000 personnel**



CASCOM Internet Planning Tool

FORCE DEVELOPMENT DIRECTORATE
UNITED STATES ARMY COMBINED ARMS SUPPORT COMMAND
FORT LEE, VIRGINIA 23801-1809



WATER PLANNING GUIDE

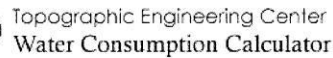
25 November 2008



**POTABLE WATER CONSUMPTION PLANNING FACTORS
BY ENVIRONMENTAL REGION AND COMMAND LEVEL**



<https://tsunami.tec.army.mil/externalpages/water/calc/Global.htm>



Enter Number of Soldiers:	12000
You Selected This Climate Zone:	☐ Tropical ☒ Arid ☐ Temperate ☐ Cold
Select Unit Type:	Small Force Deployment: ☐ Maneuver Company ☐ Battalion/Separate Company ☒ Maneuver/Separate Brigade ☐ Force Size Beyond Brigade
Start Over Print Table	Calculate Daily Water Needs

Function	Daily Gallons Water Requirement	
	Sustaining	Minimum
Universal Unit Level Consumption	7.27	5.23
Level I and II Medical	0.03	0.03
<i>Non-Organic Functional Mission Gal/Person/Day Requirements:</i>		
Level III & Level IV Medical Operations	0.88	0.88
Aircraft Maintenance Operations	0.14	0.14
Engineer Functions	1.98	1.98
Mortuary Affairs Operations	0.13	0.13
<i>SUBTOTAL (Gal/Day for 1 soldier)</i>	12.76	10.38
TOTAL Gal/Day for 12000 soldiers	153120	124560
<i>Other Theater Function Mission Potable Water Requirements:</i>		
EPW & Civilian Internee/Refuge Operations	9.16	7.11
<i>Force Provider Operations:</i>		
Military Forces Support	34.16	34.16
Support or Stability Operations Civilian Pop. Support	42.91	42.91
<i>Redeployment Vehicle Washrack Operations:</i>		
Light Force (GAL/Company Size Unit)	9900	9900
Armored/Mechanized Force (GAL/Company Size Unit)	11000	11000

Watercraft Maintenance Operations--Refer to Section II-C of the Potable Water Planning Guide (view in pdf)

Per capita
Use Estimate

CASCOM Computer Tool Estimate



Minimum Estimates from non-DOD Sources

- WHO recommends 50 liter per person per day
 - Gleick, P.H. (1996), “Basic Water Requirements for Human Activities: Meeting Basic Needs”, *Water International*, v21, p83
 - 50 liters is 13.2 gallons
 - Independent estimate is very close to CASCOM baseline planning factor



Current Practice Estimated Requirements (kgal/day)

Unit	CASCOM	KBR Planning Guide
Company (120)	1.5	2.2
Battalion (1,000)	12.7	18.4
Brigade (12,000)	153	221



Drivers

- Adequate water is essential to maintaining soldier performance in arid environments
- Lack of local sources results in requirement for water deliveries by convoy
- Cost of delivered water is estimated to be equal to or greater than fuel costs
 - AEPI Study estimated \$17/gal (Immature Theater)
 - “Sustain the Mission Project: Energy and Water Costing Methodology and Decision Support Tool,” Final Technical Report, AEPI, July, 2008
 - Estimates as high as \$400/gal



Actual Planning Factors used by KBR

- **18.4 gpcd min, 50 gpcd with DFAC, Ice, laundry and wash rack operations**
 - **Concept of Support Overview, Iraq Theater of Operations, 13 Mar 09**
- **50 gpcd**
 - **3rd Army, Central Coalition Forces Land Component Command, ARCENT Staff Estimate, Afghan Planning, 30 NOV 09**



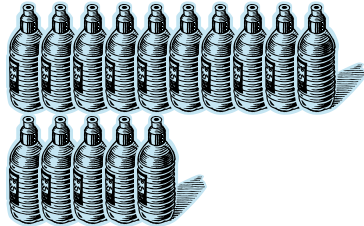
WATER REQUIREMENTS

Per Soldier/Civilian/Contractor

Low



Personal Need
(consumption, cooking)



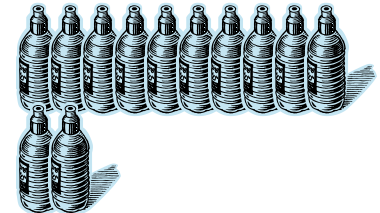
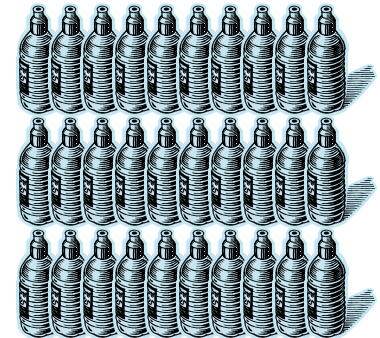
Other uses (bathing,
washing clothes,
sanitation, etc.)



Waste (20-30%)

26 Gallons

High



52 Gallons

 = 1 gallon



Field Data Collected to Date

- **Bright Start 83: 13 gpcd at Cairo West**
 - **Example of large FOB at ~7,500 personnel**
 - **Bright Star 83 After Action Report: Water Management (Production/Consumption) and Heat Stress Management, Bandy, J., et al USACERL, March 1984**
- **Camp Bulwark, Bulgaria: 20 gpcd**
 - **Example of Battalion Level FOB at 1,100 personnel**
 - **Base Camp Solid Waste Characterization Study, US Army Corps of Engineers, Europe District, DACA90-02-D-0085, DO 0028, BH Project 06200-28**
- **Kabul, Afghanistan: 1 gpcd, July and August, 2009, issued to ~17,000 personnel**
 - **Base size unknown, assumed to be only personal consumption water, very low and well below recommended**
 - **E-mail from SSG, through USA AMC**



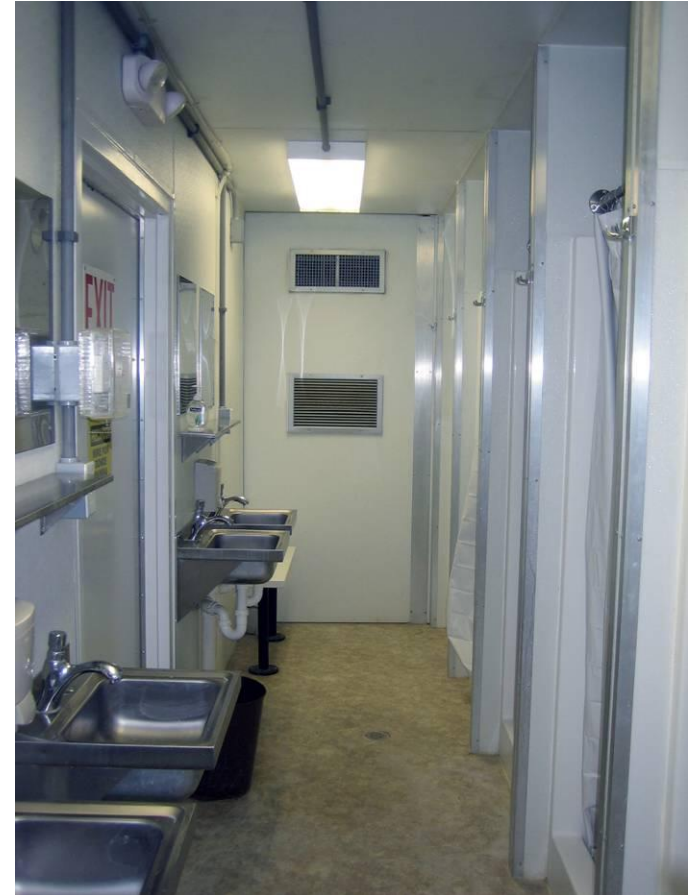
Ft. Irwin Shower Site



US Army Corps
of Engineers

Engineer Research and Development Center

Camp Atterbury FOB Shower Trailer



Field Data Collected to Date

(Continued)

- **Fort Irwin Training Center: 60-80 gpcd**
 - Size basis for estimate unknown
 - Estimate generated by CERL during visit, February 2010, evaluating water withdrawals from aquifer
- **Camp Atterbury: 6 – 23 gpcd**

Unit	JUN 09	JUL 09	AUG 09	SEP 09	OCT 09	NOV 09	DEC 09	JAN 10
Gal	196,000	370,000	167,000	384,000	490,000	74,000	41,000	40,800
PAX	620	1120	570	640	730	350	225	180
gpcd	10.5	11	9.8	20	22.7	7	6.1	7.6



Variability in Field Water Use

- **Water use in theater will vary depending on availability**
- **Overall water usage expected to be greater than planning factors**
- **However, when water is unavailable by any other means than convoy transport, planning factors should be considered the lower limit for water usage**



Summary

- **Data on actual water usage difficult to obtain**
- **KBR planning factors ~50% greater than COSCOM recommendations**
- **Range of Estimates: 13 to 80 gpcd**
 - **Example of 1 gpcd discarded as incomplete estimate**



Can you Help?

- Any data you may have for FOBs will be useful
- Locations need to indicate country only
 - i.e., U.S training facility, Iraq, Afghanistan
- Data needed would be:
 - Water used
 - Duration over which usage measured
 - Average population during that period
 - Including contractors



Contact Information

Dr. Stephen Maloney

Stephen.W.Maloney@usace.army.mil

217-373-3482

or

Dr. Eddy Smith

Edgar.D.Smith@usace.army.mil

217-373-3488

ERDC/CERL

P.O. Box 9005

Champaign, IL 61826-9005



