Identifying and Evaluating Irrigation Dams in Afghanistan

Photo Credit: Canadian International Development Agency (CIDA)

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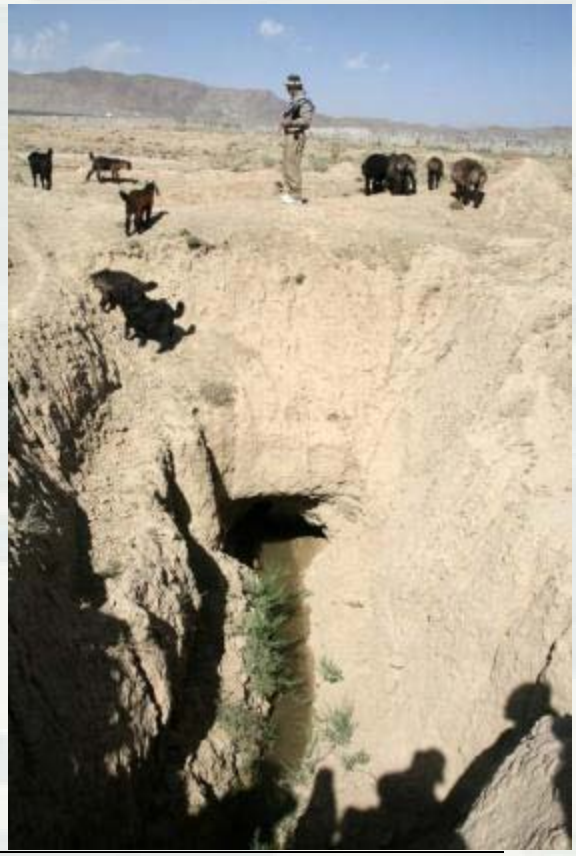
Presentation Outline

1. Afghanistan Watershed Assessments
2. Dahla Dam Improvement Project
3. Site Visit

Why WR Projects in Afghanistan?

- 80% of nation's people depend on agriculture for their livelihood
- Humanitarian
  - Improve livelihood
- Counter-insurgency (COIN)



Watershed Assessments

Project

Objectives

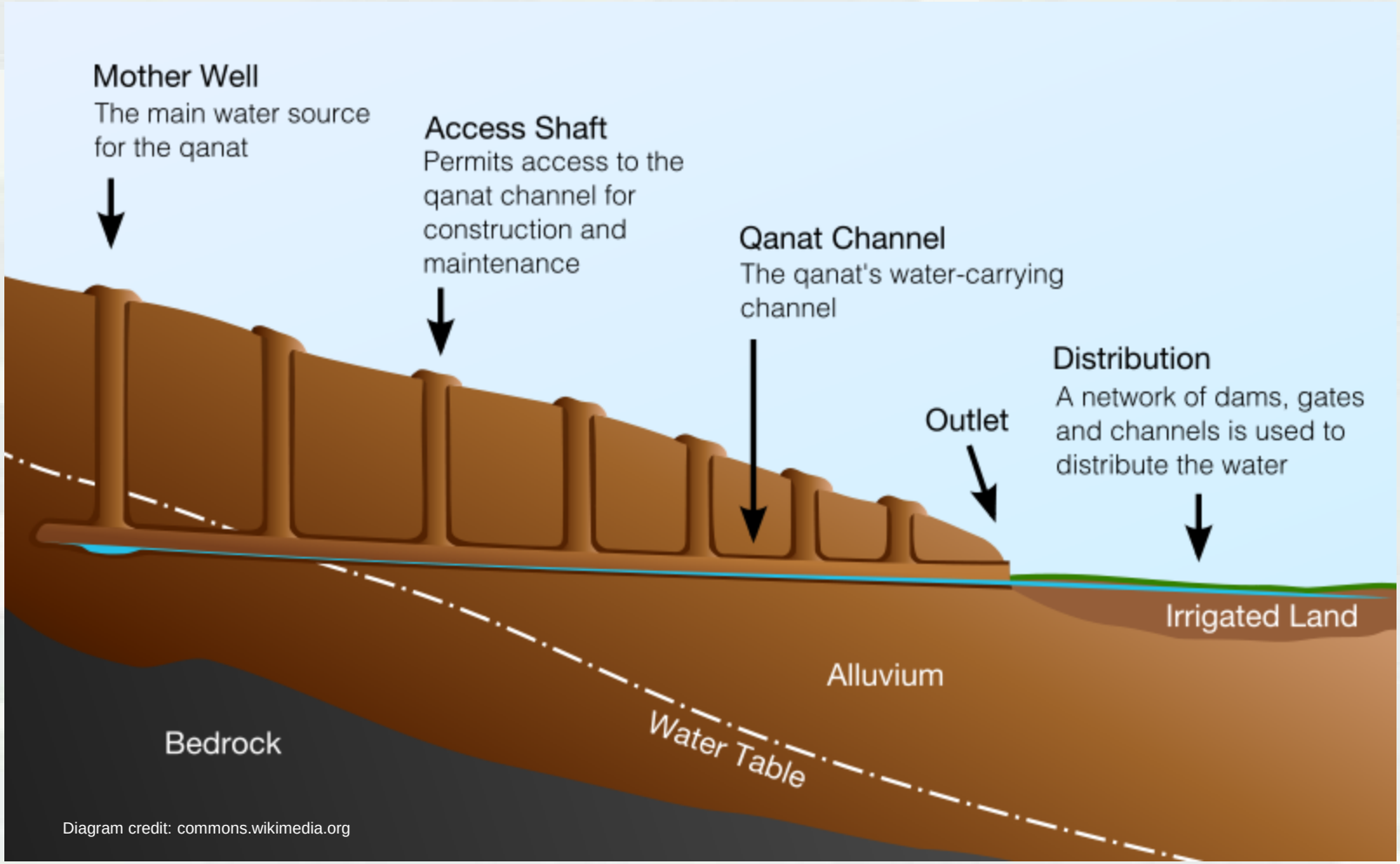
- Identify and evaluate potential dam sites (5-30 m dams)
- Rank recommended sites and screen out bad
- Starting point for more detailed analysis

Purposes

- Irrigation Reliability
- Hydropower
- GW recharge

Ancient Irrigation: Karez

Ancient Irrigation: Karez (Qanat)

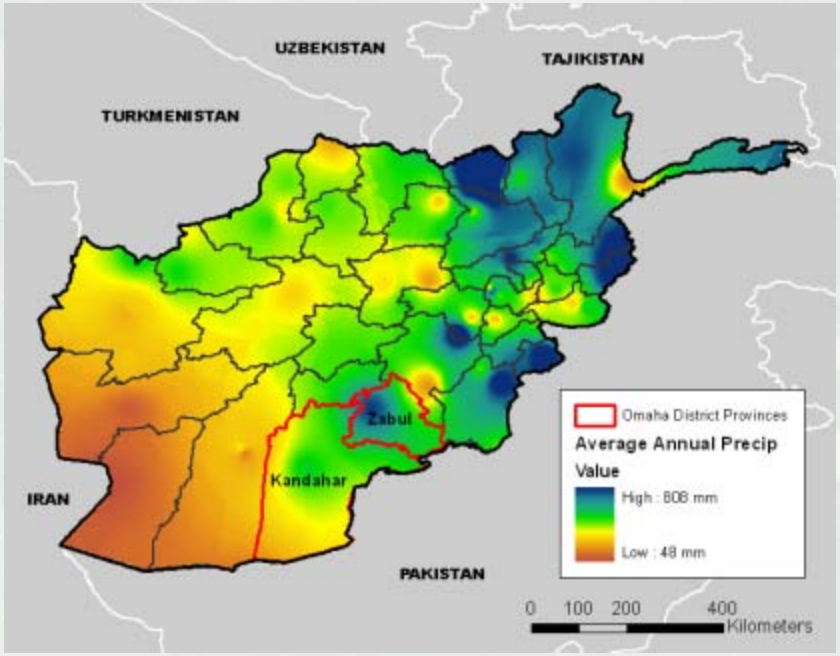


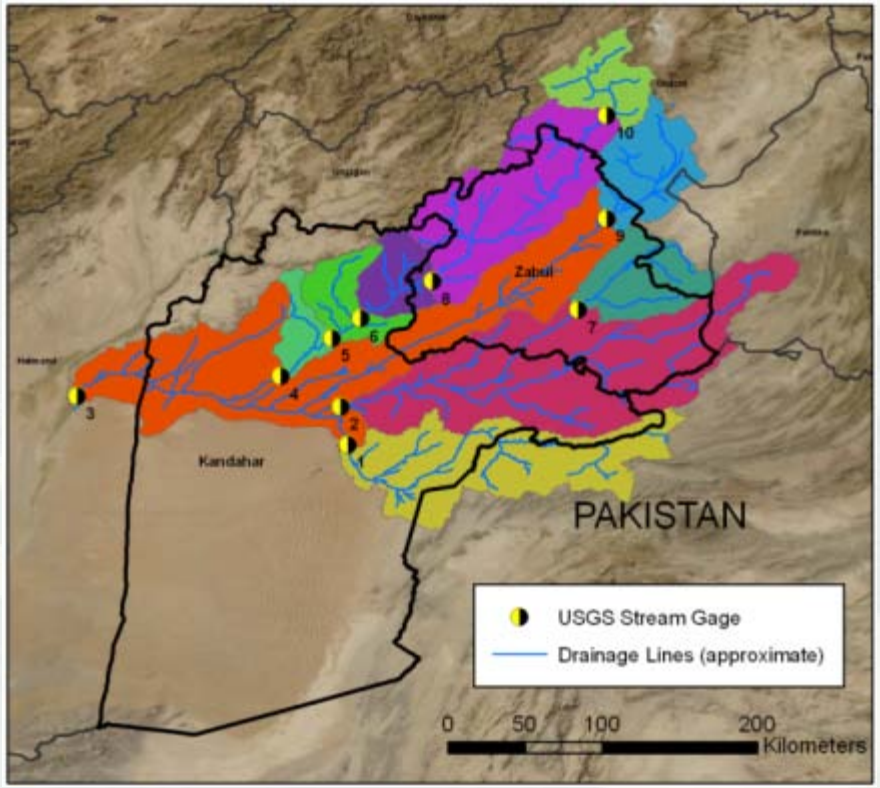
Methodology Overview

1. Research study area
2. Regional analysis
3. Site identification
4. Site evaluation
5. Site ranking and screening
6. Report results

Research & Regional Analysis

- Research climate, topography, sinks, PRTs, etc.
- Mean Annual Precipitation
- Compile Stream Gage information
- ArcGIS Pre-processing

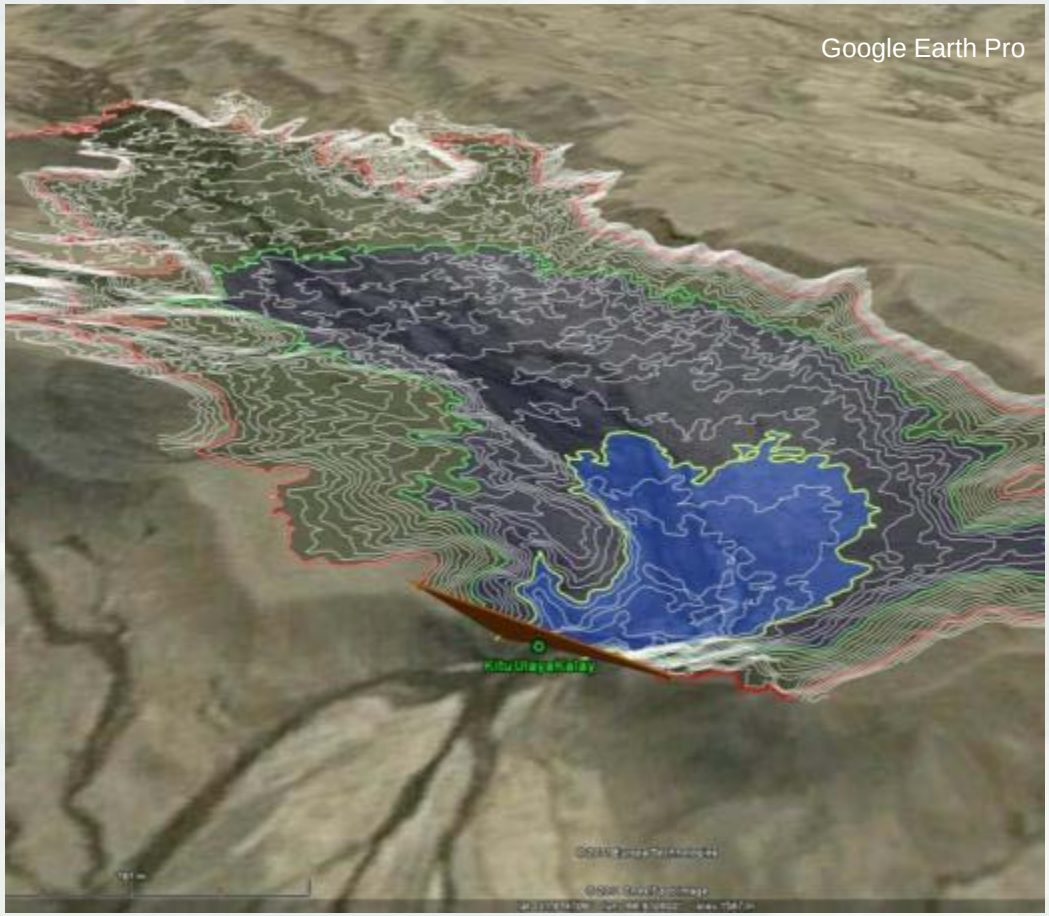




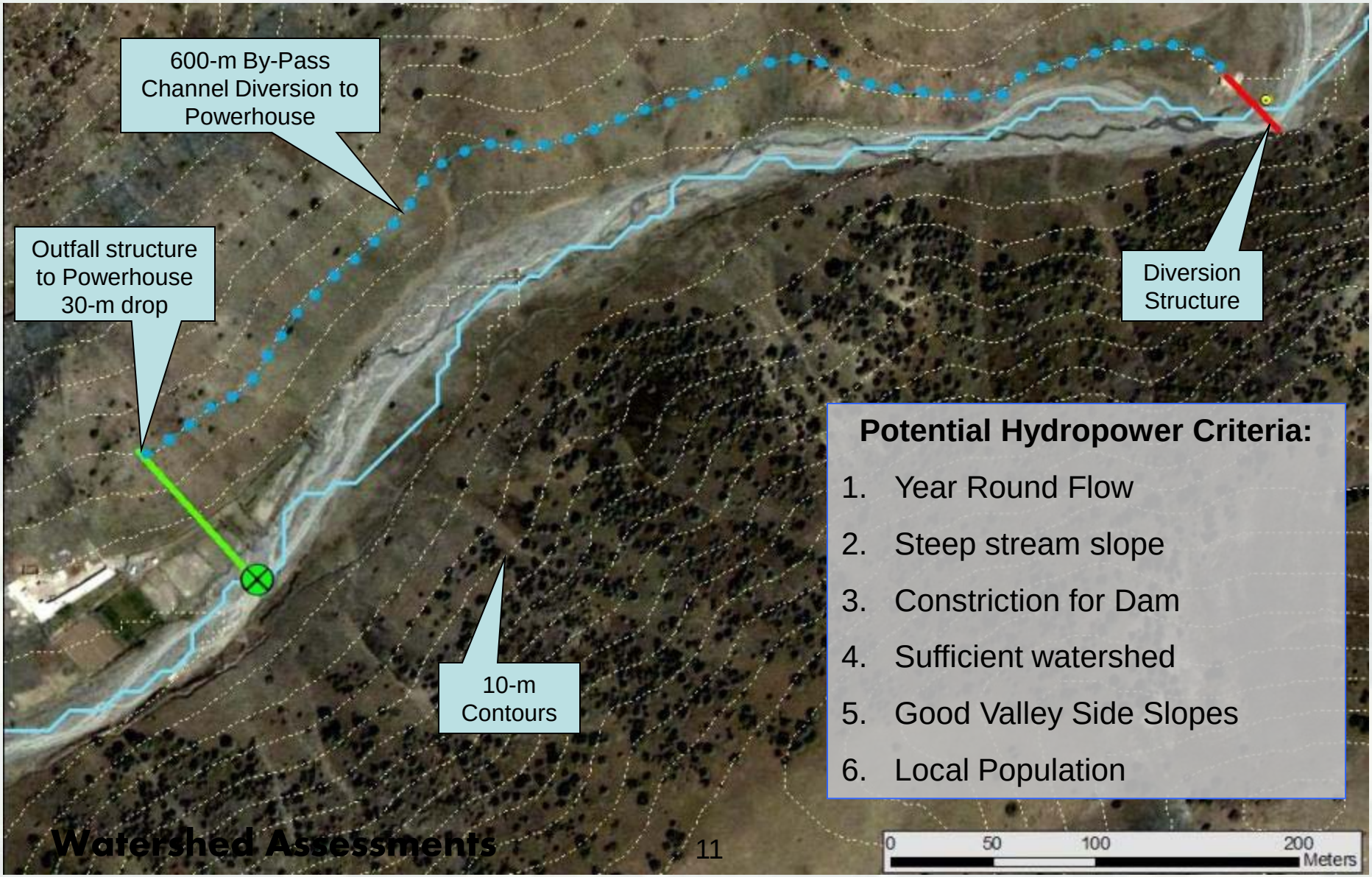
Site Identification

Irrigation Dams

- MEW proposed sites
- Input from PRT
- Canvassing imagery
  - Tributary size
  - Natural constriction
  - Ag downstream
  - Inundation impacts



Site Identification: Hydropower Only Sites

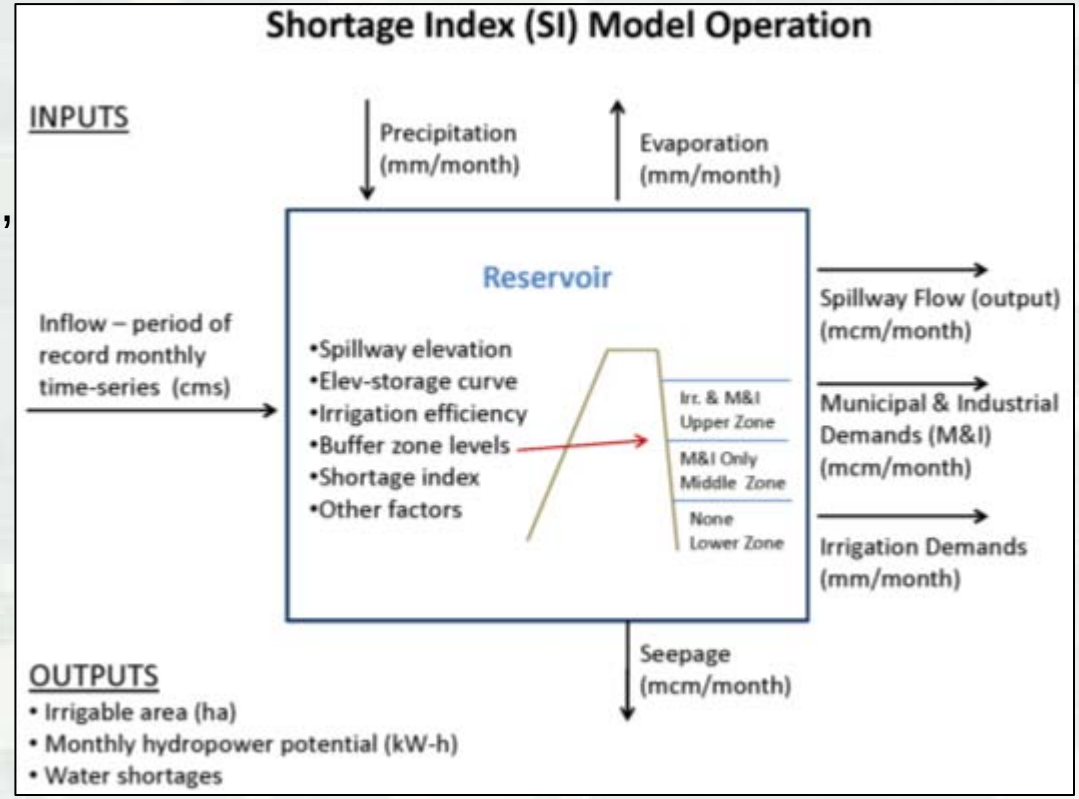


Potential Hydropower Criteria:

1. Year Round Flow
2. Steep stream slope
3. Constriction for Dam
4. Sufficient watershed
5. Good Valley Side Slopes
6. Local Population

Site Evaluation

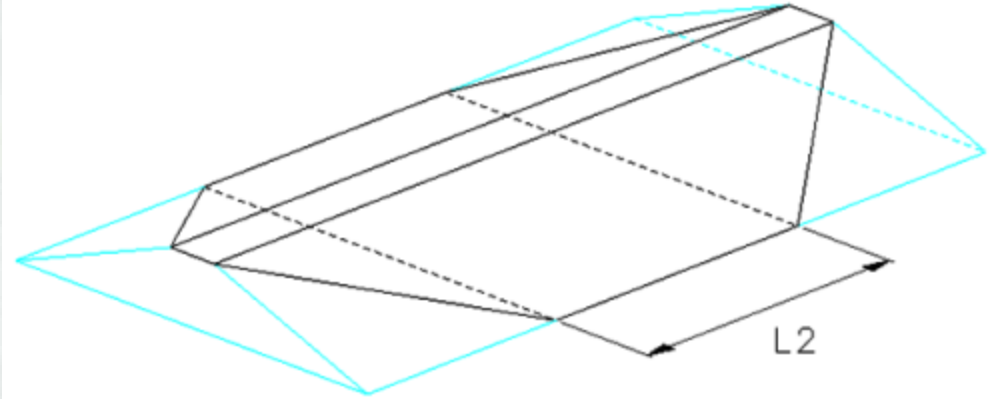
- Common sense test
- Project Sediment Life
  - Function of drainage area, reservoir elev-capacity, and dam height
- Dam Capital Cost
- Irrigation Net Benefit
  - Shortage Index reservoir simulation model
- Inundation Impacts



Economics and Site Ranking

Simplified Economics Model

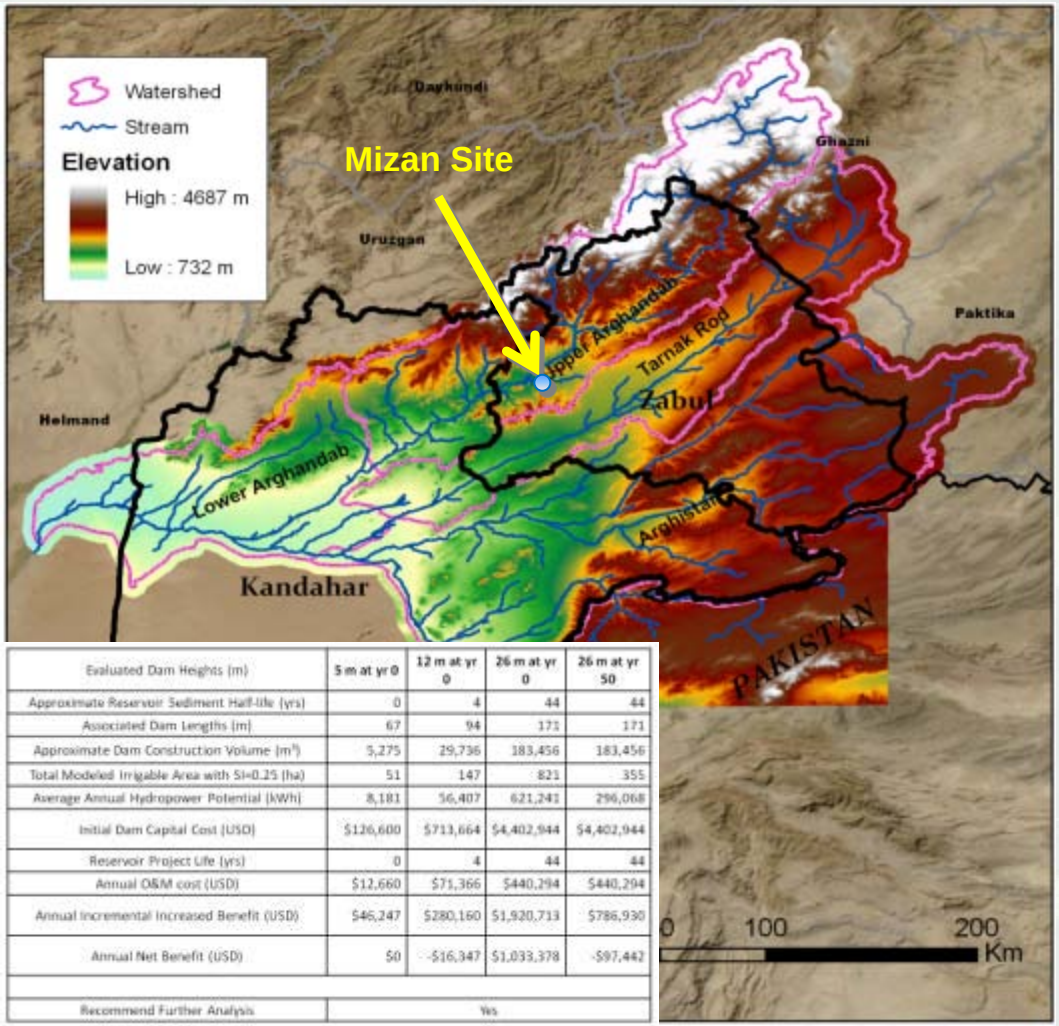
- Cost
  - Capital dam cost
  - Annual O&M cost
- Benefits
- Project life



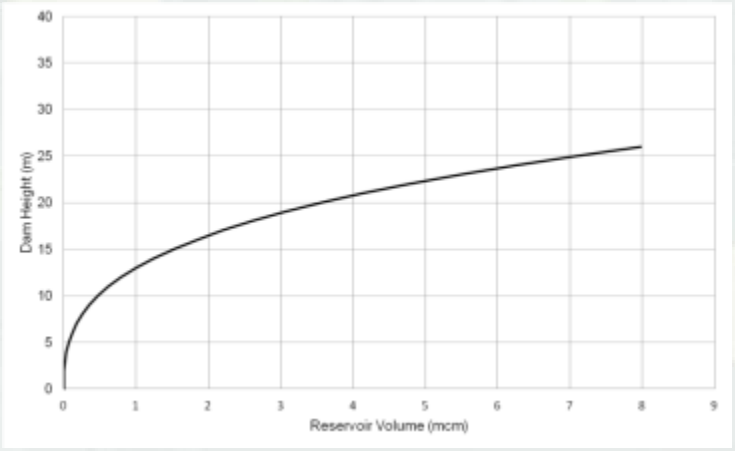
Site Ranking

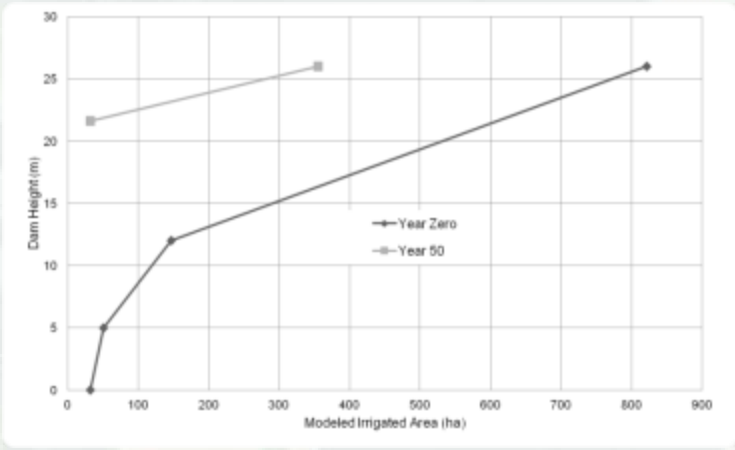
- Annual net benefit
- Meant for use as a screening tool

Example Site: Mizan

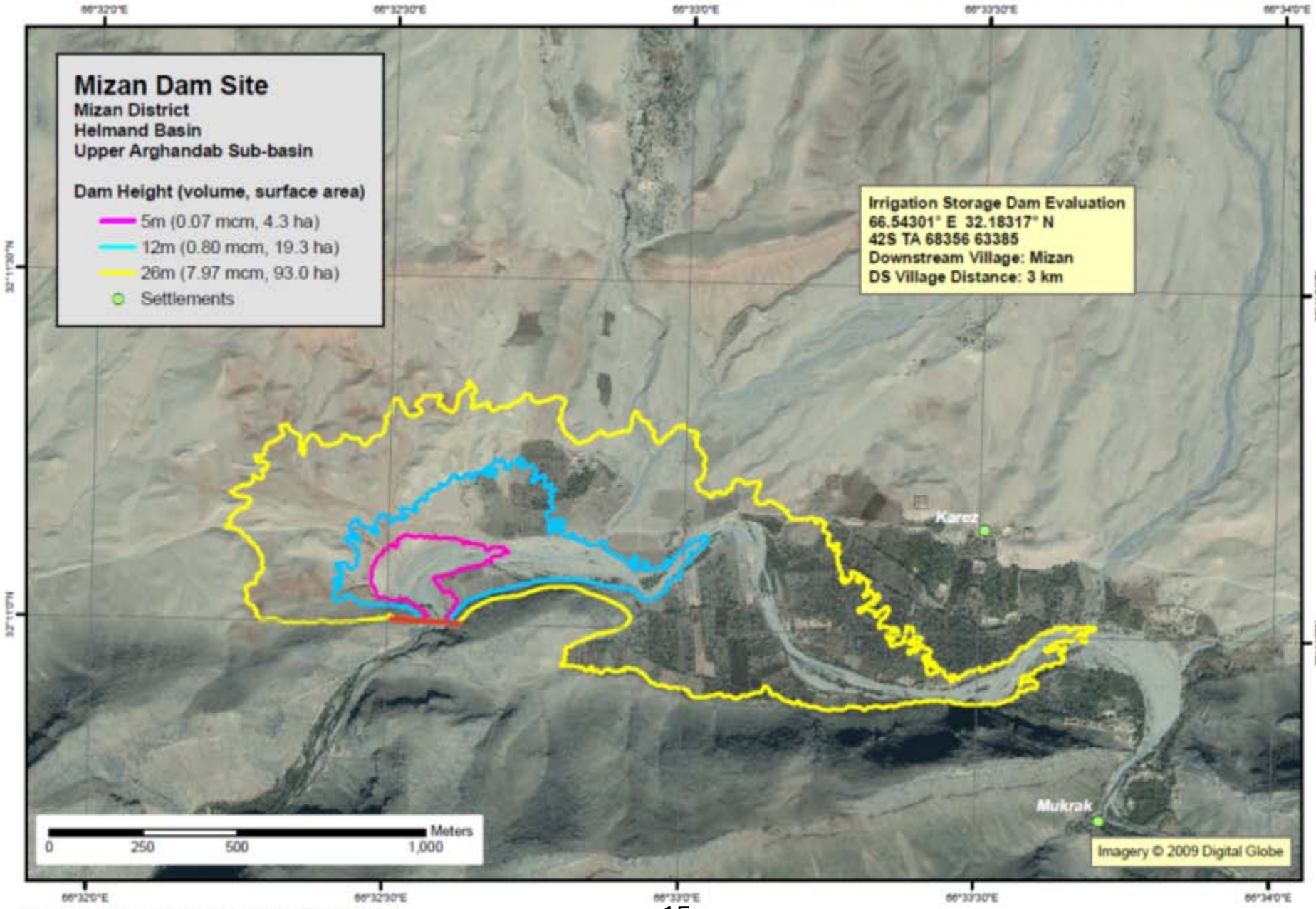


Evaluated Dam Heights (m)	5 m at yr 0	12 m at yr 0	26 m at yr 0	26 m at yr 50
Approximate Reservoir Sediment Half-life (yrs)	0	4	44	44
Associated Dam Lengths (m)	67	94	171	171
Approximate Dam Construction Volume (m^3)	5,275	29,736	183,456	183,456
Total Modeled Irrigable Area with SI=0.25 (ha)	51	147	821	355
Average Annual Hydropower Potential (kWh)	8,181	56,407	621,241	296,068
Initial Dam Capital Cost (USD)	$126,600	$713,664	$4,402,944	$4,402,944
Reservoir Project Life (yrs)	0	4	44	44
Annual O&M cost (USD)	$12,660	$71,366	$440,294	$440,294
Annual Incremental Increased Benefit (USD)	$46,247	$280,160	$1,920,713	$786,930
Annual Net Benefit (USD)	$0	-$16,347	$1,033,378	-$97,442
Recommend Further Analysis	Yes			





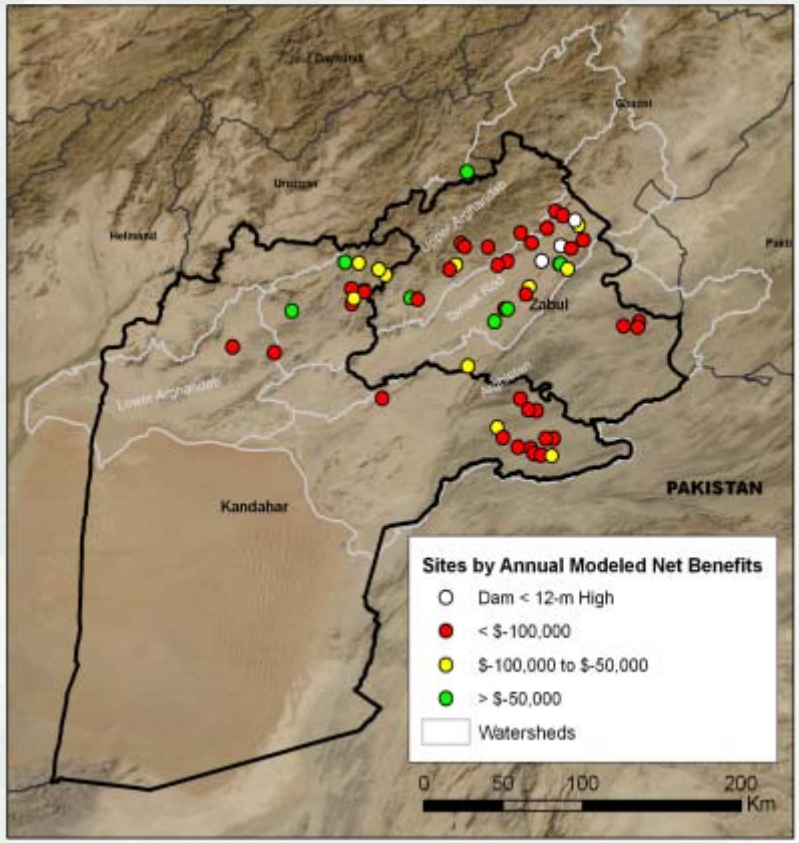
Zabul Province Watershed Assessment



Prepared by: US Army Corps of Engineers - Omaha District
Printing Date: January 20, 2011

Results

- >60 irrigation sites analyzed in Zabul & Kandahar Provinces.
- SE Study and Ph. I & II
  - 33 provinces
  - >300 hydropower sites
  - >800 irrigation dam sites
- Disqualification of many others



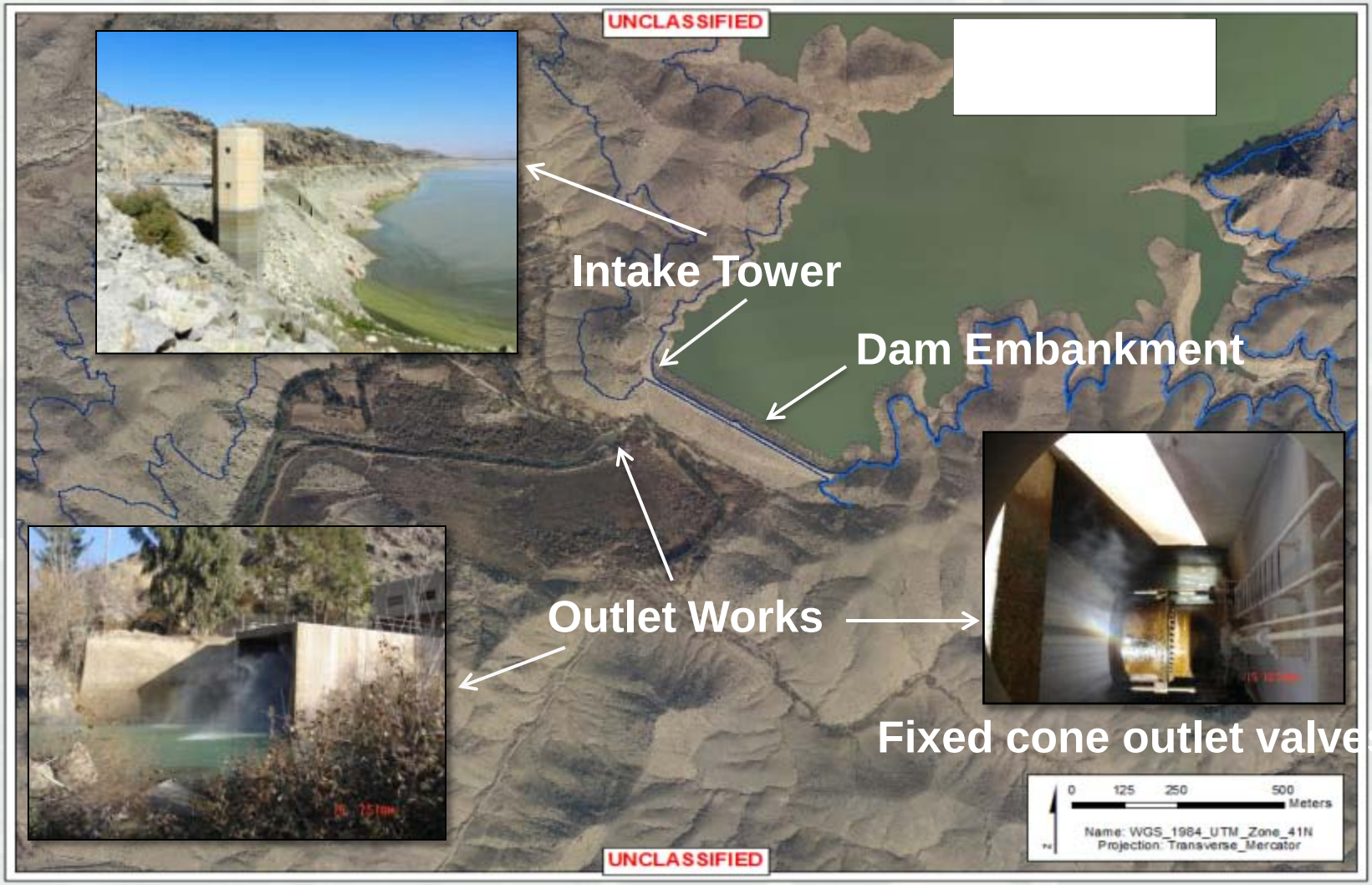
Challenges

- Development of project methodology
- Lack of data
- Standardized approach for ranking of all project sites
- Communication with in-country personnel
- Security concerns--lack of site visits

Dahla Dam

- Completed 1952 by Morrison Knudsen Corp.
- 15 mi NNE Kandahar City
- Earthen embankment, saddle dams & spillway complex
- Irrigation Dam-- ~100,000 irrigated ac
- Arghandab River: ~1,400 cfs
- ~6,000 acres
- Capacity: 314 mcm (250,000 ac ft)

Main Embankment Structures



Dahla Dam Condition

- Reservoir capacity reduced by ~34%
- Intake tower gate inoperable
- Control valves leak when closed
- Undependable electricity to valve house
- Spillways inadequate to pass design flood
- Unknown operation plan

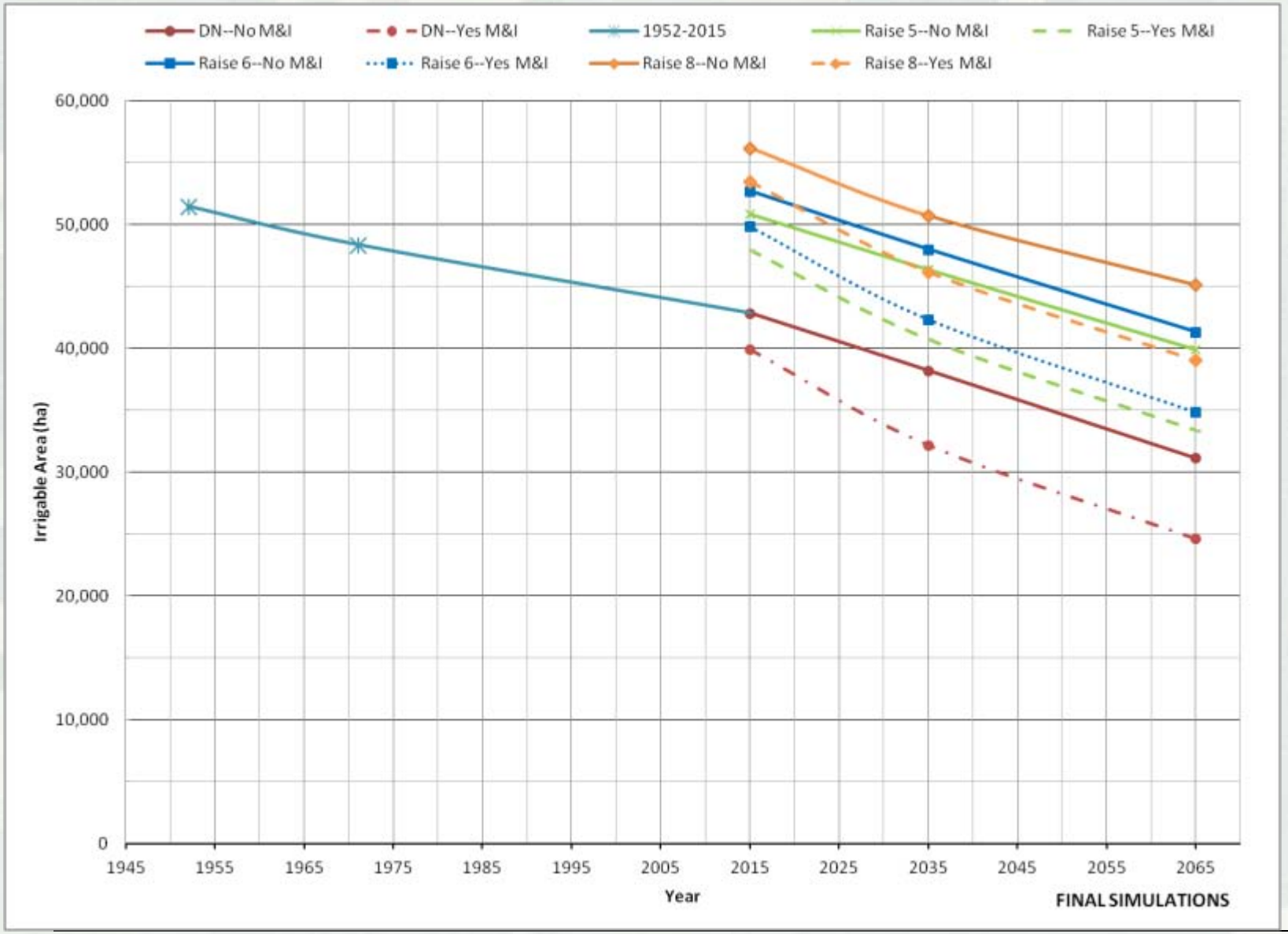
Improvements

- Base contract – 5-m dam raise (including saddle dams)
- Option – 8-m embankment raise
- Intake tower reconstruction with operable gate
- Valve house relocation & reconstruction
  - Includes small hydroelectric plant for station power
  - Allowance for future Kandahar City municipal water supply
- Spillway modifications
- Route Bear road relocation
- Design based on best available information

Hydrologic Analysis

- Raised pool inundation areas
- Design flood routing/spillway design
- Pool probability and duration
- Wind and wave analysis
- Emergency drawdown analysis
- Culvert design for highway relocation
- Reservoir simulation model
  - Varying dam raises for historic and future conditions
  - SI model

Shortage Index Reservoir Routing Results

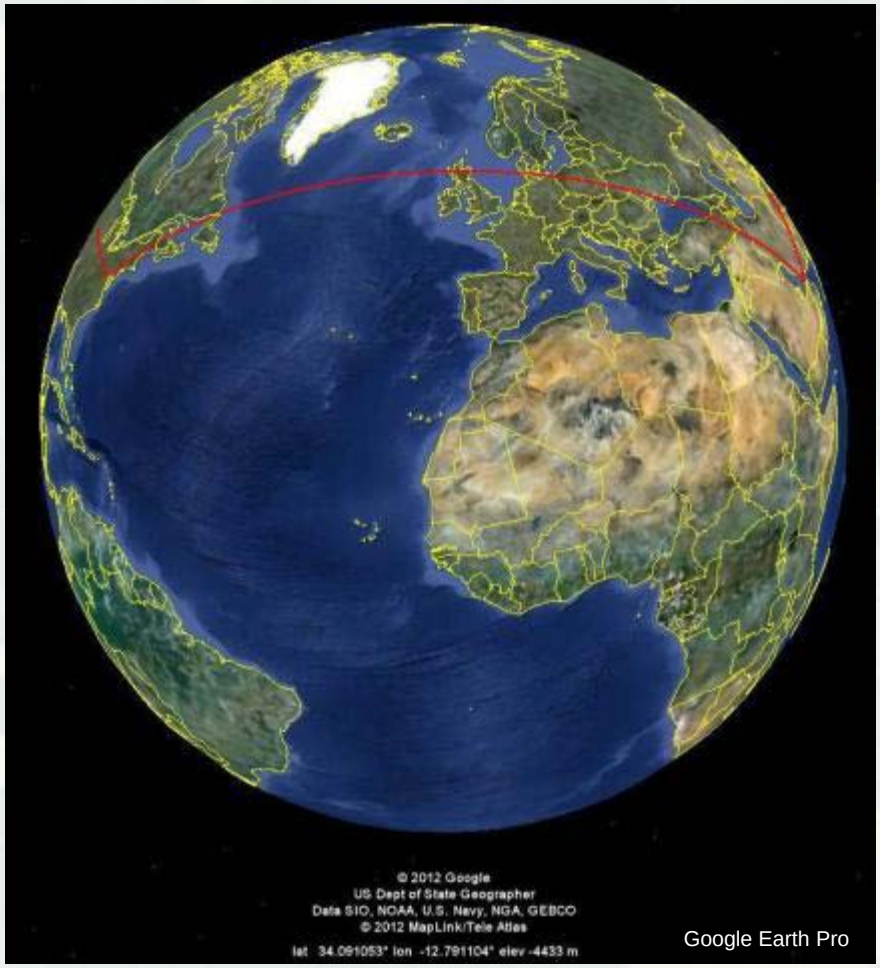


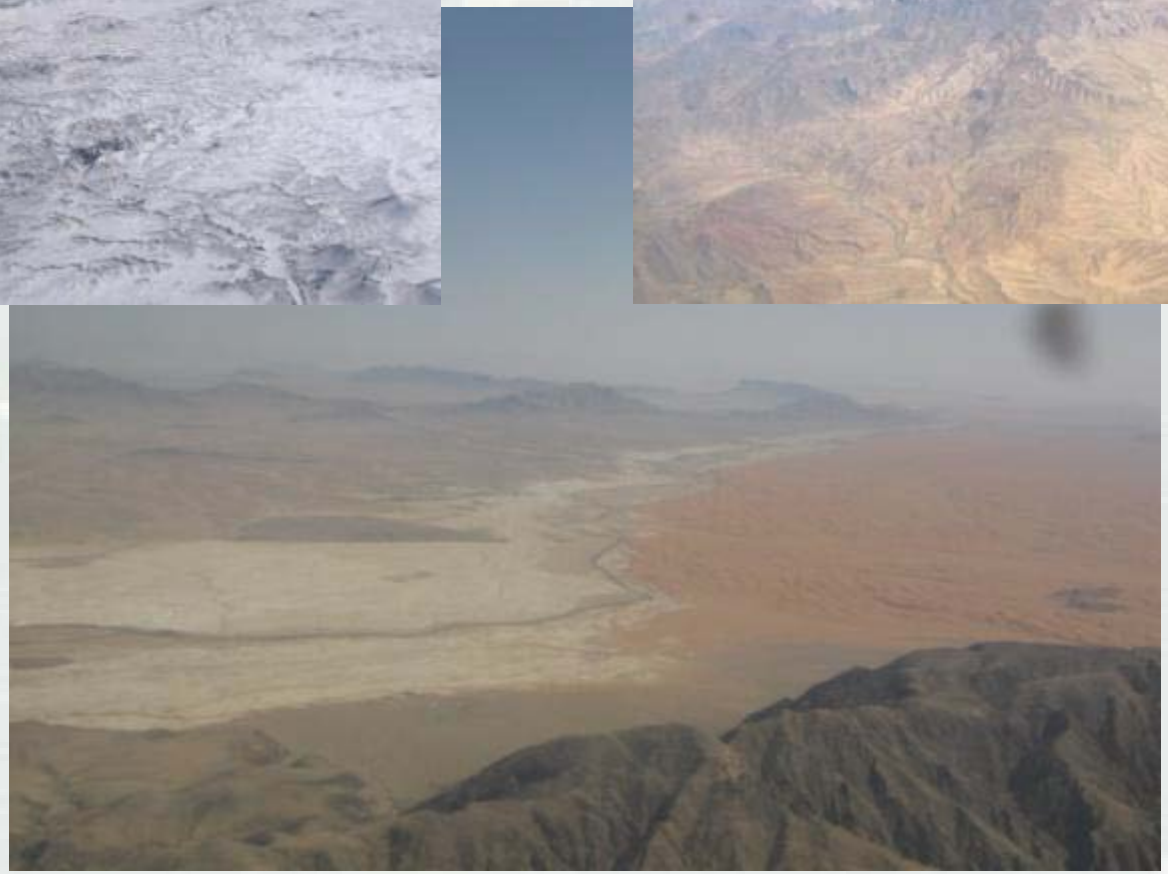
Project Sample Challenges

- Limited documentation of existing dam
  - As-builts, historic performance, no instrumentation
- Limited hydrologic data
- Access to site during design
- Surveys and investigations
  - Design based on LiDAR data and geotechnical assumptions from original design
  - Detailed surveys deferred to construction phase
- Care of water during construction
- Security unknowns in future

Site Visit

- 24 hours flight time
- 9,000 miles
- 2 helicopter transports
- Military escort to dam
- Limited access
- Limited time






CAMP NATHAN SMITH
KANDAHAR CITY
NAMED IN HONOR OF PRIVATE NATHAN SMITH
28 June 1975-17 April 2002
3rd BATTALION, PRINCESS PATRICIA CANADA LIGHT INFANTRY
15 October 2005 to 29 July 2010
29 July 2010


1/2 SCR WAREAGLES
LTC SIMS
CSM INMAN
FOB FRONTENAC


With Honor and Respect
for the Canadian Forces stationed at FOB Frontenac who gave their lives as members of the International Security Assistance Force
Avec Honneur et Respect pour les Forces Canadiennes stationnee à la BOA Frontenac qui ont donné leur vie en tant que membres de la Force Internationale d Assistance à la Sécurite
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SPC TOM, TROY ACO 18 AUG 09
CPT HALLETT, JOHN ACO 25 AUG 09
SPC SAWYER, RONALD JONC 25 AUG 09
PFC BROCHU, JORDAN CCO 31 AUG 09
SPC WALSHE, TYLER CCO 31 AUG 09
SPC COUMUS, KYLE ACO 21 OCT 09
SGT GRIFFIN, DALE CCO 27 OCT 09
SGT DELAROSA, FERNANDO CCO 27 OCT 09
PFC WALZ, CHRISTOPHER CCO 27 OCT 09
SGT JACKSON, ISAAC CCO 27 OCT 09
SPC GOOCH, GARY CCO 5 NOV 09
PFC LARONEY, JONATHAN JONC 18 AUG 09
CPT JENKINS, CORY JONC 25 AUG 09
SPC WILLIAMS, DENNIS ACO 25 AUG 09
SPC WELCH, JONATHON CCO 31 AUG 09
SPC GRAHAM, KEVIN ACO 26 SEP 09
SPC DAHL, MICHAEL ACO 17 OCT 09
SSG GONZALEZ, LUIS CCO 27 OCT 09
SGT WILLIAMSON, PATRICK CCO 27 OCT 09
SPC STANKER, JARED CCO 27 OCT 09
SPC ARNOT, AARON CCO 5 NOV 09
SPC PACI, ANTHONY BCO 4 MAR 10
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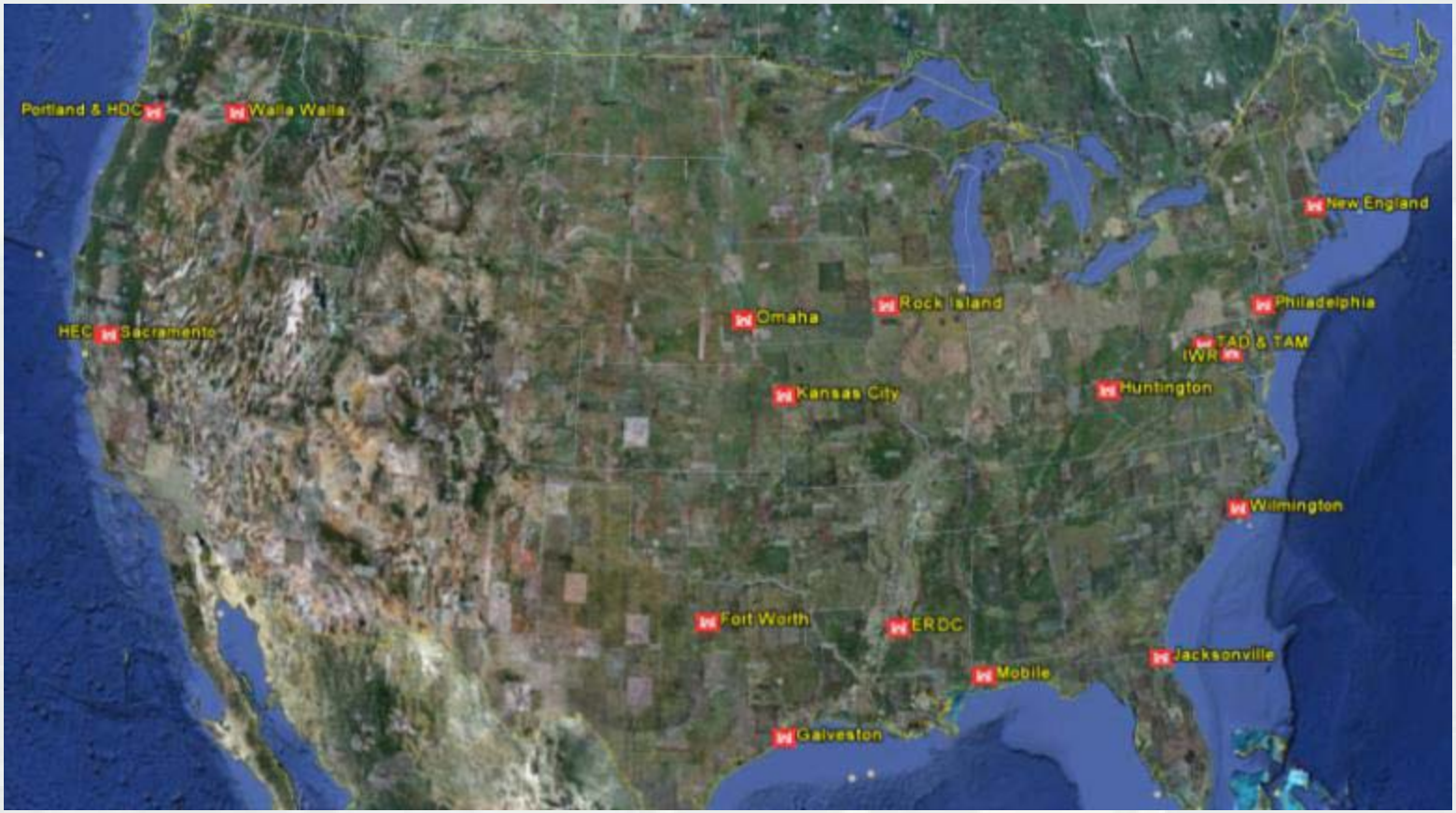
CONUS Districts & Centers Supporting NWD-TAD Reachback



THANK YOU!

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