



Glen Canyon Dam Adaptive Management Program
LOCATIONS and GEOGRAPHY

101 ON-LINE TRAINING DRAFT

Administrative History Ad-Hoc Group

(AHAHG) Course Training

Revised-140307

COURSE TRAINING TO COVER THE FOLLOWING:



COURSE TOPICS

Glen Canyon Dam
Adaptive Management
Program (GCDAMP)



OVERVIEW / PURPOSE

- GCDAMP Geographic Scope
- Basin Map –Scope boundary area
- Lake Powell
- Glen Canyon Dam
- (-) Negative River Miles
- Lees Ferry- gage- fishery
- Paria River
- Upper and Lower Marble Canyon
- Lower Colorado River (LCR)
- Grand Canyon (Eastern-Central-Western)
- Phantom Ranch
- Creeks: Havasu, Kanab, Diamond, Bright Angle
- Bright Angle Creek
- Pierce Ferry
- Lake Mead- Hoover Dam
- Tribal lands- Reservations (General locations)
- National Park Service boundaries



OVERVIEW

The Glen Canyon Dam Adaptive Management Program (GCDAMP) has a defined geographical scope. Within this scope, there are key locations and places that are discussed in the Program's nomenclature

E.g. meetings, reports, presentations, discussions

*Having a basic knowledge of these locations will be important in Program participation and understanding





LOCATIONS & GEOGRAPHY

PURPOSE OF COURSE

*SYMBOLS KEY



Indicates additional Insights



Indicates links to more details



Indicates multiple Choice Quiz



Indicates multiple Choice Test

- The purpose of training course *Locations and Geography* is to provide a general overview of commonly referred to places and locations that are linked directly to the GCDAMP
- Also included are short explanations as to why specific locations are important to the Program

Bottom-Line: “So everyone is speaking the same language.”



let's get started.



What is the GCDAMP area Scope?

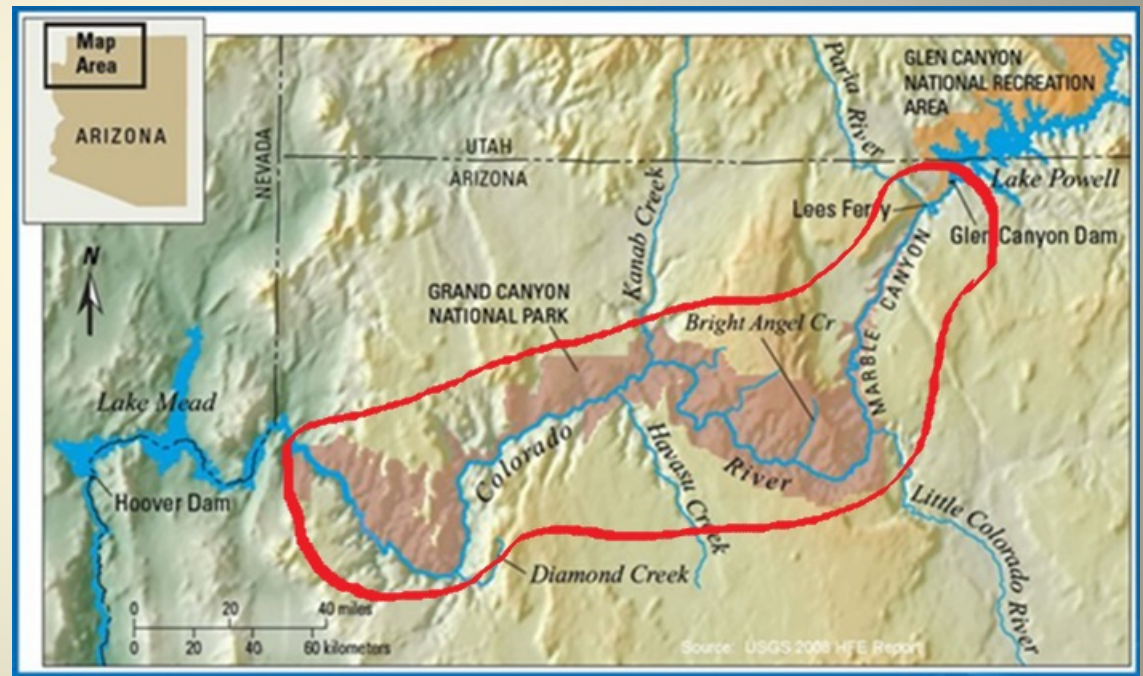
GCDAMP GEOGRAPHIC SCOPE



RULE OF THUMB:
Glen Canyon Dam down to Lake Mead

GCDAMP Geographic Scope:

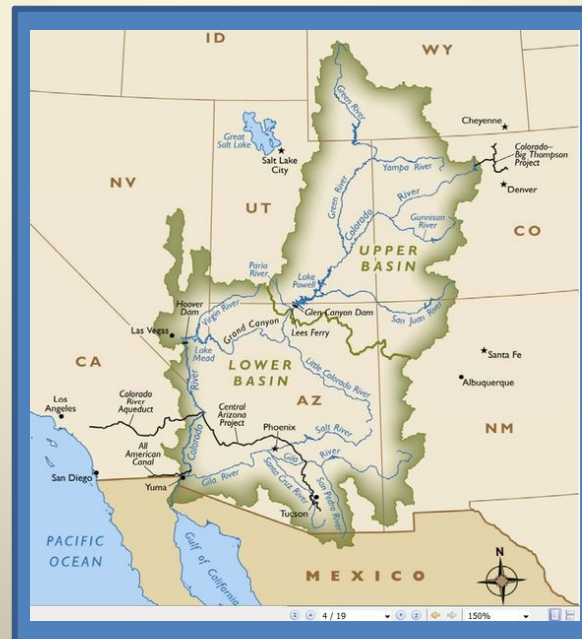
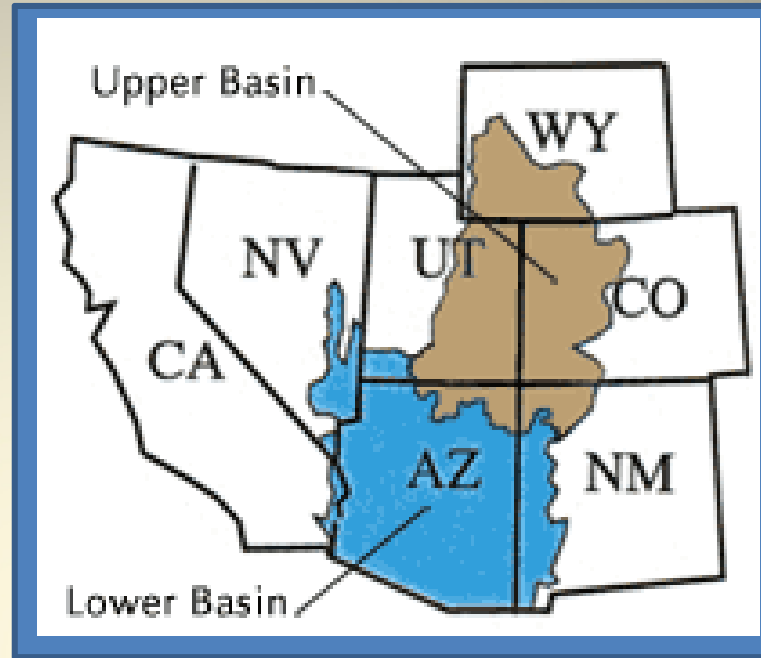
- Includes the area where the dam operations impact physical, biological, recreational, cultural, and other resources.
- The Colorado River mainstem corridor and interacting resources in associated riparian and terrace zones, located primarily from the forebay of Glen Canyon Dam to the western boundary of Grand Canyon National Park.
- The scope of AMP activities may include limited investigations into some tributaries (e.g., the Little Colorado and Paria Rivers).



**The AMP may do research outside the geographic scope defined above to obtain needed information. Such linkages with other areas "should be made on a case-by-case basis, considering ecosystem processes, management alternatives, funding sources, and stakeholder interests.*

UPPER & LOWER BASINS

- Compact of 1922:** The Compact was negotiated by the seven Colorado River Basin states and the federal government in 1922. It defined the relationship between the upper basin states and the lower basin states.
- The basin is divided into an **upper** and **lower** half, with each basin having the right to develop and use 7.5 million acre-feet (maf) of river water annually.
- Basin States:** A common reference in the Program that includes all 7 states. WY, UT, CO, NV, CA, AZ, NM



-More info on Compact

http://en.wikipedia.org/wiki/Colorado_River_Compact

- See more at Lees Ferry slide**



UPPER BASIN: WY, UT, CO, NM
LOWER BASIN: CA, AZ, NV

LAKE POWELL

- 2nd Largest man-made reservoir in the United States (*Capacity*)

Importance to GCDAMP:

- Water stored in Lake Powell provides municipal, industrial, agricultural benefits as well as recreation opportunities and hydropower production.
- Lake Powell is the main water source for downstream water releases from the dam.
- Lake levels help determine the quantity of water released each year.



Water temperature from the lake can effect downstream resources



Lake Powell – WIKI LINK

http://en.wikipedia.org/wiki/Lake_Powell



Question: How long did it take for Lake Powell to fill?

GLEN CANYON DAM

- Operated by the Bureau of Reclamation (USBR)
- The community directly next to the dam is PAGE, AZ
- Dam was started in 1956 -completed in 1964

Importance to GCDAMP:

- To fulfill the agreement in the Colorado River Compact for water storage and water delivery
- Provides hydroelectricity to various municipalities and tribes
- Because of the dam, there are downstream changes to the ecosystem



Glen Canyon Dam- Wiki

http://en.wikipedia.org/wiki/Glen_Canyon_Dam



Glen Canyon Dam- USBR Dam Facts

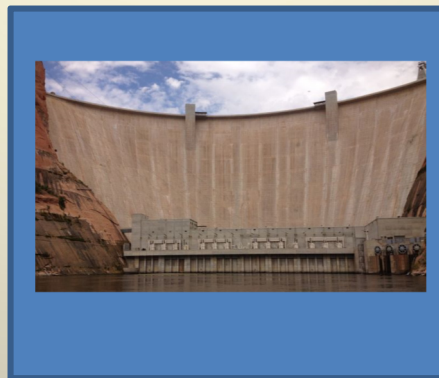
<https://www.usbr.gov/uc/rm/crsp/gc/gcFacts.html>



Based on 8,000 CFS releases, it would take about 3 days for water to travel from Lake Powell to Lake Mead.



Quiz Question: How much coal would it take to produce that same amount of power generated at Glen Canyon Dam?



What is up with this reach?

Glen Canyon (-15 RM) to Lees Ferry (0 RM)

(-) NEGATIVE RIVER MILES

- The GCDAMP will often refer to locations on the Colorado River via River Miles (RM) to mark specific locations.
- Glen Canyon Dam Reach from the dam (-15 RM) down to Lees Ferry boat launch (0 RM) is unique.
- The Negative River Miles on the Colorado River are only for this reach. “Quite possibly the only river in the world that uses negative river miles.”



(From the dam to Lake Mead)
The total length of the river in river miles is 280 RM.



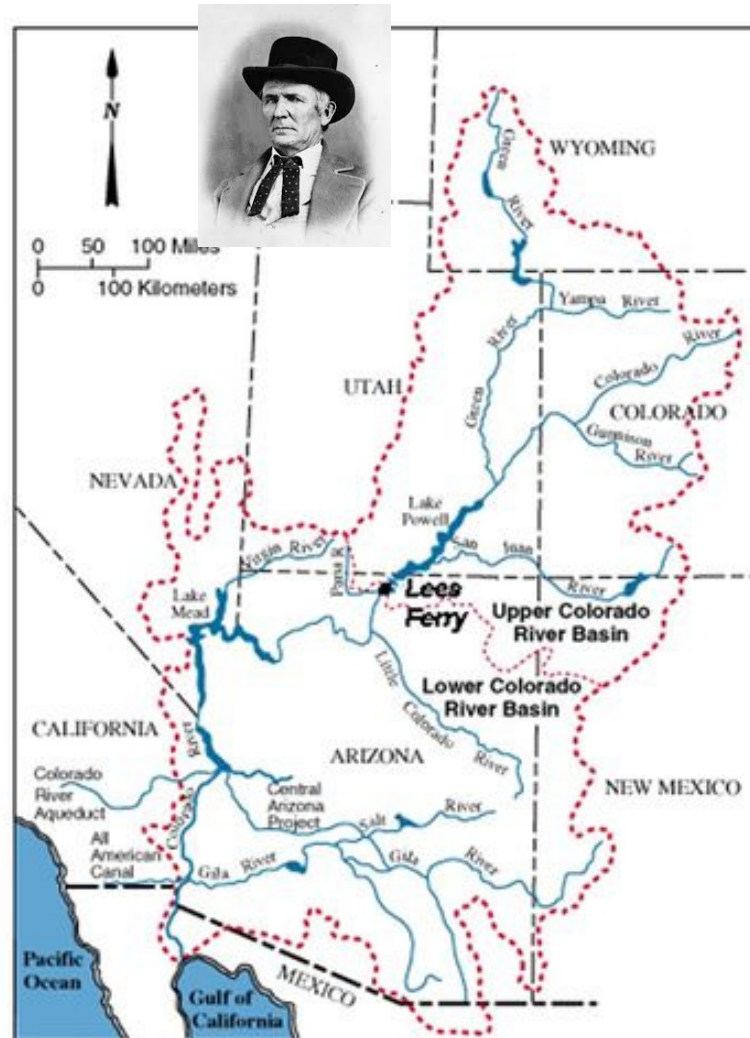
In the 1995 Humpback Chub Life History Report Valdez and Ryel, it referenced a “negative river mile” to mark river locations from Lees Ferry (RM 0). The intent was to avoid confusion with locations downstream of Lees Ferry. Ever since, the negative river miles have remained on books and maps.

LEE FERRY AND LEES FERRY

- 2 Distinct locations (1 mile apart)
- Both named for John D. Lee
- Sometimes abbreviated to "LF"

Importance to GCDAMP

- **LEE FERRY** = the official dividing point between the upper and lower Colorado River
 - Used as the measuring point for basin allocations
- **LEES FERRY** = Location where the USGS has its stream gage.
 - A good way to remember the two. The Paria river enters the mainstem in between Lee Ferry and Lees Ferry.



Map of the Colorado River basin showing Lees Ferry (black dot at center) and the division (light dotted line) between the Upper and Lower basins.

Map courtesy of the U.S. Bureau of Reclamation

"Lee Ferry" and "Lees Ferry"

Lee Ferry and Lees Ferry are actually distinct locations on the river, only one mile apart. Both are named for pioneer ferry operator John D. Lee. Lee Ferry is the point on the river on the hydrologic divide between the upper and lower basins, and is used as the measurement point for the allocation between the two basins. Lees Ferry, about a mile upstream of Lee Ferry, is the location of the U.S. Geological Survey's stream gage. (The gage could not be installed at Lee Ferry for logistical reasons.) The Paria River enters the Colorado River between Lees Ferry and Lee Ferry, so its gaged flow is added to the Lees Ferry gaged flow to measure the upper basin's total delivery to the lower basin.

To avoid confusion, we will use "Lees Ferry" to refer to both locations, although this is slightly inaccurate with respect to the Compact.



Question: When were non-native fish first introduced to LF?

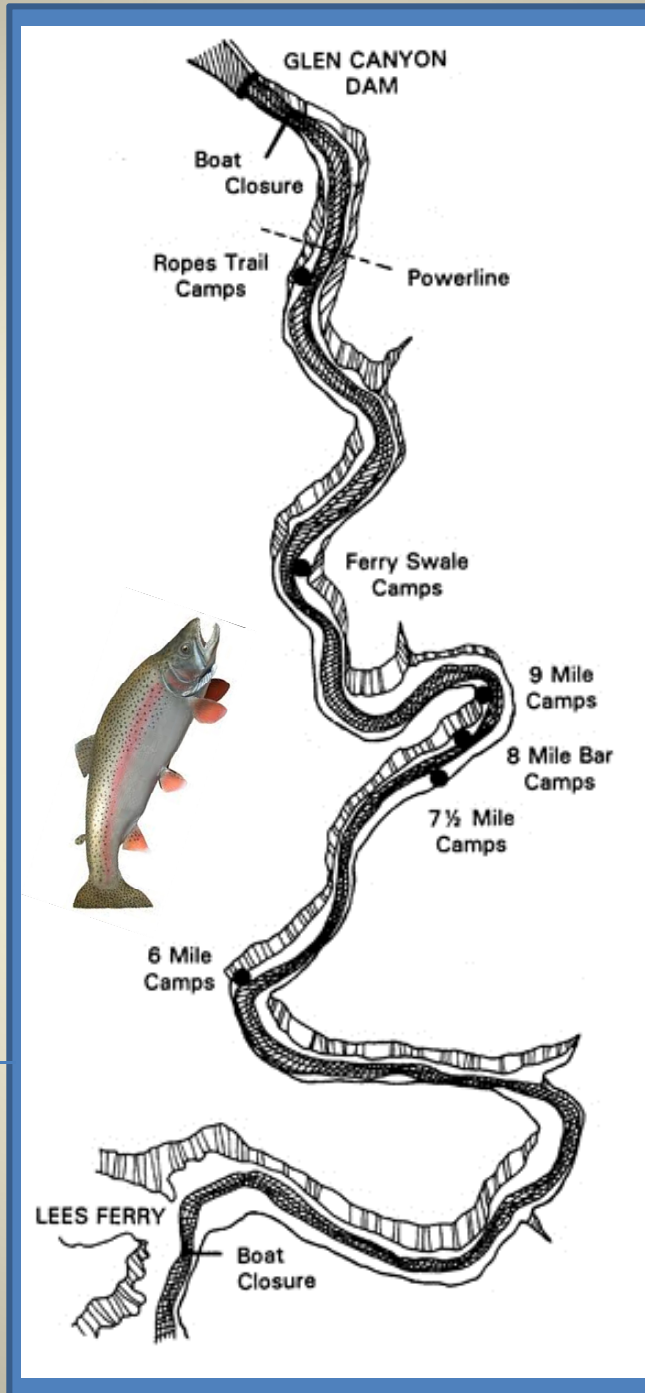
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Lees Ferry

- The whole **15.5-mile stretch** of Colorado River winding through the Marble Canyon Gorge between the Glen Canyon Dam and the beginning of the Grand Canyon is commonly referred to as **LEES FERRY**.

Importance to GCDAMP:

- One important Program Goal is to support and maintain a high-quality sport fishery
- Fly Fishing in the Lees Ferry (mainly Rainbow Trout)
- Boart ramp access for rafting
- Many river trips start here



Fly fisher downstream of Glen Canyon Dam - photo by Terry Gunn



Paria River Gage near Lees Ferry, AZ



Lee Ferry Boat Ramp access and parking



GCDAMP- POHAG- Lees Ferry Fact Sheet
[*http://www.gcdamp.gov/fs/LeesFTF.pdf](http://www.gcdamp.gov/fs/LeesFTF.pdf)



Lees Ferry Map- NPS
[*http://www.nps.gov/glca/planyourvisit/upload/lees%20ferry%20map.pdf](http://www.nps.gov/glca/planyourvisit/upload/lees%20ferry%20map.pdf)



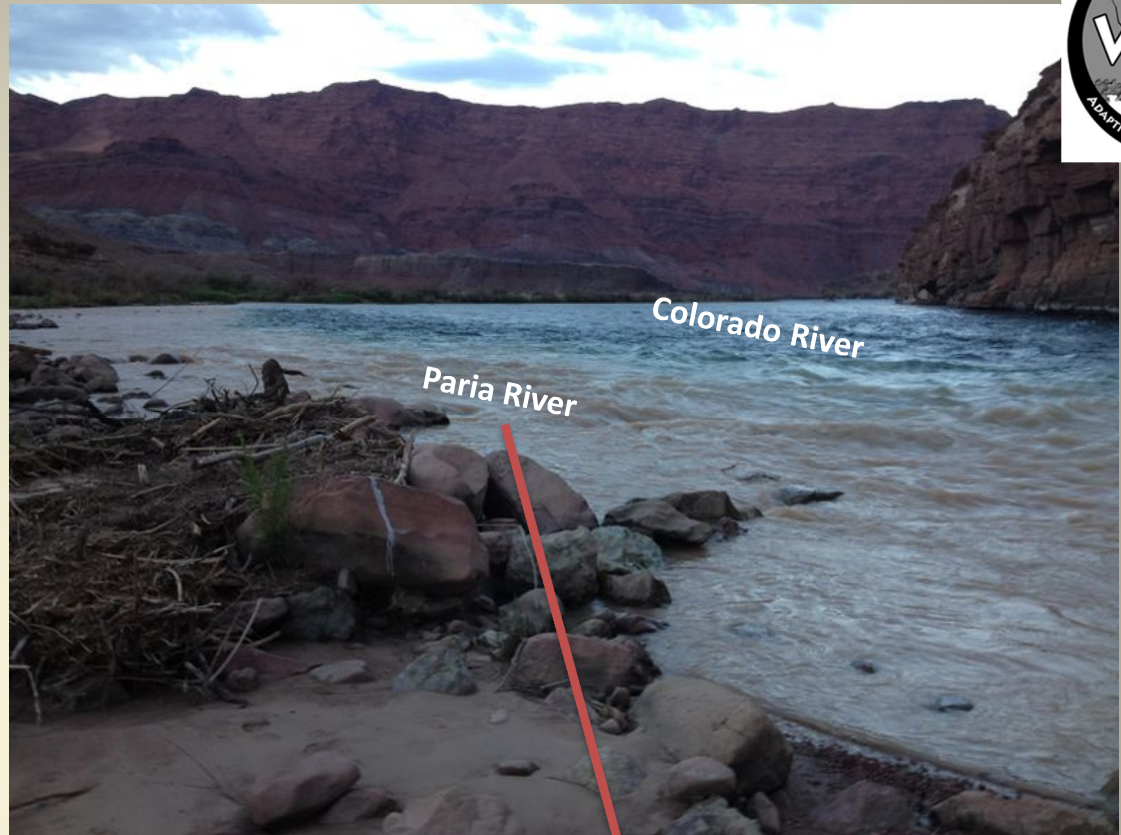
Vermillion: Video on fishing community
<http://vimeo.com/76818138>

PARIA RIVER

- Turbid water from the Paria carries fine sediments (Silts and clays) that mix with the clear water from the Colorado River mainstem

Importance to GCDAMP

- The Paria is the single largest contributor of sand, silt, and clay to the Colorado River below Glen Canyon Dam
- Sediment inputs from the Paria factor into the High Flow Experiment decisions
- Peak sediment input months are July-Oct



USGS has 3 river gauges on the Paria

Rapid Response Manuscript- WIKI LINK

http://gcdamp.com/index.php?title=GCDAMP_Rapid_Response_Learning_Page

VIDEO- Paria River Flash Flood

https://www.youtube.com/watch?v=iAw_zlg9BqI

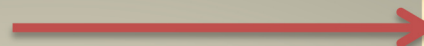


UPPER MARBLE CANYON

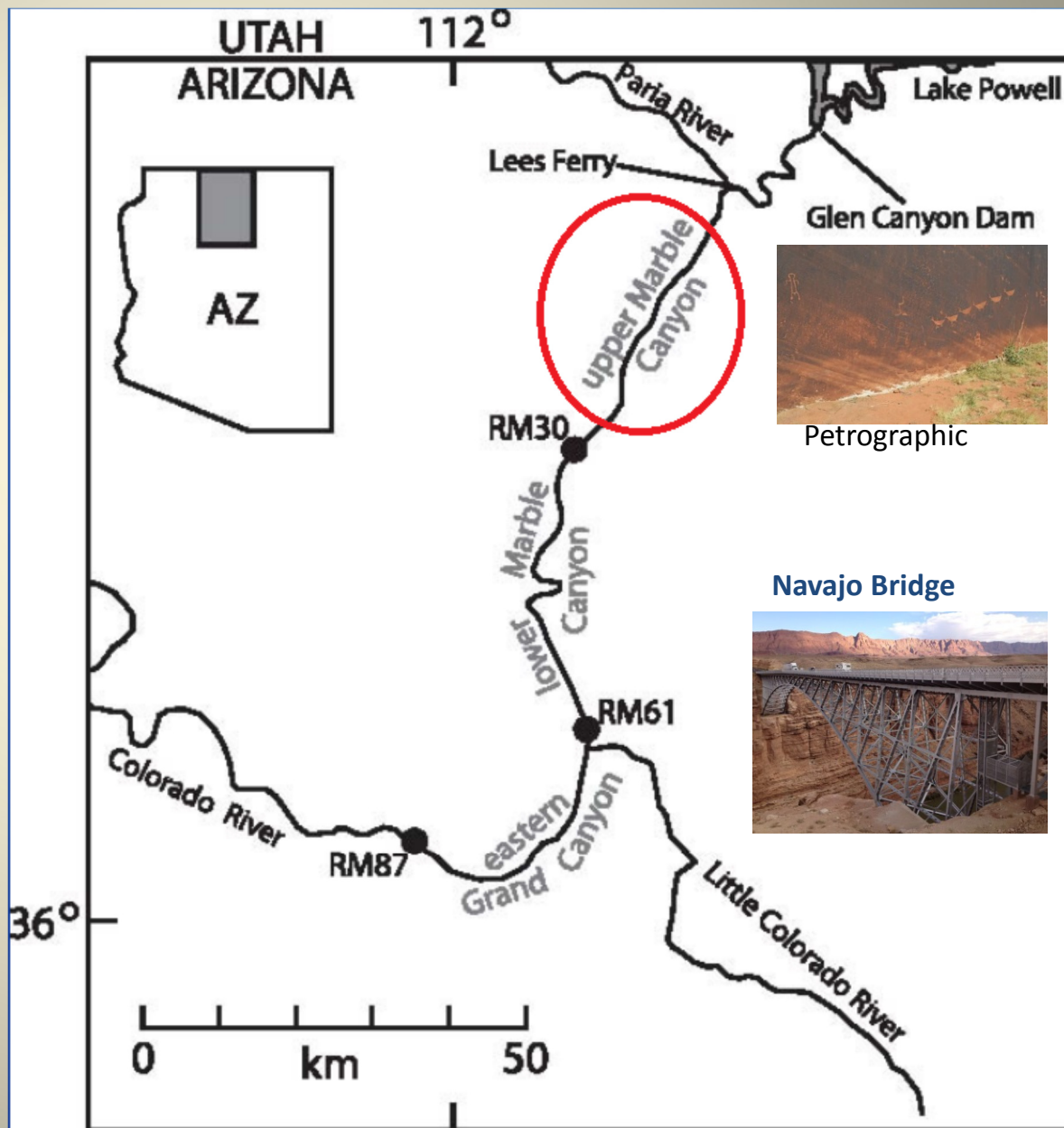
- The area from Lees Ferry RM 0 to RM 30
- High concentration of RBT and low abundance of native fish

Importance to GCDAMP:

- Upper Marble Canyon is a key reach for sediment and high flow related decisions
- This reach receives benefits of various monitoring efforts



RM 0-30 – Upper Marble Canyon
RM 30-61 – Lower Marble Canyon
RM 61-87 – Eastern Grand Canyon
RM 87-166 – Central Grand Canyon
RM 166-225 – Western Grand Canyon



Petrographic

Navajo Bridge



Navajo Bridge- located in this reach

<http://www.nps.gov/glca/historyculture/navajobridge.htm>





Dead Horse Point



LOWER MARBLE CANYON

- The river reach area from RM30 – RM61

Importance to GCDAMP:

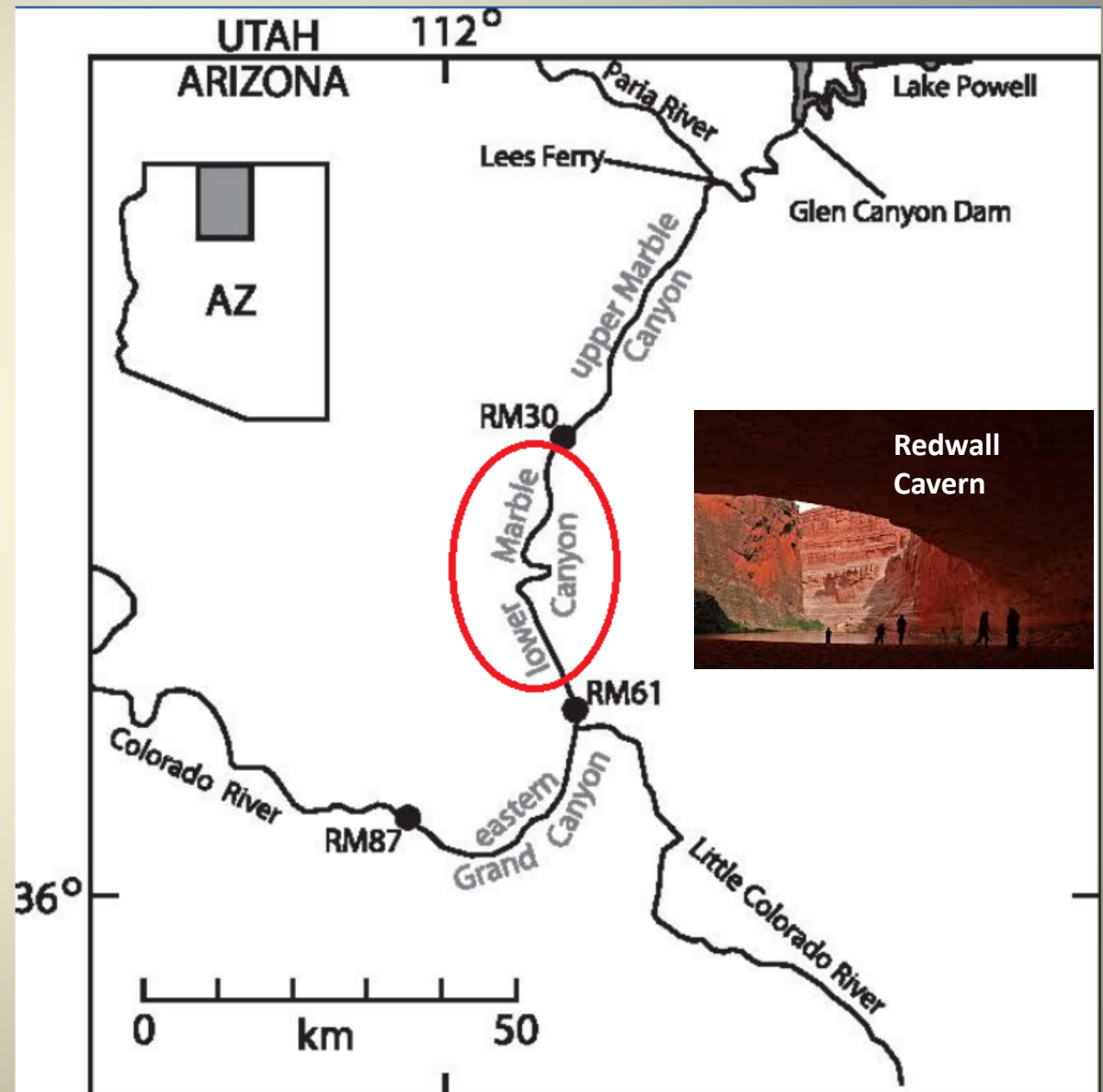
- Contains important foodbase for down stream aquatic resources
- Contains various camping beaches and visitor attractions



List of Colorado River rapids and features

http://en.wikipedia.org/wiki/List_of_Colorado_River_rapids_and_features

RM 0-30 – Upper Marble Canyon
RM 30-61 – Lower Marble Canyon
RM 61-87 – Eastern Grand Canyon
RM 87-166 – Central Grand Canyon
RM 166-225 – Western Grand Canyon

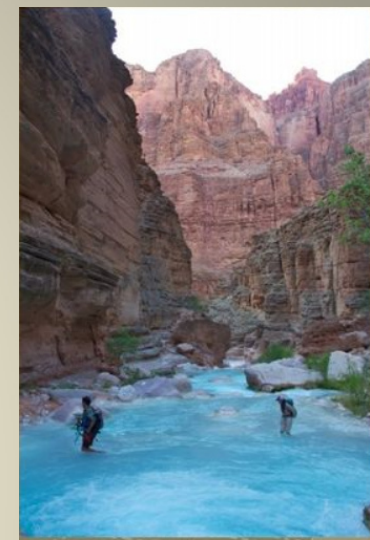
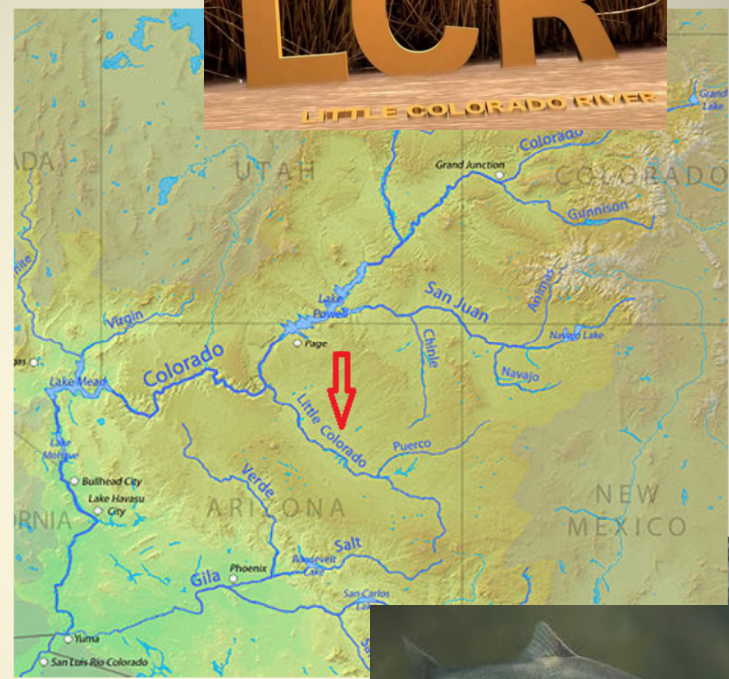


Little Colorado River (LCR)

- Confluence of LCR and Mainstem referred to often in the Program
- No fishing, camping, boating in LCR

Importance to GCDAMP:

- Area contains the largest and most robust population concentration of Humpback Chub (native fish)
- Considered a very sacred tribal area (Including the Hop, Zuni, Havasupai, and Navajo)
- 2nd largest sediment input tributary to the Colorado River



The LCR Wiki Link

http://en.wikipedia.org/wiki/Little_Colorado_River

Little Colorado River entering the mainstem



FUN Quiz Question: THE GRAND CANYON

The U.S. mainly acquired land through treaties and purchase agreements.

The Grand Canyon was obtained under which agreement?

- 1) Louisiana Purchase
- 2) Gadsden Purchase
- 3) Adams-Onis Treaty
- 4) Treaty of Guadalupe-Hidalgo *

Source: http://grandcanyonhistory.clas.asu.edu/history_whoownsgrandcanyon.html



- RM 0-30 – Upper Marble Canyon
- RM 30-61 – Lower Marble Canyon
- RM 61-87 – Eastern Grand Canyon
- RM 87-166 – Central Grand Canyon
- RM 166-225 – Western Grand Canyon

EASTERN GRAND CANYON

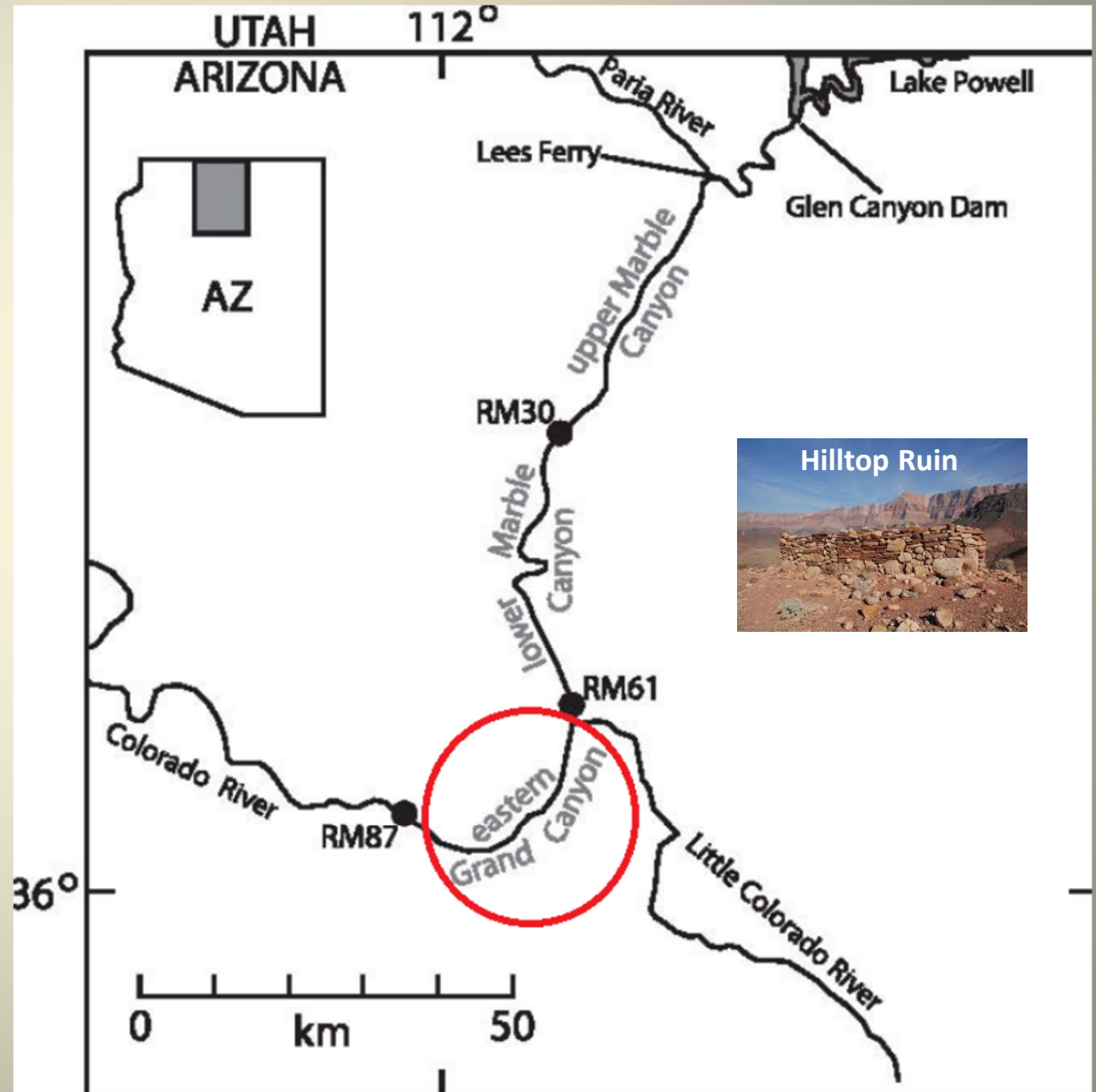
- The river reach area from RM61 – RM87

Importance to GCDAMP:

- Contains the largest abundance of archeological sites along the Colorado River corridor
- Incorporates the sacred Hopi salt mines- (No visitation)



During the 2013 HFE, this river reach experienced erosion of beaches and sandbars. A concern was exposure of sacred archeological sites.



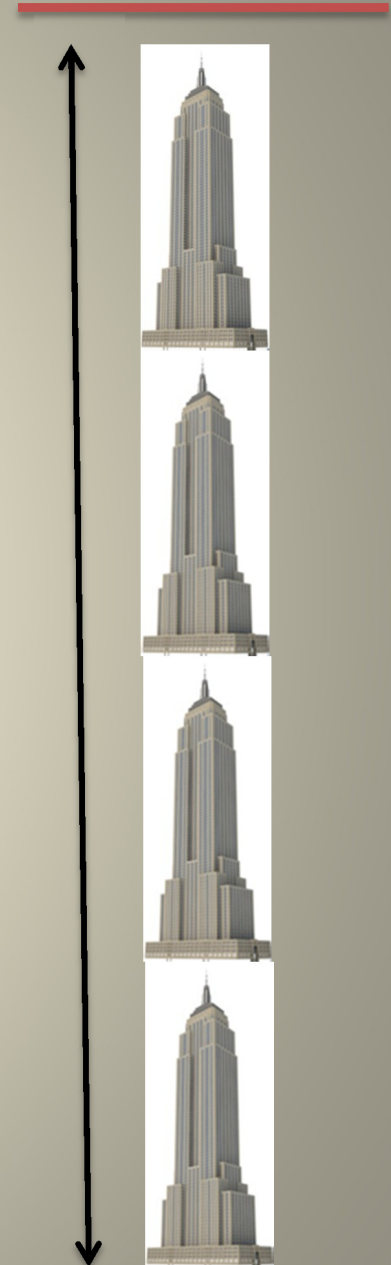
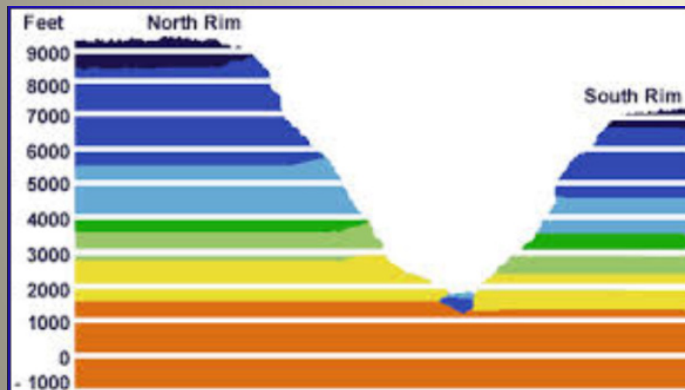


http://en.wikipedia.org/wiki/Grand_Canyon_Skywalk



The canyon is just over 1 Mile (1.8 km) deep

The height of **FOUR** Empire State Buildings
stacked on top of the other.



Four Empire State buildings high



Question: The Grand Canyon is the 2nd longest canyon in the world.
In what country is the #1 longest canyon?



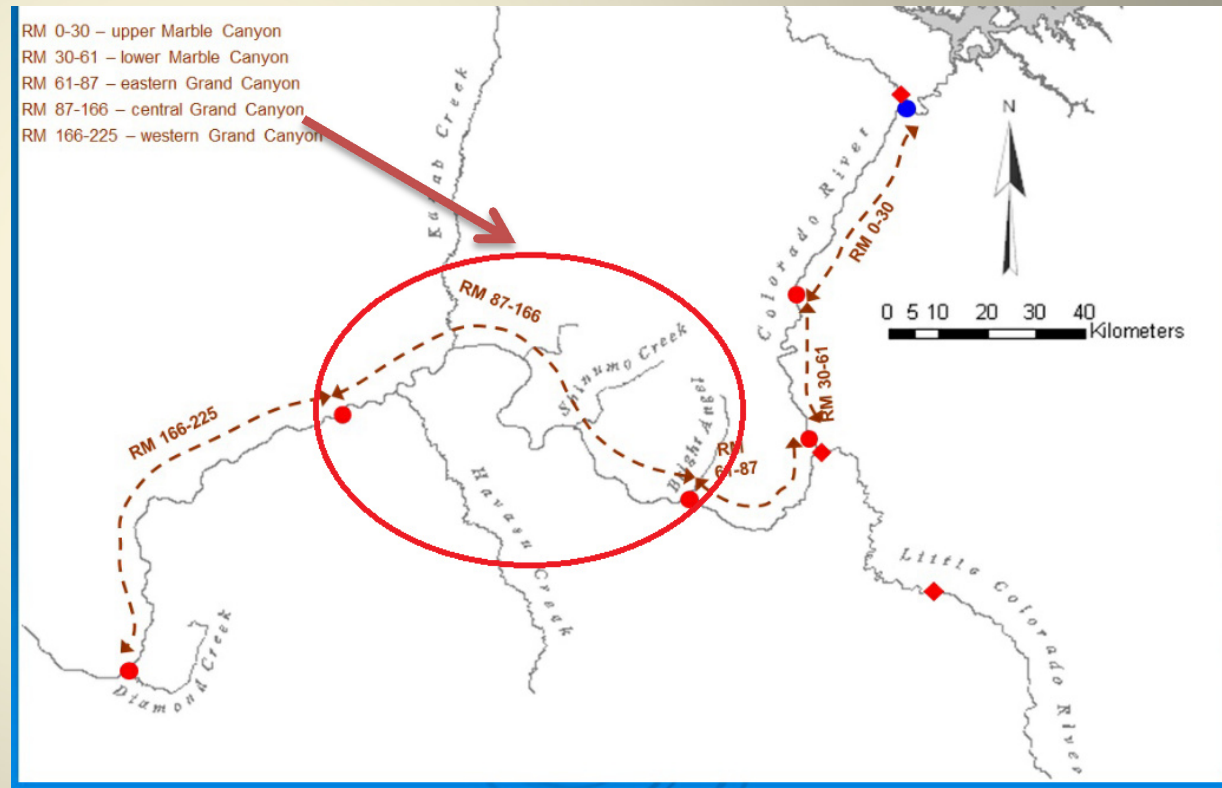
RM 0-30 – Upper Marble Canyon
RM 30-61 – Lower Marble Canyon
RM 61-87 – Eastern Grand Canyon
RM 87-166 – Central Grand Canyon
RM 166-225 – Western Grand Canyon

CENTRAL GRAND CANYON

- The river reach area from RM87–RM166

Importance to GCDAMP:

- TBD
- TBD



Google Maps: Walk-through of various key locations along the river- Craig Ellsworth

<http://maps.google.com/maps/ms?vps=2&hl=en&ie=UTF8&oe=UTF8&msa=0&msid=207926221138145380893.0004ad01b594314be2649>



FUN Quiz Question: THE GRAND CANYON

Who said, "You cannot improve on it. But what you can do is keep it for your children, your children's children, and all who come after you, as the one great sight which every American should see."

- 1) President William McKinley
- 2) President Theodore Roosevelt *
- 3) President Woodrow Wilson
- 4) President Barack Obama

Source: <http://www.history.com/this-day-in-history/theodore-roosevelt-makes-grand-canyon-a-national-monument>

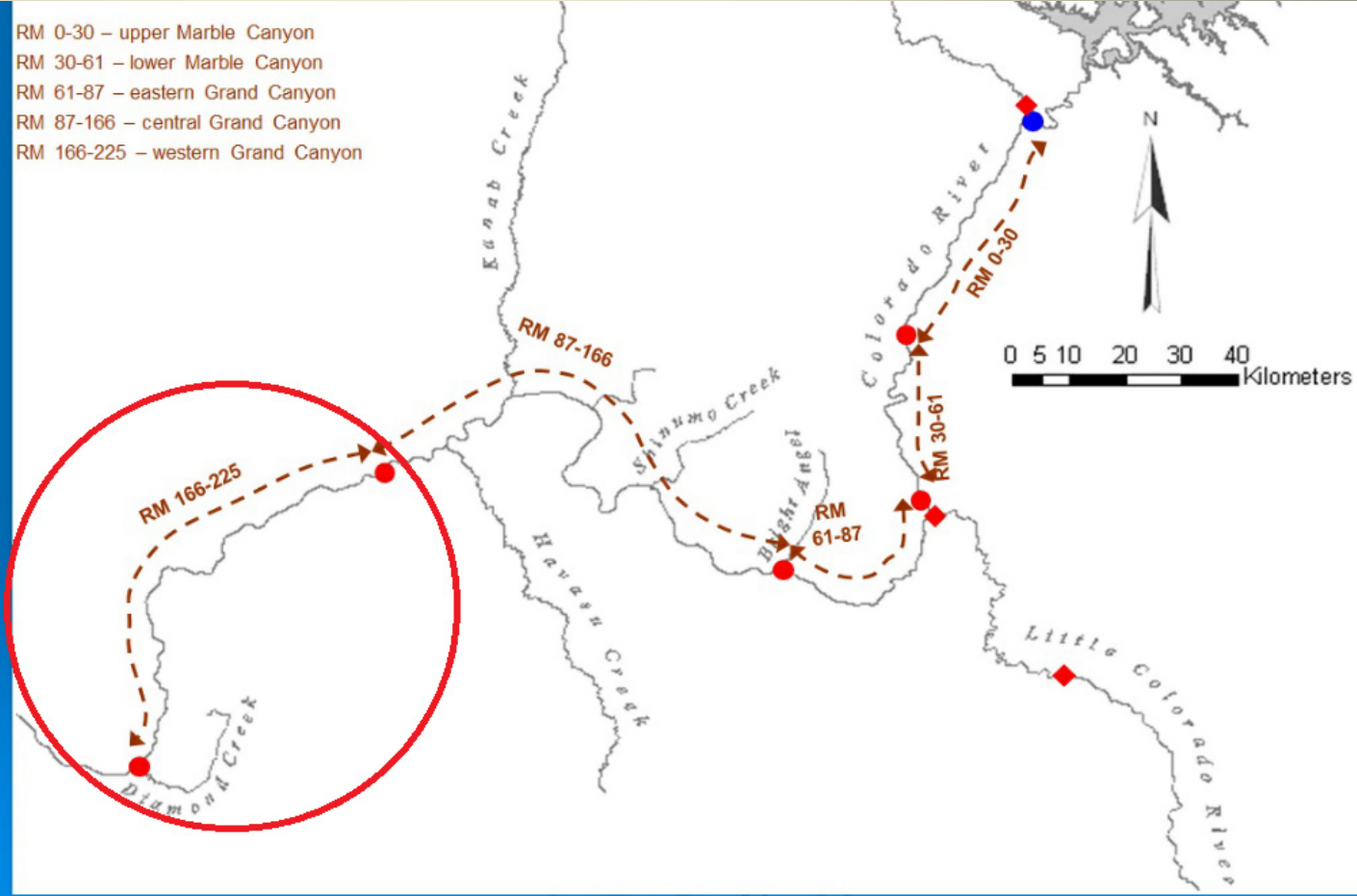


- RM 0-30 – Upper Marble Canyon
- RM 30-61 – Lower Marble Canyon
- RM 61-87 – Eastern Grand Canyon
- RM 87-166 – Central Grand Canyon
- RM 166-225 – Western Grand Canyon



WESTERN GRAND CANYON

- The river reach area from RM166–RM225



RM 0-30 – upper Marble Canyon
RM 30-61 – lower Marble Canyon
RM 61-87 – eastern Grand Canyon
RM 87-166 – central Grand Canyon
RM 166-225 – western Grand Canyon

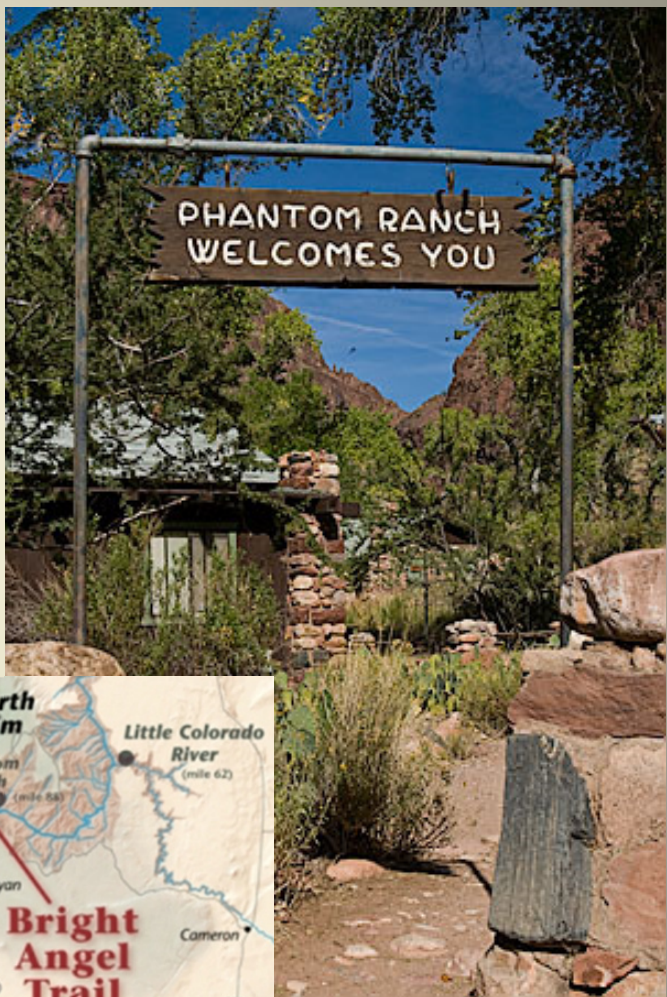
Importance to GCDAMP:

- TBD
- TBD

Take a Virtual Tour:
<http://www.nps.gov/grca/photosmultimedia/fly-through.htm>

Phantom Ranch

- Phantom Ranch is the only lodging facility below the Canyon rim
- Phantom Ranch is located at the bottom of the Grand Canyon near Bright Angel Creek trail about ½ mile from the river
- Open year-round
- The Ranch can only be reached by mule, by foot, or by rafting



Importance to GCDAMP:

- Popular stop-over point for hikers and mule riders traveling to the bottom of the Canyon
- Key landmark for river referencing



Phantom Ranch- WIKI LINK
http://en.wikipedia.org/wiki/Phantom_Ranch

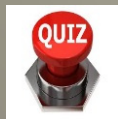
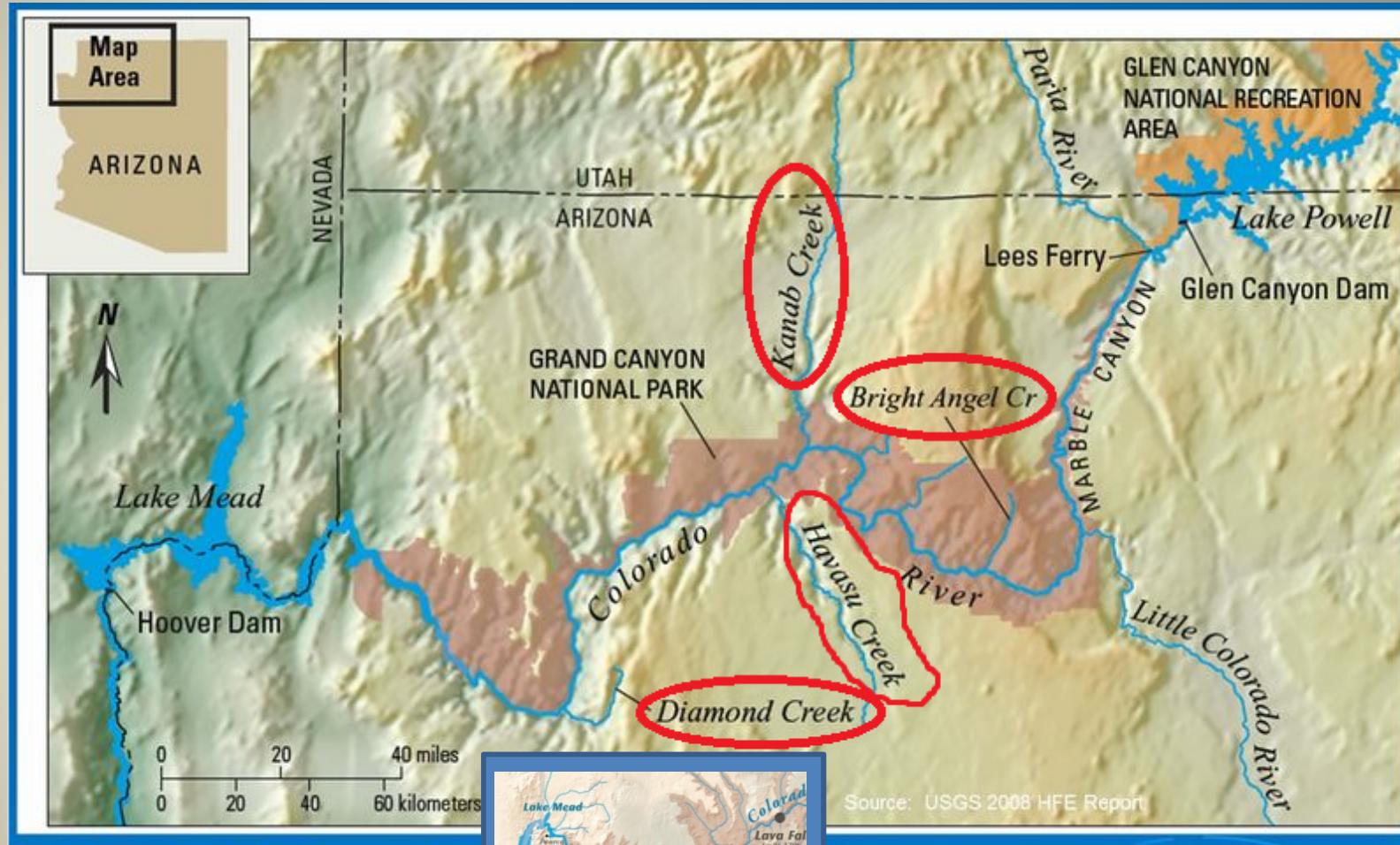


Western Grand Canyon-
Craig Pyper- Picture- 2013

CREEKS

- The Colorado is joined by over 25 significant tributaries
- Although not major water sources, listed below are names of creeks that are mentioned frequently in the Program.

- Bright Angel Creek
- Kanab Creek
- Havasu Creek
- Diamond Creek



Question: What is the biggest tributary to the Colorado River?



Colorado River Tributaries and Colorado River- WIKI LINKS
http://en.wikipedia.org/wiki/List_of_tributaries_of_the_Colorado_River
http://en.wikipedia.org/wiki/Colorado_River





Bright Angel Creek

- Bright Angel Creek once supported large numbers of native fish, including the endangered humpback chub.

Importance to GCDAMP:

- Concerns with Brown Trout eating and competing with native fish in this area
- The purpose of the Bright Angel Creek Trout Reduction Project is to benefit endangered humpback chub and other native fish species in the Colorado River



Bright Angel Creek- WIKI LINK
http://en.wikipedia.org/wiki/Bright_angel_creek



Trout Reduction Program- National Park Service LINK
<http://www.nps.gov/grca/naturescience/trout-reduction.htm>

Bright Angel Creek- GCMRC Pic

Pearce Ferry

- Marks the boundary between Lake Mead and the Grand Canyon
- Being able to navigate the Pierce Ferry rapid depends on Lake Elevation and river flows
- A ferry was operated here by the Pearce family starting around 1876



Sam Jansen- Picture



Importance to GCDAMP:

- Many science and recreation trips pull out of the river here



Pearce Ferry -WIKI LINK

http://en.wikipedia.org/wiki/Pearce_Ferry,_Lake_Mead



The mouth of Lake Mead

Where the Colorado River enters the lake

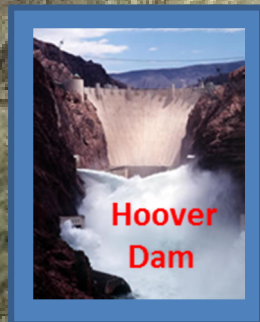


Sediment flows into Lake Mead area from the Colorado River. High Flow Experiments are no exception.

During the 2012 HFE, 1,810,000 metric tons were transported by the Colorado River between July 1, 2012, and July 1, 2013. Thus, **54% of the total delivery of sand to Lake Mead reservoir during this 1-year period occurred during approximately 5 days of the November 2012 HFE.** [Source: USGS Jack Schmidt]

Lake Mead

Largest man-made
reservoir in the U.S.
(capacity)





FUN Quiz Question: TRIBAL PARTICIPATION

Which tribe was the first cooperating agency in the Glen Canyon Dam Adaptive Management Program process in 1992?

- 1) The Pueblo of Zuni
- 2) The Navajo Nation
- 3) The Hopi Tribe*
- 4) The Hualapai Tribe

Source: Adaptive Management Program

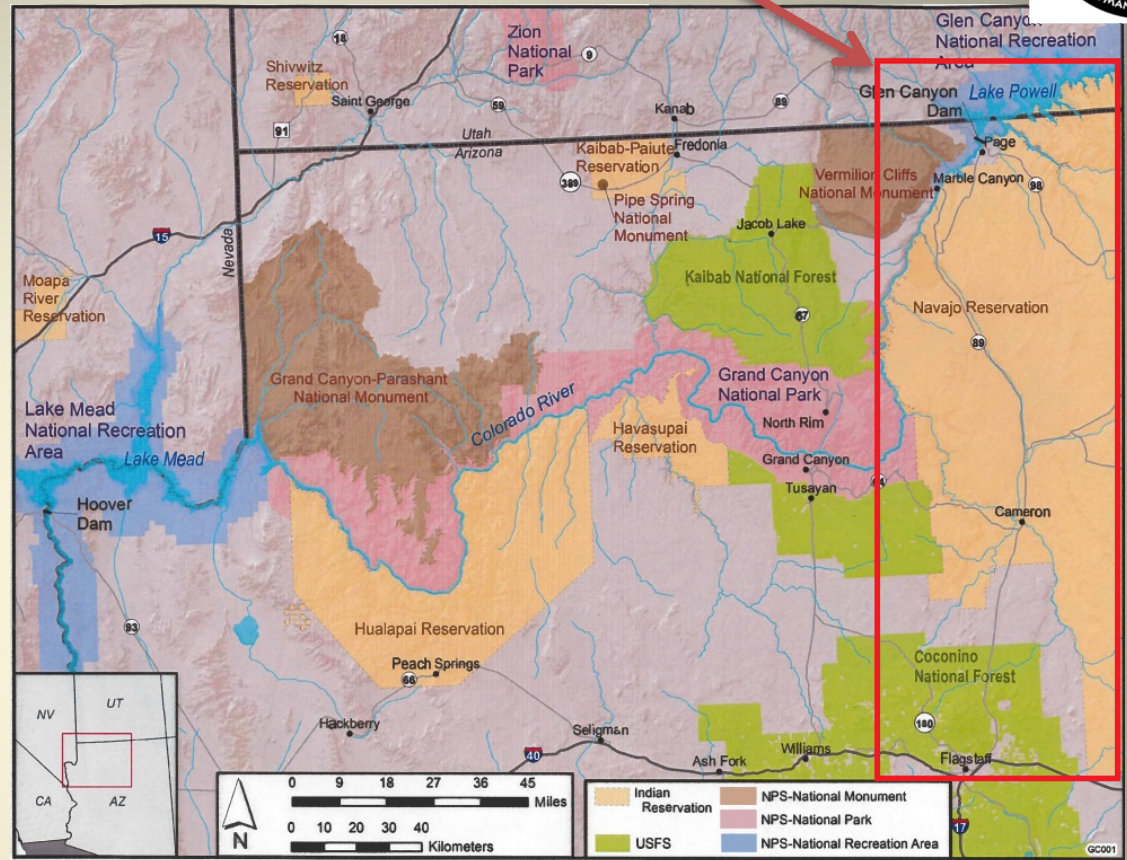
<http://www.usbr.gov/uc/rm/amp/amwg/mtgs/13aug08/index.html>

NAVAJO Tribal Land

- The *Navajo Nation* is the *largest Indian tribe* in the *United States*, with *reservation land* covering a total of 17.5 million acres.
- Very often, the size of the Navajo Nation is compared to that of the state of **West Virginia**.

Importance to GCDAMP:

- The Navajo tribe is a stakeholder in the GCDAMP.



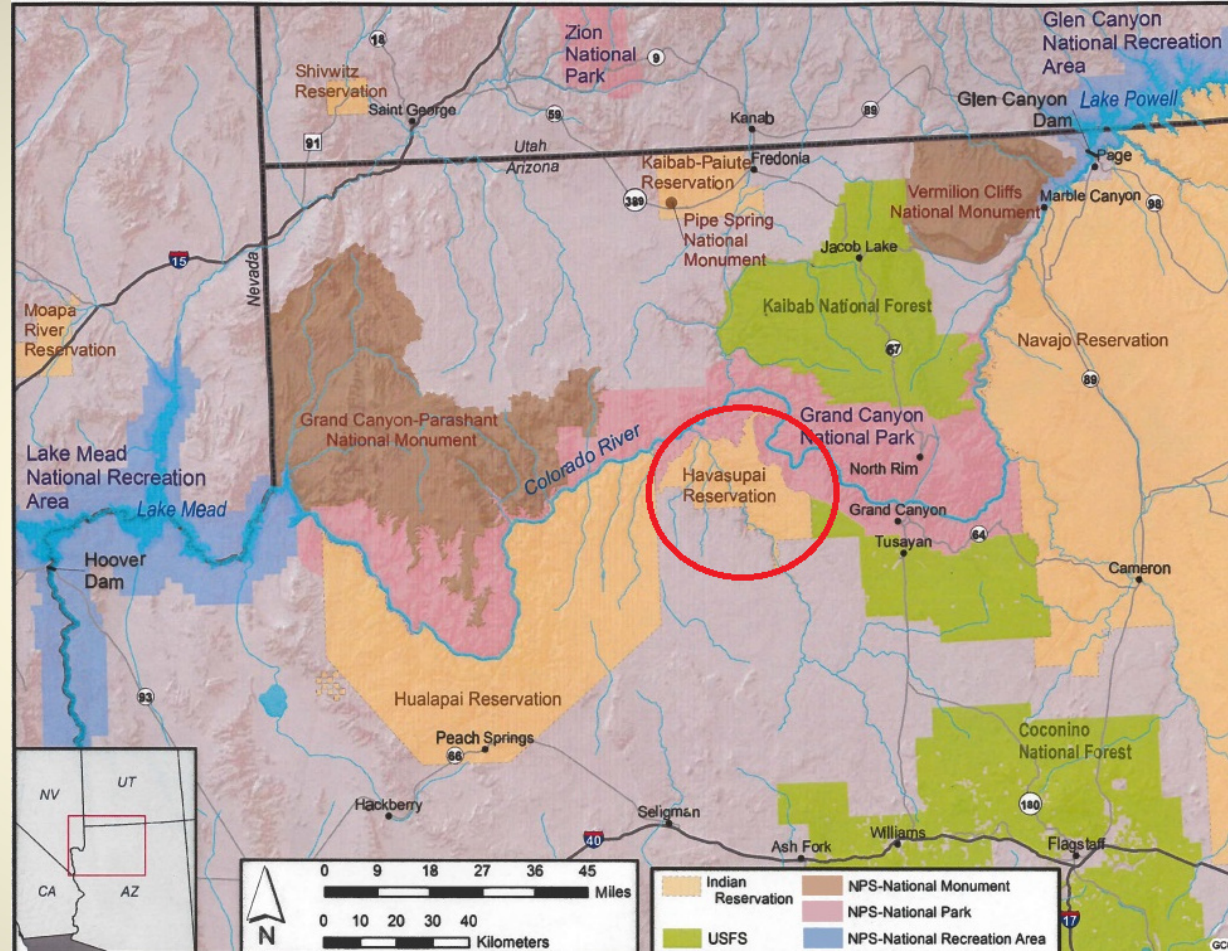
Navajo Nation- WIKI LINK
<http://www.navajo-nsn.gov/>



Havasupai Tribal Land



- The Havasupai people have lived on the south side of the Grand Canyon for over 700 years.

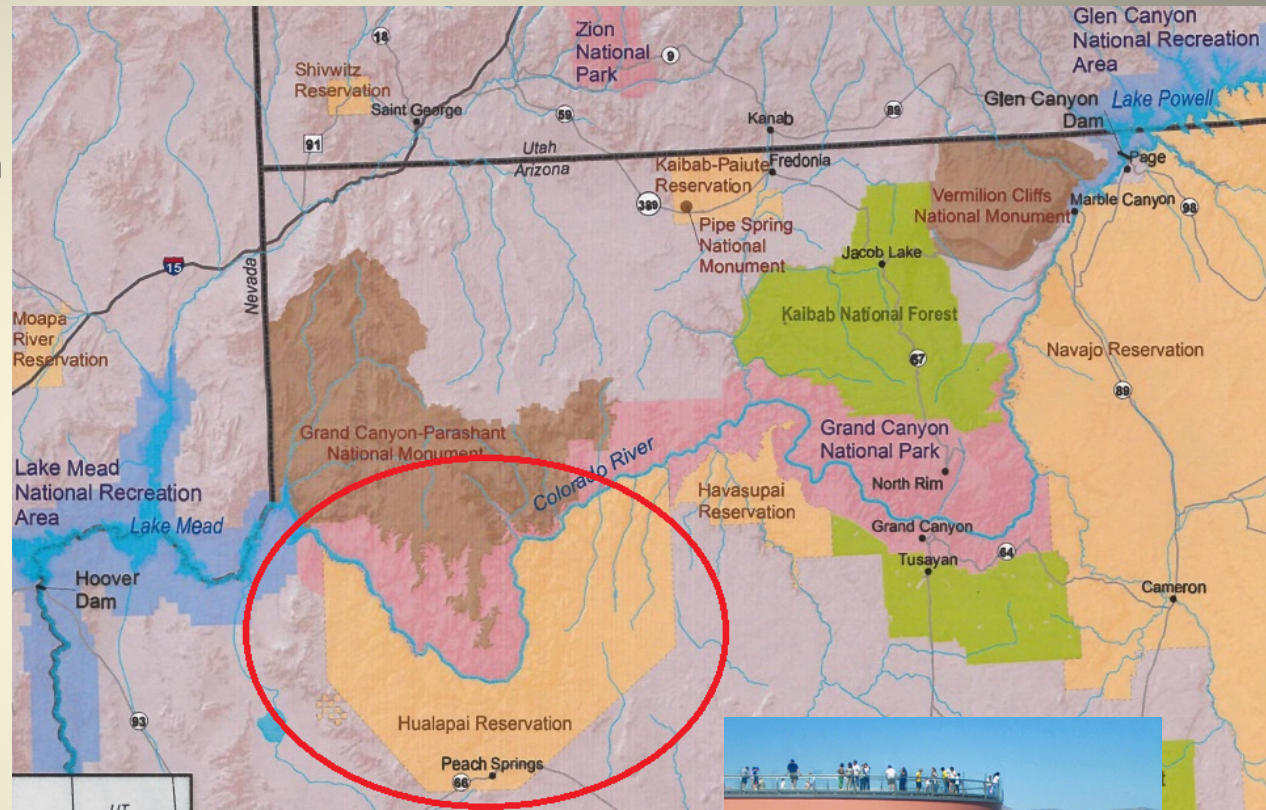


Hualapai Tribal Land

- The Hualapai Tribe owns 108 miles of the "West Rim," which lines the southwestern side of the Canyon.
- The entire Hualapai Reservation occupies nearly 1,000,000 acres.

Importance to GCDAMP:

- The Hualapai tribe is a stakeholder in the GCDAMP.
- The Hualapai have rafting interests on the river.



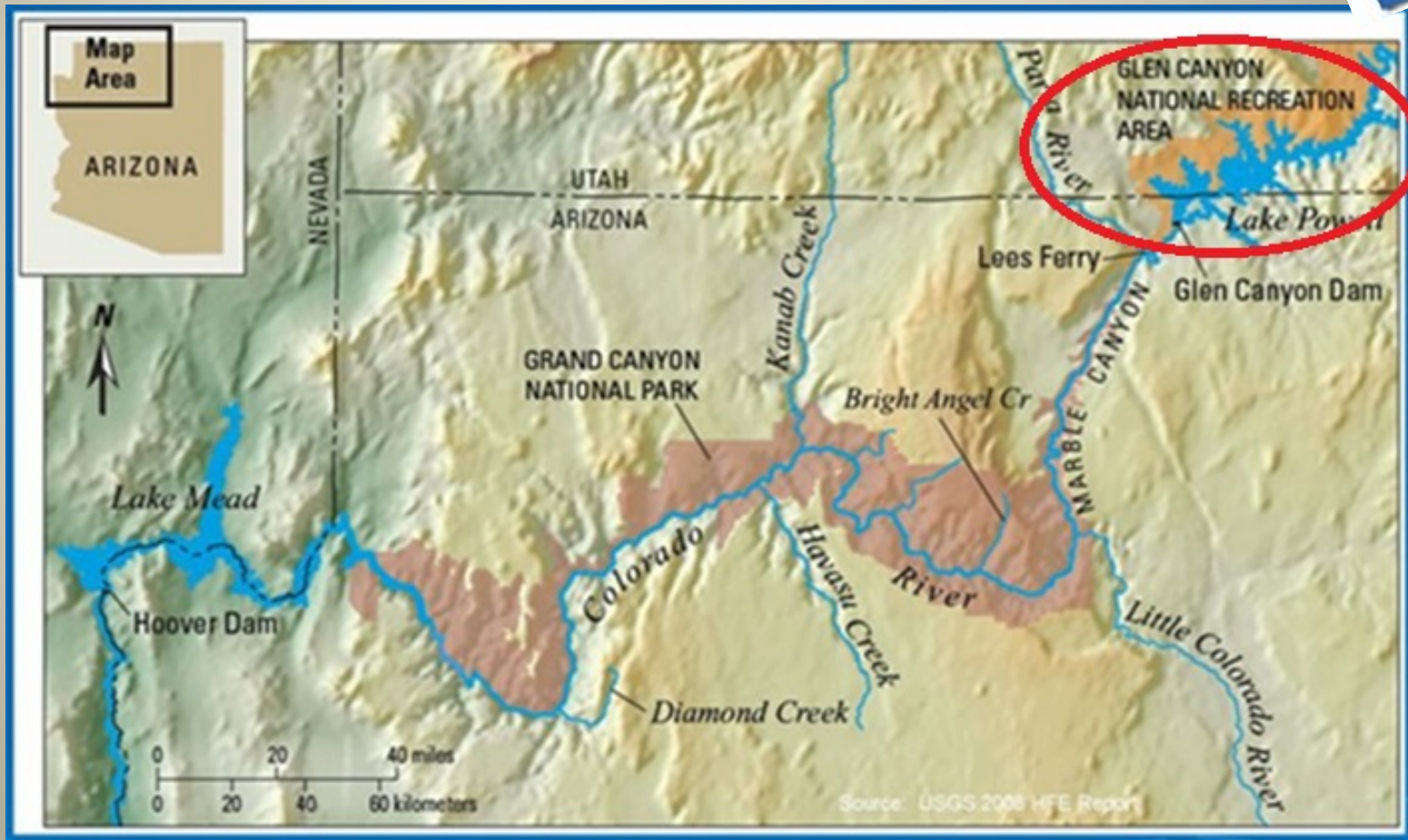
Hualapai Tribe- WIKI LINK
<http://hualapai-nsn.gov/>



GLEN CANYON NATIONAL RECREATION AREA

Area Boundary

The Glen Canyon National Recreation Area-- This recreation area is larger than the state of Delaware



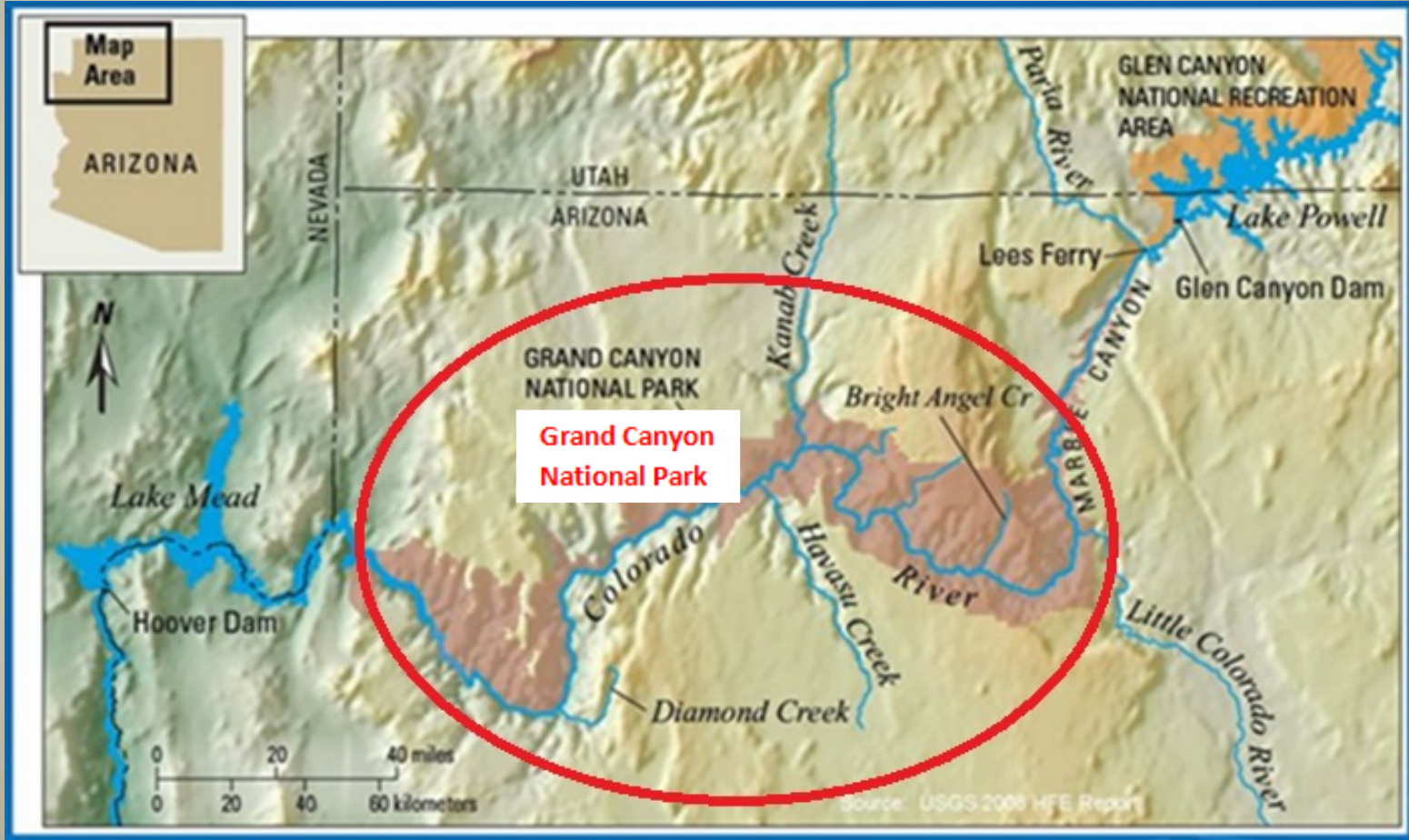
GCNRA- WIKI LINK

<http://www.nps.gov/glca/index.htm>



GRAND CANYON NATIONAL PARK

Area Boundary



Grand Canyon National Park- WIKI LINK

<http://www.nps.gov/grca/index.htm>



It is near RM 280 and just before Pearce Ferry, that the Grand Canyon National Park boundaries connect with the Lake Mead National Recreation Area



TEST