

Meeting Agenda

I – Large Group Information (~60 minutes)

- A. Introduction – Chip Jenkins (NOCA Supt.)**
- B. SRCIP Planning – Jon Riedel**
- C. River Dynamics – Don Reichmuth**
- D. Current Information Base – Jon Riedel**
- D. Questions**

II – BREAK (10 minutes)

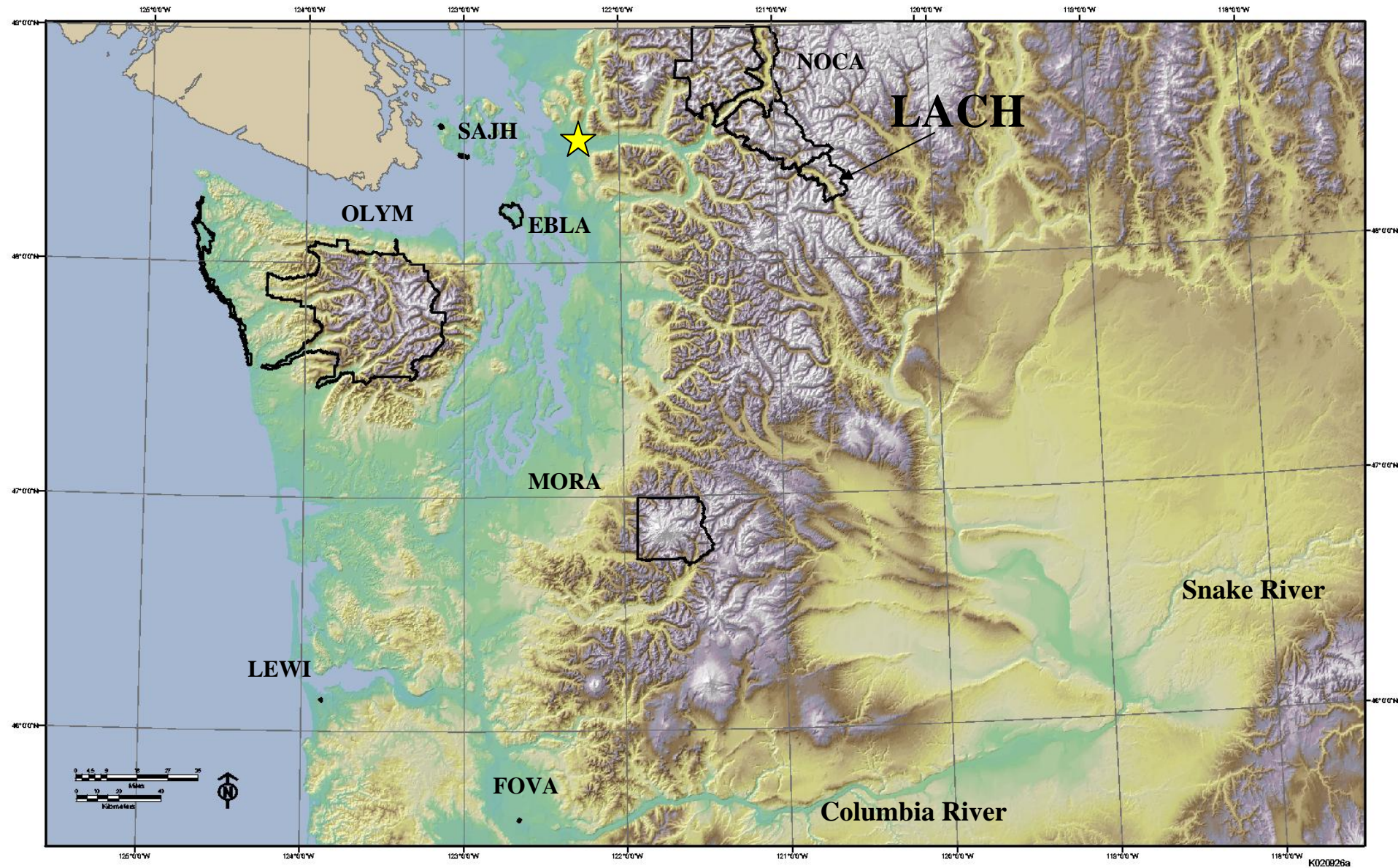
III – Small Groups (~50 minutes)

- A. Issues**
- B. Possible Action Items (responsible party, funding)**

Stehekin River Corridor Implementation Plan



Location of Lake Chelan NRA and the Stehekin River in the North Coast and Cascade Network

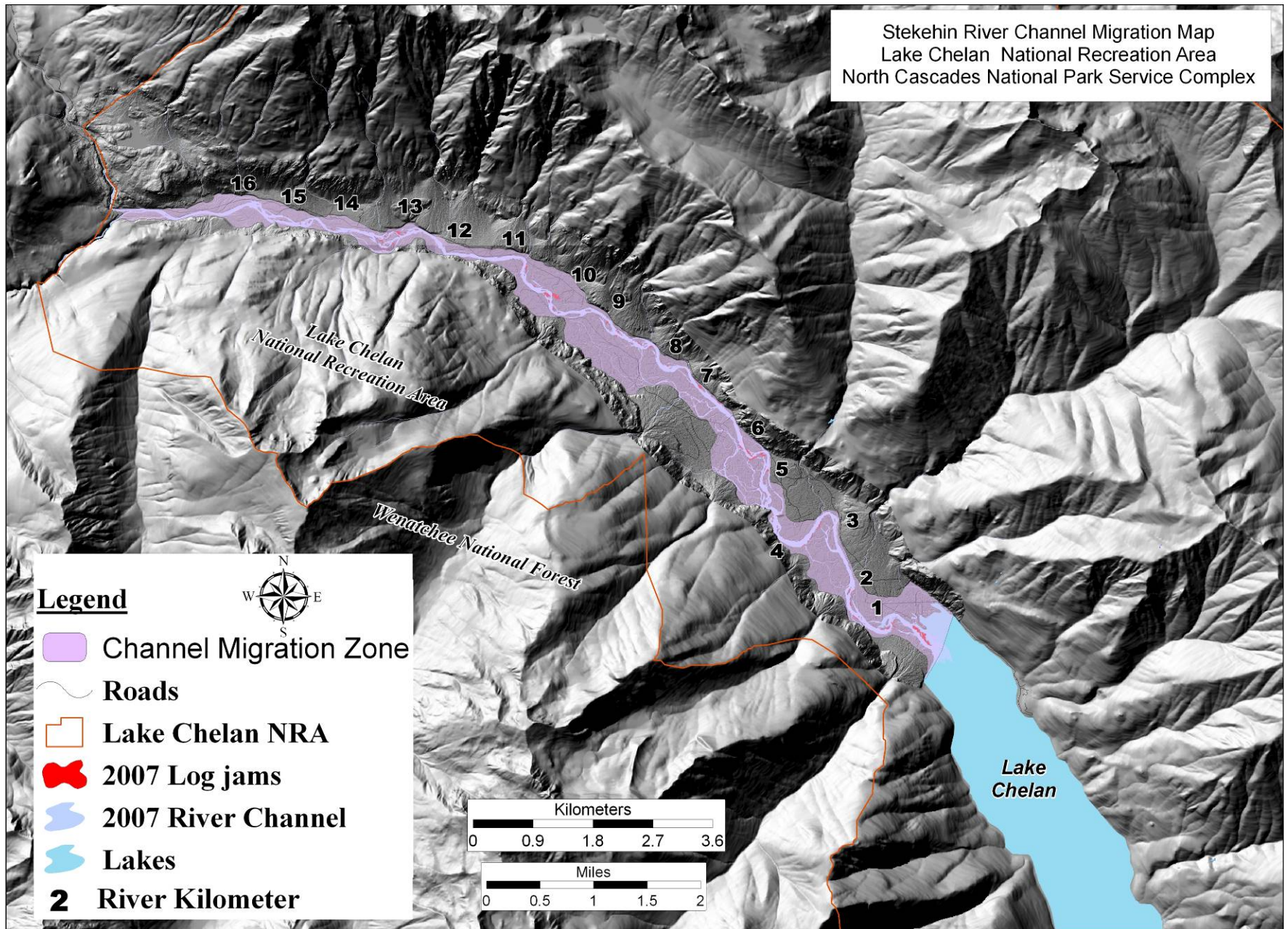


SRCIP Scope:

- Lower valley from Stehekin Valley Ranch to Lake Chelan.



Stehekin River Channel Migration Map
Lake Chelan National Recreation Area
North Cascades National Park Service Complex



SRCIP Purpose:

- Provide more detailed and updated guidance from 1995 GMP;**



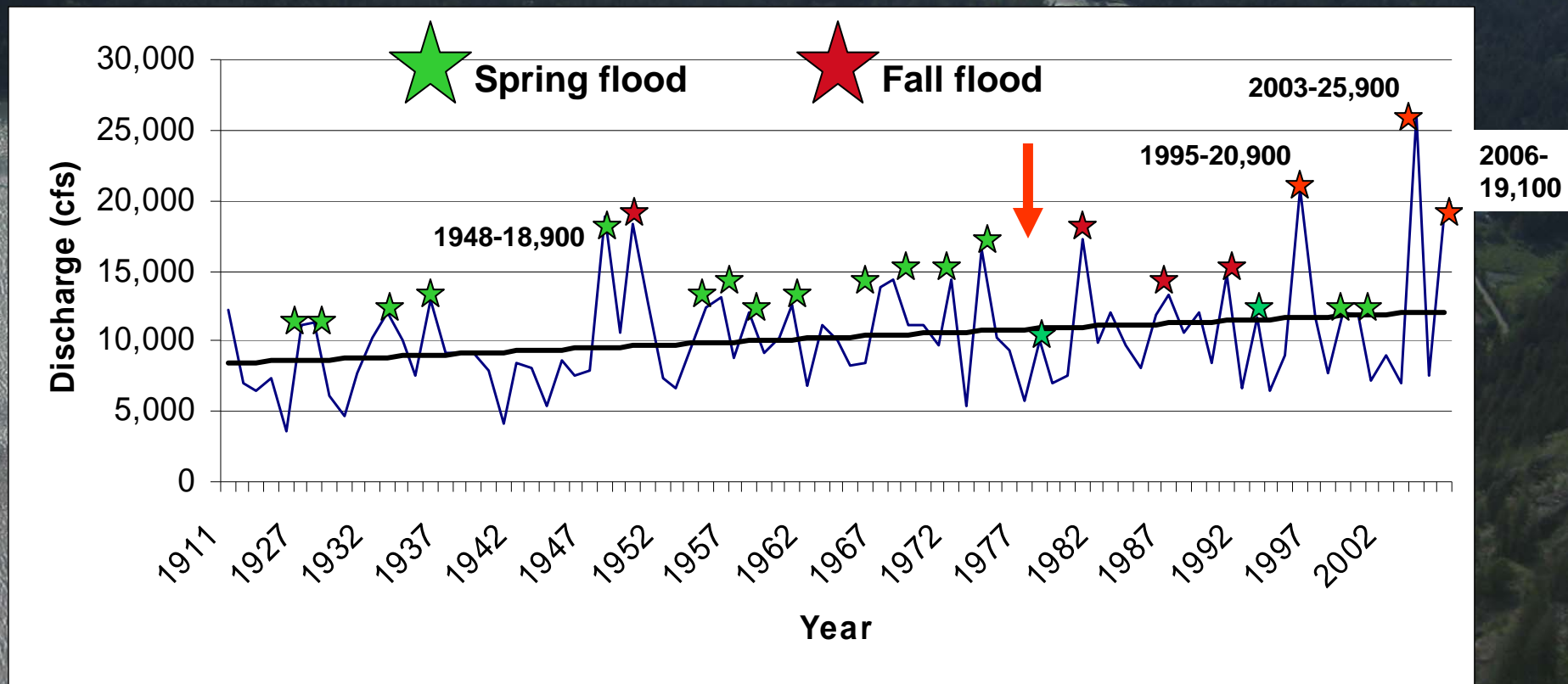
Needs:

- River channel and floodplain changes with passage of three 100 year or greater floods in 12 years.



Needs:

-Changes in the timing, magnitude and frequency of floods on the Stehekin River (sensitivity of Stehekin system to climate change).



Needs:

- **County Emergency Declarations, Army Corps of Engineers, and valley resident proposals.**
- **Assess cumulative impacts of river channelization structures**



Needs:

- Threats to Harlequin campgrounds, road system (**paving project**), and maintenance yard
- Removal of cabins in floodplain
- Limited land exchange portfolio



Challenges:

- **Two year schedule**
- **Flood management vs. erosion management**
- **High cost of river work**



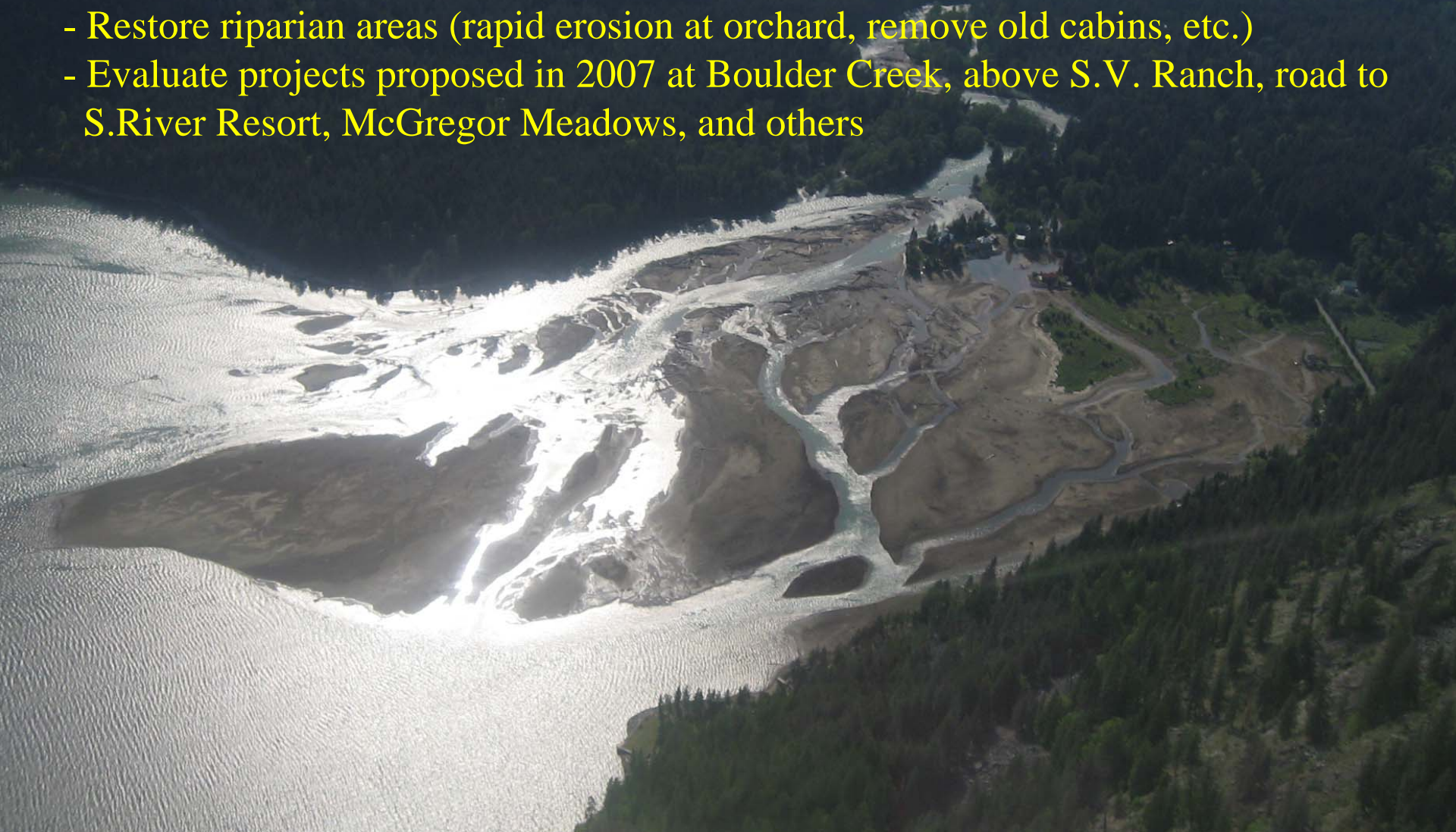
Challenges:

- **Massive logjams/ rapid wood accumulation**
- **Flood-prone river**
- **Long-term solutions (multiple land exchanges, road relocation)**



Primary Plan Elements:

- Reconfigure road system and pave road from Harlequin Bridge to S.V. Ranch
- Update Land Protection Plan – exchange land out of floodplain where possible
- Revisit GMP large wood management guidelines
- Move recreational facilities
- Restore riparian areas (rapid erosion at orchard, remove old cabins, etc.)
- Evaluate projects proposed in 2007 at Boulder Creek, above S.V. Ranch, road to S.River Resort, McGregor Meadows, and others



Planning Process:

PUBLIC/NPS identify
issues/actions winter 2008

NPS crafts
alternatives
(March 2008)

PUBLIC
REVIEW
summer 2008

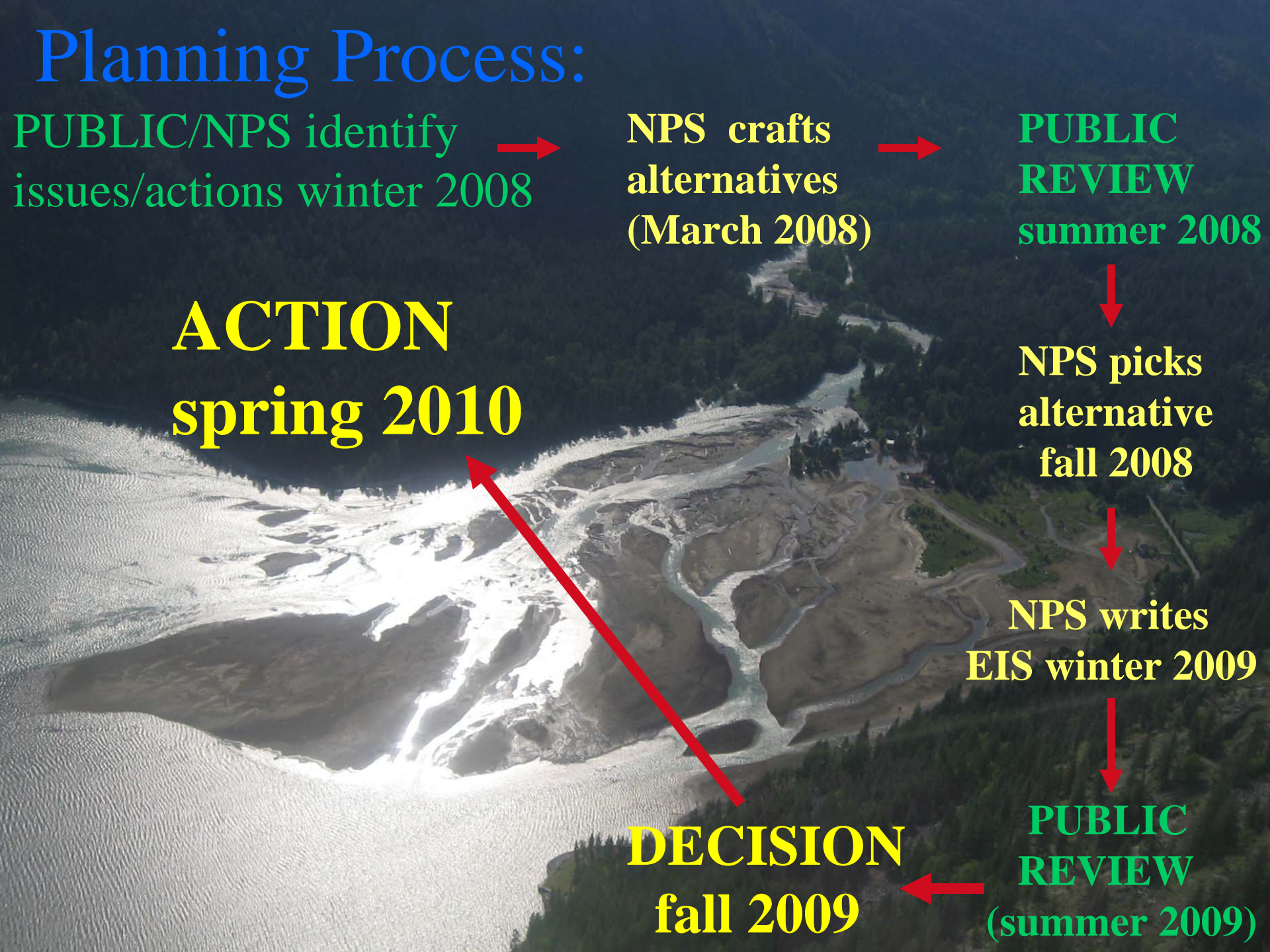
ACTION
spring 2010

NPS picks
alternative
fall 2008

NPS writes
EIS winter 2009

DECISION
fall 2009

PUBLIC
REVIEW
(summer 2009)



Technical Committee:

Jon Riedel NPS – NPS chair
Don Reichmuth – Geomax
Doug Weber – Army COE
Gina McCoy – WDFW
Bill Christman – Chelan PUD
David Morgan – USFWS
Patricia Olson – WDOE
Mike Kaputa – Chelan County



Land Protection Plan:

**Guides NPS land exchanges
and purchases**

**Based on priorities
(e.g. floodplain)**

Rigorous Review Process

Lengthy Compliance



Preliminary Stehekin River Corridor

Implementation Plan Issues:

- 1. Sustainability of public and administrative roads within the Lower Stehekin Valley.**
- 2. Possible relocation or modification of recreational and administrative facilities within the Lower Stehekin Valley.**
- 3. Updating the Lake Chelan Land Protection Plan**
.
- 4. Providing guidance for erosion and flood protection measures in the Lower Stehekin Valley, including management of large, woody debris and restoration of riparian areas.**

Current Information About the Stehekin River



Outline:

I – Watershed

II – Hydrology and Floods

III – Monitoring Large Wood and Gravel

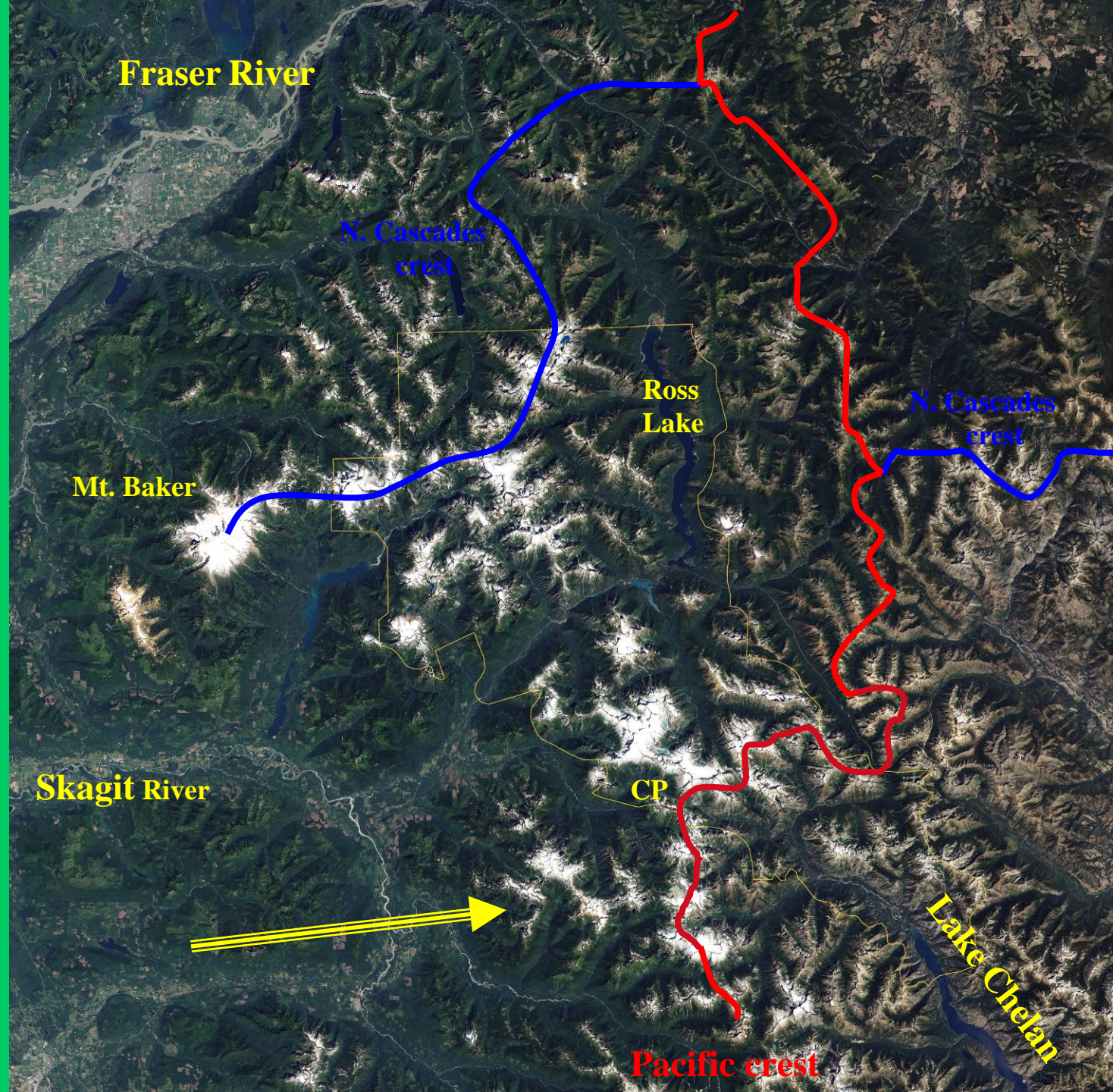
IV - Channel Changes

V – Problem Areas



I – Watershed





Fraser River

N. Cascades
crest

**Ross
Lake**

N. Cascades
crest

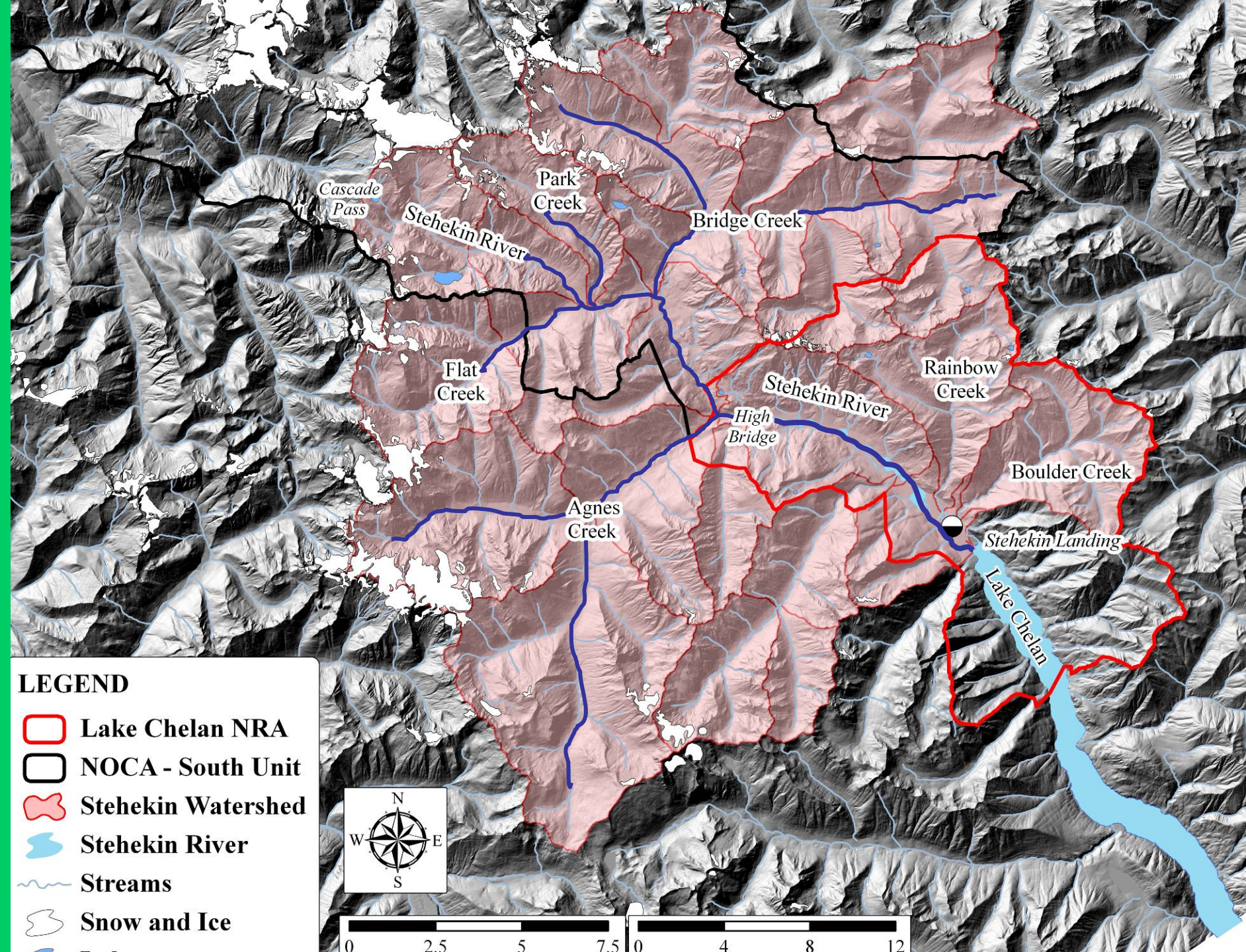
Mt. Baker

Skagit River

CP

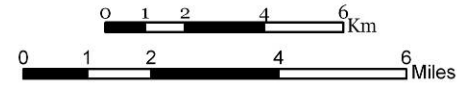
Lake Chelan

Pacific crest



Landforms of the Stehekin Watershed North Cascades National Park

DRAFT 12/11/2003



High Bridge

Legend

- | | |
|-----------------|----------------------------------|
| — STREAM | ● BEDROCK BENCH |
| ● LAKE | ● DEBRIS APRON |
| ● ALLUVIAL FAN | ● LITTLE ICE AGE MORaine |
| ● FAN TERRACE | ● PLEISTOCENE MORaine |
| ● TERRACE | ● MASS MOVEMENT-SLUMP |
| ● DEBRIS CONE | ● MASS MOVEMENT-FALL/TOPPLE |
| ● RIVER CANYON | ● MASS MOVEMENT-DEBRIS TORRENT |
| ● FLOOD PLAIN | ● MASS MOVEMENT-DEBRIS AVALANCHE |
| ● VALLEY BOTTOM | ○ UNDIFFERENTIATED |

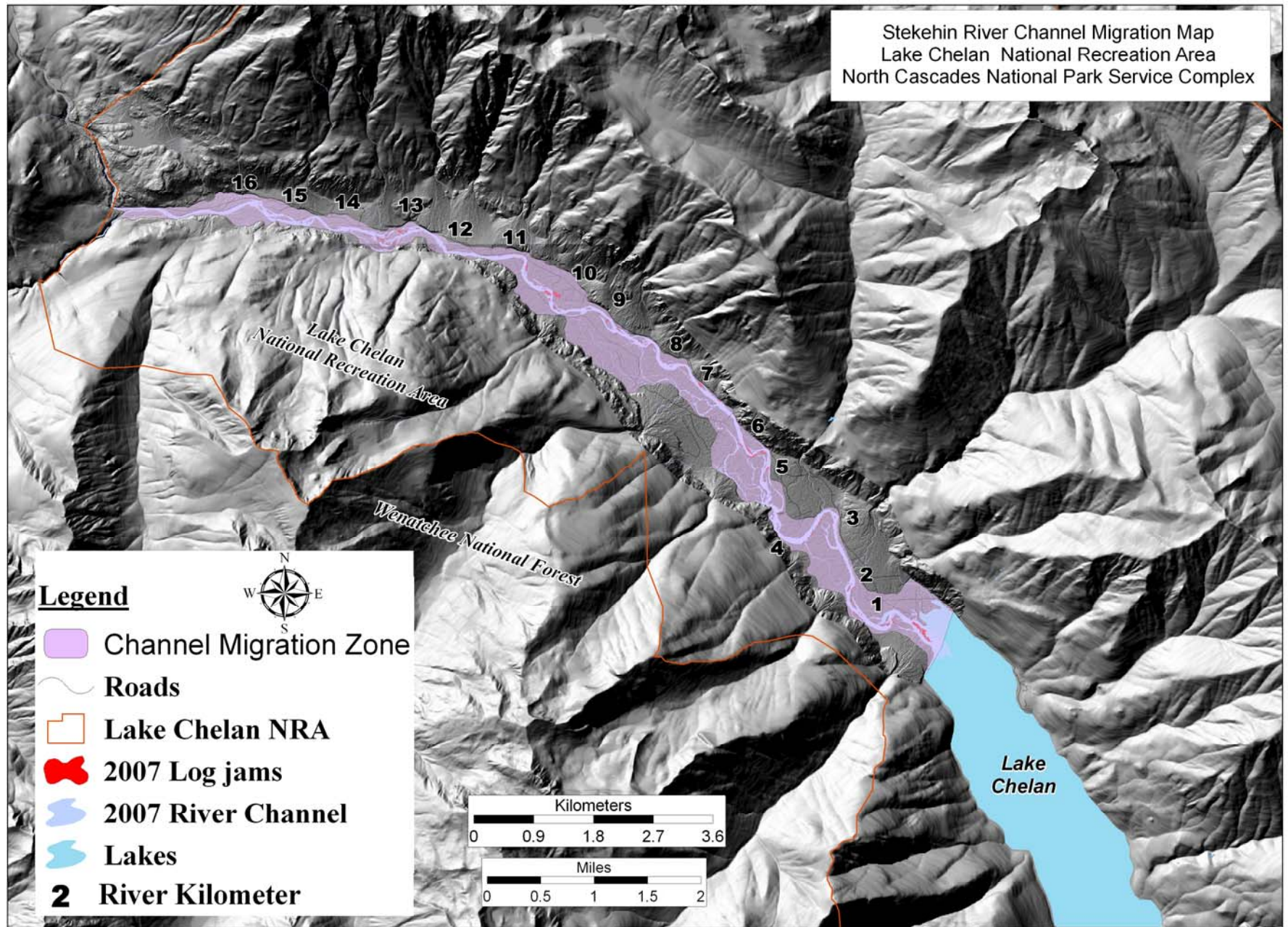
Lake Chelan



**Stehekin Gorge
at Tumwater Bridge**



Stehekin River Channel Migration Map
Lake Chelan National Recreation Area
North Cascades National Park Service Complex

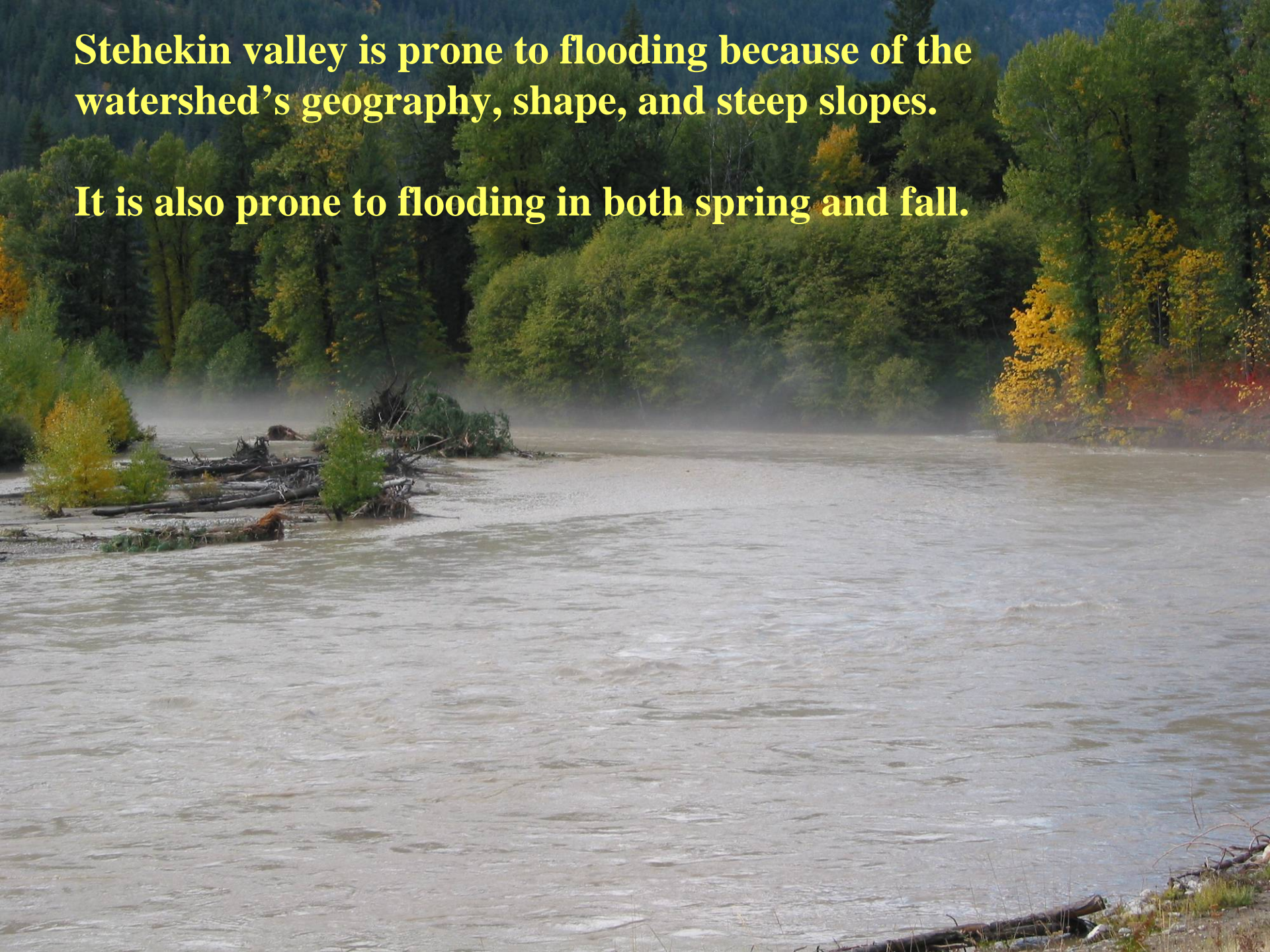


II – Hydrology and Flooding on the Stehekin River



Stehekin valley is prone to flooding because of the watershed's geography, shape, and steep slopes.

It is also prone to flooding in both spring and fall.



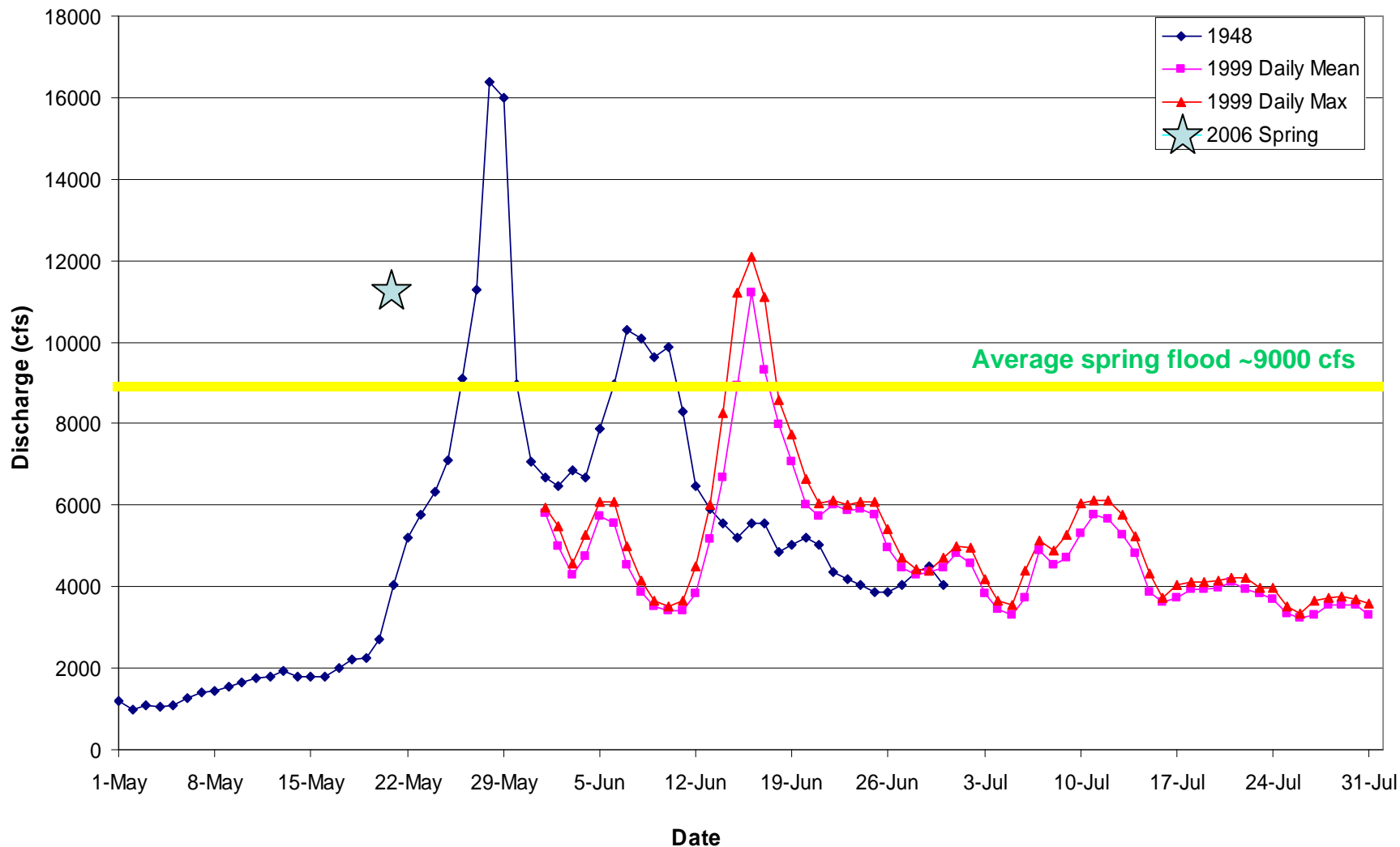
Chronology and features of the ten largest floods on the Stehekin River.

<u>Date</u>	<u>Flood type</u>	<u>Discharge cfs</u>	<u>Recurrence Interval</u>
October 20, 2003	intense rainfall	25,900*	>100 years
November 29, 1995	rain on snow	20,900	100 years
November 7, 2006	rain on snow	19,100	100 years
May 29, 1948	snow melt	18,900	100 years
November 7, 1948	rain on snow	18,400	50-100 years
December 26, 1980	rain on snow	17,300	50 years
June 16, 1974	snow melt	16,600	25 years
June 2, 1968	snow melt	14,400	10 years
June 10, 1972	snow melt	14,400	10 years
June 21, 1967	snow melt	13,900	10 years

* flood discharge an estimate due to gage malfunction

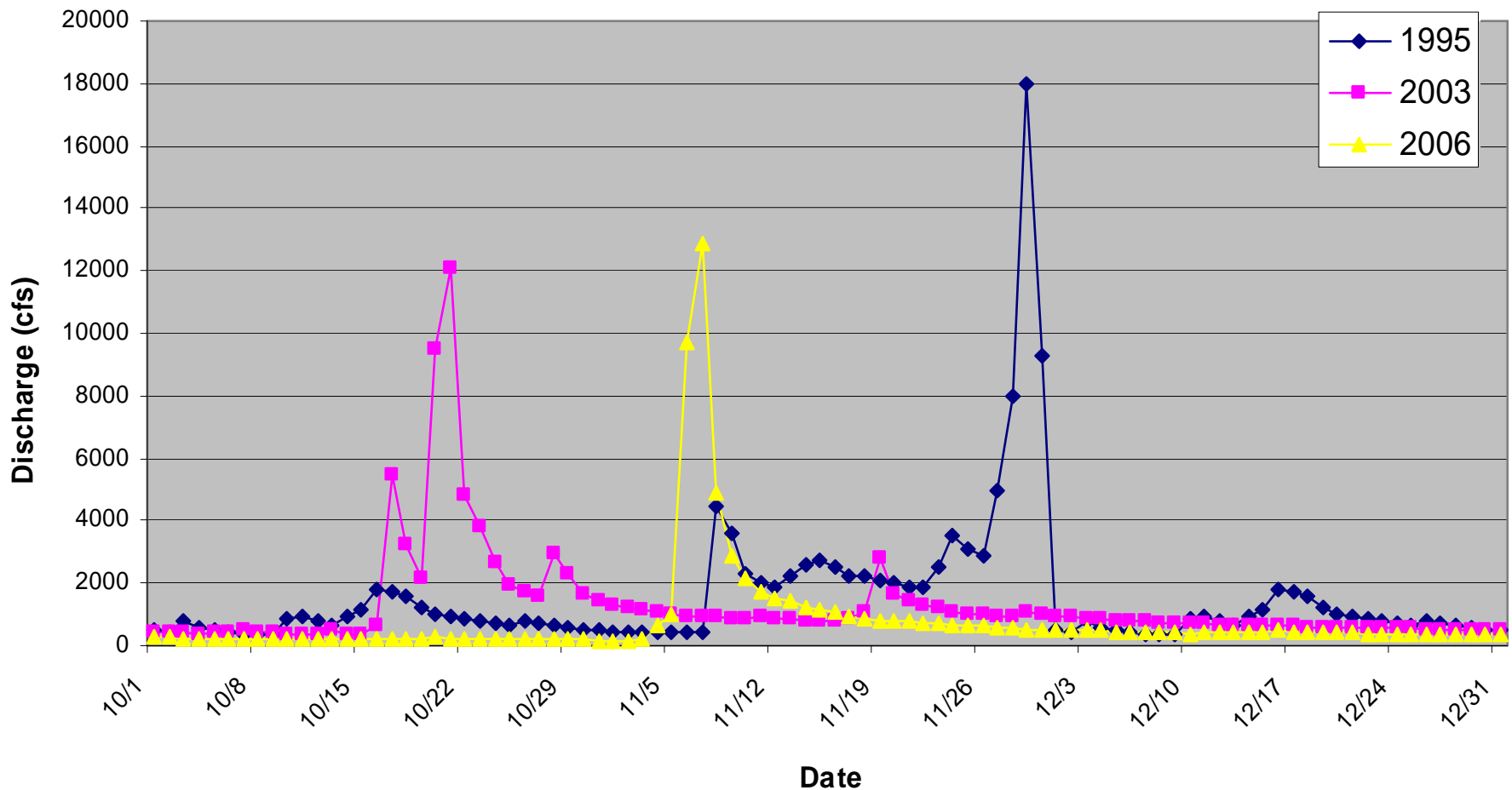
Spring Flood Hydrographs, Stehekin River, WA 1948, 1999, and 2006

Daily Mean Discharge

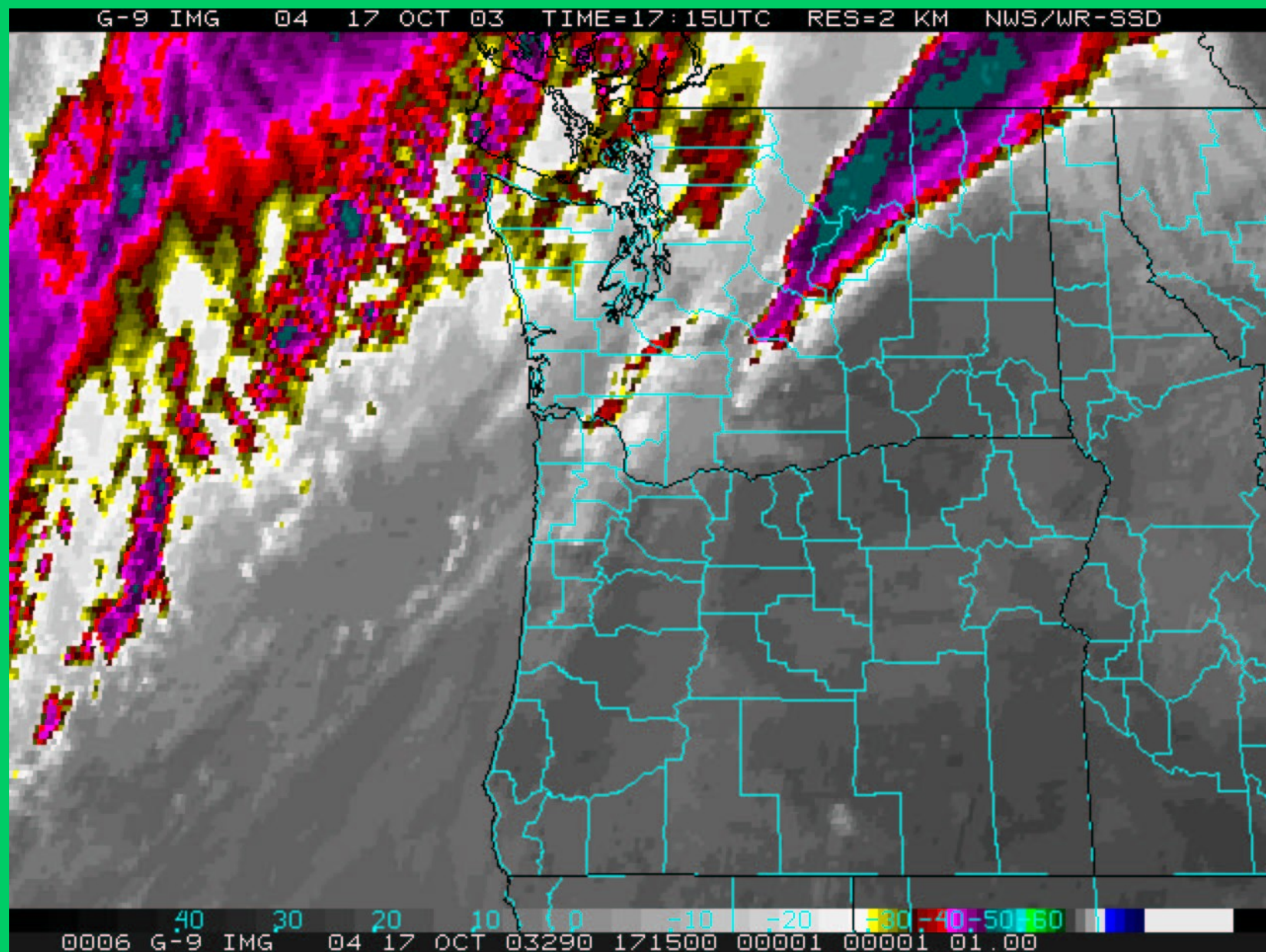


Fall Rain on Snow Event Flood Hydrographs, Stehekin River, WA

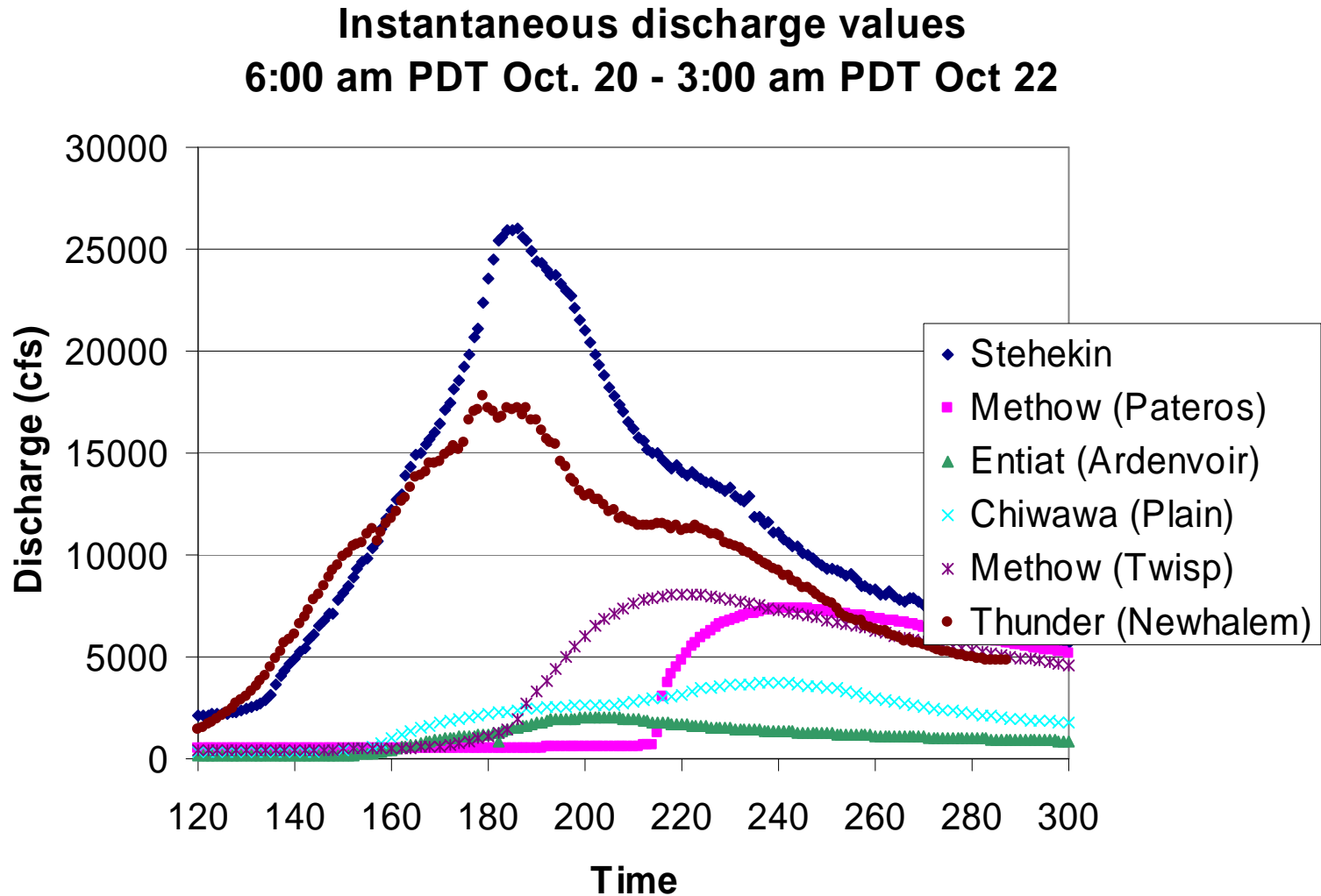
1995, 2003 and 2006 Mean Daily Discharge



Satellite (IR) views of October 17 and 20, 2003 storms



Comparison of 2003 flood size between six north-central Washington Rivers



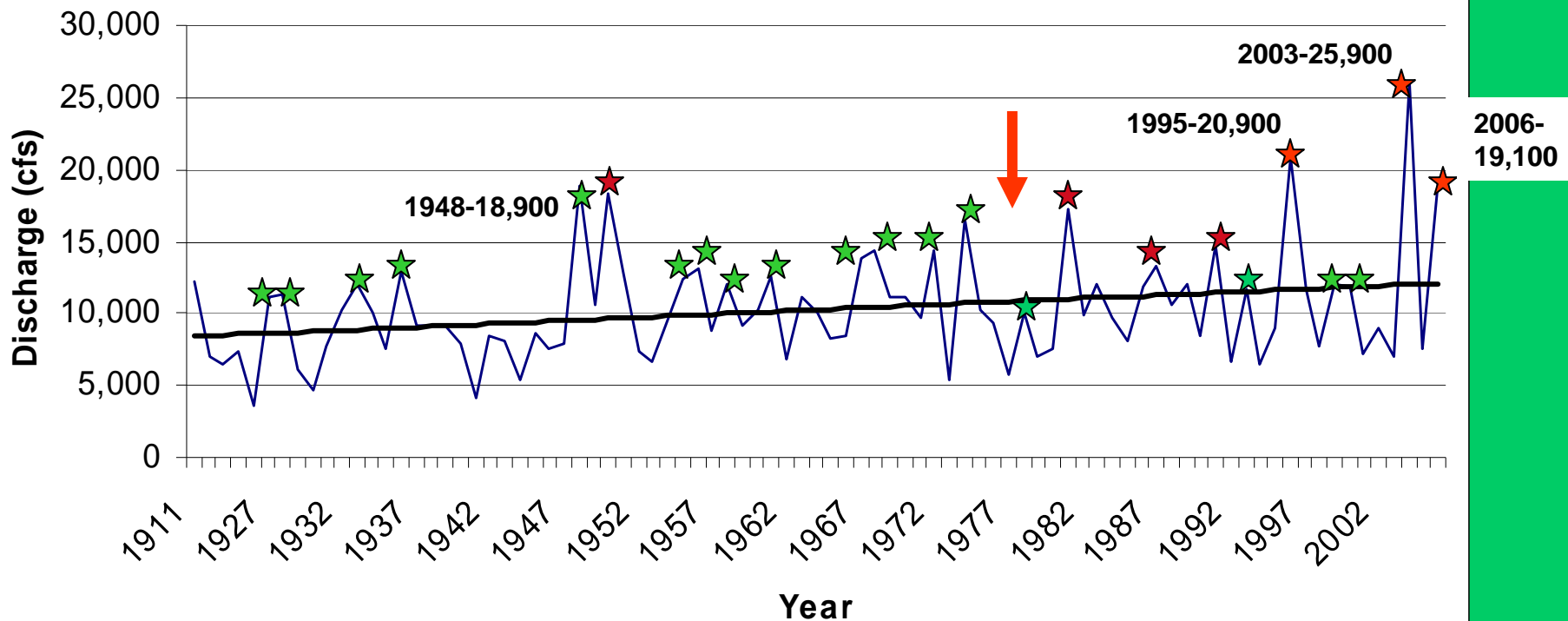
Stehekin River Flood History



Spring flood



Fall flood



Changes in peak discharge on the Stehekin River gage 12451000.

Inclusion of the 2003 and 2006 flood data (A) results in a significant increase in base flood discharge.

site	river mile	drainage area (miles ²)	PEAK DISCHARGE (cfs)			
			small floods-----big floods			
(A) 1927-2007	0	344	14,950	19,490	21,400	25,850
(B) 1927-1996	0	344	14,400	17,900	19,200	22,100
Orchard	2	308	--	16,500	17,700	20,300
Company Cr.	4.5	277	--	15,200	16,300	18,800
Lower Field	6.7	256	--	13,920	14,928	17,217

III – Gravel, Large Woody Debris, and Channel Changes



Stehekin River Sediment Yield

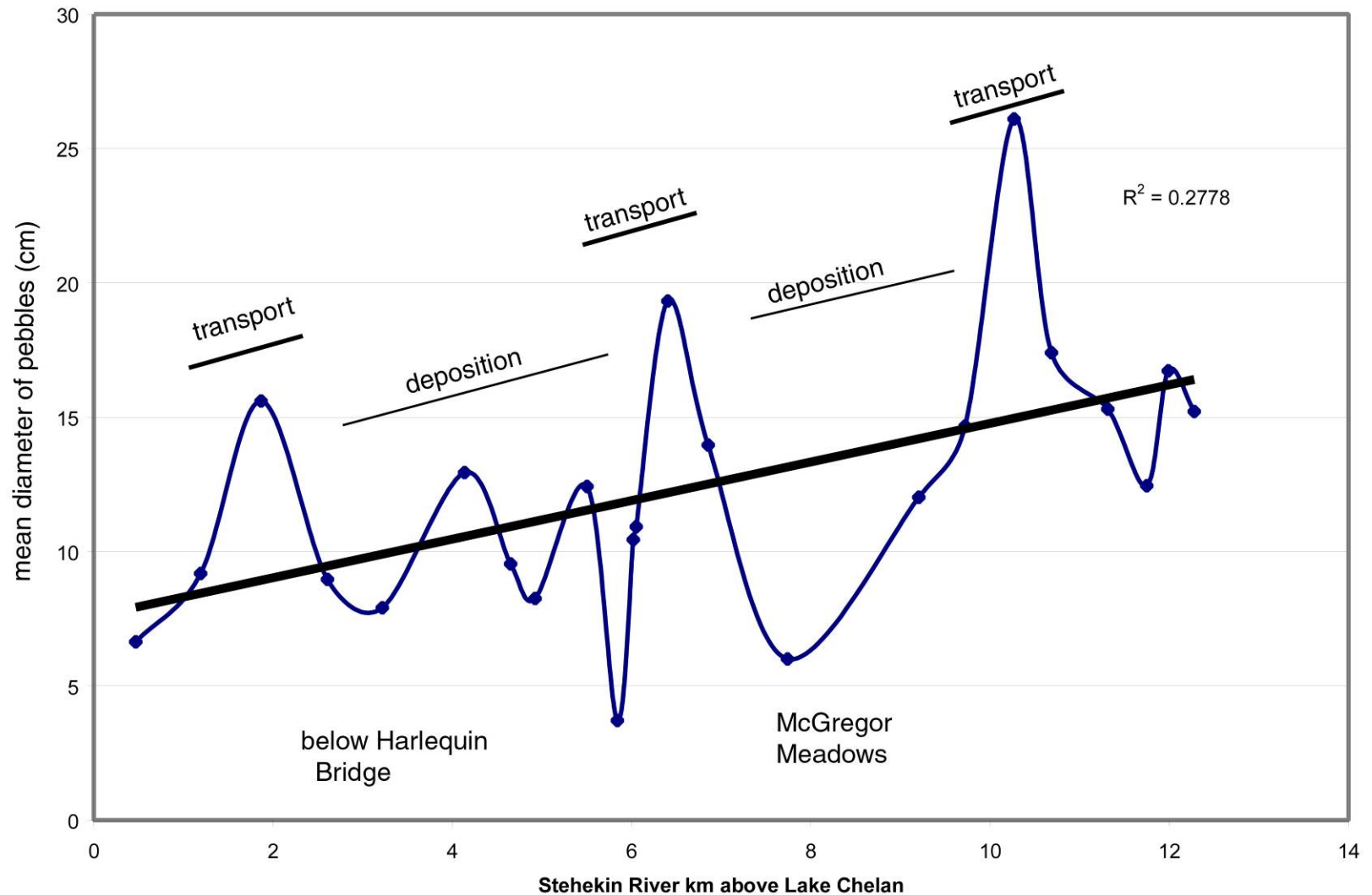
- Multiple sources, including landslides, bank erosion, gravel bars, tributaries, and glaciers.



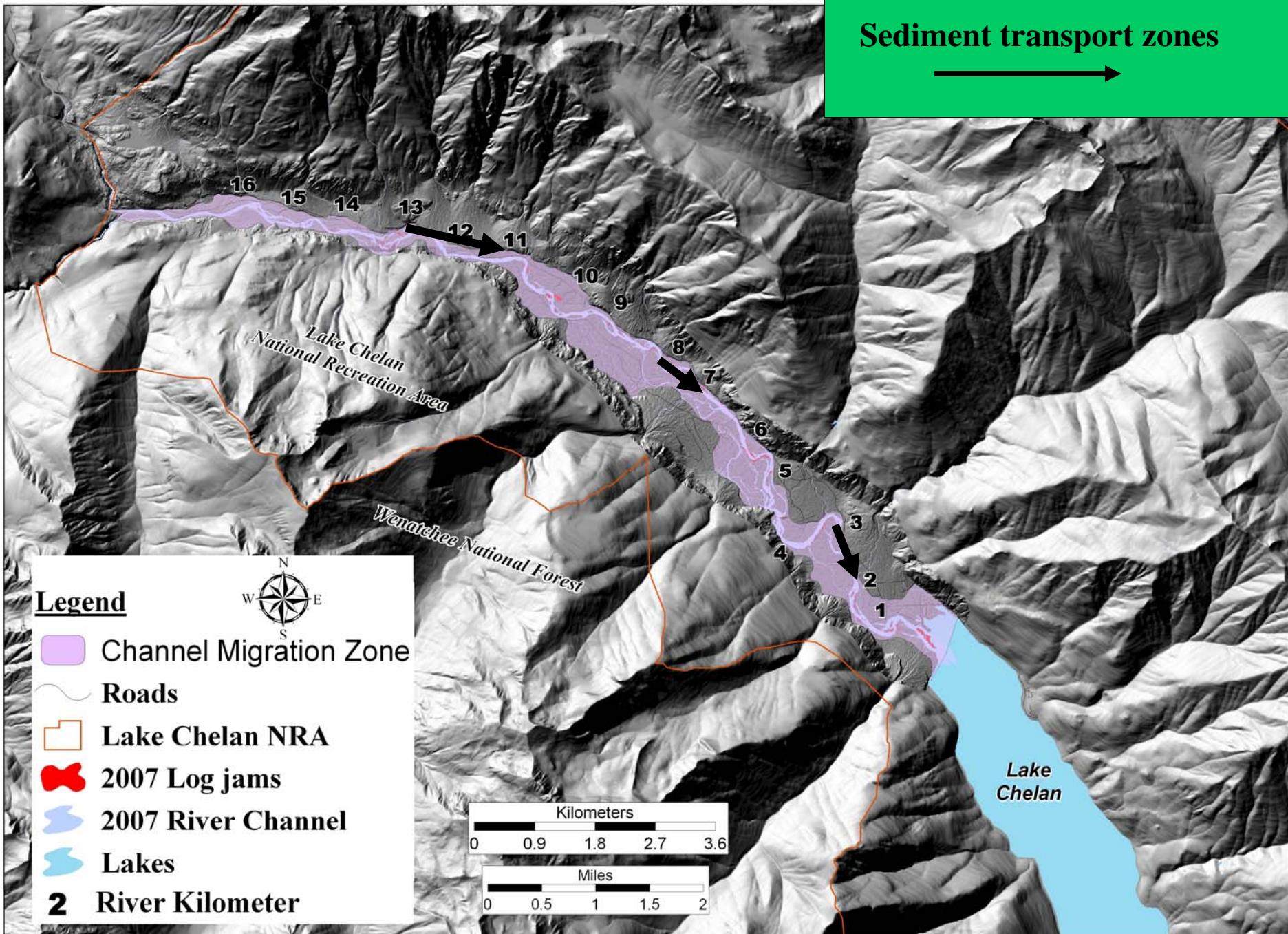
Estimating Stehekin River Sediment Yield

- 1 -Delta has grown from Buckner Orchard
to near the landing in past 9,000 years,
and it is about 250 ft. thick
= 25,000 cubic yards/year for this period.
- 2 - Nelson (USGS 1974) measured suspended load
= 19,400 cubic yards/year.
- 3 -25,000 – 19,400 = 5,600 cubic yards/year gravel*.

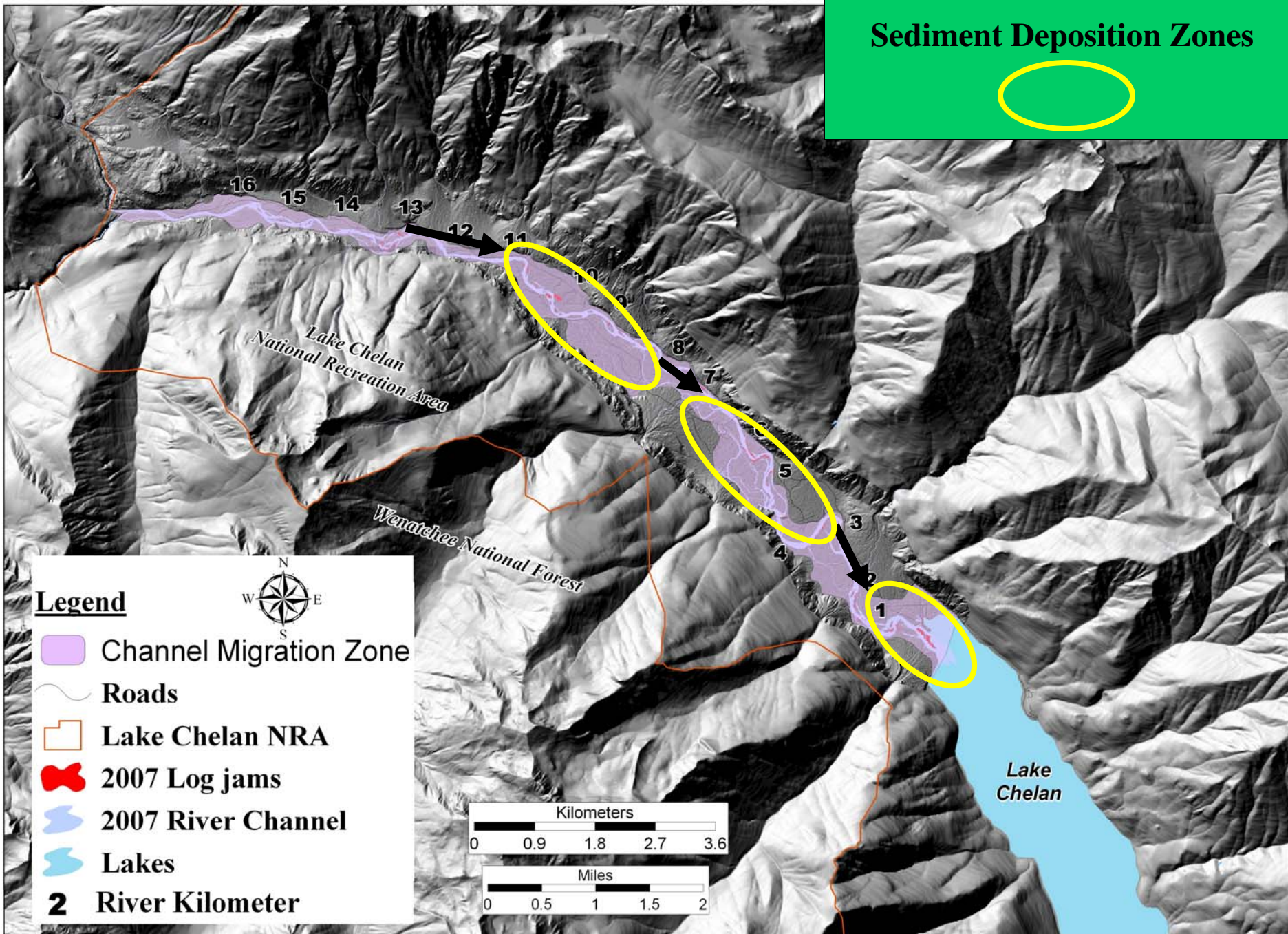
Changes in Gravel Size Along Lower Stehekin River



Sediment transport zones



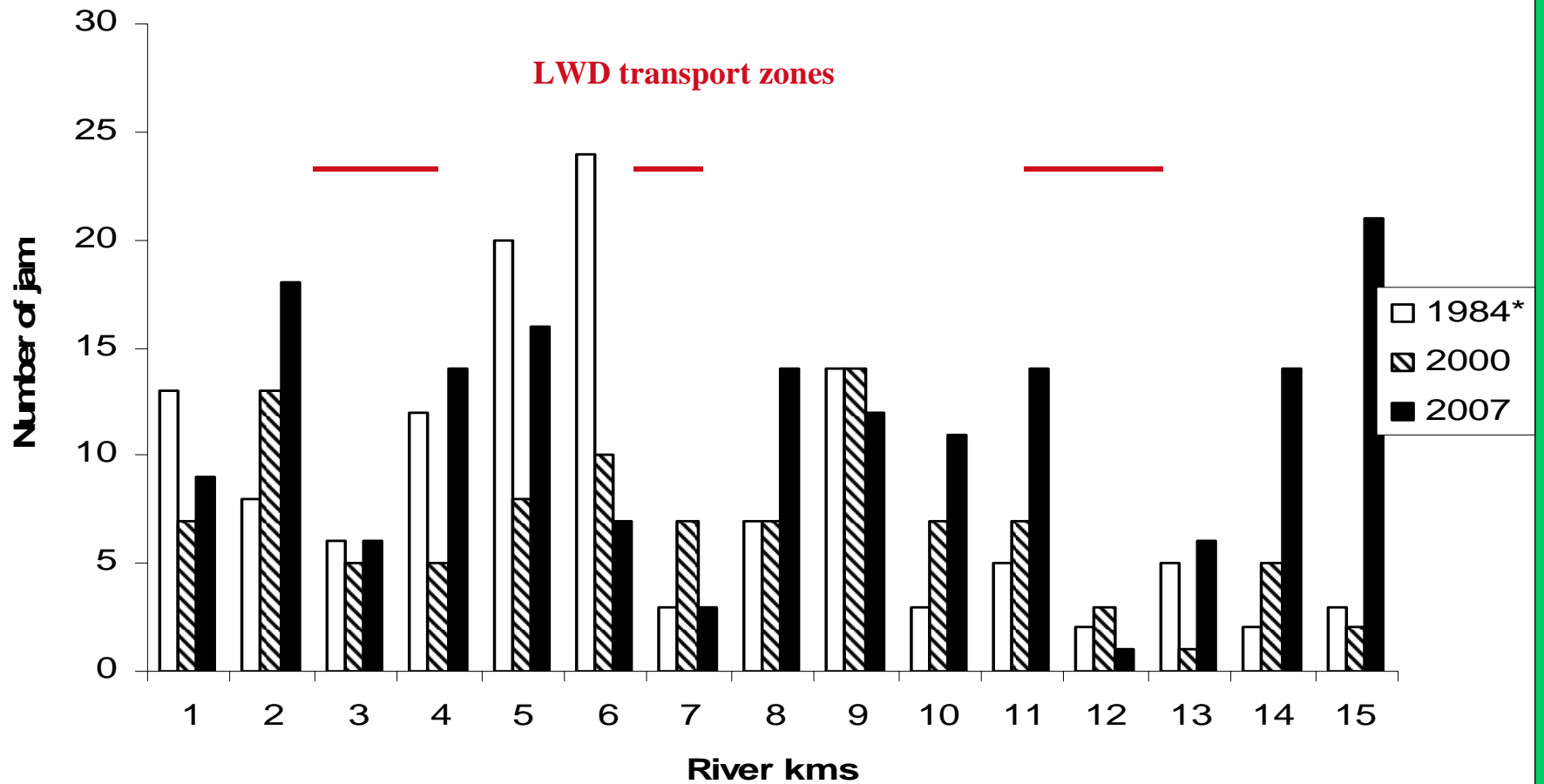
Sediment Deposition Zones



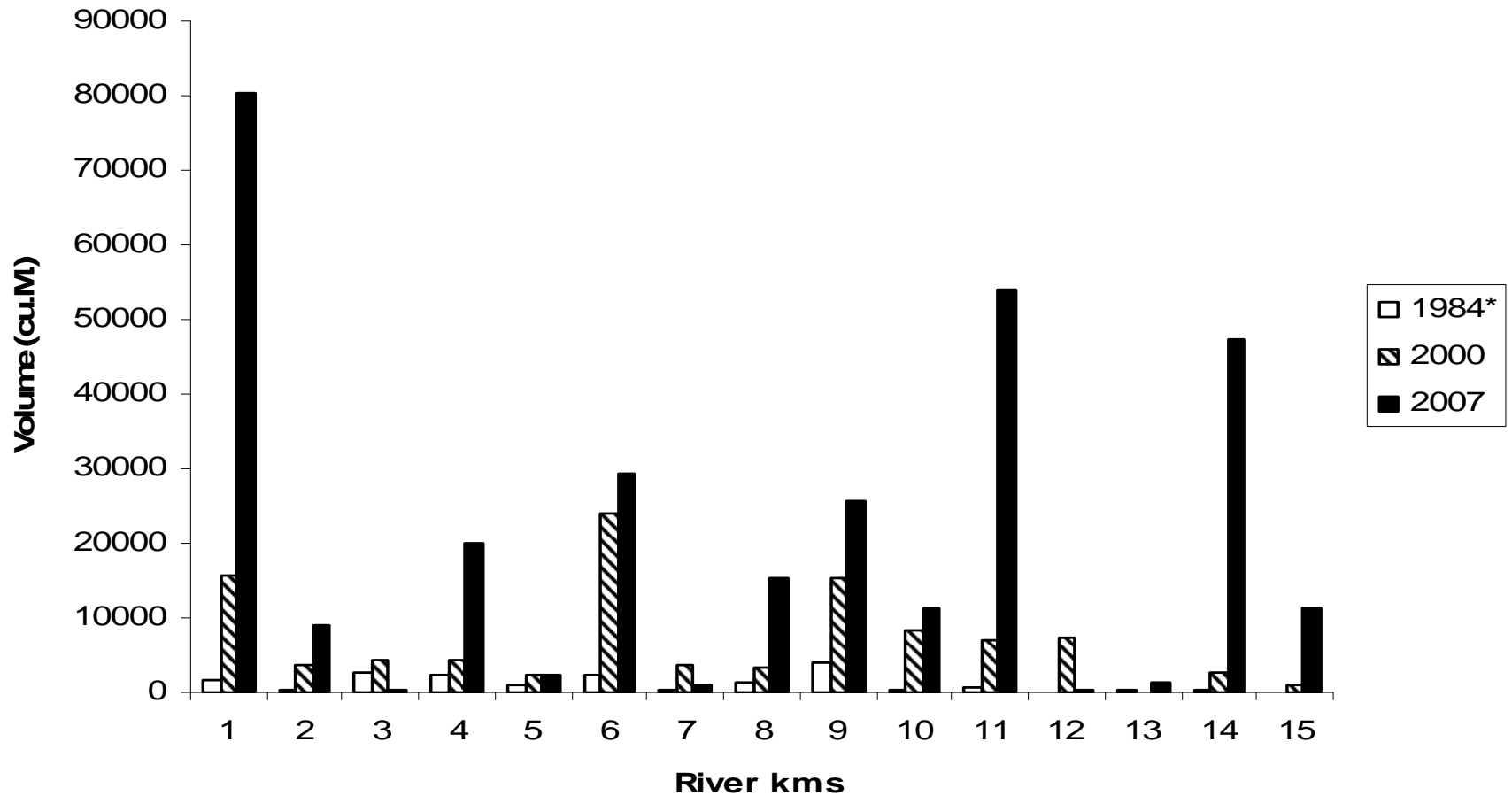
Accumulation of Large Woody Debris on the lower Stehekin River



Comparison of number of jams per km



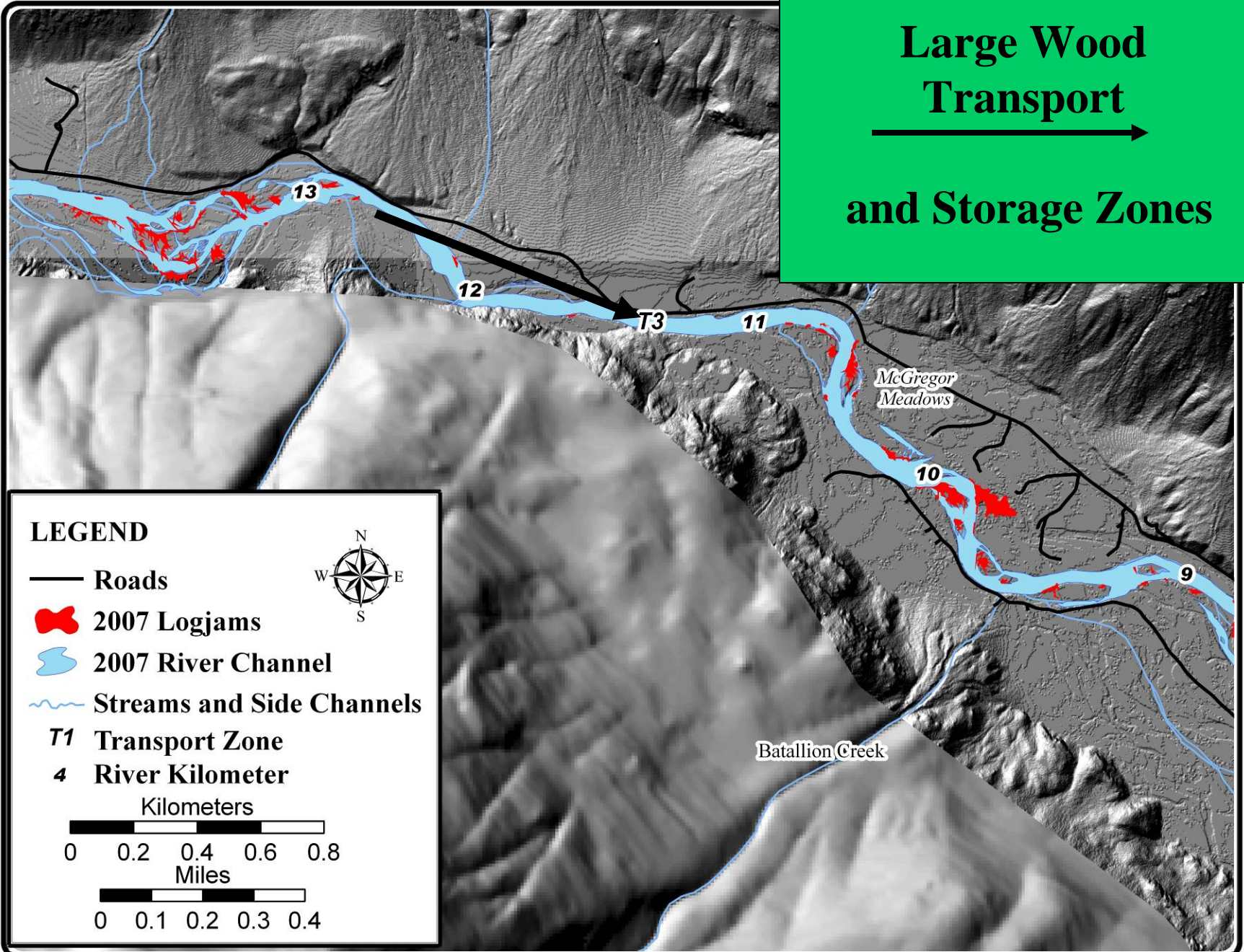
Comparison of jam volume per river km.



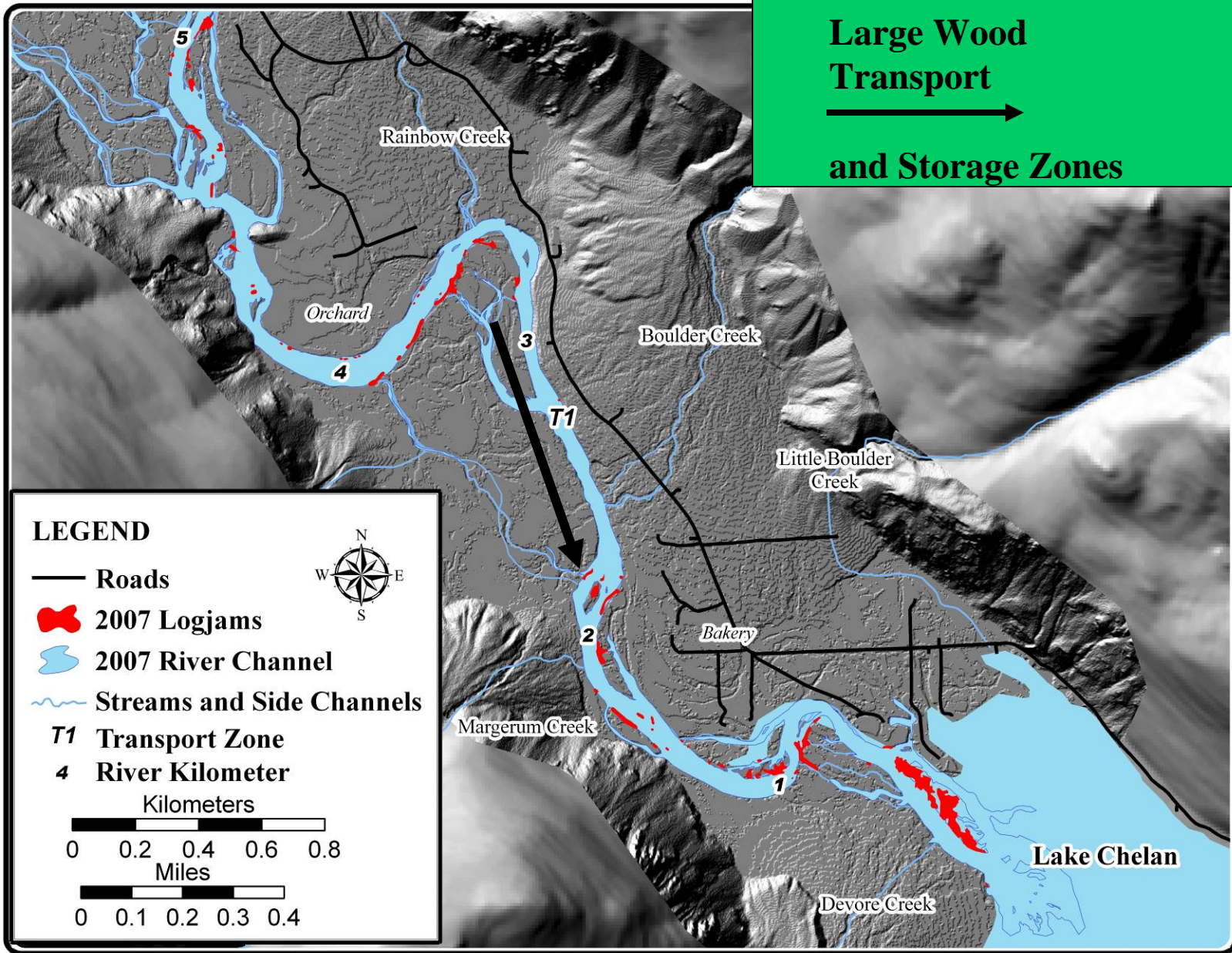
Potential Management Actions may include combinations of the following or other actions identified during the planning process. All proposed actions will follow existing laws, regulations, and policies, as well as identify sources of funding and responsible parties.

- Install bank erosion to protect Stehekin Valley Road on a case-by-case basis, or, relocate parts of the public road system from the floodplain.
- Respond to requests from private landowners regarding appropriate actions to take to evade the consequence of flooding.
- Evaluate the suitability of lands for exchange as requests for exchange are made or as the NPS acquires new land.
- Use new floodplain mapping to identify new threats to private and public structures.
- Update the Land Protection Plan to identify potential new exchange lands outside the floodplain.
- Use new floodplain mapping to identify what lands can be managed sustainably under existing conditions (with structures and facilities).
- Continue research to determine the efficacy of long-term bank stabilization (erosion protection) measures.
- Analyze stability and effect of log jams to determine if limited manipulation would protect certain areas from major flood and erosion damage.
- Remove derelict structures, debris piles, non native plants, and some facilities from the floodplain.
- Restore native riparian vegetation in developed areas to slow channel migration and improve the biological integrity of the riparian zone.
- Accept some facilities in the floodplain.

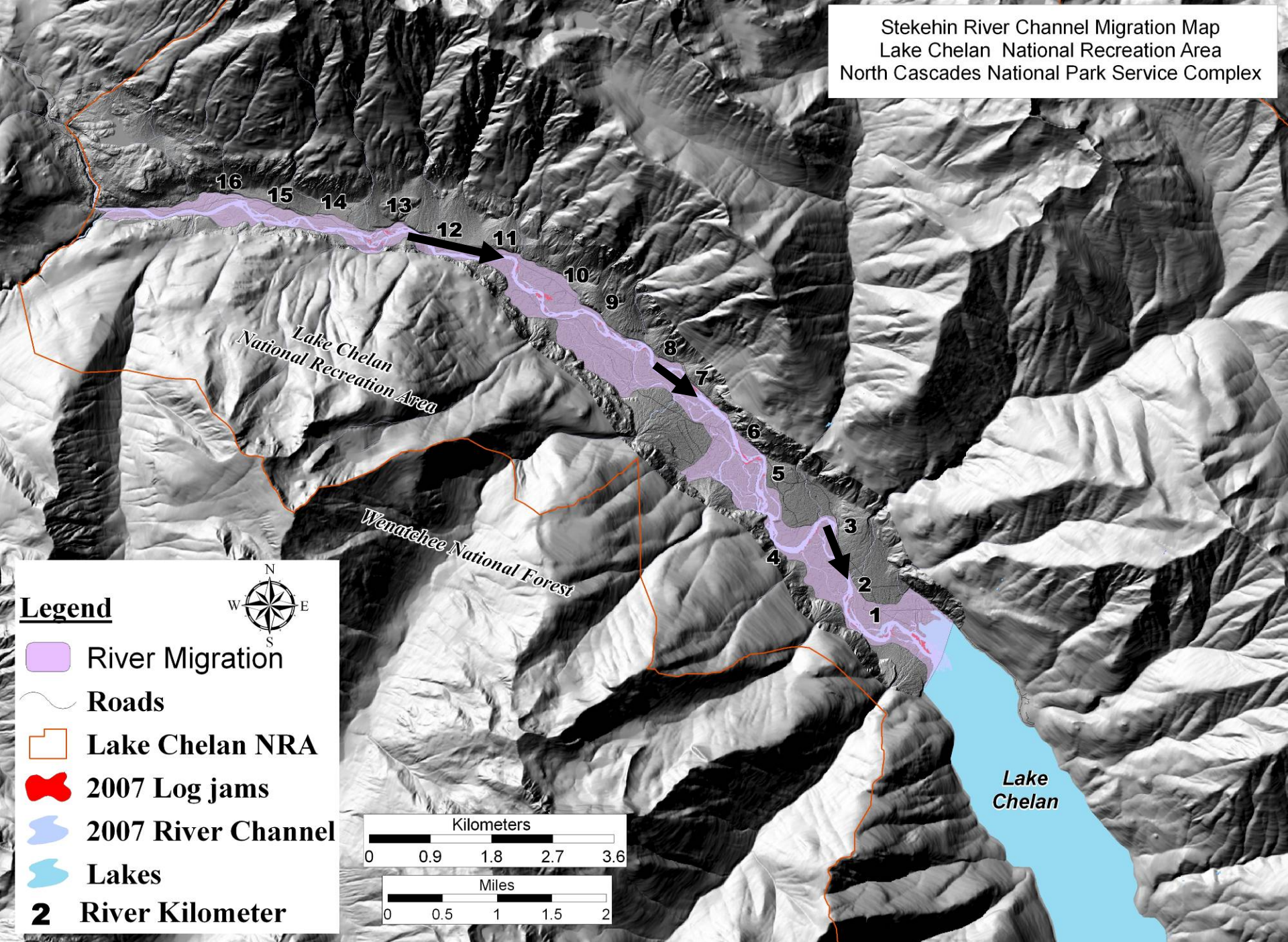
Large Wood Transport and Storage Zones



Large Wood Transport and Storage Zones



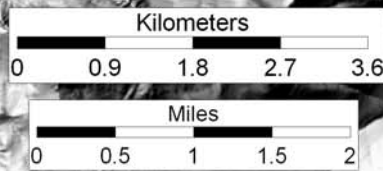
Stekehin River Channel Migration Map
Lake Chelan National Recreation Area
North Cascades National Park Service Complex



Stekehin River Channel Migration Map
Lake Chelan National Recreation Area
North Cascades National Park Service Complex

Legend

-  Channel Migration Zone
-  Roads
-  Lake Chelan NRA
-  2007 Log jams
-  2007 River Channel
-  Lakes
-  2 River Kilometer



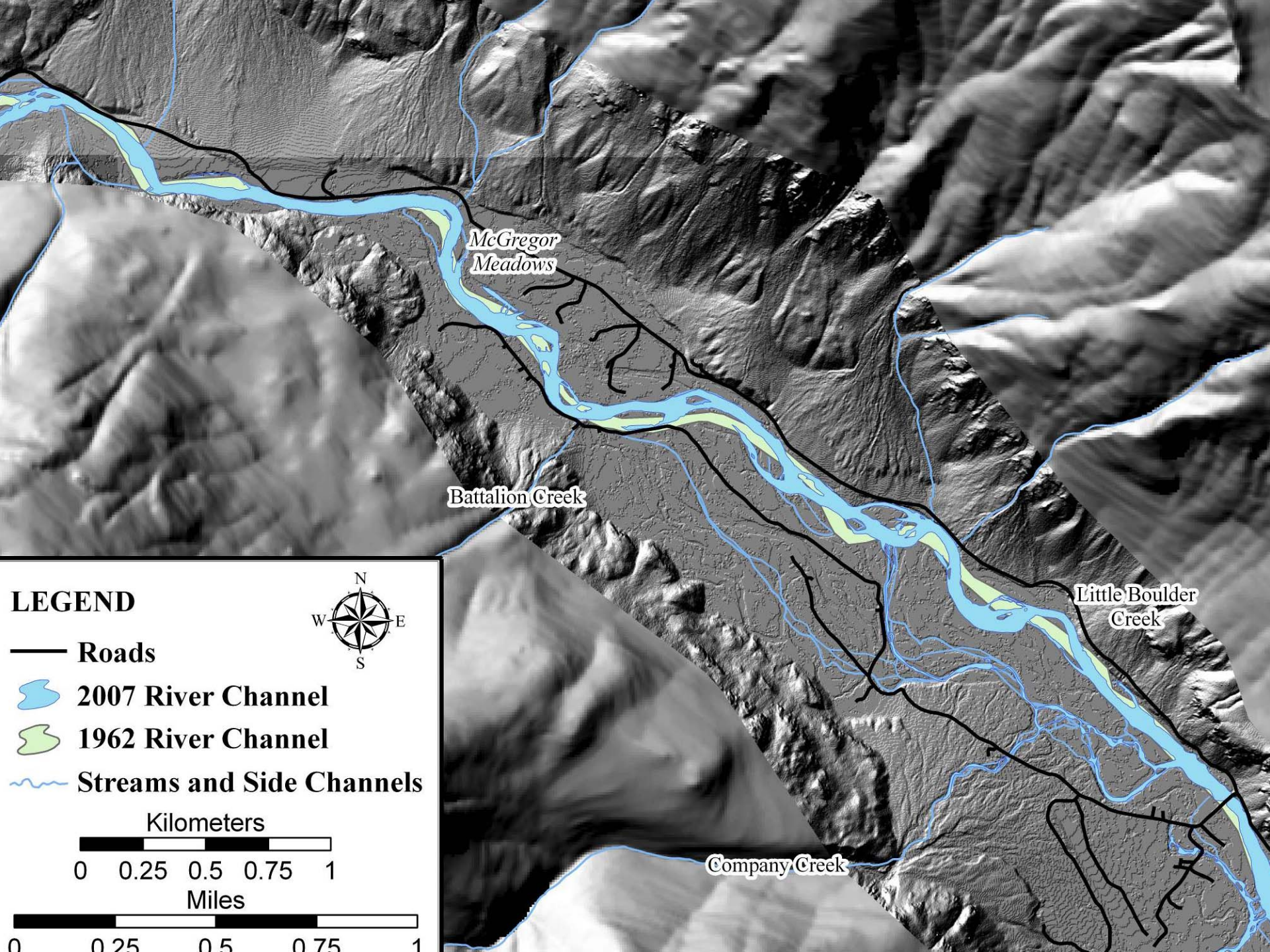
Lake Chelan
National Recreation Area

Wenatchee National Forest

Lake Chelan

IV – Channel Changes





McGregor
Meadows

Battalion Creek

Little Boulder
Creek

Company Creek

LEGEND

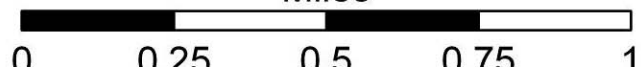
- Roads
- 2007 River Channel
- 1962 River Channel
- Streams and Side Channels

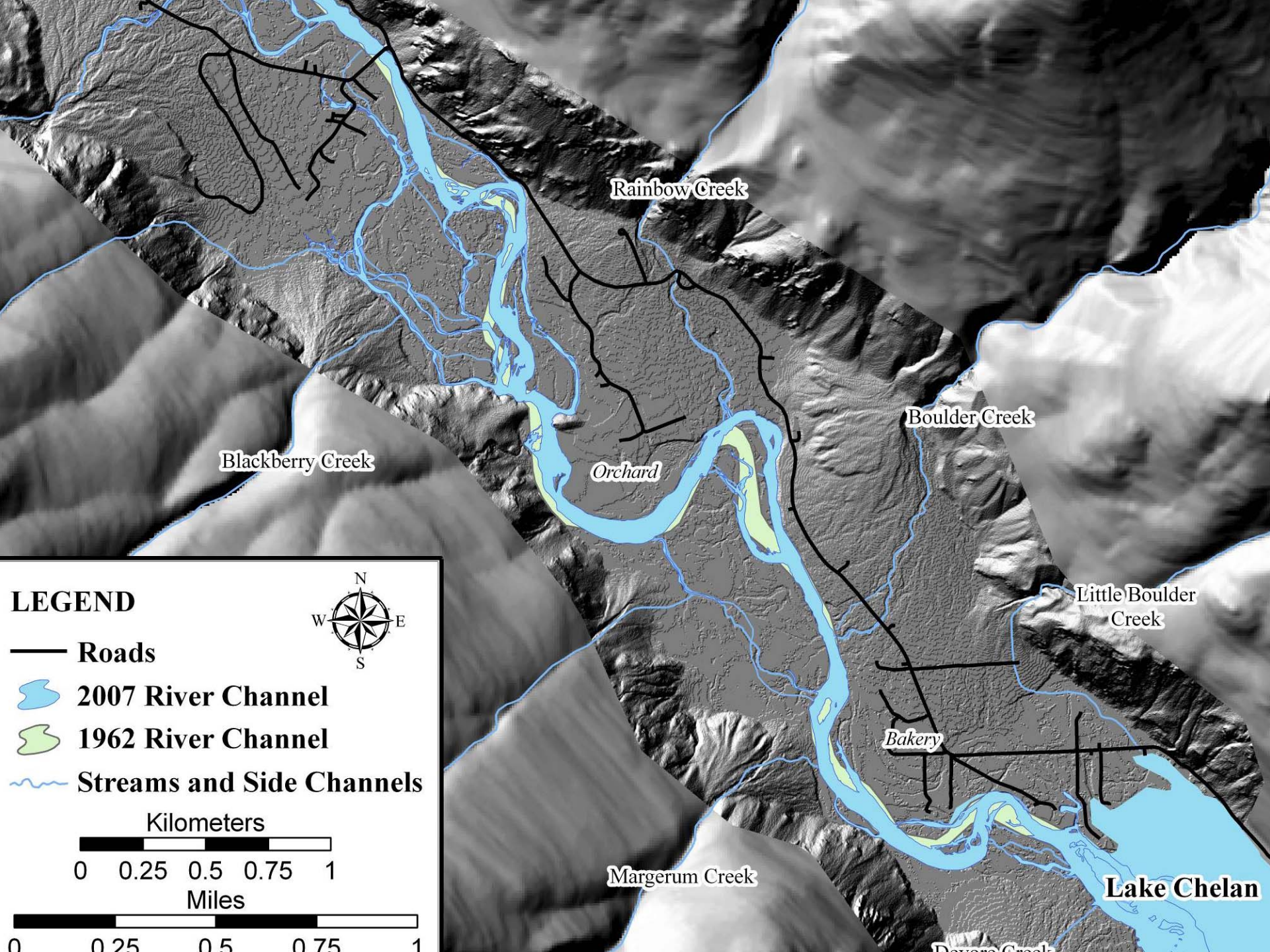


Kilometers



Miles





Rainbow Creek

Boulder Creek

Blackberry Creek

Orchard

Little Boulder
Creek

Bakery

Margerum Creek

Lake Chelan

Devore Creek

LEGEND



— Roads

2007 River Channel

1962 River Channel

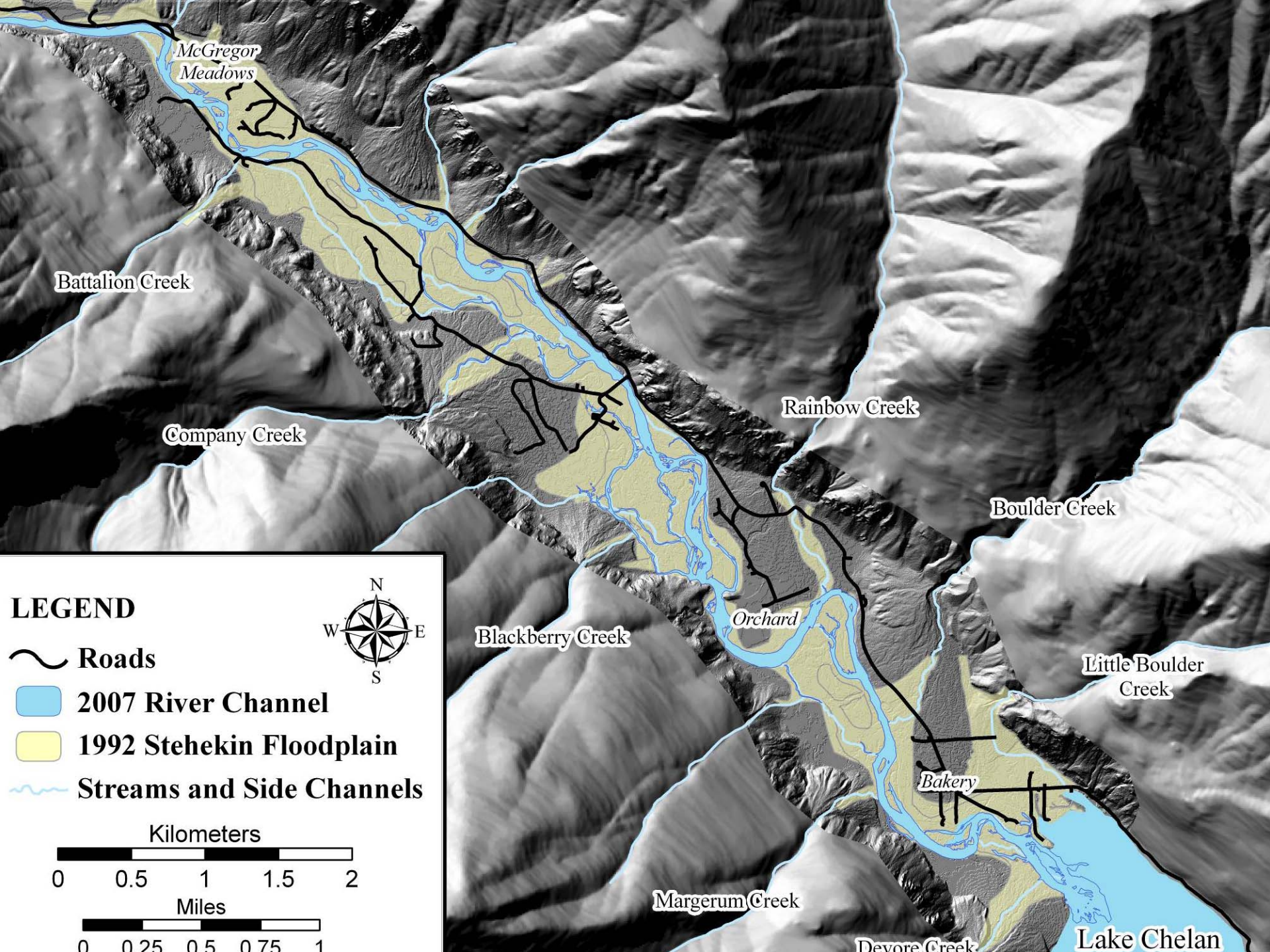
Streams and Side Channels

Kilometers

0 0.25 0.5 0.75 1

Miles

0 0.25 0.5 0.75 1



McGregor
Meadows

Battalion Creek

Company Creek

Rainbow Creek

Boulder Creek

Little Boulder
Creek

Blackberry Creek

Orchard

Baker

Margerum Creek

Devore Creek

Lake Chelan

LEGEND

~ Roads

2007 River Channel

1992 Stehekin Floodplain

Streams and Side Channels



Kilometers



0 0.5 1 1.5 2

Miles



0 0.25 0.5 0.75 1

McGregor Meadows



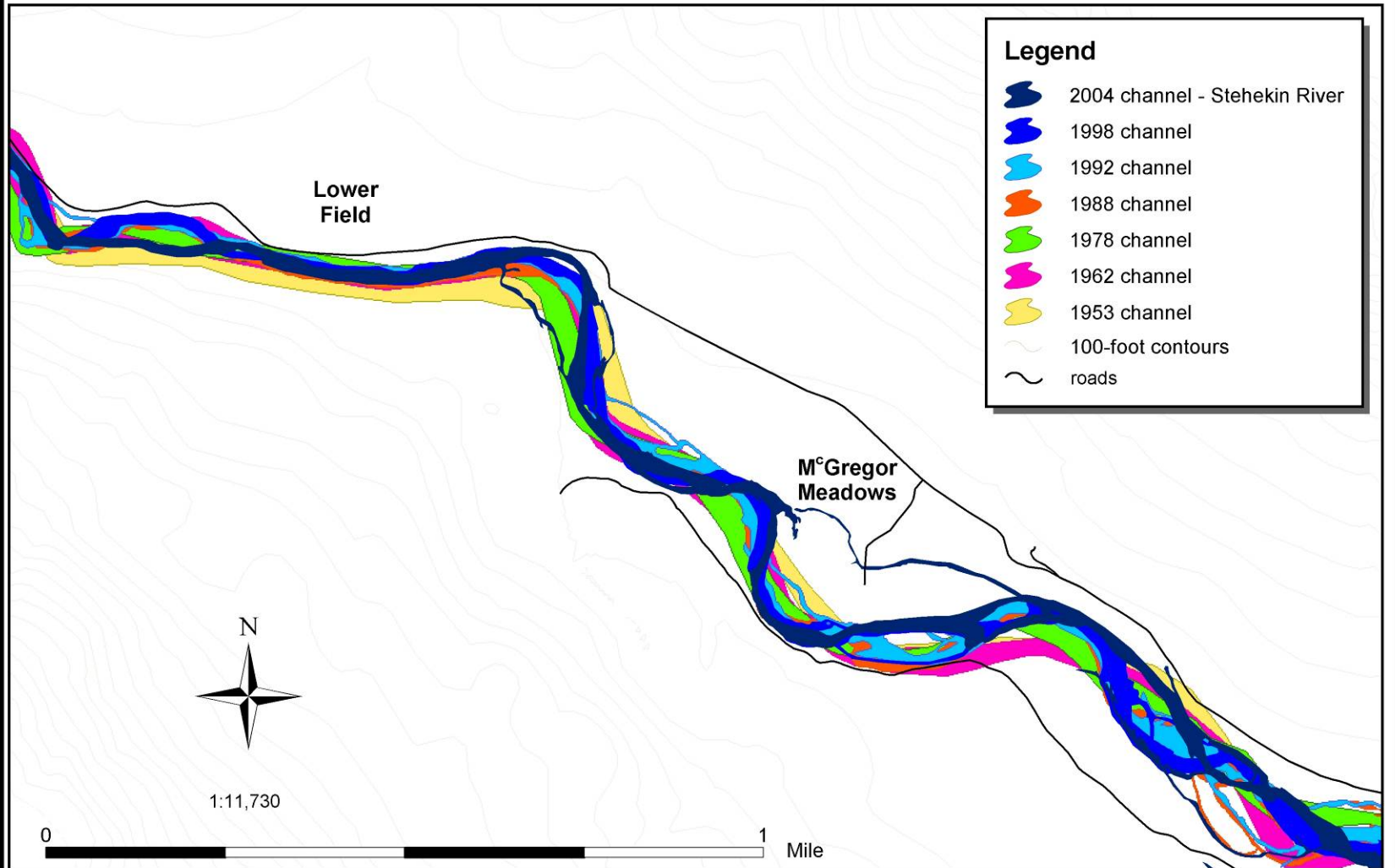
V -SRCIP two main areas of
concern:

- McGregor Meadows
- Stehekin River Mouth





Stehekin River Channels 1953 - 2004, M^cGregor Meadows Area



Produced by N. Cascades NPS Complex GIS

15 March 2004



Upper Company Cr. Road

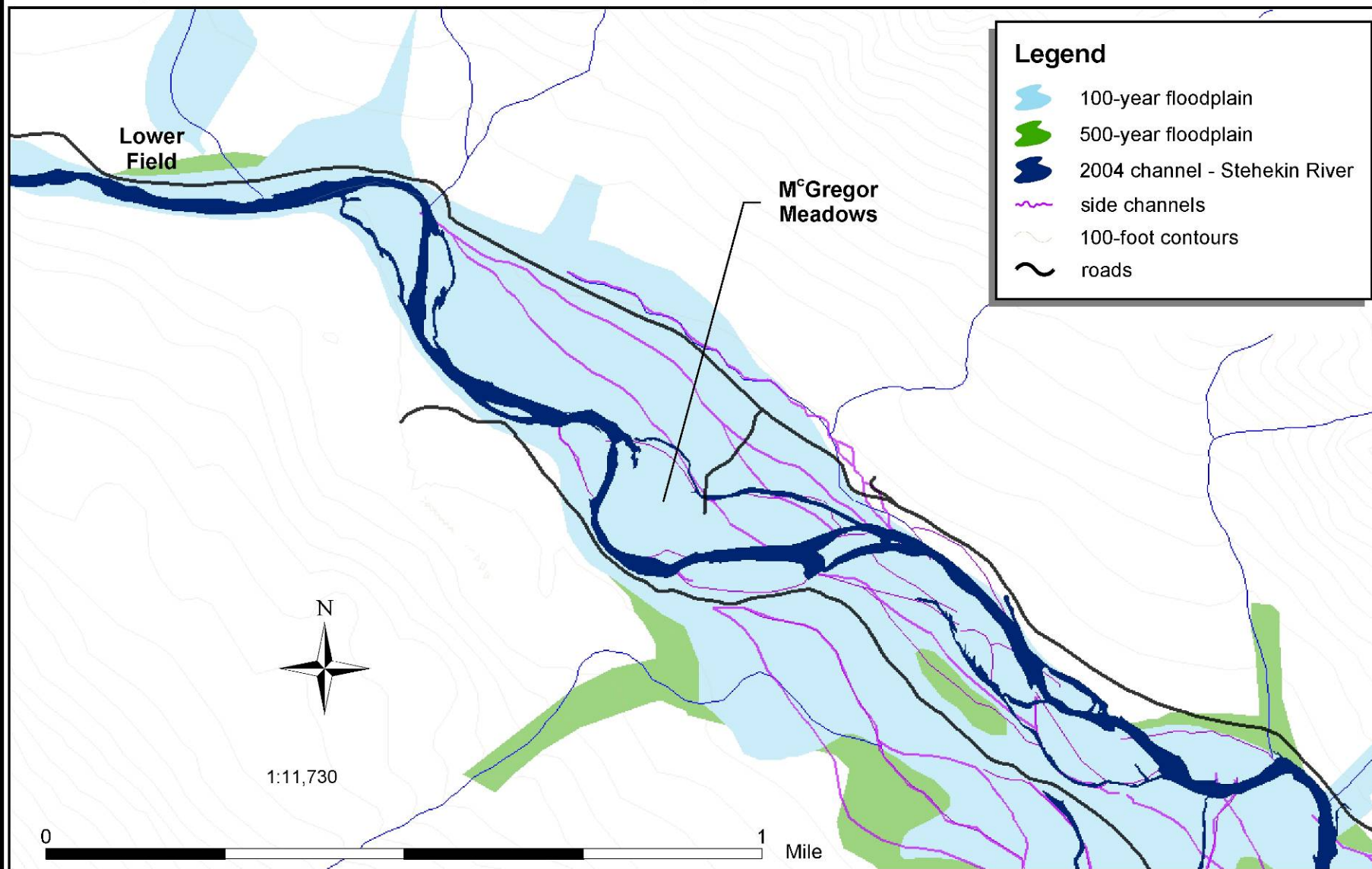
This is an aerial photograph of a river bend. The river is a milky, light-brown color, indicating sediment. The left bank is densely forested with tall evergreen trees, some of which have yellowing foliage. A road, identified as 'Upper Company Cr. Road', runs along this bank. Two lines are drawn on the image to show the river's edge: a red dotted line representing the 'modern bank' and a black dotted line representing the 'pre-2003 flood bank'. The 'pre-2003 flood bank' is further from the river, showing a large area of exposed gravel and sand. On the right side of the river, there is a large pile of logs and debris on a sandy bar.

modern bank

pre-2003 flood bank



Floodplain and Side Channels, M^cGregor Meadows Area



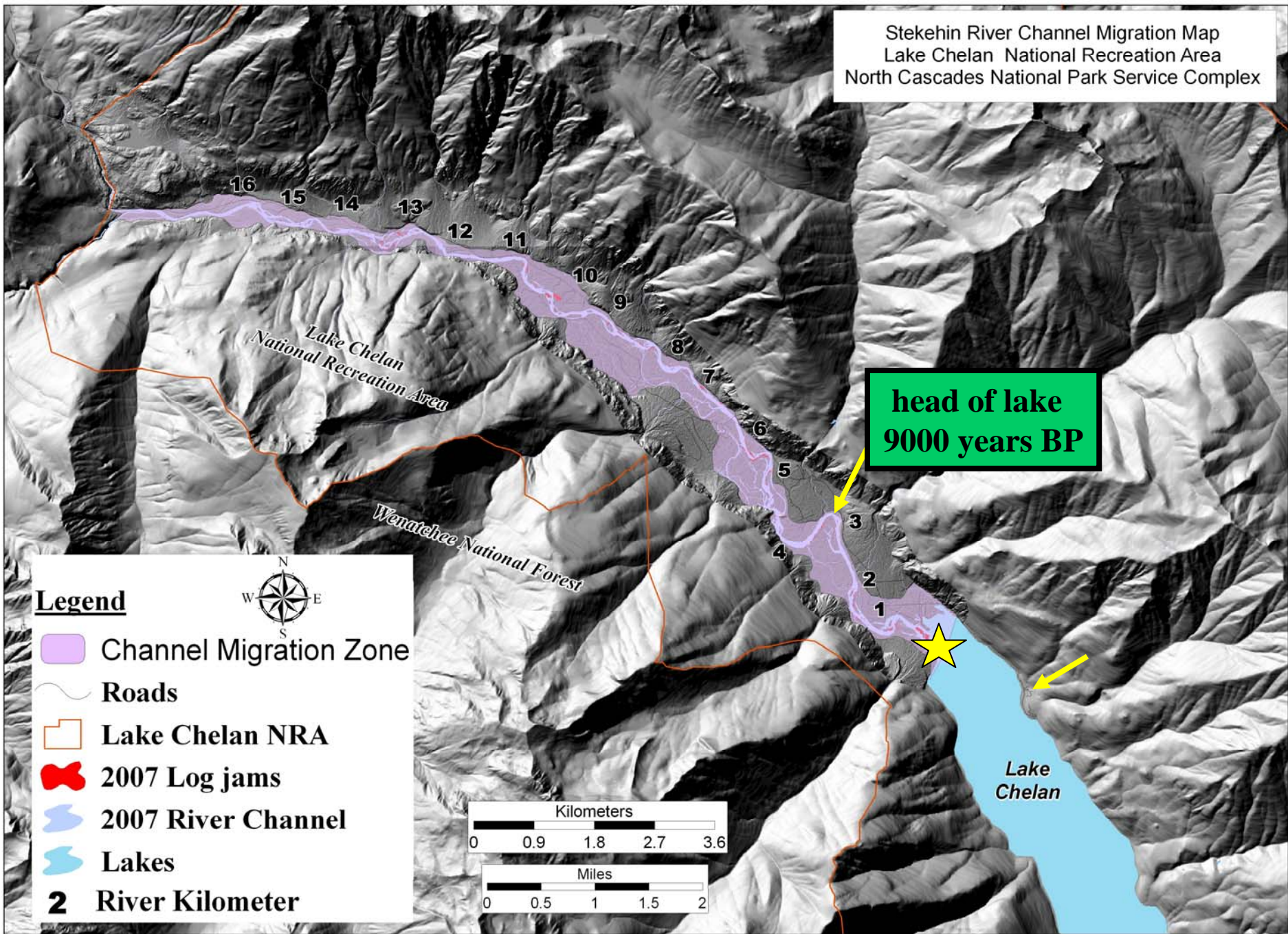
McGregor Meadows Log Jam Contains >2,000 Logs



Stehekin River Mouth

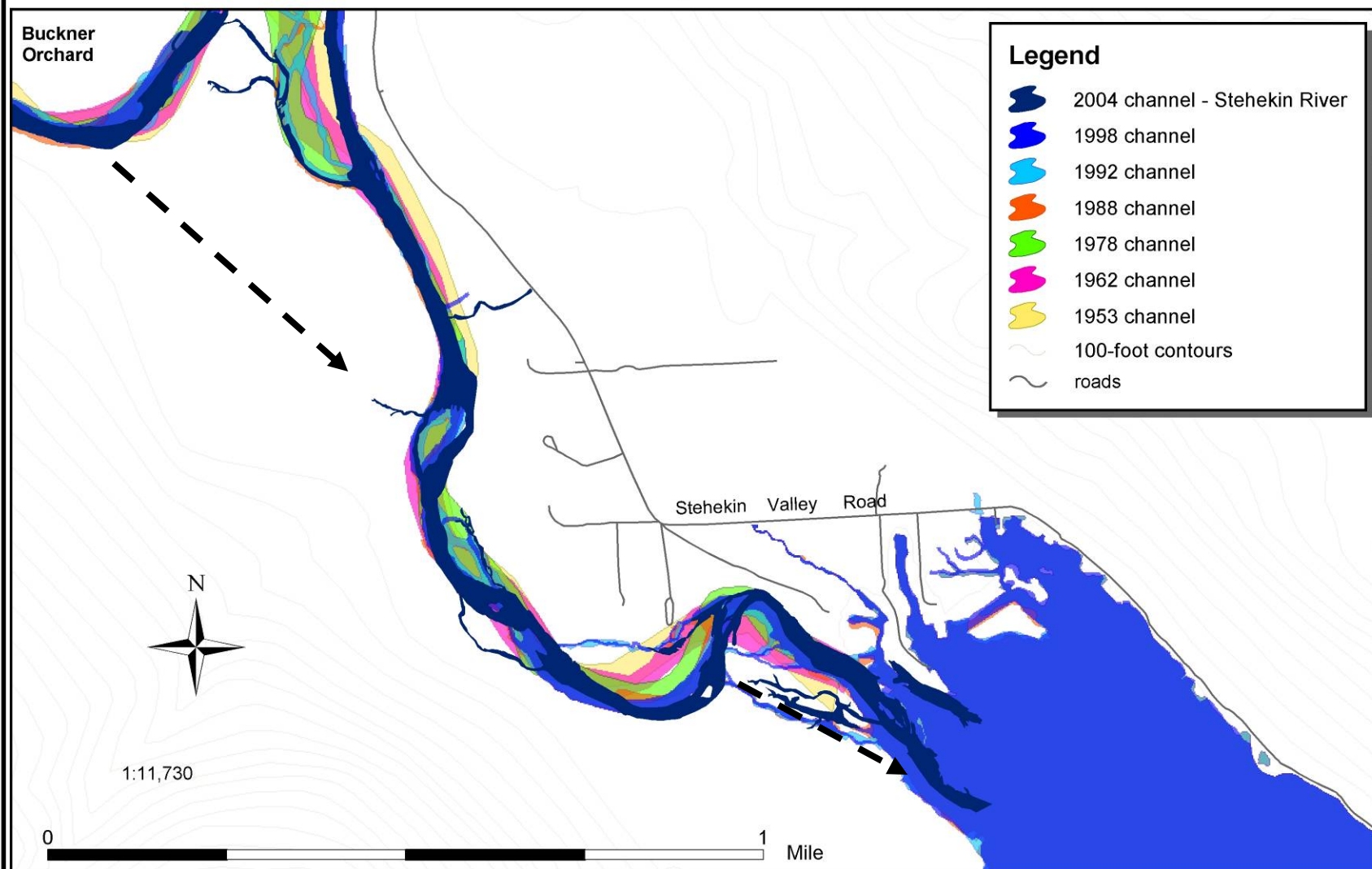


Stekehin River Channel Migration Map
Lake Chelan National Recreation Area
North Cascades National Park Service Complex





Stehekin River Channels 1953 - 2004, Near the Head of Lake Chelan



Produced by N. Cascades NPS Complex GIS

15 March 2004

FILE: ab/gis/riedel/mouth rvr changes w transparency.mxd



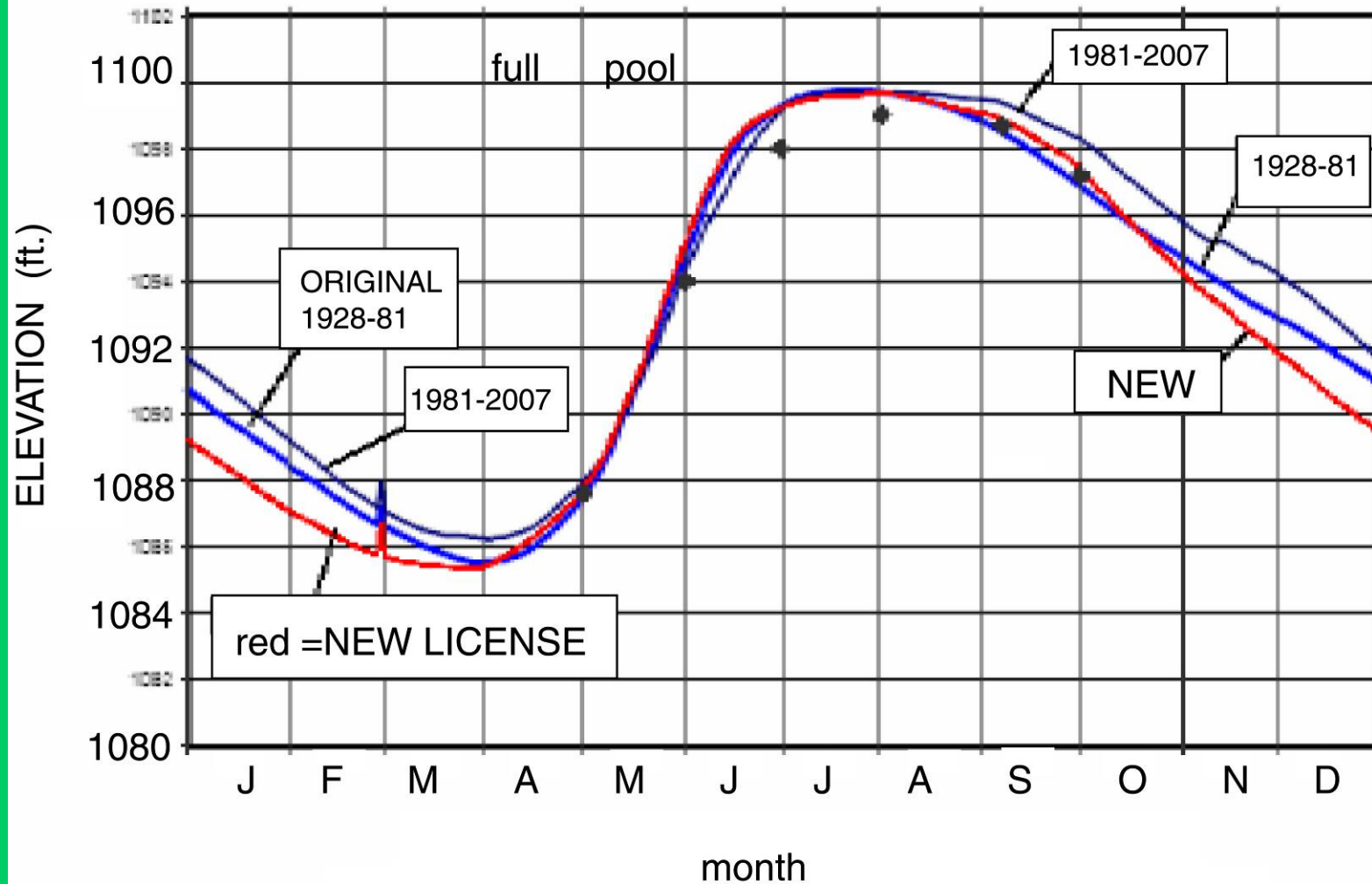
1956

**Problem Area #2:
Stehekin River
meets Lake Chelan**



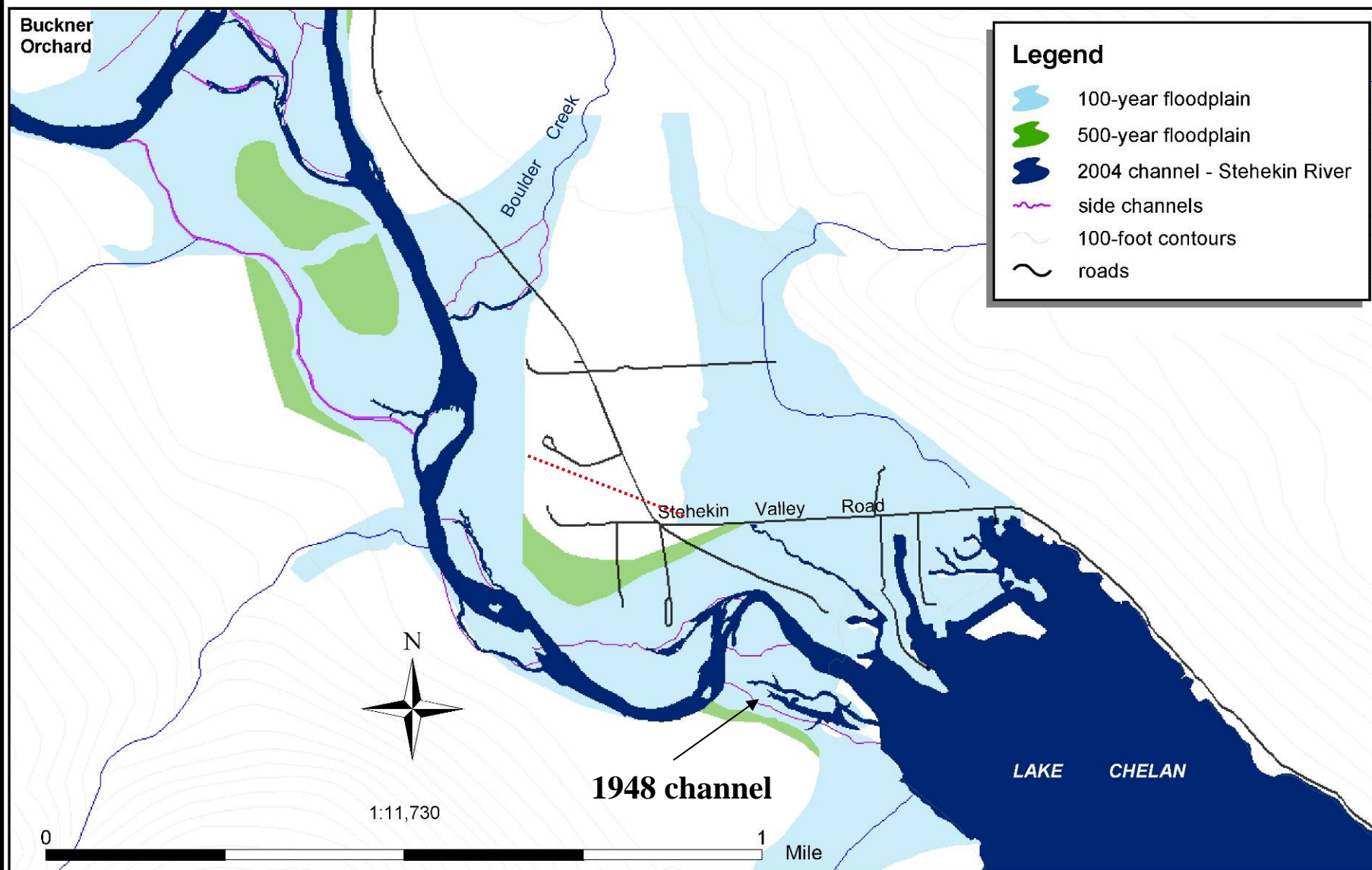
2007

Lake Chelan Average Monthly Elevation





Floodplain and Side Channels Near the Head of Lake Chelan



The End

