# A Hazard Assessment for Sunshine Point, Mount Rainier National Park, Washington

Jesse Favia January 10<sup>th</sup>, 2015

#### • Hi Juliet, Brian, and Paul.

I have included my most up to date work along with some basic informational slides from a prior presentation, mainly to give Juliet some context. The results that I am interested in your feedback on start with slide 7. My approach comprises three investigations: georeferenceing aerial images and digitizing the active Nisqually and Tahoma active channels from each image. From this I hope to give park managers a quantitative idea for how the Nisqually has acted around Sunshine Point Campground in the past. Additionally, these channel polygons provide me with geometries for the third part (scour calculations).

The second part is a geomophic map of the area at 1:5000 scale (displayed at 1:10000). This shows the presence of incised channels in the area and hopefully helps to define the area that Tahoma Creek avulses into. These avulsion have affected the campground in the past and are likely the most common hazardous event at the campground going forward. With this map, I also hope to define age of occupation (from tree size, not complete yet) and prior (and current avulsion areas).

The third part is a scour analysis: of the rip-rap revetment remaining at the southern boundary (this would be a future boundary of a new campground protected by ELJ's accordign to plans); at the outside of the major north meander immediately west of the Tahoma confluence (assuming meanders grow outward, this is the most likely source for a future major migration); and along the exposure at the west end of the campground to see if is erosion is likely there. Paul had also mentioned looking into the levee east of SSP, I may try to do a brief scour analysis at the outside of the meander bend that leads into the east side of that levee. For the scour I have gotten some good worksheets and information from Chris Brummer at King County. These calculations are based on Maynord, 1996; Fael, 2006; and HEC EM 1110-2-160. I have only just begun to look into this and I believe with the cross sections from Beason, 2013, I should be able to make good inferences. I also believe that Chris may provide me some help if I need, though I haven't contacted him in a few months.

I am confident that I can provide the Park Service with good objective data with which they can make a decision. Please let me know what I need to do to make this project work.

Jesse

Imagery: PSLC LiDAR DEM NAIP 2013 Orthoimagery Google Earth Basemaps

### The Location:

In 2006, the Sunshine Point Campground was the only remaining year round campground in Mount Rainier National Park. It sits near the Nisqually Park Entrance.





Mount Rainer National Park And the Upper Nisqually River Imagery: PSLC LiDAR DEM NAIP 2013 Orthoimagery

#### The Location:

In 2006, the flood of record on the Nisqually River destroyed a large portion of Sunshine Point Campground, the NPS would like to rebuild SSP.





Mount Rainer National Park Present Sunshine Point Campgroud Imagery: PSLC LiDAR DEM NAIP 2013 Orthoimagery

# The Methods:

Tahoma Creek Avulsion: Historical Imagery Analysis

Nisqually River Reoccupation: Historical Imagery Analysis

**Geomorphic Map of the Sunshine Point Area** 

Scour of existing levees, rip-rap, and revetments: Historical Imagery Analysis; calculation of effective scour



#### Mount Rainer National Park Present Sunshine Point Campgroud

**Georeference Imagery** 

**Digitize Channels from Imagery** 

**Occupation History** 



### The Methods:



#### The Results: Nisqually Drainage Occupation Map (discussion next slide)

# OCCUPATION MAP

- This is the basis for quantifying Nisqually River occupation. My ideas is to quantify the occupation % (idea from Collins 2011?) thus giving park managers some quantitative measures to assess risk of re-occupation.
- Both Tahoma and Kautz Creeks confluences are included to investigate possible similarities. Thus far, the very recent debris flow has limited connections, however I will look more into the nature of meanders where the active channels join at both confluences to see if I can identify a (tenuous) pattern.
- You can see nicely how then 1947 Kautz debris flows pushed the Niqsually south, but west and east of the debris flow, occupation is fairly steady.
- These channels will be displayed better and actually have percentages associated with them, I am waiting on some help from Steven Walters.

The Results: Sunshine Point Occupation Map (another image and discussion next...)



#### **Sunshine Point Area Occupation Map**

Nisqually River and Tahoma Creek over 2009 Lidar

Mount Rainier National Park, WA

Drawn by: J.G. Favia Jan. 09, 2015

# The Results: Sunshine Point Occupation Map (another image and discussion next...)



Jan. 09, 2015

### OCCUPATION MAP – CLOSE UP

- I hope that both of these show how the nisqually and tahoma creek have acted around sunshine point (SSP) since 1924 (I have a 1910 image that is not working out great). And how managers can expect the rivers to act in the future.
- This first image shows all the channels passing nicely under the bridge and the westward extent of Tahoma creek.
- The second image (close-up) hopefully shows that the Nisqually has occupied parts of the campground in the last century. However, it also shows that when rip-rap reventments were present, they were a firm boundary for the nisqually (except in 2006). The outer rip-rap was constructed in 1990, the inner by the CCC in 1934.
- These images also show the slight across slope gradient to the west, toward SSP.



#### The Results: Geomorphic Map (discussion points next slide)

## **GEOMORPHIC MAP**

- Defines important fluvial features, 2009 Lidar used as base, some features field checked.
  - Points: field sites, some have associated metadata (tree size, photos, one discharge measurement)
  - Fluvial features: based on field observations. I did not visit every one of these and some may have different charactreistics. These are my best approximations based on November 29<sup>th</sup> and 30<sup>th</sup> field visit.
  - Line units:
    - Avulsion = areas of inferred avulsion from field and mapping
    - Meander scars are important to correlate occupation images I think.
  - Polygons
    - Active channel = mainly permanent flow
    - Channels = incised channel defined by lidar, most confirmed in the field
    - The lahar unit is inferred, may be bedrock, or a landslide, I will do more to investigate this, just a place holder for now.
    - I lumped man-made levees into the anthropogenic unit, maybe I should separate these out?
    - Die off = areas of tree die off. I think these correlate to avulsions or flooding are important

#### The Problems: Georeferenceing error (discussion next)



Drawn by: J.G. Favia Jan. 09, 2015

# GEOREFERENCEING ERROR

- I did not orthorectify the images, I used as many as 11 points, or as few as 6 (in one image), but typically used 10 reference points, mainly from road intersections the south of the Nisqually river or far northwest (off of the Westside road).
- This image show the digitized centerline of the Nisqually road as it enters the park and goes along SSP. The thick black line encloses all of the roads (minus the one from the 1924 image). This polygon has a 921,000 sq ft area and length of 18400 ft, for an average with (for an average margin of error of <u>+</u> 50 ft). This is somewhat large, but you can see that the majority of the digitized roads area better constrained than the enclosing polygon, particularly at the area nearest to the campground (eastern portion of the polygon).