RVR Meander to Assess Snowslide Canyon Creek

Richard Alcala, Seema Shah-Fairbank Ph. D.
California State Polytechnic University Pomona, Civil Engineering Department

Abstract

Various computer modeling programs have been developed in order to analyze the lateral migration of rivers for stability. Within the Crystal Lake Campground, located in the San Gabriel Mountains, Angeles National Forest, Snowslide Canyon Creek flows through the campground causing damage during high flow events. Due to the "Curve Fire" in 2002 which burned down large amounts of vegetation around the campsite there has been a major problem with sediment deposits by debris flows. This leads to bed aggradations at different location within the creek so, as water flows downstream there is a deficiency of sediment. This process causes the creek to experience excess bank and bed erosion. RVR Meander was employed to examine the lateral channel migration due to bank erosion. By utilizing a dimensionless coefficient that is calculated with a bank erosion coefficient and the near-bank excess velocity to simulate hydraulic erosion the future channel centerline after "X" amount of years can be determined. Using RVR Meander with a 100-year storm event, an analysis has been conducted to determine Snowslide Canyon Creeks mobility which resulted in migration in different location ranging 10-20 feet.

Objective

- Evaluate future Snowslide Canyon Creek migration within the Crystal Lake Campground
- Determine potential of changes in planform which would result in damage to roads/walkways and in-stream structures (Figure 2)
- Perform background analysis and research on the processes leading to the natural migration of meandering channels[1,2]

Figure 1: Bank instability/channel migration

Figure 2: Culvert at point C showing excess erosion and deposition of sediment

Site Background

- Snowslide Canyon Creek is an ephemeral, gravel bed stream located within the Crystal Lake Campground in Azusa, California
- During rain events, creek deposit larges amounts of sediment (gravel-Boulders, figure 2) within campground causing camp closures and damages to buildings[3]

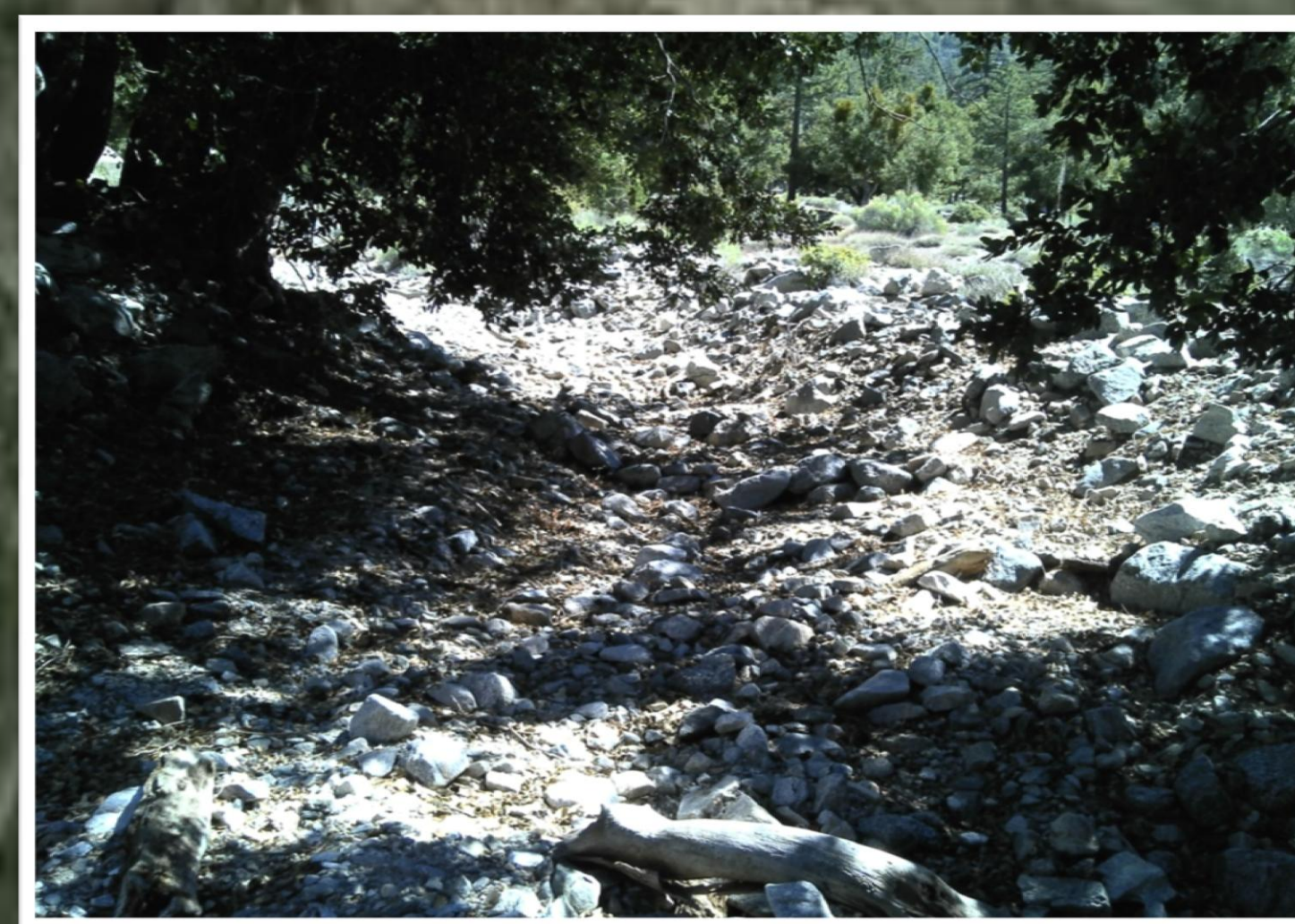Figure 3: Point A down stream from a debris basin and left of roadway

Figure 4: Point B near campsite locations

References

1. Zeedyk, William D., Van Clothier, and Tamara E. Gadzia. *Let the Water Do the Work: Induced Meandering, an Evolving Method for Restoring Incised Channels*. Santa Fe, NM: Quivira Coalition, 2009. Print.
2. Knighton, David. *Fluvial Forms & Processes: A New Perspective*. London: Arnold, 1998.
3. Wilfley, Bryan. *Crystal Lake Campground Drainage and River Stability Project*. N.p., n.d. Web.
4. Motta, Garcia, and Abad. "An Improve Meander Migration Formulation Based on Streambank Erosion Processes." *River Flow*. By Langendoen. N.p.: Bundensanstalt, 2010. N. pag. Web.
5. Motta, Davide, Jorge D. Abad, Eddy J. Langendoen, and Marcelo H. Garcia. "A Simplified 2D Model for Meander Migration with Physically-Based Bank Evolution." *Geomorphology* (2011): 10-25. Elsevier, 16 Aug. 2011. Web. <www.elsevier.com/locate/geomorph>.
6. Constantine, Dunne, and Hanson. "Examining the Physical Meaning of the Bank Erosion Coefficient Used in Meander Migration Modelig." *Geomorphology* 106 (2009): 242-52. Web
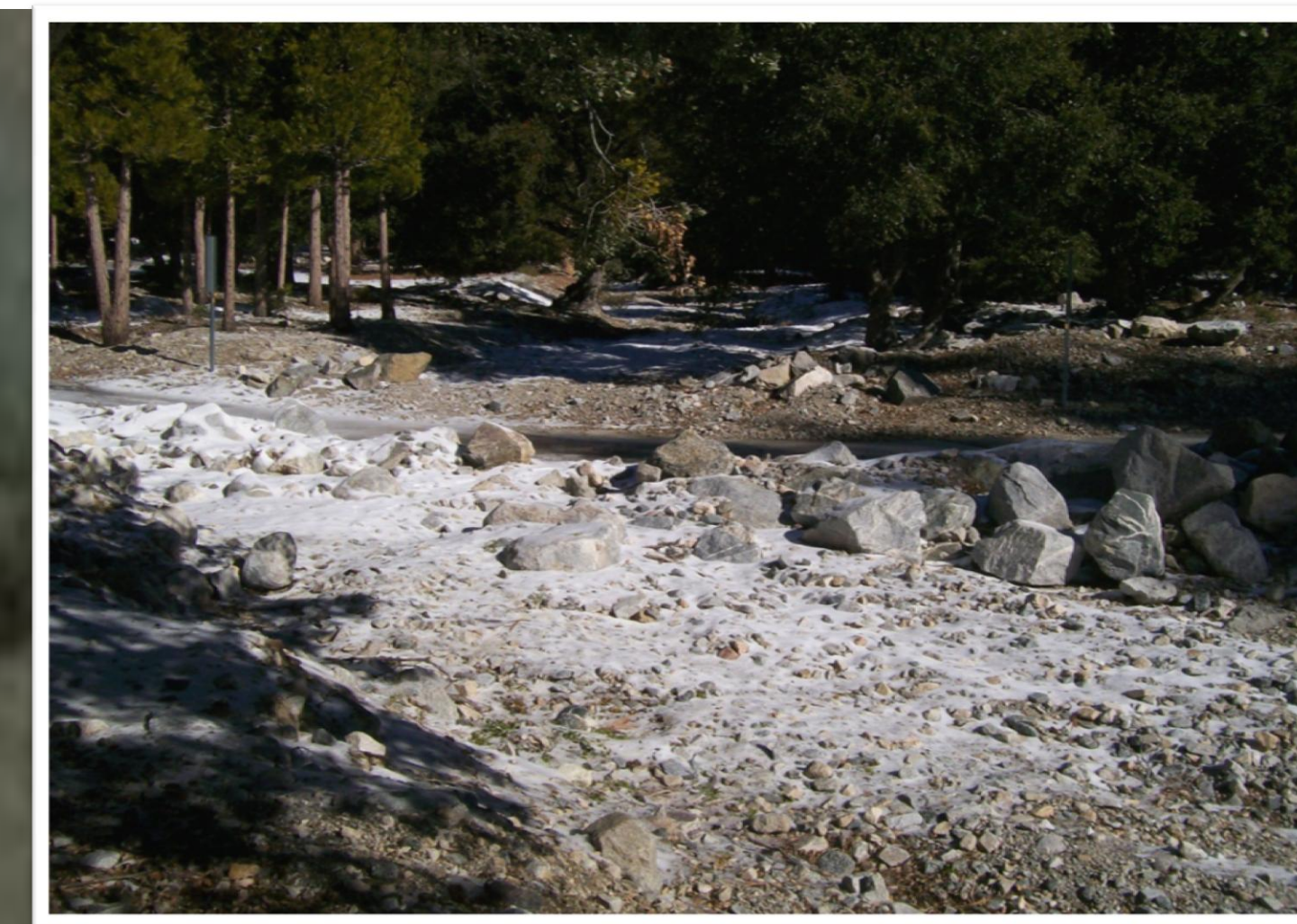
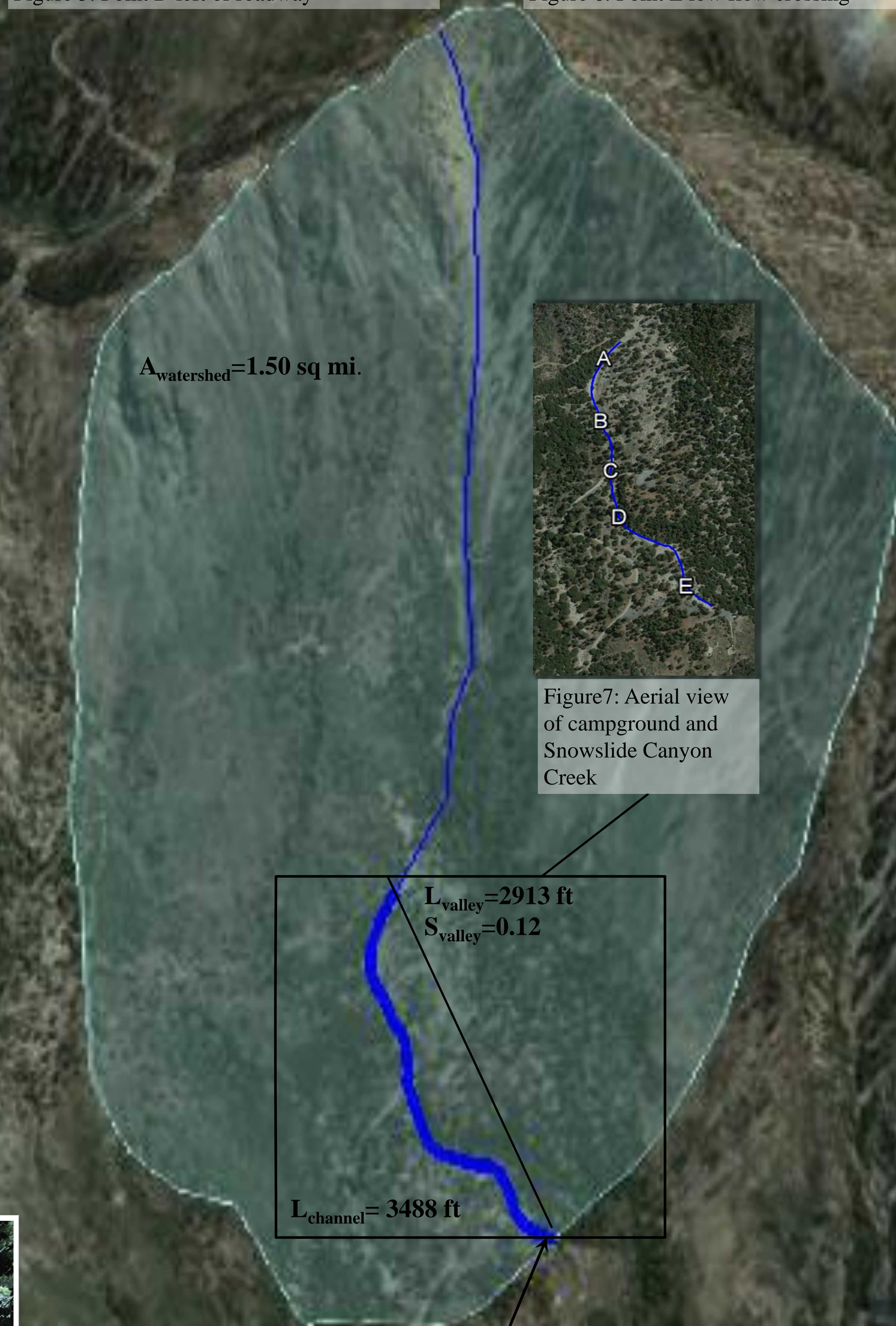Figure 5: Point D left of roadway

Figure 6: Point E low flow crossing

$A_{watershed}$=1.50 sq mi.

L_{valley}=2913 ft
S_{valley}=0.12

$L_{channel}$= 3488 ft

Figure7: Aerial view of campground and Snowslide Canyon Creek

RVR Meander[4,5]

- Model channel migration/meandering patterns
- Utilizes a dimensionless migration rate coefficient that predicts stream trajectories by applying an bank erosion coefficient with the near-bank excess velocity to simulate hydraulic erosion to predict migration of stream centerline after "X" amount of years

Table 1: Input parameters used in 100 Year Flow Simulation

Input Parameters	
Width (ft)	24
Sediment Size (in)	2.8
Manning's Roughness Coefficient	0.024
Upstream Perturbation Velocity	0
Scour Factor	2.89
Erodibility Coefficient[6] (k)	4.10E-09
Critical Shear Stress (lb/ft2)	0.122
Bed Average Shear Stress[7] (lb/ft2)	12
Coefficient of Bank Erosion[8] (E)	8.30E-08
Migration Rate (M)	1.35E-06

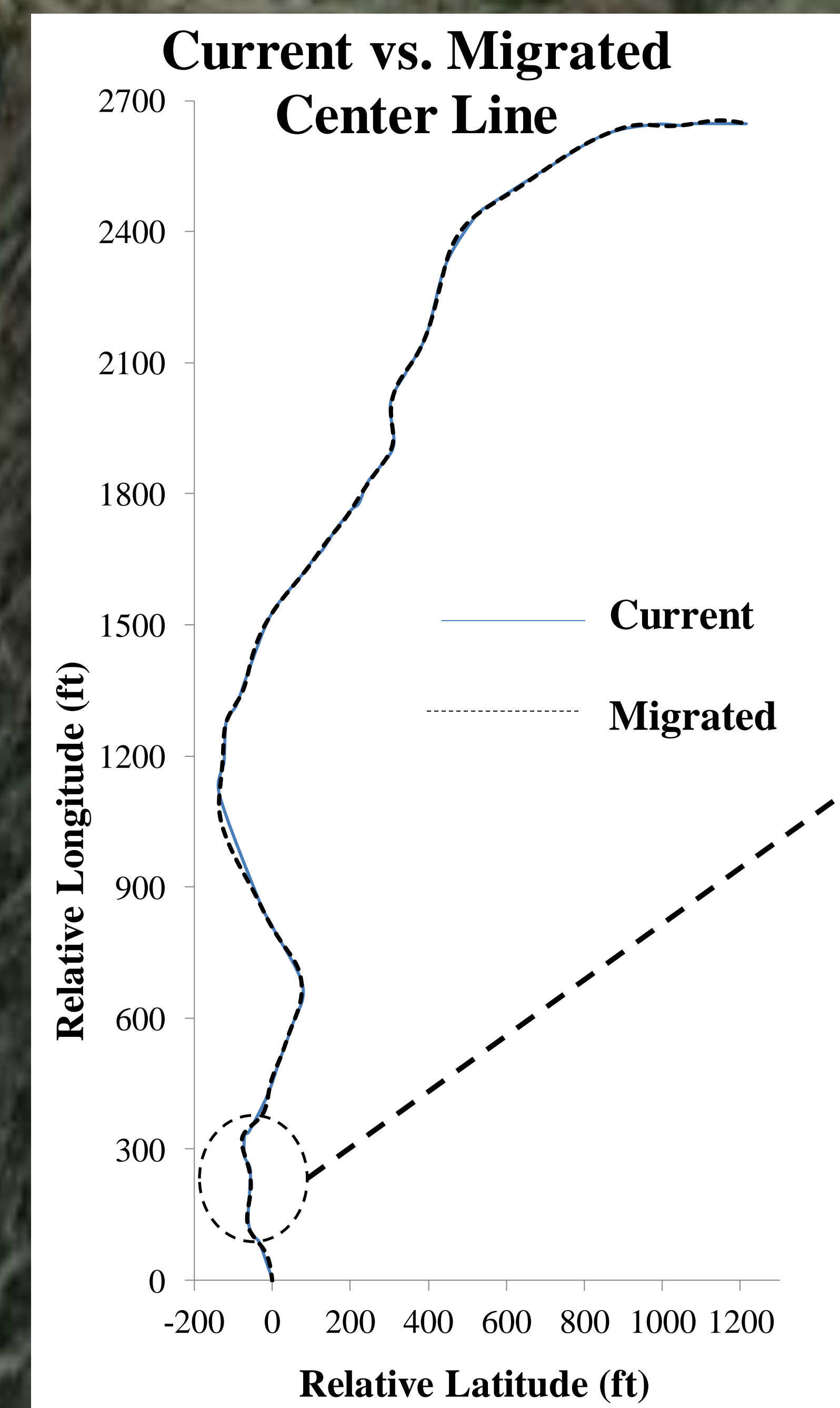**Current vs. Migrated Center Line** — Current, Migrated. Relative Longitude (ft) vs Relative Latitude (ft)

Figure 9: Migrated centerlines versus current centerline
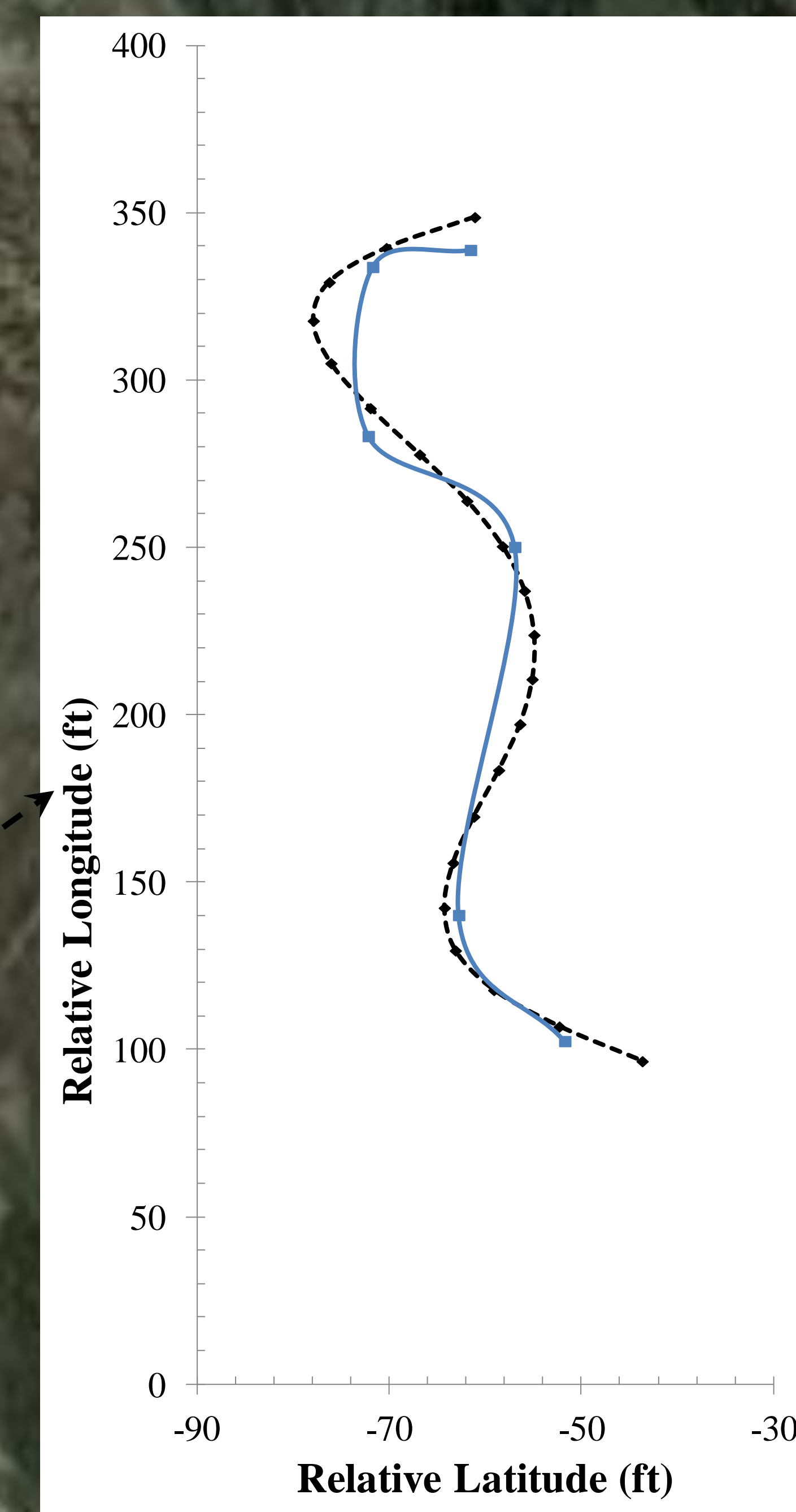
Figure 10: Area of interest, significant migration at meanders

Q=950 cfs — 100 year Flow. Flow Rate (cfs) vs Time (hrs)

Figure 8: Hydrograph showing peak discharge for 100-year storm event[7]

Conclusions and or Future Direction

- Using RVR Meander to determine the movement of Snowslide Canyon creek showed migration at some locations ranging 10-20 feet (figure 10)
- Further research will be conducted to determine the stability of the banks and the sediment yield produced by erosion during various storm events

Acknowledgements