Table of Contents

Assessment of Groundwater Contamination in Jackson, Wyoming

University of Michigan Geology, August 2001

ABSTRACT

Underground storage tanks have leaked and contaminated the groundwater at numerous locations in Jackson, Wyoming. We studied three sites: Bill's Standard gasoline company, the Wyoming Department of Transportation (WYDOT) site, and the Bridger-Teton industrial site. Our objective was to assess groundwater quality, flow direction and gradient, and the extent of contaminant plumes at each site. We measured groundwater elevations in 10 wells using an electronic probe and created a potentiometric surface map from the data. We then calculated flow direction and gradient for each site. Slug tests were performed on 10 wells using an electronic probe and bailer to estimate the hydraulic conductivity. "Low flow" sampling was performed using a submersible pump and a bailer on 10 wells to monitor flow, temperature, specific conductance, dissolved oxygen and redox potential. This data was used in contaminant plume delineation. For Bill's Standard site we calculated the flow direction as south/southwest with a gradient of 1.68 * 10^-2 ft/ft. Estimated lithology of the site was gravel interspersed with silty sand. The hydraulic conductivity of the site was 35 ft/day. For the WYDOT site we calculated the flow direction as north/northwest and the gradient as 5.88 * 10^-3 ft/ft. Estimated lithology of the site was a mixture of silt and clay. The hydraulic conductivity was .358 ft/day. For the Bridger-Teton site we only calculated hydraulic conductivity, which was 1.576 ft/day. The nature of the contaminants and the different migration patterns between Bill's Standard and the WYDOT site have led to lower pH's, higher redox potential, and higher dissolved oxygen levels at Bill's Standard site. Total dissolved solids and specific conductance were comparable at both sites. Our conclusions may be inaccurate because of the limited number of data points and limited historical data. Also, our estimates for lithology may have caused discrepancies in the calculation of hydraulic conductivity. Uncertainties for groundwater flow direction, gradient, and velocities include: the heterogeneous lithology at the WYDOT site; seasonal variations in water elevation and flow; human error in taking measurements, especially in the equalization time for wells; and the location of wells in depressions, which affected the water elevation data.

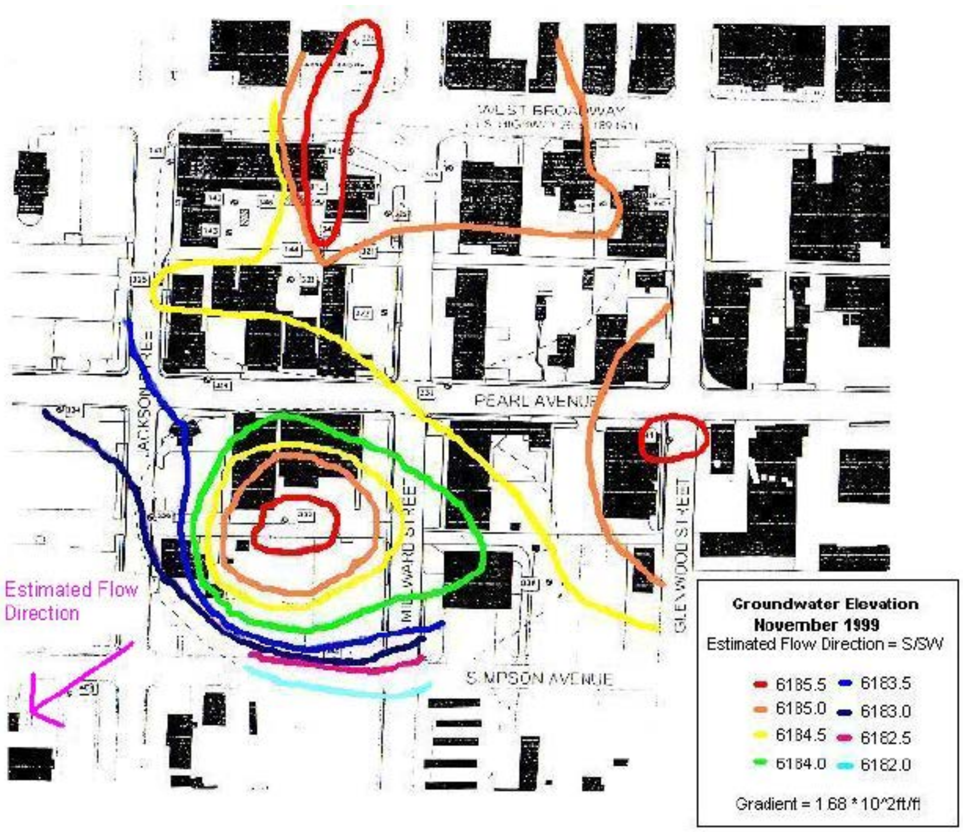


Figure 1. Groundwater Elevation near Bill's Standard Site Nov. 1999

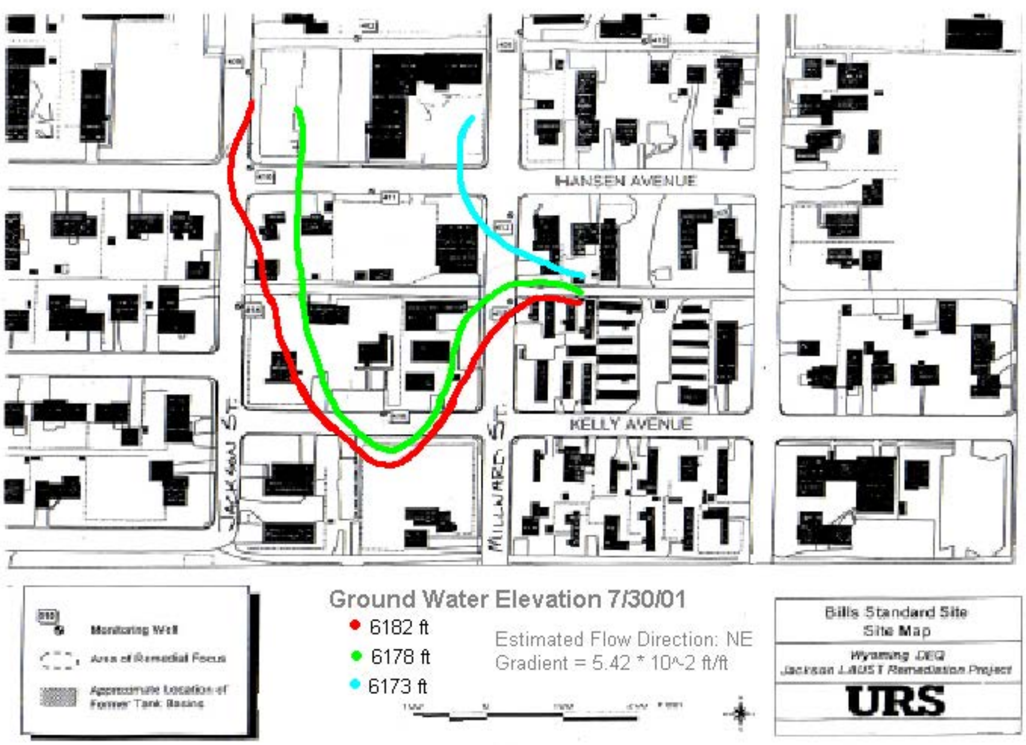


Figure 2. Groundwater Elevation near Bill's Standard Site 7/30/01

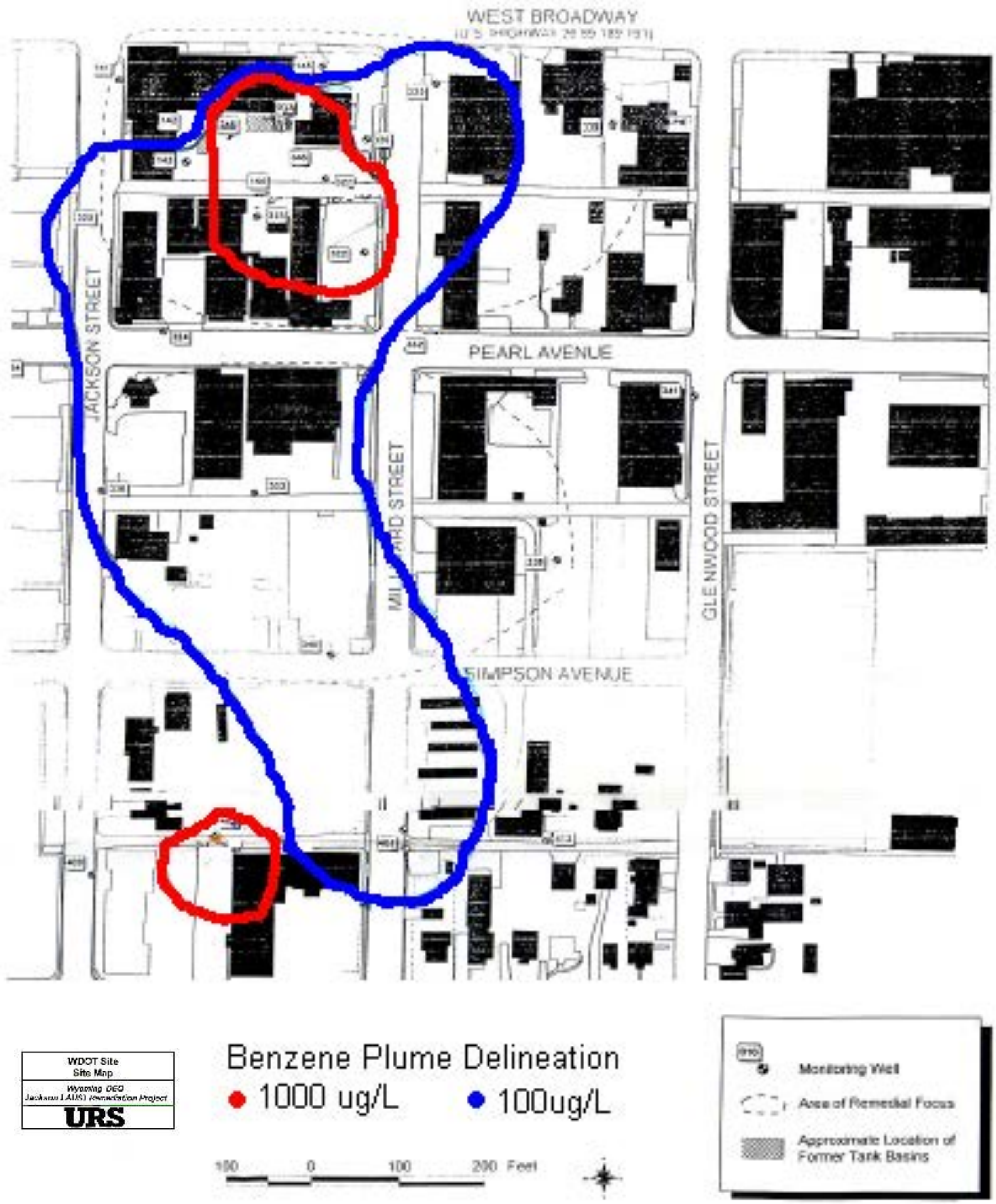


Figure 3. Benzene Plume Delineation near Bill's Standard Site 7/30/01

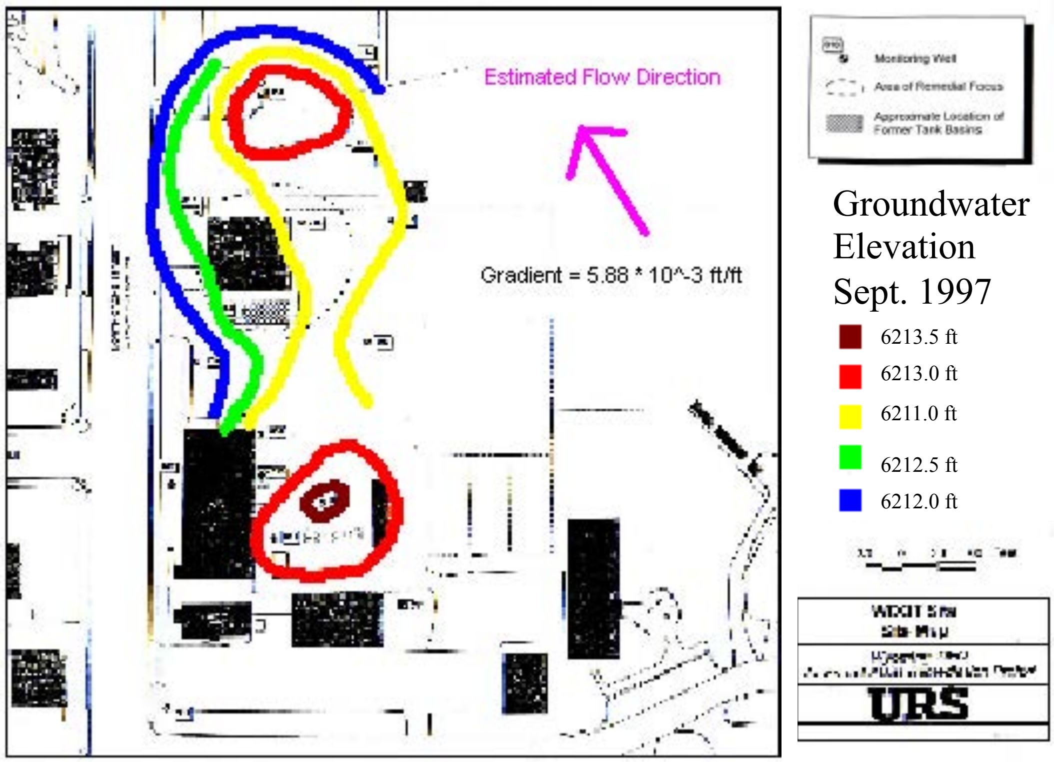


Figure 4. Groundwater Elevation near WYDOT Site Sept. 1997

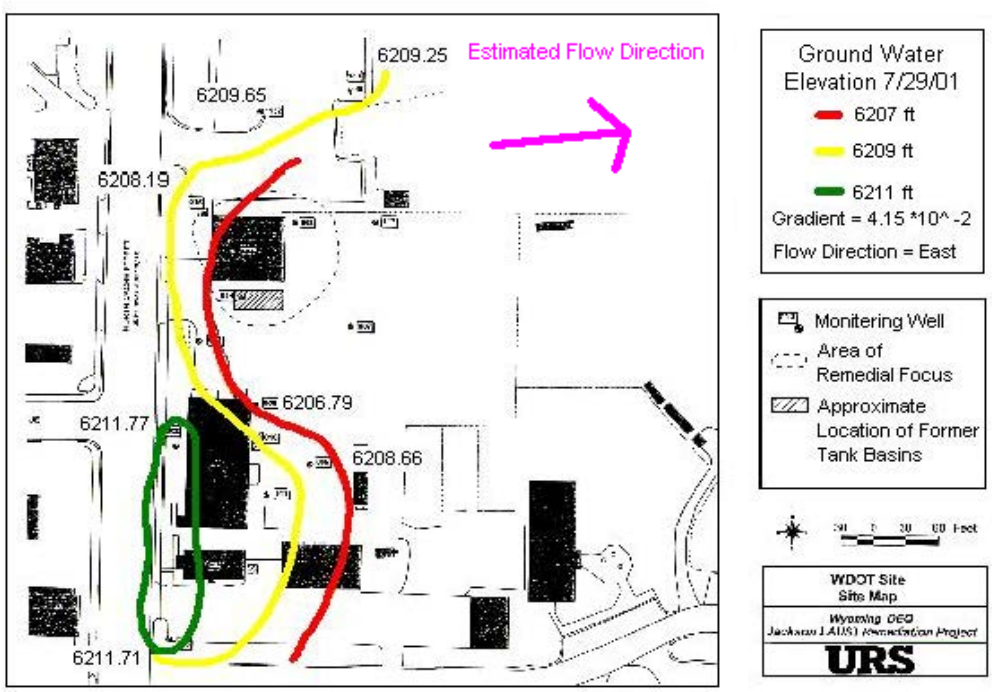


Figure 5. Groundwater Elevation near WYDOT Site 7/30/01

WYDOT Hydraulic Conductivity Trial 1

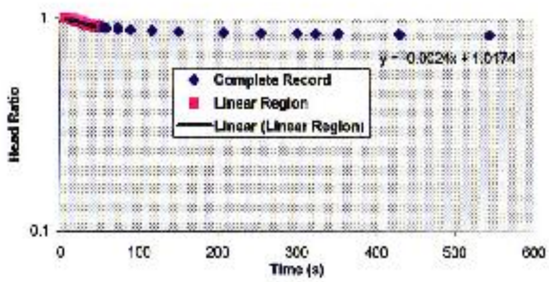


Figure 6. Graph showing hydraulic conductivity at WYDOT site (trial 1)

WYDOT Hydraulic Conductivity Trial 2

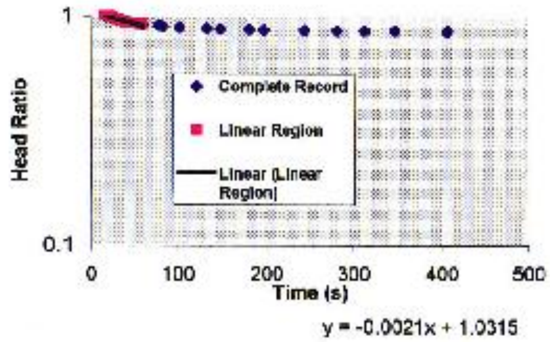


Figure 7. Graph showing hydraulic conductivity at WYDOT site (trial 2)

Hydraulic Conductivity of Bill's Standard Site

(Linear Region)

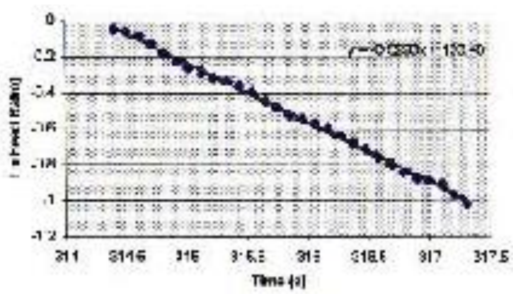


Figure 8. Graph showing hydraulic conductivity of Bill's Standard site

Hydrograph for Wells MW-326 and MW-328

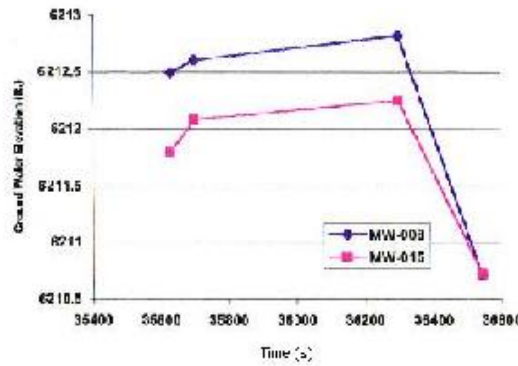


Figure 9. Hydrograph for Wells MW-326 and MW-328

Bridger-Teton Hydraulic Conductivity

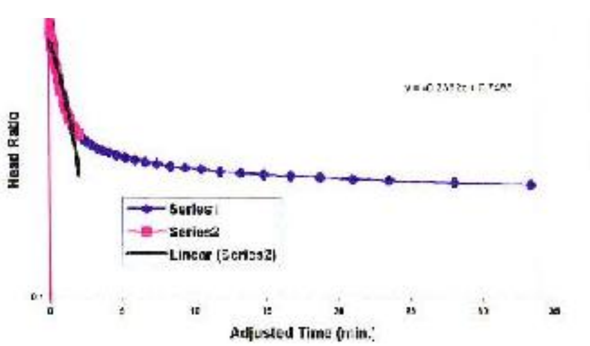


Figure 10. Graph showing hydraulic conductivity of Bridger-Teton area

Hydrograph for Wells MW-008 and MW-015

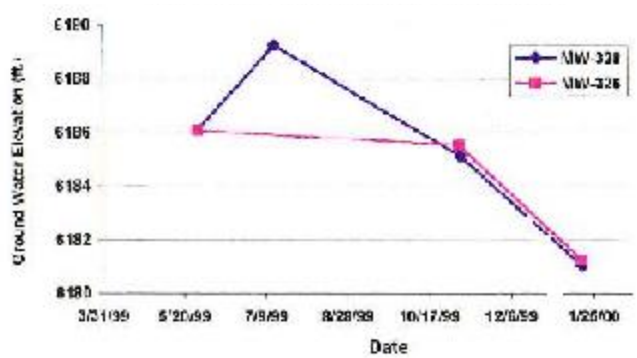


Figure 11. Hydrograph for Wells MW-008 and MW-015

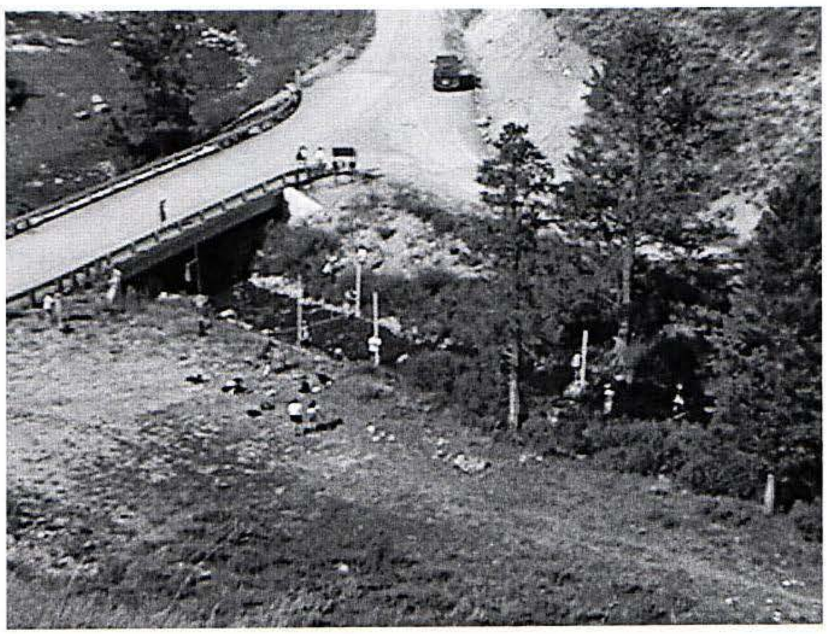
The Effects of Bridge Construction on Little Granite Creek, Jackson, WY
University of Michigan Geology, August 2001

ABSTRACT

Near the convergence of Little Granite Creek and Granite Creek in Jackson, Wyoming, a bridge was recently constructed. Our objective was to evaluate the efficiency of the bridge against long-term dynamics of the creek and to determine its affect on future stream activity. We constructed three cross sections, a longitudinal profile, and measured the velocity of the creek using a measuring rod, a tape measure, a surveyor's level, and a General Oceanic velocity meter. From this data we calculated the discharge, stream gradient, and dimensions of the bridge. We investigated the area for geomorphic clues such as undercut banks and submerged vegetation to determine recent changes in water level. We then collected 100 random stones both upstream and downstream from the bridge and measured the lengths of their intermediate axes. The size of the 84% frequency pebble was used to calculate the discharge during bankfull stage. Historical data of the recurrence interval and discharge were used to predict the average expected waiting time for a given discharge. The discharges of the fifty and one-hundred-year flood stages were calculated from this data along with the exceedance probability (the chance of a flood of a given size occurring in a given year). We calculated the velocity, width, and average elevation of the one-hundred-year flood from the historical data and hydraulic geometry graphs. We found the newly constructed bridge will be safe and stable even if the magnitude of a one-hundred-year flood was to occur. The bridge would still be approximately 8.5ft above the water and 19 feet wider than the stream during the flood stage. The construction of the bridge did have an effect on stream activity. The gradient changed from .024ft/ft upstream from the bridge to .006 ft/ft downstream from the bridge. This is most likely due to the added rocks and debris brought in during the bridge construction. The added bedload has decreased the slope of the stream and will continue to decrease it as larger rocks are moved downstream during high levels of discharge. The pebble count size and frequency data may be inaccurate due to error and bias in sample collection. This data was used to estimate the discharge of bankfull stage, which would therefore be inaccurate too. There are also uncertainties of the bridge's affect on stream activity because of the small amount of time (2 years) that has passed since its construction.

Analysis of Little Granite Creek

Jackson, Wyoming



Picture showing overview of research area
taken on south side of Little Granite Creek

Rachel Kornak

9/1/01

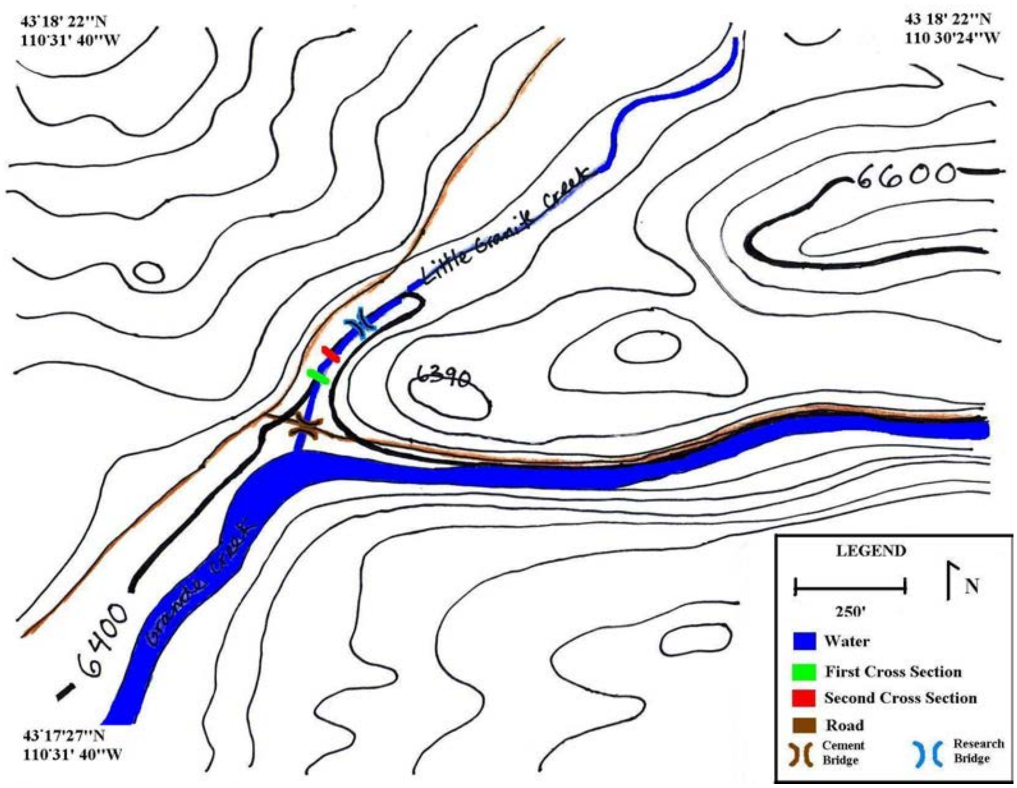


Figure 1. Topographic map of area near Little Granite Creek

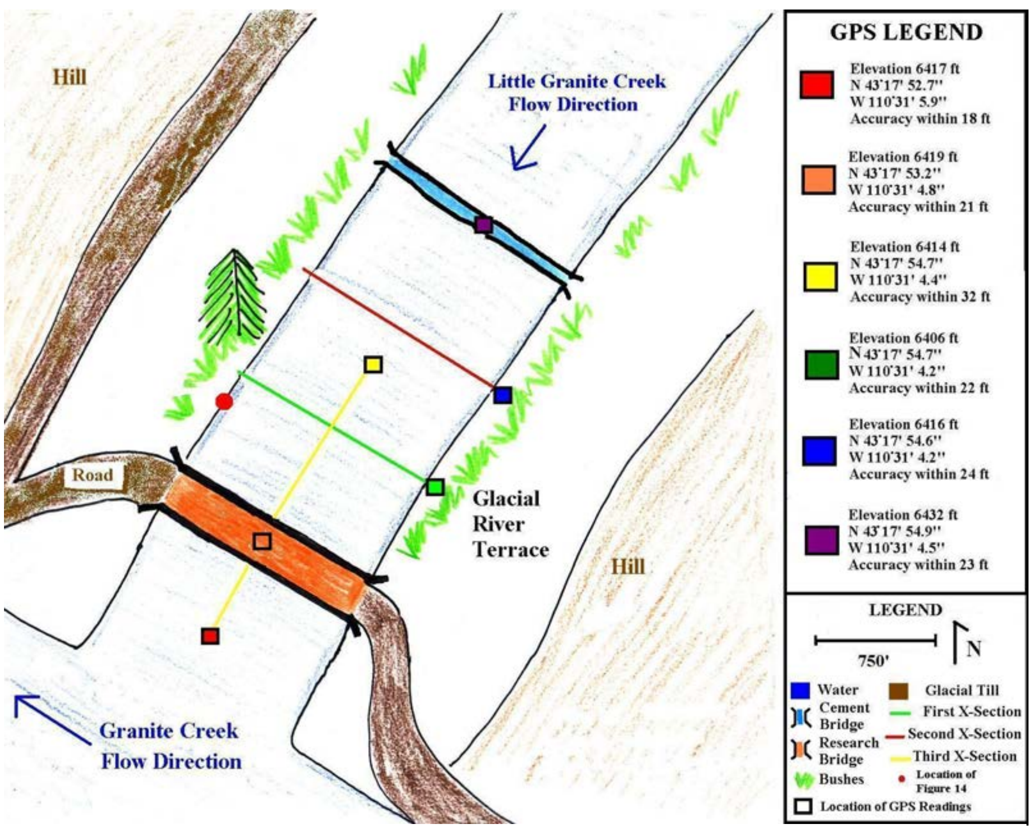


Figure 2. Sketch of area near Little Granite Creek

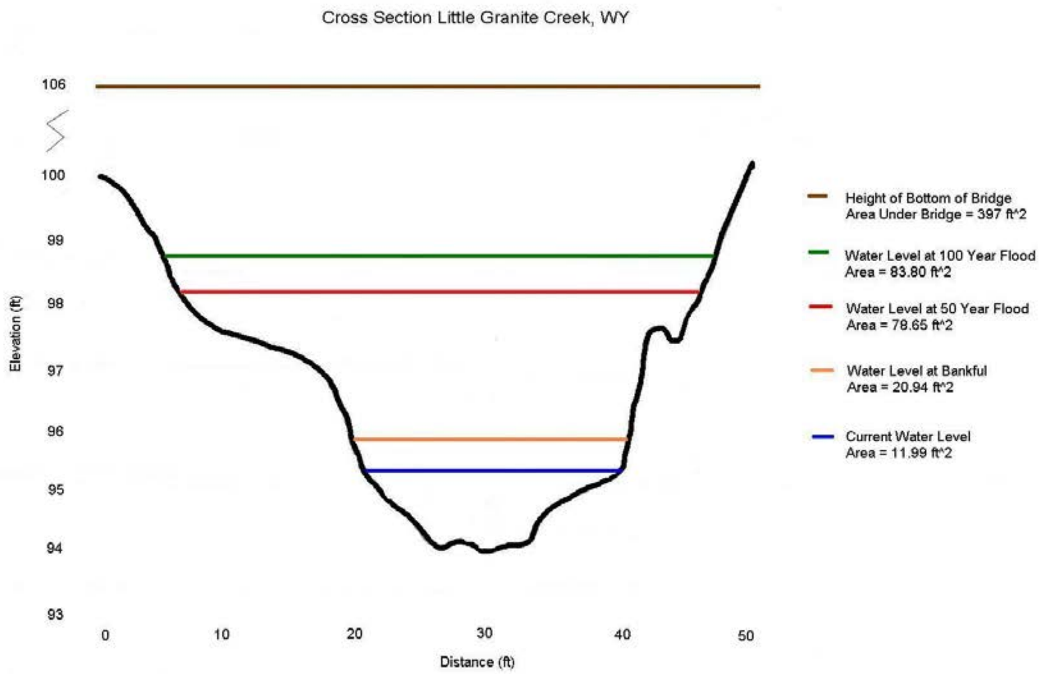


Figure 3. Cross Section underneath cement bridge showing water levels at various times

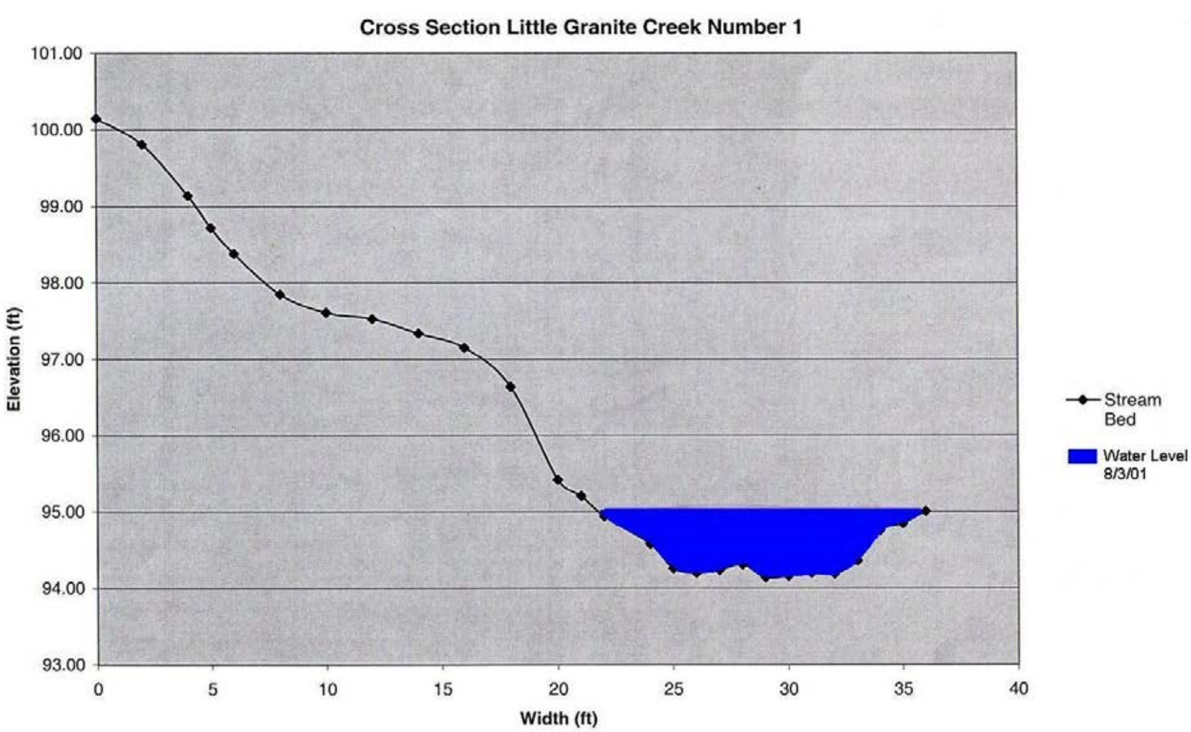


Figure 4. Cross Section at location 1 showing water level and stream bed elevation on 8/3/01

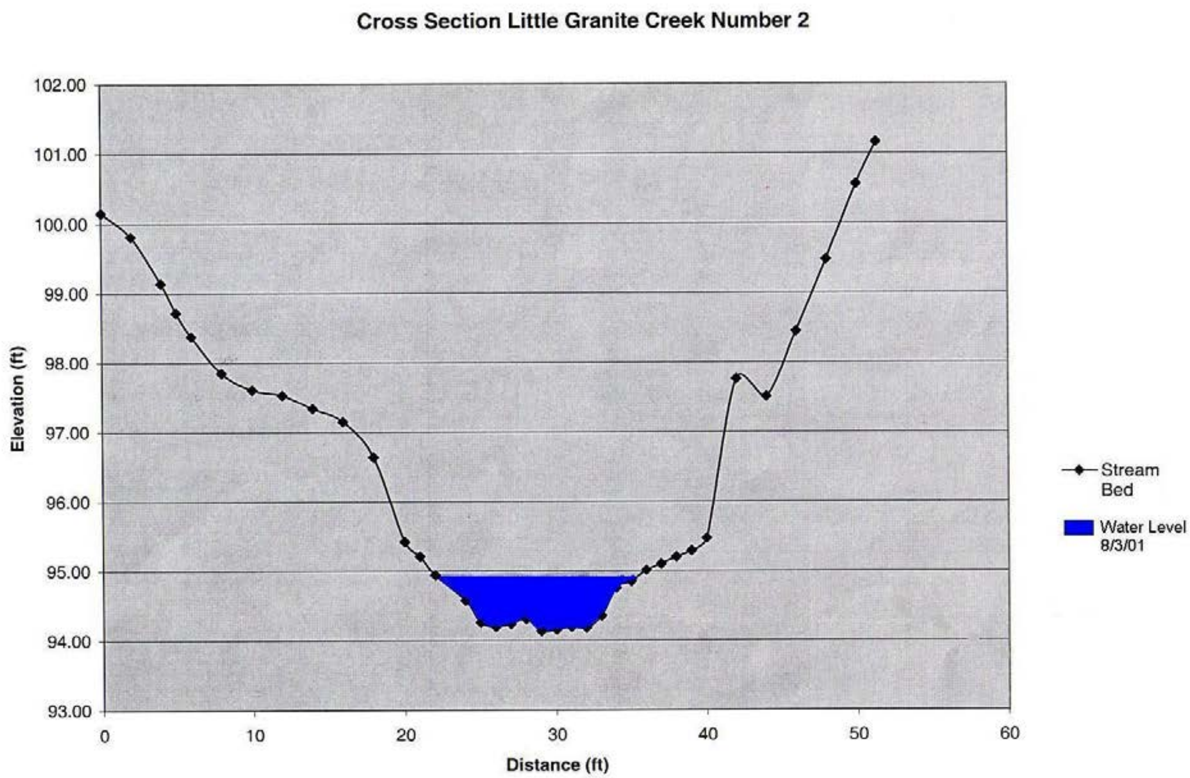


Figure 5. Cross Section at location 2 showing water level and stream bed elevation on 8/3/01

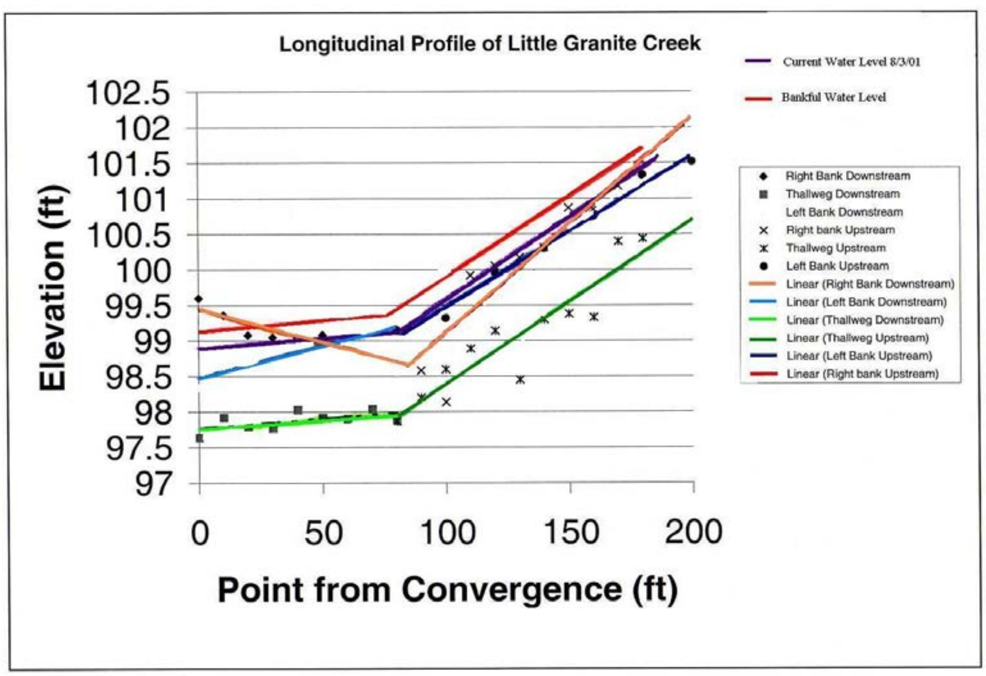


Figure 6. Longitudinal Profile of Little Granite Creek on 8/3/01

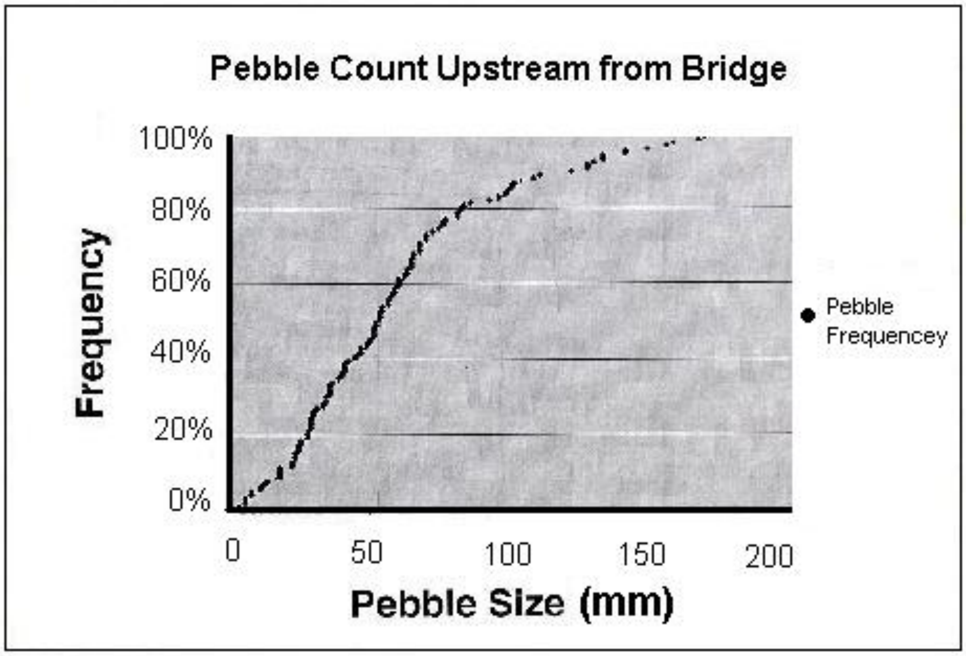


Figure 7. Graph showing pebble count upstream from bridge on 8/31/01

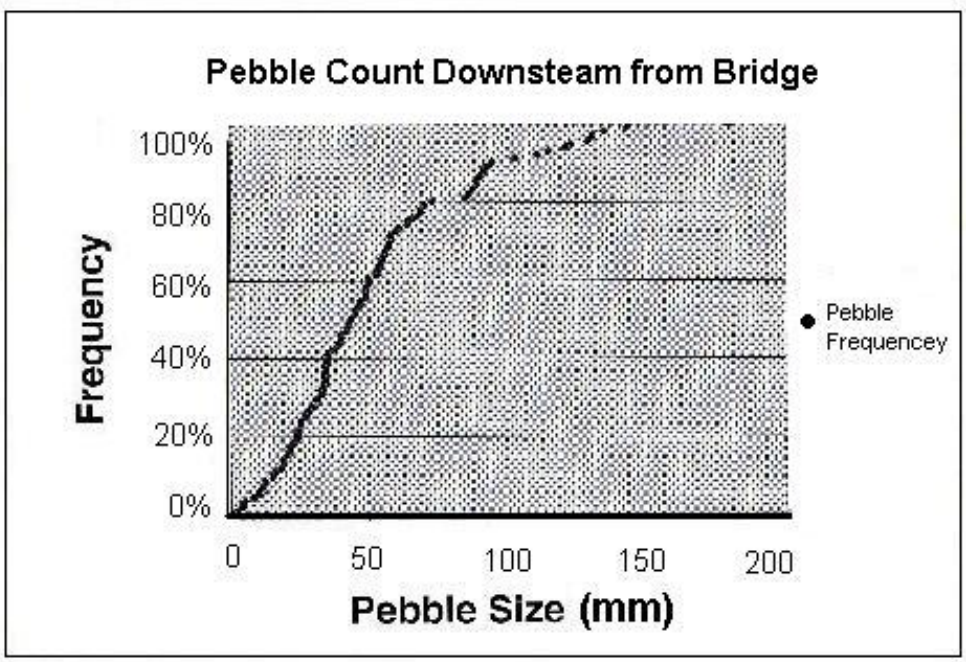


Figure 8. Graph showing pebble count downstream from bridge on 8/31/01

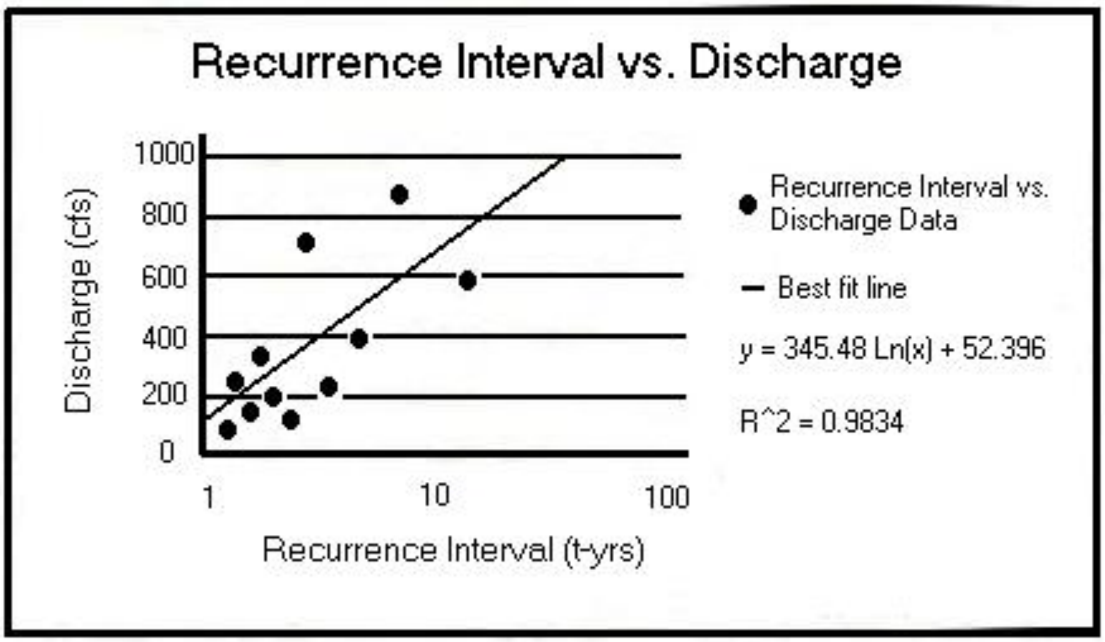


Figure 9. Graph showing Recurrence Interval vs. Discharge

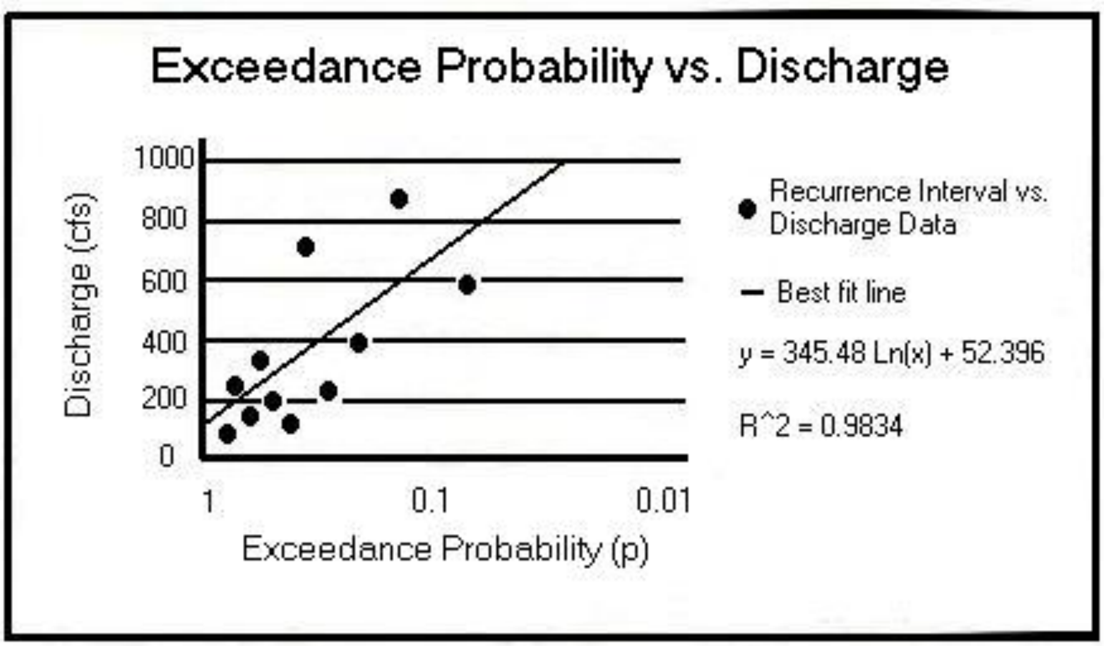
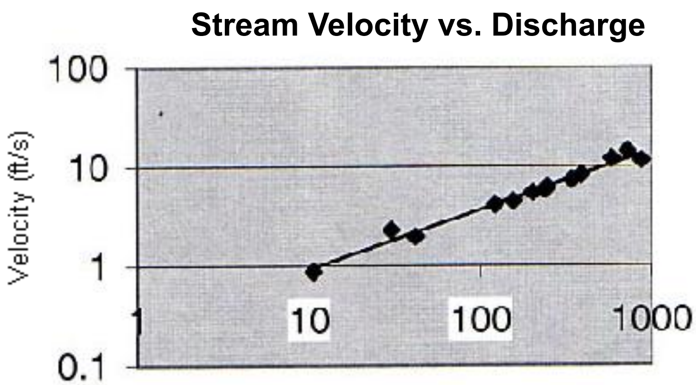


Figure 10. Graph showing Exceedance Probability vs. Discharge

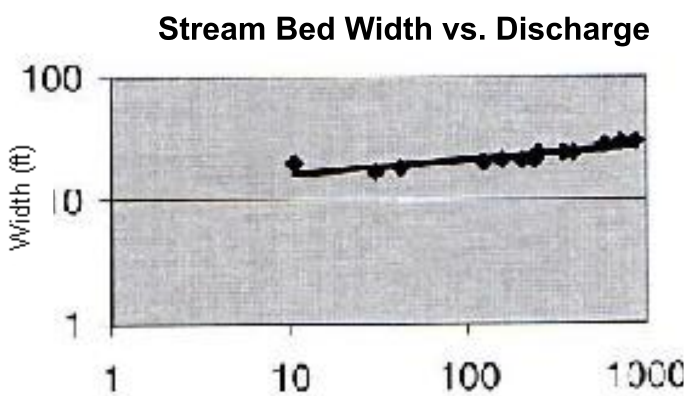


Discharge (cfs)

y = 235x^.598

R^2 = 0.979

Figure 11. Graph showing velocity versus discharge

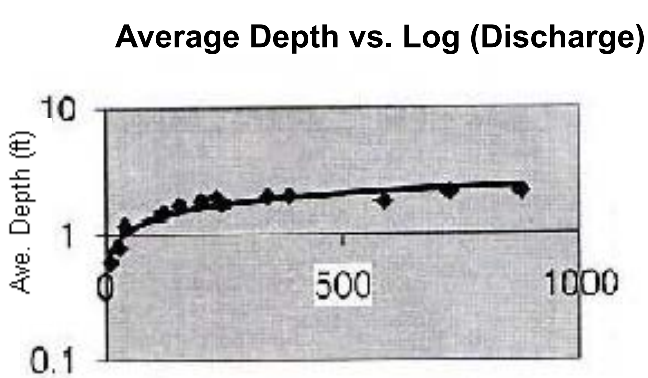


Discharge (cfs)

y = 12.576x^.112

R^2 = 0.726

Figure 12. Graph showing stream bed width versus discharge



Log Discharge (cfs)

y = 0.344x^.286

R^2 = 0.904

Figure 13. Graph showing average stream depth versus log discharge

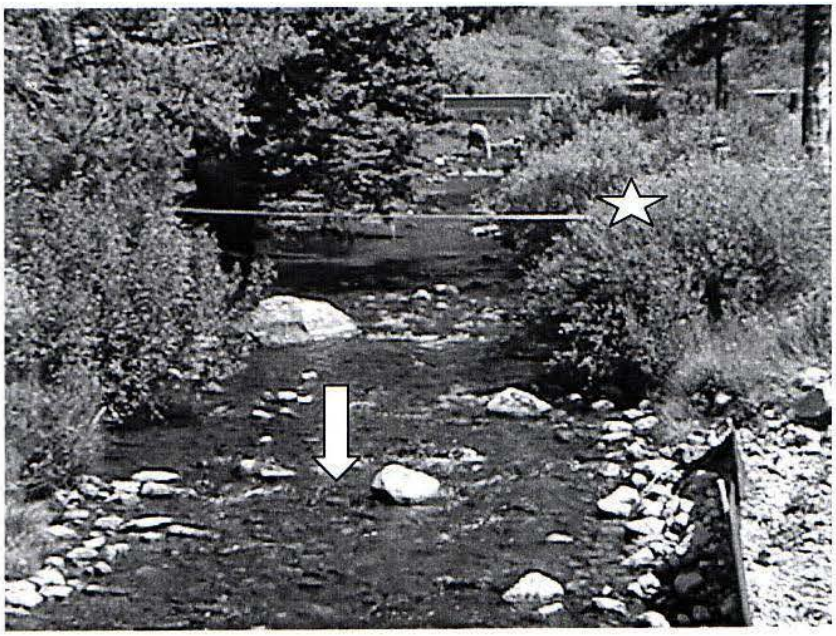


Figure 14. View of first cross section looking NE. Flow direction is from the back of the picture towards the front of the picture (follow arrow). GPS reading on right bank (marked by a star). Picture taken 8/3/01.

Elevation 6406 ft

N 43° 17’ 54.7’’

W 110° 31’ 4.2’’

Accuracy within 22 ft

Figure 15. View of second cross section looking SW. Flow direction is from the front of the picture towards the back of the picture (follow arrow). GPS reading on right bank (marked by a star). Picture taken 8/3/01.

Elevation 6416 ft

N 43° 17’ 54.6’’

W 110° 31’ 4.2’’

Accuracy within 24 ft

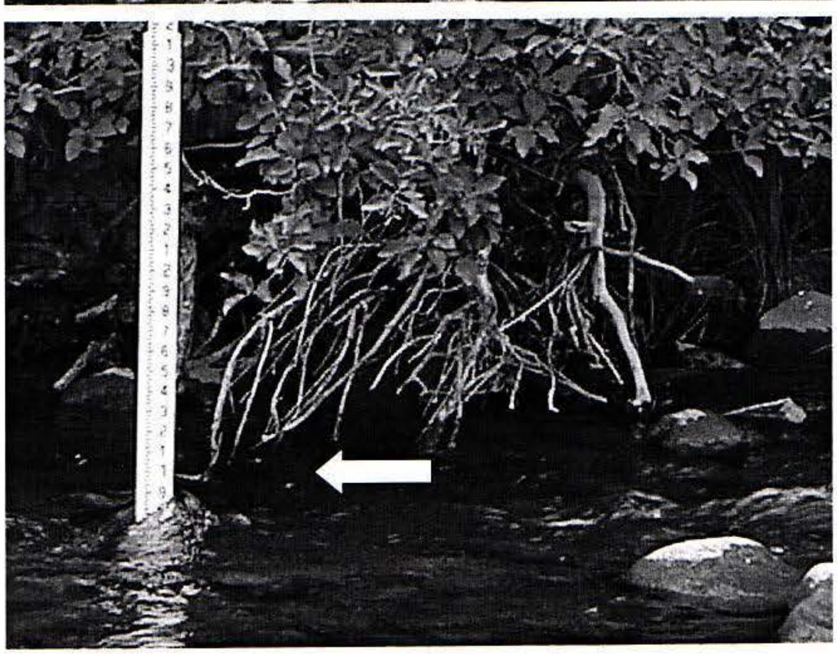


Figure 16. View of undercut bank, a possible indicator of bankfull stage. The difference between the elevation of the water level and the bottom of the root is .23ft. The difference between the elevation of the water level and the top of the root is 2 ft. Flow direction is from right to left (follow arrow). View is looking towards NW. Picture taken 8/31/01.

Assessment of Acid Mine Drainage from the McLaren Gold Mine on Soda Butte Creek, Cooke City, MT

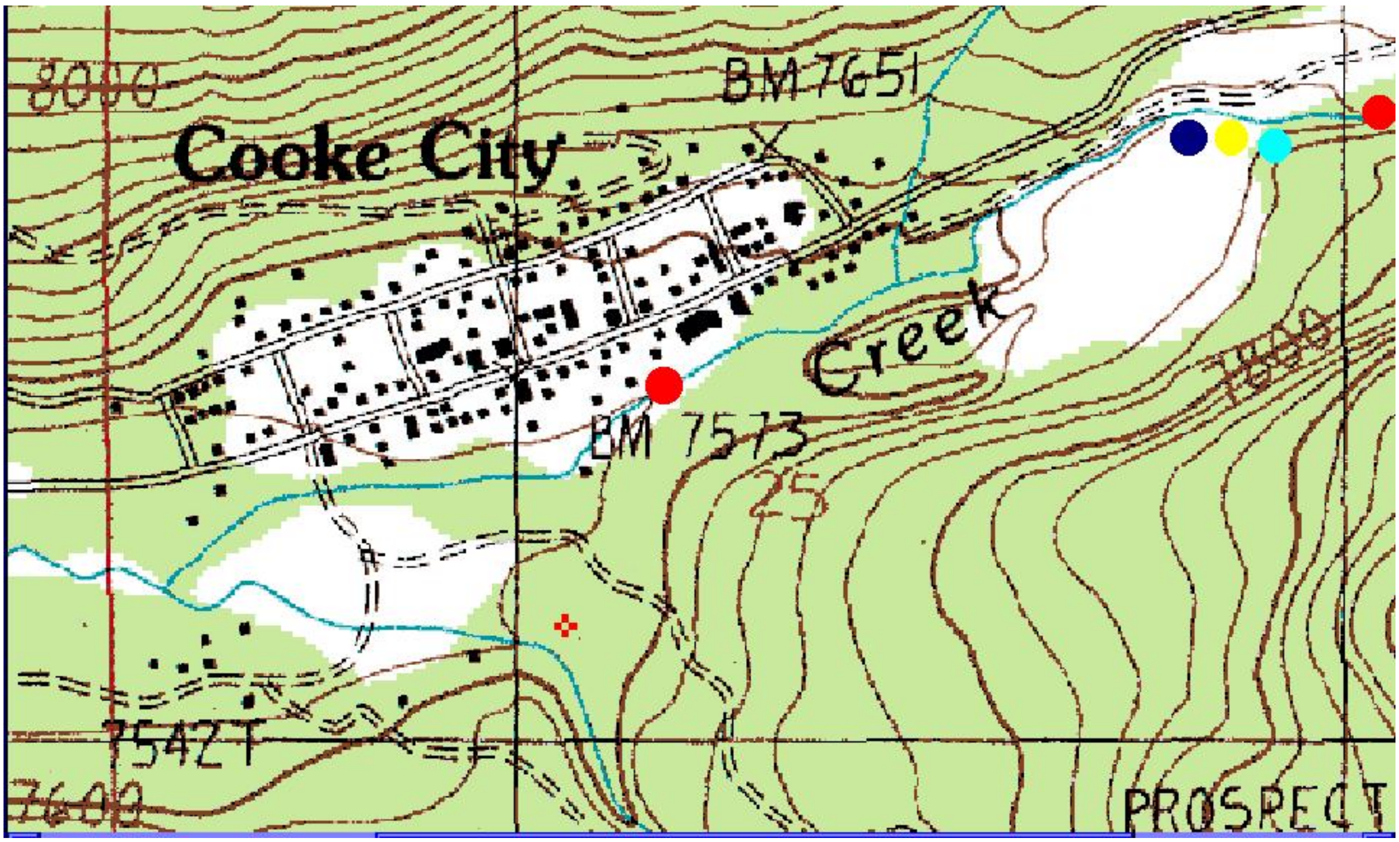
University of Michigan Geology, August 2001

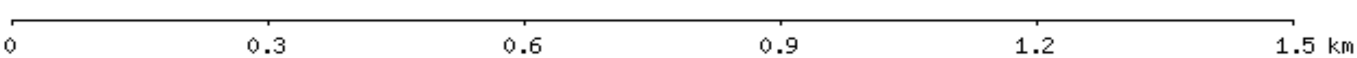
ABSTRACT

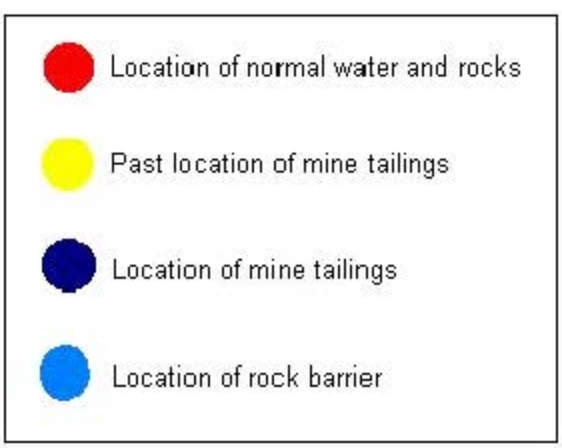
The New World Mining District is located ~2.5 miles northwest of Cooke City, MT, ~3 miles northeast of Yellowstone National Park, and ~2 miles southwest of Absaroka Beartooth Wilderness area. Economic ore deposits within the New World Mining District were mined from 1870-1953, and the largest deposit, The McLaren Gold Mine, was operated from 1933-1953. In the summer of 1950, a large flood in Soda Butte Creek breached the tailing impoundment for the McLaren mine, spilling a large amount of tailings into the creek. Our objective was to identify, describe, and map floodplain deposits in Soda Butte Creek related to the impoundment failure, assess the adverse effects of the tailings on the area, and provide a recommendation for remediation. We studied the distribution of natural sediments (rounded granite, dolomite, and sandstone) and antropogenic sediments (angular skarn, gossan, and pyrite) within the streambed of Soda Butte Creek both upstream and downstream from the mine tailings. We assessed the environmental health of the area using the presence of insects, plants, and fish as a marker of a healthy environment and their absence as a marker of an unhealthy environment. We also tested the pH of the water both upstream and downstream from the mine tailings. We found that the breached mine tailings had adverse effects on the surrounding area as they lowered the pH and added heavy metals to the water. The change in water chemistry significantly affected the local environment making it unsuitable for wildlife. No insects, fish, or aquatic plants were found within 2 miles downstream of the tailing site; they were found upstream from the tailings site and 3 miles downstream. No antropogenic sediments were found upstream from the mine tailings; they were found in abundance near the tailing site and downstream, where their occurrence decreased exponentially with distance from the site. The movement of anthropogenic sediments downstream is increasing the negative impact of the tailings with time. Our remediation recommendation is to send the tailings off-site for removal of heavy metals if funding is available or to disperse the tailings over a larger area to decrease the amount of heavy metals and acid released per unit area.

Topographic Site Map near Cooke City, MT

UTM 12 584050E 4985141N (NAD27)







1:23,000