

DATE: November 30, 2015 (email)

Rockslide Update:

In October, the County Commissioners requested proposals for “Rockslope Stabilization Engineering Services.” Responses to the “Request for Proposal” or RFP were due no later than October 20, 2015. The RFP solicited proposals for qualified engineering services to assist the County in Rockslope Stabilization engineering services and/or safe removal of rock from the slope with firms that specialize in unstable slopes and perform rock slope characterization, rock slope design, rock fall mitigation, rock slope stabilization, rock slope mapping, and landslide investigation and stabilization design. More specifically, the work proposal was to include a site visit to the rockfall location, evaluation of information in possession of Stillwater County and an evaluation of the stability of the existing rock face near the location of the recent rockfall event.

The Commissioners received four proposals in response to the above-described RFP. The four proposals received were: a) Landslide Technology; b) Shannon and Wilson; c) Golder Associates; and d) Terracon. The Commissioners opened the proposals on October 21, 2015. The matter was set for an agenda item for the following week’s agenda on October 27, 2015. At the October 27th agenda meeting, a bid committee was chosen by the Commissioners in order to review the proposals and make recommendations as to which company would be chosen. This committee then met on October 29th. Upon review and discussion, the decision was made to choose Shannon and Wilson’s proposal.

Once Shannon and Wilson was notified of its successful proposal, the Company prepared a contract for the County’s review. Shannon and Wilson’s contract was approved by the Commissioners at their November 10th agenda meeting. Once the contract was approved, a discussion ensued between the Commissioners and the company as to a time frame. At this point, Kami Deputy will be in Columbus on Wednesday, December 2, 2015 to attend the weekly Rockslide Meeting.

The four proposals are available for review at the Stillwater County Commissioner’s Office. The proposal selected is attached to this email.

On October 30, 2015, Deputy State Hazard Mitigation Officer Nadene Wadsworth notified the DES Coordinator, who in turn notified the Commissioners, that Stillwater County was unsuccessful in its landslide project grant to FEMA. The County has not received any formal letter or other notification from FEMA.

The road remains closed at this time and there are no timelines established to re-open the road at this point given the continuing safety concerns. The road is a closed area, yet the County continues to receive reports people are still traversing the rock slide day and night. It is clearly posted as a closed and no trespassing zone. The County will enforce the laws that apply.

Happy Holidays to all.

Dennis Shupak, Commissioner DShupak@stillwater.mt.gov

Gerald Dell, Commissioner GDell@stillwater.mt.gov

Maureen Davey, Commissioner MDavey@stillwater.mt.gov

Mark Schreiner, Road and Bridge Superintendent@stillwaterroadbridge.com

Joe Morse, Finance JMorse@stillwater.mt.gov

Nancy Rohde, County Attorney NRohde57@gmail.com

Cliff Brophy, Sheriff CBrophy@scsomt.org

Carol Arkell, DES Coordinator CArkell@stillwater.mt.gov

Attention: Joe Morse
Stillwater County
P.O. Box 795
400 E. 3rd Avenue North
Columbus, Montana 59019

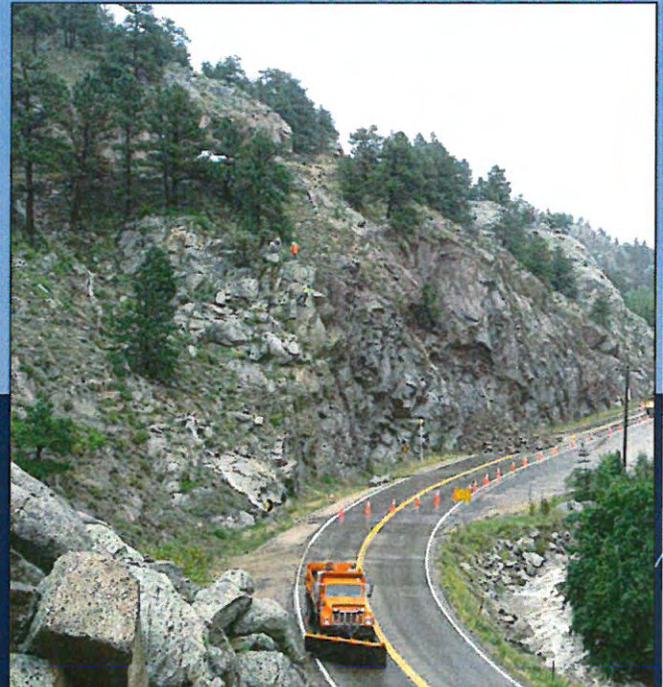
October 19, 2015



Proposal for Rockslope Stabilization Engineering Services for Stillwater County



SH 133 Emergency Rockfall Response



SH 119 Emergency Rockfall Response

Submitted By:

 **SHANNON & WILSON, INC.**
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

October 19, 2015

Stillwater County
P.O. Box 795
400 E. 3rd Avenue North
Columbus, Montana 59019

Attn: Joe Morse, Stillwater County Finance Specialist

**RE: PROPOSAL FOR ROCKSLOPE STABILIZATION ENGINEERING SERVICES,
STILLWATER COUNTY, MONTANA**

Shannon & Wilson is pleased to submit this technical proposal to provide rock slope stabilization engineering services for Stillwater County.

Shannon & Wilson is a nationally recognized consulting firm dedicated to providing quality services in the fields of geotechnical engineering and the applied earth sciences. We have a history of performance in unstable slopes, rock slope characterization, rock slope design, rock fall mitigation, rock slope stabilization, rock slope mapping (including use of vertical mapping techniques), and landslide investigation and stabilization design.

Our Colorado office is located in downtown Denver just 45 minutes from Denver International Airport. With a local staff of 27 supported by a staff of nearly 300 nationwide, we are able to respond to projects with short time frames, diverse needs, and concurrent deliverable schedules.

We are confident that we can bring value to your project. Shannon & Wilson commits the resources of the Denver Office and the Company to provide geotechnical rock slope engineering services for the duration of this project.

If you have any questions about this proposal, I can be reached at (720) 258-4114 or srw@shanwil.com. Alternatively, Denver Office Manager Greg Fischer can be reached at (720) 258-4102 or grf@shanwil.com. We look forward to working with you

Sincerely,

SHANNON & WILSON, INC.



Scott R. Walker
Senior Principal Professional

SRW:GRF/srw

GENERAL INFORMATION

COMPANY DETAILS

FIRM NAME: Shannon & Wilson, Inc. INCORPORATED IN: State of Washington
ADDRESS: 1321 Bannock Street, Suite 200 COMPANY HEADQUARTERS: Seattle, WA
Denver, CO 80204
PHONE: (303) 825-3800 OWNERSHIP: 100% Employee-Owned Corporation
MONTANA BUSINESS ENTITY ID NO.: F-037467

FIRM PROFILE AND RESOURCES

Shannon & Wilson is a nationally-recognized consulting firm dedicated to providing quality services in the fields of geotechnical engineering and the applied earth sciences. Headquartered in Seattle, Washington, we maintain 12 offices in eight states and the District of Columbia. We have annual revenue of over \$50M per year and are financially stable with no long term debt. Founded in 1954, we have more than 60 years of experience servicing a variety of private- and public-sector clients. Throughout our history, we have worked on thousands of transportation projects. Based on this experience, we have the ability to understand and communicate risks to our clients, and prioritize repairs where funds are limited.

Companywide, we maintain a staff of nearly 300 highly skilled individuals, including geological and geotechnical engineering staff experienced in civil design of rock slopes, foundations on rock, tunneling, and mine pit slopes. Our staff is experienced in rock slope engineering and rockfall hazard assessment and control. Once we assess the rock mechanics issues, we can determine the appropriate mitigation or support measures, such as trim blasting, rock bolts, wire mesh, or catchment fences. Many of Shannon & Wilson geologists and engineers are experienced in road access methods and have used these techniques to collect geologic data in areas of steep terrain. We have also conducted rockfall experiments by rolling cobbles and boulders down slopes to calibrate rockfall computer models.

COMPANY PRINCIPALS

Shannon & Wilson is 100% employee-owned, with 216 shareholders. Our principals are:

Company President

Mr. Gerard Buechel is a geotechnical engineer over with 35 years of experience. He holds professional licenses in 22 states, 2 territories, and 2 Canadian provinces. Mr. Buechel is also the Seattle office manager.

Secretary/Treasurer

Mr. Hollie Ellis has 41 years of experience in the statistical and numerical analysis in the geosciences fields, including computer modeling of soil and rock-structure interactions and risk-based analyses.

Board Chairman

Dr. Greg Fischer is Chairman of the Board and the Denver office manager. His qualifications are described below.

PROJECT STAFF

QUALIFICATIONS AND EXPERIENCE OF KEY SHANNON & WILSON STAFF

Principal-in-Charge

Greg Fischer, Ph.D., P.E., will serve as our Principal-in-Charge. As a licensed professional engineer in the State of Montana, Greg will retain overall professional responsibility for all aspects of the project. He has nearly 30 years of professional experience with the design and management of a wide variety of geotechnical engineering projects, including major highways, railroads and transit systems. His experience on transportation projects includes evaluating rockfall hazards and providing recommendations for rock slope stabilization, managing staff engineers throughout the investigation, analysis, design, and report preparation phases of projects, reviewing plans and specifications, and managing construction monitoring activities. Greg has been responsible for estimating budgets and cost management, and his technical skill in soil and rock behavior, coupled with strong management training and experience allows him to excel at managing projects of varying size and complexity. His project experience spans 25 states and 5 countries.

Technical Specialist and Senior Reviewer

Will Hultman is a geologist and geological engineer with over 25 years of experience in rock slope analysis. He has served as Resident Engineer, Project Engineer, and Project Manager on numerous rock slope stability problems in the United States and internationally. Many of his projects have involved emergency situations where railroads were out of service because of rockfall. He has extensive experience with rock bolting, blasting, hand and mechanical scaling, and rock catchment fences. As Shannon & Wilson's in-house rock mechanics subject matter expert, he will serve as a technical specialist and senior reviewer.

Project Manager

Scott Walker is a geological engineer with over 16 years of professional experience related to rock mechanics, underground engineering, and construction services. He has evaluated rockfall hazards for railroads, utilities, open pit mines, and state Departments of Transportation, and has developed recommendations for mitigation along with construction cost estimates. Scott has also developed bid documents (design drawings and specifications) for numerous projects, and he has served as resident engineer on several major heavy civil construction projects. He will serve as project manager and will be responsible overseeing and coordinating engineering analyses and other day-to-day project activities. **Scott will be the primary point of contact for the County.**

Project Engineer

Kami Deputy has over 10 years of experience in the fields of rock mechanics and geotechnical engineering investigations and analyses. Her professional experience includes: kinematic analysis and engineering design for rock slope stability; engineering design for rockfall hazards, and mitigation and design; and construction observation of rock slopes and slope stabilization. She also has experience with stability modeling and kinematic analysis of rock slopes. **Kami will be the lead engineer for this project and the secondary contact for the project.**

Support Staff

Our local staff is CADD proficient and maintains compatibility with standard electronic drafting formats, including MicroStation and AutoCAD systems. We are also proficient in the use of geographic information systems (GIS) to analyze and display spatial information. Unlike many geotechnical firms, **Shannon & Wilson has the capability and experience to prepare bid-ready plans and specifications.**

Midwest Rockfall, Inc.

Midwest Rockfall, Inc. is a contractor based in Henderson, Colorado (just north of Denver) that specializes in rockfall mitigation. They have been in business since 2007, and their management team has over 50 years combined experience in rockfall protection. As both a prime contractor and subcontractor, they have provided solutions to complex geotechnical problems for both private individuals and public entities from Vermont to Washington State to St. Croix, Virgin Islands.

Mr. Ryan Fetzer, Company President, has 15 years of experience installing and supervising various rockfall mitigation and slope stabilization systems. Mr. Luke Fetzer, Chief Estimator, has over 14 years of experience installing and supervising various rockfall mitigation and slope stabilization systems. As a crew member and supervisor he has completed over 4,700 hours of Rock Scaling; 175,000 linear feet of Permanent Ground Anchors; 2 million square feet of Wire Mesh; 1.1 million square feet of Cable Nets; 31,000 linear feet of Rockfall Fences; and 93,000 square feet of Shotcrete.



Shannon & Wilson has worked with Midwest Rockfall on numerous projects, and we have developed a strong professional relationship over the years. We are familiar with their capabilities and the quality of their work, and regularly include them when asked by clients for a list of qualified contractors from which to solicit bids.

As described more fully in our scope of work, we plan to utilize Midwest Rockfall as a project advisor. We anticipate that one of their management team will accompany us to look at the site and assist with developing costs and schedules for mitigation options. There is no additional fee associated with utilizing Midwest Rockfall in this capacity; they only request that that are provided an opportunity to submit a competitive bid on any future construction activities at the site.

PRIOR PROJECT EXPERIENCE

TAMARACK ROCKFALL, KOOTENAI RIVER SUBDIVISION, TAMARACK, MT | BNSF RAILWAY

- **Date** – 2010
- **Budget** – \$300k
- **Contact** – Lewis Ruder, 505-301-1801
- **Key Staff** – Will Hultman

In June 2010, a large rockslide occurred at MP 1291.1 on the BNSF Railway Kootenai River Subdivision, located 30 miles east of Libby, MT. The rockslide occurred on the north-side of a 900-foot-long rock cut after a period of heavy rainfall, mobilizing roughly 10,000 cubic-yards of rock. Both the main and siding-tracks were covered under 20 to 40 feet of rock debris, and sixteen rail cars of a passing west-bound freight train were derailed and partially covered by rock debris.

Shannon & Wilson provided emergency response and provided geotechnical recommendations and assisted the BNSF Railway clear the tracks and reestablish railway traffic. Rail traffic was restored two days after the rockslide occurred. Shannon & Wilson remained on site on a full-time basis, completed final design studies and provided recommendations for initial and final slope stability improvements.

Shannon & Wilson presented several options to BNSF railway to improve stability of the cut. These options included design slopes and permitting considerations to construct a more stable slope configuration to more site specific recommendations involving hand and machine scaling, and rock anchor and shotcrete ground support. Ultimately the BNSF Railway's preferred option included hand scaling of the rockfall area and rock slopes on both sides of the rock cut, and the installation of approximately 125 fifteen to twenty feet long cement- and resin-grouted tensioned anchors and rock dowels to support the rock blocks along the perimeter of the slide. Shannon & Wilson identified rock slope contractors, provided final design recommendations and plans, and full-time on-site construction observation services during construction to observe that the contractor was completing their work in accordance with our design, and to make adjustments to the scope of work as the work was completed. Final design studies and construction was completed on a fast track basis and construction was completed within two months following after the rock slide occurred.



BEARTOOTH HIGHWAY EMERGENCY REPAIRS | MONTANA DOT

- **Date** – 2005
- **Budget** – Total Project: \$20M, S&W: \$500k
- **Contact** – Mark Wissinger, PE, 460-444-6206
- **Key Staff** – Greg Fischer, Will Hultman

This project involved emergency reconstruction of 13 locations on US Highway 212 over a 10 mile length of a steep mountain side switchback roadway damaged by debris flow and associated erosion. Roadway repairs included debris removal, construction of mechanically stabilized earth (MSE) walls, temporary soil nail shoring walls, compacted rock slope embankments, earth embankments, rock cuts, debris flow training berms, rock fall fences, debris flow fences, and drainage improvements.

To design and construct these features, Shannon & Wilson conducted geologic reconnaissance and mapping at all repair sites, 14 subsurface borings, and 5 test pits. To assess future debris flow hazards and provide recommendations on appropriate debris flow hazard mitigation, geologic mapping was also conducted along each of the chutes.

Geotechnical/geologic engineering tasks to support design included rock-slope stability analyses for the rock cuts and wall rock foundations, MSE wall design, soil nail wall design, rock embankment stability analyses, and debris flow hazard assessment. Shannon & Wilson provided construction observations and recommendations on adapting design plans based on subsurface conditions exposed during construction and contractor/ equipment/access limitations.

The Beartooth Highway Emergency Repairs project for the Montana Department of Transportation was a Design/Build (D/B) project where we provided geotechnical repair designs for a major roadway damaged by debris flows in multiple locations. The D/B team beat all expectations. We completed the project \$6 million under budget and 2 weeks ahead of schedule.

Shannon & Wilson was awarded two ACEC Engineering Excellence Awards in 2006 for our work on this project: Honorable Mention (national level) and Gold Award for “Complexity” (state level).



“Shannon & Wilson’s geotechnical engineering solutions for restoring damaged highway sections and protecting the public from future debris flows was critical to reopening the highway ahead of schedule. It is a testament to Shannon & Wilson’s engineering talent and work ethic that they not only met our expectations, but also exceeded them. The work was substantially completed by the first of October and the grand opening of the road was a full week ahead of schedule. The final costs of this project will be several million dollars less than the initial cost estimate.”

*-Mark Wissinger, PE
Montana DOT*

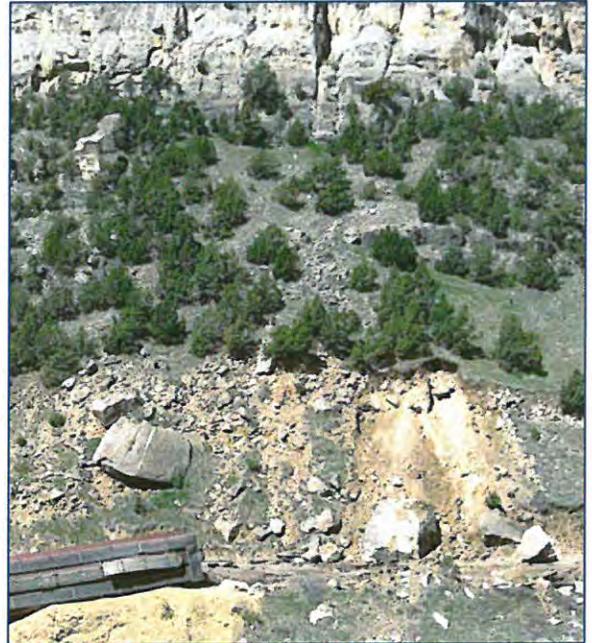
WIND RIVER CANYON ROCKFALL PROJECTS, WYOMING | BNSF RAILWAY

- **Date** – 2010, 2015
- **Budget** – \$200k
- **Contacts** – Lewis Ruder, 505-301-1801; Rafer Nichols, 817-471-6614
- **Key Staff** – Will Hultman, Greg Fischer, Scott Walker

Following a rockfall event in Wind River Canyon that led to the derailment of two locomotives and four freight cars in 2010, Shannon & Wilson, Inc. provided emergency response services and recommendations to reduce crew exposure to rockfall risk during the clean-up efforts.

Later, Shannon & Wilson assessed the rockfall hazard at 77 additional sites within the Casper Subdivision from north of Greybull to east of Shoshoni. We established a priority ranking of rockfall hazard using the Colorado Rockfall Hazard Rating System, modified by Shannon & Wilson for use on railroads.

Based on the results of the assessment, we developed recommendations for rockfall risk reduction, such as modified operations in response to triggering events (such as heavy rainfall), slide detection fences, and monitoring of specific features. We also provided conceptual-level recommendations for hazard reduction, including improved ditches to capture rockfall, scaling, spot bolting, shotcrete, draped mesh, catchment fences, barriers, and sheds. As part of the conceptual designs, we developed an opinion of probable construction cost for the hazard reduction recommendations.



In May 2015, intense rainfall caused debris flows to initiate at the head of steep talus slopes at the base of the 200- to 500- foot high vertical dolomite and limestone cliffs that form the upper canyon wall. Erosion of the talus undermined boulders up to 25 feet in diameter that rolled down the slopes and onto or across the railroad. Cobbles and boulders that did not reach the flat ground of the railroad grade or a flat area immediately on the uphill side of the railroad remained in a loose or overhanging condition on the steep uphill slopes, creating a rockfall hazard to the railroad.

Shannon & Wilson provided emergency assistance to the railroad to assist with clean-up of the debris flows and preliminary mitigation of rockfall hazards so that the line could be repaired and returned to service.

Later, we provided field observation and guidance to a rockfall mitigation contractor who completed additional scaling of rocks loosened by the debris flows.



AS-NEEDED ROCKFALL AND GEOLOGIC INVESTIGATIONS, COLORADO | COLORADO DOT

- **Date** – Ongoing
- **Budget** – \$750k
- **Contact** – Ty Ortiz, 303-398-6588
- **Key Staff** – Greg Fischer, Scott Walker, Kami Deputy

Shannon and Wilson has been providing statewide support to the CDOT Rockfall Program since early 2011. Under this contract we have performed emergency response to rockfall, debris flows, and landslides, sinkhole events; observation and inspection of scaling and blasting for hazard reduction; and design for new rockfall mitigation projects.

Special projects under the contract have included:

- development of slope instrumentation programs at several sites statewide;
- an automated data acquisition system that can provide alarm notification for a slope movement;
- a feasibility study for a permanent slope radar installation to provide remote, full time slope monitoring; and
- a statewide inventory of rockfall mitigation devices such as fences and barriers.

Additionally, we are working with CDOT to develop an asset management based rockfall management plan which will guide prioritization of future risk mitigation projects.



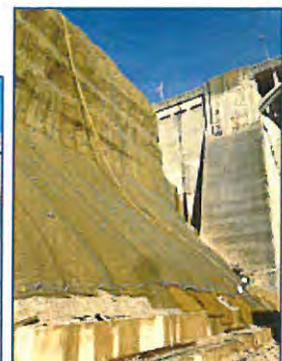
PENSACOLA DAM ROCKFALL MITIGATION, OKLAHOMA | GRAND RIVER DAM AUTHORITY

- **Date** – 2013
- **Budget** – \$160k
- **Contact** – Steve Jacoby, 918-610-9727
- **Key Staff** – Scott Walker

Rockfall from a raveling limestone bluff on the downstream right abutment of Pensacola Dam was impacting the powerhouse, and had buried a walkway that provided access to a portion of the dam gallery. Shannon & Wilson evaluated the slope and developed conceptual mitigation options. We subsequently designed an anchored mesh system to contain future rockfall, and developed bid documents (design drawings and specifications) that also included removal of the accumulated soil and rock, scaling of the slope, and trimming overhangs. During construction we provided full-time observation on behalf of GRDA utilizing our rope access-trained personnel.



Before



After

CURRENT WORK ACTIVITIES AND COORDINATION

CURRENT WORKLOAD

As a large, multi-disciplinary consulting firm, Shannon & Wilson has many ongoing projects. However, we maintain a staff of nearly 300 engineers, geologists, lab/field technicians, and administrative support staff who are accustomed to operating in a high-energy environment. Our staff have overlapping capabilities and broad based experience, giving us greater flexibility for work assignments as project requirements rise and fall. We also routinely share resources across offices, allowing us to provide high-quality services even when responding to multiple concurrent tasks or project needs.

AVAILABILITY OF STAFF

Based on current and projected workloads, we are confident that the key staff listed above have the availability to respond to the County's immediate need for a site visit, assessment, and preparation of a report with recommendations and estimated costs. We are also confident that we will have the capacity to complete any follow-on work, including design of slope repair, preparation of drawings and specifications, bid support, or other tasks as requested.

Additionally, we are accustomed to responding quickly to emergencies. Under our on-call agreements with the BNSF Railway, Union Pacific Railroad, CSX Transportation, and others, we regularly respond within hours to sites across the United States where natural hazards have impacted railroad corridors. Typically the timing of our arrival is dictated by the availability of flights, rather than the availability of our staff. Should another rockfall event occur, we will be prepared to respond as quickly as possible to assist the County if so requested.

COORDINATION WITH STILLWATER COUNTY

At Shannon & Wilson, we work on projects that are award winning, technically complex and involve major capital improvement costs. We also work on smaller-scale projects with limited budgets. Regardless of size, we give each project the same attention to technical excellence and quality.

Furthermore, while we are large enough to handle multiple projects simultaneously, we pride ourselves on our ability to be responsive to all of our clients. We regularly coordinate within each office and also across offices in order to make sure that project needs are met.

With respect to this project, we will communicate regularly with Stillwater County to make sure that the County's needs are met in a timely manner – and the County can be assured that we have the resources to do so.

Shannon & Wilson staff utilize modern communication methods so that we are available to our clients **when they need us**. Our desk telephones are linked to our mobile phones, eliminating the need to maintain multiple contact numbers. Additionally, our and company e-mail accounts are linked to our mobile phones, and we receive e-mail notifications whenever a client leaves a voicemails on our desk phone.

Stillwater County should feel confident that in the event an urgent need arises, either **Scott Walker (Primary Contact)** or **Kami Deputy (Secondary Contact)** will be available to respond.

Finally, as a firm with a national presence, we are accustomed to serving geographically diverse clients, and the proximity of Denver International Airport allows us to quickly access both urban and remote project locations across the country.

WORK PLAN

SCOPE OF WORK

Our proposed scope of work includes five tasks, as described in detail below.

Task 1 – Review of Available Data

In order to make best use of our time in the field, our first task will include reviewing available data about the regional geology, along with any data available from Stillwater County.

Task 2 – Site Visit

We will schedule a site visit to observe the recent rockfall and the current condition of the rock slope. As part of the site visit, we would like to meet with the County and its consultants so that we can fully understand the County's concerns and goals for the project.

While on site, we will evaluate the method by which the rock slope failed, and assess the potential for future rockfalls at the site. To the extent that the following activities can be completed safely, we will also:

- Measure and document the range of sizes and locations of the fallen rocks,
- Estimate the height and inclination of the slope,
- Map the geology of bedrock exposures, and
- Measure the orientation of bedrock discontinuities.

In addition to sending an experienced engineer from Shannon & Wilson, we propose to have an experienced member of Midwest Rockfall's team attend the site visit as well. Our engineer can look at the geology and probable failure mechanisms from site from an engineering geology perspective, while Midwest Rockfall's representative can assess the challenges associated with mitigation and stabilization of the slope from a contractor's perspective.

We have utilized this approach on other projects, and have found that it provides value to our clients, particularly when developing conceptual mitigation options and probable construction costs. Additionally, because Shannon & Wilson and Midwest Rockfall are separate companies, the County should feel confident that this approach does not create a conflict of interest. Shannon & Wilson will develop mitigation concepts that in our professional experience are appropriate for the site, while Midwest Rockfall will provide input on constructability and the effect of various project elements on the overall construction cost.

Task 3 – Analysis

Based on the results of the field observations, we will perform engineering analyses that will allow us to develop conceptual options for mitigating the rockfall hazard. We anticipate that our analyses will include developing a rockfall model to estimate the velocity (energy) and bounce height of future rockfalls. Additionally, to the extent we are able to safely measure the orientation of bedrock discontinuities, we will evaluate the kinematic stability of the slope and estimate the potential volume of material that could come down in the future.

Using the results of our analyses, we will develop conceptual options for reducing the future rockfall hazard at the site. In conjunction with Midwest Rockfall, we will develop a conceptual-level opinion of probable construction cost and schedule for the various options.

Task 4 – Reporting

Our deliverable to the County will be a consulting engineering report, sealed by a licensed Montana Professional Engineer. Our report will include:

- an evaluation of the site geology and ground conditions based on the field observations, published geologic maps and reports, and information from the County;
- our evaluation of the existing rock slope, including the recent rockfall and the potential for future rockfalls;
- conceptual options to both mitigate the immediate hazard and provide a long-term stabilization solution, as appropriate;
- recommendations for additional studies necessary to develop a final design (such as surveying, vertical slope mapping, etc.);
- an opinion of the probable construction cost for the conceptual options;
- an estimated timeline for the various options evaluated, from design through construction.

Task 5 – Follow up with Stillwater County

We understand that our reports often contain technical information, and that after digesting our conclusions and recommendations our Clients may have additional questions. Recognizing that follow-up should include more than submitting an invoice for services rendered, and to make sure that we provide Stillwater County with the information necessary to make an informed decision on how to move forward, we will schedule a teleconference or webinar to go over any follow-up questions or concerns after our report has been submitted and reviewed.

ASSUMPTIONS

In developing this proposal, we have assumed the following:

- The site reconnaissance and existing rock slope evaluation will be completed during one day, before snow has covered the slope face.
- The slope can be accessed at the base, and vertical slope mapping (i.e., using rope access techniques) will not be performed during the site visit.
- Right-of-entry, if required, will be provided by others.

SCHEDULE

We estimate that we can perform the site reconnaissance and rock slope field evaluation about one week after execution of the contract. We anticipate that our report can be completed within about four weeks after performing the site reconnaissance, with an allowance for holidays.

ESTIMATED FEE

We are prepared to complete the services on a time and expense basis. Our estimated fee for the scope of work described above is \$17,000, and we will not exceed this amount without prior authorized approval.

Fees for Shannon & Wilson's services are based on the actual time expended on the project by our personnel, including travel. The cost will be computed by multiplying the actual number of hours worked by the standard hourly rate for the appropriate labor category. Our standard hourly rates and a description of our billing procedures are provided on the following page.

2015 Standard Hourly Labor Rates

Senior Vice President	\$240.00/hr	
Vice President.....	\$200.00/hr	
Senior Associate	\$170.00/hr	
Associate.....	\$150.00/hr	
Senior Principal Professional	\$135.00/hr	
Principal Professional	\$120.00/hr	
Senior Professional	\$105.00/hr	
Category IV Professional.....	\$95.00/hr	
Category III Professional	\$90.00/hr	
Category II Professional	\$83.00/hr	
Category I Professional	\$75.00/hr	
	<i>Regular</i>	<i>Overtime</i>
Senior Drafter	\$100.00/hr	\$115.00/hr
Drafter III, IV	\$83.00/hr	\$96.00/hr
Drafter I, II	\$75.00/hr	\$87.00/hr
Administrative III/IV	\$80.00/hr	\$93.00/hr
Administrative I/II	\$65.00/hr	\$75.00/hr

Reimbursable Expenses

Expenses other than salary costs that are directly attributable to our professional services will be invoiced at our cost. Examples include, but are not limited to, expenses for out-of-town travel and lodging, premiums for additional or special insurance where required, long distance telephone charges, local mileage and parking, use of rental vehicles, taxi, reproduction, local and out-of-town delivery service, express mail, photographs, laboratory equipment fees, shipping charges and supplies.

Billing Procedures

- Project related services will be billed once monthly.
- Vehicle mileage will be billed at current IRS Audit Rate at time of service performance.
- Communication/computer time charges are incorporated into the hourly billing rates and will not be billed separately.
- Office related consumable supplies (e.g. copies, printing, faxing, telephone, courier, etc.) will be billed at cost with no additional mark-up.
- Travel related items such as car rental, hotel and per-diem will be billed at cost with no additional mark-up.
- Project related printing and reproduction will be billed at cost with no additional mark-up.
- Subcontractors and subconsultants will be billed at cost with a 10 percent mark-up.
- Overtime for exempt personnel will be billed at the standard hourly rate identified in the above fully burdened rate schedule.

RESUMES

Detailed resumes for our key staff are included as a separate attachment.

Gregory R. Fischer, PhD, PE | Senior Vice President

EDUCATION

PhD, Civil Engineering, University of Washington, 1994

MS, Civil Engineering, University of Illinois, 1986

BS, Civil Engineering, University of Illinois, 1984

REGISTRATIONS AND CERTIFICATIONS

Professional Engineer, Colorado (34461); Montana (15564)

Professional Engineer, 24 other states and territories (AZ, CT, FL, Guam, IL, IA, KS, LA, MD, MI, MN, NE, NV, NM, NY, NC, ND, OK, SD, TX, UT, WA, WI, WY)

PROFESSIONAL SUMMARY

Greg is a Senior Vice President and Project Manager with nearly 30 years of experience providing geotechnical engineering services on public and private transportation projects. His experience includes planning subsurface exploration programs; managing field and office work; evaluating rockfall hazards and providing recommendations for rock slope stabilization; providing foundation recommendations for new bridges and bridge widenings; designing cut-and-fill retaining walls, including mechanically stabilized earth (MSE) walls, tieback walls, soil nail walls, conventional concrete cantilever walls, and noise barrier walls; designing embankments over soft ground conditions; providing recommendations for excavations and fills; and providing subgrade parameters and design. His project experience spans 25 states and 5 countries, and includes numerous geologic hazard mitigation projects for transportation agencies from Montana to Peru. His technical skill in soil and rock behavior, coupled with experience on rock slope hazard mitigation projects and strong management training and experience allows him to excel at managing projects of all sizes and degrees of complexity.

SELECTED PROJECT EXPERIENCE

Beartooth Highway Emergency Repairs Project, Red Lodge, Montana. Greg was the Engineer of Record for geotechnical services for reconstruction of 13 locations on US Highway 212 on 10 miles of a steep mountainside switchback roadway damaged by debris flows and associated erosion. Roadway repairs included debris removal, construction of mechanically stabilized earth walls (MSEW), temporary soil nail shoring walls, compacted rock slope embankments, earth embankments, rock cuts, debris flow training berms, rock fall fences, debris flow fences, and drainage improvements. To design and construct these features, Greg's team conducted geologic reconnaissance and mapping at all repair sites, 14 subsurface borings, and 5 test pits. To assess future debris flow hazards and provide recommendations on appropriate debris flow hazard mitigation, geologic mapping was also conducted along each of the debris chutes.

Montana Rail Link, Mullan Tunnel Open Cut Excavation, Mullan Pass, Montana. Greg was the Principal-in-Charge for a project to provide a second opinion regarding rock slope stability rockfall hazard associated with new excavation slopes in rock at the west portal of the Mullan Tunnel. Based on geologic mapping and an evaluation of potential failure modes we recommended additional slope excavation and rock scaling to improve the stability of the slope.

UPRR, Rockfall Hazard Evaluation, Colorado. Greg was the senior principal reviewer for a rockfall hazard assessment and mitigation project for the Union Pacific Railroad throughout the State of Colorado. These projects include assessment of rockfall hazards and mitigation of hazards through the use of scaling, trim blasting, and rock bolts, wire mesh, and rock fences.

Burlington Northern Santa Fe Railway (BNSF), Wind River Canyon Rockfall Evaluation, Casper Subdivision, Thermopolis, Wyoming. During the spring of both 2009 and 2010, the BNSF had reported several rockfall events along stretches of track within the Wind River Canyon along the Casper Subdivision. Greg oversaw emergency response to a 2010 derailment event; assessment of the site for additional rockfall risk; priority ranking of rockfall hazards; conceptual level design recommendations to reduce the rockfall hazards, and estimation of construction costs to complete the work.

Pan American Highway Slope Improvements, Peru. Greg designed remedial measures for unstable slopes at three sites located along the arid Peruvian coast. As project manager for this fast-track 4-month-long project (fast-track schedule required to provide sufficient construction time before the anticipated El Nino event), Greg led the team in developing practical and economical solutions for 25 km of unstable sand slopes and 53 km of unstable rock slopes. He completed geotechnical explorations and laboratory testing to characterize the types of failures and the engineering properties. He completed stability analyses and designed corrective solutions, including reinforced soil walls, new drainage measures, new procedures for maintaining the roadway, realignment, rock scaling, blasting, and rock anchors.

BNSF Railway, Abo Canyon Double-Track Project, New Mexico. Greg was the principal-in-charge for preliminary and final geotechnical recommendations for an additional track through the Abo Canyon in central New Mexico. This 5-mile stretch of single track mainline was bounded by double track high capacity alignments on both ends and was a significant choke point on the BNSF's Southern Transcon. Shannon & Wilson recommended an alignment that could be constructed without impacting train traffic on the existing track, would allow reduction or elimination of rockfall hazards and the need for slide warning fences on both lines, and reduction in curvature and higher operating speeds on both lines. Shannon & Wilson provided recommendations for bridges, rock cuts, and embankments as part of final design.

Boulder Open Space and Mountain Parks Miscellaneous Investigations, Boulder, CO. Greg was the Principal-in-Charge overseeing several projects for OSMP including: rockfall evaluation at Boulder Falls; rockfall evaluation along Royal Arch Trail; and evaluation of 7 slope failures resulting from the 2013 flood event that were encroaching on private properties adjacent to OSMP boundaries. Work included providing detailed summaries of observations; opinions of future on-going risk caused by the hazards; potential mitigation options for each hazard area; and preliminary recommendations for additional studies to assist in developing mitigation strategies.

CDOT NPS Rockfall Hazards and Geologic Investigations, Denver, Colorado. Greg is the Principal-in-Charge overseeing this NPS to provide emergency response to rockfall, debris flows, and sinkhole events; routine observation of scaling and blasting; inventory of rockfall mitigation devices such as fences and barriers; development of slope instrumentation programs; and design for rockfall mitigation projects.

NFSR 211, Jefferson County, Colorado. Greg was the project manager for roadway improvements to National Forest Service Road 211 located in the Hayman Fire burn area. Work included field reconnaissance, excavation of testpits, and collection of samples for laboratory testing. Slope stability and rockfall analysis were completed to provide design recommendations for cut and fill slopes and retaining structures including gabion walls, MSE walls, soil nail walls, and rock bolts. Recommendations were also provided for roadway drainage and culvert outlets. Greg also assisted in preparation of plans and specifications for geotechnical aspects of the project.

William A. Hultman | Vice President

EDUCATION

MS, Geological Engineering, University of Idaho, 1988
BS, Geological Engineering, University of Idaho, 1986
BS, Geology, University of Idaho, 1979

REGISTRATION

Professional Civil Engineer, Washington (29668)
Professional Civil Engineer, 5 other states (RI, NH, ME, ID, DE)
Licensed Engineering Geologist, Washington (301)

Will Hultman is a geologist and geological engineer with over 25 years of professional experience. He is Shannon & Wilson's in-house expert on rock mechanics, rock slope stability, and rockfall assessment, analysis, and mitigation. Over the course of his career, he has served as Resident Engineer, Project Engineer, Project Manager, and Principal-in-Charge on a wide range of geotechnical projects involving dam abutment stability, tunnel clearance and rehabilitation, rock slope stability, rock slope design, landslides, embankment failures, and bridge foundations for the railroad industry, state and federal agencies, and utilities. Many of his railroad projects have involved emergency situations where the track was out of service because of rockfall or other slope movements. Will also has extensive experience with preparing design drawings and specifications for rock slope mitigation and other projects.

RELEVANT EXPERIENCE

BNSF Railway, Tamarack Slope Repair, Montana. Project Manager. Will helped the BNSF Railway restore service to their track that had been buried by a slide from an adjacent rock cut slope. Will led a team that evaluated several alternatives to improve the stability of the slope, which included construction of a new slope or improving the existing slope using rock scaling; and support of potentially unstable rock blocks using rock anchors, rock dowels, and shotcrete. Ultimately the BNSF choose to not construct a new slope, so working on a fast-track schedule, the Shannon & Wilson team completed final design studies for rock anchors, dowels and shotcrete, and provided construction observation during completion of the work.

BNSF Railway, Katka Siding Rock Slope Stabilization Project, Idaho. Principal in Charge. BNSF Railway constructed a siding in 1999 along the Kootenai River east of Bonners Ferry, ID. To avoid environmental impacts to the adjacent river, now rock cuts up to 250 feet high were constructed in Belt Supergroup metasediments. During construction and continuing periodically to the present time, the railroad has experienced numerous rock falls and, occasionally large rock slides have blocked the main and siding tracks. After recent major rock fall events, BNSF retained Shannon & Wilson to provide emergency response, to rate and prioritize the rock fall hazard along the 2-mile-long siding, and to design rock slope stability improvements to reduce the rock fall hazard. Based on LiDAR surveys and conventional geologic mapping we evaluated existing slope conditions (including the previously established support systems) and the rock fall failure modes, and developed mitigation measures to improve the stability of the slope. Construction of the recommended slope stability improvements has involved rock scaling, installation of about 25,000 linear feet of cement-grouted rock bolts, 7,500 linear feet of drain holes, nearly 200 cubic yards of steel fiber reinforced shotcrete for reaction blocks and slope facing, and an anchored mesh support system. Work is ongoing.

BNSF Railway, Rockfall Hazard Assessment, Various Locations. Project Manager. Will was responsible for the assessing the rockfall hazard at approximately 140 sites in Washington, Idaho, Montana, and Wyoming. He established a priority ranking of rockfall hazard using the Colorado Rockfall Hazard Rating System, modified by Shannon & Wilson for use on railroads. Will then identified preliminary stabilization measures for each site, developed estimated construction costs to complete the work, and assisted the railroad with implementation of mitigation at the highest priority sites.

Union Pacific Railroad, Caliente Rock Slide, Nevada. Will served as project engineer to evaluate the potential for an active rock slide to impact the UPRR main track through Clover Creek canyon. He and a team of engineering geologists mapped the landslide, evaluated potential failure modes, advised the railroad with scenarios on how the slide may fail, and how it might impact the railroad for each scenario. Will's team also presented preliminary alternatives to remove the rock debris and reduce the potential impact to the railroad. Subsequently, Will served as project manager for Shannon & Wilson's effort to develop a design to mitigate the slide.

BNSF Railway, Maintenance Program, Central Oregon. As Project Engineer, Will developed a maintenance program for the railroad to reduce the rockfall hazard along particularly hazardous sections of track within the Oregon Trunk Subdivision. He assisted the railroad identify chronic sites for remedial work, identified work to be performed at each site, and prepared contract documents for bidding and construction.

Seattle City Light, Boundary Dam, Pend Oreille County, Washington. Project Engineer. Will evaluated the rockfall hazard from a 400-foot high cliff over a tunnel portal that provides access to the underground powerhouse. Analyses included rockfall tests at the site to help calibrate rockfall simulation programs and evaluate rockfall hazard. The test program used digital video cameras to determine the rockfall trajectories and velocities. Using these data, he determined appropriate parameters to use in the rockfall simulation program, which was then used to map the impact zone and kinetic energy in the impact zone. Seattle City Light used these results to design and construct rockfall protection measures.

Montana Rail Link, Mullan Tunnel Open Cut Excavation, Mullan Pass, Montana. Project Manager. Shannon & Wilson was retained by MRL to provide a second opinion regarding rock slope stability and factors contributing to the ongoing rockfall hazard from new excavation slopes at the west portal of the Mullan Tunnel. Shannon & Wilson reviewed the design engineer's plans and completed a one day site visit to assess rock slope stability conditions. Based on geologic mapping and an evaluation of potential failure modes, we recommended additional slope excavation and rock scaling to remove unstable rock blocks to reduce the overall rockfall hazard and to improve the stability of the slope.

Cushman Dam No. 2 Left Abutment Rock Slope, Hoodport, Washington. Principal-in-Charge. Will was the principal-in-charge and engineer of record for assessment of rockfall hazard and design of rockfall mitigation at Tacoma Power's Cushman Dam No. 2. The project involved LiDAR surveying of the left abutment slope downstream of the dam, modeling rockfall and assessing the hazard to a fish collection facility and powerhouse at the toe of the dam, and developing design drawings and specifications for anchored wire mesh and cable nets.

Union Pacific Railroad, Rockfall Hazard Assessment, Various Locations. Project Manager. Will assisted the UPRR with evaluation of rockfall hazard, development of mitigation strategies, and an opinion of construction cost for sites in Utah, Washington, Oregon, and California.

Scott R. Walker | Senior Principal Engineer

EDUCATION

M.S., Geological Engineering, University of Missouri-Rolla, 1999

B.S., Geological Engineering, Colorado School of Mines, 1996

REGISTRATIONS AND CERTIFICATIONS

Professional Engineer, Colorado (36802); California (C67224)

Registered/Professional Geologist, Missouri (2001020175); California (7441)

Professional Geologist, Colorado (per §23-41-208, Colorado Revised Statutes)

Certified Engineering Geologist, California (2305)

PROFESSIONAL SUMMARY

Scott has over 16 years of professional experience in the fields of engineering geology and geotechnical engineering, primarily in the Rocky Mountain, New England, and Pacific Northwest regions. He has held positions ranging from staff engineer to project manager, and his primary areas of expertise include rock mechanics, underground engineering, water resources, and construction services. Specific experience includes characterizing subsurface conditions, performing and reviewing geotechnical engineering analyses related to rock slopes, underground openings, earth embankments, excavations, and foundations - including soil and rock slope stability, and rockfall. He also has experience with field inspection of rock slopes, preparation of design drawings and specifications, quantity takeoffs, development of construction cost estimates, and writing reports. In addition, Scott has served as resident engineer on several major heavy civil construction projects with multidisciplinary elements, including earth dams.

SELECTED PROJECT EXPERIENCE

BNSF Railway, Rockfall Assessment, MP 375 to MP 423, Seligman Subdivision, and MP 377 to MP 401, Phoenix Subdivision, Arizona. In response to multiple events where train traffic was affected by large rocks falling onto the tracks (including one derailment), Scott observed and documented slope conditions at 41 sites along the BNSF's double-track transcontinental mainline west of Williams, Arizona. He also looked at two sites on BNSF's single-track line between Williams and Ash Fork, Arizona. Based on the geologic conditions, Scott prioritized the sites and developed recommendations and estimated quantities for hand and mechanical scaling and ditch cleaning. Working with a rockfall contractor, Scott developed a schedule and opinion of probable cost to implement the rockfall mitigation recommendations along more than 50 miles of track.

Pensacola Dam West Abutment Stabilization, Langley, Oklahoma. A limestone bluff downstream of the dam and above the powerhouse had raveled over time and the resulting talus wedge buried an access walkway. Scott prepared specifications and design drawings for a repair, which included removal of the accumulated soil and rock, scaling of the slope, and installation of an anchored slope mesh system to contain future weathered debris. Scott also provided field observation and engineering services during construction.

U.S. Highway 36, U.S. Highway 34, and State Highway 7 Inspections, Larimer and Boulder Counties, Colorado. Following record rainfall in September 2013, Shannon & Wilson assisted the Colorado Department of Transportation with inspection and assessment of highways damaged by flooding. Scott inspected sections of U.S. Highway 36 between MP 12.5 and MP 15.5 (between Lyons and Pinewood Springs), State Highway 7 between MP 27.5 and Lyons, and the "Narrows" section of U.S. 34 to assess the potential for rockfall both during emergency reconstruction activities and after the roads were reopened to the public.

Cushman Dam No. 2 Left Abutment Rock Slope, Hoodport, Washington. Cushman Dam No. 2 is a 575-foot long, 216-foot-tall arch-gravity dam on the North Fork Skokomish River owned by the City of Tacoma. Recent improvements have included a secondary powerhouse and collection facility for anadromous fish at the base of the dam, and a tramway on the left abutment to lift collected fish to the dam crest. The most recent FERC Part 12 report raised questions about weathering along near-vertical discontinuities in the basalt bedrock of the left abutment, and Tacoma Power was also concerned about the potential for rockfalls to damage the new fish collection facility and powerhouse. Scott was the project manager and lead engineer for an evaluation of the left abutment rock mass, which included an evaluation of kinematic stability and rockfall potential, and which provided recommendations for rockfall mitigation. He was the lead designer for rockfall mitigation measures, including wire mesh, rope nets, and rock bolts.

Union Pacific Railroad, Rockfall Hazard Assessment, Portland Subdivision, Oregon Valley and Black Butte Subdivisions, California, and Ayer Subdivision, Washington. In response to past rockfall events, the UPRR has installed detection fences that are connected to the signal system. While the fences are useful for detecting rockfalls with the potential to derail a train, they can also cause delays if the system is activated due to non-rockfall events (such as falling branches or animal activity). Scott visited detection fence sites within the Columbia River Gorge west of Portland, Oregon, along the Sacramento River, Cantara Loop, and Sawmill Curve between Dunsmuir and Redding, California, and along the Snake River near Ayer, Washington. He assessed the slopes above the detection fences, and provided recommendations for modifying or stabilizing the slopes so that the fences would be less prone to nuisance activations.

Union Pacific Railroad, Rockfall Mitigation Design, Ayer Subdivision, Washington and Evanston Subdivision, Utah. Based on assessments of the rock slopes, Scott developed a design drawing and technical specifications for scaling of slopes adjacent to the railroad to reduce the rockfall hazard. Sites were located along the Snake River upstream of Lower Monumental Dam near Ayer, Washington and within Weber Canyon east of Ogden, Utah.

Boundary Dam Rockfall Study, Pend Oreille County, Washington. As a senior engineer, Scott was responsible for modeling rockfall paths and calculating probability of impact on critical infrastructure elements (outrigger arms and conductors) at the Boundary Dam hydroelectric facility in northeastern Washington.

Powder River Basin Coal Mine Rockfall Study, Campbell County, Wyoming and Decker, Montana. Scott was the project engineer for evaluation of rockfall hazards at four open pit coal mines in the Powder River Basin operated by Rio Tinto Energy America. As part of the study, Shannon & Wilson observed the path and trajectory of representative rocks rolled off the crest of a highwall at various locations in order to calibrate rockfall models. Based on the models we will evaluate bench widths and berm heights for various pit configurations.

Union Pacific Railroad, Rock Slope Stability, MP 117.2, Spokane Subdivision, Idaho. Scott assisted with the stability evaluation of a large rock block adjacent to the UPRR above the Kootenai River east of Bonners Ferry, Idaho. Evaluation included using a stereonet to determine the probability of an unsupported rock wedge sliding out of the slope onto the track.

Loveland Water Storage Dam (aka Green Ridge Glade Dam), Larimer County, Colorado. Scott served as assistant resident engineer, responsible for observation and documentation of construction activities. Scott's primary responsibilities included oversight controlled blasting, installation of rock support in the spillway channel, and the foundation grouting program.

Kami D. Deputy | Principal Engineer

EDUCATION

M.S., Civil Engineering, Virginia Polytechnic and State University, 2005

B.S., Geological Engineering, Montana Tech of the University of Montana, 2004

REGISTRATIONS AND CERTIFICATIONS

Professional Engineer, Colorado (48175)

Professional Engineer, 2 other states (NM, WA)

Kami has over 10 years of experience in rock mechanics and geotechnical engineering investigations and analyses. Her professional experience includes: kinematic analysis and engineering design for rock slope stability; developing and executing geotechnical site investigations; engineering design for rockfall hazards, and mitigation and design; quality assurance and quality control review; and construction observation of rock slopes and slope stabilization. She also has experience with stability modeling and kinematic analysis of rock slopes. Over the past year, Kami has been a project manager, technical leader, field representative, analyst, rock lab specialist, peer reviewer, quality control and quality assurance specialist, and designer for projects of varying scope and size dealing with geotechnical and rock engineering designs. Kami is a registered professional engineer in 3 states.

SELECTED PROJECT EXPERIENCE

Colorado Department of Transportation, State Highway 119A, Milepost (MP) 38.98 to MP 40.47, Boulder County, Colorado. A section of State Highway 119 has been evaluated for safety improvements and upgrades to current roadway standards following the flooding that occurred in September 2013. Shannon & Wilson's task along this portion of the highway was to develop preliminary rock cut slope angles and hazard mitigation considerations including life cycle considerations. Kami acted as a technical leader for evaluating potential roadway widening by cutting into the rock slopes bordering the road. Her effort included performing the geological rock mass mapping along the alignment at potential widening locations, evaluating potential geologic hazards, performing kinematic analyses to recommend stable rock cut slope inclinations, evaluating rockfall hazard catchment to recommend ditch widths, inclinations, or rockfall barriers, and providing construction estimates and considerations.

Boulder Open Space and Mountain Parks Elephant Buttresses Rockfall, Boulder, Colorado. Following a rockfall incident that closed a popular trail in Boulder County, Kami provided input regarding scaling activities including locations and amounts of potentially hazardous rock to remove. After scaling activities were completed, Kami provided rock reinforcement recommendations for portions of the rock slope that were unable to be removed because of size or location. Recommendations included rock bolts and rock straps to strength larger blocks in addition to preventing thin layers from falling away from the slope.

Utah Department of Transportation, US 89 Kanab Creek; Kanab, Utah. US-89 is the main access road from the Salt Lake Valley and I-15 into Kanab, Utah. North of Kanab, the highway follows the tight meanders of Kanab Creek creating blind corners and narrow shoulders along the highway. Because of the potential safety hazards to motorists, UDOT has recommended straightening and realignment of about three miles of the highway north of Kanab. Kami performed geologic rock mass mapping of the alignment slopes while rappelling as well as gathering information on a scanline survey. Kami also assisted in the office performing kinematic and global stability analyses and report preparation.

Arizona Department of Transportation, SR 202L (South Mountain Freeway), Phoenix, Arizona. ADOT is soliciting Design-Build proposals for construction of 22 miles of 10-lane freeway along a currently undeveloped alignment. The new highway will require multiple rock cuts totaling about one mile in length and ranging from 70 to 200 feet deep. Shannon & Wilson is currently providing geotechnical support for the pursuit phase of the project. Kami mapped the bedrock geology and discontinuity orientations at the locations of the proposed cuts and compiled the field data with information provided by ADOT. She then developed recommended cut slope inclinations based on kinematic stability analyses. Using on the recommended cut geometries, she also developed recommendations for ditches and barriers to prevent rockfall from entering the travelled way. The Design-Build contractor will use these recommendations to develop a competitive bid to construct the project.

Caltrans, I-405 Sepulveda Pass HOV Design Build Project, Los Angeles, California. The I-405 Sepulveda Passing Widening Project involves the widening of lanes, adding a 10-mile high-occupancy vehicle (HOV) lane, and building/improving support infrastructure such as ramps, bridges and sound walls for the I-405 corridor from the I-10 freeway to Highway 101. Kami's main role was assisting with field explorations, including rock core drilling, point load testing, photo documentation of rock core, and selecting and shipping rock samples for testing. In the office, she oversaw the laboratory testing and reviewed testing results, reduced data collected during field mapping activities and drilling, and aided in developing engineering mechanical characteristics of the rock material for design of soil nail and retaining walls and rock cut slopes. Kami performed the analysis and design of the cut slopes in rock and assisted with the report.

California American Water, Carmel River Reroute and Dam Removal, Carmel Valley, California. The San Clemente Dam was constructed between 1920 and 1921 and was originally built to impound drinking water for the Monterey Peninsula. The dam was built with the original capacity to store 1,425 acre-feet of water but had since silted in with over 2.5 million cubic yards of sediment and was impounding only 70 acre-feet of water. Studies indicated that the dam may fail during the maximum credible earthquake or probable maximum flood, thereby prompting California American Water to remove the dam and restore the ecological habitat. As part of a design-build team hired to provide the final design for removing the dam and restoring the site, Kami provided geotechnical and geological field investigation coordination. She helped write the Field Investigation and Instrumentation work plans. Kami executed the field program by attending kick off meetings with the client, regulatory agencies involved, and the design-build team. Additionally, she performed geologic rock mass mapping at the site. Kami managed the effort to design of the Reroute Channel - a rock cut through a drainage divide that was up to 700 feet in length and at the tallest point on one side of the cut, over 250 feet high. Kami acted as the technical lead and presented design information to the team for approval. During the first year of construction at the project site, Kami provided field design services and support including input and oversight on geologic mapping, rock mass mapping (performed by Kami), field design change submittals, writing and submitting requests for information, and performing instrumentation installation, reading, and data reduction.

CSX Railroad, Mulberry Siding and New Castle Siding, Birmingham, Alabama. The CSX railroad has two sections of rail line north of Birmingham that are proposed to be moved from the current line to the east approximately 15 feet. Moving the line will require excavations to be made within rock slopes to maintain a right-of-way and clearance for passing trains. Kami provided rock mechanics information for the proposal effort and performed the field data collection for geologic rock mass mapping along the proposed slopes to be excavated. Using the collected information, she performed a kinematic analysis for the slopes and provided recommendations for the two areas mapped.