Washington State Department of Transportation

Statement of Qualifications for Engineering Geology & Rock/Rockfall Geotechnical Project Delivery Packet A

LANDSLIDE TECHNOLOGY
A DIVISION OF CORNFORTH CONSULTANTS

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A DIVISION OF CORNFORTH CONSULTANTS
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December 1, 2023 P-1911

Manager, Consultant Services Office
Washington State Department of Transportation

Statement of Qualifications
Engineering Geology & Rock/Rockfall Geotechnical Project Delivery

Dear Washington State Department of Transportation (WSDOT):

Landslide Technology (LT) is pleased to submit qualifications to support the WSDOT State Geotechnical Office (SGO) with senior-level engineering geology and rock slope/rockfall related work. LT is a highly specialized geotechnical firm with experts ready to assist with projects involving rock slope and rockfall hazards for transportation infrastructure. We have a long history of teaming with state transportation agencies for project delivery and are very accustomed to serving as staffing extensions.

LT was established in 1983 specializing in slope stability projects such as highway-related rock slope/rockfall. Our business practice has been built around rapid response assessments and mitigation development for all types of slope hazards. We have the necessary expertise and resources to develop mitigations for fast-tracked emergency projects. It has been our privilege to assist numerous State DOTs with on-call slope stability services including Washington, Oregon, Idaho, Montana, Missouri, Tennessee, Utah, Wyoming, and Alaska, as well as the Federal Highway Administration. With key staff located in Olympia, Portland, and Boise, we are available to provide senior-level engineering geology expertise at project sites anywhere in Washington State within 24 hours' notice. This includes emergency response throughout the year, 7 days a week, 24 hours a day. Similarly, our staff of engineering geologists can assist when needed on subsurface investigations, geophysical services, and construction observation.

LT has 32 employees including 11 engineering geologists, 16 geotechnical engineers, and five on-call geotechnical staff consultants who are available to provide specialized expertise and additional capacity. Our full-time senior staff includes 15 geo-specialists with 10 to 48 years of project management experience. All senior staff are registered LEGs and/or PEs in the State of Washington, and they can provide a full range of services on slope hazard/engineering geology projects. LT also has an in-house climbing team who are proficient in high-angle rope access safety and experienced with accessing steep slopes for both geotechnical design and emergency response work. Our climbing team is trained and certified by the Society of Professional Rope Access Technicians (SPRAT), and they possess a safety record of zero incidents.

For this contract, LT's senior associate, Brent Black will serve as the Senior-Level Engineering Geologist and Agreement Manager (SLG). Brent has 32 years of consulting experience in the Pacific Northwest, Mountain States, and Alaska, and is a Licensed Engineering Geologist and Hydrogeologist in Washington State. His duties have included prior successful assignments as an extension of WSDOT's SGO group, and he has a strong history of project team management on multi-discipline rock slope/rockfall projects.

Brent will be backed by LT's Tom Badger as a key responder and subject matter expert. Tom is the former Chief Engineering Geologist of the WSDOT SGO group, and is based in Olympia, Washington. For over 30 years, Tom provided or managed the geotechnical response, characterization, and remediation of numerous emergent slope failures that damaged Washington State highways and threatened public safety. He is intimately familiar with the operating procedures within the SGO, and the services it provides to the Regional Maintenance, Design and Construction offices.

Our firm has a deep bench of engineering geology and rock slope/rockfall experts including Ben George, Darren Beckstrand, Adam Koslofsky, Sebastian Dirringer, Rachel Hunt, Aine Mines, Tygh Gianella, and Justin McCarley. Many of these professionals have recent experience with WSDOT engineering standards, having provided updates to WSDOT's Geotechnical Design Manual.

To supplement our regional presence, we have teamed with GeoEngineers (GEO) of Seattle, Washington. LT and GEO have a long teaming history in Washington State, including numerous recent assignments with the Seattle District Corps of Engineers. GEO brings added capacity in rock slope engineering and rope access personnel as highlighted by their senior engineering geologist, Andy Caneday. Our team also features Dr. Cathy Aimone-Martin for senior blasting consulting services. She has 50 years of experience in construction blasting and monitoring, including highway assignments for DOTs across the country. LT recognizes the important DBE contracting requirement of 17% under this contract. On that basis, we have assembled a strong group of DBE subconsultants that can supplement our in-house capabilities.

In summary, the LT team offers WSDOT the following benefits:

- Brent Black in the SLG role, who brings an excellent record of service to WSDOT's SGO group and transportation agencies.
- Tom Badger with 32 years of experience with the Agency, as a key responder and subject matter expert.
- Ample Prime capacity for engineering geology and rock/rockfall expertise with 32 engineering geologists and geotechnical engineers located near WSDOT headquarters.
- In-house rope climbing team and FAA pilot with drone/UAV capabilities.
- The ability to augment staffing resources, if needed, with Puget Sound offices of GEO for added engineering geology, rock/rockfall, and rope work expertise.
- National expert, Dr. Cathy Aimone-Martin, for controlled blasting design and construction support.
- Thorough knowledge of WSDOT geotechnical design standards through recent work with SGO.
- LT's policy of working directly for WSDOT, and never for contractors bidding on WSDOT projects.

We are confident our firm has the requisite expertise and experience to be of assistance to WSDOT under this contract, and we look forward to your favorable response.

Sincerely,

Michael R. Meyer

LANDSLIDE TECHNOLOGY
Michael R. Meyer, PE, GE, President

Criteria 1: Qualifications/Expertise of the Consultant

A. Include the following items:

- *List the type(s) of engineering geology expertise the CONSULTANT can provide.*
- *How long has the CONSULTANT been providing this engineering geology expertise?*
- *From where will the CONSULTANT be able to respond to emergency call-outs?*
- *Provide a listing of professional licenses/accreditations and certifications in Washington State that the CONSULTANT has; include the year that each license/accreditation was received for each person that might work on this contract, excluding support staff.*
- *Provide a short biography for each person that might work on this contract.*

Introduction to Prime Consultant

LANDSLIDE TECHNOLOGY
A DIVISION OF CORNFORTH CONSULTANTS

Contract Role: Prime Consultant for Engineering Geology and Rock/Rockfall Geotechnical Project Delivery
Office Location (s): Olympia, WA, Portland, OR, Boise, ID

Landslide Technology (LT) was founded in 1983 to specialize in projects with complex engineering geology components, specifically slope stability analysis and rock slope/rockfall investigation and stabilization. In our 40-year corporate history, we have performed geotechnical work on over 750 projects involving rock slope/rockfall hazards, landslides, debris flows, unstable embankments, and soil and rock cut slopes. LT has worked with State DOTs in all of the Pacific Northwest and Mountain States including Washington, Oregon, Montana, Idaho, Wyoming, Utah, and Alaska, as well as the Western Federal Lands Highway Division. We have established ourselves as leaders in the field of slope stabilization through the quality of our services and our thorough understanding of the DOT project development process. Our services on DOT assignments range from straightforward site evaluations and emergency slope reconnaissance projects, to very large, multi-year design projects that include providing detailed plans and specifications, construction observation, and technical support.

LT is highly skilled in developing reasonable and cost-effective slope stability mitigation concepts that balance tolerable risk with construction cost. We work closely with transportation agencies and Owners of critical infrastructure to develop appropriate scopes and budgets to meet project needs and provide feasible and economical solutions in a time-efficient manner.

LT is headquartered in Portland, Oregon with satellites in Olympia, Washington and Boise, Idaho. Our professional staff includes 11 engineering geologists, 16 geotechnical engineers, and two CADD operators. All of our senior staff are licensed PEs and/or LEGs in Washington State. Fifteen of our senior staff each have between 10 to 48 years of local experience and possess strong knowledge of the geologic conditions throughout the region. LT can quickly mobilize to any WSDOT site to perform on-site emergency response and fast-tracked repairs for rockfall and slope failures.

Since 2021, Landslide Technology has held the WSDOT Engineering Geology Personnel Augmentation Contract which has included 14 task orders to-date. Services provided have included emergency response for slope and embankment failures, corridor risk analyses, fish passage scoping, staff mentoring, and updates to the WSDOT Geotechnical Design Manual.

LT can provide the following types of engineering geology expertise to WSDOT:

- Broad knowledge of Washington State geology and its specific relevance to its highway system.
- Broad knowledge and experience with rockfall and slope stability hazards of all types.
- Broad knowledge and experience with design, construction, and maintenance of rockfall

mitigation elements including scaling, blasting, protection, and reinforcement.

- Rapid response hazard/risk assessments and interim recommendations for emergency rockfall and slope failures.
- Slope stability analyses and computer modeling of rock slope and rockfall behavior.
- In-house rope access team and drone/UAV capabilities with survey-grade detail.
- Geotechnical exploration methods, including geologic mapping, rock mass characterization and discontinuity mapping, drilling, and geophysics.
- Laboratory testing of soil and rock materials.
- Geotechnical instrumentation and remote sensing, monitored in real-time and remotely.
- Rock cut slope design, passive and active slope reinforcement design, rockfall drapery and flexible/rigid barrier design, embankment design, and subsurface drainage design.
- Unstable slope management systems and geotechnical asset management programs.
- Rock slope excavation and blasting design, blasting plans and special provisions, and construction blast monitoring.
- Cost comparisons of remedial alternatives.
- Preparation of technical plans & specifications.
- Rock slope and rockfall mitigation constructability assessment and construction technical support.
- Expert geotechnical review and staff mentoring.

Introduction to Subconsultant Team Members

LT has formed a strong team of subconsultants for this solicitation with the goal of providing excellent capacity, along with the ability to help meet WSDOT's DBE contracting goals. Our team members are introduced below with brief descriptions of their expertise. LT has a long history of teaming with the Puget Sound offices of GeoEngineers (GEO) on soil and rock slope investigations, including several recent assignments for the USACE, Seattle District. GEO brings a group of talented rock and rope work experts to our team that can supplement our in-house resources and aid with rapid response, if needed.

Our team also includes a selection of firms featured on the Washington State OMWBE diversity compliance list. Their range of services include hydrogeology, laboratory testing, construction observation, pavements, geophysical surveys, and drafting. One of our DBE team members, Central Geotech, shares LT's primary specialty in geo-engineering. As such, LT has developed a strong professional relationship with them, and has been mentoring on State DOT contracting methods in preparation for this contract. Central Geotech's ANTE rates have recently been accepted by WSDOT, and they are able to help immediately. Our other DBE team members include the Plateau Geoscience Group for geophysical studies, and Rivero Design for civil design in AutoCAD Civil 3D and MicroStation. Lastly, we have added national blasting expert, Dr. Cathy Aimone-Martin, to the team. Dr. Aimone-Martin has over 50 years of experience with blasting design, development of blasting plans & special provisions, and blast monitoring on highway projects. She has worked closely with LT on several prior rock slope projects in Oregon and Alaska. If selected for this contract, we will promptly coordinate getting Dr. Aimone-Martin added to the State's OMWBE diversity compliance list.

GeoEngineers

Contract Role: Geotechnical Support/Augmentation for Engineering Geology, Rock/Rockfall, Rope Work

Office Location (s): Redmond, WA; Seattle, WA; Tacoma, WA; Bellingham, WA; Spokane, WA; Kennewick, WA; Portland, OR; Lake Oswego, OR

GEO is a 425+ person earth science and engineering consulting firm based in the Puget Sound Area since its founding in 1980. The firm has worked on hundreds of rockfall and rockslide projects in the Pacific Northwest giving them a strong understanding of local geologic conditions and failure mechanisms, and enabling them to develop cost-effective, creative mitigation options. GEO has worked on more than 550 WSDOT projects, ranging from smaller, single-boring investigations in rural locations to large-scale design-build transportation

projects. GEO helped author the first WSDOT Geotechnical Design Manual, and as a result, they are intimately familiar with WSDOT's geotechnical design requirements. GEO has also provided emergency response, site evaluation, and repair of rockfall areas for other State and Local Agencies under on-call agreements. This experience gives them an in-depth understanding of the different approaches to fieldwork and design needed to address rock slope and roadway projects. GEO brings the following areas of engineering geology expertise to the team:

- Broad knowledge of WSDOT project delivery and geotechnical design requirements.
- Emergency response call-out availability from multiple office locations in Puget Sound Area.
- Rock slope/rockfall investigation and mitigation design.
- In-house rope access team.
- Construction support.

AMA

Contract Role: Geotechnical Support for Highway Blasting Design and Construction
Office Location (s): Lemitar, NM
New Mexico State DBE No.: 20066140

Founded in 2000, Aimone-Martin Associates (AMA) is a woman-owned, small business consulting firm that specializes in close-in construction, quarry, and mine blasting. AMA's expertise extends to underwater blasting, open air explosions, explosives disposals, and blasting near vibration sensitive above and below ground structures. AMA is a leader in the development of specialized instrumentation systems to measure off-site impacts of blasting to assist with well-controlled blasts. The firm offers specialized consulting and applied research solutions to manage risks and mitigate off-site vibrations and overpressures that could impact transportation structures, engage stakeholders and communities that are affected by blasting, and promote successful project completion. AMA offers engineering geology expertise in the following areas:

- Blast consulting including blast optimization; mitigation of off-site vibrations, underwater, and air overpressures; slope stability, fragmentation, and overbreak controls; and blasting risk assessments and management.
- Specialized instrumentation & monitoring systems.
- Development of blast plans, contract specifications, and bid documents for construction of highway projects and other critical infrastructure.
- Writer of performance-based guidelines that follow industry best practices.

CENTRAL GEOTECHNICAL SERVICES

Contract Role: Geotechnical Support for Hydrogeology, Laboratory Testing, Pavements, and Construction Observation
Office Location (s): Vancouver, WA, Portland, OR
Washington State DBE No.: D700028382

Central Geotechnical Services (Central Geotech) is a Washington State SEDBE consulting firm (Certification No. D700028382) with offices in Vancouver, Washington and Portland, Oregon. The firm routinely performs geotechnical explorations, analysis of data, and geotechnical report preparation with conclusions and recommendations for design and construction. Central Geotech's recent clients include Clark County, ODOT, City of Vancouver, City of Portland, US Forest Service, and the US Army Corps of Engineers (as a sub to LT). With over 25 years of geotechnical and engineering geology experience on staff, Central Geotech is well-versed in characterizing subsurface materials, interpreting findings, and offering sound recommendations within a practical approach. Areas of engineering geology expertise provided by Central Geotech includes:

- Geotechnical investigations/studies.
- Hydrogeology.
- In-house soils laboratory testing.
- Pavement analysis and design.
- Construction support.

Contract Role: Geotechnical Support for Geophysics
Office Location (s): Battle Ground, WA
Washington State DBE No.: D2F0020802

Plateau Geoscience Group (PGG) is a Washington State DBE/WBE (Certification No. D2F0020802) providing geophysical, geological, and environmental consulting services for private and public projects. PGG's key staff have more than 40 years of project experience with State and Federal Agencies in Washington and Oregon. PGG's expertise is founded in their comprehensive understanding of environmental regulations and requirements, combined with their technical training and expertise in geophysics, engineering geology, hydrogeology, and other sciences. PGG's geophysical surveying capabilities include the following:

- ImpulseRadar Raptor cart and truck-mounted array systems with Condor and GPR-Slice processing software.
- GPR application to transportation, construction QA, siting, and environmental projects.
- Remote sensing geology and structural analyses, and downhole data collection and analysis.

Contract Role: Civil Support for Drafting
Office Location (s): Portland, OR
Washington State DBE No.: D5F0027973

Rivero Design offers consulting services in civil engineering, civil design in AutoCAD Civil 3D and MicroStation, roadway design, grading & earthwork analysis, and drafting. The firm has 22 years of civil engineering experience working on a variety of infrastructure projects. Rivero Design is a woman-owned, Washington State DBE (Certification No. D5F0027973).

Team Capacity

LT is accustomed to priming project delivery teams and managing multi-discipline projects with large firms like GEO. The table below shows the number of geoprofessional personnel for the LT team. We anticipate WSDOT may not activate all capacity shown; however, we are prepared to mobilize resources as needed to meet WSDOT personnel and/or schedule demands.

Key Discipline	Prime Capacity	Sub Capacity	Total Team
Engineering Geologist	11	19	30
Geotechnical Engineer	16	122	138

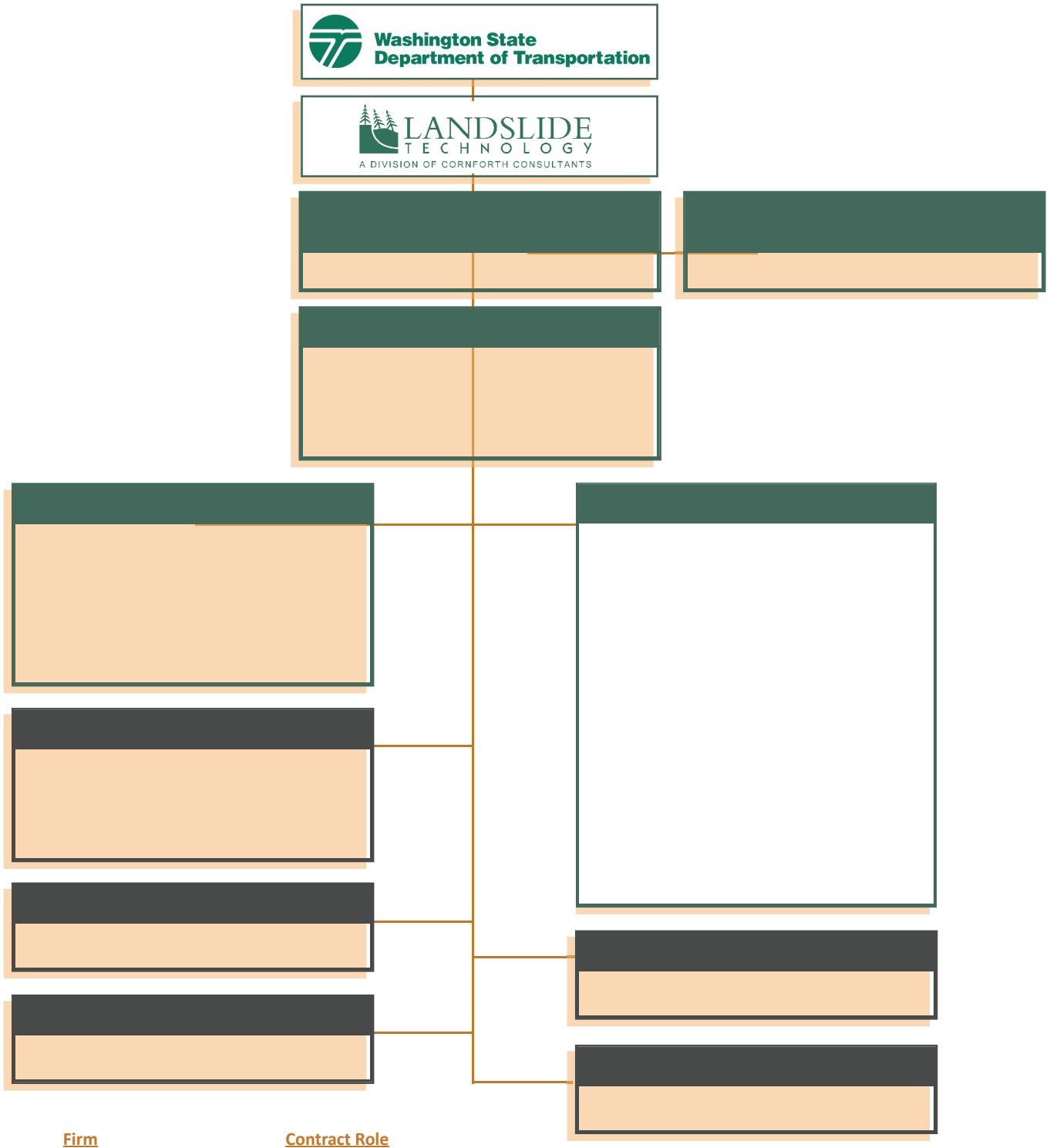
Recognizing this contract extends approximately four years with a $3.5M ceiling, it is reasonable to expect workload could reach $1M in a busy year. The LT team capacity can manage several times that demand. To demonstrate this point, $180/hr is a representative weighted average billing rate for the team members. Assuming staff are 75% utilized, $1M per year equates to about 3.6 full-time equivalent staff. Given our available resources, we are confident our team can field WSDOT assignments while maintaining our high performance standards.

Team Organizational Chart

Brent Black, LEG, LHG will serve as the Senior-Level Engineering Geologist and Agreement Manager (SLG) for this contract. He will work with the WSDOT SGO to confirm the scope, schedule, and budget of project delivery assignments. Brent will oversee the contract management, and will be WSDOT's direct point-of-contact. He will also be responsible for management of our subconsultant team members who will report directly to him. LT would be the technical lead on all assignments with support from our subconsultants for rapid response and staff augmentation, if necessary. QA/QC on the team's deliverables will be provided by Michael Meyer, who brings 35 years of geotechnical engineering experience and 12 years of executive-level oversight and guidance.

Brent will be supported by LT's engineering geology and slope stability Geotechnical Subject Matter Experts (SMEs) including Tom Badger, Ben George, Darren Beckstrand, and Adam Koslofsky. An organizational chart for our team is provided on the following page.

Organizational Chart



Firm	Contract Role
Landslide Technology	Prime Consultant for Rock/Rockfall, Ropes
GeoEngineers	Augmentation for Rock/Rockfall, Ropes
Aimone-Martin Associates**	Highway Blasting Design
Central Geotechnical Services*	Hydrogeology, Lab Testing, Construction Support
Plateau Geoscience Group*	Geophysics
Rivero Design*	Drafting

*Washington State DBE-Certified Firm

**New Mexico State DBE-Certified Firm

Key Personnel Biographies

Brent Black, LEG, LHG
Senior Associate Geologist

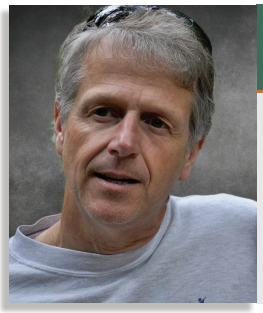
- 31 years of experience
- MS in Geology, Kent State University (1993)
- WA LG, LEG, & LHG #630 (2002)

Contract Role: Senior Level Engineering Geologist and Agreement Manager (SLG)

Qualifications. Brent Black has 31 years of engineering geology experience in the western US. The majority of his career has been dedicated to the investigation, design, and construction management of rock slope and rockfall mitigation projects. Brent's areas of expertise include rockfall hazard evaluations, emergency response and the design of mitigation measures for rockfall and unstable rock slopes, cut slope and blast design, site investigations, PS&E development, and construction quality assurance. Brent has managed or served as the lead engineering geologist for over 200 rock/rockfall projects from initial reconnaissance through final design and construction. He tailors his approach to slope stability projects based on geologic site conditions, client needs, and available budgets. Brent has worked closely with engineers and geologists at many State DOTs including Washington, Oregon, Montana, Idaho, Alaska, Wyoming, Ohio, New York, and Tennessee. He has also taught numerous classes and trained FHWA and State DOT personnel regarding the design and construction observation of cost-effective rockfall mitigation elements.

Brent currently chairs the Transportation Research Board's (TRB) Subcommittee – Advances in Landslides, Analysis, and Control to direct updates to the Board's Landslides Investigation and Mitigation Special Report 247. He is also a member of the TRB's Engineering Geology Committee and Rockfall Management and Geotechnical Asset Management Subcommittees. He recently completed a stint as a panel member for the National Cooperative Highway Research Program (NCHRP) Project 24-35 - Guidelines for Certification and Management of Flexible Rockfall Protection Systems.

Representative Experience. WSDOT Geotechnical Design Manual Updates; I-15 D3 Rock Slope Mitigation Design (MDT); Historic Columbia River Highway Trail Rockfall Mitigation (FHWA/ODOT); White Pass SR-12 Unstable Slope Corridor (WSDOT); US-26 Mt. Hood Highway Rock Slope Mitigation (ODOT); SR-75 Ketchum-Challis Rockfall Mitigation (FHWA) and Little River Road Rock Slope and Rockfall Mitigation (FHWA).



Tom Badger, PE, LEG, LHG
Senior Staff Consultant

- 39 years of experience
- MS in Geological Engineering, University of Nevada, Reno (2002)
- WA LG, LEG, & LHG #114 (2001)
- WA PE #35630 (1998)

Contract Role: Geotechnical Subject Matter Expert

Qualifications. For 32 years, Tom Badger served in roles of increasing responsibility within the WSDOT Geotechnical Office, the last four years serving as the Chief Engineering Geologist. During this time, Tom responded to or managed the geotechnical evaluation, characterization, and remediation of numerous emergency response slope failures that damaged Washington State highways and threatened public safety. His work at WSDOT on geotechnical design and construction support projects provides him with broad knowledge of Washington State geology and its specific relevance to its highway systems. Since retiring from WSDOT, Tom has continued providing engineering geology expertise after joining LT as a senior staff consultant in 2021. He is located in LT's Olympia satellite office.

Tom is an internationally recognized expert in rockfall control, rock slope stabilization, and rock slope stability. He coauthored the design guidelines for Type 1 and 2 mesh/cable net slope protection systems used by WSDOT and many other states, as well as WSDOT's specifications for rockfall mitigation and slope stabilization. Tom has lectured and published extensively on slope hazards and risk, and coauthored national design guidance on horizontal drains for slope stabilization, rock mass characterization, TRB rockfall manual, WSDOT's Geotechnical Design Manual and other agency

manuals, and Washington's Forest Practices Board Manual. Tom is the past chair of the Transportation Research Board's Engineering Geology Committee, and serves as a technical reviewer for numerous scientific journals.

Representative Experience. I-90 MP 39.95-40.17 Rock Slope Mitigation (WSDOT); SR-401 MP 2.1 Rockfall Evaluation (WSDOT); I-5 MP 248 Rockfall (WSDOT); Bogachiel Landslide SR-101 MP 184.3 (WSDOT); State of Washington's Unstable Slopes Management System (WSDOT); SR-12 MP 4.6 Embankment Repair (WSDOT); and SR-508 Onalaska Landslide (WSDOT).

Ben George, PE, LEG
Senior Associate Geologist

- 19 years of experience
- MS in Geological Engineering, Colorado School of Mines (2004)
- WA LG & LEG #20122181 (2020)
- WA PE #50372 (2013)
- SPRAT Level 2 Technician

Contract Role. Geotechnical Subject Matter Expert

Qualifications. Ben George has 19 years of engineering geology and geotechnical engineering experience in the Pacific Northwest and Mountain States. He has a MS in geological engineering from the Colorado School of Mines with a strong focus on slope stability and rock slope/rockfall mitigation design. Ben's experience includes the design of rock slope cuts and rockfall catchment areas, evaluation of rock slope hazards, characterization of rock mass quality, assessment of rock slope stability, development and design of rockfall and rockslide mitigation measures, design of rock mass reinforcement measures, and development of PS&E packages. He is well-versed in current rock excavation and highway blasting techniques, as well as the WSDOT Geotechnical Design Manual. As a senior-level engineering geologist, Ben works closely with engineers and geologists at several State DOTs including Washington, Oregon, Idaho, Montana, and Alaska. He is an active member of the TRB's Engineering Geology, Rockfall Management, and Landslide Analysis and Control Committees and Subcommittees.

Ben is also a SPRAT Level 2 Technician, and manages LT's in-house rope access team of six engineers and geologists. LT's rope access team is utilized to safely evaluate steep rock slope conditions, characterize rockfall hazards, and observe mitigation construction.

Representative Experience. SR-401 MP 2.1 Rockfall Assessment (WSDOT); SR-20 Sourdough Rockfall Emergency Response (WSDOT); Seward Highway MP 104-114 Rock Slope Mitigation Design (AKDOT&PF); I-90 MP 22 Rockslide Emergency Response (MDT); WSDOT Geotechnical Design Manual Updates; US-26 Mt. Hood Highway Rock Slope Mitigation and Cut Slope Design (ODOT); and I-84 MP 61.2 Rockfall Mitigation (ODOT).

Darren Beckstrand, LEG
Senior Associate Geologist

- 23 years of experience
- MS in Geology, Portland State University (2000)
- WA LG & LEG #2284 (2003)

Contract Role: Geotechnical Subject Matter Expert

Qualifications. Darren has 23 years of engineering geology experience working on transportation and infrastructure projects in the western US. His areas of expertise include leading the investigation, analysis, and design for projects related to rock slope and rockfall mitigation, highway corridor safety improvements, and emergency response to storm damages and sudden slope failures. He also has strong expertise in geotechnical instrumentation, monitoring, and remote data collection. His instrumentation experience includes designing, installing, collecting and analyzing data from slope inclinometers, vibrating wire piezometers, crackmeters, settlement sensors, and extensometers.

Darren is a recognized leader in the development and implementation of unstable slope and geotechnical asset management (GAM) systems. He has assisted State DOTs in Alaska, Idaho, Montana, Missouri and Tennessee with establishing GAM systems, inspections, documentation, databases, and presentation formats/media. Darren is currently the Co-Chair for the TRB's Subcommittee on Geotechnical Asset Management. He also serves

as the Communications Coordinator for the TRB's Geological & Geoenvironmental Engineering section, and is an active member of the Committees on Soil and Rock Properties and Geotechnical Instrumentation and Modeling.

Representative Experience. Seward Highway MP 104-114 Rock Slope Mitigation (AKDOT&PF); Galena Summit Rock Cut Design (ITD); Badrock Canyon Rock Slope Stability Instrumentation and Monitoring (MDT); US-26 Swan Valley Corridor Unstable Slopes Planning Study (ITD); Statewide Rockfall Hazard Process Assessment (MDT); and I-15 D3 Rock Slope Mitigation Design (MDT).

Adam Koslofsky, LEG
Associate Geologist

- 18 years of experience
- BS in Geology, Oregon State University (2004)
- WA LG & LEG #3101 (2015)
- SPRAT Level 3 Supervisor

Contract Role: Geotechnical Subject Matter Expert

Qualifications. Adam Koslofsky has 18 years of engineering geology experience in the Pacific Northwest and Mountain States. Adam is trained and certified as a SPRAT Level 3 Supervisor for the planning and implementation of rope access for challenging rock and cut slope projects. His areas of expertise include geologic reconnaissance and mapping, difficult access site explorations, geologic hazard assessments, rock slope and rockfall mitigation, and construction inspection and quality assurance. Adam excels at site investigations, particularly in difficult access locations. His SPRAT Level 3 rope access training provides him with a unique capability for geologic field mapping in extremely steep slope terrain.

Representative Experience. I-15 D3 Rock Slope Mitigation Design (MDT); Seward Highway MP 104-114 Rock Slope Mitigation (AKDOT&PF); US-26 Mt. Hood Highway Rock Slope Mitigation (ODOT); Going-to-the-Sun Road Rockfall Hazard Rating System Implementation (FHWA); Banks-Lowman Highway Rockfall Mitigation (FHWA); and Parks Highway Rockfall Mitigation (AKDOT&PF).

Sebastian Dirringer, LG, LEG
Project Geologist

- 9 years of experience
- MS in Geology, Kent State University (2015)
- WA LG & LEG #3375 (2019)
- SPRAT Level 1 Technician

Contract Role: Engineering Geologist

Qualifications. Sebastian Dirringer has nine years of engineering geology experience in the Pacific Northwest, Mountain West, and Alaska. Unstable slope stabilization is an area of expertise, including investigating, designing, and observing installation of rock slope and rockfall mitigation measures, and performing 3D rock slope data visualization. Sebastian's experience also includes development and implementation of difficult-access subsurface explorations, site reconnaissance, geologic mapping, evaluation of geologic hazards, and design and installation of geotechnical instrumentation. Sebastian is an active member of LT's rope access team with extensive experience conducting on-slope rope access techniques related to the reconnaissance, investigation, design and construction support for projects involving steep rock slopes.

Representative Experience. SR-20 Sourdough Rockfall Emergency Response (WSDOT); Historic Columbia River Highway Trail Rockfall Mitigation (FHWA/ODOT); Seward Highway MP 104-114 Rock Slope Mitigation (AKDOT&PF); Icy Point Gondola Rock Slope Mitigation (PND); and I-15 D3 Rock Slope Mitigation Design (MDT).

Rachel Hunt, LG
Project Geologist

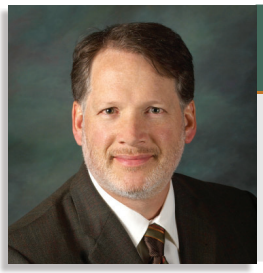
- 9 years of experience
- MS in Geology, Central Washington University (2012)
- WA LG #22014230 (2022)
- SPRAT Level 1 Technician

Contract Role: Engineering Geologist

Qualifications. Rachel Hunt has nine years of engineering geology experience and is located in

LT's Boise satellite office. Rachel provides field and geotechnical support on projects including subsurface investigation, engineering analysis, design, and construction services for design of roadways, rockfall mitigation, bridge foundations, pipelines, and embankments. Other project experience includes evaluation of rock slope hazards, characterization of rock mass quality, assessment of rock slope and block stability, and assisting with design and construction observation of rock slope and rockfall mitigation measures. Rachel is a SPRAT Level 1 Technician and an active member of LT's rope team.

Representative Experience. Klondike Highway Rock Slope Mitigation (AKDOT&PF); Seward Highway MP 104-114 Rock Slope Mitigation (AKDOT&PF); Fish Passage Scoping for Olympic Region (WSDOT); Oak Grove Penstock Rockfall Emergency Response (PGE); and Hells Canyon Access Road Rock Slope Mitigation (Idaho Power).



Charlie Hammond, LEG, LHG
Senior Associate Geologist

- 36 years of experience
- MS in Geology, New Mexico Institute of Mining & Tech (1987)
- WA LG, LEG, & LHG #873 (2002)

Contract Role: Engineering Geologist

Qualifications. Charlie Hammond has 36 years of engineering geology experience in the continental US and internationally, with a focus on the Pacific Northwest. He has specialized expertise in unstable slope characterization, geologic hazard assessment, geologic mapping, structural geology, and lidar interpretation. Charlie offers tested skills in the observation, investigation, and interpretation of site geology conditions that are necessary for establishing a strong framework for engineering design. He has a wealth of experience working on complex rock/rockfall and landslide projects affecting transportation and utility corridors, and frequently serves as an expert witness on high-profile landslide litigation cases.

Charlie was selected as a keynote speaker at the North American Symposium on Landslides (NASL) in Vail, Colorado in 2007; in Banff, Alberta in 2012; and in Roanoke, Virginia in 2017. Charlie also served as local President and National Board Member for the Association of Environmental and Engineering Geologists (AEG), and served as the landslide tour guide for the national AEG conference in Portland.

Representative Experience. White Pass SR-12 Unstable Slope Corridor (WSDOT); US-20 Cougar Creek Rockslide Mitigation (ODOT); SR-112 Resiliency Study (WSDOT); WSDOT Geotechnical Design Manual Updates; Salt Creek Tunnel Rock Slope Stability Assessment (ODOT); SR-508 Onalaska Landslide (WSDOT); and Washougal River Road Rockfall Mitigation (Clark County).

Aine Mines, PE, LEG
Associate Geologist

- 13 years of experience
- MS in Geotechnical Engineering, UC Berkeley (2011)
- WA LG & LEG #3329 (2019)
- WA PE #57178 (2019)

Contract Role: Engineering Geologist

Qualifications. Aine Mines has 13 years of engineering geology experience with particular focus on unstable slope mitigation projects for transportation agencies. Her areas of expertise include site reconnaissance and mapping, geologic hazard assessment, slope stability analysis, and geotechnical instrumentation of unstable slopes. Aine has been extensively involved in the development of GAM systems for State DOTs in Alaska, Montana, and Missouri. As part of these programs, over 1,500 high hazard rock and soil slopes and over 200 retaining walls were inventoried, with over 750 of these assets examined in the field by Aine. She is the author of a paper, *Estimating Event Likelihood for Rock Slope Assets on Transportation Networks*, published in the TRR in June 2018. It was awarded 2018's 'Best Paper' by TRB's Committee on Geological and Geoenvironmental Engineering. Aine is an active member of the TRB Committees and Subcommittees on Geotechnical Site Characterization, Geological & Geoenvironmental Engineering, and Geotechnical Asset Management.

Representative Experience. Statewide Rockfall Hazard Process Assessment (MDT); Statewide GAM

Program (MoDOT); Statewide GAM Program (AKDOT&PF); Sterling Highway Rock Cut Designs (AKDOT&PF); Yale Powerhouse Rock Block Removal (PacifiCorp); and WSDOT Geotechnical Design Manual Updates.

Tygh Gianella, PE
Project Engineer

- 9 years of experience
- MS in Geotechnical Engineering, Oregon State University (2015)
- WA PE #22024921 (2022)
- SPRAT Level 1 Technician

Contract Role: Geotechnical Engineer

Qualifications. Tygh Gianella has nine years of geotechnical engineering experience in the Pacific Northwest. He has experience performing a variety of field investigation, laboratory testing, design, and construction observation services on transportation, utility, and dam projects. In 2022, Tygh received his certification as a SPRAT Level 1 Technician to perform rope work for assessing steep rock slopes, collecting data for analysis, and performing construction observation of rock slope mitigation measures.

Representative Experience. Seward Highway MP 104-114 Rock Slope Mitigation (AKDOT&PF); Klondike Highway Rock Slope Mitigation (AKDOT&PF); J.C. Boyle Rockfall Emergency Response (PacifiCorp); US-20 Targhee Pass Highway Improvements (ITD); and Rockfall Hazard Evaluations (TDOT).

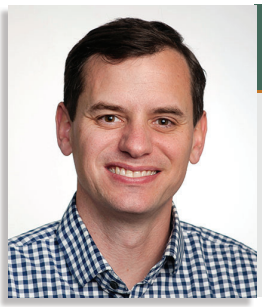
Justin McCarley, LG
Staff Geologist

- 6 years of experience
- MS in Geology, Portland State University (2018)
- OR LG #2534 (2021)
- FAA Part 107 Remote Pilot

Contract Role: Engineering Geologist

Qualifications. Justin McCarley has six years of engineering geology experience in the Pacific Northwest. His areas of expertise include slope mechanics, geospatial data, and 3D data analysis. His project experience includes geotechnical field reconnaissance, implementation of subsurface exploration programs, evaluation and mapping of unstable slopes, and installation and monitoring of slope stability instrumentation. Justin currently holds an FAA remote pilot license and utilizes drone/UAVs during site investigations for rock slope/rockfall and landslide projects.

Representative Experience. Historic Columbia River Highway Trail Rockfall Mitigation (FHWA/ODOT); Little River Road Rock Slope and Rockfall Mitigation (FHWA); Seward Highway MP 104-114 Rock Slope Mitigation (AKDOT&PF); and Southern Oregon Seismic Slopes Study (ODOT).



Andy Caneday, LEG
Associate Engineering Geologist

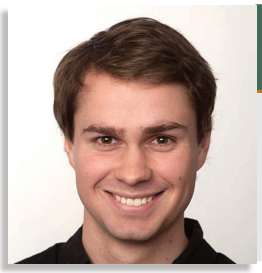
- 25 years of experience
- BA in Geology, Whitman College (1999)
- WA LEG #2555 (2005)
- SPRAT Level 1 Technician

Contract Role: Engineering Geologist

Qualifications. Andy Caneday has more than 25 years of engineering geology experience working on diverse geotechnical and geological projects, including highways, bridges, rail line corridors, tunnels, and dams. He specializes in geologic mapping and reconnaissance, the evaluation and mitigation of rockslides and rockfall, instrumentation data acquisition, rock mechanics, rock slope design, rock blasting and overbreak control, the acquisition and interpretation of subsurface data, and geotechnical laboratory testing. Andy has performed extensive on-slope reconnaissance, detailed engineering geological mapping, subsurface explorations, and mitigation design for rock slope projects in collaboration with public agencies and private entities throughout the US. He is a SPRAT Level 1 Technician.

Representative Experience. US-30 Lava Hot Springs Rock Slope Stabilization (ITD); Index Galena Road Rock Cut Design and Rockfall Mitigation (Snohomish County); Gilligan Creek Intake Road Rockslide Repairs (Skagit County PUD);

Skagit Hydro Facilities Rockfall Hazard Evaluation (Seattle City Light); and Caliente Canyon Rockslide Emergency Response (Union Pacific Railroad).



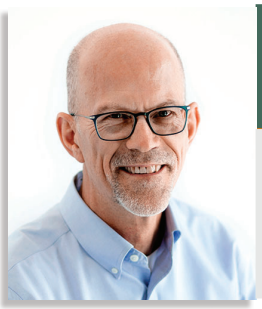
Carl Longton, PE
Senior Geotechnical Engineer

- 10 years of experience
- MS in Geotechnical Engineering, University of Washington (2013)
- WA PE #54287 (2016)

Contract Role: Geotechnical Engineer

Qualifications. Carl Longton has a decade of geotechnical engineering experience specializing in transportation and energy infrastructure projects across the western US. He specializes in managing various efforts focused on rockfall mitigation, bridge design, and landslide stabilization. Carl has provided design and construction management for a wide range of rockfall mitigation efforts, including rock dowels, catchment fences, draped mesh systems, attenuators, anchored meshes, rock blasting, and scaling. Carl also has a wealth of management and design experience on WSDOT projects, giving him an intimate knowledge of the WSDOT Geotechnical Design Manual requirements.

Representative Experience. Hells Canyon Dam Access Road Rock Slope Stabilization (Idaho Power); Shoshone Falls Rockfall Mitigation (Idaho Power); NF-454 Scenic Byway Rock Slope Stabilization (Idaho Power); and US-101 Coffee Creek Remove Fish Barrier Project (WSDOT).



J. Gordon, PE
Senior Principal Geotechnical Engineer

- 43 years of experience
- BS in Civil Engineering, University of Colorado (1979)
- WA PE #22151 (1984)

Contract Role: Geotechnical Engineer

Qualifications. J. Gordon has 43 years of experience providing geotechnical and environmental consulting services in the western US. He specializes in public sector projects and knows how to work within project delivery teams and public agencies for successful design, PS&E, and construction management of projects. He has provided a wide variety of engineering services involving development projects in rock, evaluating rock slopes for stability, and repairing rock slopes in different environments in Washington, Oregon and Idaho. Some of the development projects and public sector projects have involved blasting in rock, temporary and permanent evaluation of stability of the rock face, and design of mitigation. He has also managed the emergency response for landslide and rock failures affecting roads and other facilities. The design mitigation strategies have ranged from rock buttresses, anchored mesh, shotcrete facings with soil nails/rock anchors, mesh drapes, and rockfall catchment ditches, among others.

Representative Experience. SR-11/Chuckanut Drive Emergency Rockslide Evaluation (City of Bellingham); Stibnite Mine Access Road Rock Cut Design and Rockfall Mitigation (Perpetua); Intake Bridge Rock Slope Stabilization (Idaho Power); and Hells Canyon Dam Access Road Rock Slope Stabilization (Idaho Power).

Morgan McArthur, PE
Associate Geological Engineer

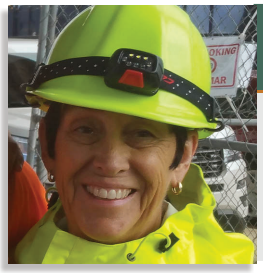
- 17 years of experience
- MS in Geological Engineering, Colorado School of Mines (2006)
- WA PE #46390 (2009)

Contract Role: Geotechnical Engineer

Qualifications. During his 17-year career at GeoEngineers, Morgan McArthur has developed extensive transportation-related experience through providing geotechnical design, construction support, project management, technical review, and oversight on projects. He has planned, managed, and conducted subsurface investigations and geotechnical studies related to roadway and corridor improvements, including bridges, culverts, walls and other transportation infrastructure, pavement and subgrade design for roadways, sidewalks and trails. He has performed geologic reconnaissance and developed investigation and instrumentation plans for unstable rock slopes, has planned and performed

surface and subsurface investigation of rock slopes, and has developed recommendations and plans & specifications for mitigation and repairs. Morgan is also well-versed in seismic design considerations and has experience working with teams to design solutions that can withstand the effects of Washington's high seismicity.

Representative Experience. I-405/Renton to Bellevue Corridor Improvements (WSDOT); Silver Bridge Abutment Foundation Stability (Shoshone County); Shoshone Falls Rockfall Mitigation (Idaho Power); Oxbow Dam Intake Rock Slope Stabilization (Idaho Power); and US-101 Coffee Creek Remove Fish Barrier Project (WSDOT).



Catherine Aimone-Martin, PhD
Principal Consultant

- 52 years of experience
- PhD in Civil Engineering, Northwestern University (1981)

Contract Role: Blasting Consultant

Qualifications. Dr. Cathy Aimone-Martin has 52 years of experience in rock blasting for wall control in mines, quarries, and highways throughout the US. Cathy served as Professor and Department Chair of Mining and Geological Engineering at New Mexico Tech for 25 years, overseeing the soil and rock mechanics laboratories, instructing in rock drilling and blasting, vibration control, and slope stability. As a blasting consultant since 2000, Cathy works with highway agencies and contractors to develop blast and monitoring plans and oversee rock removal operations, often in complex and challenging geologic terrain with difficult site access conditions and wall stability issues. Cathy routinely develops site-specific blast designs based on continual evaluation of blasting results to achieve desired fragmentation, rock movement, and reduced road closures. She has worked directly with many Transportation Agencies to develop performance-based specifications for rock blasting to control drill hole alignments, prevent overbreak, and produce stable slopes. Cathy has overseen many blast monitoring programs including novel applications of close-in, surface, and deeply buried ground motion sensors to evaluate blast performance and guide design modifications, as needed.

Representative Experience. Historic Columbia River Highway Trail Rock Slope Mitigation (FHWA/ODOT); Klondike Highway CWHM RCC Bridge Replacement (AKDOT&PF); US-26 Mt. Hood Highway Rock Slope Mitigation (ODOT); Sitka Katlian Bay Road Realignment (AKDOT&PF); and Modification of Blasting Special Provisions for Complex Highway Blasting Projects (AKDOT&PF).

Paul Crenna, LG, LEG, LHG
Principal Geologist

- 27 years of experience
- MS in Geology, Oregon State University (1996)
- WA LG, LEG, & LHG #152 (2001)

Contract Role: Engineering Geologist

Qualifications. Paul Crenna has 27 years of experience in the geotechnical and engineering geology fields. He has extensive project experience in site characterization and geologic hazard assessments. Paul has performed a wide range of design and construction monitoring and field inspections for earthwork projects including foundation subgrade, shallow and deep foundations, landslide stabilization and remediation, structural fill placement, geofoam design, and retaining walls.

Paul's career has encompassed an array of notable projects, ranging from emergency landslide remediations to the construction of multi-story public facilities. He's also been involved in conducting forensic investigations into slope failure and earthquake damage, devising effective storm water management solutions, and performing groundwater characterization studies.

Representative Experience. National Forest Disaster Remediation (US Forest Service); Roadway Slope Stabilization in Camas (Lakeridge Subdivision); and Landslide Stabilization in Estacada (Cascadia Ridge).

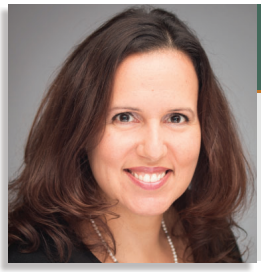
Mavis Kent, PhD, LG
Principal Geologist

- 51 years of experience
- PhD in Geology, Texas A&M University (1995)
- WA LG #1179 (2002)

Contract Role: Engineering Geologist

Qualifications. Dr. Mavis Kent has 50 years of field, analytical, documentation and project management experience through work with engineering consulting firms, state environmental regulatory agencies, and as Principal Geologist of Plateau Geoscience Group (PGG). PGG is a small business, DBE providing services in environmental and engineering geology investigations, and geophysical surveys. Mavis is responsible for all business aspects including project development, proposals, field, data collection and analysis, report documentation, and interaction with clients and regulatory agencies. Mavis manages PGG's field team conducting Ground-Penetrating Radar surveys using state-of-the-art multichannel equipment.

Representative Experience. Ground-Penetrating Radar Survey Mt. Tabor Park (City of Portland); Ground-Penetrating Radar Survey Forest Heights Subdivision (Otak); and Ground-Penetrating Radar Survey US-20 Highway Safety Improvements (ODOT).



Maria Rivero, EIT
Principal Engineer

- 22 years of experience
- BS in Civil Engineering, Washington State University (1996)
- WA EIT #22133 (1997)

Contract Role: Civil Engineer/Drafting Services

Qualifications. Maria Rivero started her own business, Rivero Design, in 1997 to provide consulting services in support of project delivery teams. Maria has a strong design and management background developed by working on a wide variety of private and public sector projects over the past 22 years. She offers consulting services in the civil engineering field including grading and site development using AutoCAD Civil 3D, stormwater design, 3D pipe design, feasibility studies, quantities/cost estimates and earthwork analysis.

Representative Experience. WSDOT Fish Passage Projects (Wolf Water Resources); SE Clay Green Street Improvements (City of Portland); and Red Line Light Rail Improvements (TriMet).

B. Include the following items:

- *Provide a rock slope project that the CONSULTANT has completed or is currently working on that demonstrates rock slope remediation using of state-of-the-art techniques.*

Seward Highway MP 104 to 114 Rock Slope Mitigation Design, Anchorage, Alaska

Client Reference: Jonathan Tymick, AKDOT&PF, 907-269-0453, jonathan.tymick@alaska.gov

Key Services:

- Rock Slope Investigation & Analysis
- Geologic Mapping
- Rope Access
- UAV/Drone Utilization
- Rockfall Modeling
- Design of Rock Slope Mitigation Measures
- Fast-Tracked Alternatives and Design Development
- Contract Documents (PS&E)
- Construction Support Services
- Traffic Control Solutions
- Compressed Construction Schedule

The Alaska Department of Transportation and Public Facilities (AKDOT&PF) retained Landslide Technology (LT) to develop rockfall mitigation measures for 11 rock slope segments adjacent to the Seward Highway south of Anchorage, from mile posts (MP) 104 to 114. The Seward Highway has experienced safety concerns related to rockfall hazards since its construction in the 1990's (high risk in the 10-mile-long corridor). Increased rockfall activity following a large-magnitude earthquake in November 2018 prompted the Agency to develop a Highway Safety Improvement Program (HSIP) project to reduce risk to the traveling public.

LT's scope of services included assisting AKDOT&PF with the following tasks: performing

a detailed review of available site information; conducting surface reconnaissance (including on-slope rope access evaluations) and geologic mapping to characterize rock slope conditions and rockfall potential; estimating potential modes of failure for rock slopes using kinematic analyses; conducting rockfall analyses for representative locations at each site to assess conceptual alternatives for rockfall mitigation measures; providing type, size, and location (TSL) recommendations and preliminary engineer's estimates for rockfall mitigation alternatives; preparing a geotechnical summary report for the field data, analysis results, and preferred mitigation alternatives and costs; and preparing contract documents including plans, specifications, and final engineer's estimates.

LT developed conceptual design options on a fast-tracked basis and presented to the Agency during several over-the-shoulder reviews for selection of preferred alternatives. This approach allowed LT to produce final construction documents in time for the next construction work window. Mitigation designs included: general and heavy scaling in targeted areas, installation of rock bolt, rock dowel, and cable lashing stabilization measures, and construction of rockfall attenuator and draped mesh systems.

The Seward Highway is a main through-way for residents and tourists from the Anchorage area to access the Kenai Peninsula. Daily traffic counts can exceed 9,000 vehicles ADT during the summer months. Likewise, the Alaska Railroad owns and operates a critical supply rail line from Whittier and Seward to Anchorage adjacent to the highway. As a result, traffic control and temporary rockfall protection (TRP) were major components of this project. LT worked with AKDOT&PF's engineers to coordinate traffic control requirements in conjunction with TRP. Several TRP options were presented with selection of a concrete barrier mounted fence as the Agency's preferred approach. This facilitated protection of the roadway and railroad along with minimizing impacts to the traveling public.

Construction for the project began in the summer of 2020 and was completed in 2023. LT provided full-time construction inspection services, including rope access services to assist with locating, installing, and testing rockfall mitigation elements.

Boom-lift rock slope assessment and traffic control along Seward Highway in Anchorage

C. Include the following items:

- *Provide a rock slope project that the CONSULTANT has completed or is currently working on that demonstrates knowledge in highway blasting techniques.*

Interstate 15 (D3) Rock Slope Mitigation Design, Helena to Great Falls, Montana

Client Reference: Jeff Jackson, MDT, 406-444-3371, jejackson@mt.gov

Key Services:

- Rock Slope Investigation & Analysis
- Rock Slope & Trim Blasting Design
- Instrumentation
- Geologic Mapping
- Rope Access
- UAV/Drone Utilization
- Rockfall Modeling
- Design of Rock Slope Mitigation Measures
- Contract Documents (PS&E)
- Construction Support Services
- Traffic Control Solutions

The steep canyon slopes along a 27-mile corridor of Interstate 15 between Helena to Great Falls caused significant safety risks to highway users and increased maintenance efforts for the Montana Department of Transportation (MDT). Landslide Technology (LT) was retained as the Prime consultant by MDT, with federal funding assistance from FHWA, to perform the investigation, design and support construction of rockfall mitigation and slope stabilization measures for 15 of the most significant rockfall hazard sites. As the Prime consultant, LT was responsible for project management, public involvement, geotechnical engineering and geologic analyses, and preparation and final assembly of the plans, specifications, and engineer's estimate. LT provided assistance during bidding and full-time construction engineering support for this complex, multi-phase and multi-year project.

LT provided MDT conceptual design approaches for each site in a Preliminary Design Report. LT translated the concepts into preliminary and detailed designs while balancing risks associated with rockfall mitigation construction while passing traffic below. The 15 sites were divided into three separate contract phases to facilitate funding and to alleviate construction traffic concerns. The second of the three contract phases consisted of three rock slope sites where considerable rock slope excavation using controlled blasting techniques was performed to increase rockfall catchment area along the road grade. Approximately 100,000 cubic yards of rock were excavated using controlled blasting techniques. In addition, LT designed trim blasts to remove over 2,500 cubic yards of large, marginally stable rock masses with adverse jointing that daylighted toward the highway. Trim blasting was also used to remove select portions on the rock slopes that acted as rockfall launch features.

The design services included the use of advanced, 3D photogrammetry equipment and software utilizing Structure-from-Motion to collect relevant geologic data and evaluate the rockfall hazards associated with each of the 15 sites. Geologic data was modelled using stereonets for potential failure mode analyses and to design the new cut slope inclinations. Trajectories of falling rocks were analyzed using specialty modelling software with detailed topographic data provided by MDT. Dozens of models were prepared for each of the 15 sites to adequately design rockfall mitigation devices that ultimately protect the travelling public and MDT's maintenance forces.

Rockfall hazards on the I-15 (D3) rock slope corridor

Field investigation efforts involved LT's in-house, SPRAT-certified rope access team. LT utilized these specialized skills to identify locations and subsequently install crackmeters to detect movement of significant rock columns high above the highway. The sensors were attached to dataloggers that continuously monitor displacement and allowed the design team to properly address the concerns of these sizeable features.

Rockfall attenuators on the I-15 (D3) rock slope corridor

Following our detailed field efforts and office analyses, preliminary rock slope mitigation options (30% design) were developed and presented to MDT for advancement to final design utilizing MicroStation CADD software. Rockfall and rock slope mitigation measures included: trim blasting, scaling, draped-mesh, high-energy flexible rock barriers and attenuation systems, rock bolting, shear-pin buttress installation, concrete barriers, and expanding fallout areas. During construction, LT provided technical input on the temporary rockfall protection measures to allow traffic to pass during scaling operations and to protect an adjacent railroad ROW. LT's rope team provided full-time on-slope construction inspection services for the more difficult access elements like trim blasting, rock bolting, and attenuator system installations.

Controlled highway blasting on the I-15 (D3) rock slope corridor

D. Include the following items:

- *Provide a response of how the CONSULTANT can achieve DBE goals in the face of limited time and money constraints placed on a project.*

Recognizing that this contract is intended for engineering geology and rock slope/rockfall project delivery, it is likely that our assignments would involve emergency response and quick turnaround times. In those situations, there is some uncertainty about the technical skills needed until an initial reconnaissance occurs. Another unknown is the WSDOT staff workload at the time of the incident. We anticipate WSDOT's SGO staff may prefer to fill many important roles in the project delivery team if their schedule allows (e.g., geotechnical/geology roles, drilling, instrumentation, lab testing, construction documents, etc.). Based on the foregoing, we have structured our team with LT as WSDOT's primary resource for rock slope engineering, with added capacity and skillsets from GeoEngineers, Dr. Cathy Aimone-Martin, and DBE subs that could be drawn upon quickly and could substitute for SGO roles, should WSDOT be unavailable. LT would also rely upon the DBE subs for disciplines that we don't possess in-house such as pavement design, larger-scale laboratory testing, and geophysical investigations, and traffic control services.

We support WSDOT's DBE goals. As a Federally certified Small Business, LT understands the importance of including DBE firms in contracting opportunities. Having held contracts with several State DOTs and the FHWA, we've experienced the complex requirements in the AASHTO audit guide, which can be a barrier to working with transportation agencies. Navigating Federal Acquisition Regulation (FAR) Audits and indirect cost rates is especially challenging for newer DBE firms with limited financial history. That is why for the past several months we have been mentoring Central Geotechnical to help facilitate their Actuals Not-to-Exceed (ANTE) rate table acceptance by the WSDOT Consultant Services Department. Assuming that we are selected for this contract, our first step will be to confirm that our remaining DBE subconsultants are cleared on the contractual side, and ready to respond to WSDOT's rock slope concerns.

LT and WSDOT's SGO staff are well acquainted through prior engineering geology staff augmentation contracts. However, we anticipate that our DBE team members may be lesser known to the SGO group. Our second step will be to hold a kick-off meeting with SGO and the firms to facilitate introductions. We would ask the subs to make brief presentations on their qualifications and provide the SGO with an opportunity to ask questions on capabilities. In that manner, the SGO can feel confident of the DBE qualifications when we assemble project teams.

Featured DBE Team Members

AMA

CENTRAL GEOTECHNICAL SERVICES

PGG LLC

RIVERO DESIGN

Criteria 2: Expertise/Experience for Work on Steep Slopes Utilizing Rope Access Techniques and Drones/UAV

A. Include the following items:

- *Please describe how the CONSULTANT assesses a steep rock slope to choose the most cost effective, safest, and quickest techniques for obtaining information.*

Assessment of Steep Rock Slopes

Prior to performing a site visit, we would complete a brief desktop study to collect and review existing information relative to the rock slope segment in question. Existing Electronic Content Management (ECM) data for the roadway segment and Unstable Slope Management System (USMS) data for the slope section(s) would be reviewed along with soliciting historical information from Regional Maintenance personnel and reviewing WSDOT's SR View program to develop a historical understanding of the hazards and timeline of significant events. Other available ortho-imagery, lidar, and topography would also be utilized to gain a better understanding of the site prior to a field visit. The level of effort expended on desktop studies conducted prior to the site visit will be adjusted according to the urgency of the project as conveyed to LT by the SGO.

A key element, especially during an emergency response, is to assist WSDOT Regional Maintenance and SGO personnel with an initial assessment of the rockfall hazards and the need for interim measures or actions to safeguard the traveling public and maintenance crews. LT's team would assist the SGO as needed by providing senior personnel during initial ER evaluations and/or act as an extension of the SGO to augment their staff for rock slope/rockfall related mitigation, design, and/or construction projects. LT's team has numerous senior-level staff that are experienced in the assessment of rock slopes and rockfall for transportation agencies.

During the field visit, we would meet with WSDOT Regional Maintenance and SGO personnel, if available, to discuss the immediate concerns and to develop a better understanding of the rockfall history at the site. The frequency, size, and occurrence of historical rockfall and ditch cleaning activity, along with the performance of the catchment area (ditch effectiveness) is an important consideration in the risk assessment and the selection of rockfall risk-reduction measures, if warranted.

LT's in-house rope access team is skilled in the assessment of steep slopes

Our team would arrive on-site prepared to utilize our in-house drone/UAV capabilities that can be used to rapidly and cost-effectively collect oblique imagery to assess slope conditions and immediate rockfall hazards. However, we are aware of WSDOT's drone capabilities and would utilize either in-house or WSDOT personnel as appropriate. In addition to initial assessments, imagery can be utilized for the development of georeferenced topographic maps and production of terrain (i.e., 3D) models utilizing structure-from-motion (SfM) software such as Agisoft MetaShape. This data can be used to assess rockfall concerns, develop mitigation concepts, and estimate construction quantities. Drones are also useful to more safely assess potential hazards upslope of the rock slope that may be inaccessible in short-term during an emergency response.

Once a task order is initiated, LT would mobilize a minimum of two rope access personnel to provide safe slope access for hazard evaluations. We have found success utilizing a third geoprofessional at road grade to direct on-slope personnel, assist with

documentation of slope and hazard assessments, and to act as a safety spotter for on-slope personnel and the traveling public, should the roadway be open. If warranted and deemed beneficial, a third senior level engineering geologist would be mobilized. Each team member would be in radio communication with traffic control and WSDOT maintenance, if needed. The use of rope access techniques are particularly useful on a tall slope or a heavily treed slope that limits the use of a drone. In addition, they allow for on-slope vantages to assess the design, placement, and constructability of mitigation elements such as immediate scaling needs, draped mesh anchor locations, rockfall attenuator anchor and post locations, rock dowel/bolt targets, etc. Any on-slope assessments would be done in coordination with Regional Maintenance personnel to ensure the safety of the traveling public.

While on the slope, we would assess slope stability and rockfall concerns. The type and condition of the rock mass, and the orientation and character of discontinuities often determines the size of rockfall and potential failure modes of larger, rock mass features. Weathering and differential erosion that undermines and removes the basal support of larger rock blocks and groundwater seepage are also important considerations to assess slope instability and rockfall potential. The identification of existing failure modes and measurement/characterization of discontinuities would also be performed. During this initial effort, mitigation concepts (i.e., removal, scaling, protection, reinforcement, or a combination of these measures) would be rapidly evaluated for effectiveness, constructability, and cost. Drone data can be used to enhance these assessments.

LT conducting a boom-lift supported rock slope assessment

B. *Include the following items:*

- *Please describe the type(s) of steep slope rope access training the CONSULTANT has completed and how often they refresh that training.*

Rope Access Team Training

LT's rope team includes six engineers and geologists who are trained in rope access maneuvers sponsored by the Society of Professional Rope Access Technicians (SPRAT). Our rope team includes one Level 3 Supervisor, one Level 2 Technician, and four Level 1 Technicians. Additionally, LT will be supported by GeoEngineers (GEO) on this contract, who brings an additional eight geoprofessionals who are SPRAT trained.

LT maintains rope access skills through several steps. Initially our team members are introduced to rope access via SPRAT training and certification. We supplement SPRAT with internal training conducted on rock slopes to simulate job site conditions. When rope access is required for a project, we provide job-specific refreshers to tailor rope access methods and equipment. Our team refreshes SPRAT training/certifications every three years. Every project utilizes a Rope Access Work Plan that defines the scope of work, anticipated hazards, potential rescue procedures, emergency contacts, chain of command, and hospital/medical information. All team members involved in the project review site specific information prior to starting work, refine applicable rope access maneuvers, and inspect equipment daily while on the project. Our team conducts an annual inspection of all rope access gear to identify equipment that may need repair or replacement.

GEO maintains SPRAT skills each year by conducting an annual refresher course. For specific projects they would adhere to LT's approach for development of a Rope Access Work Plan and performing project specific equipment inspections. LT will work with GEO to maintain a consistent rope access team approach.

C. Include the following items:

- *Please describe the types of data and samples the CONSULTANT collects while they are physically present on steep slopes and how they utilize that data and those samples.*

Data Collection and Analysis for Steep Rock Slopes

During rock slope evaluations (on-slope and ground based) we collect data on the size and shape of existing rockfall debris and characterize rockfall sources (i.e., historic or potential trajectory paths and launch features upslope chutes, existing failure areas, and existing potential failure modes). Rockfall or rock slope failure frequency, location, geometry, and height above the roadway are recorded. In addition, the width and geometry of existing catchment areas is measured along with an assessment of the effectiveness of the ditch to retain rockfall or rock slide debris. Impact scars on the slope, roadway and on other roadway features are also assessed (i.e., guardrail, concrete barriers, etc.). Proximity of adjacent features and infrastructure are also assessed. This data is compared and incorporated with data obtained from discussions with maintenance personnel familiar with the slope's rockfall history.

Rock mass characteristics are also evaluated as they generally control stability (both global and from individual rockfall), potential failure modes, and size of potential failures and rockfall. Rock mass data collected includes rock mass classification, intact rock strength (from hand specimens or subsequent point load testing or UCS tests, if warranted), degree of weathering and alteration, the presence, orientation, and condition of discontinuities, and degradability. If infilling material is present on key discontinuities, grab samples can yield useful data on plasticity and residual shear strength. Rock mass characterization would include:

- Description of lithology (i.e., rock type, color, hardness, degree of weathering, degree of jointing/fracturing, etc.).
- Measurement and evaluation of discontinuities including orientation (i.e., dip and dip direction), spacing, persistence, roughness (JRC), waviness, aperture, infilling, number of discontinuity sets, type of discontinuity (i.e., bedding, jointing, faulting, shear, gouge, dike, etc.).
- Observation, and if possible, measurement of seepage and pore pressure acting on discontinuities.
- Measurement of rock quality designation (RQD), oriented borehole logging if subsurface investigations are conducted for new rock cut slopes.
- Estimation of Geological Strength Index (GSI).

Data collected from the ground and rope access techniques supplements characterization completed using imagery collected from drones/UAV. Georeferenced topographic maps and terrain models utilizing structure-from-motion (SfM) are initially analyzed via desktop reviews and later confirmed with field observations. Geologic discontinuities can be measured from the terrain model using Cloud Compare analysis software to supplement those from on-slope observations. The use of the terrain model allows for collection of a larger discontinuity data set across the rock slope, which informs identification of rockfall hazards, measurement of jointing patterns, and completion of kinematic analyses. Often under emergent condition, remnant instability concerns are controlled by a small set of discontinuities, and extensive mapping and data collection of discontinuities are not warranted.

Data collection and analysis for steep rock slopes

Instrumentation (i.e., tape extensometers, crackmeters, strain gauges, etc.) can be extremely valuable to collect data on rates of movement of a given rock slope or rock block, which assists with the determination of stability or risk associated with an area of concern. Our rope access team has experience determining ideal types and locations of instrumentation that can assist with the understanding of rockfall activity thresholds. Systems our team have installed, include tape extensometer points, vibrating wire (VW) crackmeters, VW long-range strain gauges, tiltmeters, in-place inclinometers (such as shapearrays), cameras, and automatic data acquisition systems (ADAS) with wireless connection capabilities to facilitate transfer of monitoring data in real time. Instrumentation systems in remote locations facilitates monitoring potentially unstable rock slopes/features in both short- or long-term timeframes and can provide valuable site condition/change insight. Telemetry adds the option for near real-time assessment.

The overall data set is used to estimate the potential for additional slope failure activity, develop mitigation concepts (as necessary), and provide documentation of site conditions.

D. Include the following items:

- *Please describe how the CONSULTANT uses drones/UAV including what products they create with the data they collect.*

Drone/UAV Utilization and Work Products

During our initial assessment of slope conditions and rockfall hazards, we utilize methods that are appropriate for the circumstances. Often the most useful approach involves remote collection of oblique imagery via drones/UAVs. The imagery also facilitates development of georeferenced topographic maps and production of terrain (i.e., 3D) models utilizing structure-from-motion (SfM) software such as Agisoft MetaShape. When warranted, we will collect lidar data to develop a terrain model or to supplement SfM modeling. The terrain model, topographic maps, and imagery are initially analyzed via desktop reviews and later confirmed with field observations. Analyses include identification of slope features and hazards, assessment of slope feature/hazard geometry, measurement of geologic discontinuities, and identification of potential mitigation locations (e.g., scaling areas, rock bolt/dowel targets, rockfall attenuator post locations, etc.). Once mitigation is selected, terrain models can be used to optimize the mitigation design and for quantity take-offs. Geologic discontinuities can be measured from the terrain model using Cloud Compare terrain analysis software to supplement those from on-slope observations. The use of the terrain model allows for collection of a larger discontinuity data set, if necessary, which can inform jointing patterns and kinematic analyses.

Drone/UAV imagery for Seward Highway rock slopes

We have utilized drone/UAVs on many rockfall projects. Recently, the Seward Highway Rockfall Mitigation project included imagery collection at 10 rock slopes with heights up to 150 feet above the roadway. This informed our field reconnaissance for targeted on-slope rope access and boom-lift supported assessments, facilitated development of terrain models, and provided data to collect discontinuity measurements. We were also able to optimize post locations for Type 2 slope protection (attenuators), estimate surface areas for scaling and draped mesh take-offs, and refine rock bolt/doweling targets.

Criteria 3: Experience in Emergency Response Situations

A. Include the following items:

- *Please describe a highway rock slope emergency response situation from initial site visit through construction that demonstrates the CONSULTANTS verbal and written communication with respect to their observations and recommendations.*

General Approach to Rock Slope/Rockfall Emergency Response Situation

LT routinely provides rapid response assessments and recommendations for highway rock slope failures and rockfall events. These types of emergency projects are commonplace in our practice, and we are adept at adjusting work schedules and resource allocation to meet the time-sensitive nature of such events. As part of this contract, our point-of-contact, Brent Black, and LT's team of senior staff, will be available to WSDOT to facilitate rapid response seven days a week. Depending on the location of the incident and timing of the call, we typically will be on-site within a few hours. With team members located in Seattle (and the greater Puget Sound Area), Olympia, Portland, and Boise, we can certainly respond on-site to any emergency location within 12 hours of notice by the SGO.

Based on our extensive experience responding to rock slope and rockfall hazard events throughout the Pacific Northwest, Mountain States, and Alaska, we have developed a structured approach that addresses site-specific geologic conditions, slope hazards, and client concerns. Our project approach for a typical highway rock slope emergency response situation is detailed below.

Multi-Phased Project Approach. LT often phases rock slope and rockfall investigations while engaging Owners from the assessment/investigation phase, through design and PS&E development, and into construction. We have implemented a phased approach on previous work for WSDOT and other State DOTs with proven cost-effective, successful strategies. A major advantage of a phased approach is that it enables tailoring the level of site investigation, design effort, and support of construction to the specific slope and related hazards, and to the needs of the Owner.

Rope access for I-90 MP 22 rock slope emergency response

Phase I - Initial Response and Evaluations. The first phase typically includes a preliminary site investigation with a quick review of available site information, discussions with the WSDOT's maintenance and geotechnical personnel regarding event triggering and emergency response. Based on the direction from the SGO and the severity of the event, we would be prepared to respond with our in-house drone and rope access team, or by one of our senior-level engineering geologists. LT's team has numerous senior-level staff that are experienced in the assessment of rock slopes and rockfall for transportation agencies. A key element, during an emergency response, is to assist WSDOT personnel with an initial assessment of the rockfall hazards and the need for interim measures or actions to safeguard the traveling public and maintenance crews. Phase I involves identifying the cause of the slope movement, the likelihood of additional movement and potential impacts, evaluation of existing or needed road closures, emergency repair options, interim mitigation options, and a plan of action if follow-up work is required.

When required, LT will perform rapid/emergency detailed geologic mapping and characterization of the rock slope or rockfall hazards. In situations

where additional information is needed to accurately model the slope and assess the threat of additional movement, we will coordinate with WSDOT as approved to develop a geotechnical site investigation plan. The recommended investigation program may involve drones, rope access, or boom-lifts to collect the detailed geologic information necessary for stability evaluations and development of repair concepts. In some instances, strain gauges and crack meters can be installed to help monitor slope/mass movement. The data collected from the investigation can then be used to evaluate scaling needs, rock reinforcement requirements, potential fallout and ditch improvements, mesh, and other barrier possibilities.

LT has worked with WSDOT and many DOTs to assist with assessing the need to restrict roadway use or implement road closures. We routinely provide recommendations for risk-reduction measures, such as slope monitoring and deploying interim protective berms/barriers, including the use of WSDOT's movable rockfall barriers, to permit passage of traffic prior to construction of full corrective measures.

Phase II - Mitigation Design and Reporting. Upon completion of Phase I, results would be discussed with WSDOT to communicate key aspects of the triggering event, probable causation, conceptual treatment options, approximate construction costs of mitigation alternatives, and risk analysis to assist in making decisions on preferred remedial methods. The information and data generated by these studies and discussions with WSDOT would be documented in a Geotechnical Site Visit Report to provide evaluation details and document project decisions.

Phase III - Construction Documents. Once preferred mitigation alternatives are selected, final design and analyses are performed and construction drawings and technical specifications are prepared to develop a bid package. LT will work with WSDOT personnel to inform preparation of the construction bid package. For example, LT would provide geotechnical-specific drawings and technical specifications while WSDOT prepares the full PS&E package. If necessary, LT could provide any level of assistance that is required, all the way up to preparing the entire bid package.

Phase IV - Construction Support. LT commonly assists DOTs with development of responses to contractor questions during bidding and assists with evaluation of geotechnically related bid items and RFIs. Our staff normally works with our clients to identify construction elements that the Owner prefers to inspect and specific elements that they would prefer be observed by LT's engineering geologists. For instance, our rope access team can provide on-slope support for layout and observation of construction of difficult access mitigation elements and other remedial designs. When performing construction inspection, LT's policy is to provide daily inspection reports to the Owner summarizing observed conditions and any recommendations conveyed to WSDOT's on-site construction personnel. Our Project Managers are also accustomed to developing construction documentation and summary reports (i.e., as-builts) necessary to fulfill the requirements of grant and emergency relief funding sources.

Communications and Availability

LT will be responsive and immediately available to assist WSDOT engineering geology staff and maintenance personnel with the assessment, investigation, and remediation of rockfall, rockslides, and other geologic hazards affecting WSDOT roads and facilities. Our engineering geologists can be on-site for an emergency within a few hours, even on the weekends. Our SLG, Brent Black, and key senior staff will provide WSDOT with their direct cell phone numbers.

Accessibility to Brent and our key senior staff either in-person, by teleconference, or by electronic communications will be nearly immediate. With office locations in Seattle, Olympia and Portland, we are very close to any project work, meetings and/or other interactions that may come up during the duration of this project delivery contract. LT has current versions of Microsoft Teams to facilitate teleconferencing if in-person meetings cannot happen for whatever reason. Large electronic files can be exchanged using our Citrix ShareFile. LT is also equipped with the latest version of Word,

AutoCAD Civil 3D, and MicroStation OpenRoads. When requested, work products in progress (such as documents and drawings) can be submitted for review in electronic format by email.

The majority of LT's work comes from on-call, project delivery contracts with public agencies. As a result, LT is adept at establishing and maintaining productive working relationships, managing concurrent projects, and balancing resources to provide quality services on-time and within budget. LT is committed to continuing a productive working relationship with WSDOT on future work assignments. Our SLG, Brent Black, will be the primary point-of-contact with the Agency. Brent will be available to work as extension of SGO staff from the Tumwater office, and function as geotechnical liaison between the SGO and other state offices, as needed. In general, our ability to work with WSDOT and communicate on highway rock slope and/or rockfall emergency response assignments will be accomplished in the following manner:

- Immediately respond and visit the project site as soon as needed.
- Report back to the WSDOT SGO with our observations and findings and preliminary recommendations.
- Establish a clear understanding of WSDOT's needs and objectives, incorporating feedback and knowledge from WSDOT maintenance and geotechnical personnel to aid in the development of risk reduction and mitigation measures.
- Provide discussion with WSDOT regarding the principal work elements, along with project milestones and budget control.
- Set-up regular meetings with WSDOT to review progress of the work, schedule, specific work elements that have been accomplished, and resolve any issues related to project work elements.
- Prepare monthly progress reports, and maintain ongoing communications with WSDOT by means of in-person meetings, teleconference, and email.
- Ensure WSDOT satisfaction upon project close-out through close coordination with the SGO.

Highway emergency response for the Ketchum-Challis rockfall in Idaho

Criteria 4: Knowledge of WSDOT Design/Contracting/ Construction and Operating Procedures

A. Include the following items:

- *Describe the CONSULTANTS knowledge of WSDOT's operating procedures at the Geotechnical Office, Project Office, and Maintenance organizational levels.*
- *Describe the CONSULTANTS knowledge of WSDOT's geotechnical/engineering geology practices and design procedures.*
- *Describe the CONSULTANTS knowledge of WSDOT's contracting procedures.*
- *Describe the CONSULTANTS knowledge of WSDOT's Geotechnical Office construction support procedures.*

Knowledge of WSDOT Operating Procedures at the Geotechnical Office, Project Office and Maintenance Organizational Levels

Our team would leverage Tom Badger's over three decades of experience working for WSDOT. During his time with the Agency, Tom developed strong working relationships throughout WSDOT, focused on excellent communication and timely delivery of cost-sensitive and high quality work products. He assisted with updates and revisions to WSDOT's Standard Plans and Standard Specifications; Geotechnical Design and Construction Manuals; and authored special provisions for numerous geotechnical contract items. In 2021, Tom joined LT as a senior staff consultant, and has spent a considerable amount of time providing guidance to LT's key senior staff regarding the operating procedures within the SGO, and the services it provides to Region Maintenance, Design and Construction offices, and the manuals and policies that govern this work.

Through LT's recent work under its current Engineering Geology Personnel Augmentation Contract with the SGO, LT has updated our knowledge of changes in policies and personnel that have occurred within SGO and WSDOT since Tom's departure in 2016. Our proposed SLG, Brent Black, and LT's other key senior staff have also built new and effective relationships with SGO personnel and gained considerable experience in WSDOT's policies and work products. We will also use our experience augmenting the staff of FHWA-WFL and other State DOT's to support them with various stages of delivery for rockfall/rock slope stability related projects.

LT worked as an extension to the WSDOT SGO to assess rockfall hazards on SR-401 MP 2.1

LT fully recognizes and appreciates the importance of maintaining a close relationship with the SGO and its Task Order Manager. This includes frequent communication, vetting design/response approaches, allowing time for review, and adhering to established communication channels and procedures, while still balancing the Agency's expectation for the consultant to effectively function independently. Negotiations for task orders completed under the current Staff Augmentation Contract have been efficiently and effectively completed, and deliverables have consistently met contract objectives in a timely manner and under budget.

Knowledge of WSDOT Geotechnical/ Engineering Geology Practices and Design

Through the course of our current WSDOT Engineering Geology Personnel Augmentation Contract, Tom Badger had the opportunity to share much of his knowledge with LT's staff. Part of his role going forward will be to continue with guidance on WSDOT procedures and quality standards. Tom

is fully versed in design procedures and products within the SGO and how they support other work groups within the Agency. Tom will provide insight into the SGO's approach to review of work products to ensure adherence to technical policies and standards; assignment of work and allocation of resources; strategic and budgetary planning; coordination of emergency response to geologic hazards; and development of technical policies.

One of Tom's primary roles since joining LT has been to provide guidance regarding WSDOT's practices and procedures to our senior staff and the next generation of young professionals who will serve WSDOT in the years to come. In addition to Tom Badger's mentorship, several of LT's senior staff gained excellent familiarity with WSDOT's geotechnical practices and procedures by providing updates to the State's Geotechnical Design Manual.

Knowledge of WSDOT Contracting Procedures

The Agency engages in a great variety of contracts including design services, construction, maintenance, real estate, etc. The SGO primarily utilizes design and exploration service contracts with engineering consultants and drilling contractors. LT's experience with SGO's engagement of consultants has been updated and more broadly developed amongst our key senior staff over the past two years through our current Engineering Geology Personnel Augmentation Contract with WSDOT for a range of services from project scoping and budget development, geotechnical design, construction support, emergency response, risk assessment, and supporting development of internal policies.

In his former role in the SGO, Tom Badger regularly engaged these contracted services through existing on-call agreements and developed new contracts for engineering services, with the assistance of the Consultant Services Office and the Consultant Manager within the SGO. During the past two years that Tom has served as a senior staff consultant with LT, he has spent a considerable amount of time providing guidance to our key senior staff regarding WSDOT Contracting procedures regarding developing a scope and budget; contract/task order negotiations; execution of task assignments; ensuring adherence to design procedures and standards; managing work products, timelines, and budgets; and reviewing work products..

As an extension to SGO, LT worked with WSDOT maintenance personnel to assess rock slope and rockfall hazards on I-5 and Chuckanut Drive

Knowledge of WSDOT Geotechnical Office Construction Support Procedures

Personnel within the Geotechnical Office provide statewide technical support to Regional Construction and Maintenance Offices, who are responsible for contract execution and administration. Timeliness, communication clarity, and technical quality of geotechnical support are essential attributes to avoid/minimize impacts to contract administration. Tom Badger's experience in providing and managing geotechnical support for WSDOT construction projects, and his understanding of the relationships between the Regional and Headquarters Construction Offices and the SGO, along with his working knowledge of the documents and manuals and external entities that guide contract administration, will be a reliable source of guidance for our proposed SLG, Brent Black. LT's senior staff have decades of similar experience with geotechnical-related construction methods and materials and in providing timely and effective construction support for other State DOT's and FHWA-WFL that closely follow WSDOT's geotechnical construction support needs.

Criteria 5: Demonstrated Ability to Respond with the Appropriate Design and Construction Support for a Given Project Situation/ Budget/Timeline

A. Include the following items:

- *Using the project described under scoring criteria 1B, please describe how the CONSULTANT met the needs of the client and why a specific design was chosen over another.*

Seward Highway MP 104 to 114 Rock Slope Mitigation Design, Anchorage, Alaska

Client Reference: Jonathan Tymick, AKDOT&PF, 907-269-0453, jonathan.tymick@alaska.gov

Key Services:

- Rock Slope Investigation & Analysis
- Geologic Mapping
- Rope Access
- UAV/Drone Utilization
- Rockfall Modeling
- Design of Rock Slope Mitigation Measures
- Fast-Tracked Alternatives and Design Development
- Contract Documents (PS&E)
- Construction Support Services
- Traffic Control Solutions
- Compressed Construction Schedule

Ability to Meet the Client's Needs: The Seward Highway Rock Slope Mitigation Design project initially included weekly, then bi-weekly, over-the-shoulder interim reviews with the AKDOT&PF's geotechnical and project staff during an accelerated, six-month design period. These interim reviews were conducted on a rapid basis to refine mitigation options and traffic control measures for the first PS&E submittal, which was developed at a 90% design level. LT provided the AKDOT&PF with mitigation options and associated engineer's estimates to facilitate selection of preferred rockfall mitigation designs and traffic control measures. Utilizing the over-the-shoulder reviews, several key DOT decisions were made in real-time, balancing project design goals with fiscal and other stakeholder constraints. The project was successfully taken to final PS&E on an accelerated schedule to meet the AKDOT&PF's target dates for early construction. LT provided full-time, rope-equipped construction support for the duration of the three-year construction project by moving our key designer to the Anchorage area for each construction season. The work was successfully completed within the negotiated budget and schedule preferences.

Construction layout via rope access and drilling for rock bolt installation on the Seward Highway rock slope corridor

B. Include the following items:

- *Using the project described under scoring criteria 1C, please describe how the CONSULTANT met the needs of the client and why a specific design was chosen over another.*

Interstate 15 (D3) Rock Slope Mitigation Design, Helena to Great Falls, Montana

Client Reference: Jeff Jackson, MDT, 406-444-3371, jejackson@mt.gov

Key Services:

- Rock Slope Investigation & Analysis
- Rock Slope & Trim Blasting Design
- Instrumentation
- Geologic Mapping
- Rope Access
- UAV/Drone Utilization
- Rockfall Modeling
- Design of Rock Slope Mitigation Measures
- Contract Documents (PS&E)
- Construction Support Services
- Traffic Control Solutions

Ability to Meet the Client's Needs: MDT's primary need was to provide rockfall mitigation along 15 rock slope segments while limiting traffic disruption and mobility concerns for the only north-south interstate in the state. LT developed final design and PS&E packages for three separate contract phases to allow MDT the flexibility of selecting which construction phase would impact traffic the least and to accommodate available funding. LT provided significant input on the traffic control plans and developed temporary rockfall protection measures to allow traffic to pass during scaling operations from slopes over 200 feet tall using movable rockfall barriers and large rockfall containment nets suspended from 100-ton cranes.

In addition, considerable coordination and planning was needed to perform over 102,500 cubic yards of rock excavation and trim blasting using controlled blasting techniques that impacted traffic on the adjacent interstate, County frontage road, railroad, and recreational use of the Missouri River. LT developed and performed a training class for MDT construction personnel to introduce them to rockfall mitigation inspection and to emphasize critical elements associated with the construction of mitigation elements. LT also provided full-time, rope access construction support for the duration of the three-year construction project. The work was completed on schedule and there were no claims associated with this challenging project.

Controlled highway blasting techniques on the I-15 (D3) rock slope corridor