SOUTH FEATHER WATER & POWER AGENCY

RATH MOSELEY, GENERAL MANAGER

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January 24, 2024

Filed Electronically

Frank L. Blackett, P.E., Regional Engineer
100 First Street, Suite 2300
San Francisco, CA 94105

RE: South Feather Water & Power Agency
South Feather Power Project (FERC No. 2088)
Request for Chief Dam Safety Engineer Approval

Dear Mr. Blackett,

This letter serves as a request for your approval of Mr. Silas Sanderson, P.E. of Schnabel Engineering to be designated as the Chief Dam Safety Engineer for South Feather Water and Power Agency, as the Licensee for FERC Project No. 2088, South Fork Power Project. Mr. Sanderson has more than 19 years of experience in dam safety engineering, and his resume is attached for your review.

If you have any questions or require additional information, please feel free to contact me, or my staff Ms. Kristen McKillop at (530) 534-1221, or via email at kmckillop@southfeather.com.

Very Truly Yours,

Rath T Moseley

Rath Moseley
General Manager

cc: Kristen McKillop, Chief Dam Safety Coordinator
Dan Leon, Power Division Manager
encl: Silas Sanderson Resume

Silas Sanderson, PE

CHIEF DAM SAFETY ENGINEER

Expertise
Risk Assessment and Facilitation, Dam Analysis, Geotechnical Engineering

Education
Master of Science, Geotechnical Engineering, Portland State University

Bachelor of Science, Civil Engineering, University of Massachusetts – Amherst

Registrations
Professional Engineer / MA, WA, CA, CO

Affiliations
ASCE, ASDSO, USSD, NWHA

Years with Schnabel/Total
3/19

Silas is a specialist in dam safety risk assessment with over 19 years of geotechnical and structural engineering experience, and is a FERC approved Independent Consultant (IC). His roles have included leading several Quantitative and Semi-Quantitative Risk Analysis (SQRAs) for high hazard dams, facilitating risk assessments, planning and executing field investigations, leading and conducting dam safety inspections, conducting and reviewing complex technical analyses including seismic analysis of embankment dams, evaluation of instrumentation data, and providing cost effective and constructible designs for a diverse array of projects. Prior to joining Schnabel, Silas worked as a civil engineer for the SACE for over 10 years. During his time at USACE, Silas was heavily engaged in supporting the USACE's national dam safety program.

DAM INSPECTION, RISK ANALYSIS, AND INVESTIGATION

Idaho Power, Brownlee Dam Comprehensive Assessment / Idaho (10 Days)
Geotechnical SME responsible for inspection and Level Two Risk Assessment (L2RA). Brownlee Dam is a 395-foot-high rockfill dam with a sloping core. Additional project features include a reinforced spillway structure with seven radial spillway gates, a 173-ft wide, lined spillway chute, an intake structure, and a five unit powerhouse. Work performed included conducting an inspection of the project, background data review, brainstorming PFMs, and preparing assessment data for the SQRA. *(August 2023 to present)*

South Feather Power and Water Agency, External ODSP Audit / California (22 Days)
Project Manager and Co-Auditor responsible for conducting an independent external audit of South Feather Water and Power Agency's (SFWPA) Owner's Dam Safety Program (ODSP) in accordance with FERC requirements. The intent of this audit was to provide an independent assessment of the adequacy of the policies, procedures, organization and personnel that make up the ODSP. SFWPA owns and operates the South Feather Power Project. The power project facilities include eight dams, seven tunnels, four powerhouses, and an open conduit that includes elevated flume and siphon sections. Four of the dams are classified as high-hazard dams. FERC requires owners of high and significant hazard potential dams to develop and submit an ODSP and to periodically conduct external audits. The audit process included a review of various reports and documents, discussions with SFWPA staff during a formal meeting, numerous interviews, and a site visits to Little Grass Valley, Sly Creek, Lost Creek, South Fork Diversion, and Miner's Ranch Dams, as well as the Woodleaf Powerhouse. Following the review of project documents and completion of the interviews, a report was prepped presenting the methodology, interviews, review of records, and ODSP and findings for submission to the FERC. *(June 2023 to present)*

Portland General Electric, Faraday, River Mill, and Willamette Falls / OR (44 Days)
Project manager and geotechnical engineer responsible for coordinating and preparing for the 2023 Part12D inspections. The Faraday development consists of the Faraday Diversion Dam, Intake tunnel and canal, and Faraday Forebay Dam. The River Mill development consists of a concrete gravity dam (buttress dam filled with mass concrete), powerhouse, concrete spillway, concrete floodwall, and a short earthen dike. The dam is comprised of eight concrete gravity segments that

surround Willamette Falls between West Linn and Oregon City, OR. Work performed included, coordinating technical resources, review existing project documentation, leading field inspection, authoring reports, and managing project schedule and budget. *(November 2022 to present)*

Colorado Park and Wildlife Portfolio Risk Assessment and Prioritization/ CO (17 Days)

Two Buttes Dam: Geotechnical SME responsible for providing risk estimates for a variety of potential failure modes for Two Buttes Dam, including internal erosion, embankment overtopping, and spillway erosion as part of a semi-quantitative risk assessment (SQRA). Two Buttes Dam is a 96 ft tall, embankment dam with an outlet works tunnel and unlined spillway. Lead Engineer responsible for reviewing and compiling existing background data, pre-screening and developing PFMs, and documenting the findings of the risk assessment for Sylvan Lake Dam. Sylvan Lake Dam is a 35 ft tall, embankment dam with RCC emergency overlay, a low level outlet works, and a service spillway. *(February 2023 to present)*

Cowlitz County Public Utility District, Swift No 2. Hydroelectric Project / Cougar, WA (66 Days)

Co-Independent Consultant responsible for the 2022 Part 12 Inspection and PFMA. The project features include a 16,700-foot-long power canal and forebay, gated concrete intake, two 16-foot diameter penstocks, an indoor powerhouse with two 35 MW generating units, and a surge-arresting structure (SAS) consisting of an intake structure and associated facilities abutted against the power intake structure. Work performed included review and revision of potential failure modes to be consistent with FERC's evolving Risk-Informed Decision Making process, review of previous designs and analyses, issuance of an Independent Consultant Safety Inspection Report following FERC's guidelines for format and content, and review of annual instrumentation evaluation reports. Follow-on work included conducting a root cause analysis of an instrumentation data collection and review incident. Responsible for conducting interviews with project operations and maintenance staff to gain an understanding of the root cause of the incident and authoring the root cause analysis report. *(January 2022 to present)*

Bureau of Indian Affairs Bottle Hollow, Round Rock, and Lower Mundo Dams Comprehensive Review / UT and AZ (33 Days)

Senior Reviewer (Bottle Hollow) responsible for peer review throughout the comprehensive review (CR) process. Work included records review, advising the Examiner in advance of the physical inspection, and peer review of the CR report. The key features associated with Bottle Hollow Dams and Dike include two dam embankments (North Dam and South Dam), a dike along the southern edge of the reservoir area, and a combined service spillway and outlet works structure in the South Dam. Risk Analysis Facilitator (Round Rock) responsible for the facilitation and documentation of the quantitative risk assessment (QRA). Round Rock Dam consists of 46 ft tall, zoned earth-fill embankment dam with a low-level outlet and uncontrolled service spillway. Geotechnical Engineer (Lower Mundo) responsible for providing risk estimates for a variety of potential failure modes, including internal erosion and seismic deformation, as part of the QRA process. Lower Mundo Dam consists of 70 ft tall, zoned earthfill embankment dam with a combined service spillway and outlets works, and an auxiliary spillway. *(June 2022 to present)*

NorthWestern Energy Missouri-Madison Hydroelectric Project Drilling Program Plan / Great Falls, MT (5 Days)

Geotechnical Engineer responsible for developing a drilling program plan (DPP) for the Ryan and Rainbow developments of NorthWestern Energy's Missouri-Madison Hydroelectric Project. The DPP at Ryan included five borings drilled along the

axis of the spillway. The objective was to enhance the site characterization and determine site-specific foundation strength parameters. The DPP at Rainbow included one boring into the foundation to inform and refine erodibility parameters of the bedrock foundation. The DPP was prepared in compliance with FERC guidelines for drilling in and near embankment dams and their foundations. (*April 2022*)

Grant County PUD, Wanapum Dam Part 12D Inspection / Grant County, WA (44 Days)
Associate Engineer for the 2021 FERC Part 12D Inspections of the Wanapum Development of the Priest Rapids Project for Grant County Public Utility District No. 2 (GCPUD). The Wanapum development is a hydroelectric facility located on the mainstem of the Columbia River in central Washington State. The principal structures of Wanapum Dam include left and right earth embankment sections, left and right concrete gravity dams with upstream fish ladders and associated facilities, a reinforced concrete spillway with 12 radial gates, a trash sluice, a 10-unit powerhouse including generator hall and erection bay, and a future unit intake (FUI) section. The total length of Wanapum Dam is 8,637 feet. The maximum height from the deepest excavation to the intake deck of the dam is 186.5 feet. Work performed included, review and revision of potential failure modes to be consistent with FERC's evolving Risk-Informed Decision Making process, review of previous designs and analyses, and evaluation of instrumentation data. *(June 2021 to December 2021)*

USACE – Portland District (NWP), Willamette Valley Dam Issue Evaluation Studies (IES) / Lane and Linn Counties, OR (827 Days)
District Lead. Geotechnical engineer responsible for coordinating and managing Portland District technical resources in support of Issue Evaluation Studies in the Willamette Valley basin including Foster, Hills Creek, and Cougar dams. Responsibilities include developing and executing Field Investigation Program Plan (FIPP), performing and reviewing technical analyses, assessing project risk through the use of dam safety engineering principles and practices, and tracking project execution.

Foster Dam consists of a 1,255-foot-long, 126-foot-high impervious core rockfill dam; a 400-foot-long, 126-foot-high concrete gravity spillway with four 45 x 46-foot Tainter gates; a 2,985-foot-long embankment transition zone and wing dam embankment; and a 20 MW powerhouse with two hydropower penstocks. Specific project responsibilities included developing and executing the field investigation program plan (FIPP), performing and reviewing technical analyses including instrumentation evaluation, assessing project risk through the use of dam safety engineering principles and practices, and performing administrative duties. The FIPP included four boreholes drilled from the drainage gallery into the bedrock foundation and two boreholes drilled into the wing dam foundation. The FIPP was developed and implemented to reduce technical uncertainties related to potential liquefaction of the embankment foundation and sliding of the spillway monoliths under seismic loading. Field activities included collecting soil samples for strength characterization of the embankment foundation and retrieving bedrock and concrete samples for direct shear, UCS, and flexure testing. Analyses performed included Newmark-Type deformation analysis and preliminary liquefaction triggering analysis. (*September 2017 to November 2019*)

Hills Creek Dam consists of a 1,920-foot-long, 304-foot-high zoned earthfill dam with a central impervious core; an ogee-type spillway with three 42 x 48-foot Tainter gates; a 164-foot-high intake tower with regulating gates; a diversion and foundation drainage tunnel; and a 30 MW powerhouse including one penstock. Responsibilities included collaborating with the assigned risk cadre to plan and execute the FIPP which included 14 geotechnical borings, surface and downhole

geophysics, six test pits, and access road construction. The exploration program was built primarily around filling data gaps associated with seismic deformation of the embankment. Primary technical analyses included managing and coordinating with the work of the SME conducting the NDA modeling, evaluation of the potential for reactivation of a landslide on the left abutment, and review of technical analysis performed by other districts. (*March 2016 to August 2019*)

Cougar Dam consists of a 1,600-foot-long, 519-foot-high rockfill embankment with a sloping impervious core; an ogee-type spillway with two 40 x 43.3-foot Tainter gates; a 302-foot-high intake tower with regulating gates; a diversion tunnel; and a 25 MW powerhouse including one penstock. Responsibilities included executing a field investigation program plan which consisted of installing vibrating wire piezometers, inclinometer casing, and extensometers in nine geotechnical boreholes as well as conducting downhole geophysics. The primary objective of the FIPP was to better understand the mechanisms controlling the observed settlement and deformation patterns. Technical analyses included estimating seismic deformation using the Newmark-Type method and limited non-linear deformation analysis (NDA) modeling using FLAC, finite element modeling to inform the potential for low-stress zone formation in the embankment, internal erosion filter evaluations, instrumentation evaluation, structural screening analyses for spillway gates, piers, and monoliths, and overtopping evaluation. (*March 2016 to August 2019*)

USACE – Portland District (NWP), Targeted Potential Failure Mode Analysis (PFMA) / Lane and Marion Counties (95 Days)

Facilitator. Provided independent facilitation and technical expertise for targeted risk assessments of proposed dam modifications. Assessments were performed for Foster, Cougar, and Detroit Dam downstream fish passage projects; Big Cliff and Detroit dam post-wildfire assessments; and Portland Metro Levee System (PMLS) Feasibility Study. The purpose of the targeted PFMAs was to identify any potential dam safety impacts of the proposed projects and to formulate risk reduction alternatives if needed.

Foster Dam consists of a 1,255-foot-long, 126-foot-high impervious core rockfill dam; a 400-foot-long, 126-foot-high concrete gravity spillway with four – 45 ft by 46 ft Tainter gates; a 2,985-foot-long embankment transition zone and wing dam embankment, and two hydropower penstocks and a 20 MW powerhouse. The targeted PFMA considered the potential dam safety risks associated with the installation of a new pipe penetration through the dam. *(December 2019)*

Cougar Dam consists of a 1,600-foot-long, 519-foot-high rockfill embankment with a sloping impervious core; an ogee-type spillway with two – 40 ft by 43.3 foot Tainter gates; a 302-foot-high intake tower with regulating gates; a diversion tunnel; and a 25 MW powerhouse including one penstock. The targeted PFMA considered the potential dam safety risks associated with the construction of the floating screen structure (FSS) and mooring tower on the upstream face of the dam and water control tower. *(August 2018)*

Detroit Dam consists of a 1457 foot-long, 450 foot-high concrete gravity dam with 4 regulating outlets, 6 Tainter gates – 42 ft by 32.5 ft, stilling basin, and a 100 MW powerhouse. The targeted PFMA considered the potential dam safety risks associated with the construction of a selective withdrawal structure (SWS) for temperature control and a floating screen structure (FSS) on the upstream face of the dam. *(January 2019)*

Silas Sanderson, PE

CHIEF DAM SAFETY ENGINEER

Big Cliff Dam is a reregulation dam immediately downstream of Detroit Dam (described above) and consists of a 280 foot-long, 191-foot tall concrete gravity dam with 3 Tainter gates and an 18 MW powerhouse. The purpose of the targeted PFMAs was to identify any potential dam safety or project operations impacts from recent wildfires in the basin. *(August 2018)*

The PMLS Feasibility Study assessed alternatives with a focus on improving levee performance, incorporating resilience, and reducing flood risk to a 27-mile levee system. The purpose of the targeted PFMA was to provide the design team with a better understanding of the potential life safety risks associated with the modification options under consideration. *(December 2020)*

USACE, Consistency Review (CR) Program / Various Locations (112 Days)

Geotechnical Engineer. Responsible for reviewing SQRA reports conducted as part of the USACE Periodic Assessment program. Ensured that risk assessments were conducted in accordance with approved methodologies. Dam includes Heyburn Dam, OK, Gavins Point Dam, SD, Kanapolis Dam, KS, Paint Creek Dam, OH, and Tom Jenkins Dam, OH. *(March 2016 to August 2017)*

USACE, Periodic Assessment (PA) Program / Various Locations (328 Days)

Facilitator. Provided independent facilitation and technical expertise for risk assessments of Fern Ridge Dam, OR, Berlin Dam, OH, Blackwater Dam, NH, Laurel Dam, KY, Long Branch Dam, MO, Hult Pond Dam, OR, Bardwell Dam, TX, Foster Dam, OR, Cottonwood Dam, SD, and El Dorado Dam, KS. Responsible for reviewing analysis and project documentation from the district team, facilitation of potential failure mode analysis (PFMA) and semi-quantitative risk assessment (SQRA), and ensuring that the risk assessments were conducted in accordance with approved methodologies. Additional details of each project are provided below (Note: Unless otherwise noted all projects are owned and operated by the USACE).

Fern Ridge Dam is a multi-purpose project and consists of an approximately 6,000 foot-long, 44 foot-high embankment and concrete gravity dam with 6 Tainter gates. *(May 2020 to August 2020)*

Hult Pond Dam is owned and operated by the Bureau of Land Management (BLM) and consists of a 225 foot-long, 39 foot-high main embankment with a low level outlet; 470 foot-long, 17 foot-high spillway dike, and a 92 foot-wide uncontrolled broad-crest weir spillway. *(August 2019 to October 2019)*

Long Branch Dam is a multi-purpose project and consists of a 3,800 foot-long, 71-foot-high rolled earth embankment; an uncontrolled spillway, and an uncontrolled drop inlet structure. *(October 2018 to December 2018)*

Blackwater Dam is a multi-purpose project and consists of an 875 foot-long, 72-foot-high rolled earth embankment; a 162 foot-wide; 72 foot-high non-overflow concrete gravity dam, 1,811 feet of dike embankments with a maximum height of 38 feet; 242 foot-wide uncontrolled modified broad-crest weir concrete gravity spillway, and outlet works. *(August 2017 to November 2017)*

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Berlin Dam is a multi-purpose project and consists of a 5,086 foot-long, 30-foot-high rolled earth embankment; 120 foot-long, 96 foot-high gated concrete gravity spillway with four 30 ft by 18 high Tainter gates; and a 360 foot-long uncontrolled concrete gravity dam. *(March 2017 to June 2017)*

Laurel Dam is a multi-purpose project and consists of a 1,420 foot-long, 282-foot-high rockfill embankment; uncontrolled spillway, concrete intake tower, and powerhouse. *(August 2016 to October 2016)*

Bardwell Dam is a multi-purpose project and consists of a 15,400 foot-long, 82-foot-high rolled earth embankment; a 352 foot-wide uncontrolled broad-crest weir spillway and intake structure with outlet works. *(January 2016 to March 2016)*

Cottonwood Dam is a flood control dam and consists of a 1,300 foot-long, 123-foot-high rolled earth embankment; a 275 foot-wide uncontrolled modified broad-crest weir spillway and an intake structure with outlet works. *(July 2015 to September 2015)*

Foster Dam consists of a 1,255-foot-long, 126-foot-high impervious core rockfill dam; a 400-foot-long, 126-foot-high concrete gravity spillway with four – 45 ft by 46 ft Tainter gates; a 2,985-foot-long embankment transition zone and wing dam embankment, and two hydropower penstocks and a 20 MW powerhouse. *(May 2015 to July 2015)*

El Dorado Dam is a multi-purpose project and consists of a 9,850 foot-long, 99-foot-high rolled earth embankment; two dikes with a total length of 10,330 feet and 36 feet high; a 350 foot-wide uncontrolled spillway, and an intake structure with outlet works. *(April 2015 to June 2015)*

USACE – Spirit Lake Project, Semi-Quantitative Risk Assessment (SQRA) / Mt. Saint Helens National Monument, WA (25 Days)

Facilitator. The Spirit Lake Project is owned and operated by the US National Forest Service (USFS) and consists of a natural debris blockage dam, intake structure, and regulating outlet works. Project specific tasks included facilitating the semi-quantitative risk assessment of the Spirit Lake Outlet project for the baseline condition, and conceptual alternatives. Assessment of the risk to the project by hydrologic, seismic, and volcanic loading. Responsible for ensuring that the risk assessment was conducted in accordance with approved methodologies. *(January 2016 to March 2016)*

USACE – Dexter and Hills Creek Dams, Data Package Development / Lane County, OR (13 Days)

Geotechnical Engineer. Conducted comprehensive review of project documentation, a preliminary geotechnical risk assessment, and development of a scope of work for further data preparation and evaluation in support of an IES study. *(August 2014)*

USACE – Delaware Dam, Quantitative Risk Assessment (QRA) / Delaware, OH (395 Days)

Geotechnical Engineer. Delaware Dam consists of an 18,600-foot-long, 92-foot-high homogeneous impervious embankment and a 232-foot-long, 92-foot-high concrete gravity spillway section gated with six 32 x 25-foot Tainter gates. Collaborated in the development of geologic cross-sections. Conducted evaluation of uplift cell data and rock strength testing data to assess the loading, strength, and kinematic parameters used in the spillway monolith stability analysis. Documented uplift assessment and provided team elicitation data package for internal erosion failure mode. Utilized

team elicitation and geotechnical risk management methodologies to evaluate and estimate probabilities of risk driving failure modes. *(February 2013 to May 2015)*

USACE – Zoar Levee and Diversion Dam, Quantitative Risk Assessment (QRA) and Dam Safety Modification Study (DSMS) / Zoar, OH (364 Days)
Geotechnical Engineer. The Zoar Levee and Diversion Dam consist of a 3,893-foot-long, 45-foot-high rolled-earth filled embankment with an imperious core, and a 500-foot-long, 35-foot-high diversion dam with an impervious core, low-level outlet, and auxiliary spillway. Utilized team elicitation, geotechnical risk management methodologies, relevant case histories, and state-of-the-art technical analysis procedures to evaluate and estimate probabilities of risk driving failure modes in support of QRA. QRA project responsibilities included documentation of instrumentation evaluation and risk driving failure modes. Collaborated with a multi-disciplined design team in the formulation and planning of geotechnical risk reduction alternatives, including the unique usage of a backward piping interceptor/filter trench, in support of the DSMS. Reviewed preliminary design calculations for relief wells, filters, toe drains, and filter trenches. Utilized team elicitation to provide risk reduction estimates and evaluation criteria, including construction and design feasibility and risk reduction effectiveness, for the proposed alternatives. *(August 2012 to September 2014)*

USACE – New England District (NAE), 2011-2012 Periodic Inspection (PI) Program / MA, CT, RI, VT, and NH (208 Days)
Team Lead. Team leader responsible for coordinating the efforts of a multi-disciplined team of engineers in conducting periodic dam safety inspections of NAE dams and coastal protection barriers. Work included inspection of six miles of embankment sections ranging in height from 14 to 133 feet, gated conduits, intake towers, ungated spillway weirs, and appurtenant structures. Reviewed historical records and interviewed operations staff associated with the project. Developed a prioritized list of dam safety concerns and recommendations for additional investigations, instrumentation, and repairs to address those concerns. *(September 2011 to August 2012)*

USACE – New England District (NAE), 2011 Periodic Inspection (PI) / MA and CT (56 Days)
Geotechnical Engineer. Responsible for the inspection, preparation of geotechnical aspects of the PI report, and instrumentation evaluation for three flood control projects in the NAE area of operation. Work included inspection of two miles of embankment sections ranging in height from 14 to 85 feet. Reviewed historical records and interviewed operations staff associated with the project. Developed a prioritized list of dam safety concerns and recommendations for additional investigations, instrumentation, and repairs to address those concerns. Evaluated instrumentation data from piezometers, settlement gauges, and weirs for any significant changes or trends in response. *(May 2011 to November 2011)*

DAM DESIGN, ANALYSIS, AND CONSTRUCTION

Consumers Energy Company Hardy Hydropower Project Auxiliary Spillway Design / Newaygo County, MI (22 Days)
Senior Geotechnical Review. The auxiliary spillway is comprised of a 320-foot-wide labyrinth weir and a spillway and outlet channel 2,000 feet in length. Responsible for reviewing settlement analysis of splash wall, 2D planar seepage modeling, and seismic risk analysis. *(July 2021 to present)*

Pacific Gas & Electric – Kelly Lake Dam and Lower Peak Dam / Placer County, CA (30 Days)
Project Manager. The Lower Peak and Kelly Lake Dams are owned and operated by PG&E and are regulated by the

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CHIEF DAM SAFETY ENGINEER

California Division of Safety of Dams (DSOD) and the Federal Energy Regulatory Commission (FERC). Responsible for qualitative evaluation of internal erosion potential, reviewing stability analysis, coordinating technical resources, and tracking budget and schedule. *(January 2022 to present)*

USACE – Omaha District (NWO), Pipestem Dam Spillway Modification / Jamestown, ND (270 Days)
Senior Geotechnical Engineer. Pipestem Dam is a multiple-purpose project consisting of a zoned earthfill embankment, emergency spillway, and outlet works. The Pipestem Dam spillway modification project consists of a stepped RCC spillway chute structure with an integrated three-stage labyrinth crest control structure, approach walls, and stilling basin. The spillway is 700 feet wide and 440 feet long, with a drop of 100 feet. Project responsibilities included seepage modeling, slope stability analysis, soil and rock parameters evaluation, settlement and rebound analysis and development of plans and specifications. *(July 2019 to June 2021)*

USACE – Portland District (NWP), Lost Creek Dam Seismic Deformation Modeling / Jackson County, OR (47 Dys)
Senior Geotechnical Engineer. Lost Creek Dam is a multiple-purpose project consisting of a rock-fill shell embankment with a central impervious core, a concrete gravity spillway with three tainter gates, and a multi-level withdrawal structure with regulating outlet and conduit. The dam has a crest length of about 3,600 feet and a height of 345 feet. Work performed included material property evaluation, cross section meshing and model development, conducting non-linear deformation analysis (NDA) of the embankment subject dam subjected to seismic loading using the finite difference program FLAC, and documentation of the analysis. *(October 2020 to June 2021)*

USACE – Portland District (NWP), Cottage Grove Drilling Program Plan (DPP) and Seepage Analysis / Lane County, OR (20 Days)
Geotechnical Engineer. Cottage Grove Dam consists of a 1,750-foot-long, 95-foot-high rolled earth embankment with a central impervious core, and a 360-foot-long concrete gravity overflow spillway. Project responsibilities included the development of a FIPP which consisted of installing vibrating wire piezometers in five geotechnical boreholes as well as laboratory testing. The objective of the FIPP was to refine the level of site characterization and to reduce technical uncertainties associated with identified internal erosion and seismically induced potential failure modes. Conducted a comprehensive evaluation and analysis of instrumentation, field investigation data, and co-authored the final report. *(August 2018 to February 2019)*

USACE – Portland District (NWP), Site Specific Seismic Hazard Analysis / OR (20 Days)
Geotechnical Engineer. Collaborated with a multi-disciplined team to develop scopes for four separate site specific hazard analyses reports for projects in the Willamette River, Rogue River, and Lower Columbia River Valleys. Assisted in developing geophysical investigations aimed at obtaining representative Vs30 measurements. Responsible for reviewing work products from the contractor. (*August 2018 to June 2019)*

USACE – Columbia Stock Ranch (CSR) Setback Embankment, Field Investigation, and Preliminary Design / Columbia County, OR (70 Days)
Geotechnical Engineer. The CSR Setback Embankment project consisted of a field investigation to support the design of 6,000 feet of embankment ranging in height from 15 to 25 feet. Project specific responsibilities included formulating and

executing exploration and testing programs. Utilizing subsurface data to conduct preliminary settlement, seepage, and piping analyses. Compiling geotechnical data and analysis results into Geotechnical Data Report. Reviewing contractor Design Documentation Report, and Plans and Specifications submittals for technical adequacy. *(February 2015 to August 2015)*

USACE – Omaha District (NWO) Missouri River System Restoration Team, / Missouri River, NE (30 Days)
Geotechnical Engineer. Geotechnical team member assisting the district in developing geotechnical investigation plans and temporary repairs for levees damaged or breached during the 2011 Missouri River flooding. Developed scopes of work, designs, plans, and specifications for river bank protection projects and levee resurfacing. Conducted quality assurance and control inspections during the construction of setback levees. Investigated and evaluated potential borrow sources for levee remedial repairs. *(January 2012)*

RISK-INFORMED DECISION-MAKING FOR DAM SAFETY – RELEVANT TRAINING AND EXPERIENCE

Dam Safety Experience

- FERC approved Independent Consultant with over 10 years of experience.
- Primary or co-author on over a dozen design, analysis, and risk assessment reports.
- Technical lead for three quantitative risk assessments and several other analysis reports, including seismic assessments, seepage and internal erosion evaluations, and instrumentation evaluations.

Dam Safety Training

- Completed the following USACE training classes: Periodic Assessment, Best Practices in Dam and Levee Safety Risk Analysis, Dam Embankment Design, Internal Erosion Evaluation, Seminal Papers in Geotechnical Risk Analysis, Site Characterization, Dam Safety Alternative, HEC Consequence Training
- Completed DLS-103 (2021), DLS-104 (2019), DLS-108 (2013), DLS-109 (2013), DLS-113 (2022), DLS-202(2013/2021), DLS-212(2013), and DLS-113 (2022)

Other Dam Safety Qualifications

- Registered Professional Engineer
- USSD Embankment Dams Committee Member (2022)