August 5, 2025

Karl Hagerman
Utility Director
Petersburg Municipal Power & Light
Petersburg Borough
PO Box 329, Petersburg, Alaska 99833

Subject: Crystal Lake Dam, Blind Slough Hydroelectric Project (P-201-AK)

Re: Proposal to Perform a Dam Breach Inundation Analysis and Hazard Potential Classification Review

Dear Mr. Hagerman,

McMillen, Inc. (McMillen) is pleased to submit the enclosed letter proposal to Petersburg Municipal Power & Light (PMPL) to perform a dam breach inundation analysis and hazard potential classification review for Crystal Lake Dam. We have developed the following scope of work (SOW), cost estimate, and schedule for PMPL review. The proposal is based on our project understanding, our initial review of the recently acquired LiDAR, and previous conversations between PMPL and McMillen.

PROJECT UNDERSTANDING

The most recent dam breach and inundation mapping study for Crystal Lake Dam was performed in 1985. Since then, methods and procedures for preparing dam breach studies have improved significantly. Updated dam breach inundation mapping would provide a better understanding of the potential downstream impacts, including time to flood wave arrival, and magnitude and extent of flooding. Of particular interest are the hatchery facilities and residences approximately 1.5 miles downstream of the dam. The analyses performed as a part of this study will also improve emergency response planning based on a better understanding of flood wave arrival times and magnitude.

The Crystal Lake Dam has a High hazard potential classification. Prior to 2011, the dam had a Significant classification, and PMPL voluntarily completed a Part 12D Inspection. During review of the 2009 Part 12D, FERC questioned the Significant classification and recommended that an updated dam breach study be performed to resolve this question[1]. At the time, PMPL elected to re-classify the dam as High hazard and forgo an inundation study.

[1] McMillen, Inc. (2024) Blind Slough Hydroelectric Project, FERC No. 0201-AK, 2024 Periodic Inspection Report. January.

Previous reviews of terrain data indicated that it was generally lacking sufficient detail in the powerhouse and hatchery area to adequately define the structures, storage ponds, and other features which would be of specific interest for the hydraulic analyses. In 2025, new LiDAR data became available; the LiDAR was determined to be of adequate quality to characterize the topography around the dam, Crystal Creek downstream reach, and the potential downstream inundation areas around the hatchery and powerhouse. After conversations with the FERC Project Engineer and the Chief Dam Safety Engineer (CDSE) during the 2025 annual inspection, it was determined that performing another study, using modern techniques and utilizing the new LiDAR, would result in a more accurate representation of a potential dam breach. This updated study could also be used to inform a review of the dam's hazard potential classification.

PROJECT GENERAL ASSUMPTIONS

Based on the information provided by PMPL and our Project Understanding, the following assumptions have been made in the development of this SOW. These assumptions impact the overall Project and budget. However, McMillen will gladly entertain any discussion on these assumptions to ensure they align with PMPL goals.

- All meetings will take place virtually using Microsoft Teams.
- No site visits will be performed as part of this SOW.
- McMillen assumes the project notice to proceed to be granted within two months of submitting this proposal. If the award process is prolonged, the project's budget and schedule may need to be reassessed for potential adjustments due to the delay.
- The total duration of the project is anticipated to be 4 months.
- All technical documents will be reviewed internally by qualified McMillen personnel before submission to PMPL.
- All materials will be prepared and submitted electronically.

PROJECT APPROACH

McMillen's Project approach is identified in the following tasks and activities. The tasks will be completed in the order described, excluding Project Management, which is included for the duration of the Project.

- Task 1.0 – Project Management
- Task 2.0 – Hydraulic Modeling and Inundation Mapping
- Task 3.0 – Hazard Potential Classification

- Task 4.0 – Report Preparation

The following narratives provide our Project approach and assumptions for each work task. The narratives are the basis of the development of our labor-hour estimate.

TASK 1.0: PROJECT MANAGEMENT

Steven Klawitter, PE, will serve as the McMillen PM responsible for the overall coordination and direction of the work. He has led and performed numerous dam breach and inundation analyses. The hydraulic analyses will be performed by Gibson De Jode, EIT, with oversight and direction provided by Mr. Klawitter. Project Quality Assurance/Quality Control (QA/QC) will be performed by Cyrus Niamir, PE, the CDSE and most recent Part 12D Independent Consultant for the Blind Slough Hydroelectric Project.

Task 1.0 includes administration, project setup, accounting, and invoicing. Project Management will also cover the coordination between team members who are performing reviews, analyses, mapping, and report writing. All project deliverables will be reviewed internally by a qualified McMillen team member (QA/QC). This task also includes provisions for two meetings, one to kick off the Project at the start of the work and one to discuss the results prior to issuing the final report.

DELIVERABLES

- Invoices (PDF format).
- Monthly progress reports with each invoice (PDF format).

ASSUMPTIONS

- The Project duration is anticipated to be four months.

TASK 2.0: HYDRAULIC MODELING AND INUNDATION MAPPING

Task 2.0 will consist of developing a two-dimensional hydraulic model using HEC-RAS version 6.4 or newer. The model terrain will be based on the newly available LiDAR data where available and supplemented by other publicly available terrain sources as necessary. The model domain will extend form the dam down Crystal Creek to Blind Slough and along Blind Slough to west to the Wrangell Narrows and east towards the Sumner Strait to capture the full extents of the failure flood waves. The total downstream reach is approximately 14 miles spilt between the Crystal Creek and both east and west portions of Blind Slough.

The dam breach parameters will be developed based on previous experience, previous studies at Crystal Lake Dam, and standard engineering practices including FERC Engineering Guidelines. The developed parameters will be entered into HEC-RAS to simulate the dam breach scenario. An

iterative approach will be taken to determine the appropriate model domain configurations, computational time steps, model refinement areas, boundary conditions, and baseflow conditions. Three model scenarios will be evaluated including:

1. Sunny day dam breach at full pool (EL. 1292.0, NAVD88)
2. Probable Maximum Flood (PMF) with dam breach
3. PMF with no dam breach

The third model scenario (PMF with no dam breach) will be used to inform the general understanding of the incremental impacts between the PMF without breach and PMF with breach. Discussion of this comparison will be provided in the report developed as part of Task 4.0. This simplified analysis will not be intended to serve as a full Incremental Hazard Evaluation as would be required under FERC Engineering Guidelines Chapter 2 to revise the Inflow Design Flood (IDF) to a storm less than the PMF. In addition to the three base case scenarios, McMillen will prepare a sensitivity analysis of the selected HEC-RAS modeling parameters. This analysis will be conducted for breach formation time, breach size, and terrain roughness based on the sensitivity analyses recommended in FERC Engineering Guidelines Chapter 2, Appendix II-A (2015). Three sensitivity analysis runs will be performed, and results will be compared to the base case parameters. Details of the model results, model development, and selected modeling parameters will be included in the report prepared in Task 4.0.

The detailed downstream routing results will be utilized to develop separate sets of inundation maps for the sunny-day breach and PMF breach scenarios. McMillen's GIS team will primarily perform this task. Our GIS team has extensive experience developing detailed inundation maps to provide critical information to end-users. Inundation maps will be developed at a variable scale to provide increased resolution in areas of interest such as the fish hatchery. Map features will include selected cross sections at critical locations that report the peak flow, peak water depth, peak water velocity, and time to flood wave arrival and peak flood flow. These maps will meet FERC requirements (Engineering Guidelines Chapter 6) and will be acceptable for inclusion in the Project's Emergency Action Plan (EAP). The inundation maps will be included as an appendix to the report prepared as part of Task 4.0. Revisions will be made to the maps based on comments received during PMPL's review.

DELIVERABLES

- Electronic copy of the HEC-RAS model.
- Analyses will be summarized as part of Task 4.0 reporting.
- Digital copies of inundation maps showing sunny-day and PMF failure conditions (PDF format), consistent with FERC Engineering Guidelines Chapter 6, will be appended to Task 4.0 reporting.

Assumptions

- The existing PMF study will be provided by PMPL and is acceptable for use in this analysis.
- PMPL will provide the lake elevation-storage curve and the spillway rating curve.
- Downstream culverts and bridge crossings will be assumed to fail during the breach and will not be included in the hydraulic model.
- Sensitivity analysis will be conducted for time of breach, breach size, and roughness. Three sensitivity analysis runs will be performed.
- Two sets of inundation maps will be prepared, consistent with FERC requirements.

Task 3.0: Hazard Potential Classification

The FERC hazard potential classification system categorizes dams based on the probable loss of human life and the impacts on economic, environmental, and lifeline interests. The key difference between a Significant and a High classification determination is the expected loss of human life; Significant is characterized by no probable loss of human life, while High is conversely characterized by probable loss of human life. The dam breach hydraulic modeling and inundation mapping described in Task 2.0 will be used to inform loss of life estimates. The loss of life estimates will be performed using methods presented in the US Bureau of Reclamation Guidelines for Estimating Life Loss (RCEM, 2015) and will consider the FERC Engineering Guidelines (specifically Chapters 1, 2, and 18).

Loss of life calculations will be compared to the hazard potential classification definitions and discussions and McMillen will perform a formal of review the dam's High hazard potential classification. Topics such as impact of failure, mis-operation of the dam, property damage, and environmental concerns will be covered as part of this review.

Deliverables

- Analysis and rationale will be included as part of Task 4.0 reporting.

Assumptions

- Estimates of the number of personnel working and residing at the hatchery are available.
- Recent Sudden Failure Assessments and Evacuation Drills are available and can be relied upon for this analysis.

Task 4.0: Report Preparation

The work performed in Task 2.0 and Task 3.0 will be summarized in a Dam Breach Inundation Mapping and Hazard Potential Classification Review Report for Crystal Lake Dam. The calculations

and inundation maps will be included as appendices to the report. McMillen will develop a draft report and associated appendices for review by PMPL. Based on this review, a revised final report and supporting documents will be developed, signed, and sealed for submittal to PMPL.

DELIVERABLES

- Draft report and attachments (PDF and Word format).
- Final report and attachments (PDF format).
- Final GIS files in accordance with FERC requirements for submittal to FERC with the final report and attachments.

ASSUMPTIONS

- A revised final report will be issued within two weeks of receiving comments from PMPL.
- This proposal covers efforts to prepare documents for delivery to FERC. Additional effort based on comments received from FERC is not included.

SCHEDULE

The work will begin upon Notice to Proceed (NTP) which is assumed to occur on October 1, 2025. Table 1 provides a schedule breakdown for each task. The Project is anticipated to occur between October 2025 and January 2026.

Table 1. Proposed Schedule

Milestone	Time (Business Days)	Start	End
Notice to Proceed		10/1/2025	
1.0 Project Management			
Progress Reports and Invoicing	78	10/1/2025	1/16/2026
Project Setup and Task Coordination	78	10/1/2025	1/16/2026
External Meetings	78	10/1/2025	1/16/2026
2.0 Hydraulic Modeling and Inundation Mapping			
Data Collection and Review	7	10/3/2025	10/17/2025
Breach Parameter Development	20	10/20/2025	11/14/2025
Hydraulic Model Development	25	10/20/2025	11/21/2025
Sensitivity Analysis	10	11/24/2025	12/5/2025
Inundation Mapping	20	11/17/2025	12/12/2025
3.0 Hazard Potential Classification			
Life Loss Calculations	10	12/1/2025	12/12/2025
Hazard Classification Review	10	12/1/2025	12/12/2025
4.0 Report Preparation			
Draft Report	25	11/17/2025	12/19/2025
Final Report	10	1/5/2026	1/16/2026

BUDGET

Table 2 provides a budget summary for each task discussed above. Attachment A provides a detailed breakdown of tasks, hours, and billing rates used to support the proposed budget. The not-to-exceed amount for the Crystal Lake Dam Breach Inundation Mapping and Hazard Potential Classification Review is $59,942. The Project will be invoiced monthly on a time and materials basis.

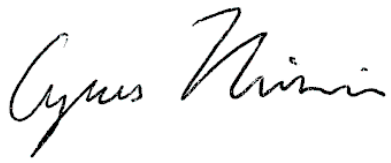
Table 2. Proposed Project Budget

Task No.	Description	Budget
1.0	Project Management	$5,148
2.0	Hydraulic Modeling and Inundation Mapping	$30,154
3.0	Hazard Potential Classification	$7,360
4.0	Report Preparation	$17,280
	Total	**$59,942**

CONCLUSION

We appreciate the opportunity to provide you with a detailed SOW, cost estimate, and schedule for execution of the dam breach inundation analysis and hazard potential classification review for Crystal Lake Dam. If you have any questions or need additional information, please contact Cyrus Niamir at niamir@mcmillen.com or 720-481-9165. We look forward to serving PMPL on this Project.

Sincerely,



Cyrus Niamir, PE
Dam Safety / Geotechnical Discipline Lead

Encl. Attachment A: Detailed Budget Breakdown

ATTACHMENT A: DETAILED BUDGET BREAKDOWN

Staff	C. Niamir (QA/QC)	S. Klawitter (PM)	G. De Jode (H&H)	Z. Uhlmann (GIS)	Tech. Editor	Admin.		Total Labor	TOTAL
Rates	$ 217	$ 185	$ 130	$ 110	$ 120	$ 105	Hours		
1.0 Project Management	**4**	**16**	**2**	**2**	**-**	**8**	**32**	**$ 5,148**	**$ 5,148**
Progress Reports and Invoicing		4				4	8	$ 1,160	$ 1,160
Project Setup and Task Coordination	2	10	2	2		4	20	$ 3,184	$ 3,184
External Meetings	2	2					4	$ 804	$ 804
								$ -	$ -
2.0 Hydraulic Modeling and Inundation Mapping	**2**	**32**	**112**	**84**	**-**	**-**	**230**	**$ 30,154**	**$ 30,154**
Data Collection and Review	2	4	12	4			22	$ 3,174	$ 3,174
Breach Parameter Development		2	20				22	$ 2,970	$ 2,970
Hydraulic Model Development		8	48				56	$ 7,720	$ 7,720
Sensitivity Analysis		2	16				18	$ 2,450	$ 2,450
Inundation Mapping		16	16	80			112	$ 13,840	$ 13,840
3.0 Hazard Potential Classification	**10**	**14**	**20**	**-**	**-**	**-**	**44**	**$ 7,360**	**$ 7,360**
Life Loss Calculations	4	8	16				28	$ 4,428	$ 4,428
Hazard Classification Review	6	6	4				16	$ 2,932	$ 2,932
								$ -	$ -
4.0 Report Preparation	**10**	**36**	**56**	**-**	**8**	**2**	**112**	**$ 17,280**	**$ 17,280**
Draft Report	8	24	40		8		80	$ 12,336	$ 12,336
Final Report	2	12	16			2	32	$ 4,944	$ 4,944
Total Hours	**26**	**98**	**190**	**86**	**8**	**10**	**418**		
Total Budget	**5,642**	**18,130**	**24,700**	**9,460**	**960**	**1,050**		**$ 59,942.00**	**$ 59,942.00**

McMillen