H2O ECOPOWER

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Subject: **Highgate Falls Hydropower Project**

Downstream Flooding Potential With and Without Rubber Dam

INTRODUCTION

Concerns have been raised about potential flooding downstream of the Highgate Hydropower Project with and without the rubber dam in place. Typically, a flood routing program like the U.S. Army Corps of Engineers HEC-RAS program would be used to compute the downstream flow conditions for each condition and then compare the different downstream flow rates for the floods of interest. In August 1987, Kleinschmidt Associates prepared a report entitled "Revised Probable Maximum Flood Study and Dam Break Analysis". In October 1995 RIVERS conducted a Flood Hydrograph Computer Model Dam Break analysis using the BOSS DAMBREAK v3.0- computer model. Both of these reports provide the necessary information to assess the differences in downstream flooding with and without the 15-foot high rubber dam. However, the Supporting Technical Information Document (STID) prepared by Mill Road Engineering, dated April 8, 2023 also provides sufficient information to conclude that there would not be an appreciable difference in downstream flood with and without the rubber dam. This memo uses information from that report to conclude that downstream flood flow impacts are not significant between the two cases.

KEY PROJECT STATISTICS

The following project statistics are key to assessing downstream flood impacts:

Vertical Datum	NGVD
Top of Spillway Abutments	El. 193 ft
Normal Pool	El. 190 ft
Fixed Spillway Crest	El. 175 ft (top of concrete)
Spillway Length	226 ft at top of abutment (El. 193 ft)
	214 ft at fixed crest El 175 ft
Crest Gate	15 ft diameter rubber dam

Top of Inflated Crest Gate	El 190 ft
Lake Level Operating Range	El. 190 ft
Maximum Recorded Discharge	63,000 cfs prorated to dam (Nov. 3, 1927)
Discharge Capacity of Spillway	44,000 cfs at El 190 ft crest gate fully deflated
	58,000 cfs at El. 192 ft
PMF Inflow	187,300 cfs
PMF Outlfow	187,000 cfs
PMF HW Elevation	El. 206 feet
100-year Storm Discharge	32,600 cfs
500-year Storm Discharge	44,000 cfs

The project is operated in run-of-river mode to maintain El. 190 feet. Normal tailwater level is 108 feet for a gross head of 82 feet. The project has 5 generating units with a maximum turbine capacity of 1800 cfs. With the rubber dam in place, the project operates in peaking mode from June 16 to March 30 with a maximum drawdown of 18-24 inches below elevation 190 ft. The project also has a sluice gate with dimensions 10.5 ft wide by 6 ft high with a capacity of 400 cfs. During flood events the hydro operations may or may not be shut down because of river debris. Given that and the fact that the powerhouse operating conditions would be the same for any spillway condition, powerhouse operations can be ignored when assessing changes in downstream flood conditions. Similarly, the sluice gate operations are a minor fraction of the 100-year storm and greater and can also be ignored.

Page 8 of the Mill Road Engineering Report states that for the Probable Maximum Flood of 187,000 cfs the inflow and outflow were both determined to be 187,300 cfs “due to the impoundments (sic) small size assuming no buffering of the inflow would occur from storage.” This is a critical point. Mill Road Engineering is essentially saying that the reservoir has little to no storage.

ANALYSIS

With the 15-foot high rubber dam in place, the project would be operated at El 190 feet. As inflow increases above the capacity of the powerhouse, the dam would be deflated. As the flow reaches 44,000 cfs, the rubber dam would be fully deflated and would be equivalent to a condition without the rubber dam. **Therefore, above a flow of 44,000 cfs, there would be no change in downstream flood conditions.** For flows less than 44,000 cfs, the rubber dam crest elevation would be above El 175 feet, with significant water flowing over the rubber dam. However, the inflow and outflow would be the same. Without the rubber dam in place, the upstream water level would be slightly different based on the spillway capacity rating curve over the ogee concrete crest versus flow over the rubber dam. Although the upstream water level could be slightly different, the outflow would be the same as inflow if upstream storage is

ignored, or if the flood hydrograph increases slowly enough to assume that an equilibrium condition is reached as inflow increases. **Therefore, there would essentially be little or no difference in downstream floods with and without the rubber dam.**

To verify the assumption of limited storage, H2O EcoPower looked at the Highgate Falls Hydro Project on Google Earth to confirm the size of the impoundment and its buffering capability. Based on the Google Earth inspection, that assumption looked reasonable. However, to be sure, it would be best to review the Kleinschmidt and RIVERS reports.

CONCLUSION

Based on the previous work conducted by Kleinschmidt, RIVERS, and the Mill Road Engineering Report, **it is reasonable to conclude that there would be insignificant differences in downstream floods from project operations with and without the rubber dam in place**.

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