

FREEBORN LAKE – CONCEPTUAL DESIGN SUMMARY

Freeborn Lake Data

- Ducks Unlimited completed a topographic survey at Freeborn Lake in July of 2015. The vertical datum was calibrated to a NGS benchmark stamped “2407 A” (PID 000718) which is a Second Order Class I benchmark in the NAVD88 datum. The published elevation is 1193.09.
- **OHW Elevation = Not Available**
- Water Elevation of Freeborn Lake on 7-7-2015 = 1215.81 (Water flowing over weir)
- Existing outlet structure is a sheet pile and concrete weir which has been previously modified and repaired. During an earlier site inspection, the existing structure appeared to be leaking and the downstream sheet pile wall is tilted badly in the downstream direction. The existing weir has an average weir crest elevation of 1215.6 and a length of approximately 68'. The breadth of the weir is approximately 20' wide.
- Lake area ≈ 2,360 acres (from aerial photo)
- Watershed, 12 square miles. Ratio ≈ 3.25:1
- **Bottom of lake elevation = ±1210.5 (top of sediment).**

Design Objectives

1. Replace the existing failing water control structure with one of similar hydraulic capacity and capable of managing water levels for drawdown to improve water quality.
2. Evaluate the available options for a fish barrier to prevent rough fish from re-entering the lake from the downstream channel.

Proposed Design

1. Remove the existing sheet pile and concrete weir and replace it with a new three sided sheet pile weir with similar hydraulic capacity. The weir length of the proposed structure would be approximately 57.5' as opposed to the 68' length due to improved hydraulics of the sharp crested weir. The proposed sheet pile weir structure would include 4 – 5' wide stoplog bays for use in managing water levels. Reconstruct and improve the earthen abutments on both ends of the new structure.
2. Remove the 8' x 6' RCB culvert and replace it with one of similar hydraulic capacity. The new culvert would be installed with a length and slope sufficient to create velocities high enough to prevent rough fish from moving upstream and into Freeborn Lake.

Structure Hydraulics for Existing Conditions

EVENT	INFLOW (CFS)	OUTFLOW (CFS)	HW ELEV. (FEET)	STORAGE (ACRE-FEET)
1-Year	1,391	27	1215.88	8,913
2-Year	1,894	41	1215.97	9,109
5-Year	2,889	74	1216.14	9,492
10-Year	3,872	109	1216.31	9,870
25-Year	5,444	174	1216.58	10,477
50-Year	6,826	239	1216.81	11,001
100-Year	8,335	315	1217.05	11,578

Starting water surface elevation at the start of each event is 1215.60

Structure Hydraulics for Proposed Conditions

EVENT	INFLOW (CFS)	OUTFLOW (CFS)	HW ELEV. (FEET)	STORAGE (ACRE-FEET)
1-Year	1,391	27	1215.88	8,913
2-Year	1,894	41	1215.97	9,109
5-Year	2,889	74	1216.14	9,492
10-Year	3,872	111	1216.31	9,870
25-Year	5,444	179	1216.58	10,474
50-Year	6,826	244	1216.81	10,997
100-Year	8,335	322	1217.05	11,572

Starting water surface elevation at the start of each event is 1215.60

Estimated Drawdown Time

Increment	Time	Max. Q
1215.6 – 1214.5	9 days	339 cfs
1214.5 – 1213.5	8.2 days	305 cfs
1213.5 – 1212.5	7.3 days	305 cfs
1212.5 – 1211.5	5.4 days	305 cfs
<u>1211.5 – 1210.5</u>	<u>5.2 days</u>	<u>157 cfs</u>
Total	35 days	

Drawdown estimate is based on removing 1.5' of boards at the start of drawdown and then removing 1.0' of boards when water elevation is at 0.5' above last stoplog. Drawdown estimate also assumes no inflows during the drawdown period.

Estimated Refill Time

Assuming average monthly precipitation and average monthly evaporation, it is estimated that Freeborn Lake would likely refill within 2 years of a complete drawdown. This is based on averages and could vary given a wet year or an extremely dry year.

Questions/Discussion Items

- 1.



