

Summary of Trends in Nutrient Loads to Lahontan Reservoir

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INTRODUCTION

The Carson River and Truckee Canal provide the main sources of water and nutrients to Lahontan Reservoir. Figure 1 shows the high annual variability of the reservoir inflows with a majority of the inflow typically coming from the Carson River. However in some years, flow from the Truckee Canal has accounted for over 50% of the reservoir inflow. Fluctuations in flow along with fluctuations in nutrient concentrations affect the overall nutrient loading to the reservoir. In a 2007 document, NDEP discussed trends in the nutrient loads to Lahontan Reservoir up through 2005. This fact sheet summarizes those findings.

TRENDS IN FLOWS

Beginning in 1967, Operating Criteria and Procedures (OCAP) were established which placed restrictions on Truckee Canal diversions. Additional restrictions have been placed on the diversions over time (Bureau of Reclamation, 1987). As a result, Truckee Canal annual flows appear to have followed a downward trend since 1967, as determined using MAKESENS, an Excel template for examining annual trends (Figure 2). Annual Carson River inflow to Lahontan Reservoir were also evaluated for a trend; however the MAKESENS analysis did not indicate that the trend line slope was not significantly different from zero (Figure 3).

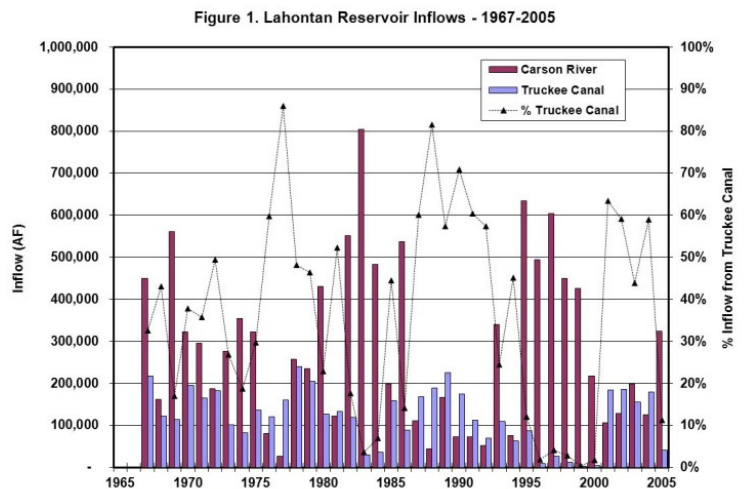


Figure 2. Trend in Annual Flows in Truckee Canal (Sta. 10351400) - 1967-2006

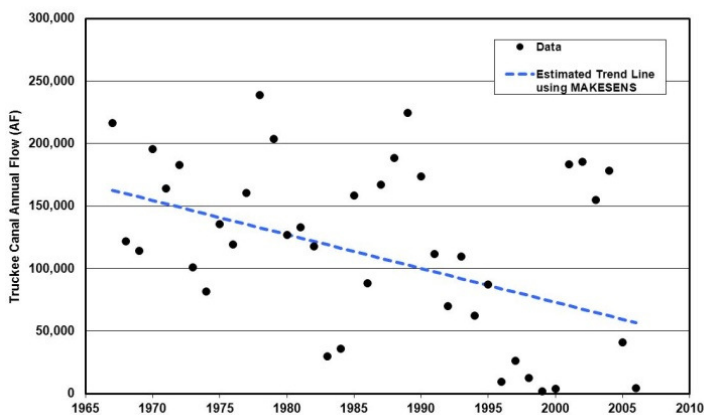
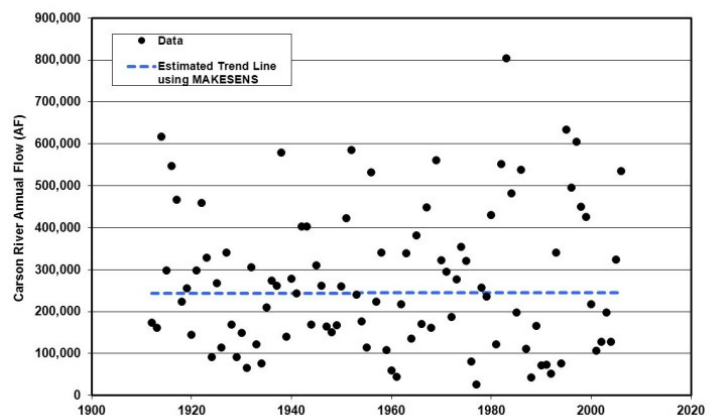


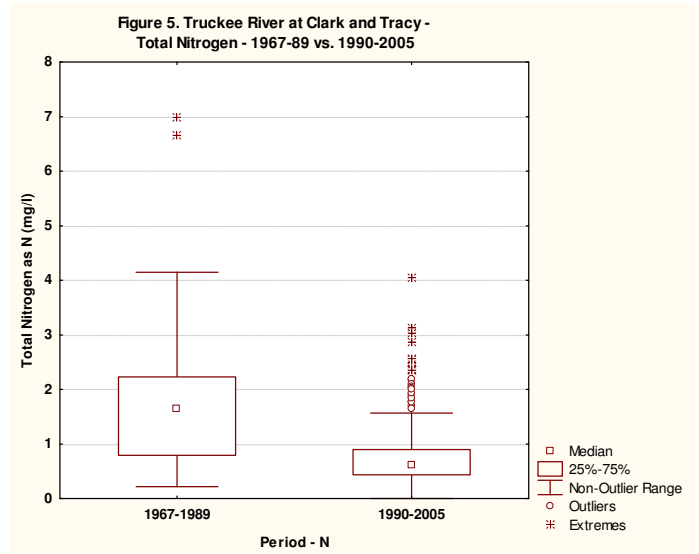
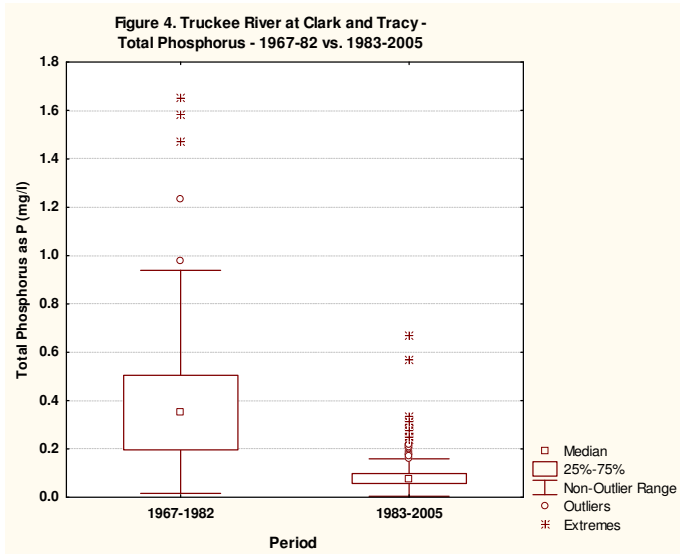
Figure 3. Trend in Annual Flows in Carson River (Sta. 10312000) - 1916-2006



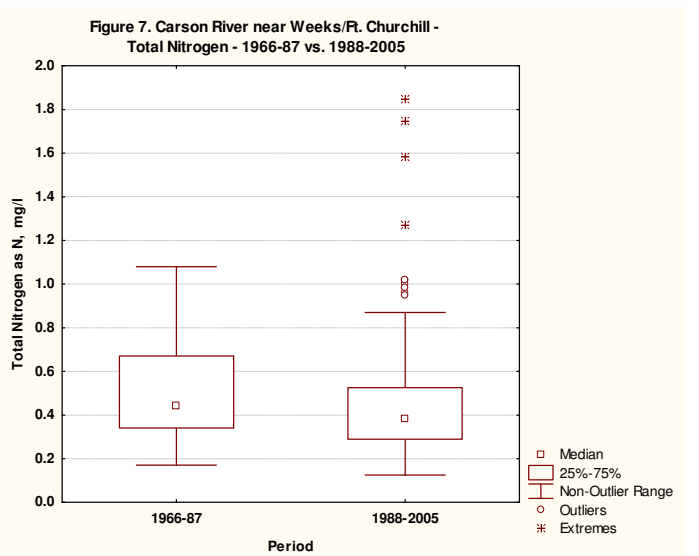
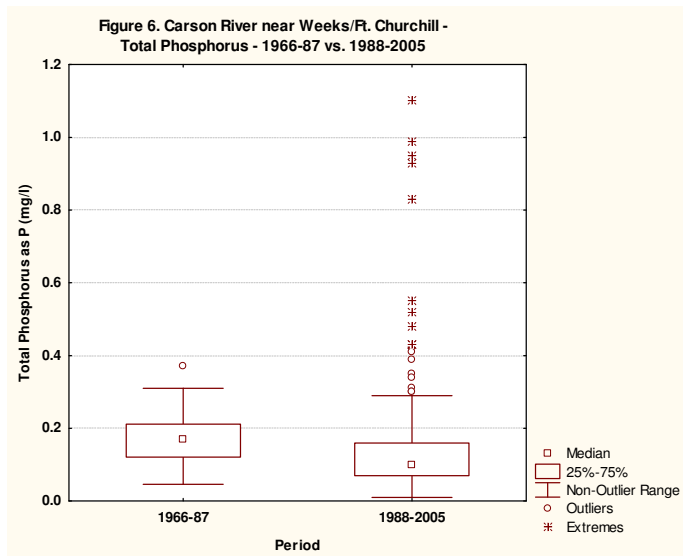
TRENDS IN CONCENTRATIONS

Nutrient concentrations in the waters entering Lahontan Reservoir have shown a marked reduction following upgrades to the Truckee Meadows Water Reclamation Facility (TMWRF) in the 1980s and the removal of direct effluent discharges to the Carson River in 1987. As a result, nutrient loads entering Lahontan Reservoir have also decreased.

Orthophosphate and total phosphorus concentrations in the Truckee River (and subsequently Truckee Canal) experienced a decrease around 1982 due to the addition of a new biological process for the removal of phosphorus. Median total phosphorus concentration in the Truckee River at Tracy/Clark decreased from about 0.35 mg/l (1967-82) to 0.08 mg/l (1983-2005) (Figure 4). Additional biological nutrient removal capabilities at TMWRF led to decreases in nitrate and total nitrogen concentrations in the Truckee River. Median total nitrogen concentrations in the Truckee River at Tracy/Clark decreased from about 1.65 mg/l (1967-89) to 0.60 mg/l (1990-2005) (Figure 5).



Following the removal of direct effluent discharges in 1987, Carson River nutrient concentrations decreased but not quite to the extent experienced in the Truckee River. Median total phosphorus concentrations in the Carson River near Weeks/Ft. Churchill decreased from 0.17 mg/l (1967-87) to 0.10 mg/l (1988-2005) (Figure 6). While the available data showed median total nitrogen concentrations near Weeks/Ft. Churchill decreased from 0.44 mg/l to 0.38 mg/l, there was insufficient data during the 1967-87 period to make a statistically valid conclusion (Figure 7).



TRENDS IN LOADS

Over the years, annual nutrient load estimates to Lahontan Reservoir have been generated by a number of authors. Based on more current information, updated nutrient loading values have been estimated for the time period 1990-2005 and compared to previous work. Given the reductions in nutrient concentrations in both the Carson and Truckee rivers and reductions in flow from the Truckee River, it is not surprising that the current loads to Lahontan Reservoir have been estimated to be significantly lower than 30 years ago. As shown in Table 1, total phosphorus and total nitrogen loads have decreased about 50% and 60%, respectively. The largest declines have been seen in the Truckee Canal loads. During the 1971-80 period, Truckee Canal total phosphorus loads contributed about 38% of the total phosphorus loads to the reservoir. In more recent years, Truckee Canal total phosphorus loads contribute only about 12% of the total loading. Total nitrogen loads from the Truckee Canal have decreased from about 50% of the total to about 29% of the total. Some of these reductions are due to the lower average canal flow used in the 1990-2005 calculations compared to the earlier estimates.

Table 1. Comparison of Average Annual Load Estimates (tons/year)

	Garcia and Carman (1985); Cooper and Vigg (1983)	Pahl (2007)	% Change
	1971-1980	1990-2005	
Carson River			
TN	340 – 361	192	-44 to -47
TP	102 – 110	74	-27 to -33
Avg. Flow (AF)	246,000	270,000	+10
Truckee Canal			
TN	336 – 340	80	-74 to -76
TP	67 – 75	10	-85 to -87
Avg. Flow	151,000	88,000	-42
Total			
TN	680 – 710	272	-60 to -62
TP	172 – 180	84	-51 to -53
Avg. Flow	397,000	358,000	-10

A closer look at the details of the 1990-2005 load estimates indicates that a majority of the Carson River nutrient loads to Lahontan Reservoir typically occur during the higher spring runoff flows from March to June. Truckee Canal loads are much more variable depending upon operations of the Derby Dam diversion. While the average annual total nitrogen loads from the Truckee Canal are much lower than the Carson River loads, the flow weighted average total nitrogen concentration in the Canal water is a little higher at about 0.67 mg/l compared to the flow weighted average of 0.52 mg/l of the Carson River. The flow weighted average total phosphorus concentration for the Carson River is approximately 0.20 mg/l, which is considerably higher than the 0.08 mg/l estimated for the Truckee Canal.

REFERENCES

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