An Analysis of Phosphorus Perchlorate Inputs to Lake Mead

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Introduction

- Considered phosphorus and perchlorate loadings from the four major inlets to Lake Mead
- Based on data collected by USBR and other available data
- Significant data gaps exist
Sources of Colorado River Data

- **Phosphorus Inputs**
  - USBR at CR413.0 and CRLM_B
  - USGS at Station 09404200 (Colorado River above Diamond Creek near Peach Springs, AZ)

- **Flow**
  - USGS Station 09404200

- **Comments**
  - USGS Station is 130 miles upstream of Hoover Dam (approx 60 miles upstream of Lake Mead)
Sources of Las Vegas Wash Data

- Phosphorus Inputs
  - USBR at LVB0.8 and LWLVB
  - Clean Water Coalition
  - USGS at Station 09419800 (Las Vegas Wash near Boulder City, NV – upstream of North Shore Road)

- Flow
  - USGS Station 09419790 (Las Vegas Wash below Lake Las Vegas)

- Comments
  - Need more information to account for NPS inputs
Sources of Virgin River Data

- Phosphorus Inputs
  - USBR at VR32.9 and VRLM_B
- Flow
  - USGS Station 09415000 (Virgin River at Littlefield, AZ)
- Comments
  - Station is located 38 miles upstream of Lake Mead
  - Seriously over-estimates flow, especially during summer, when the entire flow of the Virgin River is diverted through the Riverside and Bunkerville diversion dams
Sources of Muddy River Data

- Phosphorus Inputs
  - USBR at MR6.2 and MRLM_B
- Flow
  - USGS Station 09419507 (Muddy River at Lewis Avenue at Overton, NV)
- Comments
  - Station located 1.5 miles upstream of Lake Mead
  - Discharge is predominately irrigation return flow – an irrigation diversion 7 miles upstream of the gage diverts the entire base flow of the Muddy River
Sources of Perchlorate Data

- Collected from all lake stations, from 2001 through Spring 2005
- Except for Station CR360.7, all values were below detection limits except for one suspect occurrence (8/22/01) at the Virgin River inflow (Station VLRM_B)
- Acoustic Doppler studies conducted by Reclamation show that water at Station CR360.7, located at the Narrows, can flow upstream from Boulder Basin
- Perchlorate was detected 9 times at Station CR360.7
Inflows

- Colorado River – average of 10,470,800 ac-ft/yr for water years 1999-2001
- Las Vegas Wash – average of 167,980 ac-ft/yr for water years 1999-2001
- Virgin River – average of 118,000 ac-ft/yr for water years 1999-2001
- Muddy River – average of 14,491 ac-ft/yr for water years 1999-2001
- Rogers and Blue Point Springs – 1,670 ac-ft/yr for water years 1999-2001
Inflows to Lake Mead

- Colorado River = 97.2%
- Las Vegas Wash = 1.6%
- Virgin River = 1.1%
- Muddy River = 0.13%
- Rogers and Blue Point Springs = 0.02%
Dissolved Ortho P

- Colorado River average concentration = 3.0 ug/L, n = 29
- Las Vegas Wash average concentration = 98 ug/L, n = 27
- Virgin River average concentration = 3.6 ug/L, n = 24
- Muddy River average concentration = 2.3 ug/L, n = 20
- Rogers Spring concentration = 4 ug/L, n = 1
Total Phosphorus

- Colorado River average concentration = 224 ug/L, n = 34
- Las Vegas Wash average concentration = 788 ug/L, n = 26
- Virgin River average concentration = 98 ug/L, n = 23
- Muddy River average concentration = 78 ug/L, n = 19
- Rogers Spring concentration = 9 ug/L, n = 1
Total Phosphorus Loads

- Colorado River = $2.9 \times 10^6$ kg/yr
- Las Vegas Wash = $1.67 \times 10^5$ kg/yr
- Virgin River average = $1.43 \times 10^4$ kg/yr
- Muddy River = $1.39 \times 10^3$ kg/yr
Total Phosphorus Inputs to Lake Mead

- Colorado River = 94.1%
- Las Vegas Wash = 5.4%
- Virgin River = 0.50%
- Muddy River = 0.05%
Dissolved Ortho P Loads

- Colorado River = $3.90 \times 10^4$ kg/yr
- Las Vegas Wash = $2.80 \times 10^4$ kg/yr
- Virgin River average = 523 kg/yr
- Muddy River = 49 kg/yr
Soluble Ortho P Inputs to Lake Mead

Colorado River = 64.6%
Las Vegas Wash = 34.4%
Virgin River = 0.9%
Muddy River = 0.07%
Perchlorate was detected at all Las Vegas Bay and most Boulder Basin stations on every sampling date.

Perchlorate was detected 9 times at Station CR360.7 but only one time at all other upstream stations.

Accoustic Doppler studies conducted by Reclamation show that water at Station CR360.7, located at the Narrows, can flow upstream from Boulder Basin.

All perchlorate in Lake Mead appears to originate in Las Vegas Wash.
Next Steps

- Look for correlations between flow and concentrations to improve loading calculations
- Use data from Interagency Database and CWC to evaluate nonpoint source loadings from Las Vegas Wash
- Provide a better accounting of flows from treatment plants
- Evaluate phosphorus losses from the system