Summary of the fate of Colorado River water entering Lake Mead.

Michael Horn and Jim LaBounty

Bureau of Reclamation, Denver Colorado

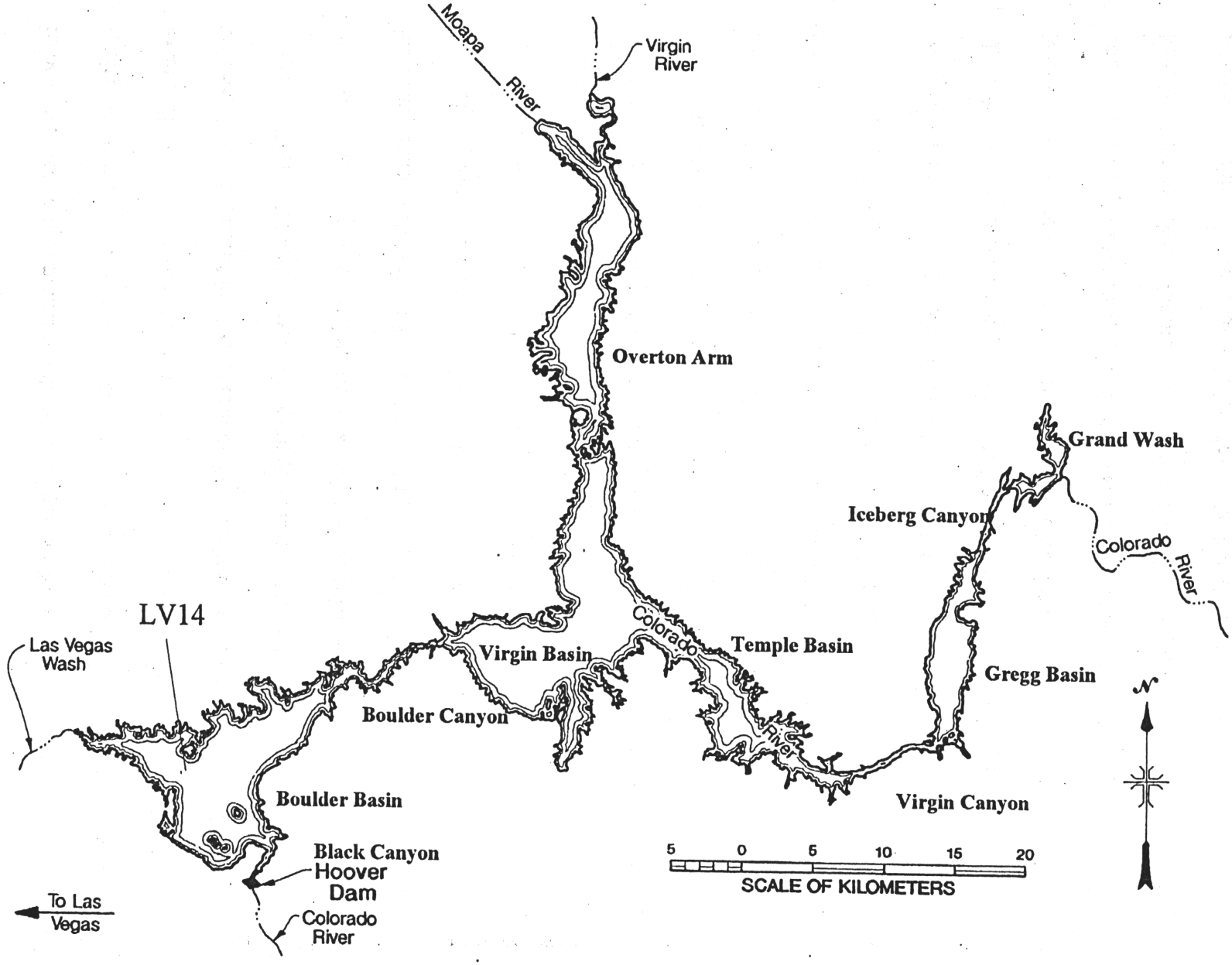
In March-April 1996 sustained high flows of approximately 1370 m^3/s for a seven day period were released to the Colorado River from Lake Powell. While not specifically addressed in response to these flows, available data suggest the potential for high flows to influence the pattern of Colorado inflow and dispersal into Lake Mead.

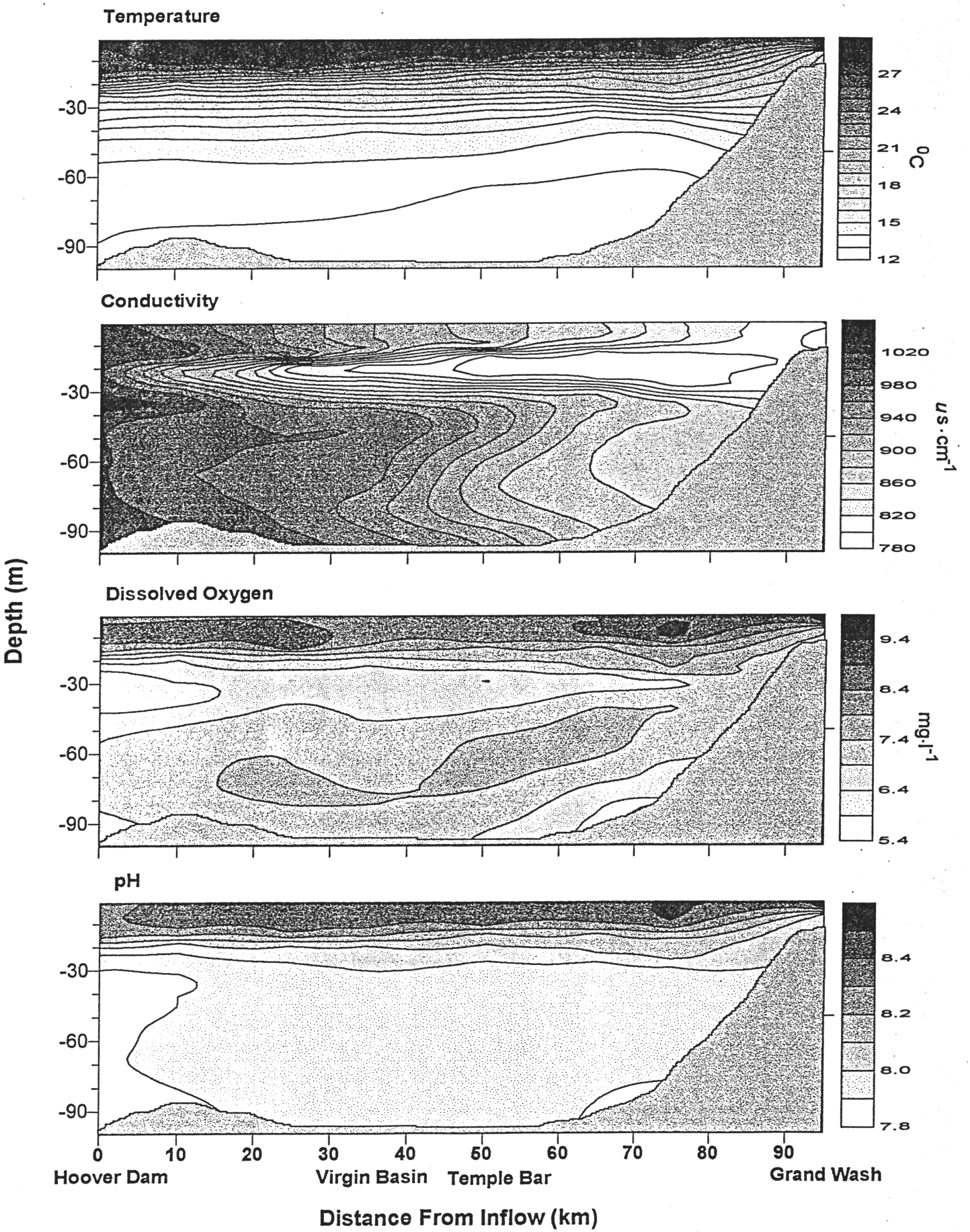
Water entering Lake Mead from the Colorado River is lower, on average, in conductivity and temperature. Density differences due to temperature and to some extent TSS, override the effects of lower salinity, and result in a plunging inflow approximately 10 km downstream of Pearce Ferry (Grand Wash) during summer months when the temperature differential between Lake Mead surface waters (25-30°C) and Colorado River Water (17^0C) is at its greatest. From this point on, water from the Colorado exist as interflow in the metalimnion and retains its identity, as characterized by lower conductivity, for much of the distance through the reservoir (See figure on longitudinal section of Lake Mead, August 1996). As far downstream as Temple Bar water samples still show the characteristic high turbidity signature of Colorado River water. The Colorado River appears to never ride higher than the metalimnion, and as such, much of the nutrient pool may not be available for biological production.

During winter months a similar flow pattern occurs. Although data are not shown here the plunge line moves downstream several km. Cooler water temperatures in Lake Mead, provide for greater mixing due to decreased amount of energy needed to mix the two bodies of water. Once it does plunge, instead of riding the metalimnion just below the thermocline, the river drops to a depth of about 80-100m, at which point it reaches an equilibrium with lake water. Distance traveled before the plume losses its identity is also shorter in the winter due an unstable water column which results in greater mixing, and because of the reduced temperature differential between the two bodies of water.

The distance through the reservoir traveled by the plume prior to dispersing also appears to be correlated to the amount of inflow entering Lake Mead. The time series graph indicate times during late summer in consecutive years when the Colorado River Plume can be observed to extend all the way to Hoover Dam (This graph represents USBR site LV14 in Boulder Basin). It was not, however, noted in 1993. Based on average flow data from the USGS station above Diamond Creek on the Colorado River the volume of water entering Lake Mead has steadily increased over the past several years, while releases from Hoover Dam have held fairly steady, indicating entrainment effects rom this source may be relatively constant. 1993 represented a relatively dry year and flows were lower. 1995 and 1996, on the other hand, represent flows that approximate more normal conditions, again with the greatest volume of water entering in 1996. During 1996 the plume was as strong as has been noted for the past several years. Part of this may be due to contributing effects of the sustained high flows earlier in the season.

In summary, under most conditions the Colorado River inflow, appears to have only limited mixing in the upper reaches of Lake Mead. It further moves through Lake Mead at a depth 20-30 m in the metalimnion where much of its nutrient load may be unavailable for biological production during times of stratification. Although the spring flood does not "cause" this plume it may make it easier to track because of the increased short-term volume of water, and allow for a better understanding of how the Colorado River interacts with the main body of Lake Mead. We can also generate from the Colorado River intrusions current position in the water column what might happen should the proposed TCD be built on Glen Canyon Dam for the benefit of native fishes. Warmer inflowing water would be expected to result in a greater degree of mixing in the upper reaches of Lake Mead and should lead to increased productivity t a time of year critical to growth and development of larval fishes. This would be expected to have positive impacts on all species of fish living in the area.


Moapa River
Virgin River
Overton Arm
Grand Wash
Iceberg Canyon
Colorado River
LV14
Las Vegas Wash
Virgin Basin
Colorado River
Temple Basin
Gregg Basin
Boulder Canyon
Boulder Basin
Virgin Canyon
Black Canyon
Hoover Dam
Colorado River
To Las Vegas
5 0 5 10 15 20
SCALE OF KILOMETERS


Temperature
-30
-60
-90
27
24
21
18
15
12
°C
Conductivity
-30
-60
-90
1020
980
940
900
860
820
780
µs·cm-1
Dissolved Oxygen
-30
-60
-90
9.4
8.4
7.4
6.4
5.4
mg·l-1
pH
-30
-60
-90
8.4
8.2
8.0
7.8
Depth (m)
0
10
20
30
40
50
60
70
80
90
Hoover Dam
Virgin Basin
Temple Bar
Grand Wash
Distance From Inflow (km)