Chapter 2
Flows in the Las Vegas Wash

Introduction

The entire Las Vegas Valley (Valley) hydrographic basin, shown in Figure 2.1, contributes flows to the lower Las Vegas Wash (Wash). Flows in the Wash originate from tributaries flowing into the Wash, treated wastewater flows returned to the Wash from the Valley's wastewater treatment plants, precipitation in the form of runoff reaching the Wash, and intercepted shallow ground water entering the Wash.

Different agencies categorize the flows in the Wash differently. For instance the Clark County Regional Flood Control District distinguishes flows as either dry weather or wet weather. Other agencies distinguish between "base" flow and stormwater. For the purposes of the Las Vegas Wash Comprehensive Adaptive Management Plan, "base" flows equal "dry weather flows," and they are defined as metered return flows (treated wastewater and once-through cooling water from the Basic Management, Incorporated (BMI) industrial facilities), urban runoff and shallow ground water that enters the Wash or what is called "intercepted shallow ground water."

This chapter delineates flows in the Wash in three major categories:

- Metered flows
- Urban runoff and intercepted shallow ground water
- Stormwater

How Flows in the Wash are Measured

Gage measurements of total flow in the lower Wash, shown in Figure 2.2, are used to estimate unmeasured components in the Wash – urban runoff,

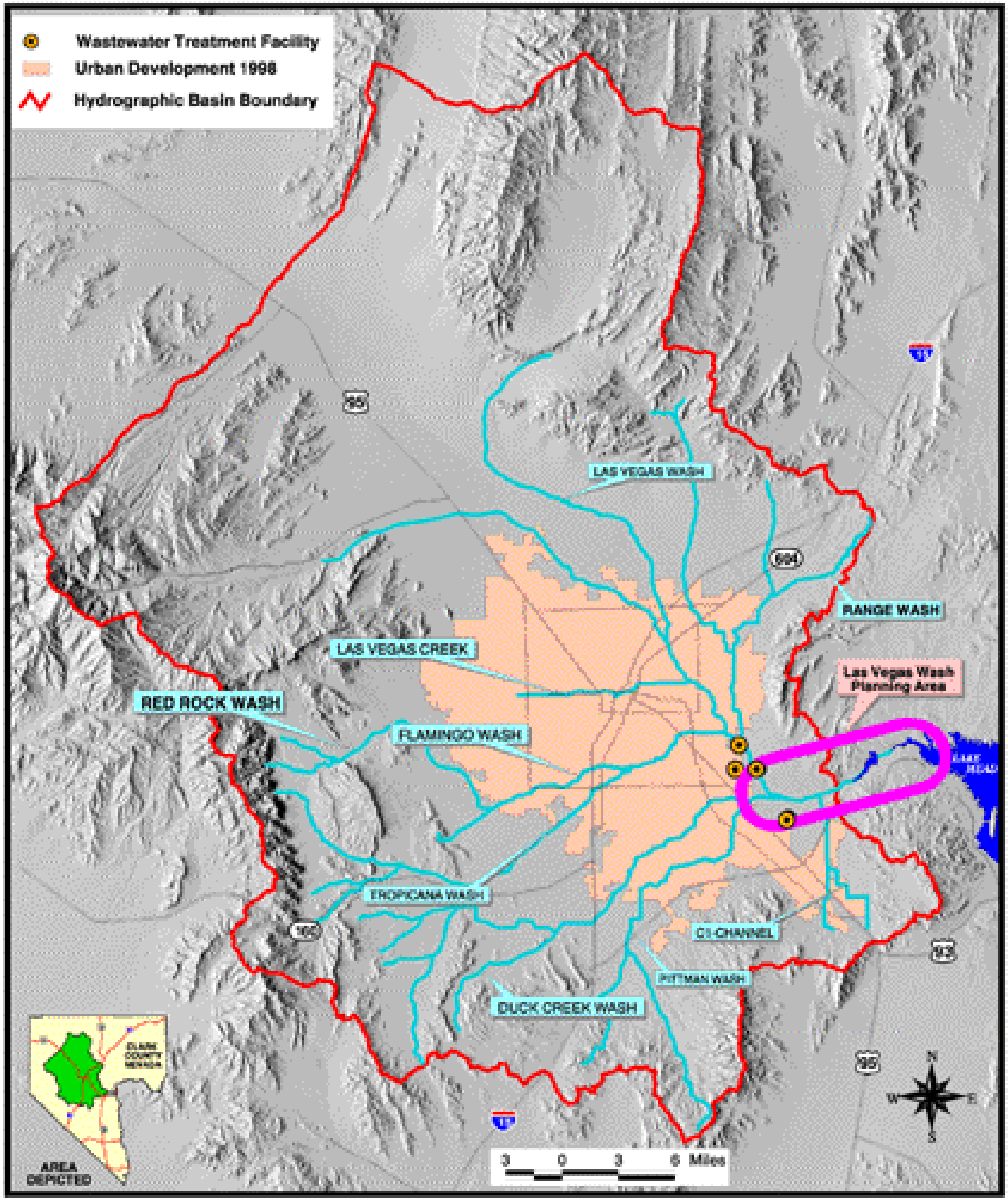


Figure 2.1 – Las Vegas Valley hydrographic basin.

intercepted shallow ground water, and stormwater. Nevada's Colorado River Commission uses these measurements as the basis for determining Nevada's return flow credits. Because these measurements are so crucial, it is also important to understand the accuracy of the measurements and the potential differences between preliminary and published measurements.

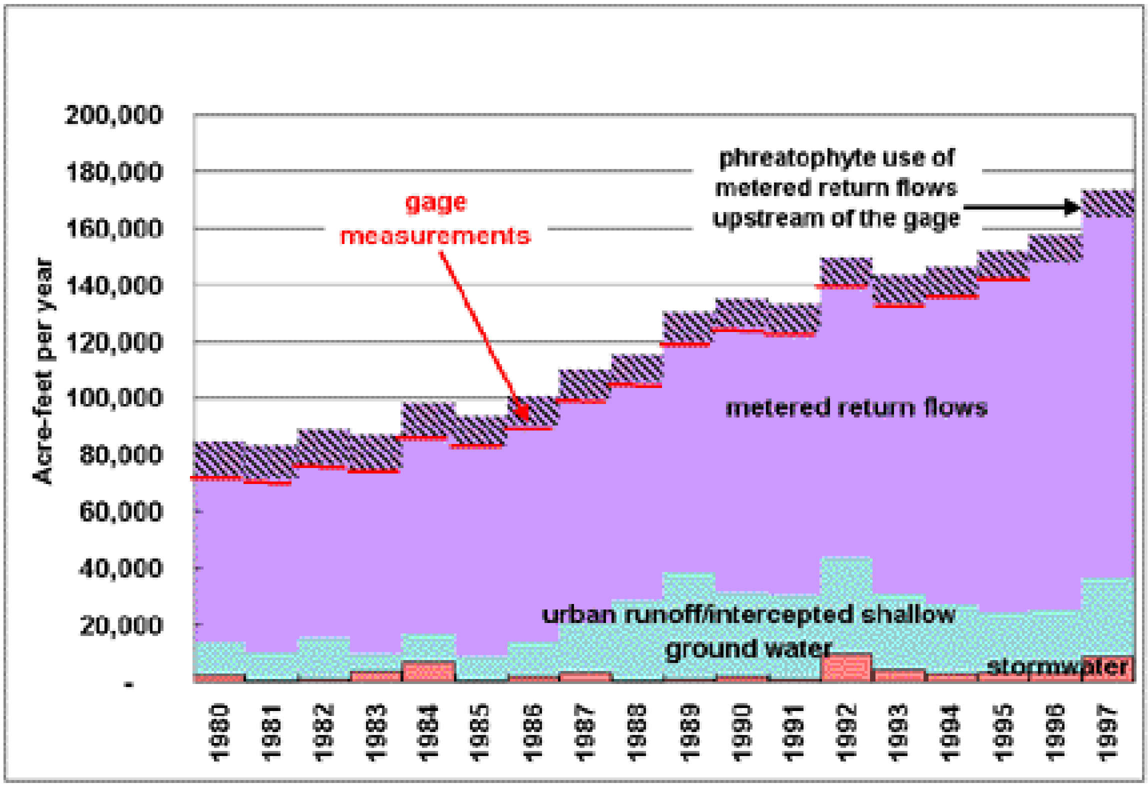


Figure 2.2 – Gage measurements of total flow in Las Vegas Wash.

Actual measurements of stormwater, urban runoff, and intercepted shallow ground water in the Wash are impossible, due to the lack of flow data on main tributaries, as well as the variable inflow of urban runoff from irrigation and the unknown volume of ground-water interception. The U.S. Geological Survey (USGS) and the Clark County Regional Flood Control District operate and maintain surface water gages on many, but not all, of the tributaries. This lack of data combined with the vast area of the Valley drainage system and the sporadic nature of precipitation events over the area make it impossible to definitively measure the various components of flow in the Wash.

Flow Measurements in Las Vegas Wash

Flow in Las Vegas Wash has been measured by the USGS since 1957, using continuous gaging equipment that enables the calculation of daily mean flow. Figure 2.3 shows the locations of four gaging stations operated and maintained by the USGS to collect flow data in the Wash since 1957. Table 2.1 shows the period of record for these gages with common names underlined.

Records of flow are published annually by the USGS on a water year basis (October 1 to September 30) with the final report generally being issued in May or June of the following year. Because of this late reporting, many analyses requiring Wash flow data earlier in the year use preliminary

USGS Gaging Station	Period of Record
Las Vegas Wash near Henderson	1957 – 1988
Las Vegas Wash near Boulder City	1969 – 1984
Las Vegas Wash above Three Kids Wash near Henderson	1988 – 1998
Las Vegas Wash below Lake Las Vegas below Henderson	1991 – present

Table 2.1 - Period of records for USGS gaging stations in the Wash.

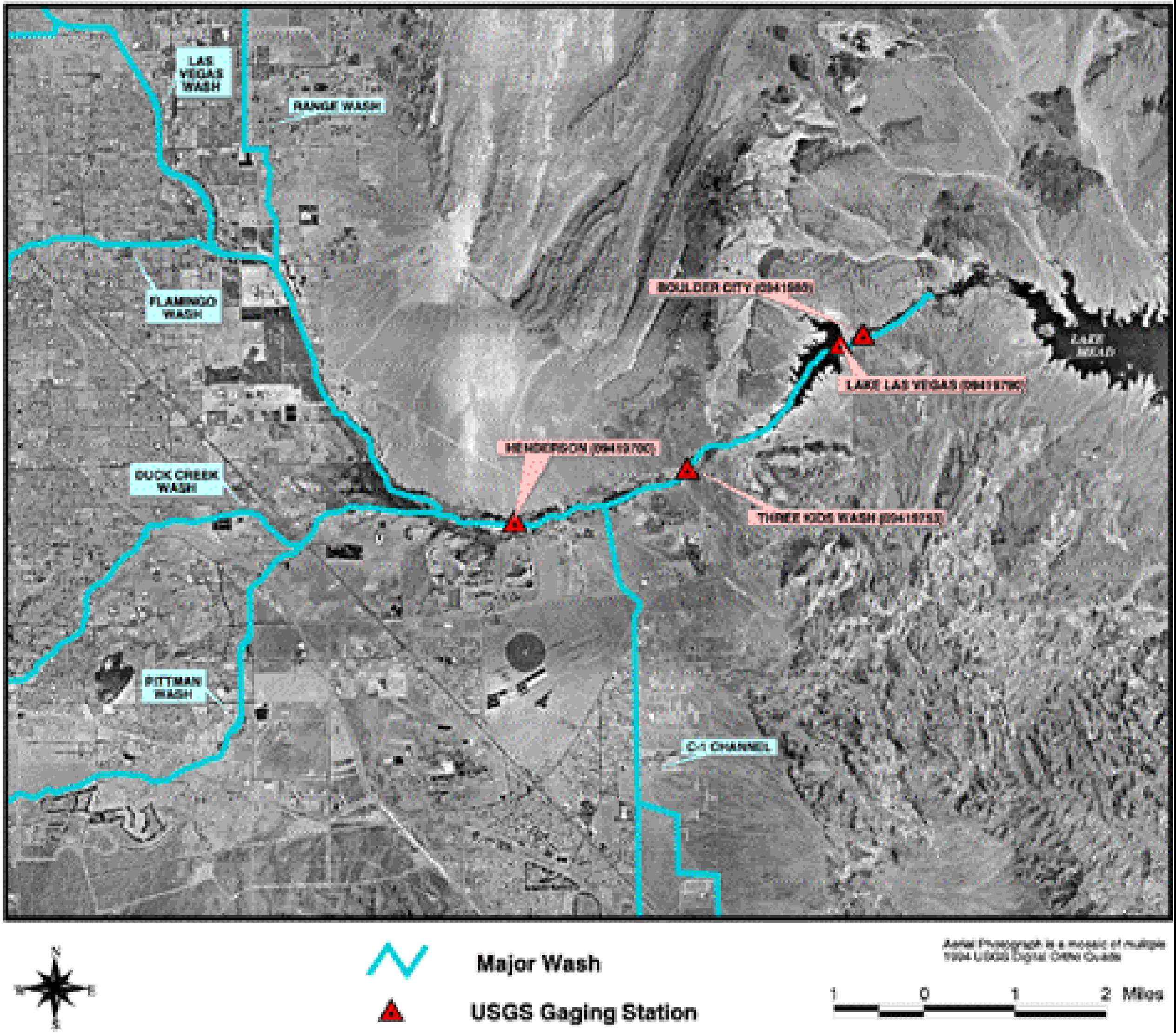


Figure 2.3 - Gaging stations operated and maintained by the USGS.

USGS data. The Colorado River return flow credit calculation uses preliminary flow data due to early reporting requirements imposed by the U.S. Bureau of Reclamation. The range of differences between published data and preliminary data varied for total annual flow volumes from as little as 130 acre-feet in 1994 to as much as 5,400 acre-feet in 1995.

Measurement Accuracy

It is important to understand the accuracy of the flow data compiled from the USGS gages. Accuracy of flow data depends primarily on the stability of the stage-discharge relation, stability of the channel, frequency of discharge measurements, accuracy of stage measurements and interpretation of recorded data. The USGS assigns an accuracy to compiled flow data by rating the year as excellent, good, fair or poor. Excellent means that about 95 percent of the daily discharges are within 5 percent of their true values, good within 10 percent, fair within 15 percent and poor greater than 15 percent. For the four Wash gages mentioned above, the majority of ratings have been fair. The ratings indicate random error from average daily gage measurements. Statistical theory dictates that the positive and negative numbers inherent in random error tend to cancel themselves out over the long run.

From 1992 to 1998, there were two gages in the lower reaches of the Wash (Three Kids and Lake Las Vegas). When two gages are present, the USGS is able to compare flow records between the gages to derive more definitive daily-mean flow values and decreases periods of no-record caused by mechanical failures (USGS, personal communication). In July of 1998, the Three Kids gage was destroyed.

Metered Returns to Las Vegas Wash

Metered returns are the largest flow component in the Wash, as shown in Figure 2.2. The Clark County Sanitation District (Sanitation District), the City of Las Vegas and the City of Henderson operate municipal wastewater treatment plants in the Valley. The Sanitation District and the City of Las Vegas began discharging treated effluent to the Wash in the mid 1950's. The City of Henderson began discharging treated effluent to the Wash in 1994. Prior to 1994, the City of Henderson used rapid infiltration basins to discharge treated wastewater to the shallow ground-water system. Basic Management, Incorporated (BMI) has been discharging once-through cooling water from its industrial site located in the southeast part of the Valley since 1982.

Figure 2.4 shows the locations of the treatment facilities, the BMI complex, and Lake Las Vegas. Figure 2.5 shows historical annual flows in the Wash by source, in acre-feet per year (afy).

Wastewater Treatment Plant Capacity

The combined wastewater treatment design capacity of the three municipal wastewater treatment entities in the Valley for 1999 is 174 mgd. Capacity expansions over time are summarized in Table 2.2.

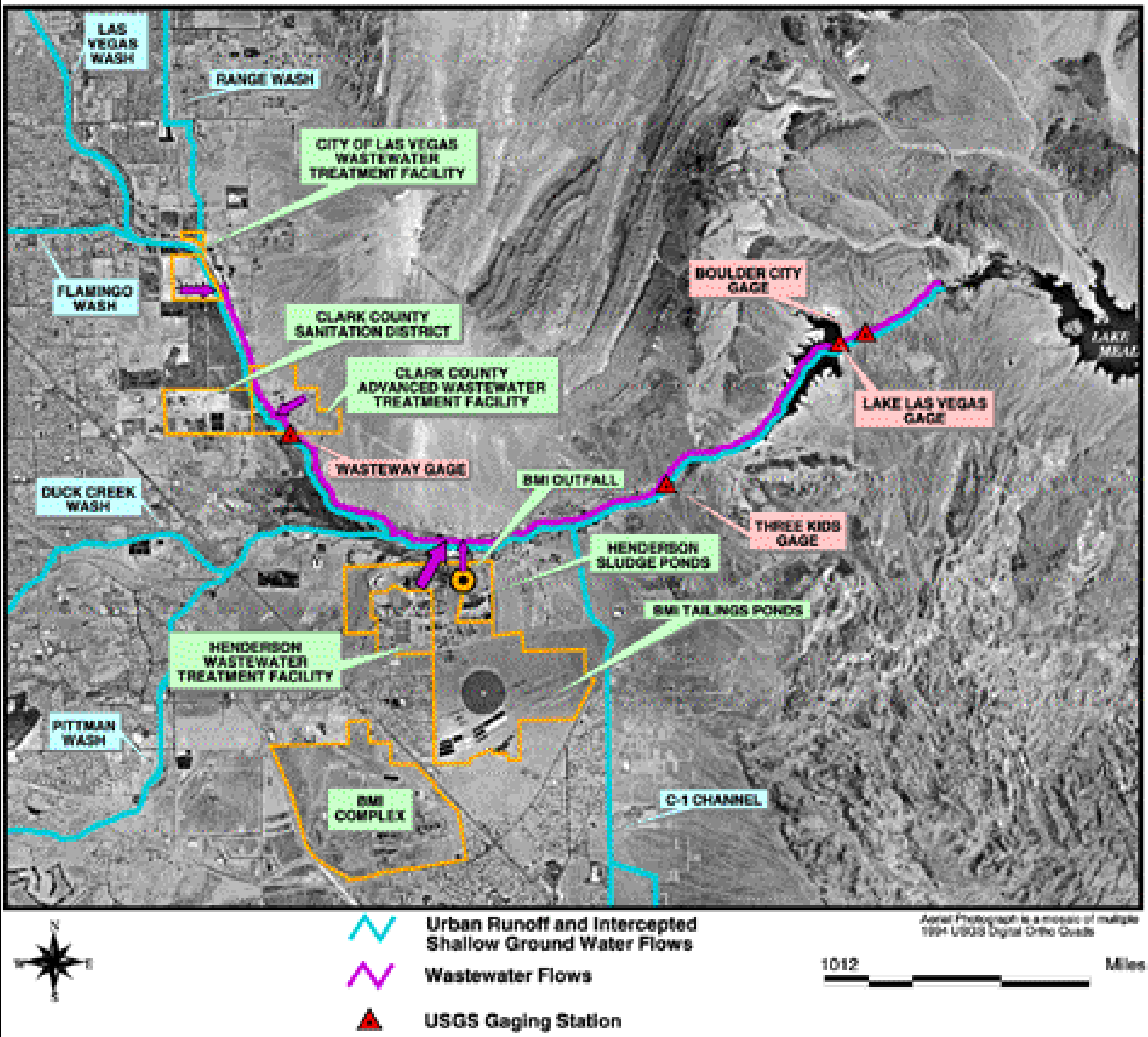


Figure 2.4 – Sources of metered returns.

Entities	1969	1979	1989	1999
Clark County Sanitation District	12	32	51	88
City of Las Vegas	30	30	41	66
City of Henderson	2-3	6	7	20
Total Treatment Capacity	**44-45**	**68**	**124**	**174**

Table 2.2 - Las Vegas Valley wastewater treatment plant capacities (mgd).

The City of Henderson had initial treatment plant capacity of 3 mgd in 1968; it was expanded to 6 mgd in 1978, and to 20 mgd in 1994. The City of Henderson utilized rapid infiltration basins discharging to the ground-water system until beginning metered direct discharge to the Wash in 1994. The City of Las Vegas had an initial plant capacity at the current site of 15 mgd in 1958; it was expanded to 30 mgd in 1968, 41 mgd in 1981 and 66 mgd in 1991. The Sanitation District had an initial plant capacity at the

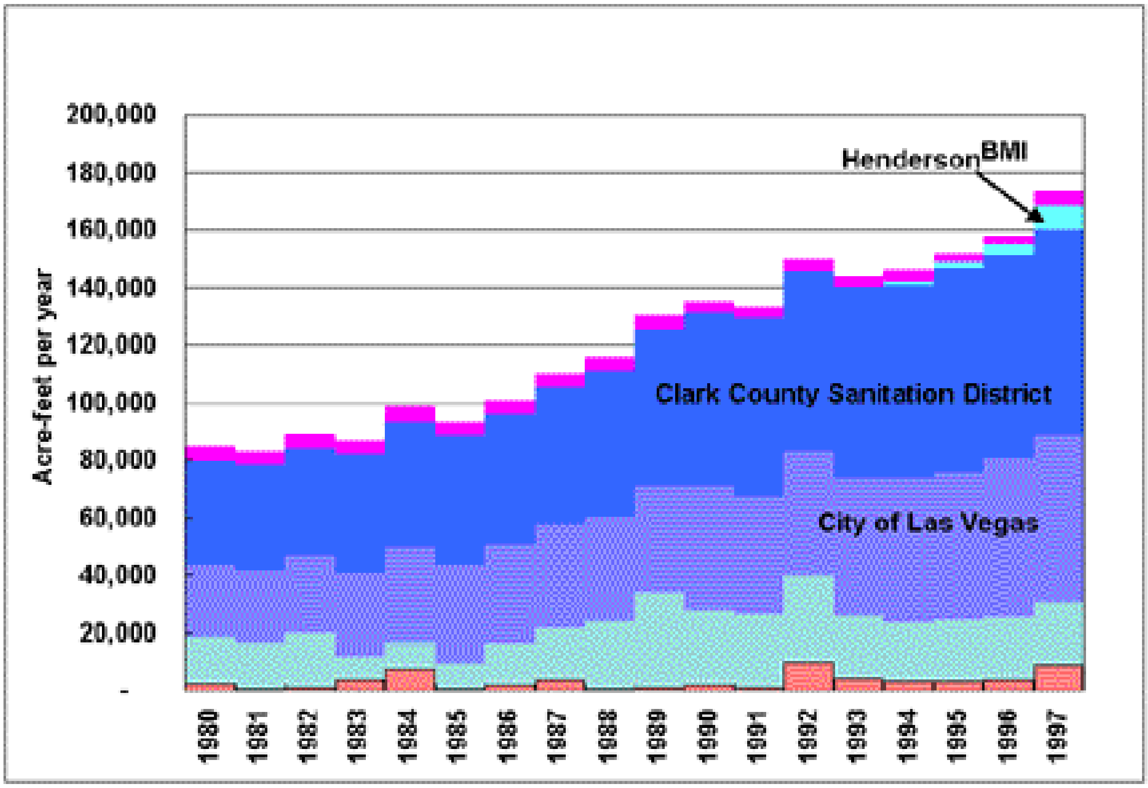


Figure 2.5 – Historical metered returns in Las Vegas Wash by source.

current site of 12 mgd in 1955; it was expanded to 32 mgd in 1973, 51 mgd in 1987 and 88 mgd in 1996. The Sanitation District's Advanced Wastewater Treatment facility was completed in 1982 to augment existing facilities by allowing 90 mgd of tertiary treatment.

Discharge Permits

Each of the wastewater treatment operations utilizes primary, secondary and tertiary treatment methods. Treated effluent discharged to the Wash is currently treated at the tertiary level. Table 2.3 shows current Wash National Pollutant Discharge Elimination System (NPDES) permitted discharge capacities for the Valley's municipal wastewater treatment facilities and BMI.

Entities	Permitted Discharge Limit (mgd)
Basic Management, Inc.	10
Clark County Sanitation District	90
City of Las Vegas	66
City of Henderson	20
Total	**186**

Table 2.3 - NPDES permit maximum discharge limits in 1999.

Daily and Seasonal Treated Wastewater Flows

Dry weather daily flows (or base flows) in the Wash generally are dependent upon the flows released from the wastewater treatment plants. Figure 2.6 shows the instantaneous flows from the Three Kids gage and Lake Las Vegas gage compared to the USGS Wasteway gage (Figure 2.4), which only measures the treated wastewater outflow from the Sanitation District and City of Las Vegas. Measurements from the Three Kids gage and the Lake Las Vegas gage exhibit a similar but slightly attenuated pattern as the Wasteway gage, which is to be expected since they are farther downstream. Because the Three Kids gage was destroyed in 1998, the Lake Las Vegas gage currently is the only gage in the Wash that measures all flows in the Wash.

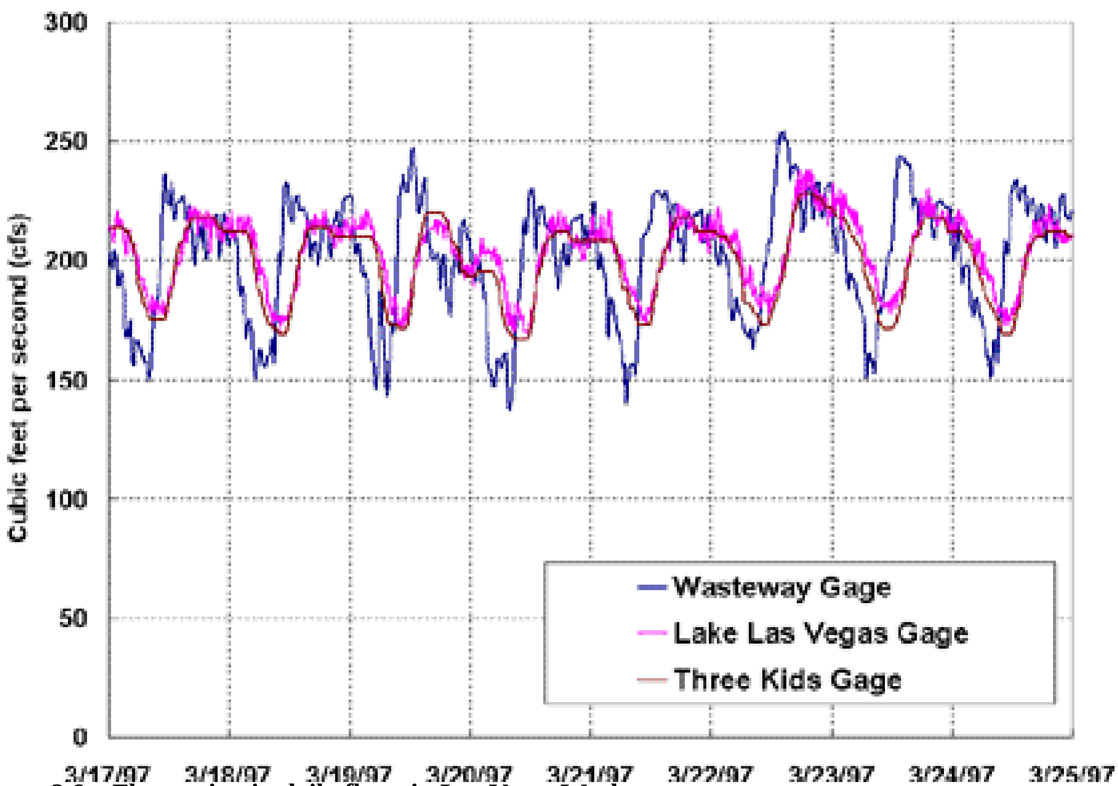


Figure 2.6 – Fluctuation in daily flows in Las Vegas Wash.

There is a slight decrease in daily mean flows during the summer months. This is probably due to the City of Henderson reusing the majority of their treated wastewater for irrigation and higher evaporation of urban runoff and intercepted shallow ground water that would otherwise have reached the Wash.

Metered Return Flows - A Utilized Water Resource

The City of Henderson, the City of Las Vegas and the Clark County Sanitation District all use a portion of their treated wastewater for reuse, called "reclaimed water." About 15,000 acre-feet were reused in 1998. The remaining treated wastewater of all three agencies is discharged to the Wash for return flow credit, as is the once-through cooling water from the BMI complex. Hence, metered returns – mostly treated wastewater – is, or is planned to be, almost completely utilized as a resource – whether returned to the Wash for return flow credit or delivered to the Valley for reuse.

Urban Runoff and Intercepted Shallow Ground Water

Urban runoff and intercepted shallow ground water contribute a significant portion (about 15 percent) of the annual flows in the Wash as shown previously in Figure 2.2. Urban runoff generally is attributed to excess water from urban uses –mainly landscape irrigation.

Intercepted shallow ground water is a result of the shallow ground-water levels rising above land surface, which in turn result in surface flows in the Wash and its tributaries. Shallow ground water is also discharged as a result of construction and permanent de-watering activities. These discharges are typically routed into the storm drain system that feeds the tributary streams of the Wash. Shallow ground water also surfaces directly in the lower Wash, down stream of the tributaries.

Figure 2.7 indicates the approximate extent of the shallow aquifer. Those areas in which ground-water levels are within 25 feet of land surface generally define the shallow aquifer. Additional discussion of the shallow aquifer can be found in Chapter 7, Shallow Ground Water Study Team.

The shallow ground-water system in the southeast and central locations of the Valley was present prior to development. The source of this water is attributed to deeper aquifers that had higher hydraulic head (artesian) in this area. Expansion of the shallow aquifer system results from over irrigation of landscapes. Low permeability clay layers, which are characteristic of the shallow aquifer sediments, prohibit drainage, resulting in retention of water not removed by transpiration or evaporation.

The retention of water causes a gradual increase in the level of the shallow aquifer. Contribution of flow to the Wash by the shallow aquifer occurs when water levels intercept land surface or when water is deliberately discharged in order to lower water levels by drains or de-watering activities. Depths to water decrease from northwest to southeast as land surface elevation declines; correspondingly the amount of shallow ground water that is intercepted also increases.

In 1982, the U.S. Bureau of Reclamation (USBR) conducted an extensive study to estimate salt loading of the Colorado River. As part of that study,

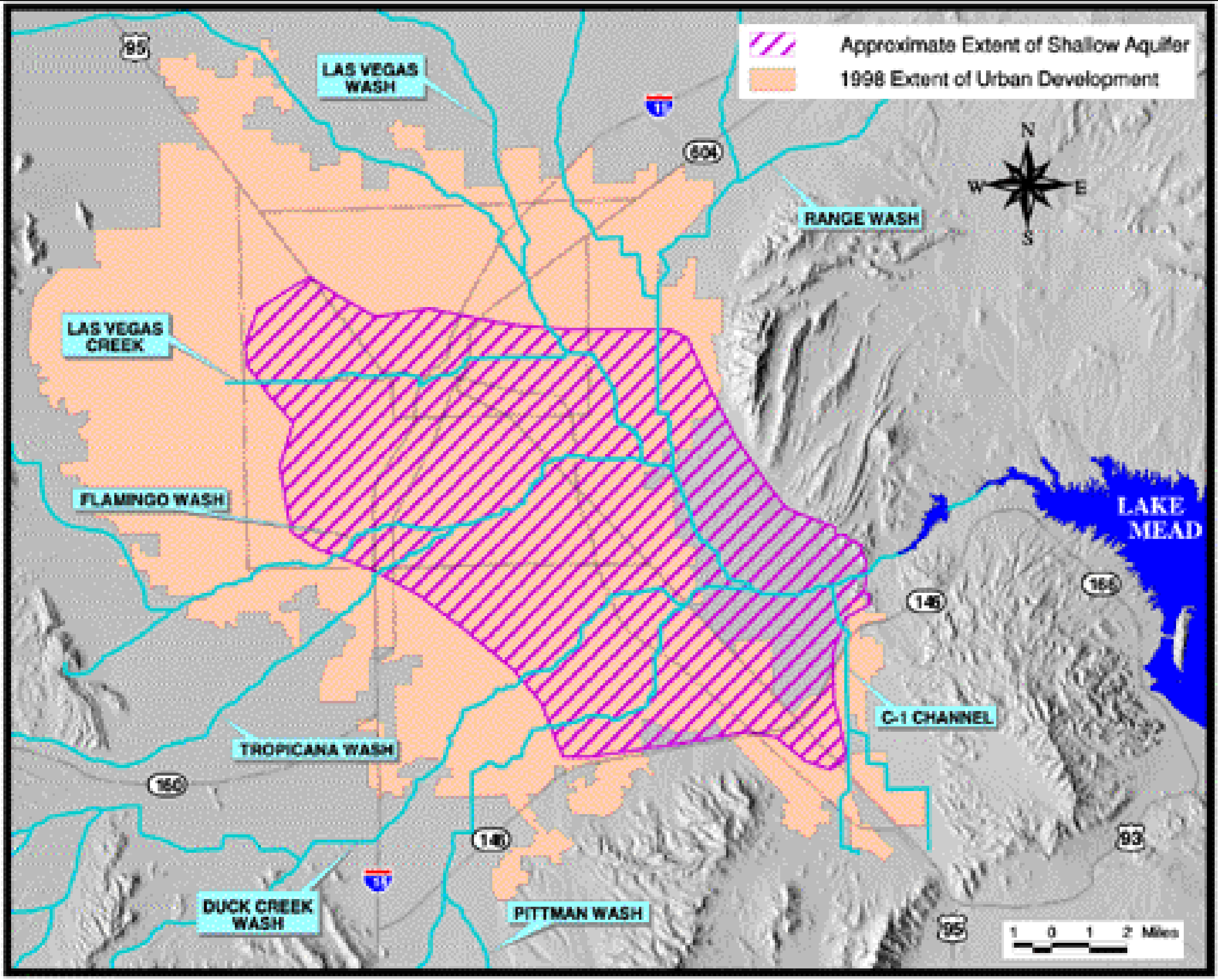


Figure 2.7 – Estimated extent of the shallow aquifer.

hydrogeologic data was collected and ground-water inflow to the Wash was estimated. The report indicated that total shallow aquifer flow to the Wash was about 23,500 afy, of which 1,970 afy was believed to come from deeper artesian aquifers. This work is believed to be the basis for the estimated ground-water component of unmeasured accruals in return flow credit methodology developed by USBR and the Nevada Colorado River Commission in 1984 (See Appendix 2.2).

	Flow (afd)	Flow (cfs)	Period of Record
Flamingo Wash	10.60	5.35	6/91-5/93, 8/94-11/94
Las Vegas Wash	3.11	1.57	8/93-8/94, 11/94-6/95
Duck Creek	6.93	3.50	7/93-5/95

Table 2.4 - Tributary flows (French and Mizell, 1995).

In 1995, French and Mizell estimated that flow from the three main tributaries amounted to almost 8,000 afy. Table 2.4 shows their flow measurements at the downstream reaches of the tributaries indicated.

French and Mizell's work in the 1990's measures most, but not all, of the tributary flows to the lower Wash. Flow components at these points include urban runoff and shallow ground water intercepting the surface. The 1982 USBR report estimates the shallow ground water intercepting the surface both in all the tributaries and in the lower Wash.

Summary

Based on the above, the total volume of urban runoff and intercepted shallow ground water is currently estimated to be around 25,000 afy.

In Figure 2.2 shown earlier in this chapter, the urban runoff/shallow ground-water annual volumes are simply the remaining flow in the Wash, after all known flows (treated wastewater) and estimated flows (stormwater) are subtracted from the total known flows. The flows in the early 1980s from this simplified "water budget" approach are between 10,000 – 15,000 afy, a little lower than USBR's estimation of 20,000 afy gathered from data in the late 1970s.

By the mid-80s, the runoff and shallow ground-water flows increase to the 30,000 – 35,000 afy range. In the mid to late 1990s, the volume drops down to the 20,000 – 25,000 afy range probably due to the City of Henderson beginning to directly discharge treated wastewater to the Wash rather than discharging to the aquifer using rapid infiltration basins. The current volumes could easily account for USBR's 20,000 afy ground water flow and French and Mizell's tributary flow, recognizing there is some double accounting in ground water estimates.

Stormwater

Stormwater flow in the Wash is one of three flow components in the Wash that is not directly measured. (See Figure 2.2 shown earlier in this chapter.) Stormwater flows are estimated from the total flow in the Wash measured by the USGS. This section discusses Clark County Regional Flood Control District's Master Plan, the frequency and volume of stormwater flows and basic concepts on potential capture and use of stormwater flows.

Clark County Regional Flood Control District

In 1985 the Nevada Legislature created the Clark County Regional Flood Control District (Regional Flood Control) to develop a comprehensive master plan to address flooding problems. Regional Flood Control was also tasked to regulate land use in flood hazard areas, fund and coordinate the construction of flood control facilities, and develop and contribute to the funding of a maintenance program for master plan flood control facilities. In 1986 the first flood control master plan was developed in accordance with Nevada State Law, and in 1996 the latest five-year update of the master plan was adopted. The service area for Regional Flood Control includes Clark County and the incorporated cities of Boulder City, Henderson, Las Vegas, North Las Vegas, Mesquite and Laughlin.

The hydrologic analysis used to provide facility planning for flood events is the 100-year recurrence interval storm, which is based on a single event storm with a six-hour duration and full development of the Valley. A 100-year recurrence interval is defined as having a 1 percent chance of occurrence in any given year.

Principal Regional Flood Control structures are detention basins, conveyance channels, bridges, and storm drains. Currently there are approximately 39 detention basins in the Valley and the master plan proposes an additional 30 basins shown in Figure 2.8. Storage capacity in the existing 39 detention basins is approximately 30,000 acre-feet. The detention basins are designed to reduce peak stormwater flows by detaining water and releasing it over a period of less than seven days. Tributary channels to the Wash function as the main conveyance structures transporting stormwater to the lower reach of the Wash.

Estimation of Stormwater Flows

Historical stormwater flows in the Wash from 1980 to 1997 have been estimated using two independent methods in a report by Johnson, 1999, titled "Estimation of Stormwater Flows in Las Vegas Wash, Nevada, and Potential Stormwater Capture" (see Appendix 2.1). Method 1 uses the estimated daily volume of precipitation that occurs in the Valley based on historical precipitation gage records and subtracts assumed transmission losses and ground-water percolation to derive a stormwater flow-volume in the Wash. Method 2 uses historical daily mean flows in the Wash and subtracts the estimated base flow to derive the remaining stormwater flow.

While both methods (precipitation and daily mean flows) give similar results (440 to 5,700 acre-feet and 3,190 acre-feet respectively), the stormwater flow-volume calculated using historical daily mean flows in the Wash (Method 2) is considered a more accurate method, because of the relatively numerous assumptions in Method 1. Furthermore, daily flow measurements used in Method 2 are derived from both actual precipitation and actual precipitation losses in the Valley. Figure 2.9 shows annual stormwater volumes plus base flows in the Lower Wash from 1980 to 1997 calculated using Method 2.

Analysis of the stormwater flow-volumes using Method 2 shows that the average annual stormwater runoff in the Wash was approximately 3,190 afy over the 18-year period from 1980 to 1997. In addition, examination of the stormwater flows on a daily basis (over the 18-year period) showed

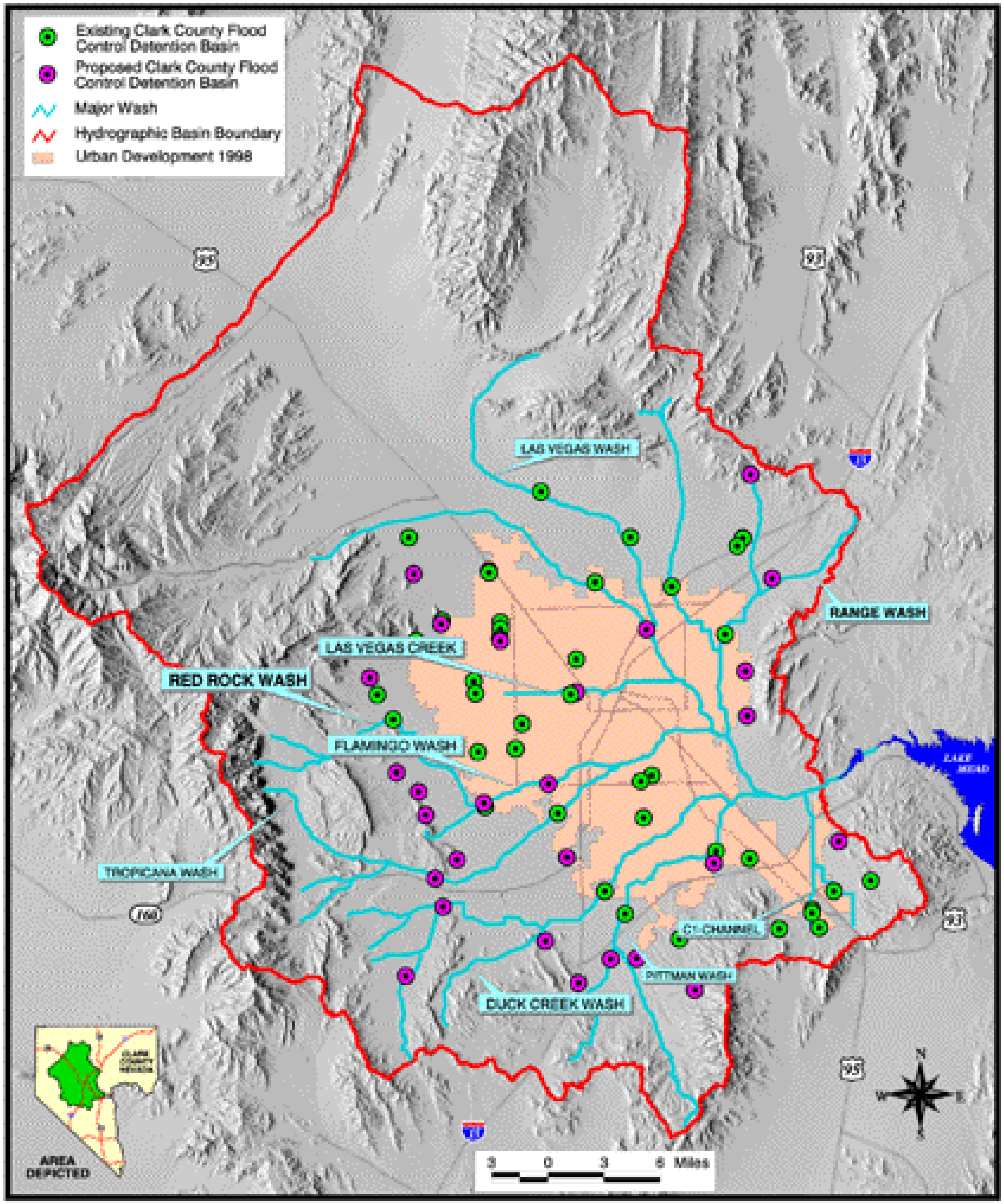


Figure 2.8 – Clark County Regional Flood Control District's Las Vegas Valley detention basins.

that storm flows only occurred in 239 days out of a total of 6,575 days (3.6 percent of the time), and 87 percent of these stormflows ranged between one and 400 acre-feet in total volume per day.

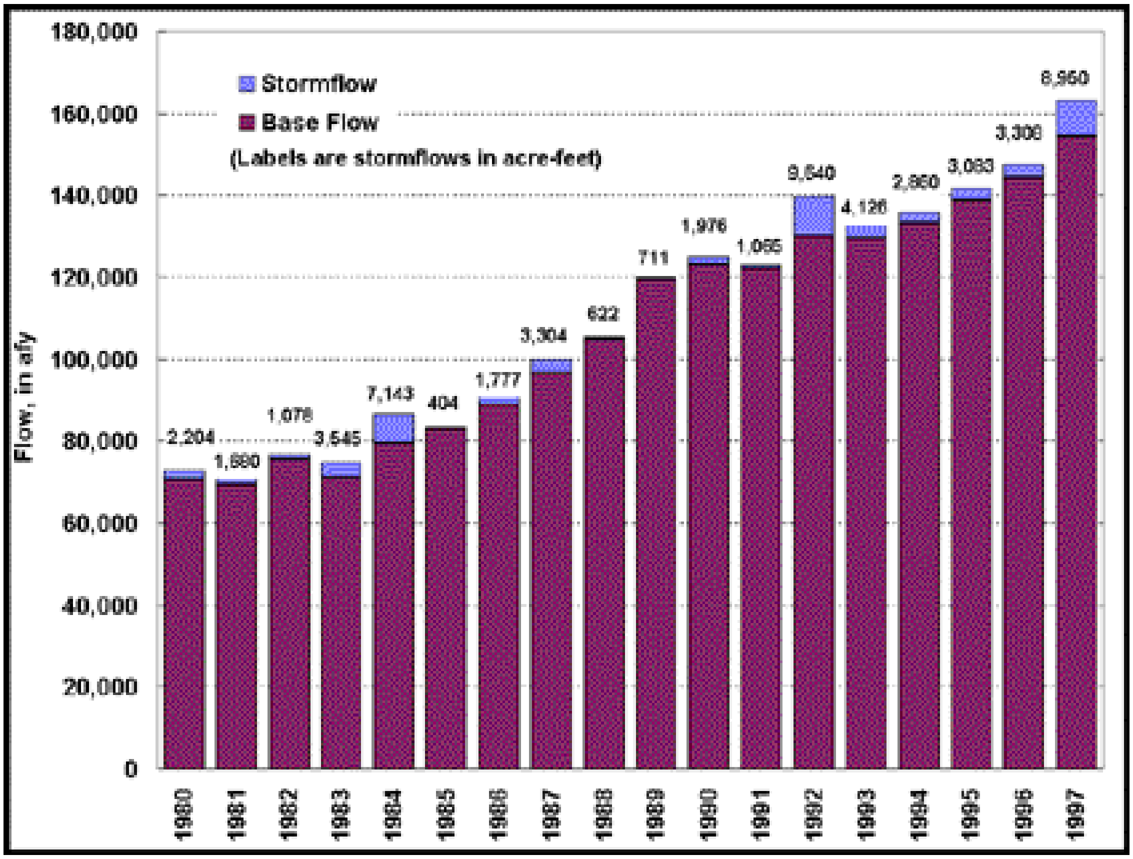


Figure 2.9 – Annual stormwater flow and base flow in lower Las Vegas Wash, estimated using daily mean flows (Method 2).

Stormwater and Return Flow Credits

Method 2, using the daily mean flows, is currently being utilized by the Colorado River Commission to calculate stormwater flows in the Wash for use in the return flow credit methodology. The method utilizes the total gage flow in the Wash and subtracts out those flows for which Nevada does not receive credit, such as stormwater flows.

In the return flow credit methodology, all flows in the Wash are summed to the total gage flows (as measured by the USGS). Total gaged flows equal measured wastewater flows plus estimated stormwater flows plus urban runoff and intercepted shallow ground water called "accruals." Return flow credits are discussed in more detail in the Water Resource and Supply section of this chapter and Appendix 2.2.

Potential Capture and Use of Stormwater

There are a number of reasons to consider capturing stormwater flows, primarily water resources augmentation, reduction of erosion and improvement of water quality. Ideas for stormwater impoundments have centered on either capturing stormwater flows before they reach the Wash in existing or new facilities or capturing the stormwater flow once they have reached the Lower Wash.

Stormwater Capture Upstream of Las Vegas Wash

Discussions on stormwater capture facilities have brought up the concept of potentially utilizing existing Regional Flood Control detention basins to capture stormflows. These basins are designed to reduce peak flows by temporarily detaining stormwater for less than 48 hours and releasing it through flow-reducing structures into the stormwater conveyance system. This design criteria meets the legal objective of Regional Flood Control which is to protect life and property by conveying stormwater flows through the Valley. Because of the design criteria, existing detention basins can not be used to store stormwater. Stormwater capture above the Wash is then reduced to three primary alternatives, 1) expansion of existing detention basins, 2) construction of new retention basins, or 3) artificial recharge of stormwater into the Valley's aquifers through existing or new detention/retention basins (legally feasible only if water does not degrade existing aquifer water-quality).

While existing detention facilities could theoretically be expanded or new facilities constructed, the volume of stormwater potentially captured in these basins on a yearly basis is equal to or less than the volume capturable in the Wash. This is because each detention basin only captures a portion of the stormwater flows in the Valley based on its location within the Valley drainage system. Capturing stormwater volumes which approximate the average annual stormwater runoff in the Wash of 3,190 afy would require constructing/expanding at least as many facilities as are currently operated by Regional Flood Control, and the facilities would have to tie into existing structures.

Capturing stormwater in existing detention basins for artificial recharge into the Valley's aquifers was examined by Bax-Valentine, Preator, and Hess, 1990, and by Buchanan, 1997. Bax-Valentine, Preator, and Hess examined the economic feasibility of constructing wells in two existing, off-channel detention basins and recharging stormwater. The study concluded that these two detention basins (the North Las Vegas Detention Basin and the Meadows Detention Basin) should not be used for artificial recharge of stormwater due to potential water quality concerns for the principle aquifer which supplies 15 percent of southern Nevada's water resources. The study also concluded that it was not economically feasible to use this type of recharge in the Red Rock Detention Basin, which is located upstream of the urban area where stormwater quality may not be an issue. Cost of artificial recharge of stormwater in the Red Rock Detention Basin at the time was over four times the cost of delivering Colorado River water to the Valley.

In 1997, Buchanan re-examined the potential of artificially recharging stormwater; he also concluded that water quality restrictions are a major obstacle. Legally, only potable water can be recharged into the aquifer; therefore, stormwater would have to be treated to drinking water standards prior to recharge. Buchanan also concluded that the volume of stormwater that may meet recharge standards (generally in detention basins on the peripheral areas of the Valley) is small. He pointed out that cost-benefit analyses on the use of stormwater need to take into account the "significant temporal variability of stormwater flows" and that "the use of [annual] average flows in an economic analysis will not provide an accurate estimate of the return investment for a [stormwater] harvest/recharge system."

<u>Stormwater Capture in Lower Las Vegas Wash</u>

Many discussions on stormwater capture have also focused on capturing stormwater in or adjacent to the Lower Wash. When considering whether or not stormwater capture in the Wash, along with its potential use, is an economically feasible management strategy, the following four factors should be considered: 1) the volume and frequency of stormwater flows, 2) impacts to return flow credits and type of capture facilities 3) reasons for capturing stormwater and water quality, and 4) existing surface water rights. Each of these factors are discussed in Appendix 2.1.

Reducing erosion in the Wash through stormwater capture has been a focus of stormwater capture discussions and is probably the most viable reason to construct stormwater capture facilities in the Lower Wash. Capture facilities designed to reduce erosion would have to consider the factors and restrictions mentioned above, and discussed in Appendix 2.1. In addition, the detention (or retention) basin would have to be large enough to detain (or retain) the majority of the stormflow events and would have to tie into additional structures in the Wash because the basin would not reduce erosion occurring from base flows. If these criteria can be met, the cost-benefit of capture facilities to reduce erosion will need to be weighed against cost of other erosion-reducing facilities.

Reducing erosion in the Wash by "skimming" peak stormflows was discussed at the Engineering Workshop Held August 30-31, 1999. This is discussed in detail in Chapter 6 Erosion and Stormwater Study Team.

<u>Summary</u>

Two independent methods were used to calculate historical daily stormflows from 1980 to 1997. Both methods showed that the average, annual volume of stormwater in the Wash is less than 5,000 acre-feet. In addition, the calculations also showed that stormwater flows are extremely variable over time.

Although a number of reasons may exist to capture stormwater, potential capture must consider 1) the volume and frequency of stormwater flows, 2) impacts to return flow credits and type of capture facilities, 3) reasons for capturing stormwater and the use or disposal of the stormwater, and 4) existing surface water rights.

Based on Regional Flood Control's restriction on existing facilities and previous studies, potential capture of stormwater above the Wash would require construction of more facilities than if capture facilities were constructed in the Wash. Also, cost benefit analyses for potential stormwater capture facilities must take into account the extreme temporal variability of stormwater flows and not rely on average annual flows.

Water Resources & Supply

The Las Vegas region and the member agencies of the Southern Nevada Water Authority (SNWA) receive the majority of their water resource from Lake Mead, which is considered part of the Colorado River.

Consumptive Use & Return Flow Credit Concept

The Colorado River is apportioned among the seven Colorado River basin states in consumptive use or "net" use units. Consumptive use is defined in Colorado River law as "diversions less return flows."

Nevada receives 300,000 acre-feet of Colorado River consumptive use. If Nevada returns flows to the River that were originally Colorado River water, then Nevada receives a credit for that volume and therefore can divert that much more Colorado River water in the same year, as illustrated in Figure 2.10. Because the Valley treats and returns the majority of its wastewater back to the river via the Wash, Nevada receives credit for those return flows and southern Nevada is able to divert more than 300,000 acre-feet in the same year, as shown in Figure 2.11.

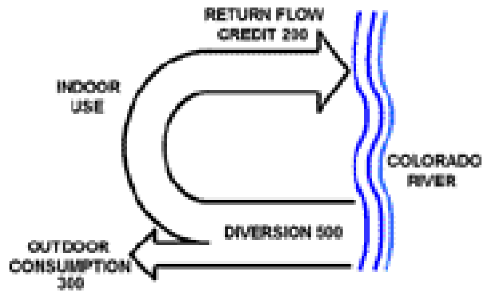


Figure 2.10 – Return flow credit method.

Because the Colorado River borders just the southern part of the state, the state's Colorado River apportionment is utilized by southern Nevada, primarily the Las Vegas region.

There are three sources of water in the Wash: metered returns which are mostly treated wastewater flows, urban runoff and intercepted shallow ground water, and stormwater. By definition, Nevada only receives credit for those return flows that are considered Colorado River water, not for ground water or stormwater.

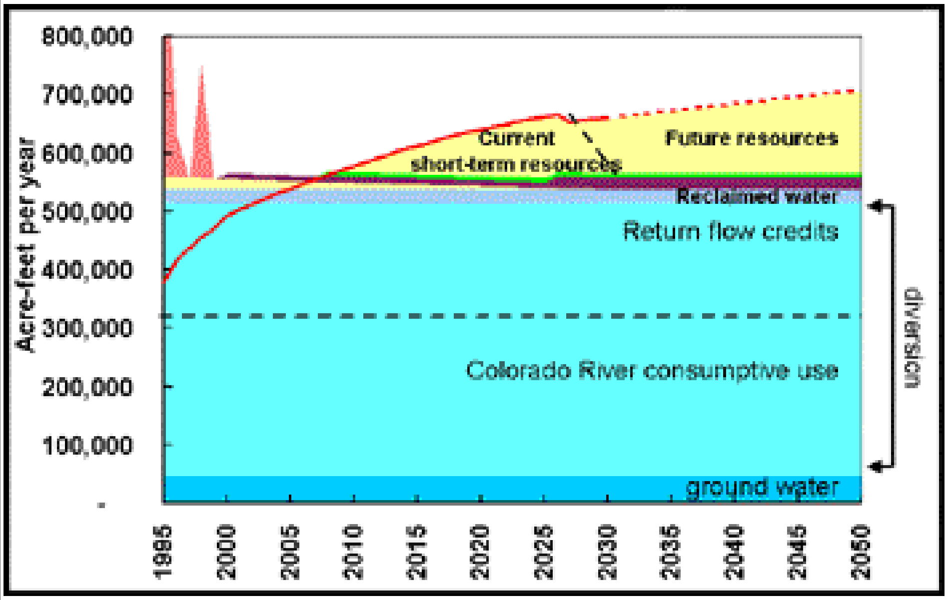


Figure 2.11 – SNWA water resources.

There currently is no way to actually measure how much of the flows in the Wash were originally Colorado River diversions to the Valley. Meters measure only the treated wastewater flows discharged from the wastewater treatment plants, BMI's discharge of once-through cooling water, and the Three Kids and Lake Las Vegas gages that measure total flow in the Wash. Given only the meter and gage measurements, in 1984 the U.S. Bureau of Reclamation (USBR) and the Colorado River Commission agreed to a return flow credit methodology that would calculate how much of the flows in the Wash were originally Colorado River water diversions.

To calculate the total Colorado River component in the Wash, the method calculates the "ground water" and Colorado River water components of metered returns and of "accruals." The method is discussed in more detail in Appendix 2.2.

<u>More Reuse Does Not Extend Supply</u>

The 1991 SNWA Cooperative Agreement, amended in 1994 and 1996, creates thresholds of wastewater reuse for each purveyor, totaling 21,800 afy. If wastewater is reused in excess of the amount specified to the purveyor in the Agreement, the excess reuse quantity is subtracted from the potable water purveyor in whose service area the reuse provider resides.

However, increasing erosion in the Wash – caused in part by treated wastewater being returned to the River for "credit" – has caused the SNWA and its member agencies to rethink this policy. It is now generally accepted that reuse can increase above 21,800 acre-feet.

The wastewater treatment agencies are actively pursuing reuse as discussed in Chapter 8, Alternate Discharge Study Team. However, while reuse is being actively pursued for environmental and future cost benefits, it will not increase water resources. To illustrate, Figures 2.12 and 2.13 show that the size of the total resource "pie" does not change, whether more treated wastewater is used to meet a reuse demand or to meet a potable demand.

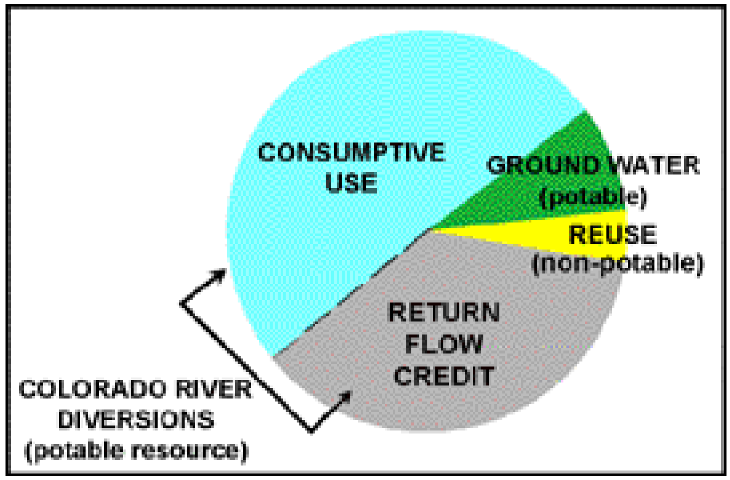


Figure 2.12 – Total water resources (little reuse).

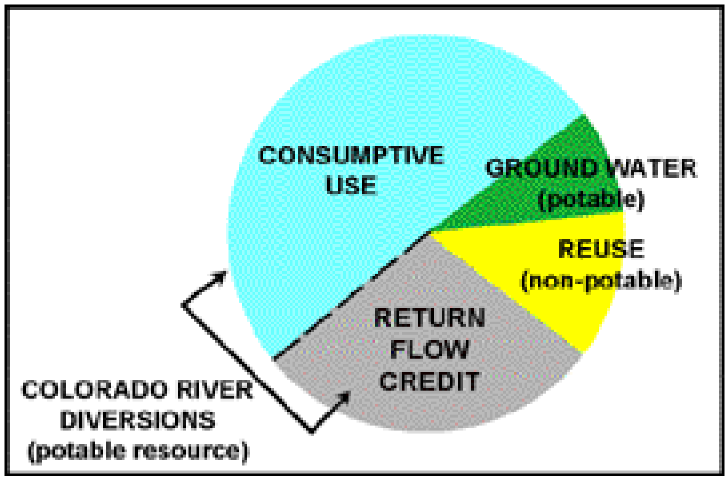


Figure 2.13 – Total water resources (more reuse).

<u>Reclaimed Water Facilities</u>

In Boulder City currently 60 percent of the treated effluent is sold and used at sand and gravel operations (600 afy). The City is working on discharge permit requirements to allow for effluent discharge to its Wetlands Park and for subsequent irrigation at the State Veteran's Cemetery.

The City of Henderson has a 20 mgd water reclamation facility capable of generating 22,400 afy of treated wastewater available for reclaimed water. Customers currently utilizing reclaimed water for irrigation include seven golf courses, highway landscaping and a mortuary. Total reclaimed water in 1998 was approximately 7,000 afy. Projected reclaimed water demand by year 2000 is estimated at 8,300 afy. All existing golf courses in Henderson utilize reclaimed water, and any new courses are required to do the same.

The City of Las Vegas currently provides a power plant with approximately 100 afy of reclaimed water from the Water Pollution Control Facility located on Vegas Valley Drive. This facility also provides up to 6.5 mgd to two adjacent golf courses. The City of Las Vegas' Northwest Water Resource Center, a 10 mgd satellite reuse facility ultimately capable of providing over 10,000 acre-feet per year of reclaimed water to golf courses, schools and parks, will be on-line by spring of 2001. The City of Las Vegas' Bonanza Mojave Water Resource Center, a 1 mgd facility, came on-line in May 1999 and is capable of providing approximately 1,000 acre-feet per year of reclaimed water to an adjacent park and golf course. The City of

Las Vegas is also participating in a valley-wide reuse study and is working to identify the need for other satellite facilities.

The Clark County Sanitation District in the Valley currently provides power plants and golf courses with over 6,600 afy of treated wastewater. Detailed design is underway for a 5 mgd satellite reuse facility called “Desert Breeze,” the first phase expected to be on-line in 2002; it has also identified the possible need for another facility beyond the year 2000. The County now requires new golf courses and nearby landscape areas to utilize reclaimed water. Total reuse in 1998 was almost 15,000 acre-feet.

<u>Summary</u>

The region’s treated wastewater is not an unutilized resource. It is returned to the Colorado River for return flow credit and equates to about one third of our permanent resource. Reuse of wastewater beyond 21,800 does not extend our current resource. It just changes our mix of resources from the currently estimated amount of return flow credit/diversion resource and reuse to less return flow credit/diversion and more reuse.

Water Resources and the Clark County Wetlands Park

In the Environmental Impact Statement for the 1995 Clark County Wetlands Park Master Plan, maximum historical consumptive use (volume not returned to the Wash) by phreatophytes in the Wash is estimated to be 10,000 to 12,000 afy. Current use (1993) is estimated at 9,500 afy. Under the proposed alternatives in the master plan, the anticipated total consumptive use needs for the Clark County Wetlands Park range from 10,100 to 10,600 afy.

Water rights continue to be an issue associated with the Clark County Wetlands Park. Rights have not been granted to the Wash region nor to the Clark County Wetlands Park, neither through the Nevada State Engineer nor through the U.S. Bureau of Reclamation (USBR). However, there is water reserved for the Park in a more or less unofficial state.

<u>Colorado River Water Rights</u>

The Clark County Wetlands Park does not have a right to Colorado River water; however, a portion of the water returned to the Wash is reserved for phreatophyte usage by the USBR and the Nevada Colorado River Commission (CRC).

USBR and the CRC generated a detailed “return flow credit” methodology to determine how much of the water returning back to the Colorado River at Lake Mead via the Wash was originally Colorado River water diverted into the Valley from Mead. (See Appendix 2.2) Southern Nevada receives credit for that portion of the return flows that the method calculates came from Colorado River diversions. It does not receive credit for the return flows calculated in the method as “ground water,” and up to 12,000 afy of that ground water is assumed to be used by phreatophytes in the Wash. (Note: 12,000 afy was incorporated in the method because 12,000 afy was the maximum historical estimated use by phreatophytes.)

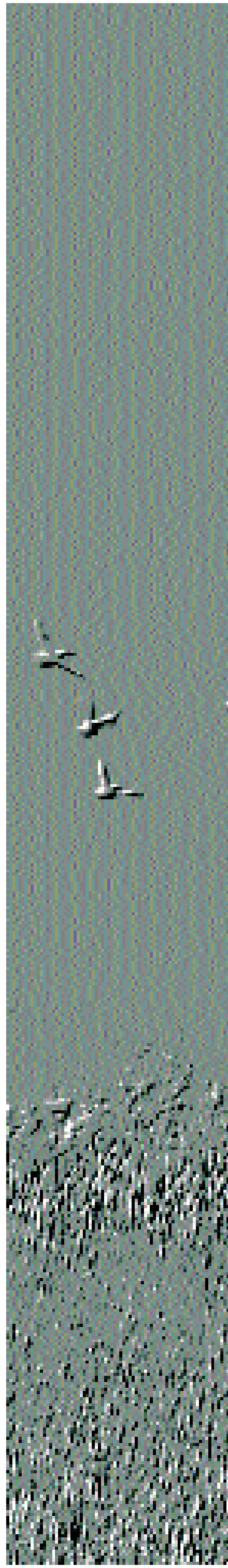
If the phreatophytes use less than 12,000 afy of ground water, that use does not increase Southern Nevada’s return flow credit, because return flow credit is only generated from Colorado River water returns. If the phreatophytes use more than 12,000 afy, then the method assumes they are using a blend of Colorado River and ground water. When they use Colorado River water, then they are using flows that otherwise would have been returned to the river. Hence, they are reducing the return flow credit resource.

State Engineer Permits

The State Engineer has jurisdiction for all of the ground and surface waters of the state, and the flows in the Wash are no exception. Primary permits are held by producers of treated wastewater; secondary permits to reuse wastewater are granted on the primary permits. The priority date of the reuse water is not the date of the primary permit; it is the date of the contract or agreement between the primary holder and the entity who will reuse the water. The Clark County Wetlands Park does not currently have a secondary permit or rights for ground or surface water from the State Engineer.

To acquire a secondary (reuse) permit for the Clark County Wetlands Park, one option would be to ask Clark County (with primary permit #21587 for 11,900 afy), Clark County Sanitation District (with primary permit #21728 for 12,000 afy), or the City of Las Vegas (with primary permit #17199 and #21014 for 10,000 afy and 30,000 afy respectively) to change the point of diversion in one of their existing secondary (reuse) permits to the Clark County Wetlands Park. Alternatively, if there is water under those primary permits that has not been certificated (beneficial use proven), then another option for the Clark County Wetlands Park would be to apply for some of that water. Yet another option is to apply for surface water on the tributaries to the Wash.

As long as the Park does not consumptively use more than 12,000 afy, there is no impact on the region’s return flow credit and therefore its water resource.



Appendices

2.1 Estimation of Stormwater Flows in Las Vegas Wash, Nevada, and Potential Stormwater Capture
2.2 Colorado River Water Return Flow Credits – An Important Component of Southern Nevada's Current Water Resources

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