

## **RAINFALL EVENT REPORT**

**August 19, 2003**

prepared by  
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Senior Hydrologist  
Clark County Regional Flood Control District  
Clark County, Nevada

An incredibly intense thunderstorm dropped up to three inches of rainfall in northwest areas of the Las Vegas Valley and overwhelmed the capacity of some drainage facilities. The area with the most rainfall is roughly bounded on the north by Centennial Road, on the east by US-95, on the south by Sahara Avenue, and on the west by the Beltway. Within the fifty to sixty square mile area directly impacted by the most rainfall, five Regional Flood Control District automatic rain gages reported in excess of 2 inches of rainfall in approximately 90 minutes. In addition, a senior National Weather Service meteorologist reported measuring 2.30" of rain in a 20-30 minute period at his residence near Cheyenne and Fort Apache. At some District gages, rainfall depths and intensities measured during this storm exceeded those of the 100-year design storm adopted for use in sizing drainage facilities in this area.

The runoff from this rainfall turned many of the west-east roads in the Northwest area into rivers. Apparently some of the worst flooding was in Gowan Road east of US-95. It appears that the majority of that flow originated in Alexander Road, Craig Road and Lone Mountain Road. The floodwaters in those roadways flowed east to US-95, and then flowed south along US-95 to Gowan Road.

The flood control facilities that are in place appeared to function as designed. The Gowan South Detention Basin captured upwards of 400 acre-feet of runoff. The chute inlets on Gowan Road at the Upper and Lower Gowan North Detention Basins captured much of the runoff flowing down Gowan Road. The same is true of the chute inlet on Buckskin Road along the southern edge of the Lower Gowan South Basin. The Cheyenne Channel, Gowan North Channel, and Buffalo Channels were all flowing at least 2-3 feet deep.

While there were no major injuries reported as a result of this storm and the associated flooding, there were a number of both helicopter rescues and swift water rescues as commuters were trapped by the floodwaters. The City of Las Vegas has estimated \$1.2 - \$1.5 million in damages to public facilities. Clark County has estimated \$330,000 in damages to roadways. The City has also estimated that one home was destroyed, 37 suffered major damages, and 21 experienced minor damages as a result of this flood. No estimate of the cost of the damages to private properties was available at the time this report was written.

The following tables summarize the rainfall and flood volumes captured by the detention basins:

Lone Mountain Detention Basin

Maximum depth of water: 12 feet  
Maximum Depth of basin: 32 feet  
Volume captured: 50 acre-feet

Gowan South Detention Basin

Maximum depth of water: 18 feet  
Maximum Depth of basin: 24 feet  
Volume captured: 410 acre-feet

Gowan North Detention Basin

Maximum depth of water: 8 feet  
Maximum Depth of basin: 20 feet

Angel Park DB Detention Basin

Maximum depth of water: 6 feet  
Maximum depth of basin: 44 feet  
Volume captured: 40 acre-feet

Lakes DB (Desert Breeze Park)

Maximum Depth: 4 feet  
Maximum Depth of basin: 18 feet

All of the above information and measurements are preliminary and subject to field verification.

**Clark County Regional Flood Control District  
August 19,2003**

DeviceID	4029	4054	4269	4254	4259	4279	4234
Units	in	in	in	in	in	in	in
08/19/03							
1800	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1745	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1730	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1715	0.00	0.04	0.08	0.00	0.00	0.00	0.00
1700	0.04	0.00	0.12	0.08	0.04	0.12	0.16
1645	0.00	0.12	0.28	0.20	0.20	0.20	0.43
1630	0.08	0.08	0.39	0.24	0.12	0.39	0.55
1615	0.08	0.08	0.55	0.28	0.12	0.55	0.59
1600	0.35	0.75	0.87	0.20	0.00	1.02	0.28
1545	0.35	0.75	0.55	0.00	0.00	0.00	0.00
1530	0.00	0.28	0.00	0.00	0.00	0.00	0.00
1515	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>TOTALS:</b>	<b>0.91</b>	<b>2.09</b>	<b>2.83</b>	<b>0.98</b>	<b>0.47</b>	<b>2.28</b>	<b>2.01</b>

**4029 Kyle Canyon Detention Basin**

**4054 Lone Mtn near Hualapai (gravel pits)**

**4269 Lone Mountain Detention Basin (Alexander at Jensen)**

**4254 Lower Gowan North Detention Basin (Gowan at Tenaya)**

**4259 Gowan South Detention Basin (Cheyenne at Tenaya)**

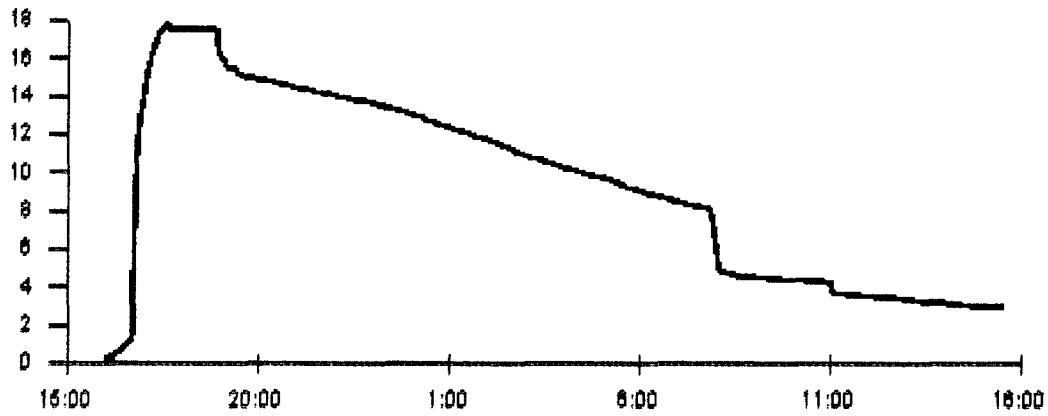
**4279 Gowan North Channel (Alexander near Durango)**

**4234 Smoke Ranch at Buffalo**

4258 Gowan South DB WL 8/19/2003 15:00 to 8/20/2003 4:00:00

Tabular Graph Options

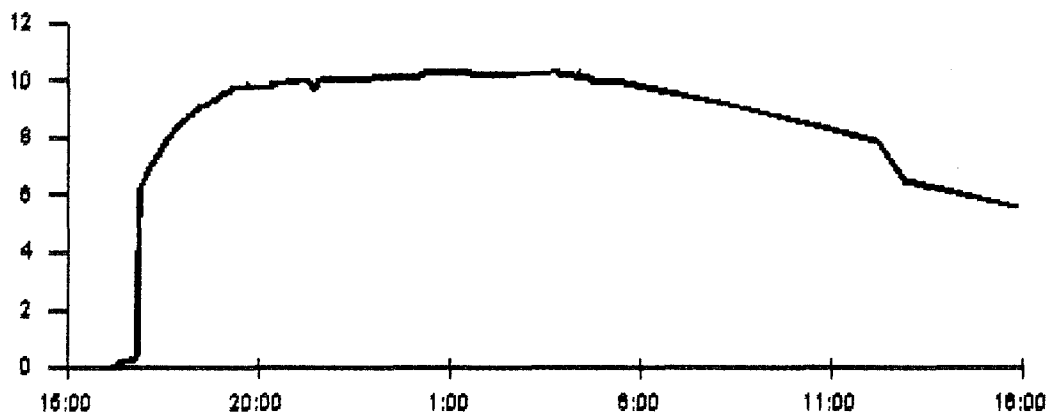
feet for 24 hours starting 8/19/2003 15:00



4253 Lower Gowan North Gowan DB WL 8/19/2003 15:00 to 8/20/2003 4:00:00

Tabular Graph Options

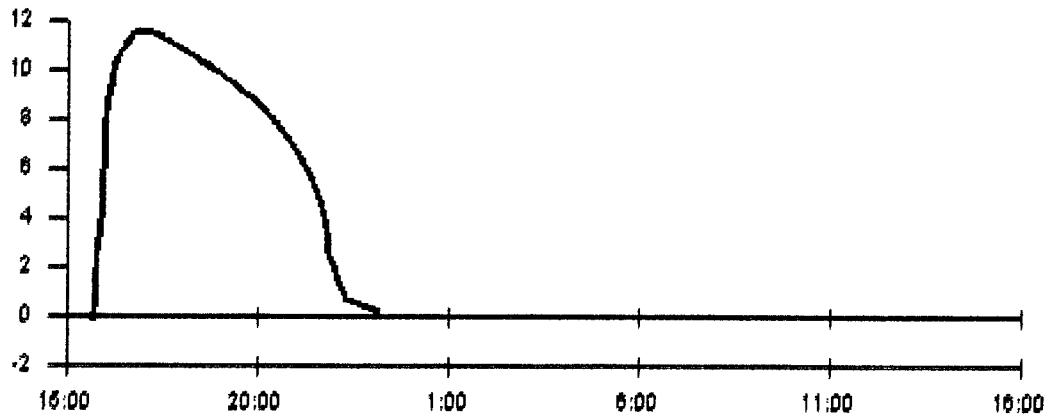
feet for 24 hours starting 8/19/2003 15:00



4268 Lone Mtn DB WL 8/19/2003 15:00 to 8/20/2003 4:00:00 PM

Tabular Graph Options

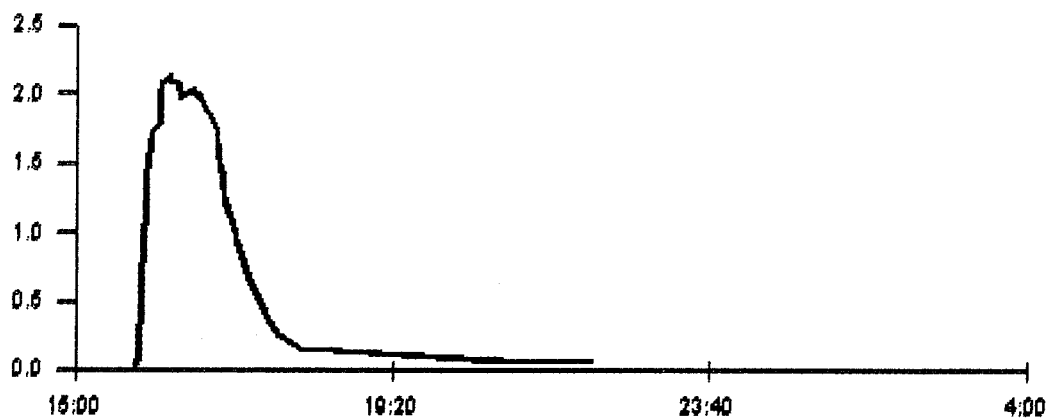
feet for 24 hours starting 8/19/2003 15:00



4278 Gowan North Channel WL 8/19/2003 15:00 to 8/20/2003 4:00:00 PM

Tabular Graph Options

ft for 12 hours starting 8/19/2003 15:00



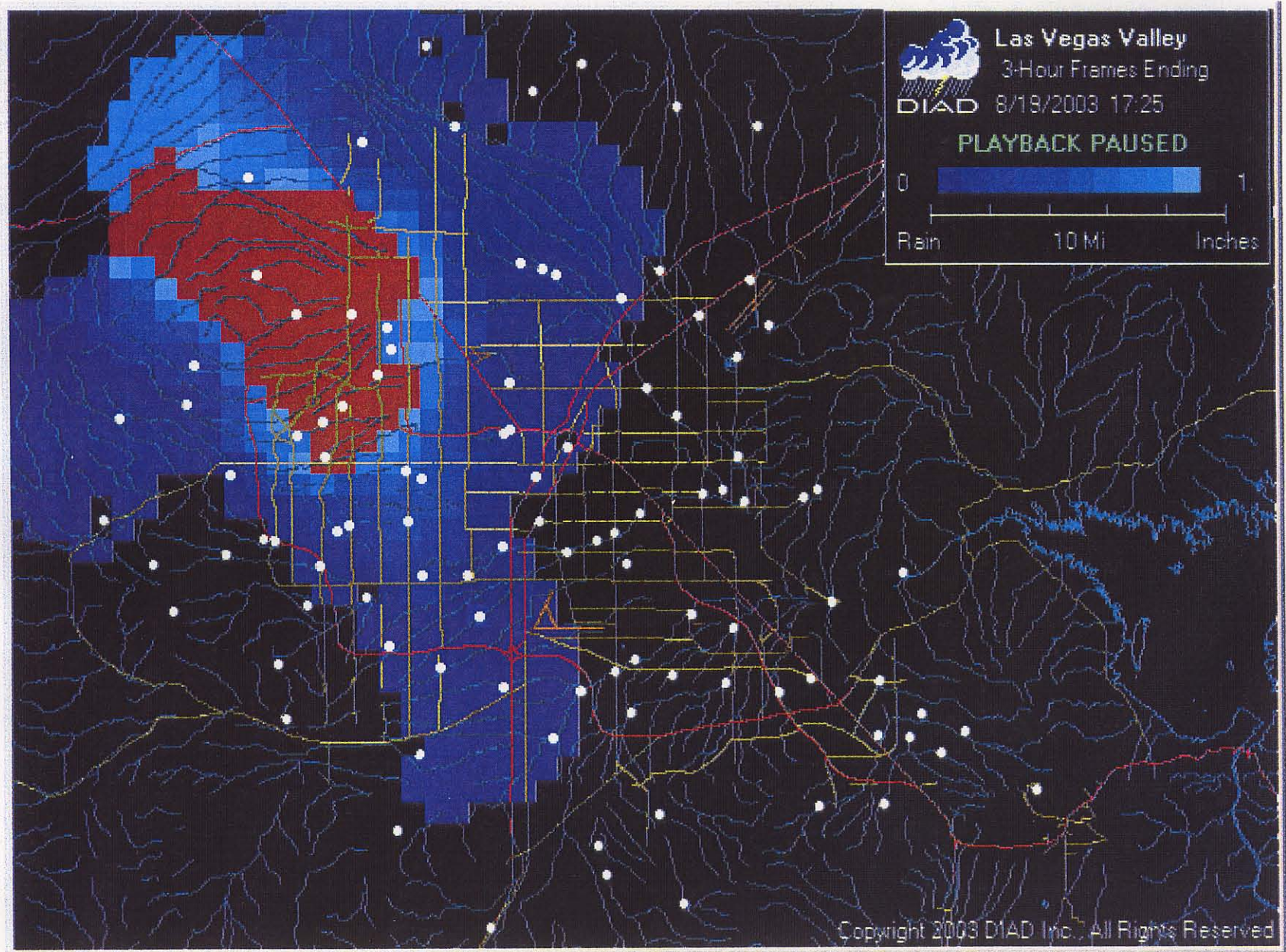


Figure 1. Approximate area receiving at least 1.0" of rain (RED) August 19, 2003.

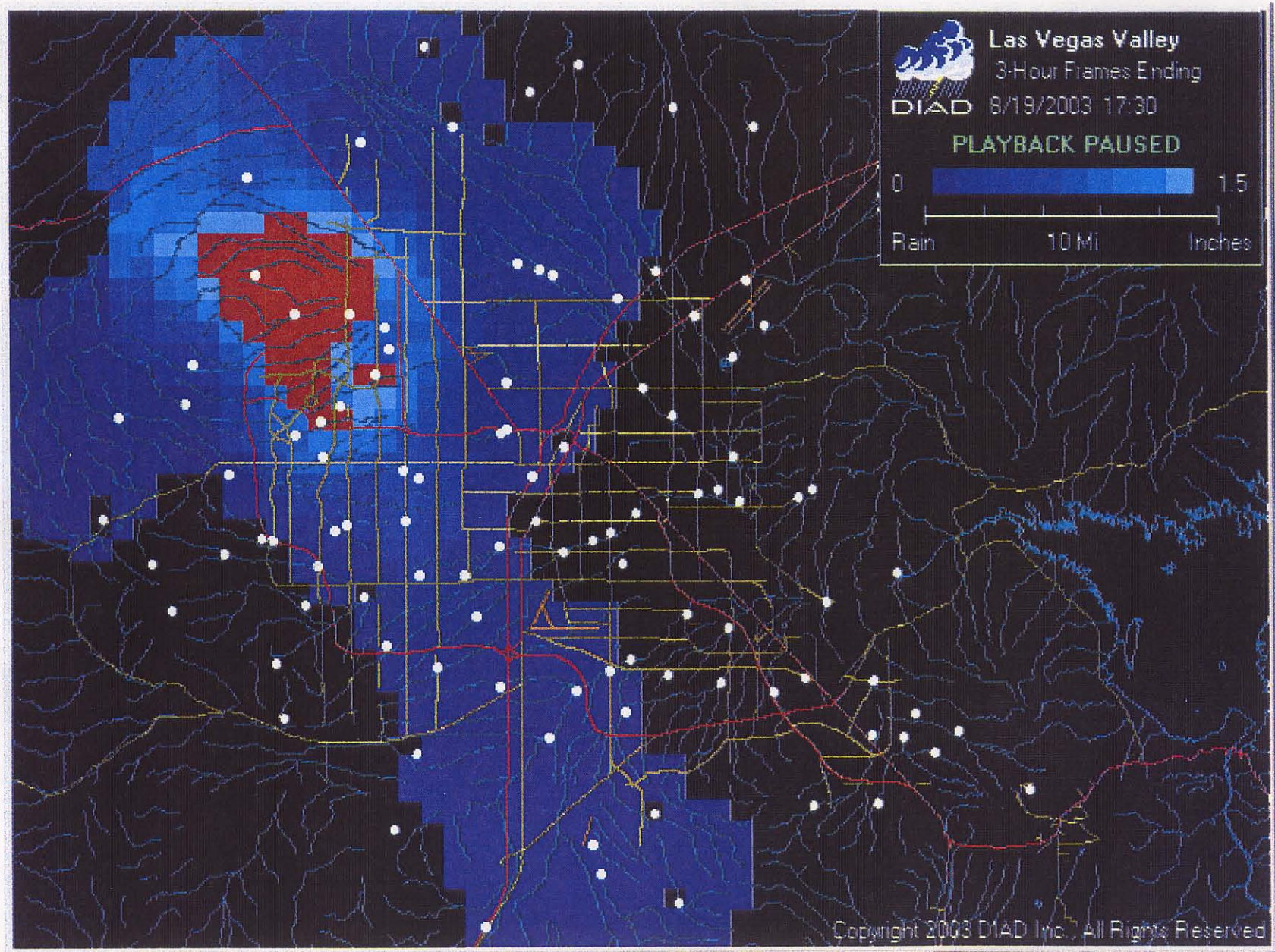


Figure 2. Approximate area receiving at least 1.5" of rain (RED) August 19, 2003.

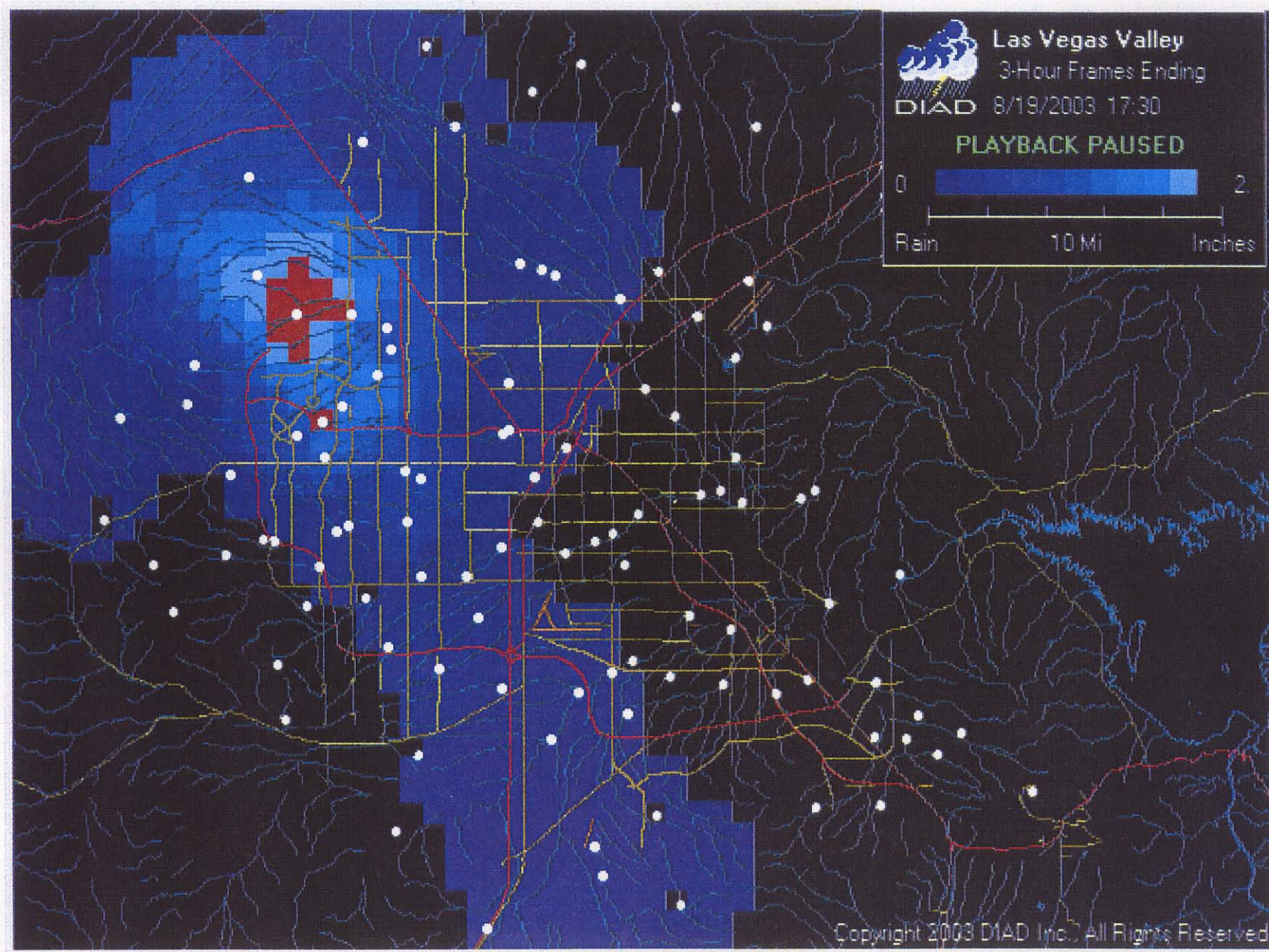


Figure 3. Approximate area receiving at least 2.0" of rain (RED) August 19, 2003.



# MEMORANDUM

GALE WM. FRASER, II, P.E.  
GENERAL MANAGER/CHIEF ENGINEER



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**TO:** Gale Fraser

**FROM:** Jill Reilly, P.E., Sr. Civil Engineer

**SUBJECT:** August 19, 2003 Storm Over Gowan Watershed

**DATE:** November 4, 2003

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Data collected by the District's network of rain gages within Clark County indicates that the most intense portion of the August 19, 2003 storm event was roughly centered over 49 square miles in Gowan watershed. Of the 15 rain gages in this area, five recorded over 2 inches of rain during the 90-minute storm. Rainfall data from the 15 gages was input into a Master Plan Update (MPU) hydrologic model (HEC-1) to determine how the August 19<sup>th</sup> event would impact proposed and existing regional facilities, and the watershed in general, under ultimate developed conditions. To demonstrate the significance of proposed facilities, subbasin runoff was rerouted in a second HEC-1 model to recreate flowpaths witnessed on August 19<sup>th</sup> assuming the same ultimate development land use. Following is a summary of the HEC-1 models created and findings based on results generated by the hydrologic models.

## **Ultimate Development / Future Condition** (all regional facilities in place)

The MPU HEC-1 model, ALLGOW5.DAT, prepared by PBS&J on February 28, 2001, was truncated to represent the watershed directly tributary to US 95 at Gowan Road downstream of Gowan Detention Basins. The 49-square mile study watershed has 119 subbasins within an area roughly bound by the Beltway on the north, US 95 on the east, Sahara Avenue on the south, and Spring Mountains on the west. Of the existing 15 rain gages that recorded rainfall influencing the study watershed, 6 gages are located outside the study area boundary, 2 are on the perimeter, and the remaining 7 gages are interior to the study area. The Thiessen Polygon method was used to determine the relative weight each gage had over a particular subbasin by establishing the proportion of a subbasin within each gage's area of influence. In the Thiessen Polygon method, the rainfall at any point in a watershed is assumed equal to the rainfall depth at the nearest gage. Hence, the influence of each gage is extended halfway to the next gage in every direction. **Map 1** shows the study watershed, rain gages, and Thiessen Polygon results.

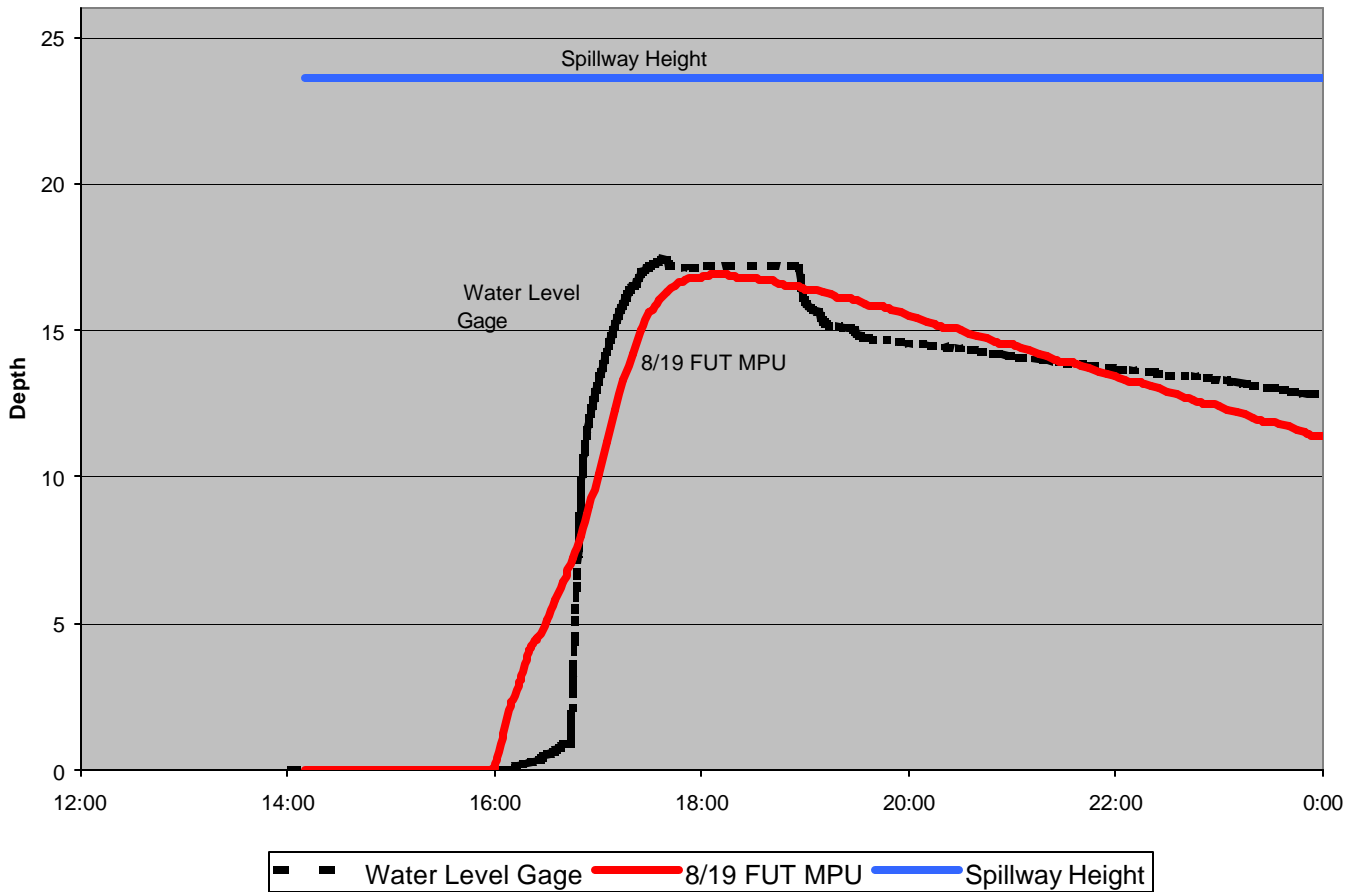
Gage identification and recorded incremental rainfall data (PR and PI records) replaced precipitation depth and distribution information (PB and PC records) in the truncated ALLGOW5.DAT model. Also, a time record was included to indicate that rainfall records began at 2:10 PM on August 19, 2003. This allows for a direct comparison of measured stormwater flow parameters with the hydrologic model output. The HEC-1 model was renamed 819GOW5.DAT and is henceforth referred to as 8/19FUTMPU Model.

The area draining to Gowan South Detention Basin is mostly developed and therefore satisfies the "ultimate development" assumption of the model. In addition, all regional flood control facilities in that area have been constructed so the Gowan South watershed also satisfies the "future condition" assumption. The accuracy of the 8/19FUTMPU Model was validated by comparing water level gage data recorded at the basin to the basin stage distribution generated by the hydrologic model. **Figure 1** illustrates that actual runoff reaching Gowan



South Detention Basin is effectively represented in the 8/19FUTMPU Model. Results are summarized in **Table 1** and published MPU characteristics are provided for comparison.

**Gowan South Detention Basin  
August 19, 2003**



**Figure 1**

<b>Table 1 – Gowan South Detention Basin</b>			
<b>Characteristic</b>	<b>Gage Data</b>	<b>8/19FUTMPU</b>	<b>MPU</b>
Peak Volume	410 ac ft	375 ac ft	700 ac ft
Peak Stage	17.8 ft	16.9 ft	23.6 ft <sup>1</sup>
Peak Inflow	4000 cfs (avg) <sup>2</sup>	5004 cfs	5820 cfs
Peak Outflow	418 cfs	407 cfs	452 cfs

<sup>1</sup> Peak Stage represents spillway height, no freeboard

<sup>2</sup> Estimated average inflow into Basin during 1 hour was 4000 cfs.

Because of the reasonable agreement between gage data and hydrologic model output, it is assumed that the 8/19FUTMPU Model also accurately represents other areas within Gowan Watershed; in particular, the area contributing flow to Gowan North Detention Basin and Gowan Road at US 95. The 8/19FUTMPU Model shows that had the August 19<sup>th</sup> event occurred over a fully developed watershed with all regional flood control



facilities in place, flow in Gowan Road at US 95 would have been approximately 684 cfs rather than the estimated 3000 cfs based on normal depth calculations. Future Master Plan channels and storm drains would have conveyed about twice the volume of water to Gowan North Detention Basin than was delivered by flood control facilities in place as of August 19, 2003. Although the August 19<sup>th</sup> storm was more intense than the District’s design standard, the 8/19FUTMPU Model indicates that regional facilities, both existing and proposed for the study watershed, have or will have adequate capacity if a similar event occurs over a fully developed watershed with the following exceptions:

- Peak inflow into Gowan North Detention Basin (GONO 0008) is about 700 cfs or 15% greater than shown in the MPU, however, only two inflow facilities show higher peak flowates than published in the MPU. The greater intensity and “flashy” nature of the August 19<sup>th</sup> event may explain the higher peak inflow into the basin. In spite of the increased peak inflow, runoff volume generated by the 8/19FUTMPU Model is only 58% of the volume available in Gowan North Detention Basin. Approximately 6 feet of freeboard remains at the spillway according to the 8/19FUTMPU Model.
- Design capacity is exceeded by 18% in the storm drain proposed in Alexander Road at Durango Drive (GOLM 0000), however, 100% level of completion drawings indicate that the hydraulic grade line may increase three feet and still meet District criteria.
- The capacity of Gowan North Channel at Buffalo Drive (GONO 0008) is exceeded by almost 6%, however, typical freeboard allowance should accommodate the additional 266 cfs shown to reach Gowan North Channel in the 8/19FUTMPU Model.

A summary of 8/19FUTMPU Model results is presented in **Tables 2, 2a, and 3**. Bold **EX** signifies existing facilities. **Map 2** shows the routing directions with all MPU facilities in place.

<b>Table 2 - Gowan North Detention Basin</b>			
<b>Characteristic</b>	<b>Gage Data</b>	<b>8/19FUTMPU</b>	<b>MPU</b>
Peak Volume	265 ac ft	562 ac ft	960 ac ft
Peak Stage	10.4 ft	14.2 ft	20 ft <sup>1</sup>
Peak Inflow	3600 cfs (avg) <sup>2</sup>	5360 cfs	4649 cfs
Peak Outflow	341 cfs	447 cfs	508 cfs

<b>Table 2a - Gowan Road at US 95</b>			
	<b>Estimated</b>	<b>8/19FUTMPU</b>	<b>MPU</b>
Total Flow	3341 cfs	1131 cfs	681 cfs
Flow in 8' x 5' RCB	341 cfs	447 cfs	560 cfs
Flow in Gowan East of 95	3000 cfs	684 cfs	121 cfs

<sup>1</sup> Peak Stage represents spillway height, no freeboard

<sup>2</sup> Estimated average inflow into Basin during ½ hour was 3600 cfs.

Facility	8/19FUTMPU	MPU
Grand Canyon @ Ann (GONO 0436)	631 cfs	1138 cfs
Grand Canyon @ Lone Mtn (GONO 0335)	855 cfs	1449 cfs
El Capitan @ Ann (GOEC 0100)	504 cfs	763 cfs
El Capitan @ Lone Mtn (GOEC 0000)	869 cfs	1243 cfs
Lone Mtn @ El Capitan (GONO 0234)	856 cfs	1449 cfs
GN III Channel @ El Capitan (GONO 0183)	1694 cfs	2830 cfs
GN III Channel @ Alexander (GONO 0117)	2516 cfs	3300 cfs
Gowan North – Buffalo Branch (GOBU 0000)	928 cfs	988 cfs
Alexander @ Durango (GOLM 0000)	<b>412</b> cfs	349 cfs
GN Channel @ Durango (GONO 0063) <b>EX</b>	4058 cfs	4183 cfs
GN Channel @ GNDB (GONO 0008) <b>EX</b>	<b>4915</b> cfs	4649 cfs
Cheyenne Ch @ Buffalo (GO02 0015) <b>EX</b>	2241 cfs	5100 cfs
Buffalo Ch @ Smoke Rch (GOSO 0123) <b>EX</b>	2758 cfs	3712 cfs

### Ultimate Development / Existing Regional Facilities

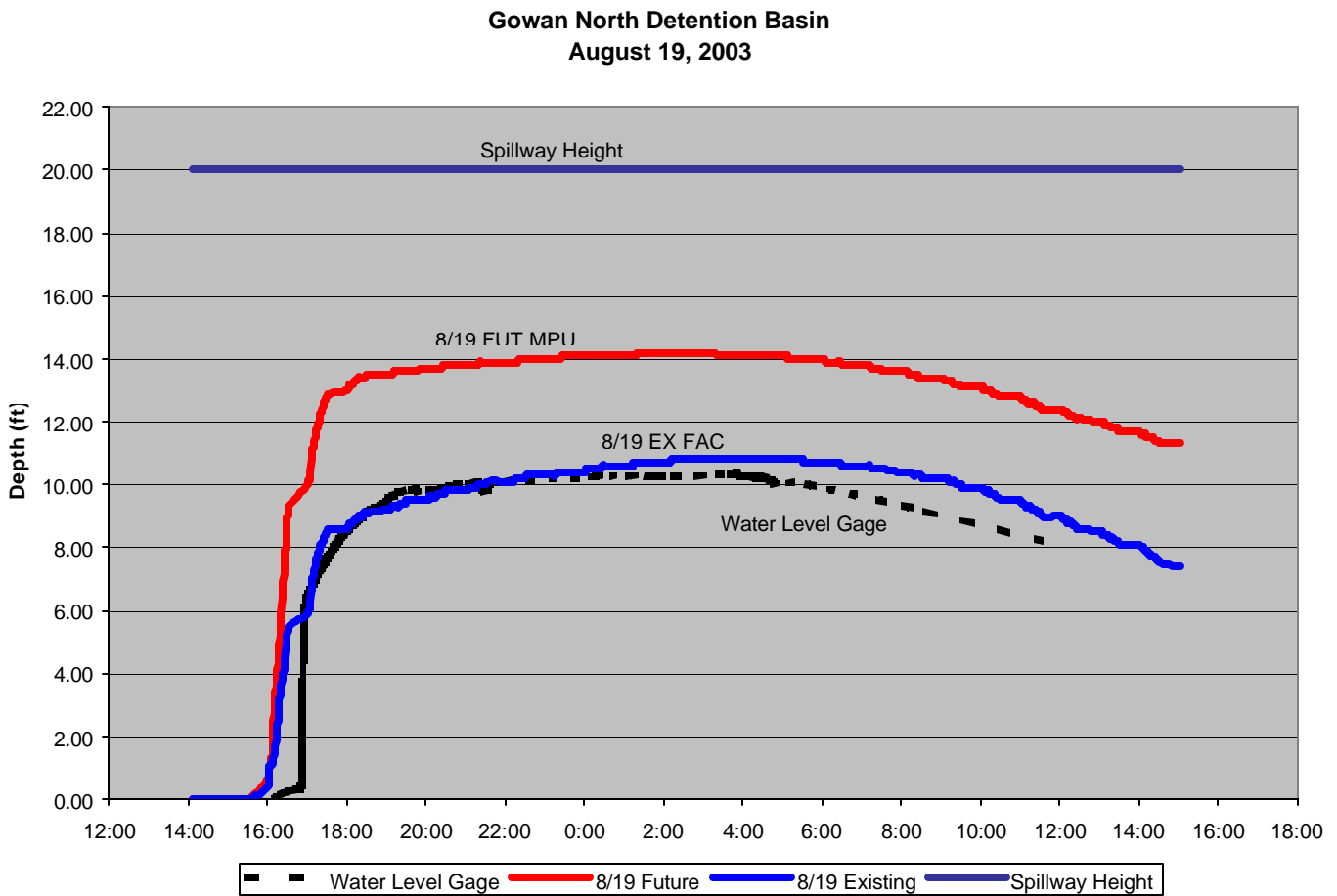
A second HEC-1 model was prepared to recreate drainage patterns witnessed during the August 19, 2003 storm to examine the impact such an event would have on a fully developed watershed without proposed regional facilities in place. Future facilities listed in **Table 4** were deleted from the 8/19FUTMPU Model. Runoff tributary to Gowan North Detention Basin from the north was generally routed south to the nearest half section line (80-ft wide) or section line (100-ft wide) roadway, and then routed east to US 95. As a result, Subbasins BWHW1-C and BSFR-C were removed from the model because runoff flowed east on Centennial Parkway toward Rancho Detention Basin. Beltway drainage facilities were assumed functional for routing flow east and south. Three subbasins west of Lone Mountain Detention Basin were routed around Lone Mountain to Craig Road based on reports that flow bypassed the detention basin in the absence of future regional flood control facilities GOLM 0246 – 0289. Hydrograph routing for subbasins tributary to Gowan South Detention Basin was not altered. **Map 3** shows the revised routing. The second hydrologic model, 819GOWEX.DAT, is referred to as 8/19EXMPU Model in this report. As a reminder, 8/19EXMPU Model represents a fully developed watershed with existing regional facilities.

CAM-10 Detention Basin and Outfall	GOAN 0000 – 0065
Gowan North System – Grand Canyon Drive	GONO 0335 – 0511
Gowan Beltway West – Lone Mountain Road	GOBW 0000
Gowan North System – Lone Mountain Road	GONO 0234
Gowan North – El Capitan Branch	GOEC 0000 – 0176
Gowan North System Phase III – Lone Mountain Road to Alexander Road	GONO 0117 – 0183
Gowan Lone Mountain System – Channel West of Beltway	GOLM 0246 – 0289
Gowan Lone Mountain System – Lone Mountain Detention Basin Outfall	GOLM 0000 – 0101
Gowan North – Buffalo Branch	GOBU 0000 - 0136

Because the 8/19EXMPU Model represents a fully developed watershed, model output should produce higher flowrates since losses typically decrease with development. Peak flow at US 95 and Gowan Road increased as expected since subbasins north of Alexander Road are generally sparsely developed although roadways are



graded and mostly paved. In the absence of regional flood control facilities in this area, rainfall runoff flowed east in roadways toward US 95 on August 19, 2003. In general, subbasins draining north to Alexander Road or directly into Gowan North Detention Basin are fully developed and are therefore appropriately represented in the 8/19EXMPTU Model. As such, the model generated a remarkably similar stage distribution to that recorded on the water level gage at Gowan North Detention Basin. Because the 8/19EXMPTU Model reproduced the stage distribution in Gowan North Detention Basin, it can be deduced that routing assumptions to the basin and US 95 are representative of what occurred during the actual event. **Figure 2** shows how comparable the water level gage data is to the stage information generated in the 8/19EXMPTU Model. **Figure 2** also shows the deeper pool that would have resulted in Gowan North Detention Basin if all regional facilities were in place.



**Figure 2**

As mentioned previously, twice the volume of water would have been impounded in Gowan North Detention Basin had all drainage facilities identified in the Master Plan been in place and functional. **Table 5** summarizes the results of 8/19EXMPTU Model with respect to Gowan North Detention Basin. Gowan South Detention Basin results were identical to the 8/19FUTMPTU Model.



<b>Characteristic</b>	<b>Gage Data</b>	<b>8/19EXMPU</b>
Peak Volume	265 ac ft	346 ac ft
Peak Stage	10.4 ft	10.8 ft
Peak Inflow	3600 cfs (avg) <sup>1</sup>	2581 cfs
Peak Outflow	341 cfs	365 cfs
<b>Peak Flow East of US 95/Gowan</b>		<b>5167 cfs</b>

<sup>1</sup> Estimated average inflow into Basin during ½ hour was 3600 cfs.

If subbasins north of Alexander Road were fully developed when the August 19<sup>th</sup> event occurred, the 8/19EXMPU Model shows that approximately 5000 cfs would have collected in Gowan Road east of US 95. The model does not account for flow that encroached on US 95 upstream of Gowan Road on August 19, 2003, so 5167 cfs is slightly higher than what is likely to occur under ultimate developed conditions.

## Conclusion

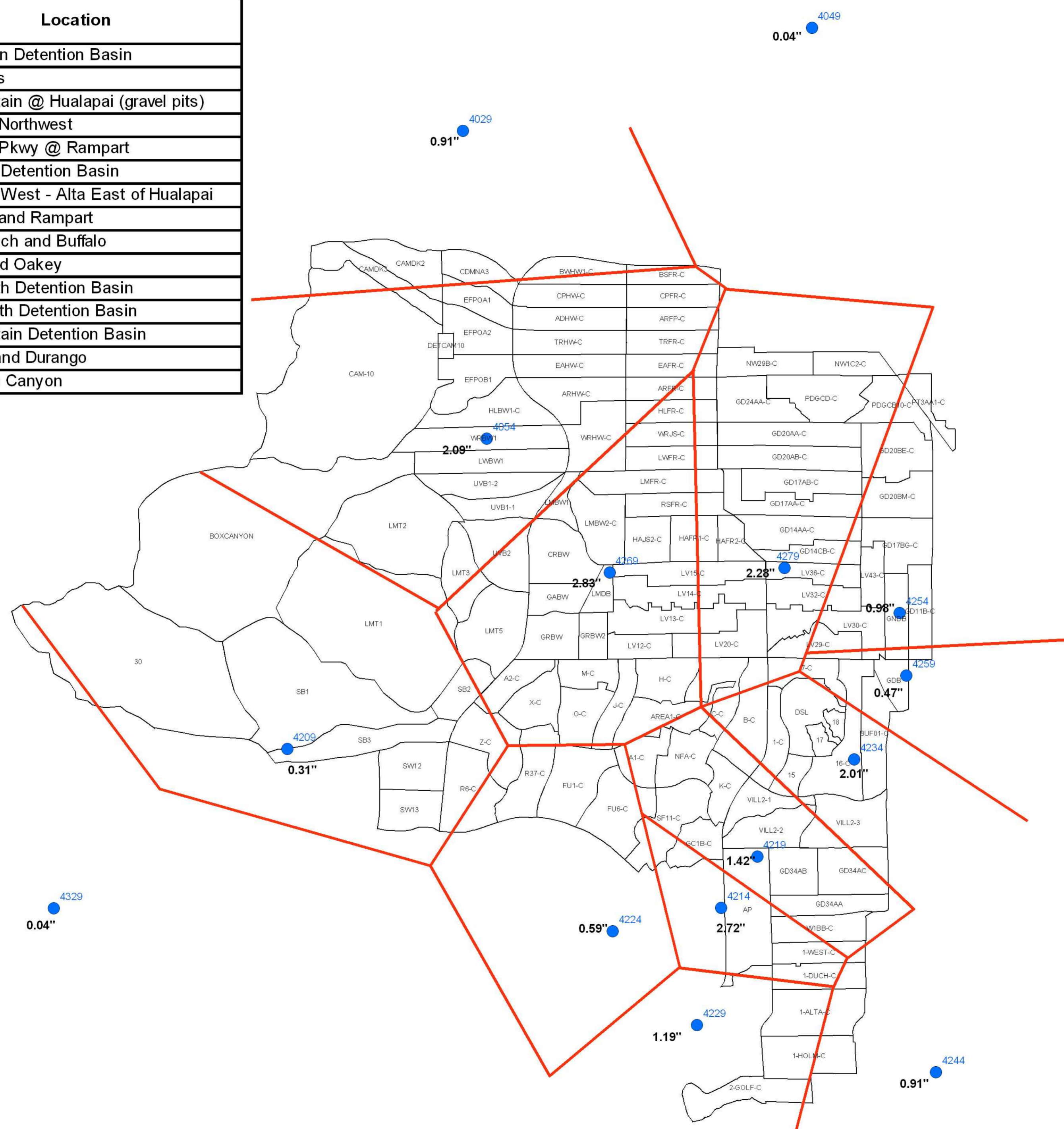
Although the August 19<sup>th</sup> event was more intense than the District's 100-year, 6-hour design storms, the 90 minutes of intense precipitation did not generate the volume of runoff equivalent to a 100-year event at Gowan Detention Basins, assuming all Master Planned facilities were constructed. Based on results generated by the hydrologic models using actual rain gage data, the August 19, 2003 storm event did not overwhelm existing facilities, nor would it overwhelm future facilities if the same storm occurs when Gowan Watershed is fully developed and all regional facilities are constructed. However, because several regional facilities north of Alexander Road are not yet constructed, peak runoff flowrates exceeded 100-year values in Gowan Road east of US 95 on August 19, 2003.

Further, correlation of District gage data with actual rainfall input into MPU model ALLGOW5.DAT without additional modifications indicates that the HEC-1 model is an accurate representation of ultimate conditions for Gowan Watershed. In addition, curve numbers tabulated in the District's *Hydrologic Criteria and Drainage Design Manual* appear to properly characterize losses in urban areas.

## Acknowledgements

Stephen C. Altman, P.E., PBS&J – MPU ALLGOW5.DAT HEC-1 Model preparation  
 Stan Clawson, Systems Administrator – Map preparation.  
 James Corney, Engineer Intern – Rain gage distribution and routing calculations.  
 Tim Sutko, Environmental Mitigation Manager – Gage data.

Rain Gage Precipitation (P) Totals and Location		
Gage	Total P (in)	Location
4029	0.91	Kyle Canyon Detention Basin
4049	0.04	Tule Springs
4054	2.09	Lone Mountain @ Hualapai (gravel pits)
4209	0.31	Summerlin Northwest
4214	2.72	Summerlin Pkwy @ Rampart
4219	1.42	Angel Park Detention Basin
4224	0.59	Angel Park West - Alta East of Hualapai
4229	1.19	Charleston and Rampart
4234	2.01	Smoke Ranch and Buffalo
4244	0.91	Rainbow and Oakey
4254	0.98	Gowan North Detention Basin
4259	0.47	Gowan South Detention Basin
4269	2.83	Lone Mountain Detention Basin
4279	2.28	Alexander and Durango
4329	0.04	Brownstone Canyon



# Gowan Study Watershed

## Thiessen Polygons Rain Gage Stations

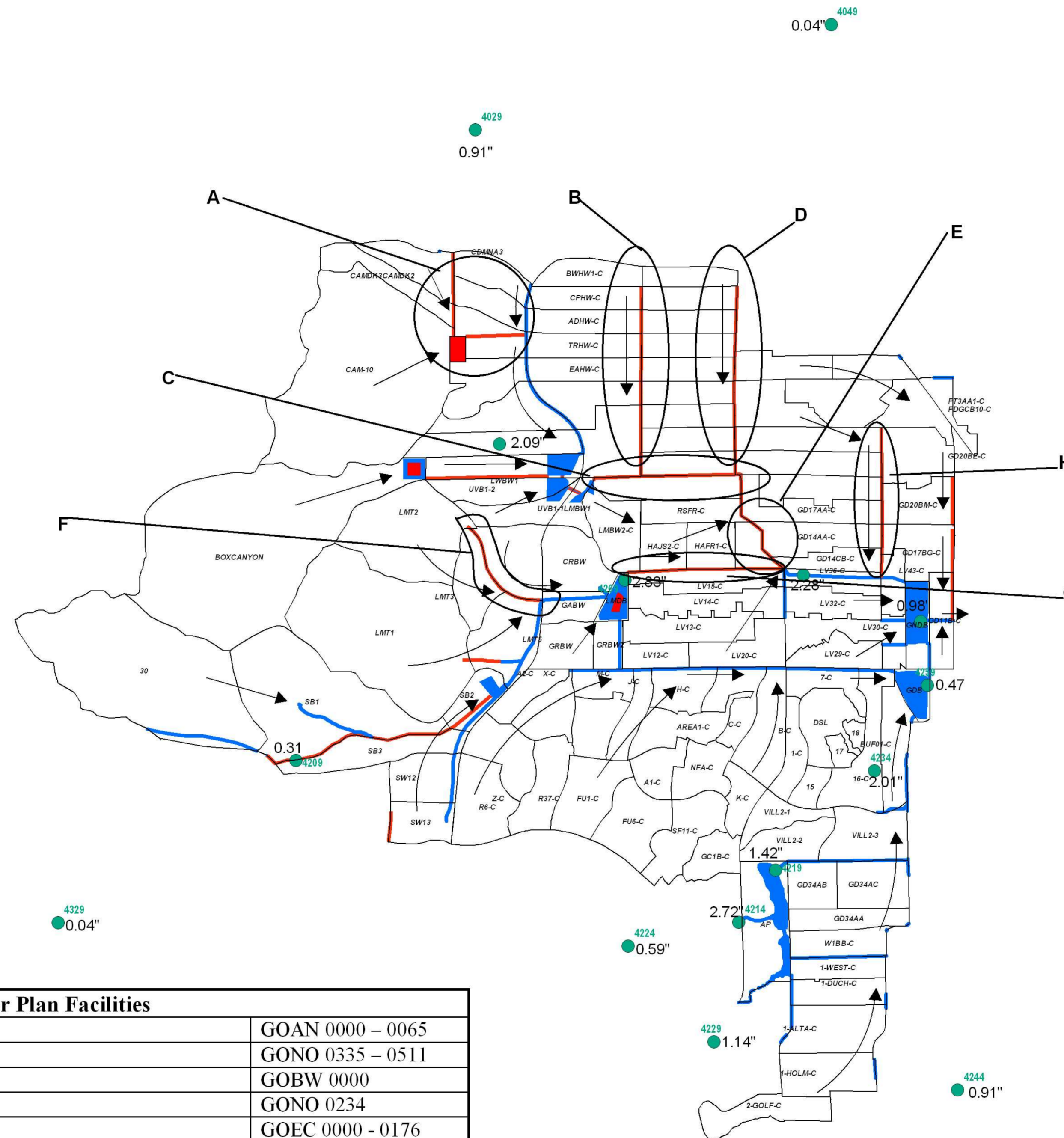
**Legend**

- Thiessen Polygon
- Rain Gage Station



Map 1

# Gowan Study Watershed Future Flowpaths



**Legend**

**Detention Basins STATUS**

- Completed (Blue square)
- Planned (Red square)

**Conveyances STATUS**

- Completed (Blue line)
- Planned (Red line)

Rain Gage Stations (Green dot)

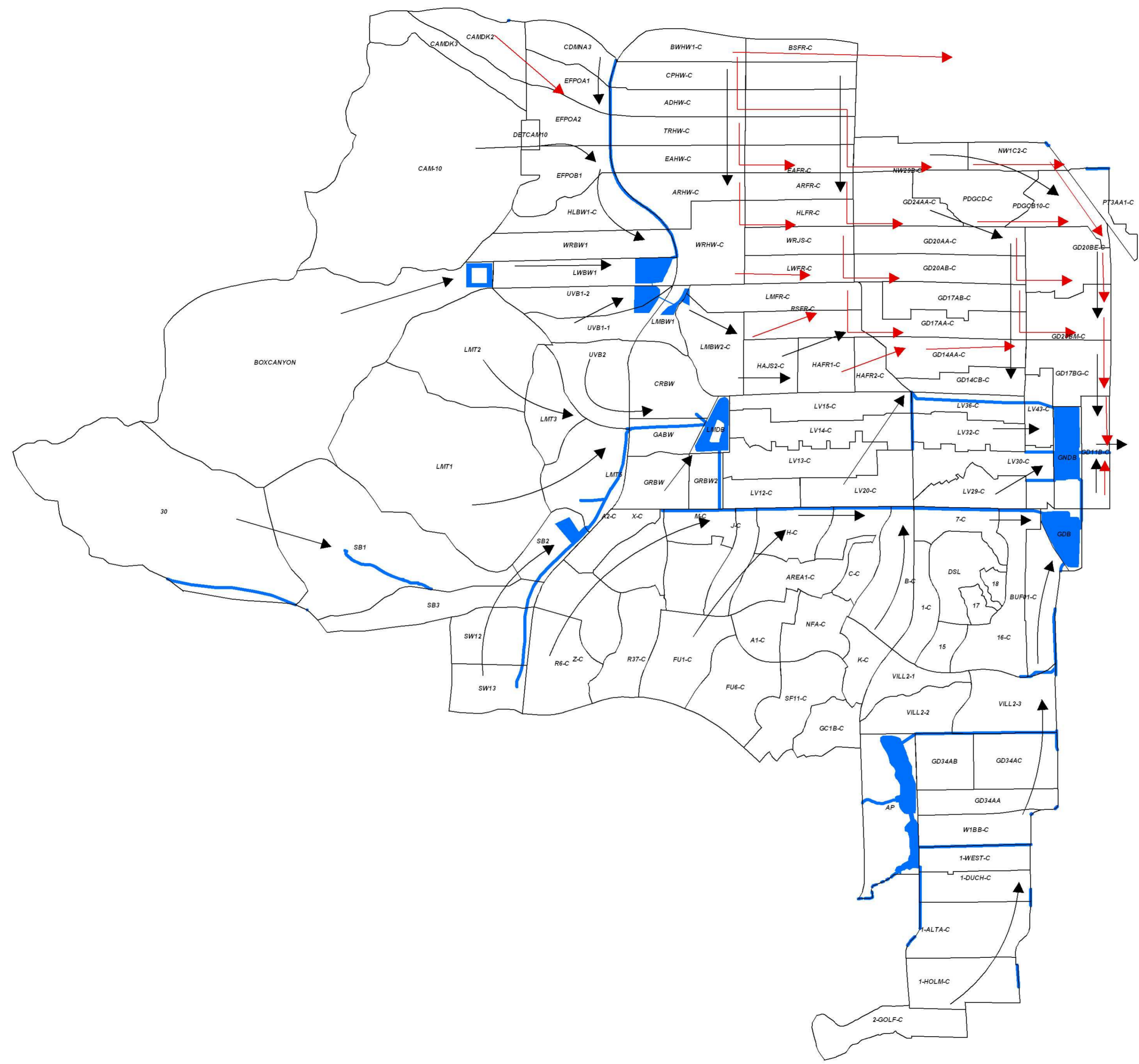
Future Master Plan Facilities		
A	CAM-10 Detention Basin and Outfall	GOAN 0000 – 0065
B	Gowan North System – Grand Canyon Drive	GONO 0335 – 0511
C	Gowan Beltway West – Lone Mountain Road	GOBW 0000
	Gowan North System – Lone Mountain Road	GONO 0234
D	Gowan North – El Capitan Branch	GOEC 0000 - 0176
E	Gowan North System Phase III Lone Mountain Road to Alexander Road	GONO 0117 – 0183
F	Gowan Lone Mountain System – Channel West of Beltway	GOLM 0246 – 0289
G	Gowan Lone Mountain System – Lone Mountain Detention Basin Outfall	GOLM 0000 – 0101
H	Gowan North – Buffalo Branch	GOBU 0000 - 0136



Map 2



# Gowan Study Watershed Existing Flowpaths



## Legend



## Flowpaths



Map 3