

Appendix G
Surface Water
Budgets

Table G-1 Water Budget for the North Subregion, Median Conditions

Component	Amount (ac-ft/yr)					
	Surface Water					Groundwater
	Rio Grande Tributaries				Costilla Creek ^{m,n}	
	Latir Creek ^j	RedRiver ^k	Cabresto Creek ^l	Total Rio Grande Tributaries Only		
Inflow						
Stream Inflow	3,660	28,380	6,884	38,924	21,796	
Recharge ^a						35,378.4
Stream Gain ^b				15,463	8,088	
Return Flow Municipal ^c				0	0	409.1
Return Flow Commercial ^d				4	0	4.5
Return Flow Domestic ^c				0	0	97.7
Return Flow Mining ^d				427	0	2,140.2
Return Flow Irrigation ^d				10,984	8,519	448.0
Total Inflow				65,802	38,403	38,477.9
Outflow						
Municipal ^e		91		91	0	802.4
Commercial ^d				5	0	35.8
Domestic ^e				0	0	195.5
Irrigation ^d				15,692	12,170	1,280.0
Industrial ^d				0	0	0.0
Livestock ^d				12	0	17.9
Mining ^d				515	0	2,578.6
Power ^d				0	0	0.0
Riparian ET ^f		693	98	790	971	2,159.6
Open Water Evap ^g		1		1	140	1,623.3
Springs flow ^h						23,551.2
Sub-flow out ⁱ		48,695		48,695	25,122	6,233.7
Total Outflow				65,802	38,403	38,477.9
Balance				0	0	0.0

Shaded cells = no estimate or not applicable

^a DBS&A calculation (Table 7-7)

^b DBS&A calc to balance surface water budget

^c DBS&A estimate (Table F1-2), usually 50% of diversions

^d Wilson et al., 2003

^e DBS&A estimate (Table 6-2)

^f DBS&A estimate (Tables 7-3 and 7-8, amount between gages applied to surface water budget)

^g DBS&A estimate (Tables 7-2 and 7-6)

^h DBS&A estimate based on water balance in surface water budget

ⁱ DBS&A estimate to balance groundwater budget, matches water table contours

^j Median Flow 1945-1970 (Table 7-1)

^k Inflow is median flow, Red River near Questa 1990-2004, outflow is Red River below Fish Hatchery (Table 7-1)

^l Median flow 1944-1995 (Table 7-1)

^m Inflow is median value for three gages:08252500, 08253000 and 08253500 (Table 7-1)

ⁿ Outflow is median value for Costilla Creek near Costilla minus the surface water depletions below gages as estimated from gage on Acequia Madre and Cerro Canal

Table G-2. Water Budget for the North Subregion, Drought Conditions

Component	Amount (ac-ft/yr)					
	Surface Water					Groundwater
	Rio Grande Tributaries				Costilla Creek ^{m,n}	
	Latir Creek ^j	RedRiver ^k	Cabresto Creek ^l	Total Rio Grande Tributaries Only		
Inflow						
Stream Inflow	1,919	6,856	3,765	12,539	4,644	
Recharge ^a						35,378.4
Stream Gain ^b				15,463	8,088	
Return Flow Municipal ^c				0	0	409.1
Return Flow Commercial ^d				4	0	4.5
Return Flow Domestic ^c				0	0	97.7
Return Flow Mining ^d				427	0	2,140.2
Return Flow Irrigation ^d				4,920	2,596	448.0
Total Inflow		6,856		33,354	15,329	38,477.9
Outflow						
Municipal ^e		91		91	0	802.4
Commercial ^d				5	0	35.8
Domestic ^e				0	0	195.5
Irrigation ^d				15,692	12,170	1,280.0
Industrial ^d				0	0	0.0
Livestock ^d				12	0	17.9
Mining ^d				515	0	2,578.6
Power ^d				0	0	0.0
Riparian ET ^f		693	98	790	971	2,159.6
Open Water Evap ^g		1		1	140	1,623.3
Springs flow ^h						23,551.2
Sub-flow out ⁱ		23,312		23,312	8,447	6,233.7
Total Outflow		24,097		40,419	21,728	38,477.9
Balance		-17,241		-7,065	-6,399	0.0

Shaded cells = no estimate or not applicable

^a DBS&A calculation (Table 7-7)

^b DBS&A calc to balance surface water budget

^c DBS&A estimate (Table F1-2), usually 50% of diversions

^d Wilson et al., 2003

^e DBS&A estimate (Table 6-2)

^f DBS&A estimate (Tables 7-3 and 7-8, amount between gages applied to surface water budget)

^g DBS&A estimate (Tables 7-2 and 7-6)

^h DBS&A estimate based on water balance in surface water budget in average year

ⁱ DBS&A estimate to balance groundwater budget, matches water table contours

^j Lowest recorded flow in 1956 (Table 7-1)

^k Inflow is 2002 flow, Red River near Questa 1990-2004, outflow is 2002 flow Red River below Fish Hatchery (Table 7-1)

^l Lowest recorded flow 1956 (Table 7-1)

^m Inflow is 2002 flow for three gages:08252500, 08253000 and 08253500 (Table 7-1)

ⁿ Outflow is 2002 flow for Costilla Creek near Costilla minus the surface water depletions below gages as estimated from gage on Acequia Madre and Cerro Canal

Table G-3. Water Budget for the Central Subregion, Median Conditions

Component	Amount (ac-ft/yr)								
	Surface Water								Groundwater
	Rio Hondo ^m	Rio Pueblo de Taos Tributaries						Surface Water Total	
		Arroyo Seco ⁿ	Rio Lucero ^o	Rio Fernando ^p	Rio Grande del Rancho ^q	Rio Pueblo de Taos ^r	Total Rio Pueblo de Taos 1990-2004		
Inflow									
Stream Inflow	22,877	1,488	15,131	2,353	12,959	16,724	48,654	71,531.8	
Recharge ^a									25,923.8
Stream Gain from Springs ^b	611						18,645	19,255.7	
Return Flow Municipal ^c	0	0	0	0	0	0	0	0.0	780.1
Return Flow Commercial ^d							180	180.5	21.0
Return Flow Domestic ^c	0	0	0	0	0	0	0	0.0	567.7
Return Flow Mining ^d	0	0	0	0	0	0	0	0.0	0.0
Return Flow Irrigation ^e	4,490	305	2,405	534	1,856	1,702	6,801	11,290.9	12,269.5
Total Inflow	27,978	1,793	17,536	2,886	14,815	18,426	74,281	102,258.9	39,562.1
Outflow									
Municipal ^f		0	0	0	0	0		0.0	1,560.2
Commercial ^d							201	200.5	148.4
Domestic ^f		0	0	0	0	0	0	0.0	1,135.4
Irrigation ^g	11,225	1,336	10,549	2,340	8,139	7,465	29,829	41,053.6	350.0
Industrial ^d							0	0.0	2.5
Livestock ^d							12	12.1	17.9
Mining ^d							0	0.0	0.04
Power ^d							0	0.0	0.0
Riparian ET ^h	210		62	17	283	179	541	751.4	3,593.1
Open Water Evap ⁱ		0	553	0	0	4	557	557.1	399.3
Spring flow ^j									17,455.0
Stream loss ^k	1,919	457	3,607	800	2,783	2,553	10,200	12,119.4	
Sub-flow out ^l	14,624					32,940	32,940	47,564.6	14,900.0
Total Outflow	27,978	1,793	14,771	3,158	11,205	43,141	74,281	102,258.8	39,561.7
Balance	0.10	0.04	2,765	-271	3,609	-24,715	0.00	0.1	0.4

Shaded cells = no estimate or not applicable

Table G-3. Water Budget for the Central Subregion, Median Conditions

^a DBS&A calculation (Table 7-7)

^b DBS&A calc to balance surface water budget

^c DBS&A estimate (Table 6-2), usually 50% of diversions

^d Wilson et al., 2003

^e Bellinger, 2004. 27.5% of Surface water diversions applied to SW budget, 29.5% applied to GW budget. GW budget also includes return flow from GW pumping.

^f DBS&A estimate (Table 6-2)

^g Wilson et al., 2003 for GW diversions, Bellinger, 2004 for SW diversions

^h DBS&A estimate (Tables 7-3 and 7-8), amount between gages applied to surface water budget

ⁱ DBS&A estimate (Table 7-2 and 7-6)

^j DBS&A estimate to balance groundwater budget

^k Bellinger et al., 2004 recharge to groundwater from streams

^l Burck et al., 2004 estimated flow to the Rio Grande from groundwater/ gaged flow in streams

^m Inflow is median flow 1990-2004 at Valdez gage, outflow is median flow at Arroyo Hondo gage 1913-1985 (Table 7-1)

ⁿ Inflow is based on balancing surface water budget on Arroyo Seco

^o Median flow 1990-2004 Rio Lucero near Arroyo Seco (Table 7-1)

^p Median flow 1963-1980 for Rio Fernando de Taos near Taos (Table 7-1)

^q Median flow 1990-2004 Rio Grande del Rancho near Talpa

^r Median flow 1990-2004 Rio Pueblo de Taos near Tao, outflow median for Rio Pueblo de Taos below Los Cordovas

Table G-4. Water Budget for Central Subregion, Drought Conditions

Component	Amount (ac-ft/yr)								
	Surface Water								Groundwater
	Rio Pueblo de Taos Tributaries							Surface Water Total	
	Rio Hondo ^m	Arroyo Seco ⁿ	Rio Lucero ^o	Rio Fernando ^p	Rio Grande del Rancho ^q	Rio Pueblo de Taos ^r	Total Rio Pueblo de Taos 2002		
Inflow									
Stream Inflow	6,617	1,488	3,620	760	2,114	3,526	11,508	18,124.8	
Recharge ^a									25,923.8
Stream Gain from Springs ^b	611						18,645	19,255.7	
Return Flow Municipal ^c	0	0	0	0	0	0	0	0.0	780.1
Return Flow Commercial ^d	0						181	180.5	21.0
Return Flow Domestic ^c	0	0	0	0	0	0	0	0.0	567.7
Return Flow Mining ^d	0	0	0	0	0	0	0	0.0	0.0
Return Flow Irrigation ^e	1,569	73	575	172	303	343	1,467	3,035.6	12,269.5
Total Inflow	8,797	1,561	4,195	933	2,417	3,869	31,619	40,596.5	39,562.1
Outflow									
Municipal ^f	0	0	0	0	0	0	0	0.0	1,560.2
Commercial ^d	0						201	200.5	148.4
Domestic ^f	0	0	0	0	0	0	0	0.0	1,135.4
Irrigation ^g	11,225	1,336	10,549	2,340	8,139	7,465	29,829	41,053.6	350.0
Industrial ^d	0	0	0	0	0	0	0	0.0	2.5
Livestock ^d								12.1	17.9
Mining ^d	0	0	0	0	0	0	0	0.0	0.04
Power ^d	0	0	0	0	0	0	0	0.0	0.0
Riparian ET ^h	210		62	17	283	179	541	751.4	3,593.1
Open Water Evap ⁱ	0	0	553	0	0	4	557	557.1	399.3
Spring flow ^j									17,455.0
Stream loss ^k	1,919	457	3,607	800	2,783	2,553	10,200	12,119.4	
Sub-flow out ^l	6,704					6,646	6,646	13,350.0	14,900.0
Total Outflow	20,058	1,793	14,771	3,158	11,205	16,847	47,974	68,044.1	39,561.7
Balance	-11,261	-232	-10,576	-2,225	-8,789	-12,977	-16,355	-27,447.5	0.4

Table G-4. Water Budget for Central Subregion, Drought Conditions

Shaded cells = no estimate or not applicable

^a DBS&A calc (Table 7-7)

^b DBS&A calc to balance surface water budget in average year

^c DBS&A estimate (Table 6-2), usually 50% of diversions

^d Wilson et al, 2003

^e Median year irrigation return flows reduced in proportion to the stream inflow in the drought year as compared to the median

^f DBS&A estimate (Table 6-2)

^g Wilson et al., 2003 for GW diversions, Bellinger, 2004 for SW diversions

^h DBS&A estimate (Tables 7-3 and 7-8), amount between gages applied to surface water budget

ⁱ DBS&A estimate (Tables 7-2 and 7-6)

^j DBS&A estimate to balance groundwater budget

^k Bellinger 2004 recharge to groundwater from streams

^l Burck, et al 2004 estimated flow to the Rio Grande from groundwater/ gaged flow in streams

^m Inflow is median flow 2002 at Valdez gage, outflow is lowest flow at Arroyo Hondo gage 1974 (Table 7-1)

ⁿ Inflow is based on balancing surface water budget on Arroyo Seco in average year

^o Flow in 2002 Rio Lucero near Arroyo Seco (Table 7-1)

^p Low Flow 1963-1980 for Rio Fernando de Taos near Taos (Table 7-1)

^q Flow in 2002 Rio Grande del Rancho near Talpa

^r Flow 2002 Rio Pueblo de Taos near Tao, outflow median for Rio Pueblo de Taos below Los Cordovas

Table G-5. Water Budget for the South Subregion, Median Conditions

Component	Amount (ac-ft/yr)				
	Surface Water				Groundwater
	Rio Pueblo ^j	Rio Santa Barbara ^k	Embudo Creek ^l	Surface Water Total	
Inflow					
Stream Inflow	38,008	25,795	2,843	66,646	
Recharge ^a					18263.4
Stream Gain ^b				16,488	
Return Flow Municipal ^c	0	0	0	0	154.1
Return Flow Commercial ^d	0	0	0	0	2.5
Return Flow Domestic ^d	0	0	0	0	111.4
Return Flow Mining ^d	0	0	0	0	0.0
Return Flow Irrigation ^d				10,815	163.1
Total Inflow				93,949	18694.5
Outflow					
Municipal ^e	0	0	0	0	308.2
Commercial ^d	0	0	0	0	18.7
Domestic ^d	0	0	0	0	222.8
Irrigation ^d				16,638	466.0
Industrial ^d	0	0	0	0	0.0
Livestock ^d				12	17.9
Mining ^d	0	0	0	0	0.0
Power ^d	0	0	0	0	0.0
Riparian ET ^f	19	601	0	620	921.5
Open Water Evap ^g	0	0	0	0	251.4
Springs/Stream Gain ^h					16488.0
Sub-flow out ⁱ			76,740	76,740	
Total Outflow				94,010	18694.4
Balance				-62	0

Shaded cells = no estimate or not applicable

^a DBS&A calculation (Table 7-7)

^b DBS&A calc to balance groundwater budget

^c DBS&A estimate (Table 6-2), usually 50% of diversions

^d Wilson et al., 2003

^e DBS&A estimate (Table 6-2)

^f DBS&A estimate (Tables 7-8)

^g DBS&A estimate (Table 7-6)

^h DBS&A estimate to balance groundwater budget

ⁱ Median gaged flow in streams

^j Median gaged flow 1990-2004, Rio Pueblo near Penasco (Table 7-1)

^k Inflow is median flow 1990-2004 Rio Santa Barbara near Penasco (Table 7-1)

^l Inflow is based on balancing surface water budget on Embudo Creek, outflow is median flow 1990-2004 Embudo Creek at Dixon (Table 7-1)

Table G-6. Water Budget for the South Subregion, Drought Conditions

Component	Amount (ac-ft/yr)				
	Surface Water				Groundwater
	Rio Pueblo (2002) ^k	Rio Santa Barbara (2002) ^l	Embudo Creek (2002) ^m	Surface Water Total	
Inflow					
Stream Inflow ^a	4,959	7,384	550	12,894	
Recharge ^b					18,263.4
Stream Gain ^c				16,488	
Return Flow Municipal ^d	0	0	0	0	154.1
Return Flow Commercial ^e	0	0	0	0	2.5
Return Flow Domestic ^e	0	0	0	0	111.4
Return Flow Mining ^e	0	0	0	0	0.0
Return Flow Irrigation ^e				1,927	163.1
Total Inflow				31,309	18,694.5
Outflow					
Municipal ^f	0	0	0	0	308.2
Commercial ^e	0	0	0	0	18.7
Domestic ^e	0	0	0	0	222.8
Irrigation ^e				16,638	466.0
Industrial ^e	0	0	0	0	0.0
Livestock ^e				12	17.9
Mining ^e	0	0	0	0	0.0
Power ^e	0	0	0	0	0.0
Riparian ET ^g	19	601	0	620	921.5
Open Water Evap ^h	0	0	0	0	251.4
Springs/Stream Gain ⁱ					16,488.0
Sub-flow out ^j			9,050	9,050	0.0
Total Outflow				26,319	18,694.4
Balance				4,990	0

Shaded cells = no estimate or not applicable

^a Estimated as percent in avg year of other two streams

^b DBS&A calculation (Table 7-7)

^c DBS&A calc to balance groundwater budget

^d DBS&A estimate (Table 6-2), usually 50% of diversions

^e Wilson, et al, 2003, return flow reduced in proportion to drought stream flow as compared to median inflow

^f DBS&A estimate (Table 6-2)

^g DBS&A estimate (Tables 7-8)

^h DBS&A estimate (Table 7-6)

ⁱ DBS&A estimate to balance groundwater budget

^j Median gaged flow in streams (Table 7-1)

^k Gaged flow in 2002, Rio Pueblo near Penasco (Table 7-1)

^l Inflow is gaged flow in 2002, Santa Barbara near Penasco (Table 7-1)

^m Inflow is based on relative proportion of flows estimated in average year on Embudo Creek, outflow is gaged flow 2002, Embudo Creek at Dixon (Table 7-1)

Table G-7. Water Budget for the West Subregion, Median Conditions

Component	Amount (ac-ft/yr)	
	Surface Water	Groundwater
Inflow		
Stream Inflow ^a	699	
Recharge ^b		3,376.3
Return Flow Municipal ^c	0	26.5
Return Flow Commercial ^d	0	9.3
Return Flow Domestic ^c	0	42.3
Return Flow Mining ^d	0	0.0
Return Flow Irrigation ^d	113	0.0
Total Inflow	813	3,454.4
Outflow		
Municipal ^e	0	53.0
Commercial ^d	0	27.7
Domestic ^e	0	84.7
Irrigation ^d	206	0.0
Industrial ^d	0	0.0
Livestock ^d	4	6.0
Mining ^d	0	0.0
Power ^d	0	0.0
Riparian ET ^f		1,543.2
Open Water Evap ^g	603	1,054.9
Sub-flow out ^h		685.0
Total Outflow	813	3,454.4
Balance	0.0	0.0

Shaded cells = no estimate or not applicable

^a Estimated inflow based on flow of Ojo Caliente Springs is 60 gpm (97 afy) and additional flow to balance surface water budget, in drought inflow equal only to spring flow

<http://geoheat.oit.edu/directuse/all/dur0346.htm>

^b DBS&A calculation (Table 7-7)

^c DBS&A estimate (Table 6-2), usually 50% of diversions

^d Wilson, et al, 2003

^e DBS&A estimate (Table 6-2)

^f DBS&A estimate, see Riparian ET table (Table 7-8)

^g DBS&A estimate (Table 7-6)

^h DBS&A estimate to balance groundwater budget