Appendix B: Design Flow Runoff Response and Sedimentation Potential

Station Fire, Angeles National Forest

September, 2009

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Wildfires result in increased runoff and sediment yield commensurate with burn severity. Burn Area Emergency Rehabilitation (BAER) teams use burn severity to estimate runoff and sediment increases resulting from fires. These increases are calculated as adjusted design flow and sediment potential. Adjusted design flow is the flow increase expected to occur as a result of decreased infiltration and interception following a wildfire. Sediment potential is the estimated potential sediment delivered to channels. Together these values are utilized to evaluate the need to increase capacity for flow or drainage structures such as culverts and bridges. Values also provide an estimate of flooding and sedimentation potential to downstream communities.

Design Flow Runoff Response

Before an adjusted design flow can be determined, pre-fire design flow must be calculated. This is the flow expected to occur prior to the fire. This is the flow responsible for forming present day channel conditions and flows used to estimate proper performance of culverts and other drainage structures. Design flow estimates have been based on Rowe, Countrymen and Storey. These estimates assume pre-fire ground infiltration and ground cover conditions.

The Rowe, Countrymen and Storey model was developed for Southern California to predict increased peak flows and sediment yields post-fire. Storm zones are developed for areas that have similar peak flows and sediments yields. These storm zones are then applied of the area of the fire. Each storm zone has specific coefficients based on a "complete burn", which correspond to high and moderate burn severity. (Refer to Figure 1: The Burn Severity Map) High and moderate are used to represent a complete burn because of the type of vegetation burned, most being chaparral. (For more information refer to the botany specialist report.) Low and unburned severity are not considered a complete burn. The model will allow for the prediction of different storm return intervals by predicting the events per year. This prediction was done for the 2, 5, 10, 25, 50, and 100 year storm.

Tables 1 and 2 show the change in pre fire and post fire discharge. The Middle West Fork San Gabriel Watershed shows the least amount of increased discharge due to a small percentage for the watershed that burned. The entire Big Tujunga Canyon was significantly affected by the fire with increased percentage ranging from 330% to 201% for a two year storm. Figures 2 through 7 predict how the 2, 5, 10, 25, 50, and 100 year storm will react compared to pre fire conditions.

Design Sediment Delivery Responds

Sediment is significantly increased after a fire this is mostly due to consumed vegetation. Rowe, Countrymen and Storey model is also used to predict sediment yields using the same storm zones as the peak flows. The model assumes sediment recovers back to pre fire conditions after ten years. Our assessment modeled for five years after the fire. Figure 8 shows how dramatically sediment increases from pre fire. After the first year post fire sediment also goes down very dramatically. The watershed that produces the most sediment is the Upper West Fork San Gabriel with 2,838,387 cubic yards with a 1,559 percent increase. Pacoima Wash had the largest percent increase, 1686, from pre fire conditions. Middle West Fork San Gabriel experienced the lowest increase from pre fire conditions with twenty-five percent increase this is mostly due to the small percent of the watershed burned.

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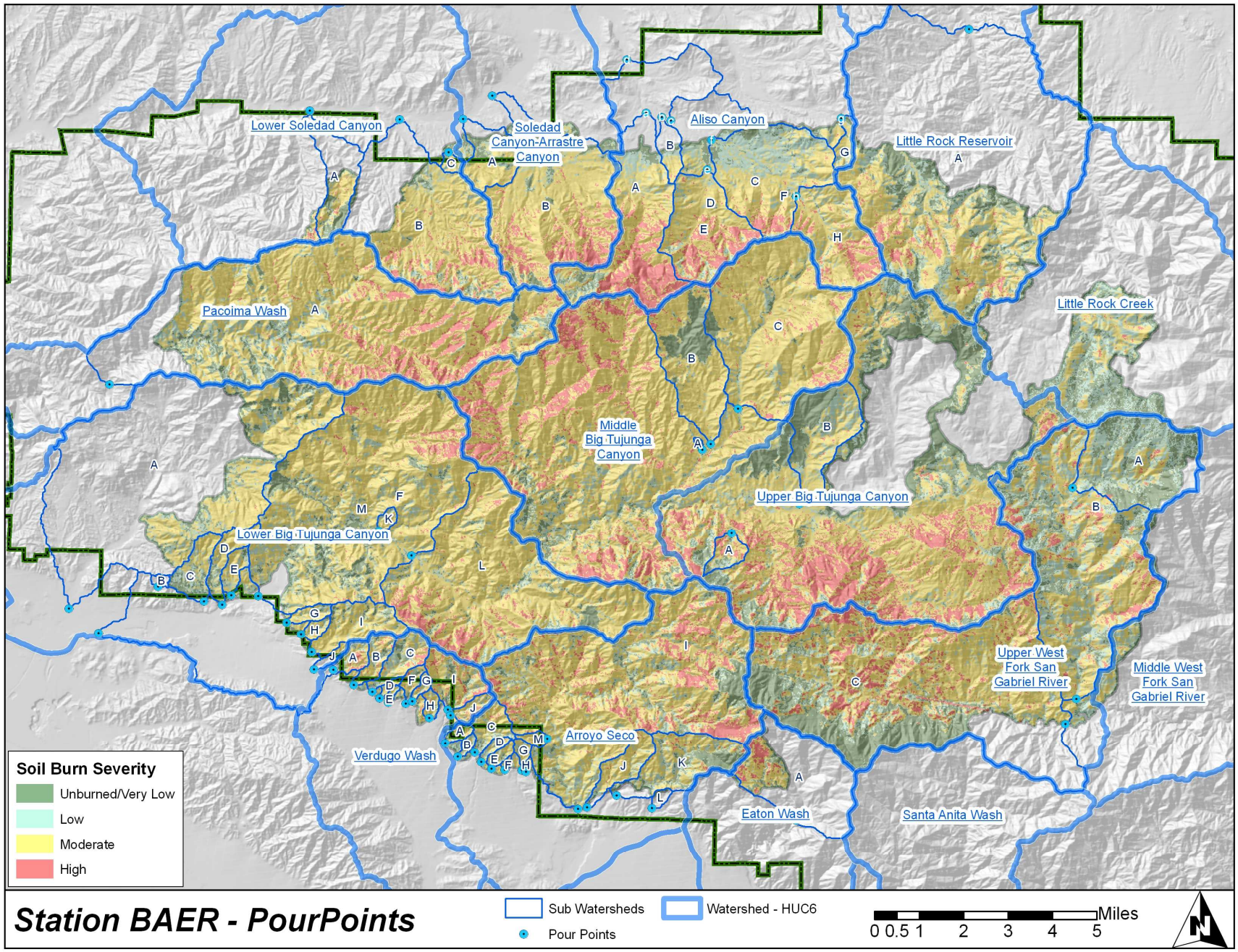


Table 1

	Pre and Post Fire Discharge for 6th Field Watersheds for the Station Fire, 2009 (cfs)												
	Pre Fire 2 yr storm	Post Fire 2 yr storm	Pre Fire 5 yr storm	Post Fire 5 yr storm	Pre Fire 10 yr storm	Post Fire 10 yr storm	Pre Fire 25 yr storm	Post Fire 25 yr storm	Pre Fire 50 yr storm	Post Fire 50 yr storm	Pre Fire 100 yr storm	Post Fire 100 yr storm	Watershed Acres
Los Angeles River													
Pacoima Wash	195	647	604	1417	964	2012	2279	4036	3202	5378	7482	11181	18138
Low Big Tujunga Canyon	487	1672	1212	2879	1790	3799	3765	6748	5173	8762	12075	18289	45067.59
Middle Big Tujunga Canyon	344	1479	924	2665	1418	3581	3301	6880	4738	9273	11846	20154	25271.3
Upper Big Tujunga Canyon	373	1123	1002	2153	1537	2967	3580	5946	5138	8136	12845	18337	27403.13
Verdugo Wash	216	377	585	823	881	1168	1900	2337	2541	3054	5399	6024	11952.64
Arroyo Seco	733	2576	1769	4203	2515	5281	4983	8864	6534	10996	12541	18849	21121.11
Eaton Wash	202	246	535	600	798	876	1645	1759	2226	2360	4597	4800	10322.35
San Gabriel River													
Upper West Fork San Gabriel	791	2,605	1,994	4,474	2,889	5,787	5,839	9,947	7,783	12,615	15,973	23,222	25,234
Middle West Fork San Gabriel	829	858	1,983	2,022	2,830	2,874	5,553	5,615	7,272	7,343	14,016	14,116	28,208
Antelope-Fremont Valleys													
Aliso Canyon	327	645	846	1,304	1,269	1,822	2,804	3,667	3,912	4,962	8,610	10,321	31,489
Little Rock Reservoir	134	167	374	424	564	626	1,240	1,339	1,710	1,825	3,945	4,259	24,048
Little Rock Creek	118	125	330	340	497	510	1,094	1,114	1,509	1,532	3,482	3,545	21,226
Santa Clara River													
Soledad Canyon/Arrastre Canyon	353	648	988	1,438	1,504	2,053	3,302	4,160	4,573	5,615	10,309	12,027	24,804
Lower Soledad Canyon	364	606	1,020	1,390	1,553	2,003	3,409	4,113	4,722	5,576	10,644	12,054	25,610

Table 2

% of Increase of Post Fire Discharge from Pre Fire Conditions for the 6th Field Watersheds for the Station Fire, 2009													
	% increase - 2 yr	2 yr (x prefire)	% increase - 5 yr	5 yr (x prefire)	% increase - 10 yr	10 yr (x prefire)	% increase - 25 yr	25 yr (x prefire)	% increase - 50 yr	50 yr (x prefire)	% increase - 100 yr	100 yr (x prefire)	Watershed Acres
Los Angeles River													
Pacoima Wash	232%	3.3	135%	2.3	109%	2.1	77%	1.8	68%	1.7	49%	1.5	18,138
Low Big Tujunga Canyon	243%	3.4	138%	2.4	112%	2.1	79%	1.8	69%	1.7	51%	1.5	45,068
Middle Big Tujunga Canyon	330%	4.3	188%	2.9	153%	2.5	108%	2.1	96%	2.0	70%	1.7	25,271
Upper Big Tujunga Canyon	201%	3.0	115%	2.1	93%	1.9	66%	1.7	58%	1.6	43%	1.4	27,403
Verdugo Wash	75%	1.7	41%	1.4	33%	1.3	23%	1.2	20%	1.2	12%	1.1	11,953
Arroyo Seco	251%	3.5	138%	2.4	110%	2.1	78%	1.8	68%	1.7	50%	1.5	21,121
Eaton Wash	22%	1.2	12%	1.1	10%	1.1	7%	1.1	6%	1.1	4%	1.0	10,322
San Gabriel River													
Upper West Fork San Gabriel	229%	3.3	124%	2.2	100%	2.0	70%	1.7	62%	1.6	45%	1.5	25,234
Middle West Fork San Gabriel	3%	1.0	2%	1.0	2%	1.0	1%	1.0	1%	1.0	1%	1.0	28,208
Antelope-Fremont Valleys													
Aliso Canyon	97%	2.0	54%	1.5	44%	1.4	31%	1.3	27%	1.3	20%	1.2	31,489
Little Rock Reservoir	25%	1.2	13%	1.1	11%	1.1	8%	1.1	7%	1.1	8%	1.1	24,048
Little Rock Creek	6%	1.1	3%	1.0	3%	1.0	2%	1.0	2%	1.0	2%	1.0	21,226
Santa Clara River													
Soledad Canyon/Arrastre Canyon	84%	1.8	46%	1.5	37%	1.4	26%	1.3	23%	1.2	17%	1.2	24,804
Lower Soledad Canyon	66%	1.7	36%	1.4	29%	1.3	21%	1.2	18%	1.2	13%	1.1	25,610

Figure 2

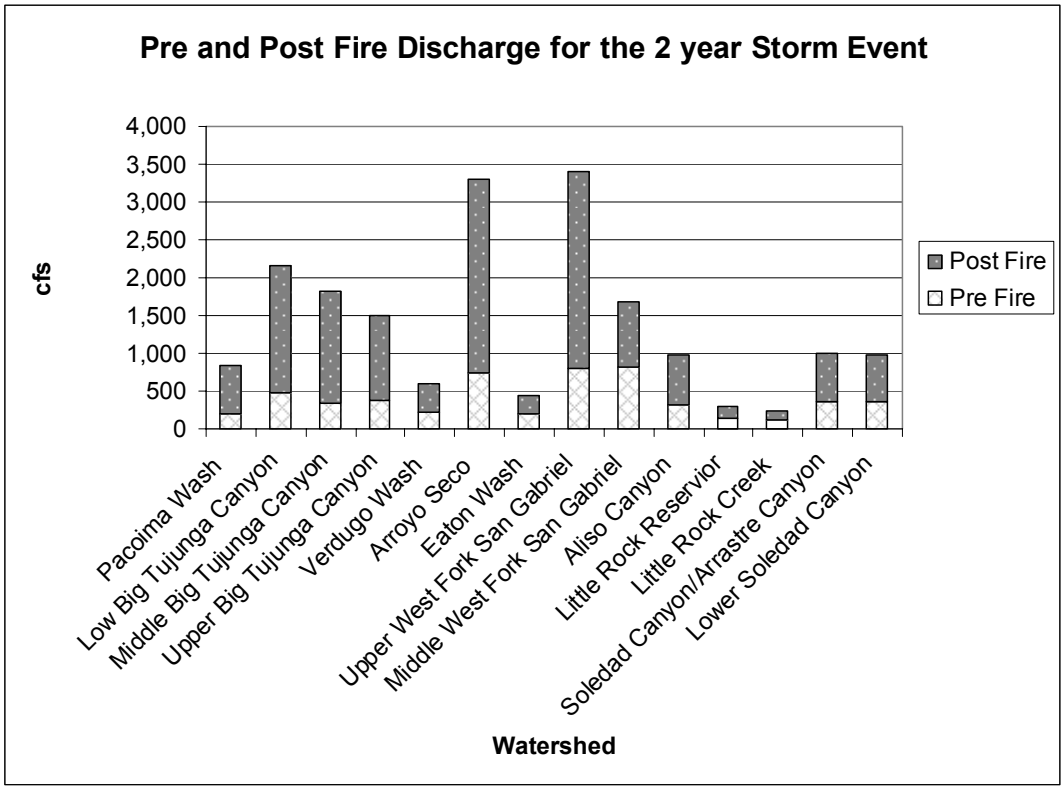
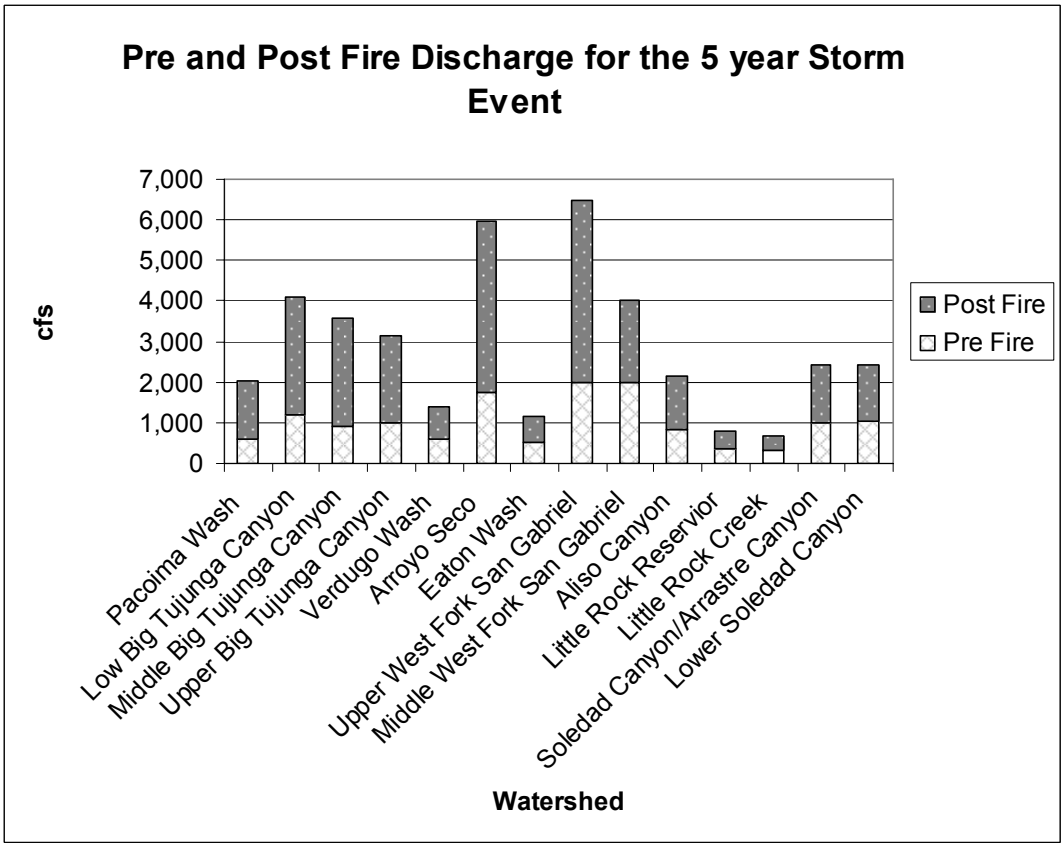


Figure 3



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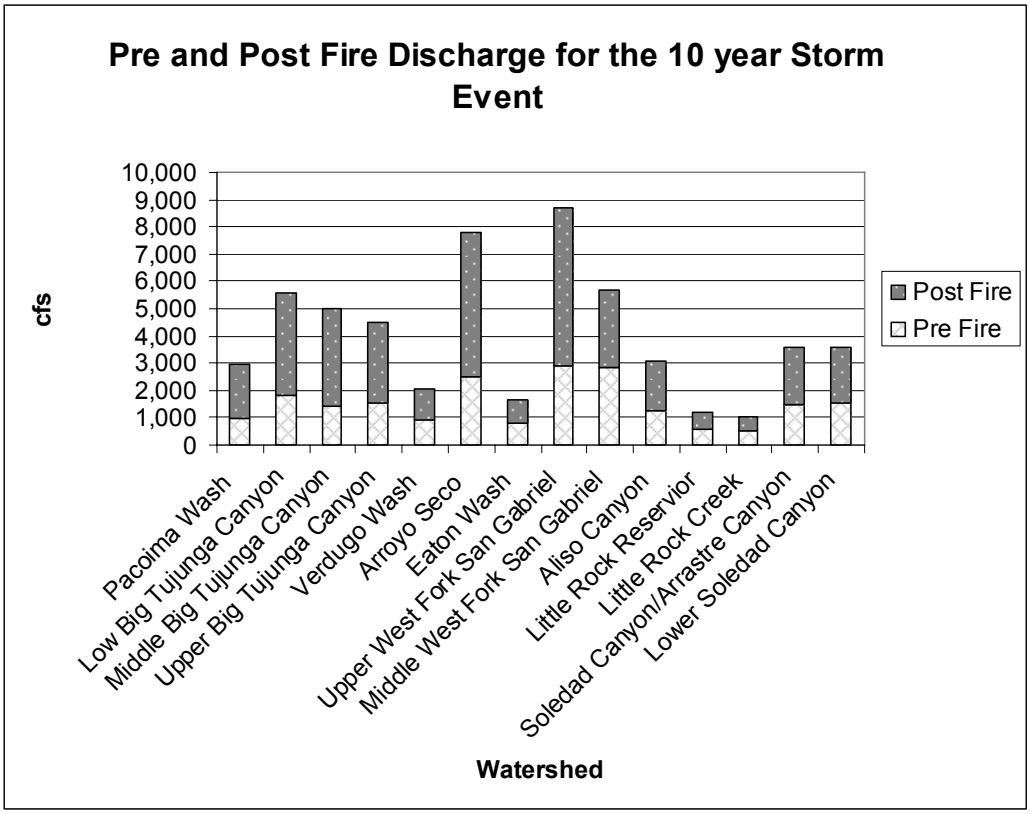


Figure 5

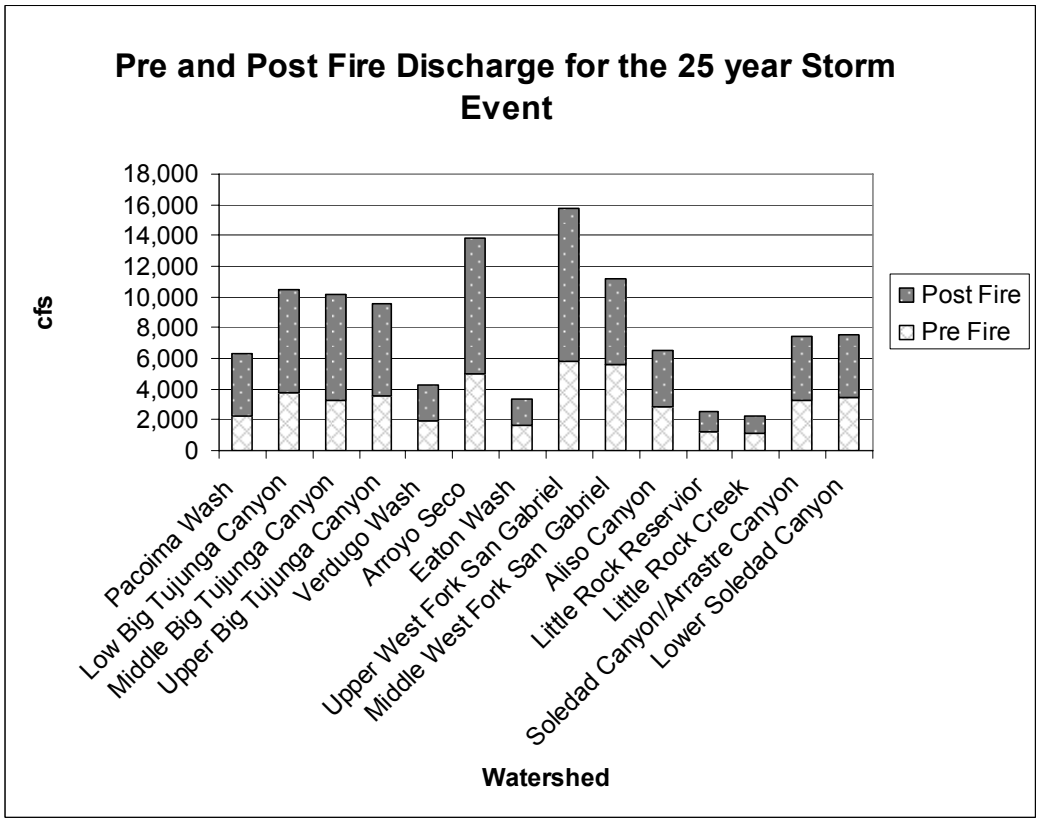
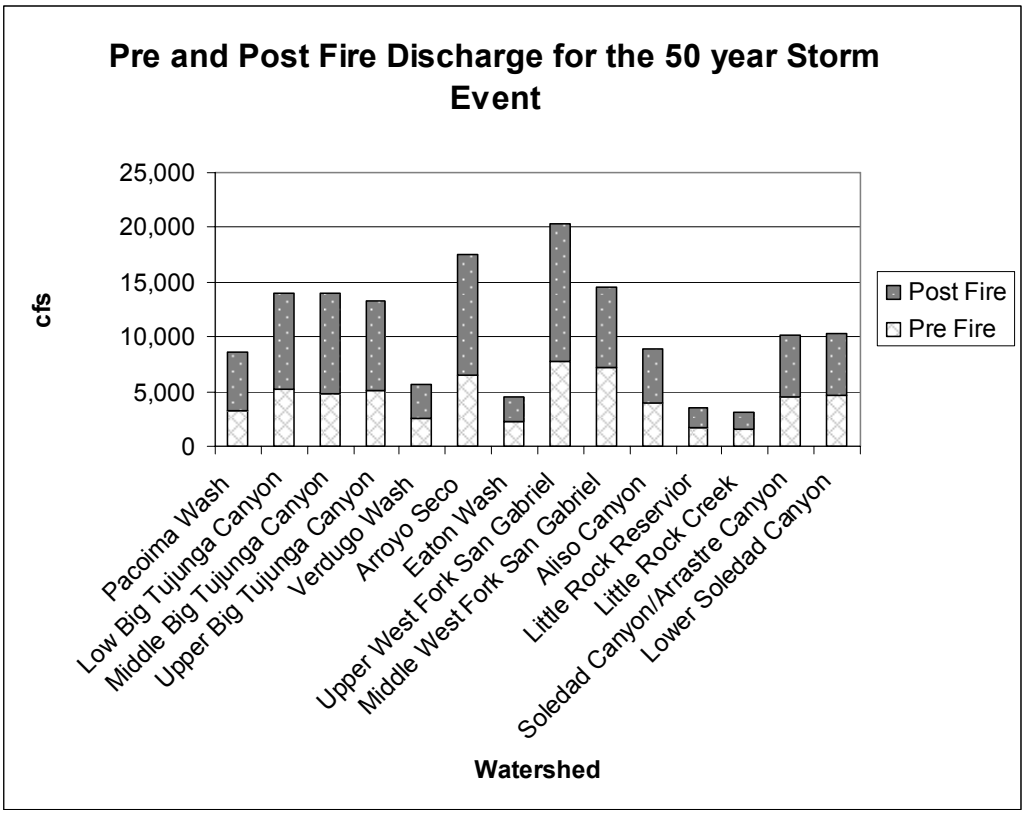


Figure 6



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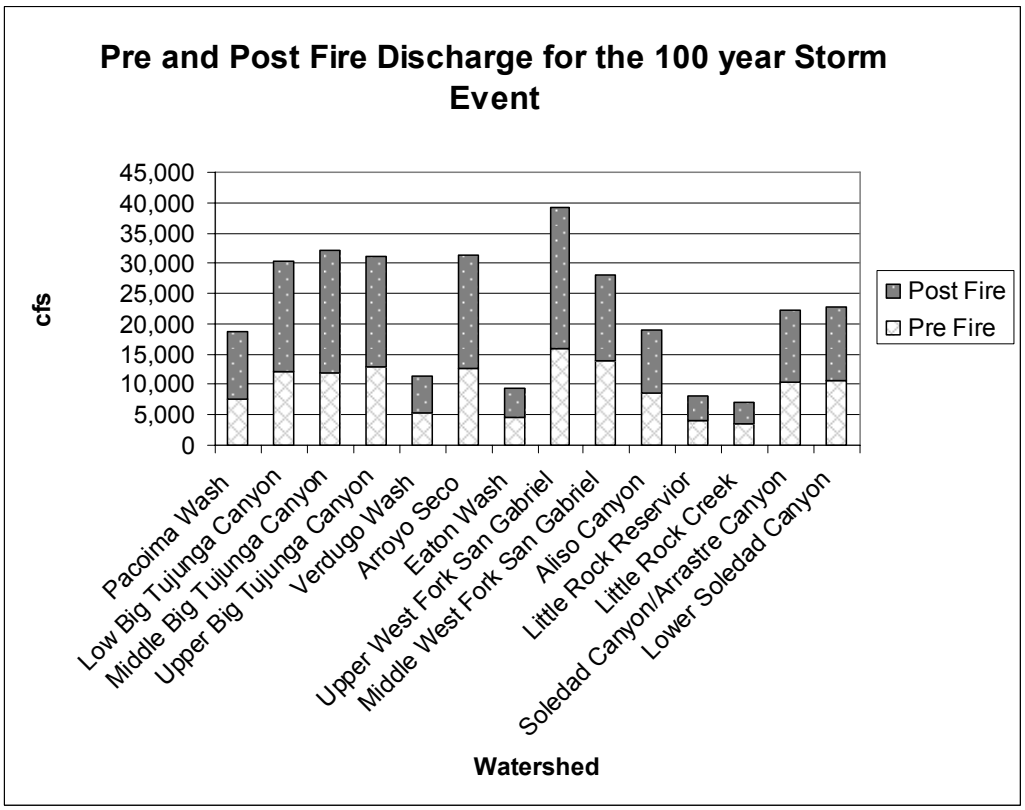

Table 3

Increased Sediment Pre Fire and Five years after Station Fire For 6th Field Watersheds							
			Year After Burn (yd^3/ year)				
6th Field Watershed Name	Drainage Area (Mi^2)	Pre-Fire	1	2	3	4	5
Pacoima Wash	28.34	38,260	683,230	248,569	133,481	122,692	93,748
Lower Soledad Canyon	40.02	68,827	378,847	170,733	131,068	109,615	95,645
Soledad/Arrastre Canyon	38.76	66,661	444,580	190,885	142,534	116,381	99,352
Aliso Canyon	49.20	57,566	446,537	184,580	135,750	108,065	90,119
Little Rock Reservoir	37.57	8,079	65,555	16,308	13,376	11,977	10,711
Little Rock Creek	33.17	7,131	18,672	8,783	8,194	7,913	7,659
Middle West Fork San Gabriel River	44.07	171,892	214,763	185,902	180,578	177,496	175,534
Upper West Fork San Gabriel River	38.05	171,045	2,838,387	1,045,093	708,020	523,185	398,856
Lower Big Tujunga Canyon	54.79	82,907	1,494,177	544,006	368,426	267,110	202,339
Middle Big Tujunga Canyon	39.49	72,260	1,801,668	636,152	420,496	300,379	217,993
Upper Big Tujunga Canyon	42.82	78,356	1,221,611	451,127	308,563	229,158	174,695

Table 4

Increased Sediment Pre Fire and Five years after Station Fire						
		Increase from Pre-Fire Conditions				
6th Field Watershed Name	Drainage Area	1 yr (x prefire)	2 yr (x prefire)	3 yr (x prefire)	4 yr (x prefire)	5 yr (x prefire)
Pacoima Wash	28.34	17.9	6.5	3.5	3.2	2.5
Lower Soledad Canyon	40.02	5.5	2.5	1.9	1.6	1.4
Soledad/Arrastre Canyon	38.76	6.7	2.9	2.1	1.7	1.5
Aliso Canyon	49.20	7.8	3.2	2.4	1.9	1.6
Little Rock Reservoir	37.57	8.1	2.0	1.7	1.5	1.3
Little Rock Creek	33.17	2.6	1.2	1.1	1.1	1.1
Middle West Fork San Gabriel River	44.07	1.2	1.1	1.1	1.0	1.0
Upper West Fork San Gabriel River	38.05	16.6	6.1	4.1	3.1	2.3
Lower Big Tujunga Canyon	54.79	18.0	6.6	4.4	3.2	2.4
Middle Big Tujunga Canyon	39.49	24.9	8.8	5.8	4.2	3.0
Upper Big Tujunga Canyon	42.82	15.6	5.8	3.9	2.9	2.2

Table 5

Increased Sediment Pre Fire and Five years after Station Fire						
		Increase from Pre-Fire Conditions				
6th Field Watershed Name	Drainage Area	% increase - 1yr	% increase - 2yr	% increase - 3yr	% increase - 4yr	% increase - 5yr
Pacoima Wash	28.34	1686%	550%	249%	221%	145%
Lower Soledad Canyon	40.02	450%	148%	90%	59%	39%
Soledad/Arrastre Canyon	38.76	567%	186%	114%	75%	49%
Aliso Canyon	49.20	676%	221%	136%	88%	57%
Little Rock Reservoir	37.57	711%	102%	66%	48%	33%
Little Rock Creek	33.17	162%	23%	15%	11%	7%
Middle West Fork San Gabriel River	44.07	25%	8%	5%	3%	2%
Upper West Fork San Gabriel River	38.05	1559%	511%	314%	206%	133%
Lower Big Tujunga Canyon	54.79	1702%	556%	344%	222%	144%
Middle Big Tujunga Canyon	39.49	2393%	780%	482%	316%	202%
Upper Big Tujunga Canyon	42.82	1459%	476%	294%	192%	123%

Figure 8

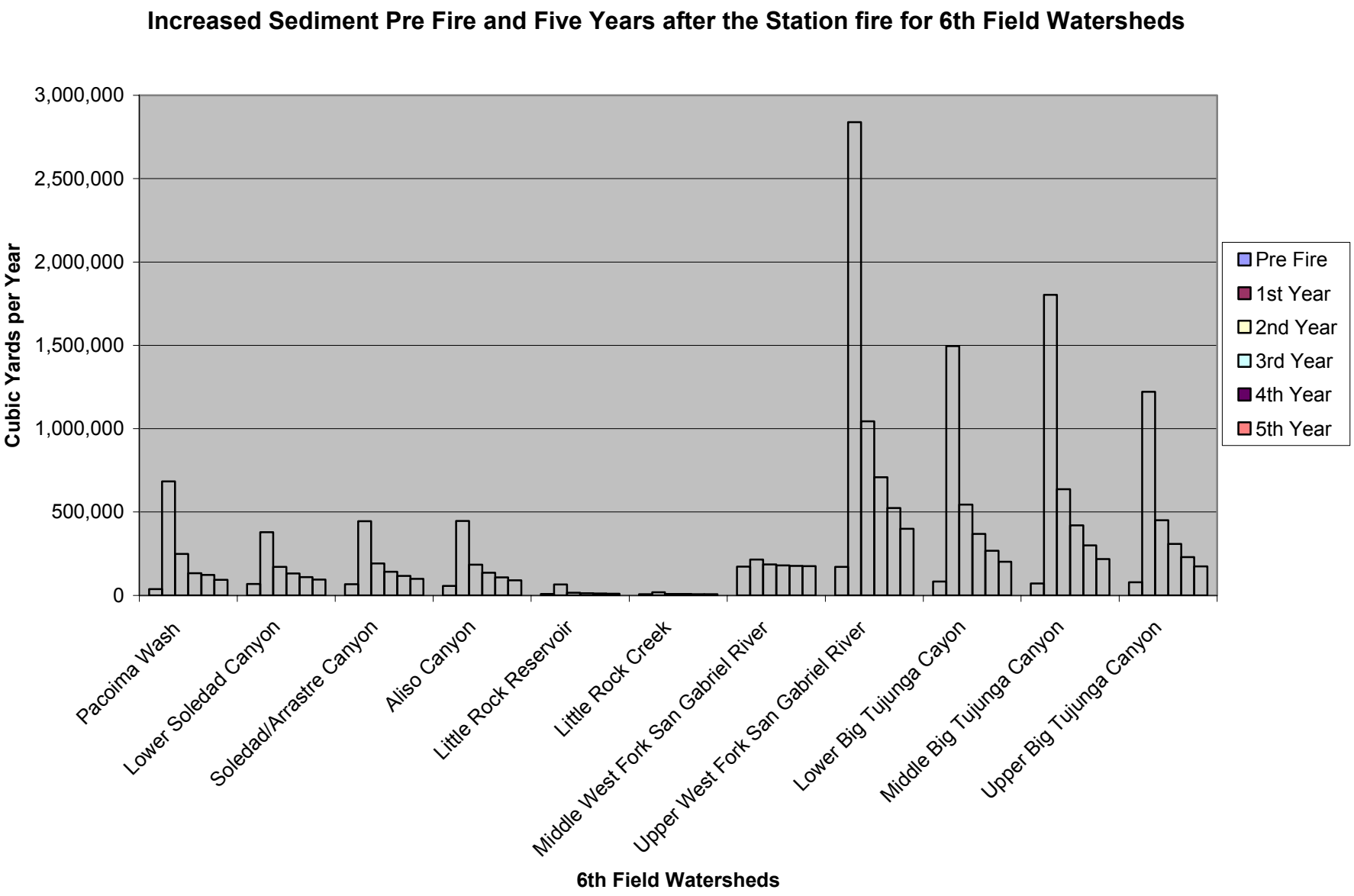
Increased Sediment Pre Fire and Five Years after the Station fire for 6th Field Watersheds
Cubic Yards per Year
3,000,000
2,500,000
2,000,000
1,500,000
1,000,000
500,000
0
Pre Fire
1st Year
2nd Year
3rd Year
4th Year
5th Year
Pacoima Wash
Lower Soledad Canyon
Soledad/Arrastre Canyon
Aliso Canyon
Little Rock Reservoir
Little Rock Creek
Middle West Fork San Gabriel River
Upper West Fork San Gabriel River
Lower Big Tujunga Cayon
Middle Big Tujunga Canyon
Upper Big Tujunga Canyon
6th Field Watersheds

Table: 6

Pre and Post Station Fire Discharge for 2, 5, 10, 25, 50 and 100 year storm													
Pour Points	Drainage Area (Square Miles)	2 year pre fire	2 year post fire	5 year pre fire	5 year post fire	10 year pre fire	10 year post fire	25 year pre fire	25 year post fire	50 year pre fire	50 year post fire	100 year pre fire	100 year post fire
Pacoima Wash - sub A	24	163	615	504	1,318	805	1,853	1,903	3,660	2,674	4,849	6,248	9,947
Lower Big Tujunga - sub A (Little T @ Reservoir)	20.63	256	491	629	945	916	1,296	1,861	2,389	2,517	3,141	5,365	6,346
Lower Big Tujunga - sub B	0.1	1	1	3	3	4	4	9	9	12	12	26	26
Lower Big Tujunga - sub C (Ebey)	0.94	12	34	29	59	42	78	85	136	115	175	245	340
Lower Big Tujunga - sub D (Doane)	0.71	9	35	22	58	32	75	64	124	87	158	186	297
Lower Big Tujunga - sub E (Akens)	0.42	5	21	13	34	18	44	38	73	51	92	108	173
Lower Big Tujunga - sub F (Big T @ Reservoir)	30.81	240	1,064	601	1,779	894	2,314	1,910	4,063	2,644	5,247	6,409	11,037
Lower Big Tujunga Canyon - sub G (Zachau)	0.3	3	16	9	28	14	36	31	64	41	80	87	148
Lower Big Tujunga - sub H (Rowley)	0.2	2	11	7	19	10	25	21	45	28	56	60	103
Lower Big Tujunga Canyon - sub I (Haines)	2	8	39	21	65	31	85	70	154	98	201	220	398
Lower Big Tujunga - sub J (Bluegum)	0.18	1	3	2	6	4	7	8	14	11	19	26	38
Lower Big Tujunga - sub K (above private home along river)	0.17	1	5	3	9	5	12	10	21	14	27	35	57
Lower Big Tujunga - sub L (Big T Fire Station	12.72	99	472	248	781	369	1,012	789	1,763	1,091	2,270	2,646	4,741

area)													
Lower Big Tujunga - sub M (Big T before communities)	43.82	342	1,271	854	2,182	1,271	2,872	2,717	5,144	3,759	6,695	9,114	14,331
Middle Big Tujunga - sub A	0.04	0	1	1	2	1	3	3	6	4	8	11	18
Middle Big Tujunga - sub B	4	33	120	89	222	137	302	318	591	457	803	1,142	1,775
Middle Big Tujunga - sub C	10	85	376	229	675	352	906	819	1,736	1,176	2,337	2,941	5,067
Upper Big Tujunga - sub A (Colby Ranch)	0.53	5	17	12	31	19	42	44	82	63	111	158	245
Upper Big Tujunga - sub B (Lynx Gulch)	2.83	25	64	66	127	102	177	237	361	339	497	849	1,137
Verdugo Wash - sub A (Blanchard)	38.8	277	549	736	1,131	1,105	1,581	2,364	3,086	3,217	4,076	7,054	8,437
Verdugo Wash - sub B (Cooks)	1.82	13	30	35	59	52	81	111	155	151	203	332	416
Verdugo Wash - sub C (Dunsmore)	0.87	10	39	28	70	42	93	91	168	121	211	257	398
Verdugo Wash - sub D (Ward)	0.1	1	6	3	10	5	13	10	24	14	29	30	54
Verdugo Wash - sub E (unnamed)	0.06	1	2	2	4	3	6	6	10	8	13	16	24
Verdugo Wash - sub F (Shields)	0.25	3	12	8	21	12	28	26	50	35	63	73	118
Verdugo Wash - sub G (Eagle)	0.14	2	6	5	12	7	15	15	27	20	35	41	65
Verdugo Wash - sub H (Goss)	0.19	2	11	6	18	9	24	20	43	27	53	56	98
Verdugo Wash - sub I (Sutton and Pickens)	1.26	15	70	40	122	61	159	131	281	176	351	373	647
Verdugo Wash - sub J (Mullally)	0.33	4	18	11	32	16	42	35	74	46	92	98	170
Arroyo Seco - sub A	0.19												

(Shover)		4	19	10	29	14	36	28	59	37	72	71	121
Arroyo Seco - sub B (Webber)	0.12	3	6	6	11	9	14	18	25	23	32	45	57
Arroyo Seco - sub C (Hall Beckley)	0.69	15	66	37	104	53	129	104	211	137	259	263	436
Arroyo Seco - sub D (Winery)	0.16	4	11	9	19	12	24	25	41	32	51	62	88
Arroyo Seco - sub E (Hay)	0.19	4	15	10	24	15	31	29	51	38	64	73	109
Arroyo Seco - sub F (Big Briar)	0.04	1	3	2	5	3	7	6	11	8	14	16	23
Arroyo Seco - sub G (Gould)	0.18	4	14	10	23	14	29	27	48	35	60	67	103
Arroyo Seco - sub H (Aqua)	0.01	0	0	1	1	1	1	2	2	3	3	5	5
Arroyo Seco - sub I (Arroyo Seco)	17.64	392	1,910	945	3,795	1,344	4,582	2,663	7,206	3,492	8,715	6,702	14,086
Arroyo Seco -sub J (El Prieto)	0.98	9	39	25	67	36	87	77	149	106	198	224	367
Arroyo Seco - sub K (Millard)	3	31	95	83	174	124	234	256	416	347	536	717	1,003
Arroyo Seco - sub L (Chiquita)	0.13	2	2	4	5	7	7	14	14	18	19	38	39
Arroyo Seco - sub M (Fall Creek @ Angeles Fire Station)	0.16	4	19	9	29	12	35	25	56	32	68	62	113
Eaton Wash (sub A)	4.6	58	101	153	216	228	304	469	580	635	767	1,311	1,510
Upper W F San Gabriel River Devil's Canyon (sub A)	4.8	56	103	157	227	236	322	514	645	705	863	1,524	1,775
Upper W F San Gabriel River Devil's Canyon (sub B)	17	200	623	560	1,202	840	1,624	1,833	3,027	2,511	3,957	5,430	7,721
Upper W F San Gabriel	22.32												

River Devil's Canyon (sub C)		590	1,981	1,434	3,272	2,050	4,163	4,006	6,921	5,271	8,657	10,543	15,501
Little Rock Reservoir A	27.6	98	132	274	324	413	475	909	1,008	1,254	1,369	2,893	3,206
Aliso Canyon - sub A	6	38	138	99	242	149	321	329	598	459	787	1,010	1,544
Aliso Canyon - sub B	0.54	4	5	9	12	14	17	31	36	43	49	95	105
Aliso Canyon - sub C	14	91	298	236	534	354	713	781	1,343	1,090	1,773	2,399	3,513
Aliso Canyon - sub D	23	152	463	394	841	591	1,130	1,307	2,148	1,822	2,847	4,011	5,681
Aliso Canyon - sub E	4	23	95	60	164	91	216	200	395	279	517	615	1,002
Aliso Canyon - sub F	8	55	185	141	329	211	438	467	822	652	1,083	1,434	2,138
Aliso Canyon - sub G	0.39	3	8	7	14	10	19	22	36	31	48	69	96
Aliso Canyon - sub H	3	22	90	57	155	86	203	190	373	265	488	583	947
Soledad/Arrastre Canyon - sub A (Bootleg)	1.48	13	43	38	83	57	112	126	212	175	279	394	566
Soledad/Arrastre Canyon - sub B (Moody and Arrastre)	8	75	338	211	612	321	810	705	1,469	976	1,905	2,200	3,732
Lower Soledad Canyon - sub A (Indian)	1.82	17	34	47	74	71	104	155	207	215	278	485	589
Lower Soledad Canyon - sub B (Mattox and Mill)	9	83	298	232	561	353	754	776	1,402	1,075	1,835	2,423	3,677
Lower Soledad Canyon - sub C (unnamed)	21	2	5	4	10	7	14	15	26	21	34	47	69
Pacoima Wash - sub A	24	615	163	1,318	504	1,853	805	3,660	1,903	4,849	2,674	9,947	6,248
Lower Big Tujunga - sub A (Little T @ Reservoir)	20.63	491	256	945	629	1,296	916	2,389	1,861	3,141	2,517	6,346	5,365
Lower Big Tujunga - sub B	0.1	1	1	3	3	4	4	9	9	12	12	26	26
Lower Big Tujunga - sub C (Ebey)	0.94	34	12	59	29	78	42	136	85	175	115	340	245
Lower Big Tujunga - sub D (Doane)	0.71	35	9	58	22	75	32	124	64	158	87	297	186
Lower Big Tujunga - sub E	0.42												

(Akens)		21	5	34	13	44	18	73	38	92	51	173	108
Lower Big Tujunga - sub F (Big T @ Reservoir)	30.81	1,064	240	1,779	601	2,314	894	4,063	1,910	5,247	2,644	11,037	6,409
Lower Big Tujunga Canyon - sub G (Zachau)	0.3	16	3	28	9	36	14	64	31	80	41	148	87
Lower Big Tujunga - sub H (Rowley)	0.2	11	2	19	7	25	10	45	21	56	28	103	60
Lower Big Tujunga Canyon - sub I (Haines)	2	39	8	65	21	85	31	154	70	201	98	398	220
Lower Big Tujunga - sub J (Bluegum)	0.18	3	1	6	2	7	4	14	8	19	11	38	26
Lower Big Tujunga - sub K (above private home along river)	0.17	5	1	9	3	12	5	21	10	27	14	57	35
Lower Big Tujunga - sub L (Big T Fire Station area)	12.72	472	99	781	248	1,012	369	1,763	789	2,270	1,091	4,741	2,646
Lower Big Tujunga - sub M (Big T before communities)	43.82	1,271	342	2,182	854	2,872	1,271	5,144	2,717	6,695	3,759	14,331	9,114
Middle Big Tujunga - sub A	0.04	1	0	2	1	3	1	6	3	8	4	18	11
Middle Big Tujunga - sub B	4	120	33	222	89	302	137	591	318	803	457	1,775	1,142
Middle Big Tujunga - sub C	10	376	85	675	229	906	352	1,736	819	2,337	1,176	5,067	2,941
Upper Big Tujunga - sub A (Colby Ranch)	0.53	17	5	31	12	42	19	82	44	111	63	245	158
Upper Big Tujunga - sub B (Lynx Gulch)	2.83	64	25	127	66	177	102	361	237	497	339	1,137	849
Verdugo Wash - sub A (Blanchard)	38.8	549	277	1,131	736	1,581	1,105	3,086	2,364	4,076	3,217	8,437	7,054
Verdugo Wash - sub B (Cooks)	1.82	30	13	59	35	81	52	155	111	203	151	416	332
Verdugo Wash - sub C (Dunsmore)	0.87	39	10	70	28	93	42	168	91	211	121	398	257
Verdugo Wash - sub D (Ward)	0.1	6	1	10	3	13	5	24	10	29	14	54	30
Verdugo Wash - sub E (unnamed)	0.06	2	1	4	2	6	3	10	6	13	8	24	16
Verdugo Wash - sub F (Shields)	0.25	12	3	21	8	28	12	50	26	63	35	118	73
Verdugo Wash - sub G (Eagle)	0.14												

		6	2	12	5	15	7	27	15	35	20	65	41
Verdugo Wash - sub H (Goss)	0.19	11	2	18	6	24	9	43	20	53	27	98	56
Verdugo Wash - sub I (Sutton and Pickens)	1.26	70	15	122	40	159	61	281	131	351	176	647	373
Verdugo Wash - sub J (Mullally)	0.33	18	4	32	11	42	16	74	35	92	46	170	98
Arroyo Seco - sub A (Shover)	0.19	19	4	29	10	36	14	59	28	72	37	121	71
Arroyo Seco - sub B (Webber)	0.12	6	3	11	6	14	9	25	18	32	23	57	45
Arroyo Seco - sub C (Hall Beckley)	0.69	66	15	104	37	129	53	211	104	259	137	436	263
Arroyo Seco - sub D (Winery)	0.16	11	4	19	9	24	12	41	25	51	32	88	62
Arroyo Seco - sub E (Hay)	0.19	15	4	24	10	31	15	51	29	64	38	109	73
Arroyo Seco - sub F (Big Briar)	0.04	3	1	5	2	7	3	11	6	14	8	23	16
Arroyo Seco - sub G (Gould)	0.18	14	4	23	10	29	14	48	27	60	35	103	67
Arroyo Seco - sub H (Aqua)	0.01	0	0	1	1	1	1	2	2	3	3	5	5
Arroyo Seco - sub I (Arroyo Seco)	17.64	1,910	392	3,795	945	4,582	1,344	7,206	2,663	8,715	3,492	14,086	6,702
Arroyo Seco -sub J (El Prieto)	0.98	39	9	67	25	87	36	149	77	198	106	367	224
Arroyo Seco - sub K (Millard)	3	95	31	174	83	234	124	416	256	536	347	1,003	717
Arroyo Seco - sub L (Chiquita)	0.13	2	2	5	4	7	7	14	14	19	18	39	38
Arroyo Seco - sub M (Fall Creek @ Angeles Fire Station)	0.16	19	4	29	9	35	12	56	25	68	32	113	62
Eaton Wash (sub A)	4.6	101	58	216	153	304	228	580	469	767	635	1,510	1,311
Upper W F San Gabriel River Devil's Canyon (sub A)	4.8	103	56	227	157	322	236	645	514	863	705	1,775	1,524
Upper W F San Gabriel River Devil's Canyon (sub B)	17	623	200	1,202	560	1,624	840	3,027	1,833	3,957	2,511	7,721	5,430
Upper W F San Gabriel River Devil's Canyon (sub C)	22.32	1,981	590	3,272	1,434	4,163	2,050	6,921	4,006	8,657	5,271	15,501	10,543

Little Rock Reservoir A	27.6	132	98	324	274	475	413	1,008	909	1,369	1,254	3,206	2,893
Aliso Canyon - sub A	6	138	38	242	99	321	149	598	329	787	459	1,544	1,010
Aliso Canyon - sub B	0.54	5	4	12	9	17	14	36	31	49	43	105	95
Aliso Canyon - sub C	14	298	91	534	236	713	354	1,343	781	1,773	1,090	3,513	2,399
Aliso Canyon - sub D	23	463	152	841	394	1,130	591	2,148	1,307	2,847	1,822	5,681	4,011
Aliso Canyon - sub E	4	95	23	164	60	216	91	395	200	517	279	1,002	615
Aliso Canyon - sub F	8	185	55	329	141	438	211	822	467	1,083	652	2,138	1,434
Aliso Canyon - sub G	0.39	8	3	14	7	19	10	36	22	48	31	96	69
Aliso Canyon - sub H	3	90	22	155	57	203	86	373	190	488	265	947	583
Soledad/Arrastre Canyon - sub A (Bootleg)	1.48	43	13	83	38	112	57	212	126	279	175	566	394
Soledad/Arrastre Canyon - sub B (Moody and Arrastre)	8	338	75	612	211	810	321	1,469	705	1,905	976	3,732	2,200
Lower Soledad Canyon - sub A (Indian)	1.82	34	17	74	47	104	71	207	155	278	215	589	485
Lower Soledad Canyon - sub B (Mattox and Mill)	9	298	83	561	232	754	353	1,402	776	1,835	1,075	3,677	2,423
Lower Soledad Canyon - sub C (unnamed)	21	5	2	10	4	14	7	26	15	34	21	69	47

Table: 7

Times Increase from Normal Discharge for Station Fire							
	Drainage Area (Square Miles)	2 year Storm (X-Increase	5 year storm (x increase)	10 year storm (x increase)	25 year storm (x increase)	50 year storm (x increase)	100 year storm (x increase)
Pacoima Wash - sub A	24	3.78	2.61	2.30	1.92	1.81	1.59
Lower Big Tujunga - sub A (Little T @ Reservoir)	20.63	1.92	1.50	1.41	1.28	1.25	1.18
Lower Big Tujunga - sub B	0.1	1.00	1.00	1.00	1.00	1.00	1.00
Lower Big Tujunga - sub C (Ebey)	0.94	2.93	2.06	1.87	1.60	1.52	1.38
Lower Big Tujunga - sub D (Doane)	0.71	4.00	2.64	2.36	1.93	1.81	1.60
Lower Big Tujunga - sub E (Akens)	0.42	4.01	2.65	2.36	1.93	1.81	1.60
Lower Big Tujunga - sub F (Big T @ Reservoir)	30.81	4.43	2.96	2.59	2.13	1.98	1.72
Lower Big Tujunga Canyon - sub G (Zachau)	0.3	4.51	2.92	2.53	2.08	1.95	1.70
Lower Big Tujunga - sub H (Rowley)	0.2	4.57	2.95	2.56	2.10	1.97	1.71
Lower Big Tujunga Canyon - sub I (Haines)	2	4.89	3.11	2.70	2.20	2.05	1.81
Lower Big Tujunga - sub J (Bluegum)	0.18	3.29	2.24	2.00	1.71	1.62	1.47
Lower Big Tujunga - sub K (above private home along river)	0.17	4.12	2.79	2.45	2.03	1.90	1.66
Lower Big Tujunga - sub L (Big T Fire Station area)	12.72	4.76	3.15	2.74	2.24	2.08	1.79
Lower Big Tujunga - sub M (Big T before communities)	43.82	3.72	2.55	2.26	1.89	1.78	1.57
Middle Big Tujunga - sub A	0.04	3.88	2.64	2.33	1.94	1.83	1.61
Middle Big Tujunga - sub B	4	3.62	2.49	2.21	1.86	1.76	1.56
Middle Big Tujunga - sub C	10	4.41	2.94	2.57	2.12	1.99	1.72
Upper Big Tujunga - sub A (Colby Ranch)	0.53	3.62	2.49	2.21	1.86	1.76	1.56
Upper Big Tujunga - sub B (Lynx Gulch)	2.83	2.60	1.91	1.74	1.52	1.46	1.34
Verdugo Wash - sub A (Blanchard)	38.8	1.99	1.54	1.43	1.31	1.27	1.20
Verdugo Wash - sub B (Cooks)	1.82	2.27	1.69	1.55	1.39	1.34	1.25
Verdugo Wash - sub C (Dunsmore)	0.87	3.75	2.50	2.20	1.85	1.74	1.55
Verdugo Wash - sub D (Ward)	0.1	5.04	3.20	2.77	2.25	2.09	1.80
Verdugo Wash - sub E (unnamed)	0.06	3.51	2.37	2.10	1.77	1.68	1.50
Verdugo Wash - sub F (Shields)	0.25	4.08	2.68	2.35	1.95	1.83	1.61
Verdugo Wash - sub G (Eagle)	0.14	3.85	2.56	2.25	1.88	1.77	1.57

Verdugo Wash - sub H (Goss)	0.19	4.71	3.02	2.62	2.14	2.00	1.74
Verdugo Wash - sub I (Sutton and Pickens)	1.26	4.69	3.02	2.62	2.14	2.00	1.73
Verdugo Wash - sub J (Mullally)	0.33	4.69	3.01	2.61	2.14	2.00	1.73
Arroyo Seco - sub A (Shover)	0.19	4.52	2.93	2.54	2.09	1.96	1.70
Arroyo Seco - sub B (Webber)	0.12	2.35	1.74	1.59	1.42	1.37	1.27
Arroyo Seco - sub C (Hall Beckley)	0.69	4.29	2.80	2.44	2.02	1.89	1.66
Arroyo Seco - sub D (Winery)	0.16	3.11	2.15	1.92	1.65	1.57	1.42
Arroyo Seco - sub E (Hay)	0.19	3.53	2.38	2.11	1.78	1.69	1.51
Arroyo Seco - sub F (Big Briar)	0.04	3.45	2.34	2.07	1.76	1.66	1.49
Arroyo Seco - sub G (Gould)	0.18	3.62	2.43	2.14	1.81	1.71	1.52
Arroyo Seco - sub H (Aqua)	0.01	1.43	1.23	1.19	1.13	1.12	1.09
Arroyo Seco - sub I (Arroyo Seco)	17.64	4.88	4.01	3.41	2.71	2.50	2.10
Arroyo Seco -sub J (El Prieto)	0.98	4.19	2.73	2.39	1.92	1.87	1.64
Arroyo Seco - sub K (Millard)	3	3.01	2.09	1.88	1.62	1.55	1.40
Arroyo Seco - sub L (Chiquita)	0.13	1.07	1.04	1.03	1.02	1.02	1.01
Arroyo Seco - sub M (Fall Creek @ Angeles Fire Station)	0.16	5.16	3.28	2.82	2.29	2.13	1.83
Eaton Wash (sub A)	4.6	1.77	1.41	1.33	1.24	1.21	1.15
Upper W F San Gabriel River Devil's Canyon (sub A)	4.8	1.83	1.45	1.36	1.25	1.22	1.16
Upper W F San Gabriel River Devil's Canyon (sub B)	17	3.11	2.15	1.93	1.65	1.58	1.42
Upper W F San Gabriel River Devil's Canyon (sub C)	22.32	3.36	2.28	2.03	1.73	1.64	1.47
Little Rock Reservoir A	27.6	1.34	1.18	1.15	1.11	1.09	1.11
Aliso Canyon - sub A	6	3.59	2.44	2.16	1.82	1.71	1.53
Aliso Canyon - sub B	0.54	1.52	1.29	1.23	1.17	1.14	1.11
Aliso Canyon - sub C	14	3.27	2.26	2.02	1.72	1.63	1.46
Aliso Canyon - sub D	23	3.03	2.13	1.91	1.64	1.56	1.42
Aliso Canyon - sub E	4	4.08	2.71	2.38	1.97	1.85	1.63
Aliso Canyon - sub F	8	3.40	2.33	2.07	1.76	1.66	1.49
Aliso Canyon - sub G	0.39	2.94	2.08	1.87	1.62	1.54	1.40
Aliso Canyon - sub H	3	4.05	2.70	2.37	1.96	1.84	1.62
Soledad/Arrastre Canyon - sub A (Bootleg)	1.48	3.19	2.19	1.96	1.68	1.60	1.44
Soledad/Arrastre Canyon - sub B (Moody and Arrastre)	8	4.49	2.90	2.52	2.08	1.95	1.70
Lower Soledad Canyon - sub A (Indian)	1.82	2.07	1.59	1.47	1.33	1.29	1.21
Lower Soledad Canyon - sub B (Mattox and Mill)	9	3.60	2.42	2.13	1.81	1.71	1.52

Lower Soledad Canyon - sub C (unnamed)	21	3.33	2.27	2.02	1.72	1.64	1.46

Table: 8

Increased Sediment Pre-Fire and Five Years After Burn		Increase from Pre-Fire Conditions				
6th Field Watershed	Drainage Area (Square Miles)	1 year (x prefire)	2 year (x prefire)	3 year (x prefire)	4 year (x prefire)	5 year (x prefire)
Pacoima Wash - sub A	24.00	21.2	7.6	4.0	3.6	2.7
Lower Big Tujunga - sub A (Little T @ Reservoir)	20.63	7.2	3.0	2.3	1.8	1.5
Lower Big Tujunga - sub B	0.10	1.0	1.0	1.0	1.0	1.0
Lower Big Tujunga - sub C (Ebey)	0.94	19.6	7.1	4.7	3.4	2.6
Lower Big Tujunga - sub D (Doane)	0.71	21.4	7.6	5.1	3.6	2.7
Lower Big Tujunga - sub E (Akens)	0.42	21.4	7.7	5.1	3.6	2.7
Lower Big Tujunga - sub F (Big T @ Reservoir)	30.81	25.6	9.0	6.0	4.2	3.1
Lower Big Tujunga Canyon - sub G (Zachau)	0.30	24.8	8.8	5.8	4.1	3.0
Lower Big Tujunga - sub H (Rowley)	0.20	25.2	8.9	5.9	4.2	3.0
Lower Big Tujunga Canyon - sub I (Haines)	2.00	26.8	9.5	6.2	4.4	3.2
Lower Big Tujunga - sub J (Bluegum)	0.18	16.2	6.0	4.1	3.0	2.3
Lower Big Tujunga - sub K (above private home along river)	0.17	23.3	8.3	5.5	3.9	2.9
Lower Big Tujunga - sub L (Big T Fire Station area)	12.72	29.5	10.3	6.8	4.7	3.4
Lower Big Tujunga - sub M (Big T before communities)	43.82	20.5	7.4	4.9	3.5	2.7
Middle Big Tujunga - sub A	0.04	24.6	8.7	5.8	4.1	3.0
Middle Big Tujunga - sub B	4.00	19.9	7.2	4.8	3.5	2.6
Middle Big Tujunga - sub C	10.00	25.7	9.0	6.0	4.3	3.1

Upper Big Tujunga - sub A (Colby Ranch)	0.53	20.0	7.2	4.8	3.5	2.6
Upper Big Tujunga - sub B (Lynx Gulch)	2.83	12.6	4.8	3.3	2.5	2.0
Verdugo Wash - sub A (Blanchard)	38.80	7.7	3.2	2.4	1.9	1.6
Verdugo Wash - sub B (Cooks)	1.82	9.6	3.8	2.7	2.1	1.7
Verdugo Wash - sub C (Dunsmore)	0.87	19.7	7.1	4.7	3.5	2.6
Verdugo Wash - sub D (Ward)	0.10	28.4	9.9	6.5	4.6	3.3
Verdugo Wash - sub E (unnamed)	0.06	23.3	8.3	5.5	3.9	2.9
Verdugo Wash - sub F (Shields)	0.25	21.9	7.8	5.2	3.8	2.8
Verdugo Wash - sub G (Eagle)	0.14	20.4	7.3	4.9	3.6	2.6
Verdugo Wash - sub H (Goss)	0.19	26.2	9.2	6.1	4.3	3.1
Verdugo Wash - sub I (Sutton and Pickens)	1.26	26.0	9.2	6.0	4.3	3.1
Verdugo Wash - sub J (Mullally)	0.33	26.0	9.2	6.0	4.3	3.1
Arroyo Seco - sub A (Shover)	0.19	24.5	8.7	5.7	4.1	3.0
Arroyo Seco - sub B (Webber)	0.12	10.0	3.9	2.8	2.2	1.7
Arroyo Seco - sub C (Hall Beckley)	0.69	27.0	9.5	6.2	4.5	3.2
Arroyo Seco - sub D (Winery)	0.16	15.1	5.6	3.8	2.9	2.2
Arroyo Seco - sub E (Hay)	0.19	17.9	6.5	4.4	3.2	2.4
Arroyo Seco - sub F (Big Briar)	0.04	17.4	6.3	4.3	3.2	2.4
Arroyo Seco - sub G (Gould)	0.18	18.5	6.7	4.5	3.3	2.5
Arroyo Seco - sub H (Aqua)	0.01	3.8	1.9	1.6	1.4	1.2
Arroyo Seco - sub I (Arroyo Seco)	17.64	26.9	13.0	8.4	5.9	4.1
Arroyo Seco -sub J (El Prieto)	0.98	22.7	8.0	5.3	3.8	2.9
Arroyo Seco - sub K	3.00	14.6	5.5	3.8	2.8	2.2

(Millard)						
Arroyo Seco - sub L (Chiquita)	0.13	1.5	1.1	1.1	1.1	1.0
Arroyo Seco - sub M (Fall Creek @ Angeles Fire Station)	0.16	28.7	10.0	6.6	4.7	3.3
Eaton Wash (sub A)	4.60	6.2	2.7	2.0	1.6	1.4
Upper W F San Gabriel River Devil's Canyon (sub A)	4.80	6.6	2.8	2.1	1.7	1.5
Upper W F San Gabriel River Devil's Canyon (sub B)	17.00	15.4	5.7	3.9	2.9	2.2
Upper W F San Gabriel River Devil's Canyon (sub C)	22.32	28.9	10.2	6.6	4.7	3.4
Little Rock Reservoir A	27.60	10.7	2.4	1.9	1.7	1.4
Aliso Canyon - sub A	6.00	19.0	6.9	4.6	3.3	2.5
Aliso Canyon - sub B	0.54	4.6	2.2	1.7	1.5	1.3
Aliso Canyon - sub C	14.00	19.2	6.9	4.7	3.4	2.5
Aliso Canyon - sub D	23.00	15.2	5.6	3.8	2.8	2.2
Aliso Canyon - sub E	4.00	22.4	8.0	5.3	3.8	2.8
Aliso Canyon - sub F	8.00	17.7	6.4	4.4	3.2	2.4
Aliso Canyon - sub G	0.39	14.5	5.4	3.7	2.8	2.1
Aliso Canyon - sub H	3.00	22.2	7.9	5.3	3.8	2.8
Soledad/Arrastre Canyon - sub A (Bootleg)	1.48	15.8	5.9	4.0	3.0	2.3
Soledad/Arrastre Canyon - sub B (Moody and Arrastre)	8.00	24.7	8.8	5.8	4.1	3.0
Lower Soledad Canyon - sub A (Indian)	1.82	8.3	3.4	2.5	2.0	1.6
Lower Soledad Canyon - sub B (Mattox and Mill)	9.00	22.1	7.9	5.2	3.8	2.8
Lower Soledad Canyon - sub C (unnamed)	0.18	16.8	6.2	4.2	3.1	2.4

Table: 9

Increased Sediment Pre-Fire and Five Years After Burn			Year After Burn (cubic yards/year)				
6th Field Watershed	Drainage Area (Square Miles)	Pre-Fire	1	2	3	4	5
Pacoima Wash - sub A	24	31951	676877	242245	127165	116377	87435
Lower Big Tujunga - sub A (Little T @ Reservoir)	20.63	46634	336513	141301	104967	84318	70857
Lower Big Tujunga - sub B	0.1	225	225	225	225	225	225
Lower Big Tujunga - sub C (Ebey)	0.94	2992	58663	21173	14195	10229	7644
Lower Big Tujunga - sub D (Doane)	0.71	1613	34455	12338	8222	5882	4357
Lower Big Tujunga - sub E (Akens)	0.42	942	20144	7213	4806	3438	2546
Lower Big Tujunga - sub F (Big T @ Reservoir)	30.81	39440	1008745	356190	235924	166140	121845
Lower Big Tujunga Canyon - sub G (Zachau)	0.3	679	16851	5957	3923	2810	2035
Lower Big Tujunga - sub H (Rowley)	0.2	469	11822	4174	2746	1964	1420
Lower Big Tujunga Canyon - sub I (Haines)	2	1168	31357	11108	7291	5158	3740
Lower Big Tujunga - sub J (Bluegum)	0.18	137	2223	824	560	413	315
Lower Big Tujunga - sub K (above private home along river)	0.17	213	4971	1768	1177	835	617
Lower Big Tujunga - sub L (Big T Fire Station area)	12.72	28021	826095	288816	189795	132339	95868
Lower Big Tujunga - sub M (Big T before communities)	43.82	56084	1148949	413211	277614	198935	148993
Middle Big Tujunga - sub A	0.037	118	2903	1026	679	485	353
Middle Big Tujunga - sub B	4	6964	138895	49982	33530	24367	18082
Middle Big Tujunga - sub C	10	17937	460570	162262	107066	76323	55237
Upper Big Tujunga - sub A (Colby Ranch)	0.53	961	19204	6909	4634	3367	2498
Upper Big Tujunga - sub B (Lynx Gulch)	2.83	5177	65142	24729	17252	13087	10230
Verdugo Wash - sub A (Blanchard)	38.8	43795	335882	140042	103094	82415	68731

Verdugo Wash - sub B (Cooks)	1.82	2062	19735	7885	5650	4399	3571
Verdugo Wash - sub C (Dunsmore)	0.87	2006	39457	14228	9519	6940	5146
Verdugo Wash - sub D (Ward)	0.1	232	6590	2307	1508	1070	765
Verdugo Wash - sub E (unnamed)	0.06	188	4389	1559	1031	741	540
Verdugo Wash - sub F (Shields)	0.25	572	12537	4477	2972	2148	1575
Verdugo Wash - sub G (Eagle)	0.14	323	6577	2364	1578	1147	848
Verdugo Wash - sub H (Goss)	0.19	439	11492	4046	2656	1895	1366
Verdugo Wash - sub I (Sutton and Pickens)	1.26	2907	75725	26671	17514	12500	9011
Verdugo Wash - sub J (Mullally)	0.33	765	19896	7008	4603	3285	2369
Arroyo Seco - sub A (Shover)	0.19	877	21486	7591	5013	3614	2595
Arroyo Seco - sub B (Webber)	0.12	552	5509	2167	1547	1210	965
Arroyo Seco - sub C (Hall Beckley)	0.69	5310	143436	50313	33032	23655	16825
Arroyo Seco - sub D (Winery)	0.16	767	11564	4285	2934	2201	1667
Arroyo Seco - sub E (Hay)	0.19	896	16000	5817	3927	2902	2155
Arroyo Seco - sub F (Big Briar)	0.041	194	3367	1228	831	616	459
Arroyo Seco - sub G (Gould)	0.18	831	15342	5559	3744	2759	2041
Arroyo Seco - sub H (Aqua)	0.013	62	237	119	97	85	76
Arroyo Seco - sub I (Arroyo Seco)	17.64	82712	2222455	1072861	692650	486336	336052
Arroyo Seco -sub J (El Prieto)	0.98	1127	25562	9065	6014	4269	3221
Arroyo Seco - sub K (Millard)	3	6160	90141	33712	23127	17183	13264
Arroyo Seco - sub L (Chiquita)	0.13	327	478	376	357	347	339
Arroyo Seco - sub M (Fall Creek @ Angeles Fire Station)	0.16	762	21881	7642	5000	3566	2522

Eaton Wash (sub A)	4.6	11270	69703	30440	23075	18490	16213
Upper W F San Gabriel River Devil's Canyon (sub A)	4.8	11903	78663	33711	25477	20582	17466
Upper W F San Gabriel River Devil's Canyon (sub B)	17	42423	651628	241430	166295	121620	93190
Upper W F San Gabriel River Devil's Canyon (sub C)	22.32	6100	176290	61920	40260	28670	20740
Little Rock Reservoir A	27.6	5924	63371	14149	11219	9820	8554
Aliso Canyon - sub A	6	6750	128176	46400	31157	22515	16913
Aliso Canyon - sub B	0.54	633	2928	1383	1094	931	825
Aliso Canyon - sub C	14	22712	435452	157487	105674	76298	57255
Aliso Canyon - sub D	23	26819	406312	150738	103098	76088	58579
Aliso Canyon - sub E	4	4110	92125	32850	21801	15537	11476
Aliso Canyon - sub F	8	9589	169447	61789	41721	30343	22968
Aliso Canyon - sub G	0.39	460	6678	2490	1710	1267	980
Aliso Canyon - sub H	3	3899	86563	30892	20515	14631	10817
Soledad/Arrastre Canyon - sub A (Bootleg)	1.48	2547	40347	14972	10136	7520	5816
Soledad/Arrastre Canyon - sub B (Moody and Arrastre)	8	14228	351105	124961	81860	58548	43368
Lower Soledad Canyon - sub A (Indian)	1.82	3138	26005	10655	7729	6147	5116
Lower Soledad Canyon - sub B (Mattox and Mill)	9	22626	499764	179464	118418	85399	63899
Lower Soledad Canyon - sub C (unnamed)	0.18	303	5086	1875	1263	932	716

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