PIKES PEAK AREA
FLASH FLOOD WARNING SYSTEM
NEEDS ASSESSMENT

Population and Structures at Risk

with

TECHNICAL APPENDIX

Bill Leon

with

Sally Brown Marina La Riva Deborah Woldruff

1986

Center for Community Development & Design

University of Colorado
Colorado Springs

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PIKES PEAK AREA
FLASH FLOOD WARNING SYSTEM
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Population and Structures at Risk

with Technical Appendix

for

The Pikes Peak Flood Hazard Task Force

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University of Colorado
Colorado Springs

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EXECUTIVE SUMMARY

The results of the inventory reported here indicate that the Region (western El Paso County) is home to many people who could be killed and contains many structures that could be damaged in the event of a major flash flood. El Paso County, Colorado Springs, Fountain, Manitou Springs, Green Mountain Falls, and Palmer Lake all have significant numbers of residents at risk. The percentages of 100 year flood plain residents in each of these communities and their proportionate shares of the $200,000 initial warning system cost (based on these percentages) are listed below.

	% of Residents	Share of Initial Warning System Cost
Colorado Springs	37.9%	$ 75,776
El Paso County	42.0%	$ 84,108
Manitou Springs	7.8%	$ 15,528
Green Mountain Falls	2.3%	$ 4,626
Fountain	8.6%	$ 17,113
Palmer Lake	1.4%	$ 2,849
TOTAL	100.0%	$200,000

Although the proposed warning system would have only a minor effect on property losses, it could help save the lives of hundreds of the 9,338 estimated residents in the Region's 100 year flood plains. The warning system described in this report is recommended as an important and timely component of region-wide flood warning and response capabilities and inter-community flood plain management.

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ACKNOWLEDGEMENTS

This report presents the results of data collected to enhance cooperative, multi-community planning for improved flood plain management. Its publication is also the result of extensive cooperation among all of the communities studied. In addition, the particular individuals and organizations listed below contributed significantly to the success of this project.

Flood Hazard Task Force

Dan Bunting, Regional Flood Plain Administrator, Regional Building Department
Frank Bustamento, City Manager, Fountain
Karen Cooper, Cripple Creek
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Deanna Di Velez, Concerned Westside Neighbors
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Toby Wells, State Soil Conservation Board
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Richard Wray, Simons, Li & Associates

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Federal Emergency Management Agency

International Hydrological Services

Eve Gruntfest, University of Colorado at Colorado Springs

Marie McIntire, Sally Meadows, Lisa Sedlak and Robin Cunningham, Center for Community Development and Design

INTRODUCTION

The need for a region-wide flash flood warning system as an important addition to flood plain management options in the Pikes Peak Region has been noted by many knowledgeable individuals and jurisdictions. The combined effects of meteorology and topography in western El Paso County create the potential for large-scale flooding on Fountain and Monument Creeks and their tributaries. Indeed, significant floods have occurred on these creeks, and these events have been documented in other reports. This publication has been designed to present the results of survey work that has documented the numbers of people who could die and the numbers of structures that could be severely damaged in the event of unpredicted flooding in the study area.

In March of 1986, the Center for Community Development and Design (CCDD) at the University of Colorado--Colorado Springs held a symposium to discuss the threats and implications of flash flooding and possible mitigation measures. In discussions there, representatives from jurisdictions and community groups in the area formed the Pikes Peak Flood Hazard Task Force. The Task Force met two days later at UCCS with representation from El Paso County, Colorado Springs, Manitou Springs, Green Mountain Falls, Fountain, Monument, Palmer Lake, the Organization of Westside Neighbors, and Teller County. Advisers to the Task Force included representatives from CCDD, UCCS, the State Division of Disaster Emergency Services, the Colorado Water Conservation Board, the Federal Emergency Management Agency, the U.S. Army Corps of Engineers, the National Weather Service, and Simons, Li and Associates. The Task Force noted the need for improvement in many aspects of flood plain management. It also saw the development and operation of a flash flood warning system as a major and immediate need that is inexpensive relative to other measures or the value of lives at risk.

Following many months of discussion, deliberation, and investigation, the Task Force agreed that an initial-stage warning system using rain gauges, stream gauges, and a central computer could serve the needs of all Task Force participants in making an early flash flood warning possible. Cooperative efforts by the jurisdictions involved were necessary to agree on the approach adopted, and greater cooperative efforts will be needed to fund, develop, and operate the warning system and to respond to the warning that it could one day give.

Discussions by the Task Force have often focused on the need for better information on the magnitude of risk in the region and in different communities. It was felt that a comprehensive inventory of populations and structures in the various flood plains was needed to apportion warning system costs and to better plan warning and response strategies. Responding to this need, CCDD initiated (at its own expense) such a survey of all streams within the warning system planning area defined by the Task Force.

PIKES PEAK REGION EARLY FLOOD WARNING SYSTEM

From the outset it was obvious to the Task Force that any system developed would have its primary impact on saving lives and not property. The historic development of the flood plain areas had left little hope of reducing property loss without the expenditure of large amounts of money on reclamation, reconstruction, and floodproofing. The conceptual design cost for a single capital improvement project would pay the majority, if not all, of the cost for implementation of a warning system.

The plan developed, listed courses of action and resources to be explored. Research of available or planned systems that already attempt to meet the need was done. Key people in utility departments and federal and state agencies were contacted. Federal agencies such as the Army Corps of Engineers, the Federal Emergency Management Agency and the National Weather Service were contacted to request funding and design support. Other jurisdictions that had implemented programs were contacted for advice, information, and support.

DESCRIPTION

The early warning system would cover approximately 580 square miles in western El Paso County including six municipalities and the most heavily urbanized portions of the county. The proposed system consists of 26 remote sensing stations--6 stream level gauges and 20 precipitation gauges. The remote sensors would relay data through a radio transmitter to a primary base station located at the El Paso County Disaster Services office, 230 East Kiowa. Disaster Services is responsible for initiating and coordinating evacuation activities during emergencies. A secondary base station would be located at the Regional Building Department, 101 West Costilla. The Building Department would function as the operation and maintenance group for the system. In addition, the data collected would be forwarded to the National Weather Service at Peterson Field. The Weather Service is responsible for issuing flash flood warnings. Exhibit 1 depicts a preliminary siting of the equipment.

COST

The base station's major components are a micro-computer, radio receiver/data decoder, and printer. The primary base station would also be equipped with weather radar and detailed regional mapping. The secondary base station would not have these two features but would include necessary maintenance equipment and replacement parts. Costs for the system are estimated as follows:

Primary Base Station

Receiver/decoder	$ 3,000
Micro Computer	8,000
ALERT Software(1)	3,000
Weather Radar	12,000
Miscellaneous Hardware	1,000
Subtotal	$ 27,000

Data Collection System

26 remote stream and precipitation gauges	$104,000
Radio repeater stations	21,000
Subtotal	$125,000

Secondary Base Station and Maintenance Equipment

Receiver/decoder	$ 3,000
Micro Computer	8,000
ALERT Software	3,000
Test and Repair Equipment	5,000
Replacement Parts	3,000
Subtotal	$ 22,000
Installation and start up	4,000
10% contingency	17,000
Subtotal	$ 21,000
Total System Cost	$195,000

Maintenance costs for the system would run between $3,000 and $5,000 annually, with a predicted life expectancy of 25 years. The system is expandable to several hundred gauges. Approximately forty gauges are estimated to be the optimum needed for this region. The initially proposed 26 gauge system will give the minimum adequate coverage.

This early warning system will give accurate real-time (instantaneous) reporting of precipitation and stream level conditions. This information, in conjunction with the National Weather Service meteorologic forecasting and weather radar, will substantially improve the advanced warning of an impending flood, allowing a more organized and efficient evacuation.

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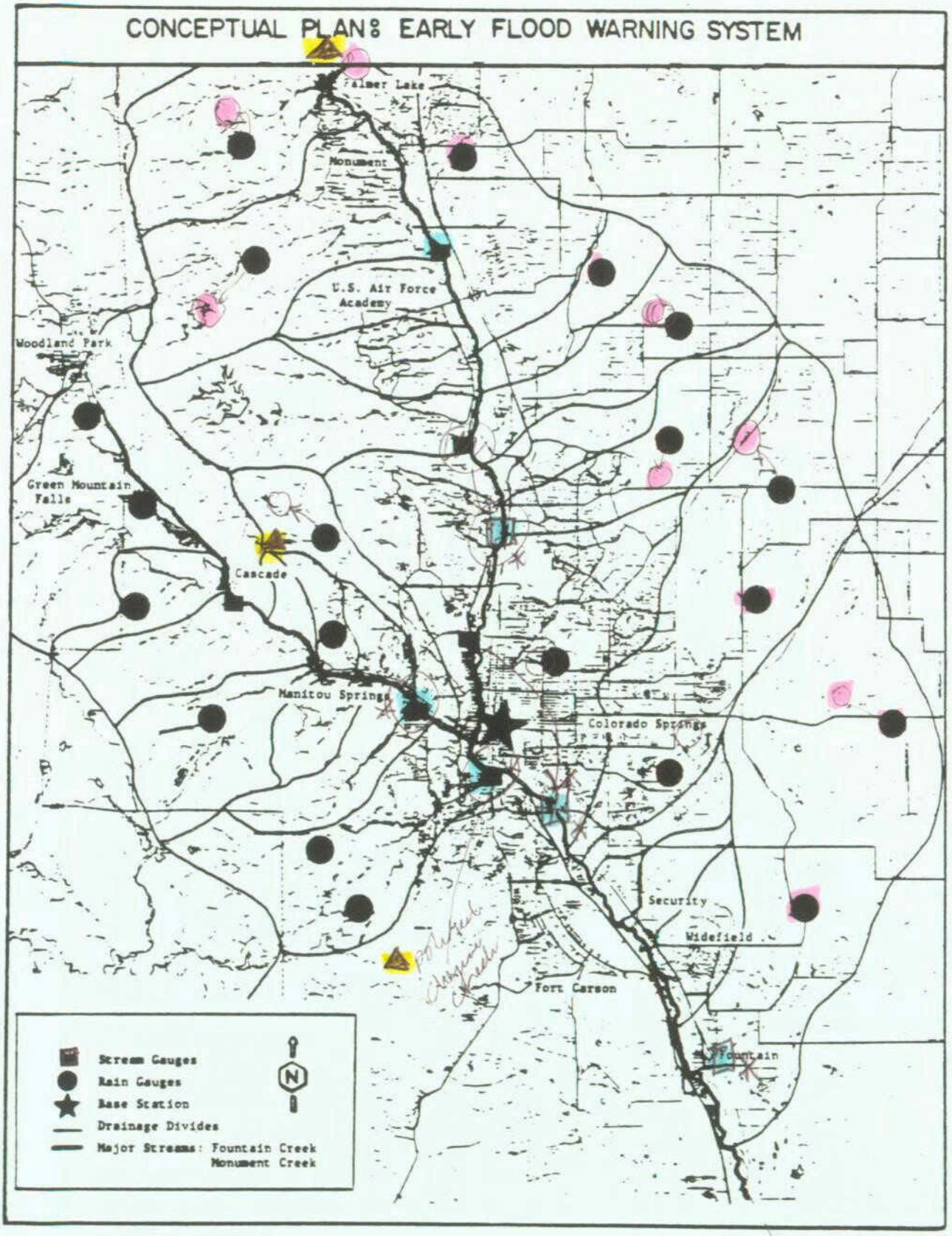
(1) ALERT is a data management and analysis system offered by International Hydrological Services that provides real-time information for flood warning systems.

EXHIBIT 1


CONCEPTUAL PLAN: EARLY FLOOD WARNING SYSTEM
Palmer Lake
Monument
U.S. Air Force Academy
Woodland Park
Green Mountain Falls
Cascade
Manitou Springs
Colorado Springs
Security
Widefield
Fort Carson
Fountain
Stream Gauges
Rain Gauges
Base Station
Drainage Divides
Major Streams: Fountain Creek
Monument Creek
N

POPULATION AND STRUCTURES AT RISK

INVENTORY METHODOLOGY

The inventory of structures was conducted with supervisory assistance from Dan Bunting of the Pikes Peak Regional Building Department and Mark Matulik of the Colorado Water Conservation Board. Mr. Matulik and three students at UCCS were involved in gathering the data.

Primary resources were the latest flood plain maps published by the Federal Emergency Management Agency. The maps indicated areas subject to potential 100 year and 500 year floods (floods with 1% and 0.2% annual frequencies). Data were collected by street addresses and classified under appropriate jurisdiction and tributary. Estimated error in the data collection phase is under three percent.

Data from the 1980 census of population were used in estimating the population in these areas. The figure used was population per household. Each residential unit was counted as one household. As an example, five single family homes (or multi-family units) in census tract 34, which has 2.39 persons/household, equal 11.95 people. No adjustments for vacancies were made.

Each jurisdiction was broken down by subtotals of single family structures, multi-family structures, residential units, single family and multi-family populations. A further break down was completed by tributary with the above subtotals (SFH, MFH, etc.). Other data on non-residential structures were also collected. All the information was compiled on computers at UCCS.

INVENTORY RESULTS

The results of the regional inventory are summarized in Table 1 which shows the numbers of structures and people occupying the 100 year flood plains in the region and in the six jurisdictions with significant risk.(2)

The Region contains 3,368 single family structures, 88 multi-family structures and a total of 3,979 residential units in its flood plains. The estimated population in these units is 9,338. In addition, 681 non-residential structures were inventoried.

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(2) Monument is omitted because it has only a single, non-residential structure in the flood plain within its boundaries.

Colorado Springs has approximately 3,538 residents living in its flood plains. This figure represents 37.9% of the regional population. This percentage represents $75,776 of the $200,000 initial warning system cost and $1,894 of the $5,000 annual maintenance cost.

El Paso County has approximately 3,927 residents living in its flood plains. This figure represents 42.0% of the regional population. This percentage represents $84,108 of the $200,000 initial warning system cost and $2,103 of the $5,000 annual maintenance cost.

Manitou Springs has approximately 725 residents living in its flood plains. This figure represents 7.8% of the regional population. This percentage represents $15,528 of the $200,000 initial warning system cost and $388 of the $5,000 annual maintenance cost.

Green Mountain Falls has approximately 216 residents living in its flood plains. This figure represents 2.3% of the regional population. This percentage represents $4,626 of the $200,000 initial warning system cost and $116 of the $5,000 annual maintenance cost.

Fountain has approximately 799 residents living in its flood plains. This figure represents 8.6% of the regional population. This percentage represents $17,113 of the $200,000 initial warning system cost and $428 of the $5,000 annual maintenance cost.

Palmer Lake has approximately 133 residents living in its flood plains. This figure represents 1.4% of the regional population. This percentage represents $2,849 of the $200,000 initial warning system cost and $71 of the $5,000 annual maintenance cost.

TABLE 1

PIKES PEAK FLASH FLOOD RISK DATA

All 100 Year Flood Plain	Region	Colorado Springs	El Paso County	Manitou Springs	Green Mtn Falls	Fountain	Palmer Lake
Residential	Res	Res	Res	Res	Res	Res	Res
S F Struc	3368	1096	1696	228	80	221	47
M F Struc	88	36	17	24	3	8	0
Res Struc	3456	1132	1713	252	83	229	47
S F Units	3368	1096	1696	228	80	221	47
M F Units	611	357	86	128	10	30	0
Res Units	3979	1453	1782	356	90	251	47
S F Pop	7723	2570	3674	451	192	703	133
M F Pop	1615	968	253	274	24	96	0
Res Pop	9338	3538	3927	725	216	799	133
% Res Pop	100	37.88819	42.05397	7.763975	2.313129	8.556436	1.424287
% Cost	200000	75776.39	84107.94	15527.95	4626.258	17112.87	2848.575
% Maint.	5000	1894.409	2102.698	388.1987	115.6564	427.8218	71.21439
Non-Resid'l	Non-Res	Non-Res	Non-Res	Non-Res	Non-Res	Non-Res	Non-Res
Structures	681	295	97	269	15	4	1
% Struc	100	43.31864	14.24375	39.50073	2.202643	0.587371	0.146842

CONCLUSIONS AND RECOMMENDATIONS

The numbers of structures and people occupying the Region's flood plains are significant in total and in most communities. A flash flood warning system is a necessary component of wise flood plain management within the Region at this time. It would not significantly reduce property damages during a flood, but it could help save hundreds of lives.

The Pikes Peak Flood Hazard Task Force recommended on September 12, 1986 that local jurisdictions cooperatively fund the development, implementation, and operation of the proposed flood warning system. (See Appendix 1.) The formula for cost distribution suggested was based on the residential occupation of the Region's 100 year flood plains as substantiated in this report. On October 8, 1986 the Pikes Peak Area Council of Governments also gave formal approval to the recommended system and cost distribution formula and encouraged member communities to contribute to its initial and ongoing funding.

It should be noted that the warning system proposed is one element in a region-wide planning, warning, and response approach to threats posed by flash floods. Once it is in place, there will still be a great need for local jurisdictions to cooperate in all phases of region-wide disaster preparedness and hazard mitigation. As a first step toward cooperative, comprehensive flood plain planning, however, the development of the warning system now would be the best policy for all jurisdictions in the Region.

APPENDICES

APPENDIX 1: TASK FORCE RESOLUTION

September 12, 1986

BE IT HEREBY RESOLVED:

THAT, the Pikes Peak Regional Flood Warning Task Force endorse the current Flood Warning concept and system, based upon the occupancy of the 100 year floodplain; and

THEREFORE, recommend that the individual jurisdictions appropriate funding accordingly.

APPENDIX 2: PIKES PEAK FLASH FLOOD RISK DATA

PIKES PEAK FLASH FLOOD RISK DATA

All 100 Year Flood Plain	Region	Colorado Springs	El Paso County	Manitou Springs	Green Mtn Falls	Fountain	Palmer Lake
Residential	**Res**	**Res**	**Res**	**Res**	**Res**	**Res**	**Res**
S F Struc	3368	1096	1696	228	80	221	47
M F Struc	88	36	17	24	3	8	0
Res Struc	3456	1132	1713	252	83	229	47
S F Units	3368	1096	1696	228	80	221	47
M F Units	611	357	86	128	10	30	0
Res Units	3979	1453	1782	356	90	251	47
S F Pop	7723	2570	3674	451	192	703	133
M F Pop	1615	968	253	274	24	96	0
Res Pop	9338	3538	3927	725	216	799	133
% Res Pop	100	37.88819	42.05397	7.763975	2.313129	8.556436	1.424287
% Cost	200000	75776.39	84107.94	15527.95	4626.258	17112.87	2848.575
% Maint.	5000	1894.409	2102.698	388.1987	115.6564	427.8218	71.21439
Non-Resid'l	**Non-Res**	**Non-Res**	**Non-Res**	**Non-Res**	**Non-Res**	**Non-Res**	**Non-Res**
Structures	681	295	97	269	15	4	1
% Struc	100	43.31864	14.24375	39.50073	2.202643	0.587371	0.146842
Lodging	**Lodging**	**Lodging**	**Lodging**	**Lodging**	**Lodging**	**Lodging**	**Lodging**
Motel Sp	643	159	11	463	10	0	0
RV/Camp Sp	610	465	70	75	0	0	0
Lodging Sp	1253	624	81	538	10	0	0
% L Sp	100	49.80047	6.464485	42.93695	0.798084	0	0
Totals	**Totals**	**Totals**	**Totals**	**Totals**	**Totals**	**Totals**	**Totals**
Structures	4137	1427	1810	521	98	233	48
Population	9338	3538	3927	725	216	799	133

PIKES PEAK FLASH FLOOD RISK DATA

All 100 Year Flood Plain	CS--Camp Creek	Cheyenne Ck-CS	Fountain Ck A-CS	So Shooks Run-CS	Bear Ck-CS	North Mon-CS	Monument Ck A-CS
Residential	Res	Res	Res	Res	Res	Res	Res
S F Struc	307	462	135	52	1	1	14
M F Struc	2	11	16	5	0	0	0
Res Struc	309	473	151	57	1	1	14
S F Units	307	462	135	52	1	1	14
M F Units	42	78	189	34	0	0	0
Res Units	349	540	324	86	1	1	14
S F Pop	792	1050	291	107	2	3	40
M F Pop	96	167	597	78	0	0	0
0	888	1217	888	185	2	3	40
% Res Pop	9.509530	13.03276	9.509530	1.981152	0.021417	0.032126	0.428357
% Cost	19019.06	26065.53	19019.06	3962.304	42.83572	64.25358	856.7144
% Maint.	475.4765	651.6384	475.4765	99.05761	1.070893	1.606339	21.41786
Non-Resid'l	Non-Res	Non-Res	Non-Res	Non-Res	Non-Res	Non-Res	Non-Res
Structures	20	21	117	2	5	0	3
% Struc	2.936857	3.083700	17.18061	0.293685	0.734214	0	0.440528
Lodging	Lodging	Lodging	Lodging	Lodging	Lodging	Lodging	Lodging
Motel Sp	12	0	147	0	0	0	0
RV/Camp Sp	0	0	465	0	0	0	0
Lodging Sp	12	0	612	0	0	0	0
% L Sp	0.957701	0	48.84277	0	0	0	0
Totals	Totals	Totals	Totals	Totals	Totals	Totals	Totals
Structures	329	494	268	59	6	1	17
Population	888	1217	888	185	2	3	40

PIKES PEAK FLASH FLOOD RISK DATA

All 100 Year Flood Plain	Butler Creek-PL	Monument Trib-PL	North Cty Crystal-CO	North Cty Mon-CO	North Cty Hay Ck-CO	NC-Dirty Woman-CO	Widefield Creek-CO
Residential	**Res**	**Res**	**Res**	**Res**	**Res**	**Res**	**Res**
S F Struc	29	18	1	2	3	9	43
M F Struc	0	0	0	0	0	0	0
Res Struc	29	18	1	2	3	9	43
S F Units	29	18	1	2	3	9	43
M F Units	0	0	0	0	0	0	0
Res Units	29	18	1	2	3	9	43
S F Pop	82	51	3	6	9	29	157
M F Pop	0	0	0	0	0	0	0
0	82	51	3	6	9	29	157
% Res Pop	0.901891	0.560932	0.0329960	0.065992	0.098988	0.318961	1.726792
% Cost	1803.783	1121.865	65.992080	131.9841	197.9762	637.9234	3453.585
% Maint.	45.09458	28.04663	1.6498020	3.299604	4.949406	15.94808	86.33963
Non-Resid'l	**Non-Res**	**Non-Res**	**Non-Res**	**Non-Res**	**Non-Res**	**Non-Res**	**Non-Res**
Structures	0	1	0	0	0	0	0
% Struc	0	0.162866	0	0	0	0	0
Lodging	**Lodging**	**Lodging**	**Lodging**	**Lodging**	**Lodging**	**Lodging**	**Lodging**
Motel Sp	0	0	0	0	0	0	0
RV/Camp Sp	0	0	0	0	0	0	0
Lodging Sp	0	0	0	0	0	0	0
% L Sp	0	0	0	0	0	0	0
Totals	**Totals**	**Totals**	**Totals**	**Totals**	**Totals**	**Totals**	**Totals**
Structures	29	19	1	2	3	9	43
Population	82	51	3	6	9	29	157

PIKES PEAK FLASH FLOOD RISK DATA

All 100 Year Flood Plain	CS-Ftn & Cheyenne	Ftn Ck S'moor-CO	Fountain Ck-FTN	Fountain Ck B-CS	Ftn Ck CO	Cheyenne Ck-CS	Ftn Creek MS
Residential	**Res**	**Res**	**Res**	**Res**	**Res**	**Res**	**Res**
S F Struc	2	345	221	3	0	14	109
M F Struc	0	10	8	0	0	2	8
Res Struc	2	355	229	3	0	16	117
S F Units	2	345	221	3	0	14	109
M F Units	0	20	30	0	0	14	60
Res Units	2	365	251	3	0	28	169
S F Pop	4	902	703	6	0	29	204
M F Pop	0	52	96	0	0	30	127
0	4	954	799	6	0	59	331
% Res Pop	0.042835	10.21632	8.556436	0.064253	0	0.631826	3.544656
% Cost	85.67144	20432.64	17112.87	128.5071	0	1263.653	7089.312
% Maint.	2.141786	510.8160	427.8218	3.212679	0	31.59134	177.2328
Non-Resid'l	**Non-Res**	**Non-Res**	**Non-Res**	**Non-Res**	**Non-Res**	**Non-Res**	**Non-Res**
Structures	7	7	4	8	0	45	206
% Struc	1.027900	1.027900	0.587371	1.174743	0	6.607929	30.24963
Lodging	**Lodging**	**Lodging**	**Lodging**	**Lodging**	**Lodging**	**Lodging**	**Lodging**
Motel Sp	0	0	0	0	0	0	432
RV/Camp Sp	0	0	0	0	0	0	75
Lodging Sp	0	0	0	0	0	0	507
% L Sp	0	0	0	0	0	0	40.46288
Totals	**Totals**	**Totals**	**Totals**	**Totals**	**Totals**	**Totals**	**Totals**
Structures	9	362	233	11	0	61	323
Population	4	954	799	6	0	59	331

PIKES PEAK FLASH FLOOD RISK DATA

All 100 Year Flood Plain	Beckers Trib--MS	Ruxton Ck--MS	Sutherlan Ck--MS	Williams Ck--MS	Fountain Ck--GMF	Catamount Ck--GMF	Foun/Cat Cks--GMF
Residential	**Res**	**Res**	**Res**	**Res**	**Res**	**Res**	**Res**
S F Struc	7	22	47	43	25	35	20
M F Struc	2	11	1	2	2	1	0
Res Struc	9	33	48	45	27	36	20
S F Units	7	22	47	43	25	35	20
M F Units	6	49	4	9	8	2	0
Res Units	13	71	51	52	33	37	20
S F Pop	13	50	107	77	60	84	48
M F Pop	11	111	9	16	19	5	0
O	24	161	116	93	79	89	48
% Res Pop	0.263968	1.770787	1.275846	1.022877	0.868895	0.978882	0.527936
% Cost	527.9366	3541.575	2551.693	2045.754	1737.791	1957.765	1055.873
% Maint.	13.19841	88.53937	63.79234	51.14386	43.44478	48.94412	26.39683
Non-Resid'l	**Non-Res**	**Non-Res**	**Non-Res**	**Non-Res**	**Non-Res**	**Non-Res**	**Non-Res**
Structures	6	22	34	1	5	6	4
% Struc	0.977198	3.583061	5.537459	0.162866	0.814332	0.977198	0.651465
Lodging	**Lodging**	**Lodging**	**Lodging**	**Lodging**	**Lodging**	**Lodging**	**Lodging**
Motel Sp	0	0	31	0	10	0	0
RV/Camp Sp	0	0	0	0	0	0	0
Lodging Sp	0	0	31	0	10	0	0
% L Sp	0	0	2.474062	0	0.798084	0	0
Totals	**Totals**	**Totals**	**Totals**	**Totals**	**Totals**	**Totals**	**Totals**
Structures	15	55	82	46	32	42	24
Population	24	161	116	93	79	89	48

PIKES PEAK FLASH FLOOD RISK DATA

All 100 Year Flood Plain	Ftn Ck Chip-CO	Ftn Ck Cas-CO	Widefield Ck-CO	Security Ck-CO	Stratmoor Hills-CO	Temp Gap Fwy-CS	Dry Ck CS
Residential	**Res**	**Res**	**Res**	**Res**	**Res**	**Res**	**Res**
S F Struc	28	25	41	1174	25	0	1
M F Struc	0	3	0	0	4	0	0
Res Struc	28	28	41	1174	29	0	1
S F Units	28	25	41	1174	25	0	1
M F Units	0	10	0	0	56	0	0
Res Units	28	35	41	1174	81	0	1
S F Pop	67	60	150	2212	79	0	3
M F Pop	0	24	0	0	177	0	0
0	67	84	150	2212	256	0	3
% Res Pop	0.717498	0.899550	1.606339	23.68815	2.741486	0	0.032126
% Cost	1434.996	1799.100	3212.679	47376.31	5482.972	0	64.25358
% Maint.	35.87491	44.97751	80.31698	1184.407	137.0743	0	1.606339
Non-Resid'l	**Non-Res**	**Non-Res**	**Non-Res**	**Non-Res**	**Non-Res**	**Non-Res**	**Non-Res**
Structures	13	7	26	29	15	0	0
% Struc	1.908957	1.027900	3.817914	4.258443	2.202643	0	0
Lodging	**Lodging**	**Lodging**	**Lodging**	**Lodging**	**Lodging**	**Lodging**	**Lodging**
Motel Sp	11	0	0	0	0	0	0
RV/Camp Sp	70	0	0	0	0	0	0
Lodging Sp	81	0	0	0	0	0	0
% L Sp	6.464485	0	0	0	0	0	0
Totals	**Totals**	**Totals**	**Totals**	**Totals**	**Totals**	**Totals**	**Totals**
Structures	41	35	67	1203	44	0	1
Population	67	84	150	2212	256	0	3

PIKES PEAK FLASH FLOOD RISK DATA

All 100 Year Flood Plain	Pine Ck CS	Monument Ck B-CS	Cottonwd Ck-CS	Fountain Ck C-CS	Douglas So-CS	Douglas No-CS
Residential	**Res**	**Res**	**Res**	**Res**	**Res**	**Res**
S F Struc	0	13	12	79	0	0
M F Struc	0	0	0	0	0	0
Res Struc	0	13	12	79	0	0
S F Units	0	13	12	79	0	0
M F Units	0	0	0	0	0	0
Res Units	0	13	12	79	0	0
S F Pop	0	25	39	179	0	0
M F Pop	0	0	0	0	0	0
0	0	25	39	179	0	0
% Res Pop	0	0.267723	0.417648	1.916898	0	0
% Cost	0	535.4465	835.2966	3833.797	0	0
% Maint.	0	13.38616	20.88241	95.84493	0	0
Non-Resid'l	**Non-Res**	**Non-Res**	**Non-Res**	**Non-Res**	**Non-Res**	**Non-Res**
Structures	0	5	0	0	3	59
% Struc	0	0.734214	0	0	0.440528	8.663729
Lodging	**Lodging**	**Lodging**	**Lodging**	**Lodging**	**Lodging**	**Lodging**
Motel Sp	0	0	0	0	0	0
RV/Camp Sp	0	0	0	0	0	0
Lodging Sp	0	0	0	0	0	0
% L Sp	0	0	0	0	0	0
Totals	**Totals**	**Totals**	**Totals**	**Totals**	**Totals**	**Totals**
Structures	0	18	12	79	3	59
Population	0	25	39	179	0	0

PIKES PEAK FLASH FLOOD RISK DATA

100 Year or 500 Year Flood Plain	Region	Colorado Springs	El Paso County	Manitou Springs	Green Mtn Falls	Fountain	Palmer Lake
Residential	**Res**	**Res**	**Res**	**Res**	**Res**	**Res**	**Res**
S F Struc	4420	1417	2043	235	80	598	47
M F Struc	144	50	17	32	3	42	0
Res Struc	4564	1467	2060	267	83	640	47
S F Units	4420	1417	2043	235	80	598	47
M F Units	1082	483	86	222	10	281	0
Res Units	5502	1900	2129	457	90	879	47
S F Pop	10859	3357	4809	466	192	1902	133
M F Pop	2898	1315	253	412	24	894	0
Res Pop	13757	4672	5062	878	216	2796	133
% Res Pop	100	33.96089	36.79581	6.382205	1.570109	20.32419	0.966780
% Cost	200000	67921.78	73591.62	12764.41	3140.219	40648.39	1933.561
% Maint.	5000	1698.044	1839.790	319.1102	78.50548	1016.209	48.33902
Non-Resid'l	**Non-Res**	**Non-Res**	**Non-Res**	**Non-Res**	**Non-Res**	**Non-Res**	**Non-Res**
Structures	1018	493	178	296	15	35	1
% Struc	100	48.42829	17.48526	29.07662	1.473477	3.438113	0.098231
Lodging	**Lodging**	**Lodging**	**Lodging**	**Lodging**	**Lodging**	**Lodging**	**Lodging**
Motel Sp	702	159	11	522	10	0	0
RV/Camp Sp	610	465	70	75	0	0	0
Lodging Sp	1312	624	81	597	10	0	0
% L Sp	100	47.56097	6.173780	45.50304	0.762195	0	0
Totals	**Totals**	**Totals**	**Totals**	**Totals**	**Totals**	**Totals**	**Totals**
Structures	5582	1960	2238	563	98	675	48
Population	13757	4672	5062	878	216	2796	133

PIKES PEAK FLASH FLOOD RISK DATA

100 Year or 500 Year Flood Plain	CS--Camp Creek	Cheyenne Ck-CS	Fountain Ck A-CS	So Shooks Run-CS	Bear Ck-CS	North Mon-CS	Monument Ck A-CS
Residential	**Res**	**Res**	**Res**	**Res**	**Res**	**Res**	**Res**
S F Struc	441	483	170	111	2	1	14
M F Struc	4	11	17	11	0	0	0
Res Struc	445	494	187	122	2	1	14
S F Units	441	483	170	111	2	1	14
M F Units	82	78	192	67	0	0	0
Res Units	523	561	362	178	2	1	14
S F Pop	1138	1095	383	231	4	3	40
M F Pop	187	167	603	162	0	0	0
Res Pop	1325	1262	986	393	4	3	40
% Res Pop	9.631460	9.173511	7.167260	2.856727	0.029076	0.021807	0.290761
% Cost	19262.92	18347.02	14334.52	5713.454	58.15221	43.61416	581.5221
% Maint.	481.5730	458.6755	358.3630	142.8363	1.453805	1.090354	14.53805
Non-Resid'l	**Non-Res**	**Non-Res**	**Non-Res**	**Non-Res**	**Non-Res**	**Non-Res**	**Non-Res**
Structures	22	22	141	5	23	0	3
% Struc	2.161100	2.161100	13.85068	0.491159	2.259332	0	0.294695
Lodging	**Lodging**	**Lodging**	**Lodging**	**Lodging**	**Lodging**	**Lodging**	**Lodging**
Motel Sp	12	0	147	0	0	0	0
RV/Camp Sp	0	0	465	0	0	0	0
Lodging Sp	12	0	612	0	0	0	0
% L Sp	0.914634	0	46.64634	0	0	0	0
Totals	**Totals**	**Totals**	**Totals**	**Totals**	**Totals**	**Totals**	**Totals**
Structures	467	516	328	127	25	1	17
Population	1325	1262	986	393	4	3	40

PIKES PEAK FLASH FLOOD RISK DATA

100 Year or 500 Year Flood Plain	Butler Creek-PL	Monument Trib-PL	North Cty Crystal-CO	North Cty Mon-CO	North Cty Hay Ck-CO	NC-Dirty Woman-CO	Widefield Creek-CO
Residential	**Res**	**Res**	**Res**	**Res**	**Res**	**Res**	**Res**
S F Struc	29	18	1	3	3	9	207
M F Struc	0	0	0	0	0	0	0
Res Struc	29	18	1	3	3	9	207
S F Units	29	18	1	3	3	9	207
M F Units	0	0	0	0	0	0	0
Res Units	29	18	1	3	3	9	207
S F Pop	82	51	3	9	9	29	756
M F Pop	0	0	0	0	0	0	0
Res Pop	82	51	3	9	9	29	756
% Res Pop	0.622390	0.387096	0.0227703	0.068311	0.068311	0.220113	5.738140
% Cost	1244.781	774.1935	45.540796	136.6223	136.6223	440.2277	11476.28
% Maint.	31.11954	19.35483	1.1385199	3.415559	3.415559	11.00569	286.9070
Non-Resid'l	**Non-Res**	**Non-Res**	**Non-Res**	**Non-Res**	**Non-Res**	**Non-Res**	**Non-Res**
Structures	0	1	0	0	0	0	0
% Struc	0	0.121359	0	0	0	0	0
Lodging	**Lodging**	**Lodging**	**Lodging**	**Lodging**	**Lodging**	**Lodging**	**Lodging**
Motel Sp	0	0	0	0	0	0	0
RV/Camp Sp	0	0	0	0	0	0	0
Lodging Sp	0	0	0	0	0	0	0
% L Sp	0	0	0	0	0	0	0
Totals	**Totals**	**Totals**	**Totals**	**Totals**	**Totals**	**Totals**	**Totals**
Structures	29	19	1	3	3	9	207
Population	82	51	3	9	9	29	756

PIKES PEAK FLASH FLOOD RISK DATA

100 Year or 500 Year Flood Plain	CS-Ftn & Cheyenne	Ftn Ck S'moor-CO	Fountain Ck-FTN	Fountain Ck B-Cs	Ftn Ck CO	Cheyenne Ck-CS	Ftn Creek MS
Residential	**Res**	**Res**	**Res**	**Res**	**Res**	**Res**	**Res**
S F Struc	2	464	598	7	15	14	115
M F Struc	0	10	42	0	0	2	16
Res Struc	2	474	640	7	15	16	131
S F Units	2	464	598	7	15	14	115
M F Units	0	20	281	0	0	14	154
Res Units	2	484	879	7	15	28	269
S F Pop	4	1213	1902	14	48	29	217
M F Pop	0	52	894	0	0	30	265
Res Pop	4	1265	2796	14	48	59	482
% Res Pop	0.029076	9.195318	20.32419	0.101766	0.348913	0.428872	3.503670
% Cost	58.15221	18390.63	40648.39	203.5327	697.8265	857.7451	7007.341
% Maint.	1.453805	459.7659	1016.209	5.088318	17.44566	21.44362	175.1835
Non-Resid'l	**Non-Res**	**Non-Res**	**Non-Res**	**Non-Res**	**Non-Res**	**Non-Res**	**Non-Res**
Structures	11	10	35	14	71	58	233
% Struc	1.080550	0.982318	3.438113	1.375245	6.974459	5.697445	22.88801
Lodging	**Lodging**	**Lodging**	**Lodging**	**Lodging**	**Lodging**	**Lodging**	**Lodging**
Motel Sp	0	0	0	0	0	0	491
RV/Camp Sp	0	0	0	0	0	0	75
Lodging Sp	0	0	0	0	0	0	566
% L Sp	0	0	0	0	0	0	43.14024
Totals	**Totals**	**Totals**	**Totals**	**Totals**	**Totals**	**Totals**	**Totals**
Structures	13	484	675	21	86	74	364
Population	4	1265	2796	14	48	59	482

PIKES PEAK FLASH FLOOD RISK DATA

100 Year or 500 Year Flood Plain	Beckers Trib--MS	Ruxton Ck--MS	Sutherlan Ck--MS	Williams Ck--MS	Fountain Ck--GMF	Catamount Ck--GMF	Foun/Cat Cks--GMF
Residential	**Res**	**Res**	**Res**	**Res**	**Res**	**Res**	**Res**
S F Struc	7	22	48	43	25	35	20
M F Struc	2	11	1	2	2	1	0
Res Struc	9	33	49	45	27	36	20
S F Units	7	22	48	43	25	35	20
M F Units	6	49	4	9	8	2	0
Res Units	13	71	52	52	33	37	20
S F Pop	13	50	109	77	60	84	48
M F Pop	11	111	9	16	19	5	0
Res Pop	24	161	118	93	79	89	48
% Res Pop	0.182163	1.222011	0.895635	0.705882	0.599620	0.675521	0.364326
% Cost	364.3263	2444.022	1791.271	1411.764	1199.240	1351.043	728.6527
% Maint.	9.108159	61.10056	44.78178	35.29411	29.98102	33.77609	18.21631
Non-Resid'l	**Non-Res**	**Non-Res**	**Non-Res**	**Non-Res**	**Non-Res**	**Non-Res**	**Non-Res**
Structures	6	22	34	1	5	6	4
% Struc	0.728155	2.669902	4.126213	0.121359	0.606796	0.728155	0.485436
Lodging	**Lodging**	**Lodging**	**Lodging**	**Lodging**	**Lodging**	**Lodging**	**Lodging**
Motel Sp	0	0	31	0	10	0	0
RV/Camp Sp	0	0	0	0	0	0	0
Lodging Sp	0	0	31	0	10	0	0
% L Sp	0	0	2.362804	0	0.762195	0	0
Totals	**Totals**	**Totals**	**Totals**	**Totals**	**Totals**	**Totals**	**Totals**
Structures	15	55	83	46	32	42	24
Population	24	161	118	93	79	89	48

PIKES PEAK FLASH FLOOD RISK DATA

100 Year or 500 Year Flood Plain	Ftn Ck Chip-CO	Ftn Ck Cas-CO	Widefield Ck-CO	Security Ck-CO	Stratmoor Hills-CO	Temp Gap Fwy-CS	Dry Ck CS
Residential	**Res**	**Res**	**Res**	**Res**	**Res**	**Res**	**Res**
S F Struc	28	25	86	1177	25	17	12
M F Struc	0	3	0	0	4	5	0
Res Struc	28	28	86	1177	29	22	12
S F Units	28	25	86	1177	25	17	12
M F Units	0	10	0	0	56	50	0
Res Units	28	35	86	1177	81	67	12
S F Pop	67	60	314	2222	79	57	41
M F Pop	0	24	0	0	177	166	0
Res Pop	67	84	314	2222	256	223	41
% Res Pop	0.487024	0.610598	2.282474	16.15177	1.860870	1.620992	0.298030
% Cost	974.0495	1221.196	4564.948	32303.55	3721.741	3241.985	596.0601
% Maint.	24.35123	30.52991	114.1237	807.5888	93.04354	81.04964	14.90150
Non-Resid'l	**Non-Res**	**Non-Res**	**Non-Res**	**Non-Res**	**Non-Res**	**Non-Res**	**Non-Res**
Structures	13	7	26	36	15	27	0
% Struc	1.277013	0.687622	2.554027	3.536345	1.473477	2.652259	0
Lodging	**Lodging**	**Lodging**	**Lodging**	**Lodging**	**Lodging**	**Lodging**	**Lodging**
Motel Sp	11	0	0	0	0	10	0
RV/Camp Sp	70	0	0	0	0	0	0
Lodging Sp	81	0	0	0	0	10	0
% L Sp	6.173780	0	0	0	0	0.762195	0
Totals	**Totals**	**Totals**	**Totals**	**Totals**	**Totals**	**Totals**	**Totals**
Structures	41	35	112	1213	44	49	12
Population	67	84	314	2222	256	223	41

PIKES PEAK FLASH FLOOD RISK DATA

100 Year or 500 Year Flood Plain	Pine Ck CS	Monument Ck B-CS	Cottonwd Ck-CS	Fountain Ck C-CS	Douglas So-CS	Douglas No-CS
Residential	**Res**	**Res**	**Res**	**Res**	**Res**	**Res**
S F Struc	0	52	12	79	0	0
M F Struc	0	0	0	0	0	0
Res Struc	0	52	12	79	0	0
S F Units	0	52	12	79	0	0
M F Units	0	0	0	0	0	0
Res Units	0	52	12	79	0	0
S F Pop	0	100	39	179	0	0
M F Pop	0	0	0	0	0	0
Res Pop	0	100	39	179	0	0
% Res Pop	0	0.726902	0.283492	1.301155	0	0
% Cost	0	1453.805	566.9840	2602.311	0	0
% Maint.	0	36.34513	14.17460	65.05778	0	0
Non-Resid'l	**Non-Res**	**Non-Res**	**Non-Res**	**Non-Res**	**Non-Res**	**Non-Res**
Structures	42	6	0	57	3	59
% Struc	4.125736	0.589390	0	5.599214	0.294695	5.795677
Lodging	**Lodging**	**Lodging**	**Lodging**	**Lodging**	**Lodging**	**Lodging**
Motel Sp	0	0	0	0	0	0
RV/Camp Sp	0	0	0	0	0	0
Lodging Sp	0	0	0	0	0	0
% L Sp	0	0	0	0	0	0
Totals	**Totals**	**Totals**	**Totals**	**Totals**	**Totals**	**Totals**
Structures	42	58	12	136	3	59
Population	0	100	39	179	0	0

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