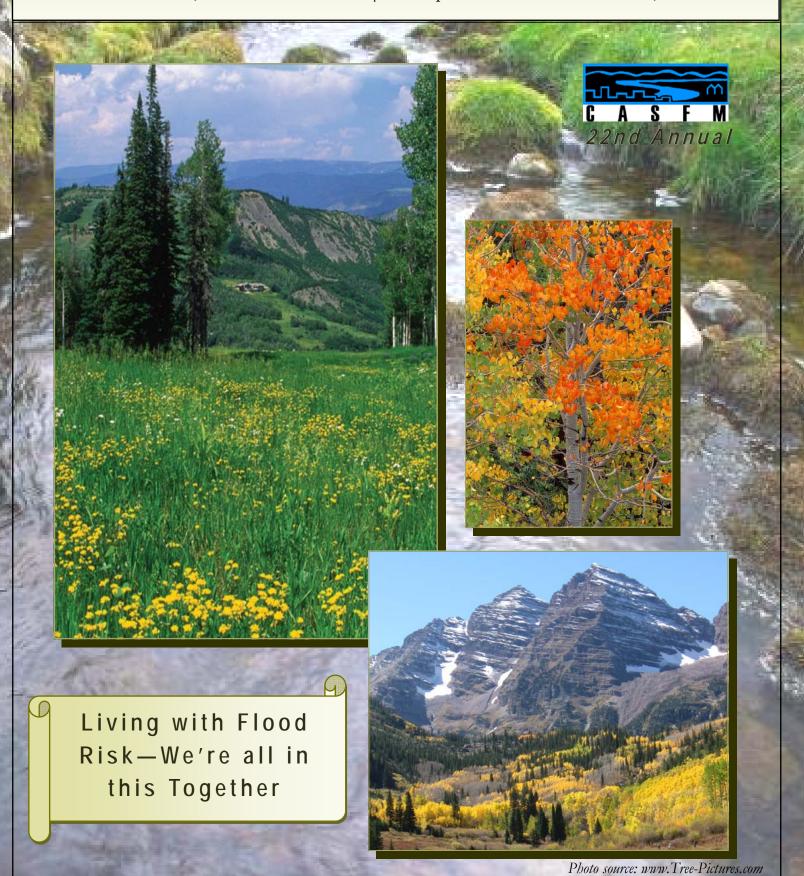
2011 CASFM CONFERENCE

Snowmass, Colorado | September 27-30, 2011





$\mathcal{WELCOME}!$

Welcome to the 22nd Annual CASFM Conference!

Living with Flood Risk, We're All in this Together

Welcome CASFM members! We're All in this Together and we are excited to use the conference to share new ideas and initiatives. Thank you to everyone for participating in this CASFM conference and making this an important annual event. We appreciate the returning members that have attended this annual conference in years past, and welcome the new members. We want to thank the many speakers that worked hard to prepare for this conference and are the backbone of this event. I hope you find the conference to be of value to you from a networking and educational perspective, as well as a highlight to your daily work routine.

We have been actively working all year to prepare for this conference and have high expectations for this event. We heard your comments from last year's conference, and have made a few changes. We are breaking up the technical presentations over two days and would like your comments on the new program arrangement. We are excited to announce that this conference includes a keynote from a local author on the Colorado River, a featured presentation on last year's amazing Snowmass Mammoth discovery, 39 technical presentations, 2 educational workshops, 3 project award presentations, and 2 field trips.

Many CASFM members have devoted significant time to help organize this conference. I would like to express special gratitude and appreciation to the following individuals for donating their time and effort to organize this year's conference:

- Shea Thomas, Program Chairman
- Stuart Gardner, Facilities Chairman & Web Master
- Alan Turner, Registration
- David Krickbaum, Vendors & Sponsorships
- John Pflaum, Project Awards
- Brian Murphy, Field Trips Coordinator
- Rich Ommert, Bike Tour Coordinator
- Dave Center, Golf Tournament
- Janae Newman, Olsson Associates Conference Announcement and Brochures

Enjoy the conference, and we look forward to seeing you in Steamboat Springs next year in September 2012!



Robert Krehbiel Conference Chairman

A special thanks to our conference sponsors!

Platinum Sponsor: Matrix Design Group

old Sponsors: Michael Baker Jr.

Lyman Henn Atkins TRS Nilex Moser & Associates

AMEC Earth & Environmental Bowman Construction Supply Hanes Geo Components Enginuity Engineering Solutions Triton Environmental

Muller Engineering Co.

Anderson Consulting Engineers Contech Construction Products Short Elliott Hendrickson Parson Brinkerhoff Advanced Drainage Systems

ERO Resources Corporation

Bronze Sponsors:

Ayres Associates

JVA

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SCHEDULE AT-A-GLANCE

Tuesday, September 27, 2011				We	dnesday, S	epte	mber	28, 2011			
7:00				7:00			Certified F Manager I				
8:00	Certified Floodplain			8:00	Registration and Brea	kfast	•				
9:00	Manager Training Session			9:00	Introduction and Wel	come					
					Post-Fire Flood Prepa	redness					
10:00	(Lunch provided)			10:00	Keynote Address - Ru the Sea Down the Col		-				
11:00				11:00							
12:00				12:00	Lunch Introduction of 2011/2012 Officers and Committee Chairs Presentation of Scholarship Recipients						
1:00				1:00		n Retrofit Update by Basil Hamdan					
2:00		Workshop #1	Workshop #1	Workshop #1	Workshop #1		2:00	Con Risk Management	Stream Re Floor	hnical Sessi storation / Iplain	
3:00		Culvert Hydraulics	Workshop #2	3:00	<		eak	>			
4:00			Colorado Risk Map Program	4:00							
5:00	Dinner on your own				Happy Hour Sponsored by Michael Baker						
6:00				6:00							
7:00				7:00	Dinner on your own						
8:00	Ice Breaker Social H	our	8:00	Hospitality Suite Sponsored by Enginuity Engineering Solutions							



Stay informed of CASFM proceedings throughout the year at:

www.casfm.org



Thursday, September 29, 2011										
7:00										
	General Membership	Breakfast I	Meeting							
8:00										
	2011 CASFM Award F	inalist Pres	entations							
9:00										
10:00	Break									
11:00	Featured Present A Mammoth Disc by Jon Sikora	overy		Concurrent hnical Sessions						
12:00	Lunch Board Member Meeting									
1:00										
	Con	current Tec	chnical Sessi	ions						
2:00	Watershed Studies	Manage	nwater ment and Control	Water Quality						
3:00	<		eak	>						
4:00										
5:00										
4.00	Cocktail Hour									
6:00										
7:00	CASFM Association Dinner									
8:00										
9:00	Karaoke Night									
10:00										

Friday, September 30, 2011										
7:00										
	Continental Brea	Continental Breakfast								
8:00										
	Closing Remarks	5								
9:00	Field	Trips								
10:00	Mammoth Discovery Site	Mountain Bike Tour	Golf Tournament							
	and	2								
11:00	Campground									
	Run Slump									
12:00										
1:00										
2:00										







FEATURED SPEAKERS

JON WATERMAN

Jonathan Waterman is the author of Running Dry: A Journey from Source to Sea Down the Colorado River and ten other popular books. Three-time winner of the Banff Best Adventure Travel Book award and a NEA Literary Fellowship, he works as an immersion journalist, making arduous passages through remote landscapes to develop an intimate sense of place. Supported by the National Geographic Society during many of these journeys, he is now researching and photographing 16 drying rivers in the southwest, in hopes of affecting public policy before these waterways are lost. Through stunning photography, story telling, and scholarly research, Waterman implores his readers and lecture audiences to care about the overtaxed river. His lucid



presentation is also tinged with hope, a direction for restoration, and potential solutions for the future.

Waterman lives with his family in a self built, sustainable Carbondale, Colorado, home, which he dreams of one day disconnecting from the western power grid to run on native wind and solar energy.



JOHN SIKORA

The Ziegler Reservoir Enlargement Project was supposed to be an easy dam enlargement project. The geotechnical investigation in May 2010 followed by the mammoth discovery in mid-October of 2010 changed that assumption. The over-4,500 paleontological bones discovered during the excavation for the dam changed the scope of the project forever. This presentation is a brief summary of the engineering aspects of the project. The paleontological aspects of the project will be featured in a National Geographic presentation later this year.

John Sikora is a licensed engineer in the State of Colorado and a Diplomat of Water Resources Engineering. He is a graduate of the University of Illinois in Agricultural Engineering and has over 25 years of water resources experience. He is the Project Manager for URS Glenwood Springs for the Ziegler Reservoir Enlargement Project.





CERTIFICATION AND WORKSHOPS

CERTIFIED FLOODPLAIN MANAGER-TRAINING AND EXAM

Kevin Houck—Colorado Water Conservation Board Kallie Bauer—Michael Baker Craig Jacobson—ICON Engineering

The Certified Floodplain Manager (CFM) program lays the foundation for ensuring that highly qualified individuals are available to meet the challenge of breaking the flood damage cycle and stopping its negative drain on the nation's human, financial and natural resources. A fundamental goal for this certification is to help reduce the State's flood losses and protect and enhance the natural resources and functions of its floodplains by improving the knowledge and abilities of floodplain managers in the State. The CFM program was developed and is administered by the Association of State Floodplain Managers.

CULVERT HYDRAULICS WORKSHOP

Richard Smith—Ayres Associates

Participants will learn the essential elements of the hydraulic analysis and design of culverts. Learning will be reinforced through flume demonstrations of the theoretical principles. Topics covered will include factors affecting culvert capacity; inlet control vs. outlet control; effects of barrel roughness, size, shape, slope and inlet treatment. Energy dissipators will be briefly examined.

COLORADO RISK MAP PROGRAM WORKSHOP

Thuy Patton, Colorado Water Conservation Board Dawn Gladwell and Julie Baxter, FEMA Region VIII Dave Jula, Michael Baker

The vision for Risk MAP is to deliver quality data that increases public awareness and leads to action that reduces risk to life and property. Risk MAP builds on flood hazard data and maps produced during the Flood Map Modernization (Map Mod) program.

FEMA plans to realize this vision with the help of more comprehensive scoping efforts (now referred to as Discovery); a new suite of non-regulatory Risk MAP Products; and a new timeline with enhanced outreach opportunities. This workshop will provide an in-depth look at these new procedures and products and lessons learned from the early applications of the program. The CWCB is launching a new Risk Map website and that will be presented as well.







2011 CASFM AWARD FINALISTS

COTTONWOOD CREEK RESTORATION AND STABILIZATION

City of Colorado Springs

AMEC Environment and Infrastructure

A major drainageway within the City of Colorado Springs, Cottonwood Creek (which runs through the northeastern part of the City) has been experiencing a substantial increase in flows, resulting in horizontal and vertical channel migration and threatening of adjacent structures. During the past 20-30 years, the creek bed has down-scoured about 12 feet at several locations. As a result of the imminent risks, the City received a Pre-Disaster Mitigation grant of \$3M from FEMA to stabilize the creek. The grant, along with cost sharing from the City, Qwest and Current USA, covered the \$4.3M project budget.

AMEC Environment & Infrastructure recently completed the preliminary design to restore and stabilize a 1.5-mile stretch of Cottonwood Creek between Academy Boulevard and Monument Creek confluence, and the

final design and specifications package for the most highly-impacted half mile stretch immediately east of I-25. Duration for design and construction for the project was September 2007 through May 2011.

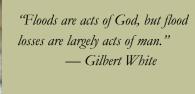
GILBERT F. WHITE MEMORIAL FLOOD LEVEL MARKER Gilbert F. White Memorial Committee

While honoring Gilbert, often referred to as the "Father of Floodplain Management," the Memorial stands tribute to his life's work, and is as he would have demanded—that if built, it should serve a functional purpose. In his honor, the City of Boulder now has an important icon and a sustainable flood hazard education program. Both art and science, the flood level marker is a vivid reminder of the powerful force of rushing floodwaters. The marker's size (20' high!) will startle both a viewer standing next to it, and someone driving across the Broadway Bridge, who will be able to see it from their car.

The marker is located in Central Park in downtown Boulder. The area is at the nexus of a major transportation corridor, and the major floodway in

Boulder. It is also at the apex of the area where we might expect the greatest flood damage. This is the first public flood level marker in the city—the city with the greatest risk for flash flooding in the State of Colorado.





PINEY CREEK STREAM STABILIZATION AND BRIDGE CROSSING IMPROVEMENTS

Southeast Metro Stormwater Authority, Urban Drainage and Flood Control District

Master planning for the Piney Creek drainage basin identified a series of grade control structures and areas requiring bank stabilization necessary to lower the erosive velocities in the channel and to reduce erosion of the stream bank. Piney Creek exhibits the down-cutting typical of an urban stream environment. The amount of base flow in Piney Creek has increased due to the increase in impervious surfaces, and this base flow has increased sediment loads. In addition to its active role in channel bank erosion, sediment transport is also a major factor in stormwater pollution control issues in the Cherry Creek watershed, of which Piney Creek is a major



tributary. Sediment is considered the primary transport mechanism for phosphorous.

East Caley Drive crosses Piney Creek in the Piney Creek Ranches subdivision. A potentially dangerous flood safety issue existed with the frequent overtopping of the roadway in events as small as a 2-year storm. Arapahoe County constructed an Emergency Access Road for residents of Piney Creek to utilize during these flooding conditions in 2006, but the 'when and where' logistics of utilizing the road for both residents and emergency personnel were too complicated for a long-term solution. The construction of the Caley Bridge provided residents and emergency vehicles access during flooding events up to a 100-year storm.

CASFM would like to acknowledge the following additional projects that were nominated for consideration in the awards competition, but were not selected as one of the three finalists. Nevertheless, they are outstanding projects deserving of our recognition.

NEW STATE FLOODPLAIN RULES AND REGULATIONS

Colorado Water Conservation Board ICON Engineering, Inc.

AIRPORT CREEK IMPROVEMENTS

City of Westminster Muller Engineering

BOULDER CREEK-THIRD-PARTY TMDL

City of Boulder Tetra Tech A special thanks to the judging committee:

- * John Pflaum—Awards Chair
- * David Hollingsworth, City of Longmont
- * Kevin Wegener—City of Aurora
- * Alan Searcy—City of Lakewood

As you're wrapping up your projects in 2011, keep them in mind for the 2012 CASFM Project Award. Here is the important submittal requirements:

Eligibility: Colorado project completed prior to May 2012

Submittal: A brief one-page abstract/description of the project and any supplemental

information including photographs, drawings, renderings, reports, graphic

media, etc.

Criteria: Does the project enhance the public health, safety and welfare?

Does the project enhance the surrounding environment?

Does the project incorporate any creative, unique or innovative designs?

Does the project include multiple-objective management in achieving its goal?

Did the project meet its goal with respect to solution, budget and schedule?

Can the project serve as a model for other communities and/or projects?



FIELD TRIPS

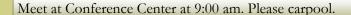
MAMMOTH DISCOVERTY SITE AND CAMPGROUND RUN SLUMP

Brian Murphy, CDM

During construction of the Ziegler Reservoir expansion project near Snowmass Village, a bulldozer operator noticed something unusual sticking out of the ground that turned out to be rib bones from a woolly mammoth estimated to be 10,000 years old. The Denver Museum of Nature and Science joined the excavation work on the site that museum officials called "one of the most significant scientific discoveries in Colorado history."

This field trip will include a visit to the mammoth discovery site, led by John Sikora of URS Corporation. Though construction is nearing completion, participants will see where the bones were discovered, get a feel for the unique geologic formation that likely led to such a massive collection of pre-historic remains, and see the dam embankment that was under construction at the time of the discovery.

After the mammoth site, the group will proceed to the Snowmass Ski Resort to see the mudslide that occurred on Campground Run in July. This area is prone to landslides, springs and old mine shafts reopening. If time allows, the group will also check out other drainage and debris flow areas on the Snowmass Ski Resort.





MOUNTAIN BIKE TOUR

Rich Ommert, Moser & Associates

Mountain biking is an excellent way to immerse yourself in the beauty that the Rocky Mountains have to offer! This year's bike tour will follow a paved trail, winding through 12 miles of scenic mountain vistas known as the Owl Creek Trail. The trail will begin near Snowmass Village and lead to the heart of Aspen, where riders will have the option to bike back on the same trail or take a shuttle from Aspen back to Snowmass.

Mountain bike rentals are available at Four-Mountain Sports, located in the Snowmass Mall. After riding to Aspen, rented bikes may be returned at the Four-Mountain Sports Aspen location, just one block from the shuttle bus stop. After returning your rental, you may climb aboard the shuttle returning to Snowmass free of charge. If you ride a personal bike, you may take the shuttle back to Snowmass for a charge of \$2. For more information on bike rentals and pricing, contact Four-Mountain Sports at (970) 920-2337.

9:00 am Meet at Conference Center 12:00 pm Arrive in Aspen 1:00 pm Return to Snowmass

CONFERENCE SCHEDULE

TUESDAY, SEPTEMBER 27, 2011

8:00 AM-5:00 PM CERTIFIED FLOODPLAIN MANAGER

TRAINING SESSION

Location: Main Ballroom—Anderson Side

Kallie Bauer, Chris Tagert—Michael Baker

Kevin Houck—Colorado Water Conservation Board

Craig Jacobson—ICON

2:00 PM-5:00 PM CULVERT HYDRAULICS WORKSHOP

Location: Club Room (3rd Floor in the Silvertree Hotel)

Richard Smith—Ayres Associates

3:00 PM-5:00 PM COLORADO RISK MAP PROGRAM WORKSHOP

Location: Kearns Room

Dawn Gladwell, Julie Baxter—FEMA Region III

Dave Jula—Michael Baker

Thuy Patton—Colorado Water Conservation Board

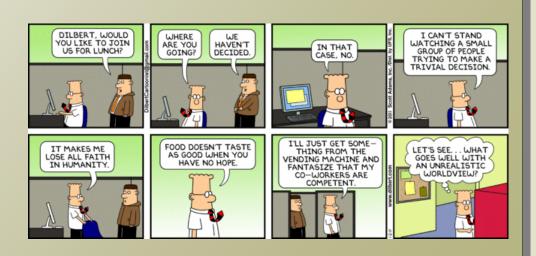
5:00 PM-8:00 PM DINNER ON YOUR OWN

8:00 PM-9:00 PM | ICE BREAKER SOCIAL HOUR

Location: The Cabaret Room (Below the Main Lobby in the Silvertree Hotel)

WONDERING WHERE TO EAT?

There is a flyer at the registration desk with a list of restaurants in Snowmass and Aspen that are open for business.



WEDNESDAY, SEPTEMBER 28, 2011

7:00 AM-10:00 AM CERTIFIED FLOODPLAIN MANAGER EXAM

Location: Main Ballroom—Hoaglund Side

Kallie Bauer-Michael Baker

8:00 AM-9:00 AM REGISTRATION AND BREAKFAST

Location: Conference Center Lobby and Vendor Area

Alan Turner—CH2M Hill

9:00 AM-9:30 AM INTRODUCTION AND WELCOME

Location: Main Ballroom—Anderson Side

CASFM Chair: David Mallory—Urban Drainage and Flood Control District

9:30 AM-10:00 AM POST-FIRE FLOOD PREPAREDNESS

Location: Main Ballroom—Anderson Side

Mike Chard—Boulder Office of Emergency Management Kevin Stewart—Urban Drainage and Flood Control District

10:00 AM-11:30 AM KEYNOTE ADDRESS

RUNNING DRY: A JOURNEY FROM THE SOURCE

TO THE SEA DOWN THE COLORADO

Location: Main Ballroom—Anderson Side

Jon Waterman

11:30 AM-1:30 PM LUNCH

Location: Roof Garden (Second Floor of the Conference Center)

Introduction of 2011/2012 Officers and Committee Chairs

LT1 Bioretention Retrofit Update by Basil Hamdan—Fort Collins

1:30 PM-2:00 PM CONCURRENT TECHNICAL SESSIONS:

Use codes to find abstracts, starting on Page 22.

RM1 LIVING WITH FLOOD RISK DUE TO MUD AND DEBRIS

FLOWS

Location: Main Ballroom—Anderson Side

Alaina Smith—Tetra Tech

SR1 SH119 ALONG NORTH CLEAR CREEK-HYDRAULICS

AND FLOODPLAIN ANALYSIS

Location: Main Ballroom—Hoaglund Side

John Hunt, Nikki Randall—Ayres Associates

Mike Pierce—Tetra Tech, Alfred Gross—CDOT Region 1

WEDNESDAY, SEPTEMBER 28, 2011 (continued)

TM1 2-D MODELING AS A CALIBRATION TOOL FOR RIVERINE FLOODPLAIN ANALYSIS ON THE FRONT RANGE

Location: Kearns Room

Cory Hooper, Alan Turner—CH2MHill

Shea Thomas—Urban Drainage and Flood Control District

2:00 PM-2:30 PM CONCURRENT TECHNICAL SESSIONS:

RM2 COLORADO'S FLOOD DECISION SUPPORT SYSTEM:
A REVIEW OF THE 2011 FLOOD SEASON

Location: Main Ballroom—Anderson Side Amy Volckens—Riverside Technology

Carolyn Fritz—Colorado Water Conservation Board

SR2 REGIONAL HYDRAULIC GEOMETRY RELATIONSHIPS
FOR THE FOUNTAIN CREEK WATERSHED-REVISITED

Location: Main Ballroom—Hoaglund Side

Lucas Babbitt, Graham Thompson—Matrix Design Group

TM2 RADAR-BASED DEPTH AREA REDUCTION FACTORS
FOR COLORADO

Location: Kearns Room

David Curtis—WEST Consultants
Daniel Bare—City of Colorado Springs

2:30 PM-3:00 PM CONCURRENT TECHNICAL SESSIONS:

RM3 MODELING AND COMMUNITY ENGAGEMENT TOOLS FOR FLOOD HAZARD AND RISK ASSESSMENT MITIGATION PLANNING UNDER CHANGING CONDITIONS

Location: Main Ballroom—Anderson Side

Graeme Aggett—AMEC
Doug Walker—Placeways

SR3 SOUTH PLATTE RIVER SEGMENT 15 PHASE II
HABITAT IMPROVEMENTS

Location: Main Ballroom—Hoaglund Side Brian Murphy, Katie Goodwin—CDM

WEDNESDAY, SEPTEMBER 28, 2011 (continued)

EAGLE P3 ADVERSE IMPACT ANALYSIS-TM3

CONSTRUCTING A \$2 BILLION TRANSPORTATION

CORRIDOR ACROSS DRAINAGE MAYHEM

Location: Kearns Room

Don Jacobs—Enginuity Engineering Solutions

Rich Thornton—HDR

3:00 PM-3:30 PM **BREAK**

Location: Vendor Area

3:30 PM-4:00 PM CONCURRENT TECHNICAL SESSIONS:

> A No Adverse Impact Approach to Managing RM4

FLOOD RISK IN FORT COLLINS

Location: Main Ballroom—Anderson Side Brian Varrella—City of Fort Collins

TAKING MATTERS INTO YOUR OWN HANDS-SR4

FLOODPLAIN REMAPPING IN SPRINGFIELD, MO Location: Main Ballroom—Hoaglund Side

Todd Wagner, Errin Kemper—City of Springfield, MO

FINDING HIGH GROUND-DAM BREACH AND HAZARD TM4

CLASSIFICATION GUIDELINES IN COLORADO

Location: Kearns Room

Jeremy Franz, Jason Ward—Colorado Division of Water Resources

4:00 PM-4:30 PM CONCURRENT TECHNICAL SESSIONS:

> ESTIMATING FLOOD DAMAGE IMPACTS ON EXISTING RM5

> > AND FUTURE DEVELOPMENT WITHIN THE POUDRE RIVER FLOODPLAIN IN FORT COLLINS, COLORADO

Location: Main Ballroom—Anderson Side

Jeff Brislawn—AMEC

Brian Varrella—City of Fort Collins

SR5 CONVERTING NATURAL CHANNELS INTO DIMENSIONLESS RATIOS (AND THEN BACK)

Location: Main Ballroom—Hoaglund Side

Danny Elsner—SEH

Graham Thompson—Matrix Design Group

Dave Skuodas—Urban Drainage and Flood Control District

PAGE 14

WEDNESDAY, SEPTEMBER 28, 2011 (continued)

TM5 APPLYING RADAR BASED "RAINFALL" TO DEVELOP

RUNOFF PARAMETERS

Location: Kearns Room

Lucas Babbitt—Matrix Design Group Dan Bare—City of Colorado Springs

4:30 PM-5:00 PM CONCURRENT TECHNICAL SESSIONS:

RM6 REDUCING RISKS THROUGH FEMA MITIGATION

GRANTS

Location: Main Ballroom—Anderson Side

Deanna Butterbaugh, Iain Hyde, Ken Brink—Colorado Division of

Emergency Management

Mark Donelson—Aurora Water

SR6 ODE TO FLOODPLAINS-HOW PROTECTING NATURAL

SYSTEMS PROTECTS ALL OF US

Location: Main Ballroom—Hoaglund Side Julie Ash—Walsh Environmental

Bill DeGroot, David Mallory—Urban Drainage and Flood Control District

TM6 Using Inexpensive 2-Dimensional Hydraulic

MODELS TO ENHANCE SWMM AND HEC-RAS

ANALYSIS

Location: Kearns Room

Beck Anderson, Jeff Sickles, Don Jacobs—Enginuity Engineering Solutions

5:00 PM-6:30 PM HAPPY HOUR

8:00 PM

Location: Vendor Area

Sponsored by Michael Baker

HOSPITALITY SUITE

6:30 PM DINNER ON YOUR OWN

BY ENGINUITY ENGINEERING SOLUTIONS

Location: Room 409 (Snowmass Suite)

Open to all registered conference participants



All work and no play makes Jack a dull boy.



THURSDAY, SEPTEMBER 29, 2011

7:30 AM-8:30 AM GENERAL MEMBERSHIP BREAKFAST MEETING

Location: Main Ballroom—Anderson Side

8:30 AM-10:00 AM 2011 CASFM AWARD FINALISTS

Location: Main Ballroom—Anderson Side

COTTONWOOD CREEK RESTORATION AND STABILIZATION

Thomas Repp—City of Colorado Springs
Dorothy Eisenbraun—AMEC Earth and Environmental

GILBERT F. WHITE MEMORIAL FLOOD LEVEL MARKER

Clancy Philipsborn—Gilbert F. White Memorial Committee

PINEY CREEK STREAM STABILIZATION AND BRIDGE CROSSING IMPROVEMENTS

Molly Trujillo—Southeast Metro Stormwater Authority Rich Borchardt—Urban Drainage and Flood Control District Walt Pennington—Ayres Associates

10:00 AM-10:30 AM BREAK

Location: Vendor Area

10:30 AM-11:45 AM FEATURED SPEAKER

ZIEGLER RESERVOIR-A CHALLENGING ENGINEERING PROJECT OF MAMMOTH PROPORTIONS

Location: Main Ballroom—Anderson Side John Sikora—URS

11:45 AM-12:00 PM ASFPM FOUNDATION PRESENTATION

Location: Main Ballroom—Anderson Side Doug Plasencia—Michael Baker

10:30 AM-12:00 PM CONCURRENT TECHNICAL SESSION

TS1 CHARACTERIZATION OF BACTERIA LOADING FOR DEVELOPMENT OF A TMDL UTILIZING THE LOAD

DURATION CURVE METHODOLOGY

Location: Main Ballroom—Hoaglund Side

PAGE 16 Megan Monroe—Tetra Tech



TS2 Addressing the Last Flooding Problem along

THE METRO I-25 CORRIDOR

Bruce Behrer, John Yager—Muller Engineering

TS3 ADVENTURES IN TUNNELING

David Skuodas, Barbara Chongtoua—Urban Drainage & Flood Control District

Matt Ursetta—ICON Engineering

12:00 PM-1:30 PM CONFERENCE ATTENDEE LUNCH

Location: Roof Garden

BOARD MEMBER MEETING

(OFFICERS AND COMMITTEE CHAIRS)

Location: Brothers Grill—5th Floor

1:30 PM-2:00 PM CONCURRENT TECHNICAL SESSIONS:

WS1 BIG DRY CREEK STUDY: AN URBAN WATERSHED;

LESSONS LEARNED AND NEW PARADIGMS

ESTABLISHED

Location: Main Ballroom—Anderson Side

Jim Kaiser—City of Thornton

Andrew Earles-Wright Water Engineers

SM1 DESIGN AND CONSTRUCTION OF A SAINT ANTHONY

FALLS ENERGY DISSIPATOR TO CONTROL EROSION

AT STATE HIGHWAY 392

Location: Main Ballroom—Hoaglund Side

Steve Griffin—Colorado Department of Transportation

WQ1 EFFECTIVENESS OF PERMEABLE PAVEMENT

Installations in Fort Collins, CO

Location: Kearns Room

Chris Olson—Colorado State University

Basil Hamdan—City of Fort Collins





2:00 PM-2:30 PM CONCURRENT TECHNICAL SESSIONS:

WS2 WALKING COLORADO'S RIPARIAN CORRIDORS—
REDUCING RISK FROM GREELEY TO DURANGO

Location: Main Ballroom—Anderson Side

Brian Hyde—RBH Planning

SM2 GETTING AHEAD OF DEVELOPMENT-INDUCED BASE FLOWS-A PREVENTATIVE MAINTENANCE PILOT PROJECT

Location: Main Ballroom—Hoaglund Side

Kyle Hamilton—CH2M Hill

Lanae Raymond, Mason Staub—Southeast Metro Stormwater Authority

WQ2 DEVELOPING THE OPTIMUM WATER QUALITY CAPTURE VOLUME FOR STORMWATER BMPS

Location: Kearns Room

Ben Urbonas-Urban Watershed Research Institute

James Guo-Colorado University, Denver

Ken MacKenzie—Urban Drainage and Flood Control District

2:30 PM-3:00 PM CONCURRENT TECHNICAL SESSIONS:

WS3 McMurdo Gulch Reclamation—A Watershed-Wide Template for Stream Management

Location: Main Ballroom—Anderson Side

Joe Juergensen, Jim Wulliman, Jim Watt-Muller Engineering

David Van Dellen—Town of Castle Rock

SM3 STORMWATER PERMIT IMPLEMENTATION AT LOS
ALAMOS NATIONAL LABORATORY

Location: Main Ballroom—Hoaglund Side

Matt Lindburg, Lavanya Kraus, Jennifer Winters—Brown and Caldwell

WQ3 LOW IMPACT DEVELOPMENT ON A FEDERAL SCALE-MEETING ENERGY INDEPENDENCE AND SECURITY ACT LEGISLATION AT THE USAFA

Location: Kearns Room

Scott Stevens, Laura Hallam—URS Corporation



3:00 PM-3:30 PM BREAK

Location: Vendor Area

3:30 PM-4:00 PM C

CONCURRENT TECHNICAL SESSIONS:

WS4 RISKY BUSINESS-HARM PREVENTION (AKA

FLOODPLAIN MANAGEMENT) STRATEGIES IN THE

CHERRY CREEK BASIN

Location: Main Ballroom—Anderson Side Kimberley Pirri—URS Corporation

Monica Bortolini—Southeast Metro Stormwater Authority

SM4 CONSTRUCTION BMPs: WHAT WORKS AND WHAT

DOESN'T

Location: Main Ballroom—Hoaglund Side

Nicole Johnston, Deborah Kula—City of Aurora

WQ4 A NEW TOOL FOR QUANTIFYING VOLUME

REDUCTION FOR SITE LEVEL DESIGNS

Location: Kearns Room

Holly Piza—Urban Drainage and Flood Control District

4:00 PM-4:30 PM CONCURRENT TECHNICAL SESSIONS:

WS5 FLOOD RISK AWARENESS IN YOUR POCKET

Location: Main Ballroom—Anderson Side

Joshua Price, Scott Anderson—Atkins Global

SM5 STREAMLINED PROCESSES IN STORMWATER

PERMITTING FOR DRY UTILITIES

Location: Main Ballroom—Hoaglund Side

Brad Cox—Southeast Metro Stormwater Authority

Nick Holland—Summit Services Group

WQ5 IMPLEMENTING LOW IMPACT DEVELOPMENT

PRACTICES IN SHEA HOMES'
BACKCOUNTRY COMMUNITY

Location: Kearns Room

Jim Wulliman, Derek Johns-Muller Engineering

David Montoya—Shea Homes



4:30 PM-5:00 PM CONCURRENT TECHNICAL SESSIONS:

WS6 AN APPRECIATION FOR COLORADO PRECIPITATION

Location: Main Ballroom—Anderson Side
Nolan Doesken—Colorado Climate Center

SM6 PUBLIC ENFORCEMENT OF CONTRACTOR

COMPLIANCE-SHARING THE BURDEN OF EROSION

CONTROL INSPECTIONS

Location: Main Ballroom—Hoaglund Side

Jason Sprague—SEH

John Burke—City of Westminster

WQ6 AN EVALUATION OF HYDRAULIC RETENTION

TIME ON BMP WATER QUALITY

PERFORMANCE

Location: Kearns Room

Jason Messamer—Olsson Associates

Chris Olson, Larry Roesner—Colorado State University

5:00 PM-6:30 PM HAPPY HOUR

Location: Vendor Area

Sponsored by ERO Resources

7:00 PM-9:00 PM CASFM Association Dinner and Awards

Location: The Cabaret Room (Below the Main Lobby in the Silvertree Hotel)

Sponsored by Muller Engineering Company Grand Prize Drawings—Stuart Gardner, CDOT

2011 CASFM Project Awards Presentation—John Pflaum

9:00 PM-11:00 PM ENTERTAINMENT: KARAOKE NIGHT

Location: The Cabaret Room





FRIDAY, SEPTEMBER 30, 2011

7:30 AM-8:30 AM CONTINENTAL BREAKFAST

Location: Main Ballroom—Anderson Side

8:30 AM-9:00 AM CLOSING REMARKS

Location: Main Ballroom—Anderson Side

CASFM Chair: David Mallory—Urban Drainage and Flood Control District

9:00 AM-VARIES FIELD TRIP OPTIONS:

MAMMOTH DISCOVERY SITE AND CAMPGROUND RUN

SLUMP

Coordinated by Brian Murphy—CDM

MOUNTAIN BIKE TOUR-OWL CREEK TRAIL

Coordinated by Rich Ommert—Moser & Associates

10:00 AM-3:00 PM GOLF TOURNAMENT AT ASPEN MUNICIPAL GOLF

Course

Coordinated by Dave Center—AECOM Transportation

If you didn't sign up for a field trip during registration, it may not be too late. Contact the field trip coordinator to see if there is room available.



Risk Management—Brad Anderson, Anderson Consulting Engineers

Stream Restoration—Dave Bennetts, Urban Drainage and Flood Control District

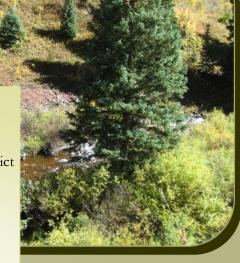
Technical Modeling—Kimberly Pirri, URS Corporation

Thursday AM Session—Jim Wulliman, Muller Engineering

Watershed Studies—David Jula, Michael Baker

Stormwater Management—Tom Blackman, Denver Wastewater

Water Quality—Darren Mollendor, Denver Wastewater



PRESENTATION ABSTRACTS

<u>RM1</u> LIVING WITH FLOOD RISK DUE TO MUD AND DEBRIS FLOWS

Alaina Smith - Tetra Tech

alaina.smith@tetratech.com

The many unknowns in predicting mud and debris flow on alluvial fans make it a regulatory challenge from a development and safety perspective. Because the science is more involved and complicated than clear water flow, the understanding and management of alluvial fan development is more challenging than clear water floodplain development. As such, regulations are not consistent between communities. FEMA has some regulations but these tend to be less rigorous than for clear water floodplains. This paper discusses the different approaches utilized for mud and debris flow analyses, and alluvial fan regulations as it pertains to site development. The paper also presents some solutions to the regulatory problems created by mud and debris floodplain development. This paper includes a case study located close to the conference location in Pitkin County.

RM2

COLORADO'S FLOOD DECISION SUPPORT SYSTEM: A REVIEW OF THE 2011 FLOOD S EASON

Carolyn Fritz - Colorado Water Conservation Board | Amy Volckens - Riverside Technology

carolyn.fritz@state.co.us | amy.volckens@riverside.com

Colorado's Flood Decision Support System became operational in October 2010, making the 2011 flood season the first test of the system's reliability and usefulness in providing timely flood hazard information to the Colorado Water Conservation Board personnel and other stakeholders. This presentation will summarize the successes and gaps in using the Flood Decision Support System to monitor 2011 flood conditions. In addition, a portion of the presentation will focus on recent system enhancements, including new historical flood layers and photographs, wildfire burn polygons that indicate areas with elevated flood risks, and print functionality.

RM3

MODELING AND COMMUNITY ENGAGEMENT TOOLS FOR FLOOD HAZARD AND RISK ASSESSMENT MITIGATION PLANNING UNDER CHANGING CONDITIONS

Graeme Aggett – AMEC Earth & Environmental | Doug Walker – Placeways

graeme.aggett@amec.com | doug@placeways.com

The ability to quantifiably forecast the potential hydrologic implications of proposed land-use policies before their implementation offers land-use decision-makers a valuable tool for discerning which proposed land-use alternatives will be effective at minimizing storm water runoff. With many communities in Colorado facing the challenge of managing growth and development in settings increasingly exposed to flood and other natural hazards, the tools and application approach discussed here will likely hold value for flood mitigation in Colorado. This paper first develops a methodology for integrating a land-use forecasting and model with an event scale, rainfallrunoff model in support of improving land-use and flood hazard mitigation policy formulation at the watershed and subwatershed scale. The models selected for integration are loosely coupled, structured upon a common GIS platform that facilitates data exchange.

RM4

A NO ADVERSE IMPACT APPROACH TO MANAGING FLOOD RISK IN FORT COLLINS Brian Varrella – City of Fort Collins Stormwater Utility bvarrella@fcgov.com

The City of Fort Collins is preparing an Adverse Impact Review (AIR) process for the Cache la Poudre River. This process is rooted in the concepts presented by No Adverse Impact (NAI) that carry floodplain regulation beyond the limitations of properties under development. With the new AIR technical criteria and public safety standards in place, applicants within the Poudre River basin will be able to quantify their impacts on adjacent neighbors and work toward mitigation alternatives. If approved by City Council, AIR will provide a development review process that protects life safety and property both now and in the future.

RM5

ESTIMATING FLOOD DAMAGE IMPACTS ON EXISTING AND FUTURE DEVELOPMENT WITHIN THE POUDRE RIVER FLOODPLAIN IN FORT COLLINS, COLORADO

Jeff Brislawn, Shelby Hudson – AMEC Earth & Environmental | Brian Varrella – City of Fort Collins jeff.brislawn@amec.com | bvarrella@fcgov.com

This presentation will discuss a City of Fort Collins study that estimated the economic and other detrimental impacts from flooding on existing and proposed development in four study areas along the Cache la Poudre River. The purpose of the study was to help decision makers understand the life safety and economic benefits of various higher regulatory floodplain standards being considered for adoption. This presentation will discuss techniques, limitations, and challenges of estimating site-specific losses to existing development and residual flood losses to future development. The application of HAZUS as a tool for site specific loss estimation will be discussed in the presentation.

RM6

REDUCING RISKS THROUGH FEMA MITIGATION GRANTS

Mark Donelson - Aurora Water | Deanna Butterbaugh, Iain Hyde, Ken Brink - Colorado Division of Emergency Management

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The Department of Homeland Security, Federal Emergency Management Agency (FEMA), manages three (3) grant programs that were created to assist communities in mitigating against the many natural hazards we face in Colorado. The three grant programs are: Pre-disaster Mitigation (PDM), Flood Mitigation Assistance (FMA), and Repetitive Flood Claims (RFC). All three grant programs are managed at the local level by the Colorado Division of Emergency Management (CDEM). Staff from the City of Aurora selected a project, Montview Bridge and channel improvements that met the requirements of the PDM grant program while providing the most community benefit. The City received significant assistance in the preparation and submittal of the PDM grant from the Colorado Division of Emergency Management. This presentation outlines State and local collaborative efforts to work together and seek alternative funding opportunities in efforts to mitigate or reduce hazard risk.

<u>SR1</u>

SH 119 ALONG NORTH CLEAR CREEK – HYDRAULICS AND FLOODPLAIN ANALYSIS John Hunt, Nikki Randall – Ayres Associates | Michael Pierce – Tetra Tech | Alfred Gross – CDOT Region 1 huntj@ayresassociates.com | randalln@ayresassociates.com | michael.pierce@tetratech.com | alfred.gross@dot.state.co.us

Ayres Associates Inc. (Ayres) conducted the hydrologic and hydraulic analysis for the Colorado Department of Transportation (CDOT) State Highway (SH) 119 Main Street South project located in Gilpin County, CO, just south of the City of Black Hawk. This project includes 1.5 miles of SH 119 roadway widening and realignment, and a new bridge over North Clear Creek. As the roadway widening encroaches into North Clear Creek, the project also focuses on realignment and restoration of North Clear Creek, designed by Tetra Tech, as the creek harbors the effects of years of mining. This project consisted of many unique design features and required unconventional analysis methods for stream restoration, bridge hydraulics, scour analysis and countermeasure design, and floodplain impacts assessment and compliance.

SR2

REGIONAL HYDRAULIC GEOMETRY RELATIONSHIPS FOR THE FOUNTAIN CREEK WATERSHED - REVISTED

Lucas Babbitt, Graham Thompson – Matrix Design Group

lucas_babbitt@matrixdesigngroup.com | graham_thompson@matrixdesigngroup.com

Staff at Matrix Design Group has been heavily involved with planning and design efforts in the Fountain Creek Watershed which extends from Pikes Peak and the Palmer Divide through Colorado Springs and south to Pueblo. As a result, we have begun to compile and analyze hydrologic, hydraulic, and geomorphic data to establish regional hydraulic geometry relationships for creeks and streams in the watershed. Hydraulic geometry relationships are plots comparing dependent channel variables such as width, depth, and cross sectional area to an independent variable such as drainage area or discharge. The underlying theory for hydraulic geometry relationships is the concept that channels develop in measurable, reproducible forms as a function of their formative factors including climate, hydrology, sediment load, vegetation, and bed material among others.

SR3

SOUTH PLATTE RIVER SEGMENT 15 PHASE II HABITAT IMPROVEMENTS

Brian Murphy – CDM | Katie Goodwin – Metro Wastewater Reclamation District

murphybm@cdm.com | kgoodwin@mwrd.dst.co.us

Metro Wastewater Reclamation District (District) discharges treated effluent to Segment 15 of the South Platte River, in northeast Denver. Modifications to the river channel have replaced much of the natural aquatic habitat with steep, armored banks to prevent erosion and sharply reduced diversity in riverbed structure. The District is implementing a habitat improvements program in Reach 9 of Segment 15 (Brantner Ditch diversion to 124th Avenue). The improvements are intended to provide increased aquatic habitat diversity and channel structure through varying flow depth, velocity, and protective cover. The presentation will describe the design approach including the proposed improvements, location of the habitat improvements, hydraulic analysis, and the design details.

SR4

TAKING MATTERS INTO YOUR OWN HANDS – FLOODPLAIN REMAPPING IN SPRINGFIELD, MISSOURI

Todd Wagner, Errin Kemper – City of Springfield Department of Public Works

twagner@springfieldmo.gov | ekemper@springfieldmo.gov

When the City of Springfield Missouri found themselves unhappy with the 1997 remapping of their community, they worked with FEMA to produce the new maps themselves. The process resulted in a highly defensible new FIS, as well as several educational tools aimed at educating Springfield's citizens about flood hazards. This is the story of the advantages, pitfalls, and lessons learned during this 15 year process.

<u>SR5</u>

CONVERTING NATURAL CHANNELS INTO DIMENSIONLESS RATIOS (AND THEN BACK) Danny Elsner – SEH | Graham Thompson – Matrix Design Group | David Skuodas – UDFCD

delsner@sehinc.com | graham_thompson@matrixdesigngroup.com | dskuodas@udfcd.org

The Urban Drainage and Flood Control District, in conjunction with Boulder County, has just completed two ecological channel restoration projects along Rock Creek using dimensionless ratios from nearby reference channel reaches as a guide in design. This presentation will discuss these projects and how channel geometry data was gathered from Coal Creek and used as a "blueprint" for design of restoration on the Carolyn Holmberg Preserve reach of Rock Creek. During the presentation we will discuss how this approach was used, where this application is not well suited, how needed reference data was collected, and how to organize and manipulate the data to develop dimensionless ratios of channel geometry.

SR6

ODE TO FLOODPLAINS—HOW PROTECTING NATURAL SYSTEMS PROTECTS ALL OF US Julie Ash – Walsh Environmental | David Mallory, Bill DeGroot – Urban Drainage and Flood Control District jeash@walshenv.com | dmallory@udfcd.org | bdegroot@udfcd.org

What are we trying to protect? The riparian corridor, often referred to as the green line or ribbon of green is enormously important in western regions. "Riparian areas comprise less than one percent of the land area of most western States, yet up to 80 percent of all wildlife species in this region of the country are dependent upon riparian areas for at least part of their life cycles." - EPA Congressional Testimony. Periodic flooding of overbank areas is a natural process that supports healthy riparian corridors. Urbanization often results in a transition from intermittent to perennial flow and the conversion of grassy swale systems to stream systems with defined bed and banks. Urbanization accelerates stream degradation that disconnects low flow channels from floodplains. Preserving, protecting and restoring stream corridors promote healthy ecosystems and the attendant natural and beneficial functions, or ecosystem services.

TM1

2-D MODELING AS A CALIBRATION TOOOL FOR RIVERINE FLOODPLAIN ANALYSIS IN THE FRONT RANGE OF COLORADO

Cory Hooper, Alan Turner – CH2M HILL | Shea Thomas – Urban Drainage and Flood Control District cory.hooper@ch2m.com | alan.turner@ch2m.com | sthomas@udfcd.org

Regulatory issues surround 2-D models that can make them difficult to match existing 1-dimensional Federal Emergency Management Agency (FEMA) regulatory models and obtain Letter of Map Revisions (LOMR) from FEMA or to regulate on a local basis. Using 2-D modeling as a calibration tool for 1-D Modeling can provide a quick method to define multiple flow paths and understand the peak flow rates along each of those flow paths. This presentation will provide an understanding of the efficiencies involved in utilizing 2-D flow models as a calibration tool for 1-D regulatory flow models in stream reaches with multiple flow paths. This presentation will also provide and understanding of the important calibration parameters that will need to be adjusted to bring and adequate level of concurrence between the 2-D models and 1-D models.

TM2

RADAR-BASED DEPTH AREA REDUCTION FACTORS FOR COLORADO

David Curtis – WEST Consultants | Daniel Bare – City of Colorado Springs

dcurtis@westconsultants.com | dbare@springsgov.com

The geometric properties of more than 340,000 fifteenminute storm cells, nearly 45,000 one-hour cells, and over 20,00 three-hour cells found in 21 months of gage adjusted radar-rainfall estimates (GARR) over El Paso County, CO, were identified and evaluated. Data were evaluated for months containing runoff producing events observed in the Fountain Creek Watershed within El Paso County from 1994-2008. Storm centered Depth Area Reduction Factors (DARFs) were computed and compared to DARFs published by the U.S. National Weather Service (NWS) in Technical Paper 29, which are widely used in stormwater infrastructure design. Radar-based storm centered DARFs decay much more sharply than the NWS standard curves. The results suggest lower watershed average rainfall inputs from radar-based storm centered DARFs than from standard NWS DARFs for a given watershed area.

TM3

EAGLE P3 ADVERSE IMPACT ANALYSIS – CONSTRUCTING A \$2 BILLION TRANSPORTATION CORRIDOR ACROSS DRAINAGE MAYHEM Don Jacobs – Enginuity Engineering Solutions | Rich Thornton – HDR

 $djacobs@enginuity-es.com \mid richard.thornton@hdrinc.com$

The Eagle P3 project is a public-private partnership agreement facilitated by the Regional Transportation District (RTD) to construct and operate over 36-miles of new transit commuter rail lines in the Denver metro area. The proposed rail lines cross several locations referred to as Urban Flooding Areas (UFAs), where stormwater runoff from large, urbanized tributary drainage basins cross the tracks without a defined drainage channel, swale, or adequate pipe network. Addressing the UFAs with a typical drainage design using stormdrains or open channels proves to be extremely difficult due to the combined large design flow rates and fully developed urban nature of the landscape. The challenges associated with designing for Urban Flooding Areas along the Eagle P3 project not only include engineered drainage facilities, but also careful consideration of constructability, maintenance, operations, potential liability, and overall cost of the commuter rail system. This presentation explores the engineering challenges encountered with crossing the UFAs, the detailed methods of hydraulic analysis/modeling used, and ultimately the design decisions made by RTD and the Eagle P3 Concessionaire.

<u>TM4</u>

FINDING HIGH GROUND – DAM BREACH AND HAZARD CLASSIFICATION GUIDELINES IN COLORADO

Jeremy Franz, Jason Ward - Colorado Dam Safety Branch

jeremy.franz@state.co.us | jason.ward@state.co.us

In 2010, the Colorado Safety of Dams Program finalized "Guidelines for Dam Breach Analysis" and "Guidelines for Hazard Classification," with the intent of providing guidance and criteria for performing dam breach analyses and bringing objectivity and consistency in assigning the hazard classification of a dam. The guidance documents will help establish consistency in the analysis and review of dam safety projects in Colorado. This paper provides an overview of the guidelines.

TM5

APPLYING RADAR BASED "RAINFALL" TO DEVELOP RUNOFF PARAMETERS

Lucas Babbitt – Matrix Design Group | Dan Bare – City of Colorado Springs

lucas_babbitt@matrixdesigngroup.com | dbare@springsgov.com

The Jimmy Camp Creek watershed has been studied extensively as a part of the Stormwater Management Assessment and Standards Development project which is managed by Matrix Design Group (Matrix) for the City of Colorado Springs. The primary objective of this noteworthy project was to develop recommended Curve Number values and other model parameters to be published in the City's updated criteria manual and used for hydrologic modeling in the Colorado Springs area. The Matrix team utilized gage-adjusted radar rainfall data from 6 different historic storm events as input into the rainfall-runoff model for the watershed. This data, along with the corresponding USGS gage-measured hydrographs at the watershed mouth, were used to evaluate the response of the watershed for 5 of the 6 storms for key runoff parameters. A rigorous calibration process was performed by pairing multiple combinations of Curve Number and initial abstraction values and comparing the results against what was measured by the USGS gage for each of the respective storms.

TM6

USING INEXPENSIVE 2-DIMENSIONAL HYDRAULIC MODELS TO ENHANCE SWMM AND HEC-RAS ANALYSIS

Beck Anderson, Jeff Sickles, Don Jacobs – Enginuity Engineering Solutions

banderson@enginuity-es.com | jsickles@enginuity-es.com | djacobs@enginuity-es.com

With consistently evolving enhancements to traditional hydrologic and hydraulic modeling software, users must find balance between the level of detail, available resources, as well as time and budget constraints when tasked with performing complex analyses. While traditionally accepted 1demensional flood routing models have served as the industry standard for many years, the ability of these programs to analyze 2-demensional flow patterns has remained limited. We have found the incorporation of relatively quick and inexpensive 2-dimensional analysis to be an effective means of enhancement for both 1-dimensional HEC-RAS hydraulic models and SWMM hydrology. A detailed overview of specific project examples utilizing 2-dimensional modeling enhancement techniques will be presented. Final results and comparison to more traditional approaches will be discussed, along with the applicability and validity of incorporating 2-D modeling into traditional hydrologic and hydraulic modeling methods.

<u>TS1</u>

CHARACTERIZATION OF BACTERIA LOADING FOR DEVELOPMENT OF A TOTAL MAXIMUM DAILY LOAD (TMDL) UTILIZING THE LOAD DURATION CURVE METHODOLOGY: BOULDER CREEK, BOULDER, COLORADO

Megan Monroe - Tetra Tech

megan.monroe@tetratech.com

A third party total maximum daily load (TMDL) was developed for the urban reaches of Boulder Creek in Boulder, Colorado to address concerns associated with bacteria (*E. coli*). To account for changing flow conditions, flow variable load capacities for Boulder Creek were calculated through the development of load duration curves. This study presents a local application of the load duration curve methodology, paired with detailed GIS analysis for TMDL development. Application of load duration curves for TMDL implementation will also be explored.

<u>TS2</u>

ADDRESSING THE LAST FLOODING PROBLEM ALONG THE METRO I-25 CORRIDOR (AT THE I-25 AND ALAMEDA SUMP) VIA A 6-PUMP STORMWATER PUMP STATION

Bruce Behrer, John Yager – Muller Engineering Company bbehrer@mullereng.com | jyager@mullereng.com

With the completion of the TREX project in 2006, there remained one significant low lying sump condition along I-25 in the metro area that seemed to get flooded on a regular basis, and seemed to make the news every time it occurred. Several goals for the proposed design included the following: Limit the contribution of offsite runoff from CCD, reduce the local basin directly tributary to the sump, and design a pump system that could handle pumping a 100-year event. A triple 16' span by 7' rise CBC is being constructed across I-25 to route 2,150 cfs, or 84% of these offsite flows to the South Platte River, the local basin area tributary to the sump was reduced by placing inlets and outfall pipes at the lowest possible location for gravity feed systems to the river, and a pump station with (4) 12-inch pumps and (2) 6-inch pumps that was configured to have a dual chamber wet well with dual 30-inch pipes routing the local flow to the pump system. This design can serve as an example of the unique design of pumping stormwater sump conditions.

TS3

ADVENTURES IN TUNNELING

David Skuodas, Barbara Chongtoua – Urban Drainage and Flood Control District | Matt Ursetta—ICON

dskuodas@udfcd.org | bchongtoua@udfcd.org | mursetta@iconeng.com

In 2009, the Urban Drainage and Flood Control District partnered with Adams County to construct 48-inch and 84-inch storm sewer tunnels underneath Interstate 76 and the O'Brian Canal. Disaster struck during the initial O'Brian Canal tunnel construction, as sinkholes had formed resulting in \$10,000 per day liquidated damages until emergency crews could perform repairs. The project team regrouped, and decided to rebid the project using a combination of traditional design-bid-build with design-build contracting. The presentation will discuss the valuable lessons learned in tunneling methods and contracting strategies.

LT1

DESIGN, CONSTRUCTION AND VOLUME REDUCTION BENEFITS OF RETROFIT BIORETENTION IN A SEMI-ARID CLIMATE Basil Hamdan – City of Fort Collins | Chris Carlson – City of Loveland | Chris Olson – CSU

bhamdan@fcgov.com | carlsc@ci.loveland.co.us | colson23@engr.colostate.edu

In an effort to implement innovative stormwater management strategies in Colorado, the City of Fort Collins initiated a demonstration project to construct a retrofit bioretention basin at the City's Utility Service Center parking lot. The goal of the Fort Collins project was multi-faceted and involves a significant monitoring effort. Likewise, the City of Loveland recently constructed a bioretention basin placed laterally along Highway 287 in downtown Loveland. Both bioretention basins were based on the exact same methodology and design approach. The drainage basins contributing to these bioretention areas are highly impervious, fully developed, lack room for idealized construction conditions or standard designs, and contain a significant amount of public right-of-way or paved areas typical of urbanized environments. The City of Fort Collins has partnered with Colorado State University to collect and analyze data from a variety of LID-type BMPs, including this project.

WS1

BIG DRY CREEK STUDY: AN URBAN WATERSHED – LESSONS LEARNED AND NEW PARADIGMS ESTABLISHED

Jim Kaiser – City of Thornton | Andrew Earles – WWE jim.kaiser@cityofthornton.net | aearles@wrightwater.com

The Big Dry Creek (Adams) basin stretches to the foothills of Jefferson County, but is largely controlled above the urban corridor by Standley Lake. Not since 1973, prior to most of the present urban development, has a single study been performed for the entire main stem through the urban corridor. UDFCD, the Cities of Thornton and Westminster, and Adams County partnered to undertake such a study; hiring Wright Water Engineers (WWE) to perform the work. The study required extensive modeling updates; incorporated over 70 detention ponds, most of which would be considered "sub-regional"; and required alternative modeling to analyze a major inadvertent detention at the railroad embankment near the downstream limits of the study.

WS2

WALKING COLORADO'S RIPARIAN CORRIDORS - REDUCING RISK FROM GREELEY TO DURANGO

Brian Hyde – RBH Planning

gunnison@gmail.com

Greenways along floodplains offer recreational travel opportunities on foot, wheels, or maybe boat. Could we travel the length of one major stream in Colorado; or more? Could communities connect their greenways to form regional systems and link the Front Range to Durango? A survey of local governments in selected Colorado communities indicated opportunities for greenway networks: (1) in the Denver metro area, (2) along the Front Range, and (3) in portions of western Colorado. On May 27, 2011, Secretary of the Interior, Ken Salazar, proposed to connect the Rocky Mountain Arsenal Wildlife Refuge (north of Stapleton) to the Rocky Flats Wildlife Refuge (west of Broomfield) via greenways, with an eventual extension to Rocky Mountain National Park. Let's do it!

WS3

McMURDO GULCH RECLAMATION – A WATERSHED-WIDE TEMPLATE FOR STREAM MANAGEMENT

Joe Juergensen, Jim Wulliman, Jim Watt – Muller Engineering Company | David Van Dellen – Town of Castle Rock | Bill Ruzzo – CCBWQA

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A reclamation plan for McMurdo Gulch, a major tributary to Cherry Creek in the upper watershed, was developed in 2010 and implemented in 2011 under the sponsorship of the Cherry Creek Basin Water Quality Authority and the Town of Castle Rock. This partnership established a new directive within the Cherry Creek Basin to improve the health and water quality of Cherry Creek by allocating funds to maintain or improve contributing tributaries. The timing of this project allowed for a proactive approach to protect/preserve the gulch prior to the impacts of urbanization. The reclamation plan took a global look at the entire McMurdo Gulch watershed to define strategies that further reduce impacts due to stormwater runoff from developing areas, in addition to implementing surgical bioengineered stream stabilization improvements. A template document describing the design process is being completed to serve as a guide for future work in similar tributary watersheds.

WS4

RISKY BUSINESS – HARM PREVENTION (AKA FLOODPLAIN MANAGEMENT) STRATEGIES IN THE CHERRY CREEK BASIN

Kimberley Pirri – URS Corporation | Monica Bortolini – Southeast Metro Stormwater Authority

kimberley_pirri@urscorp.com | mbortolini@semswa.org

Floodplain management, in its broadest sense, equals harm prevention. This presentation will highlight how floodplain management strategies are implemented in the Cherry Creek Basin and show how to build on the minimum requirements provided by FEMA to establish a strong floodplain management program that benefits the public by reducing risk, providing open space areas, and decreasing flood insurance premiums through Community Rating System credits.

<u>WS5</u>

FLOOD RISK AWARENESS IN YOUR POCKET Joshua Price, Scott Anderson – Atkins Global

scott.anderson@atkinsglobal.com

Do you know if you are standing in a floodplain right now? Do you know which roads you could take out of town that wouldn't be covered by flood water and wash you and your car down a river? Most of us don't know the answers to those questions, but GIS and smart phones can help you by leveraging the phone's GPS and Internet capabilities. FloodMapTM Mobile receives location input from the phone's GPS, or user entered location, and places that location on a map with FEMA flood hazard data, USGS and NOAA stream gages, USGS ground elevation, National Bridge Inventory and other critical information. Using home values from Zillow.com® and geospatial processing from open-source GeoServer, the app gives the user flood risk information reports that include: distance to floodplain, depth of flood hazard, insurance cost, FEMA mapping metadata, USGS elevation, stream gage locations, and much more. Community and State reports tell the user how many flood claims have been processed or losses incurred from floods in that area.

WS6

AN APPRECIATION FOR COLORADO PRECIPITATION

Nolan Doesken – Colorado Climate Center nolan@atmos.colostate.edu

Several topics will be covered in this presentation – all related to the measurement and analysis of precipitation in Colorado. A brief review of precipitation measurement will be given beginning with early data collection in Colorado from the 1800s up to current gauges and observation systems in use today. A status report will be given on the current progress made by the National Weather Service in updating the NOAA Precipitation Frequency Atlas for the Western United States, Volume II for Colorado published 38 years ago in 1973. Trends in observed heavy precipitation will be discussed and comparisons to recently completed California rainfall frequencies and IDF curves will be presented. Finally, the upcoming statewide water education celebration called "Water 2012" will be described.

SM1

DESIGN AND CONSTRUCTION OF A SAINT ANTHONY FALLS ENERGY DISSIPATOR TO CONTROL EROSION AT STATE HIGHWAY 392

Steven Griffin – Colorado Department of Transportation

steven.griffin@dot.state.co.us

A St Anthony Falls energy dissipator was recently constructed on State Highway 392 east of Windsor, Colorado. This structure was designed and constructed in response to severe stream degradation caused by powerful flow bursts from an upstream control gate. Design decisions, as well as challenges faced and overcome during design and construction will be presented, as well as video and photos taken during and after construction.

<u>SM2</u>

GETTING AHEAD OF DEVELOPMENT-INDUCED BASE FLOWS – A PREVENTIVE MAINTENANCE PILOT PROJECT

Kyle Hamilton – CH2M HILL | Lanae Raymond, Mason Staub – Southeast Metro Stormwater Authority kyle.hamilton@ch2m.com | lraymond@semswa.org | mstaub@semswa.org

As watershed development occurs, the stormwater runoff from the new structures, paved areas, and other changes to the landscape increase the runoff rates from the developed area. The slow and consistent erosive forces of new base flows often cause erosion in the natural drainages. In 2006, the Southeast Metro Stormwater Authority (SEMSWA) and CH2M HILL partnered together to investigate opportunities to be proactive with watershed management, and address the development-induced base flows before they start to cause problems. This presentation will review the history and purpose of the pilot project, discuss the decision model selection factors used to determine the pilot project site, detail the various pilot project improvements to stabilize the project reach, and discuss the lessons learned from monitoring the stabilization measures.

SM3

STORMWATER PERMIT IMPLEMENTATION AT LOS ALAMOS NATIONAL LABORATORY Matt Lindburg Layerya Kraya Jamifor Winters

Matt Lindburg, Lavanya Kraus, Jennifer Winters – Brown and Caldwell

mlindburg@brwncald.com | lkraus@brwncald.com | jwinters@brwncald.com

Implementing the requirements of an NPDES Individual Storm Water Permit (IP) at Los Alamos National Laboratory (LANL) is a complex process involving coordination with other permit activities and managing more than 400 sites spread over 37 square miles of lands with sometimes severe topography and complex hydrology in north-central New Mexico. The IP requires that baseline storm water controls are installed at all sites, storm water discharges from all sites are monitored, and further corrective actions are taken if storm water monitoring results show exceedances of water quality targets. Storm water managers at LANL are bringing together staff expertise and technology to manage implementation of the IP. Developing technical processes and decision making criteria complemented by information technology solutions provide the foundation for the execution of IP requirements.

SM4

CONSTRUCTION BMPS WHAT WORKS AND WHAT DOESN'T

Nicole Johnston, Deborah Kula – City of Aurora Water Department

njohnsto@auroragov.org | dkula@auroragov.org

This presentation will discuss a variety of storm water management best management practices (BMPs) used during construction. The City of Aurora has been proactive in revising old standards of BMPs and looking for new solutions to unresolved problems. This will include constructed BMPs from raw materials and some manufactured BMPs including, but not limited to; silt fence, vehicle tracking control pads, inlet protection, perimeter controls, materials in roadways, rolls filled with recycled tires or other materials, concrete washouts, and more.

SM5

STREAMLINED PROCESSES IN STORMWATERS PERMITTING FOR DRY UTILITIES

Brad Cox – Southeast Metro Stormwater Authority | Nick Holland – Summit Services Group

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The SEMSWA Annual Grading, Erosion, and Sediment Control (GESC) Permit program provides a mechanism to implement water quality requirements for comparable, consistent, and repetitive land disturbance activities in our service area. This program recognizes those entities and agencies that share SEMSWA's water quality goals by streamlining the site plan review/approval, inspection, and closeout process. The Annual Permit has proven to be a collaborative process allowing SEMSWA to better educate owners, plan prepares, and contractors as to the reasons for implementing BMPs and protecting water quality for these types of projects. SEMSWA can also more efficiently utilize its staff resources for field compliance efforts rather than during the site plan submittal, review, re-submittal and approval process for these comparable, consistent and repetitive dry utility projects.

SM6

PUBLIC ENFORCEMENT OF CONTRACTOR COMPLIANCE – SHARING THE BURDEN OF EROSION CONTROL INSPECTIONS

Jason Sprague – SEH, Inc. | John Burke—City of Westminster

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This presentation has three basic learning objectives for the attendee.

- 1. Learn how a Midwestern community leveraged the public involvement process when implementing their construction site erosion control protocol, enabling them to do more with less staff/budget.
- 2. Understand how to implement existing web-based technology to track weekly and event-driven erosion and sediment control inspections and provide the inform--ation to all involved parties, including the public.
- 3. Promote the concept of complete governmental transparency to improve erosion control through more regular and consistent inspections and remedial efforts to protect storm water quality.

<u>WQ1</u>

EFFECTIVENESS OF PERMEABLE PAVEMENT INSTALLATIONS IN FORT COLLINS, CO Chris Olson – Colorado State University | Basil Hamdan – City of Fort Collins Utilities

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This presentation will present the findings from 1-2 years of monitoring three different permeable pavement (PP) installations in Fort Collins, CO. One site is comprised of porous concrete, another of permeable pavers with a subbase including a sand filter layer and another of permeable pavers with subbase of only course aggregate. Practical insights about the water quality treatment, runoff quantity reduction and stability of the PP installations will be presented. In addition, the presentation will include a brief discussion of the technical details of monitoring PP installations.

<u>WQ2</u>

DEVELOPING THE OPTIMUM WATER QUALITY CAPTURE VOLUME FOR STORMWATER BMPS Ben Urbonas – Urban Watershed Research Institute | James Guo – Colorado University-Denver | Ken MacKenzie – Urban Drainage and Flood Control District burbonas@urbanwatersheds.org | james.guo@ucdenver.edu | kmackenzie@udfcd.org

The most accurate way to find the Water Quality Capture Volume (WQCV) for any site and Best Management Practices (BMP) is to use continuous simulation. This presentation will demonstrate a freeware computer model WQ-COSM for calculating the WQCV for any site in United States and any type BMP. All that is needed are site imperviousness, the use specified WQCV and long-term rainfall data. This model was developed by the Urban Watersheds Research Institute and partially funded by the Urban Drainage and Flood Control District, and is offered at no cost to anyone wanting to use it.

WQ3

LOW IMPACT DEVELOPMENT ON A FEDERAL SCALE - MEETING ENERGY INDEPENDENCE AND SECURITY ACT LEGISLATION AT THE UNITED STATES AIR FORCE ACADEMY

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In an effort to assist the United States Air Force Academy (USAFA) in Colorado Springs, meet federal guidelines related to storm water design requirements, URS Corporation has implemented Low Impact Development drainage features with recently upgraded or new projects. These improvements, not only meet the federal requirements, but have proven to provide a reduced impact on existing storm drainage infrastructure. These projects are currently under construction and will be completed during the summer of 2011.

WQ4

A NEW TOOL FOR QUANTIFYING VOLUME REDUCTION FOR SITE LEVEL DESIGNS Holly Piza - Urban Drainage and Flood Control **District**

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UDFCD recently developed a straightforward tool for calculating volume reduction for use with site level designs. This tool allows you to calculate volume reduction resulting from disconnecting impervious areas and using conveyance based BMPs such as grass swales. It can be used to calculate the effective imperviousness and reduction in required storage volumes for a range of storm events. Using a real site in Denver, this presentation demonstrates the tool.

WQ5

IMPLEMENTING LOW-IMPACT DEVELOPMENT PRACTICES IN SHEA HOMES' BACKCOUNTRY **COMMUNITY**

Jim Wulliman, Derek Johns - Muller Engineering Company | David Montoya - Shea Homes

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The vision for Shea Homes' BackCountry development was to connect an expansive 467-acre tract of undisturbed conservation area to the community with a network of natural drainage corridors that touch most of the planned home sites. This presentation describes the process of implementing the open space vision for BackCountry and incorporating a low impact development (LID) approach. The challenges involved in the design and construction process are discussed, as are cost implications and benefits of the approach. The intent of the presentation is to share some of the knowledge gained during the design and construction process to benefit others contemplating low impact development approaches.

WQ6

AN EVALUATION OF HYDRAULIC RETENTION TIME ON BMP WATER QUALITY **PERFORMANCE**

Jason Messamer—Olsson Associates | Chris Olson, Larry Roesner - CSU

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Structural best management practices (BMPs) improve the quality of stormwater runoff by increasing the hydraulic retention time (HRT), which allows pollutants to be removed through settling, adsorption, and other physiochemical processes. Design standards for BMP drawdown times have been primarily based on theoretical simulations of captured runoff through rainfall record analysis and theoretical removal of contaminants. A recent stormwater sampling study in Fort Collins, CO, shows that a BMP providing a longer HRT will achieve better, more consistent effluent quality than a BMP with a lesser HRT. Additional data was obtained by estimating individual storm HRTs and matching them to storm effluent quality results from the International BMP Database. Results were evaluated to determine whether BMPs providing longer HRTs have been significantly improving effluent quality or if similar effluent quality was achieved even with increased HRTs.

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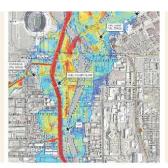
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Parson Brinkerhoff	Thomas Roberts robertstw@pbworld.com	555 17th Street, Suite 500 Denver, CO 80202	303.728.3003 303.832.9096	www.pbworld.com
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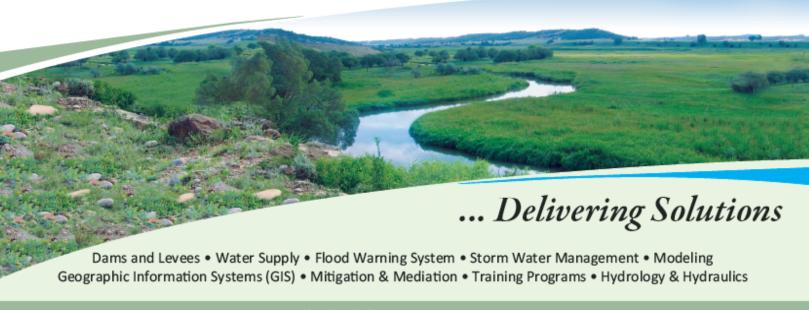
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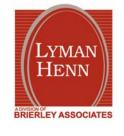
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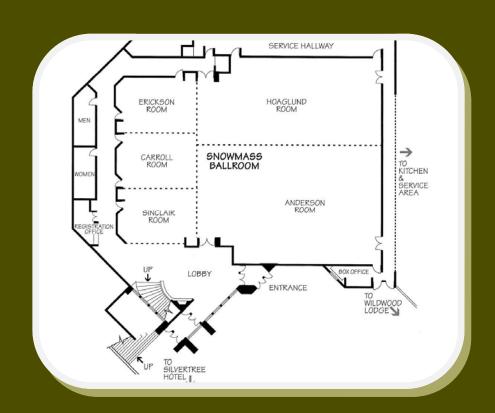


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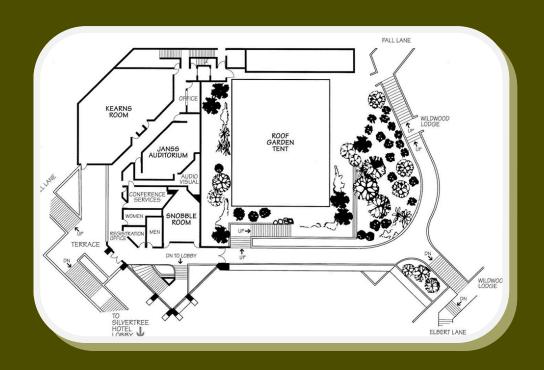
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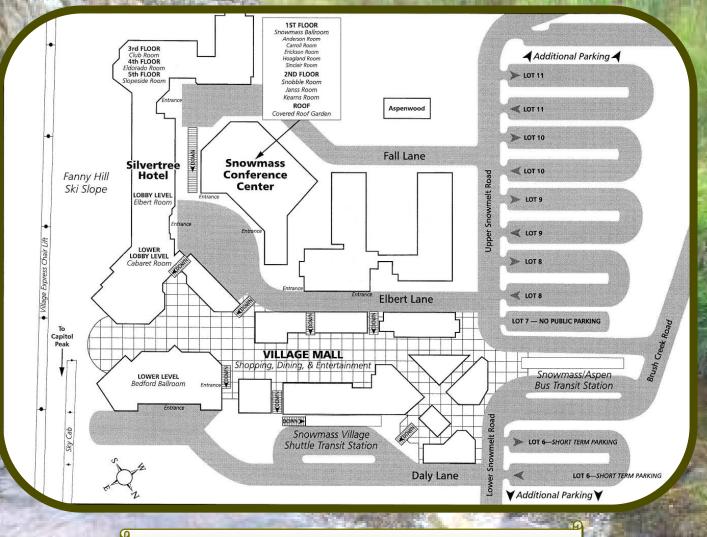
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