

The Open Channel

Summer/Fall 2008 Vol. 19 / Issue 1

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CASFM 19th Annual Conference

By David Bennetts, Conference Program Chair

The annual CASFM conference will be held in Crested Butte at the Crested Butte Mountain Resort September 10-12, 2008. The Certified Floodplain Manager's exam review class will begin a day earlier on September 9th, 2008. This is the 19th annual conference and it is the first time it has been held in Crested Butte. The theme of this year's conference is "High Elevation—Low Impact, Sustainable Stormwater Management".

The conference will have a little different format this year. The first day of the conference will feature a keynote address by Tom Ballestero on "LID from the Watershed Perspective and Decision Making Process". During lunch we will have a presentation from the 2008 CASFM Scholarship recipient. After lunch will be a presentation on "Determining Performance and Whole Life Costs of BMP's". Wrapping up the first day will be the project presentations, followed by a happy hour.

This year all of the technical presentations have been moved to one day. Thursday will be a full day with over 40 technical presentations planned on a wide range of topics. To see the conference program,

visit the CASFM website and click on the conference link. We will finish the day with a happy hour followed by the Association dinner and awards ceremony.

Friday Morning has been set aside for field trips, and we are currently planning on having three to choose from. One will feature the Taylor Park Dam, a water storage reservoir on the Gunnison River, and will include a boat tour around the reservoir and up to the dam. Another will be a mountain bike tour on the trail parallel to the Slate River and will highlight improvements which blend into the natural landscape of the area. The third field trip will be a Crested Butte walking tour exploring the flood history and land development issues of downtown Crested Butte. Following the field trips on Friday afternoon is our annual golf tournament.

This will be a great conference in Crested Butte. If you are interested in attending the conference, please see the conference webpage at www.casfm.org for more information. Registration for the conference is online only, and payment can either be made by PayPal or by check. Registration must be made by August 1st to receive the early registration rate of \$250.

High Elevation Low Impact, Sustainable Stormwater Management



**CASFM Conference
September 9th, 2008
Crested Butte**

*Register online
casfm.org*



Greetings, CASFM members!

It has been an exciting year in the world of floodplain and stormwater management, both within our beautiful state and nationally. As always, we have been presented with a number of challenges, and I thank everyone for your work, regardless of how minor, in the field. As the second largest chapter in the country, a lot of work is getting done by our membership.

The past month has seen a number of devastating events in our country, primarily due to heavy rains in the midwest. The rising waters and failing levees of the Mississippi River and its tributaries brought back instant memories of both the 1993 floods (in the same area) and Hurricane Katrina along the Gulf Coast. While much press has been given to the damage that actually occurred this summer, very little attention was placed on the LOSSES AVOIDED due to proactive floodplain management that has been carried out in the fifteen years since the last event. This reminded me of what many of us already know—when we do our job well, it is actually the things that DON'T happen that become newsworthy (or not!).

We were faced with similar circumstances in our very own state this spring, but due to heavy snowfall, not rain. Many watersheds received snowpack that hasn't been seen in over decade, some areas even longer. The end result? Only isolated flooding, and no major structural damages of any kind. While it is simple to assign the lack of any noteworthy events to a favor-

able meteorological regime from Mother Nature (which did happen), I believe there is more to the story than this. Many of the watersheds DID see flows higher than any experienced in over a decade, some even longer. However, prepared emergency managers on the ground, combined with very proactive floodplain management over many years led to a successful handling of this problem. There was little news to report, and this is indicative of the work that we all do.

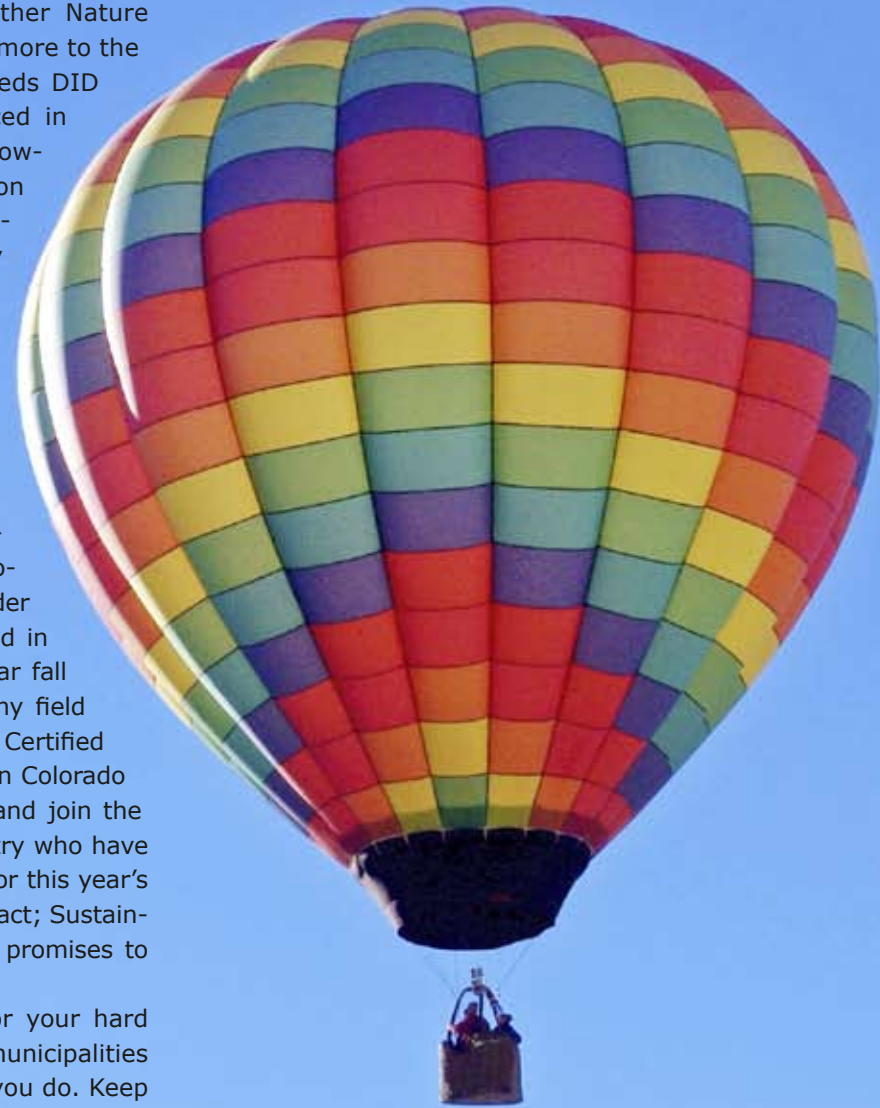
As summer starts, it is time to start thinking about registering for annual fall conference, in this case our 19th conference, which will take place September 10-12th in Crested Butte, Colorado. I encourage everyone to consider attending this event, the first ever held in SW Colorado. Come see the spectacular fall colors, consider taking one of the many field trips offered, and if you're not already a Certified Floodplain Manager (almost 250 of us in Colorado are!), consider taking the CFM exam and join the ranks of nearly 5,000 around the country who have achieved this certification. The theme for this year's conference is "High Elevation—Low Impact; Sustainable Stormwater Management", and it promises to be a good one. I hope to see you there!

Again, thank you to all of you for your hard work in our field. Our state and municipalities are all safer because of the work you do. Keep up the good work!

Kevin Houck

CASFM Chair

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Committee News

Project Awards For Engineering Excellence

John Pflaum

A total of five projects were submitted, and reviewed by volunteer judges to determine the four finalists. The Judges who lent their time to review the projects were:

David Hollingsworth City of Longmont

Kevin Wegener City of Aurora

Thuy Patton Colorado Water Conservation Board

The four finalists nominated for the CASFM Grand Award are:

McIntyre Gulch Stabilization

Olsson Associates, Inc.

Jefferson County Public School District

Fossil Creek Drainage Improvements

Stantec Consulting, Inc.

City of Fort Collins Utilities Department

Public Education Marketing Brochure

Urban Drainage & Flood Control District

Matrix Design Group

Montclair Strom Drainage Project

City and County of Denver

WHPacific, Inc.

The presentations will be made at the CASFM Annual Conference on Wednesday afternoon, September 10th.

Technical Training Committee

- **Kevin Gingery** is retiring from the Chair position in September. Kevin originally proposed the idea of the training committee as a way to bring more value and opportunities to CASFM members. Kevin has chaired the committee, conducted the needs survey and spearheaded the curriculum for this wildly successful program. The training needs identified in the original survey have been completed and Kevin will turn over the Chair position to Chris Carlson. Kevin has held nearly every position available in CASFM over the years and we are deeply indebted to Kevin for his service to the organization, Thank you!
- **Chris Carlson** will conduct a new training needs survey at the upcoming annual conference in order to gain new direction from the membership.

Membership Committee

Kevin Gingery

CASFM has reached an historic milestone with 707 active members.

Floodplain & CFM Committee

Kallie Bauer

Nationally there are roughly 5000 registered CFMs with the majority of these being in states that have their own CFM program. Colorado leads the rest of the states with over 250 CFMs. We will be offering the exam at the CASFM Annual Conference on September 10th. Anyone interested in taking the exam needs to go to www.floods.org and download the certification application. The application must be submitted to AS-FPM at least 2 weeks prior to the test. CASFM will also be offering a review course on Tuesday, September 9th before the exam. To register for the review course go to casfm.org. The conference has been preapproved for 12 continuing education credits.

Outreach Committee

Ken MacKenzie

Ken Cecil attended the Colorado Municipal League's Legislative Workshop.

Ken MacKenzie made a presentation at the AWARE Colorado Land Management Workshop.

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CRS Committee

Marsha Hilmes-Robinson

There have been three meetings of the CRS Committee, so far. The most recent meeting was in Boulder on June 26th. The next meeting is scheduled for August 21, 10 AM-noon, at the CWBCB offices, 1313 Sherman Street, Conference Room 518 on the 5th floor, Denver.

At the first meeting, the following goals were established for the committee:

1. Increase awareness among CASFM members of the CRS program
 - a. Amount of work required to enter/maintain CRS credits
 - b. Identify issues where assistance may be necessary

2. Provide a mechanism for communities to be more informed about CRS issues and be able to provide feedback to the CRS Task Force
3. Increase the number of CRS communities in Colorado
4. Establish new CRS. credit activities specific to this region of the country
 - a. Wildfires, erosion stability, etc.

The committee is planning a one day workshop in the late fall. This will be a great chance for communities who are considering joining the CRS to learn more about the program and also for new CRS coordinators to learn details about some of the CRS activities. Special emphasis will be on activities that communities may already be doing that can earn them points within the CRS. More details on the workshop will be coming in the fall.

At the CASFM conference in Crested Butte in September, Kerry Redente, ISO Specialist for the CRS program in Colorado, will be offering to meet one-on-one with communities to discuss the CRS program. She is willing to meet with communities interested in joining the CRS or with existing CRS communities that want to discuss specific details of their CRS program or learn more about specific activities. To arrange a meeting time, please contact Kerry directly at, Phone: 719-539-6501, or by email: kredente@iso.com.

If anyone would like to receive updates on the CRS committee or have questions about the committee's activities, please contact Marsha Hilmes-Robinson with the City of Fort Collins at 970-224-6036 or mhilmesrobinson@fcgov.com. Also, please plan to join us for the next committee meeting in August in Denver.

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Metro Socials

CASFM Metro Region socials have been the place to be for educational opportunities, networking, and enjoying meeting friends and colleagues in a relaxed atmosphere! CASFM sponsors quarterly social gatherings in the Denver Metropolitan region as a means of outreach and organizational activities. The socials have moved to all four corners of the region to make sure nobody is left out. We encourage greater participation and welcome input on how to enhance these social events. Here is a list of the recent socials over the last year:

August 15, 2008 in Boulder at the Millennium Harvest House. Larry Roesner, PhD, will present "Stormwater Facilities Design to Minimize Impacts on Streams in Urbanizing Watersheds." A special treat of a live band will follow outdoors on the patio to enjoy a wonderful Colorado summer Friday afternoon.

June 18, 2008 in Aurora at BJ's Brewhouse. Tiffany McEachen and Sarah Foster with CH2M Hill discussed, "Prairie Waters Project—LID and Permitting Highlights for Stormwater and Floodplain Management Professionals." There were 25 attendees.

February 12, 2008 in Lakewood at 240 Union. Dave Lloyd, former Executive Director with the Urban Drainage & Flood Control District discussed, "Where We've Been and Where We're Going with Stormwater Management." There were 35 attendees.

November 15, 2007 in the Denver Tech Center at the Great Northern Tavern. Scott Franklin from the US Army Corps of Engineers is discussed "Understanding Section 404 Permit Requirements for Development in Floodplains." There were 50 attendees.

August 23, 2007 in downtown Denver at Dixons Downtown Grill. Todd Hanlin from Stan-tec Consulting showcased, "A Village Amid Troubled Water—A Case Study in Floodplain Management in the Grand Canyon." There were 35 attendees.

June 12, 2007 in downtown Denver at La Loma Restaurant. Tom Blackman, Senior Engineer, City & County of Denver Public Works, presented, "Turning a Premier Park into a Stormwater Detention Facility: Denver's City Park Project." There were 30 attendees.

Northeast Region Report

The Northeast Region of CASFM held a social on Tuesday, May 6 in Fort Collins. The social included a tour of the Colorado State University Hydraulics Laboratory, followed by food and socializing at C.B. & Potts in the Campus West neighborhood.

A group of 12 people attended the tour of the CSU Hydraulics Lab. The NE Region would like to give special thanks to Amanda Cox, Research Associate and Manager of the Hydraulics Laboratory, for arranging and providing the tour of the facility. Amanda took us on a full tour of the indoor and outdoor facilities, and afforded the group an opportunity to visit the academic side of water resources and hydraulic design projects. The tour was an outstanding way for NE Region members to view current projects outside their day-to-day perspective, and to become familiar with current research projects conducted by CSU faculty and staff.

The tour of the Hydraulics Lab was followed by a social hour at C.B. & Potts in Fort Collins. The social hour was also attended by 12 CASFM members from various agencies and consulting firms around Northern Colorado, including Greeley, Fort Collins, Loveland, and Longmont.

Regional News

The NE Region looks forward to another tour and social hour in November open to all members. If anyone has a recent project they are anxious to share, or any other input on NE Region activities, please send an e-mail to Brian Varrella at bvarrella@fcgov.com. Thanks again to Amanda Cox at CSU, to C.B. & Potts, and to Paul Clopper of Ayres Associates for the photography



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Ben Urbonas Scholarship Award

By Kevin Houck



Kevin Houck (right) presents Ben Urbonas with a plaque at the 2008 UDFCD Board meeting.

As many of you know, Ben Urbonas recently retired from the Urban Drainage and Flood Control District with over 31 years of service. In addition to his duties as Manager of the Master Planning Program at the District, Ben is known by many for his academic work throughout the course of his career. Ben is known for many developments, including significant input into much of the UDFCD Criteria Manual (especially Volume 3) as well as development of the Colorado Urban Hydrograph Procedure (CUHP) for hydrologic analysis in the Denver metro area. Ben has been supportive over the years of continuing education for all of us in the floodplain and stormwater management field.

In recognition of Ben's contributions throughout the years, a resolution was passed at the general meeting of the Colorado Association of Stormwater and Floodplain Managers on March 20th, 2008 in Lakewood that officially renames the annually awarded CASFM scholarship to the "Ben Urbonas CASFM Scholarship". As Chair of this organization, I had the pleasure of announcing this change to the UDFCD board and presenting Ben with a plaque at the UDFCD Board Meeting on April 17th, 2008.

Congratulations, Ben, and I hope this scholarship continues to inspire students to pursue greatness in their careers in floodplain and stormwater management.

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Colorado Statewide Flooding Outlook

By Kevin Houck

As of the time of this report, it appears that Colorado will escape substantial snowmelt flooding, despite the highest snowpack in over a decade. The vast majority of mountain watersheds saw their highest flows in over a decade, but there were few, if any, newsworthy events. Are we out of the woods, then? No!

Consider this—there have been disasters that have occurred in the State of Colorado that have exceeded \$39 million dollars in damages every decade since the 1900's, except for one, the 1940's. The list is here (all damages reported in 2003 \$):

- 10's – Cherry Creek in Denver (\$131 million, 2 deaths)
- 20's – Arkansas River at Pueblo (\$832 million, 78 deaths)

- 30's – Monument Creek (\$56 million, 18 deaths)
- 50's – Purgatoire River at Trinidad (\$39 million, 2 deaths)
- 60's – South Platte River in Denver (\$2.4 billion, 8 deaths)
- 70's – Big Thompson Canyon (\$93 million, 144 deaths)
- 80's – Heavy Snowmelt Runoff 1984 (\$51 million, 2 deaths)
- 90's – Fort Collins, Sterling, Lower Arkansas River (\$421 million, 6 deaths)
- 00's – ????????

You will note that we have not experienced an event of this magnitude yet this decade. You may

also note that with the exception of 1984, each and every one of these events was based on rain-induced events, not snowmelt. Rain-induced flash flooding remains the deadliest and costliest natural disaster in the State of Colorado. And specific events are nearly impossible to predict with much lead time.

When do these events occur? Typically, the "epi-center" of flash flooding in Colorado tends to occur around the 1st of August east of the Continental Divide and from mid-August through early-October west of the Divide. But flooding events can happen at any time during the spring, summer, or fall. Our last major flood disaster in the state occurred in 1999 during the first week of May. So keep your eyes out and be safe this summer.

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What I learned in Paver School

By Michelle DeLaria



*Roman road in Pompeii.
Photo Courtesy Paul Vlaar*

There are several low impact development (LID) techniques used to mimic predevelopment hydrology and reduce the negative effects of urbanization on waterways. While vegetative LID techniques such as grass swales, buffers, green roofs and porous landscape detention areas are attractive, they have limited use and effectiveness in significantly reducing runoff volume in existing, highly impervious environments. Permeable pavers and porous pavement are techniques that can substantively reduce stormwater

runoff volume AND provide detention capacity in highly urbanized areas. Urban Drainage and Flood Control District (UDFCD) includes guidelines on modular block paving and other porous pavement techniques in Volume 3 of the Technical Criteria Manual. There are also several successful installations of these materials in Colorado, yet comments and concerns about cost, cold climate function, maintenance and plowing linger. Communities along the Front Range are increasingly regulated for the effects of excess urban runoff and are collecting millions of dollars in fees annually to manage hundreds of millions of dollars in backlogged waterway stabilization and water quality needs. Permeable pavers and porous pavements can be part of the solution. This article addresses some of the misperceptions and how paver systems and porous pavements can be used in our communities to produce a more functional, sustainable urban environment.

Last fall, I attended a one-day training class at the School for Advanced

Segmental Paving in Franksville, WI taught by instructors from the Chicago area. The school is modeled after the European apprenticeship method where students learn in a classroom setting and further develop skills in an on-site installation practice area. The school was established by several leaders in the segmental paver industry who are dedicated to establishing standard methods and practices in this field. The school also offers three and four day classes that are tailored to the level of involvement and skills desired in paver systems. For example, there are classes to learn paver installation in variable field conditions as well as classes for geared for estimators and sales people. The class that I attended included the history of paver systems, applications, benefits, and a demonstration in the practice area.

While the words permeable, porous and pervious are often interchanged and UDFCD includes pavers under the porous pavement section of best management practices, in this article they will be used as follows: The term

“permeable” will refer to water moving through openings between pavers and aggregate. “Porous” refers to the material and how water moves through it as is the case with porous concrete and asphalt that has voids in the material because the fines are removed. “Pervious” refers to the ability of the surface of the material to accept water.

The first thing I learned is permeable paver installations with an open-graded aggregate system are based on Roman road construction techniques from 2000 years ago. Romans would excavate a trench and fill it with a layer of large rock on the bottom, then smaller rock, followed by a setting bed. They would then fit large stones on top of the aggregate layers for the travel surface or a “wearing course”. Some sections of Roman roads are still used today with a new asphalt wearing course, although many sections have been preserved as historical remnants throughout Europe. Roman road construction is the basis of current road construction and instead of pavers, asphalt or concrete is used



Open-graded aggregate base course layers. Photo by Michelle DeLaria.



Screed boards are used to lay a level setting bed. Photo by Michelle DeLaria.



One quarter inch aggregate is swept into the paver joints. Photo by Michelle DeLaria.

Pavers with Open Graded Aggregate

The open-graded aggregate system consists of aggregate layers placed and compacted to provide a stable sub-surface for heavy vehicles and point loads. Pavers with the full 18" depth of open graded aggregate also provide detention. The layers from bottom to top are as follows:

- Twelve inches of 1 1/2 inch size, all-fractured face aggregate. This is called #4 aggregate and is compacted in 4" to 6" lifts.
- Four inches of 3/4 inch all-fracture face aggregate. This is called #67 aggregate. It is also called a choker course because this size rock remains on top of the 1 1/2 inch aggregate and "chokes" off the top of the larger aggregate, while allowing water to flow downward into the void space of the 1 1/2 inch aggregate. The smaller rock does not sift into the voids. This layer is compacted.
- Two inches of 3/8 inch granite "chip" material is then placed on top of the base course. This is the setting bed. It is important that this material be all-fracture face and not rounded "pea gravel". The setting bed is not compacted.
- Pavers are placed on top of the setting bed by hand or machine. The joints between the blocks are filled with 1/4 inch material and a compactor is run over

the blocks to vibrate and "lock in" the blocks. Fabric, or other means of separating the aggregate layers, is not used in this system. Current research indicates that separating aggregate layers in infiltration systems introduces a clogging layer and causes more rapid degradation of the system. Depending on the subsoil, a geogrid may be used between the soil and the base course aggregate to increase stability.

Several million square feet of permeable pavers with the open-graded aggregate system have been installed in the Chicago area over the past 20 years. I visited several sites in various stages of completion with Chuck Taylor, the permeable paver instructor who installs pavers in the Midwest. One site was a private road under construction in a large-lot subdivision. The road, if built using traditional methods, would have been the majority of impervious area and the greatest source of runoff. Since the road was constructed with permeable pavers over the aggregate layers, a detention pond and conveyance infrastructure that is typically required to handle road runoff was not needed.

A college in the Chicago area installed permeable pavers on an 8% slope and combined the paver installation with curb cuts directing stormwater into sumped landscape areas.



Pavers can be plowed. Photo Courtesy Chuck Taylor (Advanced Pavement Technologies)



Standing water and free/thaw cycles create and auto and pedestrian hazard and shorten the life of the paving material. Photo by Michelle DeLaria.



Pavers are largely free from ice and snow and accumulation Photo Courtesy Interlocking Concrete Pavement Institute



Model of aggregate layers for stability and detention capacity. Photo by Michelle DeLaria.



Pavers with the open-graded aggregate system in Illinois and swales for added detention capacity. Photo by Michelle DeLaria.



Private road in Illinois with detention capacity underneath pavers. Photo by Michelle DeLaria.

Block pavers can be plowed and are less prone to black ice and other surface freeze/thaw problems. In addition to the void space of the open-graded aggregate system, there is more air moving through the system to keep the surface free of ice and snow when compared to impervious surfaces such as asphalt and concrete.

An installation of a permeable paver system with open-graded aggregate layers was recently completed for this residential driveway in the Denver area.

The cost benefit analysis is variable. For example, at an installation in Florida, permeable paver systems broke even after 22 years when comparing the materials, construction and maintenance to concrete and asphalt surfaces. On another site in the Chicago area, after 50 years an asphalt surface would have cost 10 times as much as pavers to maintain. Additionally, comparing costs of materials and installation is not a complete and perhaps not an appropriate evaluation. In the Denver area for example, a concrete parking lot would

cost approximately 50% more than asphalt and a permeable paver system with the full open-graded aggregate system, would cost two to three times as much as asphalt. Based upon initial investment, asphalt or concrete appear to be more cost effective than pavers. However, the cost of asphalt or concrete does not include the costs of inefficient use of land and associated cost if a detention structure is required. Also not included are costs associated with managing offsite impacts that are generated such as: excess stormwater runoff rate and volume, pollutants washing off of impervious area into receiving waters, and future waterway stabilization needs. Pavers may have a larger initial investment, but the cost of detention is included and offsite impacts are reduced.

While permeable paver, porous concrete and porous asphalt systems provide infiltration and can be designed for detention capacity, there are additional advantages that may be important to some property owners. The wearing courses have similar recommended annual maintenance needs

such as removing surface grit by using a sweeper or vacuum truck. However, it is possible that the subsurface aggregate may accumulate enough solid material resulting in decreased infiltration and detention capacity that cannot be regenerated by a power vacuum. At this point, porous asphalt or concrete needs to be removed and discarded. However, paver systems are completely modular. The system can be deconstructed, the aggregate layers cleaned and all the products reinstalled with minimal waste. The reduced waste in a paver system may be preferable. Additionally, pavers can be manufactured in lighter colors and a project can receive LEED points for reduced urban heat island effects.

Also note that for porous concrete, UDFCD has requested a moratorium on future installations based on current performance. Several installations are showing excessive and rapid surface degradation and potential causes are being studied. Permeable pavers and porous asphalt are still used for porous hardscape.



Model of aggregate layers for stability and detention capacity. Photo by Michelle DeLaria.



Pavers with the open-graded aggregate system in Illinois and swales for added detention capacity. Photo by Michelle DeLaria.



Private road in Illinois with detention capacity underneath pavers. Photo by Michelle DeLaria.

Summary

From a stormwater management perspective, porous asphalt, porous concrete or permeable pavers (all with the open-graded aggregate system) are all techniques that can restore permeability and infiltration as well as provide large storm detention volume. Parking lots, alleyways, driveways, fire lanes, and parking lanes on streets are common examples impervious flatscape areas that can instead be porous or permeable to reduce runoff. Communities can retrofit highly urban areas to help retain the economic benefits of developed land while reducing offsite impacts and flood control costs.

We know how much money communities collect in stormwater fees to fund drainageway stabilization projects and water quality programs. We know that

total maximum daily loads (TMDLs) for temperature or E coli are going to be expensive and cumbersome to correct with our existing drainage-based land development design and infrastructure. We even know of communities that are adopting low impact development standards and retrofitting their urban environments to protect receiving waterways. Perhaps instead of discussing the expenses and maintenance of runoff reduction and infiltration best management practices, we should examine the collective costs and ramifications of not using these techniques.

Supplemental note

Chuck Taylor with Advanced Pavement Technologies will be at the CASFM conference this fall and will present his seminar on permeable paver systems.

Author Bio

Michelle DeLaria is a project manager for Meza Construction Company in Denver, Colorado, specializing in Low Impact Development (LID) and stormwater structure maintenance. Prior to joining Meza Construction, Michelle developed and managed Jefferson County's Stormwater Quality program for five years and has an additional 10 years of experience in water quality and environmental compliance. Michelle holds a Master's degree in Environmental Science and Engineering from Colorado School of Mines and is a Registered Environmental Health Specialist. Michelle is also the stormwater quality committee chair person for Colorado Association of Stormwater and Floodplain Managers.

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Water Quality Field Trip

By Michelle DeLaria

On June 17th, 50 people participated in the annual CASFM field trip arranged by Ken MacKenzie from Urban Drainage and Flood Control District (UDFCD) and Michelle DeLaria from Meza Construction Company. The group visited several water quality and low impact development techniques in the Denver area and Douglas County. Any technique that detains water to allow pollutants to settle out or allows runoff to be filtered or precipitation to be absorbed is a water quality technique. However not all water quality techniques are low impact development techniques. The difference between water quality and LID techniques is that LID emphasizes reducing the runoff volume of small, frequent storms through infiltration and absorption.

For example, several acres of parking area will generate an increased volume of runoff compared to the predeveloped condition. This excess runoff is often conveyed to a detention pond and the detention pond has additional volume capacity to allow sediment to settle. This meets the water quality requirement. A low impact development solution could be to reduce impervious parking area with a permeable paver or porous asphalt. This style of development would reduce runoff volume, conveyance infrastructure and the required detention capacity. Typical land development design creates and



manages excess flows and associated pollutants whereas LID techniques are based on prevention.

This year's field trip group visited both types of sites. The first stop was a porous concrete installation at Colorado Blvd and Evans Ave. Porous concrete is an LID technique because it substantially reduces runoff by allowing infiltration into the wearing course of the parking area. It was installed at this site in spring 2007 and is experiencing rapid surface wearing and breakdown. UDFCD has requested a moratorium on more installations until forensic engineers can determine the causes for this rapid surface spalling.

The group then visited several sites in Douglas County. The first was Highlands Ranch Backcountry, which is an integrated stormwater system at Shea Homes residential development. Jim Wulliman from Muller Engineering developed this design concept and led this portion of the field trip along with Erik Nelson from Douglas County. The features in this subdivision include flush curbs to allow runoff to flow off the streets and onto street-side vegetated areas, surface swales instead of drop inlets and conveyance pipe to carry stormwater and a series of small detention areas that mimic natural open-channel habitat. Some of the detention ponds also have been permitted to reuse water to irrigate adjacent

Highlands Ranch Backcountry 118 flush curb (left), the Denver Wastewater paver demonstration area (above, right) and Grant ranch Micropool (background).

landscaping. These integrated features increase the value of the site and reduce offsite impacts compared to conventional drainage-based designs.

We then visited several sand filters and porous landscape detention areas at Highlands Ranch Town Center. Erik Nelson, Douglas County's Stormwater Quality Coordinator, led the group to the structures serving the Town Center. The discussion included successes and struggles that include aesthetics, access, poor inlet design, and incorrect sand that led to accelerated clogging in one structure. These discussions are often the most valuable because attendees can learn what to look for on designs in their own jurisdictions or what to adjust or inspect.

We then visited an extended detention basin at Grant Ranch subdivision. The discussion at Grant Ranch was led by John O'Brien from Wright Water Engineers. Wright Wa-

ter has been conducting water quality monitoring activities at this site for several years. This site offers the benefit of a well-designed forebay and micro pool that provides habitat and balanced ecology. Even though there is about four feet of standing water in the micro pool area there were no mosquitoes seen. This is because the micro pool provides the water depth and associated vegetation necessary for dragon flies and birds, both of which predate heavily on mosquito larvae and adults.

Near the detention pond and micro-pool is a constructed wetland basin. Since wetlands serve as nutrient sumps, this structure is collecting the nutrient-laden runoff flowing off of nearby lawns. The result is a solid algae mat growing on the water from nutrients. Birds were seen walking on the algae mat and this area has mosquitoes and homes very close to the water. There was discussion

about how to reduce nutrients flowing into the constructed wetland or remove the nutrients and improve the aesthetics of this structure.

The Denver Wastewater building was the last site visited. Porous asphalt and paver system systems were recently installed in front of the building. Darren Mollendor and Ted Christianson showed our group an infiltration demonstration by dumping a barrel of water on both the porous asphalt and pavers. Since this is a demonstration area, both structures are underlain by a liner to direct subsurface flow to the existing inlet area, where water quantity and quality sampling can be conducted. During the demonstration, a hose was left on the asphalt so the group can observe the time delay from the water traveling downward through the layers and laterally to the drain. The reduction from surface runoff and time delay from subsurface flow help mimic pre-

development hydrology and show the capabilities and benefits of low impact development techniques.

The response to this year's field trip was very positive and we are pleased to be able to showcase the regional talent in stormwater management and provide a forum for field learning, group discussion and networking. There are always lessons learned and the main one this year was to bring more drinking water.

Summary provided by Michelle DeLaria from Meza Construction Company and the CASFM Stormwater Quality chairperson. Please refer to the CASFM Stormwater Quality photo database for pictures and a summary of this year's structures and feel free to contact Michelle at mdelaria@meza-construction.com or 303.778.8381 for additional information or to provide additional information about the profiled sites. [Return to page 1]



A functional sand filter with aesthetic challenges

The Open Channel

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Southeast Region (Region Map)

Dennis Maroney, P.E.
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Committee Chairs

Conference

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I wish to thank everyone who contributed articles to this edition of Open Channel and helped with content review. This is the first issue in the "electronic format". We decided to put our efforts into format and graphics while saving on the printing and mailing costs. What do you think? I'd love to hear your comments (dmallory@udfcd.org).

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