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SWS

STORM WATER SOLUTIONS

THE STORM WATER AND EROSION CONTROL RESOURCE

2021 TOP PROJECTS

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SCRANTON GILLETTE COMMUNICATIONS

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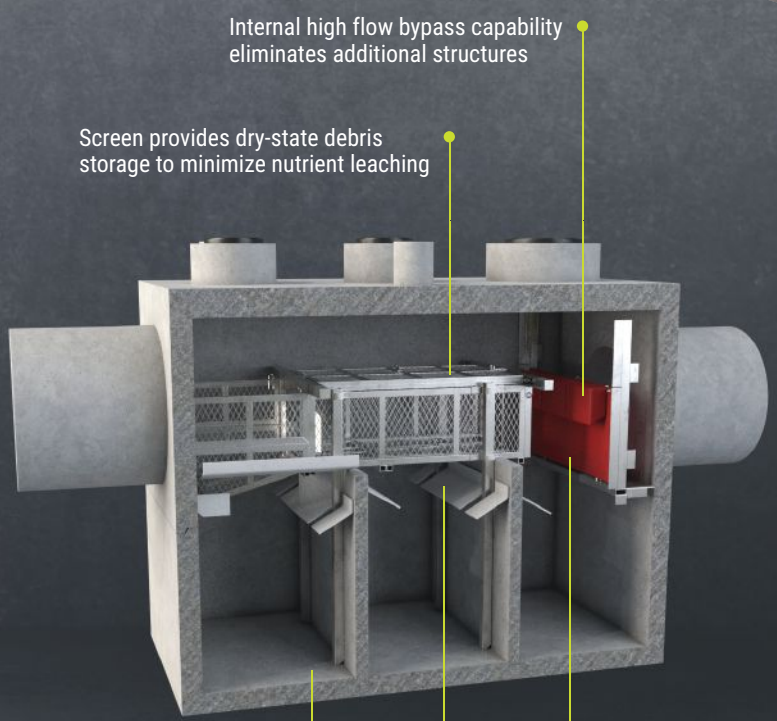

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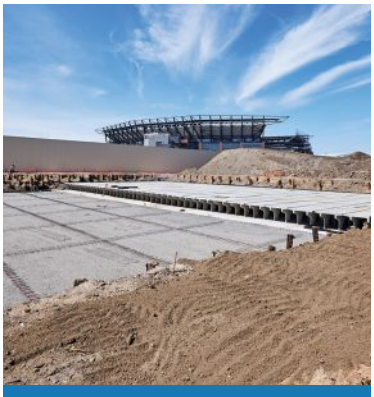
Departments



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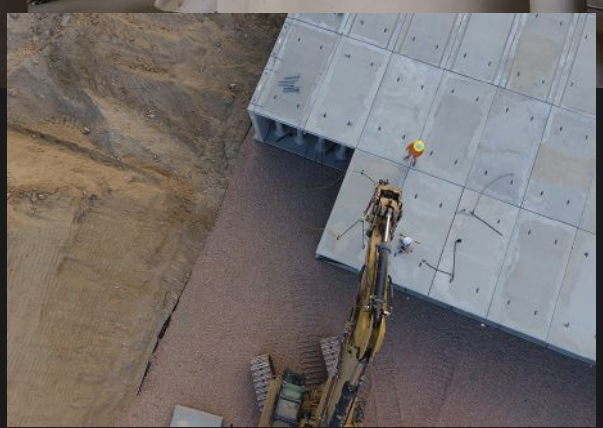
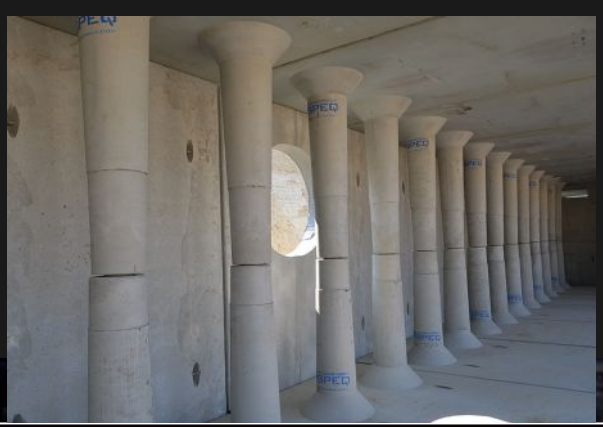
MANAGING STORM WATER UNDERGROUND





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Reflections on 2021

Katie Johns
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It has been quite a year.

Coming off of a tumultuous 2020, 2021 brought back a slight sense of normalcy. Though the COVID-19 pandemic is still impacting us, we found a way to move forward.

In 2021, the storm water industry hit a few milestones. In March, storm water was included as its own category for the first time on the American Society of Civil Engineers (ASCE) Report Card for America's Infrastructure. For its first grade, storm water earned a D.

We also saw the introduction of the Infrastructure Investment & Jobs Act. As of writing this, the House of Representatives hasn't voted on the bill, but the Senate passed the bill in August. If passed by the House, the bill would provide funding to certain storm water improvements, including $1.4 billion over five years for the U.S. EPA Sewer Overflow & Stormwater Reuse Municipal Grant Program, of which no less than 25% will go to rural and financially disadvantaged communities; in addition to $50 million for storm water infrastructure planning/development and implementation grants; and more.

On more of a ground level, we saw the return of some in-person events. While some shows remained virtual or took place as hybrid events, it was nice to see some industry folks in person again.

To gauge how these events impacted the industry, we typically would present our State of the Industry results in this issue. However, we have moved the publication of those results to our January 2021 issue. We wanted more time to collect results to get a better understanding of how the year, a busy year at that, went for the industry. However, we are including in this issue some of the results of a residential survey we conducted. We sent out a nine question survey to those in the residential market to see how storm water practices and management impact their work. You can read more about those results on page 16. And, please check out our January issue for the full results of our State of the Industry survey.

I hope you all have a happy and healthy holiday season!

TUNE IN

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2021 TOP PROJECTS

SWS HIGHLIGHTS THE TOP STORM WATER & EROSION CONTROL PROJECTS

EACH YEAR, the SWS editorial team seeks to honor the best projects from the year. These 10 projects highlight innovation in the storm water and erosion control industry. From watershed management to restoration, the following projects required close collaboration between contractors, designers, owners, manufacturers and more to bring each project to completion. SWS thanks everyone who submitted projects this year, and we look forward to seeing the innovative projects that are nominated next year.

Winner profiles were compiled by SWS Managing Editor Katie Johns and Associate Editor Cristina Tuser. Johns can be reached at kjohns@sgcmail.com and Tuser can be reached at ctuser@sgcmail.com.

#1 TOP PROJECT

Location: Ma'alaea (Kihei), Hawaii (Island of Maui)
Cost: $613,158
Size: 5.268 acres (watershed area)
Owner: State of Hawaii Divison of Forestry and Wildlife, Spencer Family (currently, sale is pending to County of Maui)
Manager: Maui Nui Marine Resource Council
Designer: Maui Environmental Consulting & Goodfellow Bros
Contractor: Maui Environmental Consulting, Goodfellow Bros. & Sunshine Vetiver
Manufacturer: Eureka Water Probes & Goodfellow Bros.

"Vision for Pohakea" Project Comes to Life

In order to improve nearshore ocean water quality and the health of coral reefs in Maui's Ma'alea Bay, the Vision for Pohakea Storm Water Management Project set out to reduce the transport of sediment via storm water runoff from the adjoining Pohakea Watershed.

However, that was not the only goal. The project also included installing firebreaks, a priority in the project, to suppress wildfires in the watershed; monitoring storm water runoff from several headcuts; utilizing the filter feeding abilities of more than 5,000 caged oysters in Ma'alaea Harbor to remove sediment from the water; continue monitoring ocean water quality in the Bay every three weeks year-round; and utilizing technology to generate additional data on the impaired water quality and establish solutions.

This project has been in the works since 2018, when the Maui Nui Marine Resource Council commissioned Maui Environmental Consulting to create the Pohakea Stormwater Management Plan. Ma'alaea Bay is home to various wildlife, including green sea turtles and humpback whales; a recreation area for surfers, boaters, fisherpeople and more; and Ma'alaea Harbor.

Overtime, sediment has become a major source of pollution and has contributed to the significant decline of the bay's coral reefs. Part of the reason sediment is such an issue is due to the frequent wildfires that break out, which strip the land of the vegetation that holds soil in place. In December 2020, the firebreaks were installed to suppress wildfires, and hence, protect nearshore water quality.

In January 2020, the Maui Nui Marine Resource Council (MNMRC) installed the oysters, each of which can filter approximately 40 to 60 gallons of ocean water per day. Then, in early 2021, MNMRC's monitoring of three headcuts revealed that 60,000 pounds of sediment were eroded and flowed into Ma'alaea's coastal waters in just one moderate rainstorm. MNMRC is now

working to repair those headcuts and writing grants to obtain proper funding. In fall 2021, MNMRC worked to plant drought-tolerant vetiver in the watershed, which will help hold soil on steeply sloped areas.

This project is ongoing, including one major step — the acquisition of a 257-acre parcel of the watershed that is on private property. The majority of the watershed is on state-owned land managed by the Hawaii Division of Forestry and Wildlife, so MNMRC worked with the DOFAW, Ma'alaea Village Association, Trust for Public Lands and the County of Maui to secure $5.5 million in funding in the 2022 Maui County budget for the purchase of the parcel.

Once that land is purchased, DOFAW can combine it with the 4,000 acres of the West Maui watershed to actively manage all lands to address wildfire and erosion into the bay.

"We are proud that this is a multi-faceted approach to address the issue of sediment runoff in Ma'alaea Bay: our work is in the water (our oyster bioremediation project) and on land (our work in Pohakea watershed). It is a model for other watersheds and impaired coastal areas of Hawaii," said Anne Rillero, communications, community outreach and development manager for the Maui Nui Marine Resource Council.

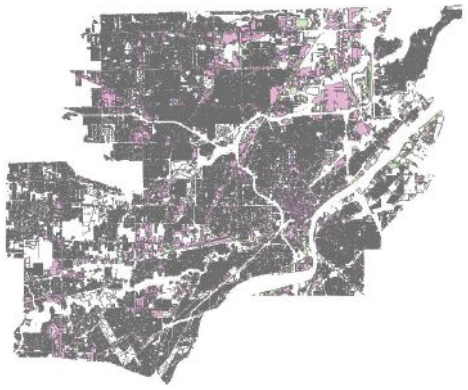
Impervious Surface Mapping Aids in Utility Overhaul

The city of Toledo, Ohio, needed to update its storm water utility. Toledo prioritized updating and maintaining an accurate and equitable GIS dataset for use in levying storm water bills. Impervious surface mapping enables cities like Toledo to update its equivalent residential unit database and determine how much to charge customers for its storm water utility.

Location: Toledo, Ohio
Cost: $1,002,748.49
Size: 80 square miles, storm sewers; 986 miles, drainage ditches; 64 miles, real estate parcels; 119,000
Owner: Dough Stephens; Lorie Haslinger; Christy Soncrant
Manager: Brian Stevens; Frank Orr; Crystal Childers
Designer: Brian Stevens & Daniel Ngoroi
Contractor: Woolpert
Manufacturer: Esri, Trimble, Woolpert, Safe Software

This was a two-phase program: the first phase entailed a mapping component, which is complete; and the second phase is a billing integration (SAP billing system), which will take nine to 10 months. The second phase will correct links and design web interfaces so the public can see how each property was assessed. For the mapping portion, Woolpert worked with the department of engineering services in Toledo, and within the second phase, Woolpert is working with Toledo's billing department.

Buildings, tree canopies and shadows presented a challenge, as these elements obscured some hard surfaces, preventing accurate mapping. Another large challenge was that prior to the project, Toledo had inconsistencies in its processes, including broken links within the billing system. Machine learning was used to achieve the desired accuracy and schedule.



Machine learning processes rely on a 4-band orthoimagery with 3-inch resolution and aerial lidar with a density of 2 points/square meter.

"I feel very good about the overall result," said Woolpert Vice President Brian Stevens. "The client has a dataset that can not only help manage storm water runoff but can understand how water is flowing through the community to identify flooding issues and provide solutions."

The project is in Phase 2 and expected to wrap up early 2022.

Fighting Flooding & Fixing Bank Erosion

Located in Rock Hill, South Carolina, the College Avenue Improvement Project assisted with mitigating downstream flooding and bank erosion that occurred along the section of stream between College and Charlotte avenues. The design engineer (Keck & Wood), the city, and Lindsay Precast were involved with the project.

Issues reported downstream of the watershed were overbank flooding of residential yards and one basement, bank erosion, trash and debris in the creek, and trees dying and falling into the creek.

Location: Rock Hill, South Carolina
Cost: $775,000
Size: 0.35 acres
Owner: City of Rock Hill
Manager: David F. Dickson
Designer: Matt Crawford & Keck & Wood
Contractor: City of Rock Hill
Manufacturer: Caterpillar & Freightliner

A key component of this project is that it was built by in-house crews and no outside contractors were involved. The crews replaced pipes and installed a detention basin, using trash racks to capture debris from upstream.

The crew also dealt with weather challenges. During and after rainfall events, the creek and pond would swell and the excavated areas would become saturated, which caused project delays.

Unsuitable soils and groundwater were also encountered throughout the majority of the project, which resulted in washed stone and suitable soils from offsite being brought in for use.

"Since completion of the project, several large storm events have hit the area and the detention pond appears to be functioning effectively," said Project Owner and Manager David F. Dickson, PE, City Engineer III, Public Works.

Revegetation Efforts Aid in Railway Projects

The San Diego Association of Governments (SANDAG) is currently working on multiple projects to support growth in the Los Angeles - San Diego - San Luis Obispo (LOSSAN Corridor). One of these is the Mid-Coast Corridor Transit Project.

Location: San Diego, California
Cost: $21 million (for just the erosion control, landscape & irrigation efforts)
Size: 42 acres
Owner: San Diego Associated Governments (SANDAG)
Managers: Caltrans, Mid-Coast Transit Constructors (MCTC-JV consisting of Stacy and Witbeck, Herzog, and Skanska)
Federal Transit Administration
Designer: KTU&A
Contractors: Diversified Landscape Co. & Profile Products
Manufacturer: FINN

This project is an 11-mile extension of the San Diego Trolley that will operate within the right-of-way of the Metropolitan Transit System (MTS).

The other work in the overall project includes the San Diego River Double Track and the Elvira to Morena Double Track, each of which are adding a second main track in their portions of the MTS.

To complete these projects, the contractors must earn a Notice of Termination, which includes revegetation efforts along the new railways. To meet these requirements, the project includes amending the soil with biotic soil media, establishing sustainable vegetation, and safely applying an erosion control product to hold seed and soil in place until germination.

Like many projects, the Mid-Coast Transit Corridor project, which is still ongoing, dealt with numerous challenges, including poor soil conditions, limited rainfall and vegetating steep slopes in highly trafficked areas and more. Additionally, it was important to the project team to apply the proper solution on the first try as this project uses taxpayer dollars.

As of press time, based on areas where construction is complete, the vegetative cover has unofficially achieved 70% cover. The team is confident that when the Notice of Termination is filed in 2022, it will be accepted.

Slope Repairs Assist Channel & Protect Properties

A project to repair severe erosion to the slopes of the channel in Fort Worth, Texas, and to restore the slopes with a design that could withstand heavy and continuous water flow began December 2020.

There were channel structures and concrete steps that were beginning to become undermined. Erosion issues were exposing utilities including storm drains, elevated power lines, and sanitary sewer main lines. Private properties were also impacted by erosion.

Location: Fort Worth, Texas
Cost: $213,472
Size: 630 feet
Owner & Manager: Robert Chapman
Designer: City of Fort Worth Stormwater Engineering
Contractor: City of Fort Worth Reconstruction Team
Manufacturer: CAT, International & Bomag

A mostly in-house operation, with the exception of suppliers for materials, consisting of The Transportation and Public Works Department (TPW) Stormwater Channel Reconstruction Team including crew leaders, senior equipment operators, and equipment operators, tackled the project.

The main challenges were that the slopes were completely gone, and a ramp entrance had to be built into the bottom of the channel and hold up under continuous use.

Channel easement and utility locations and soil types did not allow the team to rebuild the slopes in a way that would tie the natural slope materials to the materials being used to repair the erosion to the slope.

Fill materials, rock, concrete and erosion blankets were all used to tackle the erosion issue. Once design changes were made, the slopes and erosion controls held design grades.

"It has taken on the native characteristics of a natural creek," said Teanna Thompson, TPW Stormwater Superintendent, Street and Storm Water Operations of the project, which was completed April 2021. "The slopes are intact and vegetated. The channel is working at its designed capacities."

The design used has been implemented in several locations around Fort Worth, for both small and large projects.

Trash Collection Net Ramps up Pollution Prevention

When the city of Irving, Texas, was updating its Pollution Prevention and Good Housekeeping Plan for one of its large municipal operations facilities, a need was recognized for trash capture.

The facility stores solid waste collection vehicles, so in order to have a positive impact on storm water quality, the project team decided to install a trash collection net at the end of the main outfall pipe.

"I believe that as storm water managers we are obligated to do everything in our power to keep our creeks, streams and rivers as healthy as possible. We are responsible for everything that discharges into the greater watersheds and should be good stewards of this precious natural resource. If not us, then who?" said Cody Cash, drainage programs specialist for the city of Irving.

Location: Irving, Texas
Cost: $2,500
Size: 48" diameter outfall pipe
Owner & Manager: Cody Cash
Designer: Cody Cash & Brent Redd
Contractor: City of Irving Drainage Crew
Manufacturer: InCord

In Irving, a five-man maintenance and equipment crew is responsible for all storm water operations and maintenance, so with the help of a few tools, they installed the pilot project net in late summer 2020 and to date, the net has captured 750 pounds of trash. The team installed a second net at another site that has captured 1,425 pounds of trash from January 2021 to September 2021.

But, getting approval for the second net was a challenge. The team had to wait to gather enough data from the first net in order to gain approval to continue the second installation. Currently, the team is working on locating two more suitable outfalls.

Micro-bioretention Device Helps Infrastructure Improvement Goals

With the goal of improving existing infrastructure in Fairmount Heights, Maryland, the Clean Water Partnership, Corvias Infrastructure Solutions and Prince George's County, set out to install a micro-bioretention device in the public right-of-way in the town.

The site is located within a TMDL catchment area for sediments and is intended to treat runoff from the surrounding area before it runs into the Cabin Branch stream, which flows into the Anacostia River. Hence, the two major goals of the project were to treat unmitigated storm water and provide storage for runoff during heavy rain events.

Location: Fairmount Heights, Maryland
Cost: $469,515
Size: ~200 square yards
Owners: Corvias Infrastructure Solutions & Prince George's County, Maryland
Manager: HDR
Designer: Soltesz, LLC
Contractors: Nardi Construction, Stormwater Maintenance, LLC & L.E. Blue
Manufacturer: Link-belt, CASE, John Deere

Along with the storm water improvements, the CWP has overarching socio-economic goals that are aligned with this project – the inclusion of over 80% participation by target class businesses (local, minority, disadvantaged small, minority and women-owned business entities) meeting and exceeding the requirement of 50% target utilization.

But though the project goals were met, that does not mean that the team did not face any challenges. Along with the COVID-19 pandemic, the project team also had to deal with both community and public sector involvement, existing infrastructure challenges and flooding issues.

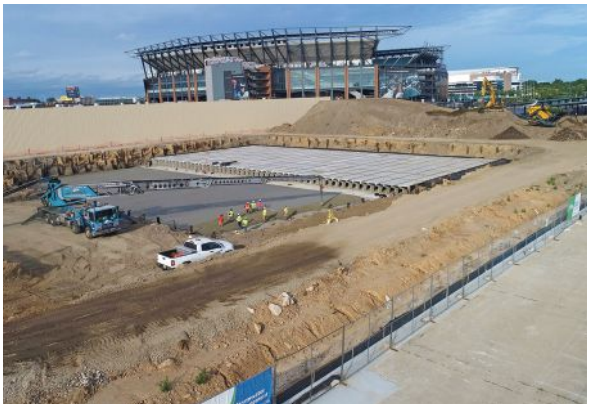
"The project is a true example of our community-based centric goals and efforts connecting environmental needs and improvements to social impact through public engagement and connection," said Keisha Brown, director of Partnerships and Client Relations for Corvias. "We worked with the community to mitigate a local environmental issue, beautified, and enriched the physical community and supported the local economy through the utilization of local businesses and residents."

As of press time, the project was fully established and functioning as intended.

Storm Water Management System Levels City Plan

To help Philadelphia meet its Clean Water Act goals and the goals of the Green City - Clean Waters Program started by the Philadelphia Water Department, the Darien Crossing Stormwater Retrofit project involved installing a 1.8 million-gallon underground storm water management practice.

Location: Philadelphia, Pennsylvania
Cost: $13.1M
Size: 67 "Greened Acres"
Owner: Resource Environmental Solutions LLC
Manager: Resource Environmental Solutions LLC
Designesr: SAS Geospatial Inc. & Pennoni Associates Inc.
Contractors: Brightfields Inc. & American Sitework LLC
Manufacturer: StormTrap | AC Miller Concrete Products Inc.



Through a PWD Greened Acre Retrofit Program grant, RES designed and constructed the practice within the Sports Stadium District of the city, which is known as Darien Crossing. Along with the underground system, the project also consisted of demolishing a vacant portion of an existing warehouse and constructing a new parking lot with green vegetation and infrastructure, such as trees, grases and bioswales.

The existing drainage network was retrofitted with four large bioswales to serve as pretreatment for rainwater, which is then stored in the basin and released into the city's combined sewer overflow system. An early challenge was sourcing an underground detention system that could withstand large weight on top of it, then because of the small footprint of the former warehouse, which was 4.3 acres, the installation of the system was done in three phases. During each phase, 450 chambers of the system were installed. The detention system provides 251,653 cubic feet of storm water storage. In its entirety, the new system brings 67 greened acres to the site.

As of completion, the site is fully operational and serves as a parking lot for sports fans as the site is near the Lincoln Financial Field and Citizens Bank Park.

Enhancing Water Quality With Trash Capture

The main issues driving the project were to alleviate flooding within the Modjeska Park boundaries and surrounding neighborhoods, which were caused by an undersized storm drain. Enhancing local water quality was also a goal of the project.

The project was designed to capture and infiltrate 182-acre feet per year (AFY) of storm water that flowed untreated into storm drain channeling, and to the Pacific Ocean.

Location: Anaheim, California
Cost: $3,316,218
Size: 37,000 square feet
Owner: City of Anaheim
Managers: Gary Solsona, Kevin Miako & Tim Flint
Designers: Cannon & GHD
Contractors: GJ Gentry General Engineering Inc. & Ghirardelli Associates
Manufacturers: Jensen Precast & Akerstone

The project is the first to be completed as part of the Citywide Drought Resiliency Program, which aims to identify, inventory and compare all potential detention/retention sites within Anaheim and construct projects that have the capacity to capture and infiltrate up to 1,800 AFY of water.

The city of Anaheim, Cannon, Ghirardelli Associates, GHD, Group Delta, C Below, GJ Gentry Engineering, Inc. and StormSensor collaborated on the project.

A challenge was discovered after geotechnical investigation and percolation tests showed more favorable soils between 35 and 40 feet below grade, which was 10 to 15 feet deeper than the proposed depth of the infiltration gallery. The team proposed a series of 66 drywells to act as wicks underneath the system to assist with infiltration.

"Modjeska Park has performed incredibly well since completion. It has been able to capture and infiltrate 100% of the storm events since it was placed into service in July of 2020," said Bill Grigsby, Anaheim Public Works engineer. "It has yet to have a storm event large enough to bypass this facility. Maintenance has not been a problem, and the trash capture facility has simplified the maintenance effort. The public has made many positive comments to staff and the infiltration on the parking lot has been universally welcomed."

PHOTO: SATOSHI / STOCK.ADOBE.COM

The benefits of the project include better water quality, reduced flooding and increased local water supply.

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Trash Capture Devices Aid in Clearing Storm Water Systems

With an overall goal of cleaning trash and debris from its storm water system before water enters the Napa River and San Pablo Bay, the city of Vallejo, California, set out to find the best strategy to reach its goal.

While eliminating trash in the system, the Vallejo Flood & Wastewater District (VFWD), the project owner, also wanted to achieve the trash reduction requirements included in the San Francisco Bay Regional Water Quality Control Board, NPDES Municipal Regional Stormwater Permit, Section C.10.

Location: Vallejo, California
Cost: $3,678,811.82
Size: N/A
Owner: Vallejo Flood & Wastewater District
Managers: Mark Tomk & George Gourgui
Designer: BKF Engineers
Contractor: KJWoods Construction Inc.
Manufacturer: StormTrap

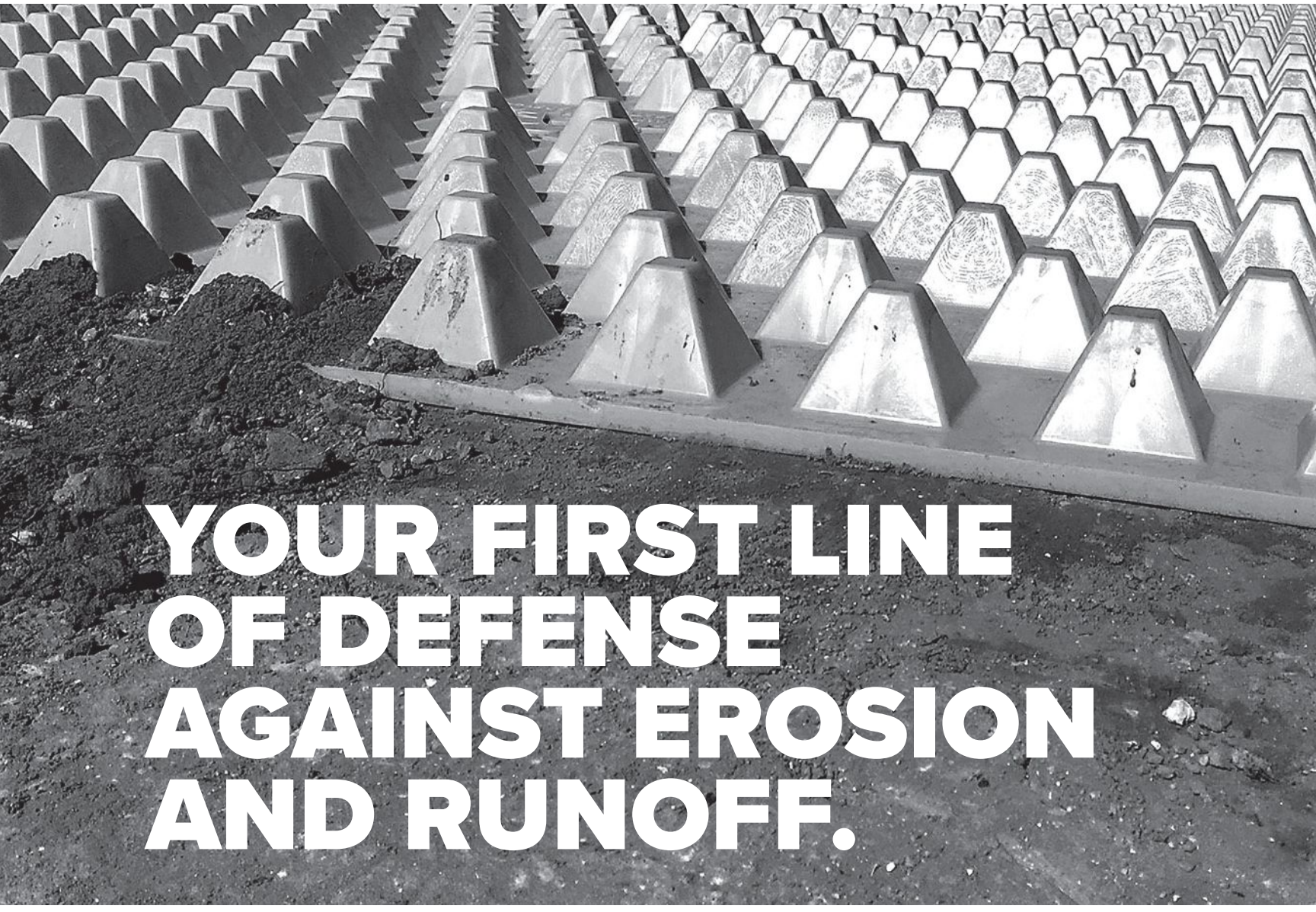
The VFWD worked with multiple parties to bring the project to fruition. In the design phase, the group worked together to select the strategy for trash removal, type of trash removal device and locations of where to install the chosen devices.

When they reached the construction phase, the group had to work with the supplier, StormTrap, in fabricating and delivering the large trash capture devices. During construction, the team held weekly meetings to identify and address any problems that arose. The team had to identify three areas around the city where storm water exits to the bay. Once those spots were selected, the contractor surveyed the site for plan accuracy, accessibility and constructability. Additionally, the sites required deep excavation, sheet piles for shoring and dewatering, placing and pumping concrete and the use of heavy equipment to lower the precast concrete housing and devices.

The devices at Solano Avenue and Sonoma Boulevard were installed before the last rainy season and performed well, according to project engineers. The third trash capture device was installed after rainy season but is anticipated to perform well too.

Overall, the team is most proud of the environmental and aesthetic impact the devices will have on removing trash before it reaches the Napa River and San Pablo Bay.

FERGUSON WATERWORKS



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SWS Surveys Residential Sector

Builders & remodelers share how important storm water solutions are to their work

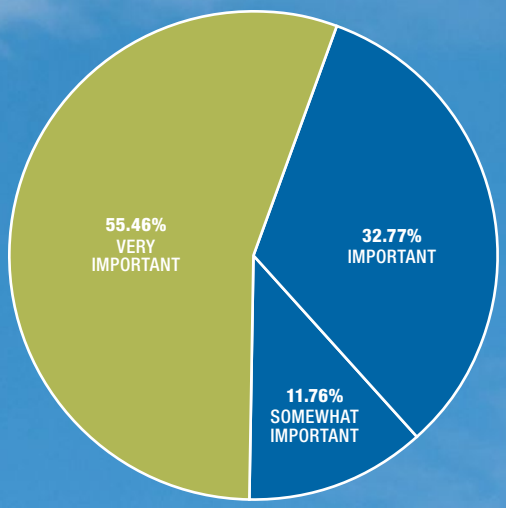
In June and July, 2021, Storm Water Solutions (SWS) sent out a 9-question survey to builders and remodelers from the databases of Pro Builder and Pro Remodeler magazines (SGC/SGC Horizon brand(s)). SWS sought to measure the importance and need for storm water, runoff and erosion control solutions and sustainable design amongst residential builders and remodelers as it relates to their businesses and customers. In total, 142 people completed the survey.

On this page and the next, we are sharing some of those results, though for the full findings, visit our website, www.estormwater.com.

Findings indicate that the majority of respondents (55.46%) said storm water and runoff solutions are very important to their jobs. 38.66% deal with storm water and runoff challenges quarterly. Similarly, 25.21% of respondents deal with those challenges weekly, and 24.37% deal with them monthly. When asked what storm water challenges they face the most, the majority (39.5%) said regulations are the biggest hurdle, followed by erosion control and soil stabilization (31.09%). 68.91% said they are currently planning construction that will include storm water and runoff challenges. Lastly to note, is that 49.58%, the majority, said storm water solution information would be the most valuable to them. Other topics that would be important include runoff, flooding, soil stability and municipal regulations.

For complete Residential Survey results go to www.estormwater.com.

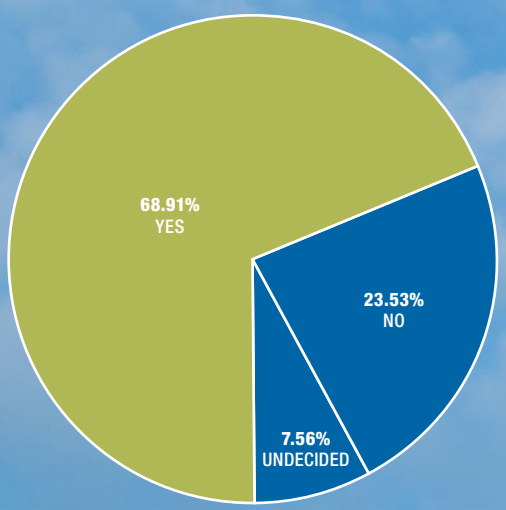
HOW IMPORTANT ARE STORM WATER/RUNOFF SOLUTIONS TO YOUR JOB?



SOURCE: 2021 SWS RESIDENTIAL STORM WATER SURVEY

Storm water solutions are "very important" to a majority (55.46%) of respondents.

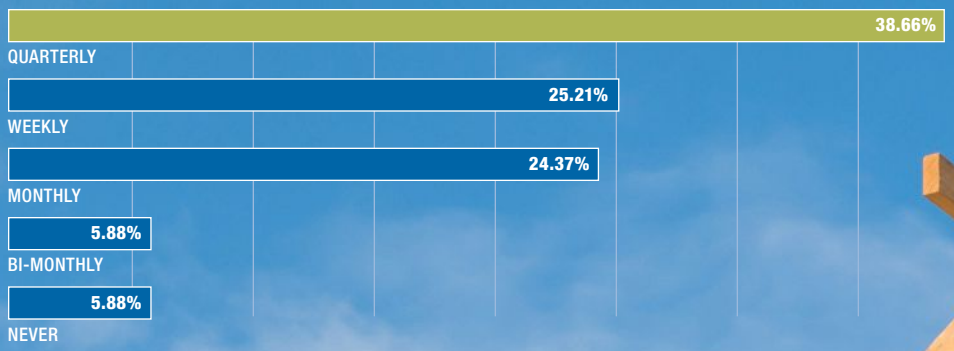
ARE YOU CURRENTLY PLANNING CONSTRUCTION THAT WILL INCLUDE STORM WATER/RUN OFF CHALLENGES?



SOURCE: 2021 SWS RESIDENTIAL STORM WATER SURVEY

68.91%, the majority of respondents, are currently planning construction that will involve storm water.

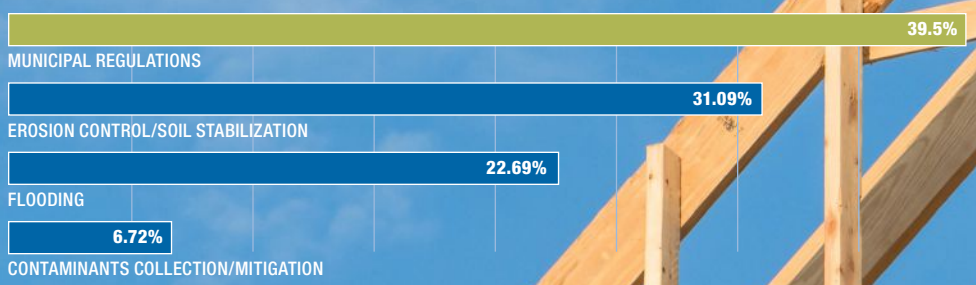
HOW OFTEN DO YOU DEAL WITH STORM WATER/RUNOFF CHALLENGES AS IT RELATES TO YOUR PROJECTS?



SOURCE: 2021 SWS RESIDENTIAL STORM WATER SURVEY

Most respondents (38.66%) said they deal with storm water challenges quarterly.

WHAT ARE THE MOST COMMON STORM WATER/RUNOFF CHALLENGES YOU FACE?



SOURCE: 2021 SWS RESIDENTIAL STORM WATER SURVEY

Municipal regulations are the biggest challenge when it comes to storm water, according to the majority (39.5%) of respondents.

PHOTO: TRONGNGUYEN / STOCK.ADOBE.COM

Minimizing Sediment Loss by Following the Construction Sequence

Because construction sites strip the topsoil that helps to infiltrate runoff, the risk of erosion is increased

Sediment is a pollutant that is displaced by rain and carried as storm water runoff to our rivers and streams. Construction sites strip the topsoil that helps to infiltrate runoff and therefore increases the risk of erosion. The grading and moving of soils on construction sites make these locations particularly at risk to discharge sediment.

Sediment control on construction sites became a main area of concern following the Clean Water Act amendments of 1972. Sediment control is the practice to minimize the movement of sediment by use of temporary and permanent controls. Erosion control is the act of minimizing the risk of erosion such as providing stabilization. If you manage erosion as a first step it helps to decrease the demand of maintenance of sediment controls. There have been studies into cost analysis about the savings that can occur if you practice good erosion control.

On a job site some common sediment control practices include the perimeter silt fence, check dams, diversions, sediment traps/basins and outlet protection. All of these controls and more play a vital role in sediment control. But what if they are installed late or skipped all together? The construction sequence and storm water and erosion and sediment control plans are prepared to help minimize this

If sediment control measures are overlooked, the project could be at risk of discharging off site, failing inspections, stop-work orders or fines.

PHOTO: CHESHIRE CAT / STOCK.ADOBE.COM

PHOTO: EYEMARK / STOCK.ADOBE.COM

The grading and moving of soils on construction sites make these locations particularly at risk to discharge sediment.

risk. As we all know, construction sites are on a strict timeline and budget. The grading contractor may be pushed to have the site pad ready by a certain date not leaving much time to install these important measures. It is critical to put the installation of these controls as a top priority to ensure that the sediment remains on site. If these measures are overlooked, the project could be at risk of discharging off site, failing inspections, stop work orders or fines. These enforcement procedures cause an impact on the timeline if the job is shut down.

A new project is about to break ground and the pre-construction meeting is being held with responsible land disturbers, owners, municipalities, engineers and consultants. One item that is almost always pointed out but not always followed is the construction sequence. The construction sequence normally looks something like this:

- Contact municipality prior to beginning any land disturbance.
- Host pre-construction meeting.
- Install all perimeter controls prior to begging any upslope land disturbance.
- Install sediment traps/basins.
- Begin grading of site.
- Stabilize site before converting the BMPs to permanent configuration.

Some municipalities require an initial inspection to ensure sediment controls are installed prior to beginning land disturbance. However, some municipalities do not, and this step gets put on the back burner. Ensuring that these controls are installed prior to beginning work can save the site a big headache. In the event some of these controls are skipped and earthwork begins, the site could be at a huge risk of discharge.

One item that is often not thought about in initial control is stabilization. Earthern structures, such as traps, basins and diversions, require immediate stabilization. This will help to reduce the erosion potential of these structures and therefore reduce the impact to the sediment controls downslope. Many states' regulations differ for how quickly you have to stabilize denuded soils so be sure to check your local regulations.

The sequence of construction also addresses stabilizing the site within a certain timeframe once final grade is achieved. This can help reduce the need for maintenance of permanent structures and also aid in getting the project closed out quickly.

Example Scenario

Construction has kicked off on a job site but the project is under a strict timeline. The contractor begins working upslope simultaneously while building the sediment basin. Weeks pass and the sediment basin no longer becomes a priority and the concentration is elsewhere. A rain event occurs and inches fall in the matter of a couple hours. The sediment basin was not completed and did not have the stabilization or capacity that was needed for this storm. This overwhelmed the pond and caused the embankment to fail. The failing embankment allows sediment to leave the limits of disturbance and enter a neighboring pond.

This loss of sediment must be reported to the enforcement agency. This site was subject to fines for discharging into state waters and the sediment outside of the limits of disturbance must be retrieved by hand which caused delays.

The importance of erosion and sediment control continues to be a top priority at job sites. Spending the time and resources to ensure that these measures are installed correctly and timely can save the project money and time in the long run. With climate change and increasing intensity and duration of storms, these controls continue to be vital to the success of the project. Do not be caught without your initial controls installed and do your future self a favor by installing these critical controls.

Melissa Lanzara is a senior storm water inspector for Parker Design Group. Lanzara can be reached at mlanzara@parkerdg.com.

Implementing Effective Flood Protection

Examining the key factors, approaches & necessary steps to ensure structures are protected from flood events

Flood protection is the effort to reduce loss of life and property by lessening the impact of disasters, according to the Federal Emergency Management Agency (FEMA). Effective flood protection requires understanding local and larger risks, addressing difficult choices and investing in long-term community well-being. Without sound flood protection action as it relates to a structure, the safety, financial security and self-reliance of the structure may be jeopardized.

Five key factors to an effective flood protection system include:

- Affordability;
- Reducing future flooding disruptions;
- Allowing facility operations during most extreme events;
- Construction without significantly

Passive flood protection minimizes the need for human interaction, however, this is not always feasible. While active flood protection may have lower costs, it typically requires human intervention to deploy the system.

PHOTO: EUGENEF / STOCK.ADOBE.COM

impacting facility operations; and
- Operating easily with minimal maintenance.

Five consultant qualifications clients should consider when hiring a consultant to design a flood protection system include:
- Demonstrated experience with FEMA oversight flood protection design and successful implementation;
- Deep federal floodplain construction code and requirement knowledge;
- Understanding the interactions and co-dependencies of the various project architectural, civil, MEP and structural requirements;
- Ability to educate client staff on flood protection systems operation and maintenance and;
- Ability to develop operational protocols for optimal system performance.

Flood Protection Basis

Flood protection projects should start with developing site-specific risk definitions. Knowledge of hydrology, stream hydraulics and site topography define the potential flood

PHOTO: MICHAEL ROLANDS / STOCK.ADOBE.COM

Knowledge of hydrology, stream hydraulics and site topography define the potential flood elevations and the associated risk(s) to the improvements and operations of the facility.

elevations and the associated risk(s) to the improvements and operations of the facility. Structural and building enclosure knowledge determines likely leak and collapse points that may impact the facility improvements and operations considering architectural and/or mechanical, electrical and plumbing (MEP) features. Modifying architectural and MEP features can be difficult because existing features are required for various reasons; the team must understand all the interdependencies to successful design and implement flood protection. This common understanding of risk forms the basis of the design decision-making. The client's direction on risk, cost and reward are then used to establish the design basis parameters.

Flood Protection Approach

The client should understand the differing costs and risks associated between active and passive flood protection. Passive flood protection minimizes the need for human interaction to engage the protection measures, however, this is not always feasible. While active flood protection may have lower costs, it typically requires human intervention to deploy the system. Experience indicates many active flood protection systems "fail" simply because they are not deployed in time or not completely deployed due to operator absence or error.

Alternatively, wet flood protection projects involve applying measures that prevent or provide resistance to damage from flooding by allowing floodwaters to enter the facility. Minimal cleanup is normally required before resuming operations; this is more typically applied to structures such as parking garages.

Flood Protection Selection

The solution is collaboration between the architect; civil, structural and MEP engineers; and the client's personnel to establish protection and risk expectations. In many cases with existing buildings, the codes governing the improvements are not well defined. The team collaborates with the vendors of flood protection products to find workable solutions, often working with them to create specific attributes for the unique conditions that exist at the property and then working with code officials to resolve ambiguities. The solution must meet specific parameters defined by FEMA and local emergency management agencies when they are providing a portion of the funding for the project.

Proactive clients address flood risks by assembling a cohesive team that understands the specific flooding concerns of the facility to be protected to deliver a well thought out and properly executed project.

The six basic steps of a successful project follow:

- **Scoping:** The initial phase is a feasibility study or scoping to set the project parameters.
- **Assessment:** The second phase, facility assessment, forms the basis of what is and is not feasible or practical in terms of flood protection options with respect to constructability and finances. The assessment needs to determine the appropriate level of flood protection required.
- **Design:** Flood protection design is site specific and is examined here in very broad terms. The engineers drive the flood protection system requirements and designs. Meanwhile, the architect guides the aesthetic elements focusing on the appearance of the finished product while the team maintains constructability and functionality.
- **Bidding:** Contractors should list previous flood protection projects and contacts to prove prior work and historical performance. A pre-bid site walk with all potential bidders and providers of significant

pre-engineered components, such as flood gates/doors, is strongly encouraged so all parties understand the intention, constraints and specific requirements. The design team is often active in the bid tabulation and selection of manufacturers and contractor(s).

- **Construction:** Visits are required at appropriate intervals for the team to become familiar with the progress and quality of the work and to determine if the work is being performed in a manner indicating that construction, when completed, will be in accordance with the contract documents. Retrofit flood protection projects require more frequent construction visits to ensure the new and existing constructions are properly connected.
- **Maintenance:** After construction, a written operational protocol that addresses how to operate the flood protection system should be developed to provide the necessary understanding and documentation for deployment of the system. The documentation serves as a guide to train future staff and is a critical reference before and during a storm event. The end of construction is the beginning of the flood protection system life. Staff should train and maintain the system on a semi-annual to quarterly basis. Documentation addressing system maintenance, testing, and operations must be developed by the design team in consultation with the client's staff to establish future protocols and responsibilities.

> Effective flood protection requires understanding local and larger risks, addressing difficult choices, and investing in long-term community well-being.

Flood protection projects range from new projects to expansions and retrofits, generally including commissioning testing to prove the system integrity before final delivery.

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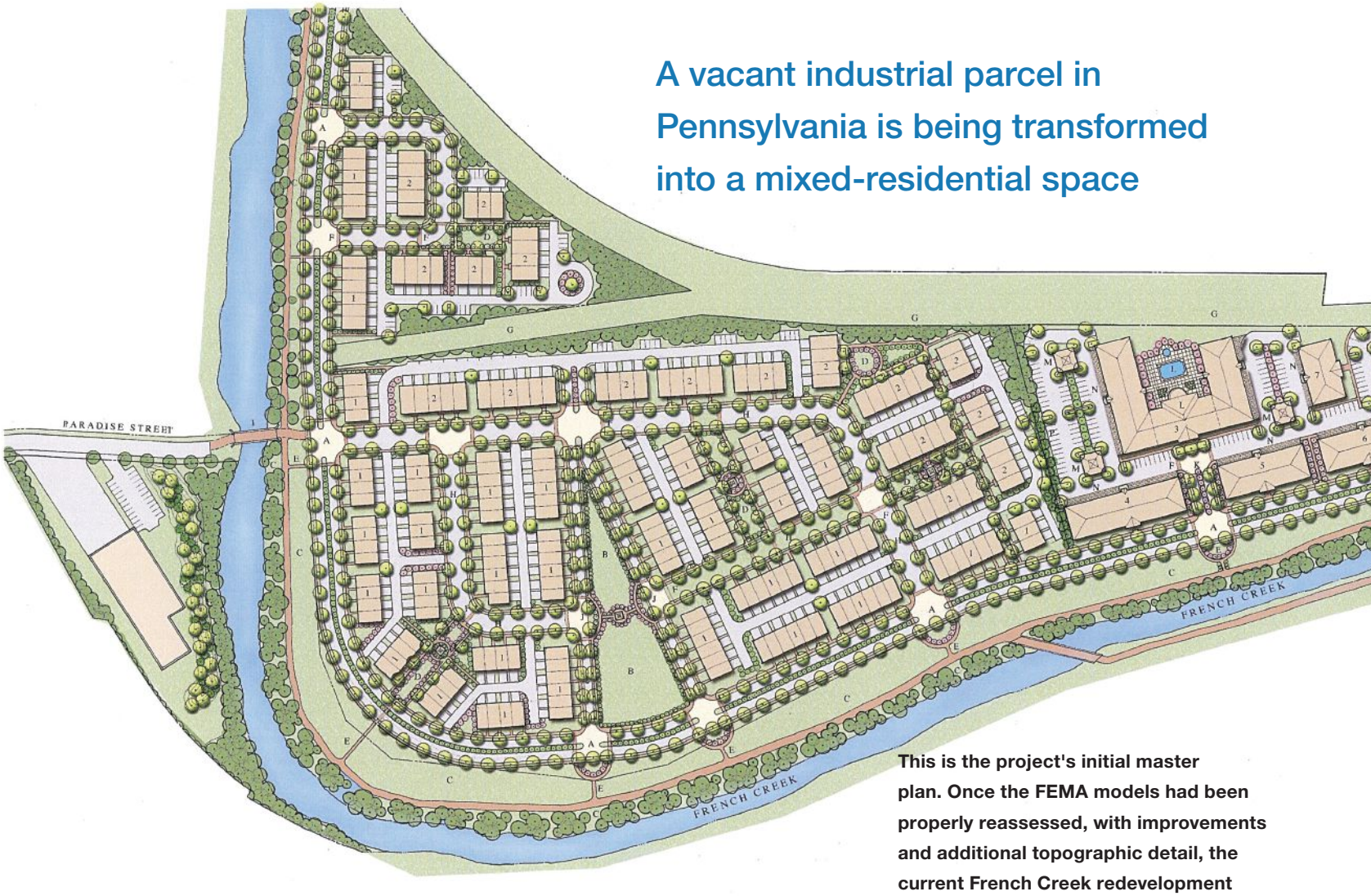
Redeveloping the French Creek West Industrial Site

A vacant industrial parcel in Pennsylvania is being transformed into a mixed-residential space



This is the project's initial master plan. Once the FEMA models had been properly reassessed, with improvements and additional topographic detail, the current French Creek redevelopment project became viable.

Pictured here is the collapsed rail bridge. With the final project, the Paradise Street bridge was reconstructed at a point of higher elevation.

In Phoenixville Borough, Pennsylvania, 20 miles northwest of Philadelphia, the former Phoenix Iron Works foundry lies alongside the waterway of French Creek. A manufacturing site since the 1700s, the foundry was closed in the 1980s and demolished in the 1990s. As the borough and surrounding communities experienced an economic rebirth in recent decades, the 64-acre industrial parcel sat derelict.

A number of redevelopment projects were proposed for the site, but until recently all had been discarded. Almost the entire site lies along the Federal Emergency Management Agency's (FEMA) floodplain, a geographic area the agency has defined according to varying levels of flood risk. In addition, the borough adopted even more stringent floodplain requirements. Any development would have to meet a zero-increase standard, meaning it could not result in any measurable increases on flood heights, making most projects unviable.

It took a rigorous and more accurate reassessment of outdated FEMA models to determine what project could meet the strict floodplain standards. Once those standards were met, the resulting project site under construction was built robustly enough to weather the effects of the recent Hurricane Ida without any flood damage.

Reassessing FEMA's Analysis

The latest redevelopment proposal is a mixed residential project with townhomes, condominiums, additional borough parking and a new fire station. It was approved and is currently under construction following the aforementioned reassessment of FEMA's floodplain model for the site and surrounding area.

A review of the French Creek models produced by FEMA indicated that the original floodplain analysis was prepared in 1977. Aside from a datum shift, no further updates had been made to the FEMA result since the original analysis. At the time of the original study the existing steel mill buildings were present and represented a large floodplain obstruction on the site. A dam depicted in the original FEMA profile was found to be 8 feet lower in the present condition.

The outdated FEMA model also factored in two bridges leading into the site area and one just downstream. The downstream bridge had been reconstructed in 1991, whereas the FEMA study was based on a more obstructive stone arch bridge originally constructed in 1847. An old rail bridge leading into the site was partly collapsed and hazardous, and its complete removal would be required for any project. The second dilapidated bridge on Paradise Street would also be initially removed and eventually be rebuilt for site access and traffic circulation. All these factors would be considered as FEMA's models were subjected to reassessment and remodeling.

A 5,000-foot stream length floodplain model was developed which included the present condition of these noted features to create an updated and highly detailed baseline of existing conditions. In its original study, FEMA had seven analysis sections. The updated model, using HEC-RAS software, was far more robust, with 80 analysis sections.

The removal of both bridges resulted in a development model with a flood elevation that would comply with both Borough and FEMA floodplain requirements. With this proof-of-concept favorably received by the borough, work

Pictured here is the restored stream bank. Following Hurricane Ida, which brought severe rainfall to the area, the project's design was validated as a post-storm inspection showed the site remained dry and unimpacted.

could finally begin. The anticipated completion of the project will be sometime in late 2022.

Storm Water & Erosion Control During the Construction Process

A loop road which paralleled the French Creek stream was constructed and purposely caused the development site to assume a bowl-like shape for erosion control purposes. Permanent storm water outfalls were simultaneously installed with backflow prevention measures. This separated the development area from the floodplain and allowed runoff during construction to be captured and treated with sediment traps and basins prior to discharge.

A new Paradise Street bridge was required for additional site access and circulation. The bridge's deck would be set more than 6 feet above the old bridge and its length widened by 40 feet. This design element would allow floodwater to pass underneath it, greatly reducing the level of these waters and keeping the development well within floodplain requirements.

The new bridge includes a steel truss superstructure, a nod to the site's ironworks heritage, and a protected pedestrian sidewalk which connects the development to nearby baseball fields.

Post Construction Storm Water Management Design

The existing site condition was nearly entirely impervious, meaning it would allow little or no storm water infiltration and contributed to increased levels of storm water runoff and flooding. Storm water infiltration was not recommended because of the potential pollutants associated with a derelict industrial site.

To address the storm water rate and volume mitigation requirements, the post construction design of the development would "green" the site with lawns, open spaces and other areas where soil and vegetation could be established. The soil fill cap addressed environmental concerns and raised the new homes above the flood elevation. New driveways and roadways would also guide runoff before discharge into the storm sewer systems.

Storm water outfalls are distributed along the stream length to avoid concentrating flows. Underground detention best

management practices (BMPs) are provided to capture a "first flush" event, enable slow discharge and ensure water quality included surface vegetated rain gardens and hydrodynamic devices. Through these measures, elements such as hydrocarbon, debris and silt can be managed through the storm water discharge process.

Hurricane Ida & Model Validation

Hurricane Ida devastated the region, with rainfall levels that overwhelmed storm water systems in many communities. This resulted in catastrophic flooding that put municipalities and major roadways underwater, as well as the deaths of dozens of people across several states.

The French Creek watershed was impacted similarly from the remnants of Ida as excessive rainfall hit the area on September 1 of this year. By this point, the site was still under construction, but the proposed floodplain elements of the project were effectively complete. The site has been filled, the old rail bridge removed, and the Paradise Street bridge reconstructed at the point of higher elevation as planned.

The model for the French Creek redevelopment project was validated when a site inspection after peak water receded showed the site remained high, dry and unimpacted by one of the worst storms in recent U.S. history. The floodplain and storm water design elements had worked exactly as planned for this event.

Conclusion

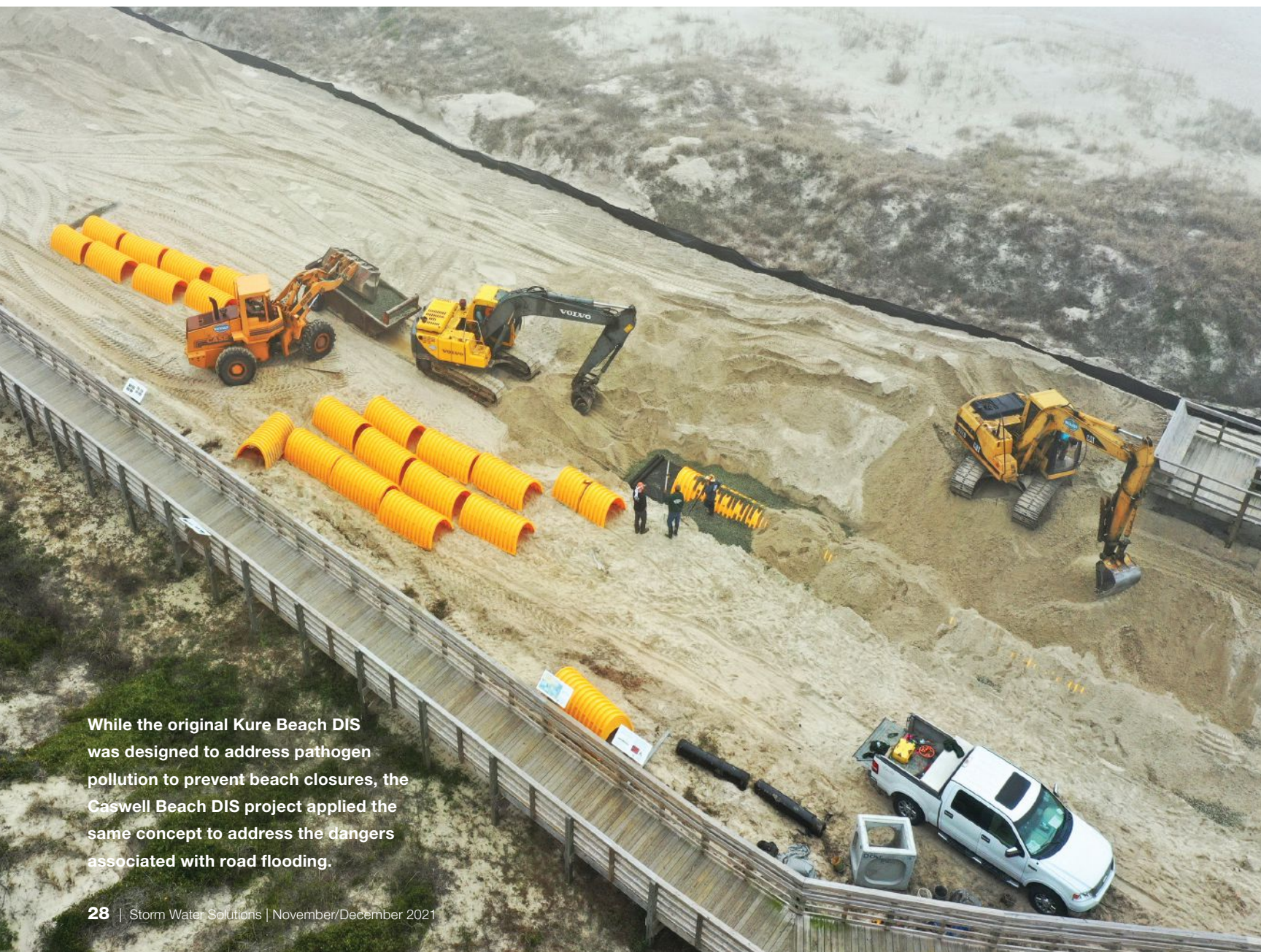
The reassessment of the FEMA modeling for the site, while rigorous, was done cost effectively and in increments, at first using publicly available data and basic field measurements. It illustrates the importance of working with design and engineering firms, such as T&M Associates. FEMA models should always be reviewed in the context of present conditions for land development projects, as they may be obsolete.

Once the models had been properly reassessed and updated, with improvements and additional topographic detail, the current French Creek redevelopment project became viable. Good planning allowed for a remediation of a historic industrial site and the creation of a project that will bring lasting benefits to the local community.

Validation of FEMA's product, outdated due to modeling improvements and topographic changes, yielded a viable redevelopment project, which also remediated the former industrial use.

Zachary H. Ranstead is project manager with T&M Associates. Ranstead can be reached at zranstead@tandmassociates.com.

Addressing Increasing Coastal Flooding with Dune Infiltration



While the original Kure Beach DIS was designed to address pathogen pollution to prevent beach closures, the Caswell Beach DIS project applied the same concept to address the dangers associated with road flooding.

Coastal flooding is more than a mere nuisance; it can be a safety hazard to communities, but DISs are low-impact solutions to diminishing storm water discharges

For the Caswell Beach site, the elevation difference between the road's low-lying areas and the proposed chamber required the use of a pump.

For this project, comprehensive groundwater modeling was performed to ensure that the groundwater mounding underneath the DIS would not affect any adjacent private structures, including building foundations or seepage back onto the road.

Most of the time, when a road floods, it is just a minor inconvenience leading people to find another way around the flooded area. However, when the road is a primary thoroughfare, it can become a significant issue that can disrupt critical access and cause a potential safety hazard. Over the past few decades, portions of Caswell Beach Road in Caswell Beach, North Carolina, had become impassible to passenger vehicles after moderate rainfall events, and it was not unusual for the road to remain impassable for more than eight hours.

The road is the only ingress/egress for approximately 240 residents, the Duke Energy Progress Nuclear Pumping Station, the U.S. Coast Guard Station on Oak Island and the North Carolina Baptist Assembly grounds at Fort Caswell. A solution for this hazardous flooding issue was needed to allow safe passage and adequate response to emergencies during and immediately after storms.

To aid the town of Caswell Beach in solving this flooding and access problem, WK Dickson evaluated the feasibility of implementing a new system known as a Dune Infiltration System (DIS). Developed in 2005 as a pilot project for the Town of Kure Beach through a partnership between the Town of Kure Beach, the North Carolina Department of Transportation, and the North Carolina State University Biological & Agricultural Engineering Department, this application was initially applied to address water quality issues.

The uniqueness of the Caswell Beach project was its use in addressing localized flooding and public safety beyond its initial application as a water quality practice. For Caswell Beach, the new system allows the town to collect and pump water out of low-lying areas along Caswell Beach Road through storm water piping into a series of infiltration chambers embedded within the dunes that utilize the existing beach sand as infiltration media. The DIS system was optimized to reduce street flooding to a level safe for vehicular traffic within two to four hours following storm events. The DIS at Caswell Beach is the second location in North Carolina to put a DIS into action.

DISs can be a low-cost, low-impact solution for diminishing storm water discharge and reducing bacteria loads to recreational beaches.

Addressing Localized Flooding

The initial concept involved pumping floodwaters from four critical flooding areas to four local DISs. A conceptual design report identified potential system locations and routes for storm water pipe alignments, dune infiltration system suitability and layout, required easements, required permitting, and planning level construction cost estimates. This conceptual analysis determined several design constraints that narrowed the four potential sites to one ideal location on town-owned property near a highly visible public beach access point.

In addition to providing water quantity benefits, a DIS provides secondary water quality improvements. When it rains, water flows across impervious surfaces and picks up pollutants. Elevated bacterial levels in these pollutants can lead to beach closings or swimming advisories, impacting the local tourism-based economy. Additionally, if these elevated bacterial levels are not addressed, they can degrade the beaches' natural setting, destroy wildlife and endanger public health.

However, a DIS uses the sand's natural filtering ability to remove rainfall runoff pollutants. After the runoff is diverted into the DIS, the storm water infiltrates into the sand and strips the pollutants and pathogens using natural sorption and bacterial desiccation. The filtered groundwater then migrates to the ocean flowing underneath the dunes and beach sand. Studies show these systems remove between 75% and 95% of pollutants, including pathogens, hydrocarbons, and excess nutrients.

Once design and permitting were approved, the project was bid, and construction began in January 2021. The exact timing of construction was an essential component of this project. For coastal towns, keeping the beaches open during the summer months is critical for economic vitality. Caswell Beach is a thriving vacation destination, so construction needed to be complete before the tourists arrived for the summer. Additionally, construction was timed as not to impact the area's sea turtles during their annual nesting season.

Construction entailed installing polypropylene open-bottom chambers buried beneath the dune, which collect diverted runoff. As this runoff is pumped into the chambers, the water spreads out into a bed of gravel and sand, which filters the runoff before it reaches groundwater. When the runoff is 75 feet down shore, bacteria levels are similar to that found in normal groundwater.

Overcoming Project Challenges

The complexity of this project involved both engineering and non-engineering issues. From an engineering standpoint, site suitability was a primary focus. The ideal site for the DIS has an elevated dune system (typically a site with a primary and secondary dune area) with a seasonal high-water table several feet below the surface. It was important to size the system accurately and ensure the groundwater mounding would not impact adjacent properties. For this project, comprehensive groundwater modeling was performed to ensure that the groundwater mounding underneath the DIS would not affect any adjacent private structures, including building foundations or seepage back onto the road.

Depending on the allowable elevation of the proposed DIS, the storm water runoff can either drain via gravity or be pumped into the DIS chambers. For the Caswell Beach site, the elevation difference between the road's low-lying areas and the proposed chamber required the use of a pump. The town invested in a trailer-mounted pump attached to the fire truck, and special pump ports were installed at the low points. This setup targets specific low points as needed to ensure a quick response in addressing the flooding issues.

From an environmental standpoint, this project had to be coordinated with the North Carolina Division of Coastal Management to get approval to construct in the secondary dune system, as overall impacts to the dune systems should be minimized. After multiple meetings discussing the benefits provided by the proposed DIS, the submitted request was approved. The permitting request involved a variance to their permit to show the system was the only option to solve the flooding issues and that this project was crucial to protecting public health and safety.

For future projects, easements will most likely need to be acquired for construction and maintenance access. This process can prove to be challenging for oceanfront property. Fortunately, the final site chosen out of the four areas studied happened to be on property the town already owned.

While the original Kure Beach DIS was designed to address water quality (specifically pathogen pollution to prevent beach closures), the Caswell Beach DIS project applied the same concept to address the dangers associated with road flooding. The DIS can be implemented within beachfront communities to address road flooding issues while also providing a water quality benefit. Another significant advantage of these systems is that they can utilize oceanfront property's primary and secondary dune systems that will never be developed, assuming clear access to the site.

Overall, the completion of this DIS project resulted in several important benefits:

- **Flooding.** The project addresses flooding on the only access road. Emergency vehicles and first responders will reach people quicker after storm events, and the road will become passable sooner than previously.
- **Water Quality.** By taking storm water runoff and infiltrating it back into the ground, the project results in a water quality benefit by reducing runoff from the road, stripping pollutants out of the runoff and contributing to the area's groundwater recharge. For beach communities dealing with beach closures due to contaminated storm water from a direct discharge system, a DIS can reduce or eliminate their ocean outfalls and keep their beaches clean and open to the public.
- **Educational.** The proximity of the DIS to a highly visible public beach access provides educational opportunities for visitors and residents to learn about the benefits of infiltration systems and storm water improvements.

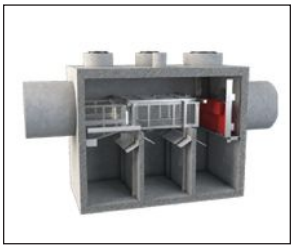
Coastal Flooding Complexities

Coastal flooding is more than a mere nuisance; it can be a significant safety hazard to these communities. DISs are a low-cost, low-impact solution for diminishing storm water discharge and reducing bacteria loads to recreational beaches.

"Being prepared for flooding and the safety of our citizens is a primary concern for the town," said Deborah Ahlers, mayor of Caswell Beach. "The recently completed dune infiltration system will help in this regard and provide a water quality benefit – a vital component for coastal communities like Caswell Beach. With this project being only the second one of its kind in the state, we are proud to lead the way in how our neighboring communities can deal with increasing coastal flooding."

Marc Horstman, PE, PH, CFM is a project manager for WK Dickson's storm water group. Horstman can be reached at mhorstman@wkdickson.com.

Treatment Systems



The Nutrient Separating Baffle Box (NSBB) is an advanced vault treatment system for storm water runoff. Its patented screen system is designed to capture and store debris in a dry state to minimize nutrient leaching and allow for easy servicing. The NSBB is widely accepted nationwide as a storm water treatment BMP.

Oldcastle Infrastructure | www.oldcastleinfrastructure.com | 888.965.3227

Storm Water Management

Rain Guardians provide pretreatment for storm water/bioretention/rain garden/vegetated BMP systems and are available in various configurations to meet both commercial and residential needs. The grate, filter and chamber combination captures leaves, trash and other debris with overflow points preventing inlet debris from causing bypass before the bioretention system reaches capacity. These pretreatment devices are often used in urban curb line applications that lack the space for typical sediment forebays. Maintenance is simple with Rain Guardian pretreatment devices, as sediment and debris can be easily removed from the chamber with a shovel and the drop-in filter can be cleaned with a broom or hose.

Ferguson Waterworks | www.ferguson.com/waterworks

Valves

The In-Line CheckMate UltraFlex Check Valve, with its patented "Snap Pressure Technology" and optimized construction, opens sooner than other check valves, allowing pipelines and collection systems to drain faster. The CheckMate UltraFlex Check Valve "snaps" open with less head pressure, significantly increasing pipeline capacity, allowing free flow of water during weather events and restricting standing water from collecting upstream.

Red Valve Co. | www.redvalve.com | 412.279.0044

Trash Racks & Screens

StormRax are an alternative to painted and galvanized steel racks for use in storm water management ponds and general water screening. They are structurally sound with a long-lasting quality appearance.

Plastic Solutions Inc. | www.plastic-solution.com | 877.877.5727

Storm Water System

A 4.2 million gallon storm water capture system was required for a new single-family subdivision in Castaic, California. Storm Prism designed a rectangular (168 feet X 330 feet) StormPrism EQ system that included 400 modules. Installation began in September and will finish in October. The design of StormPrism EQ allows the company to use conventional equipment and provides for fast installation.

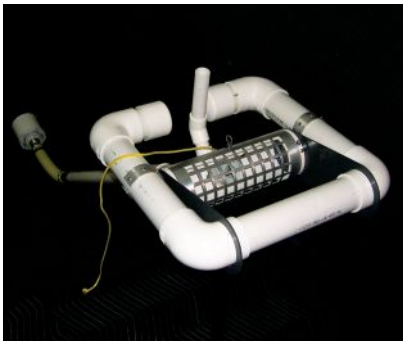
Storm Prism | www.stormprism.com | 805.527.0841

Treatment Systems

StormTrap offers water treatment applications to capture and remove trash and debris, floatables, hydrocarbons and sediments from waterways, particularly for storm water, urban runoff and combined sewer outfall (CSO) discharges. The SiteSaver hydrodynamic separator utilizes disposable mesh nets, inclined plate technology and baffles to remove impurities. The product can be utilized as a stand-alone device or work in a treatment train approach as the pretreatment phase.

StormTrap | www. stormtrap.com | 815.941.4549

Surface Drains



These surface drains are BMP sediment basin skimmers that are reliable, easy to use and usually ship within one business day. They float on the surface, releasing clean water near the surface and draining the basin slowly over several days at a constant rate to maximize settling. Eight sizes with adjustable orifices are available.

JW Faircloth | www.fairclothskimmer.com | 919.732.1244

Hydromulcher

This mulcher seeds up to 4,000 square feet per tank load. It is suitable for small seeding and touch-up jobs. The low-maintenance, 354-gallon-capacity, skid-mounted model is also suitable for virgin wood, paper mulch or bonded fiber matrix products.

Bowie Ind. Inc. | www.bowieindustries.com | 940.872.1106

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Storm Water Goes Mainstream With New Committee

A new committee is devoted to developing standards applicable to storm water control measures

ASTM International (ASTM) has been a recognized leader in consensus standard development by many different industries for more than 100 years now. ASTM's newest technical committee, E64[1], is devoted specifically to developing standards applicable to the broad class of storm water management practices known as storm water control measures (SCMs). ASTM is not entirely new to the world of storm water and SCMs. Prior to the formation of E64, a subcommittee working under the umbrella of the C27 Precast Concrete Products Committee was working on several new storm water standards specific to hydrodynamic separators. However, with the growing breadth of SCMs available that extend beyond concrete products, and a clear need for several new standards to bring consistency to the evaluation of SCM effectiveness, there was widespread consensus that a standalone committee was warranted.

In addition to having a dedicated focus on SCM issues and standard development, another expected benefit of having a standalone committee is a much larger pool of stakeholders to participate in the standard development process. E64 hopes to have participation from a broad range of storm water professionals, including SCM manufacturers, academia, engineering/consulting professionals, regulators/program managers, laboratory operators/researchers, and other professionals with a vested interest in SCMs and relevant expertise to contribute. Ultimately, a diverse pool of participants will lead to stronger standards than drawing from a subset of SCM/storm water professionals would likely yield.

Another program underway is the national SCM verification program known as Stormwater Testing and Evaluation for Products and Practices (STEPP). The STEPP program recently found a new home under the umbrella of the National Municipal Stormwater Alliance (NMSA)[2]. It has also secured the funding needed to move the program forward in 2021. The STEPP program intends to serve as a credible source of SCM performance verification based on testing under nationally accepted standards. Before the formation of E64, STEPP was already collaborating with ASTM to develop standards based on the New Jersey Department of Environmental Protection's laboratory protocols for HDS and Filtration SCMs[3] and the Washington State Department of Ecology's Technology Acceptance Protocol-Ecology (TAPE) field evaluation program[4]. Work was already underway to develop HDS standards from the NJDEP protocol under C27, and this effort is now being transferred to E64. Once complete, E64 will continue work on a variety of additional standards for evaluating filtration systems, trash and debris removal, and field monitoring that will be applicable to the STEPP program moving forward.

Given the wide variety of SCMs now available, varying performance expectations, the current patchwork of protocols and methodologies used to evaluate performance, and the growing complexity of storm water regulations, the need for robust and credible standards for SCM evaluation and deployment has never been greater. The standards produced by E64 will be an asset for those involved in storm water management. Credible standards will increase knowledge of SCM performance, improve comparability of different types of SCMs, increase the credibility of SCM performance claims and streamline vetting and acceptance of SCMs by the regulatory community. Paired with the STEPP National Verification program, ASTM standards for SCMs will also help create predictability and a pathway for acceptance for SCM manufacturers that should also drive future investment in SCM innovation. Most importantly, strong SCM standards will ultimately be a net positive for water quality.

> "Most importantly, strong SCM standards will ultimately be a net positive for water quality."

Derek Berg is director of storm water regulatory management, East, for Contech Engineered Solutions. Berg can be reached at Derek.Berg@conteches.com.

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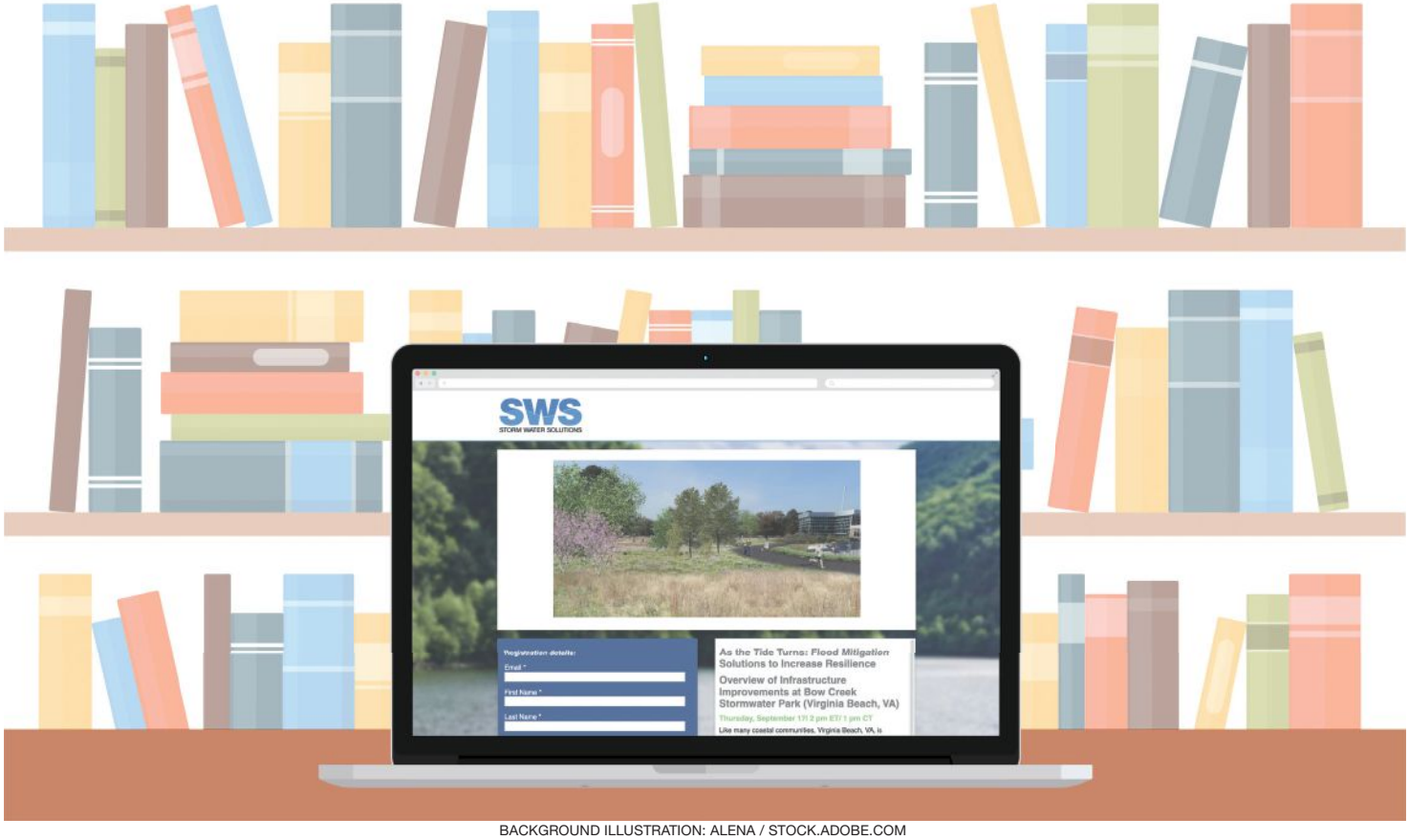

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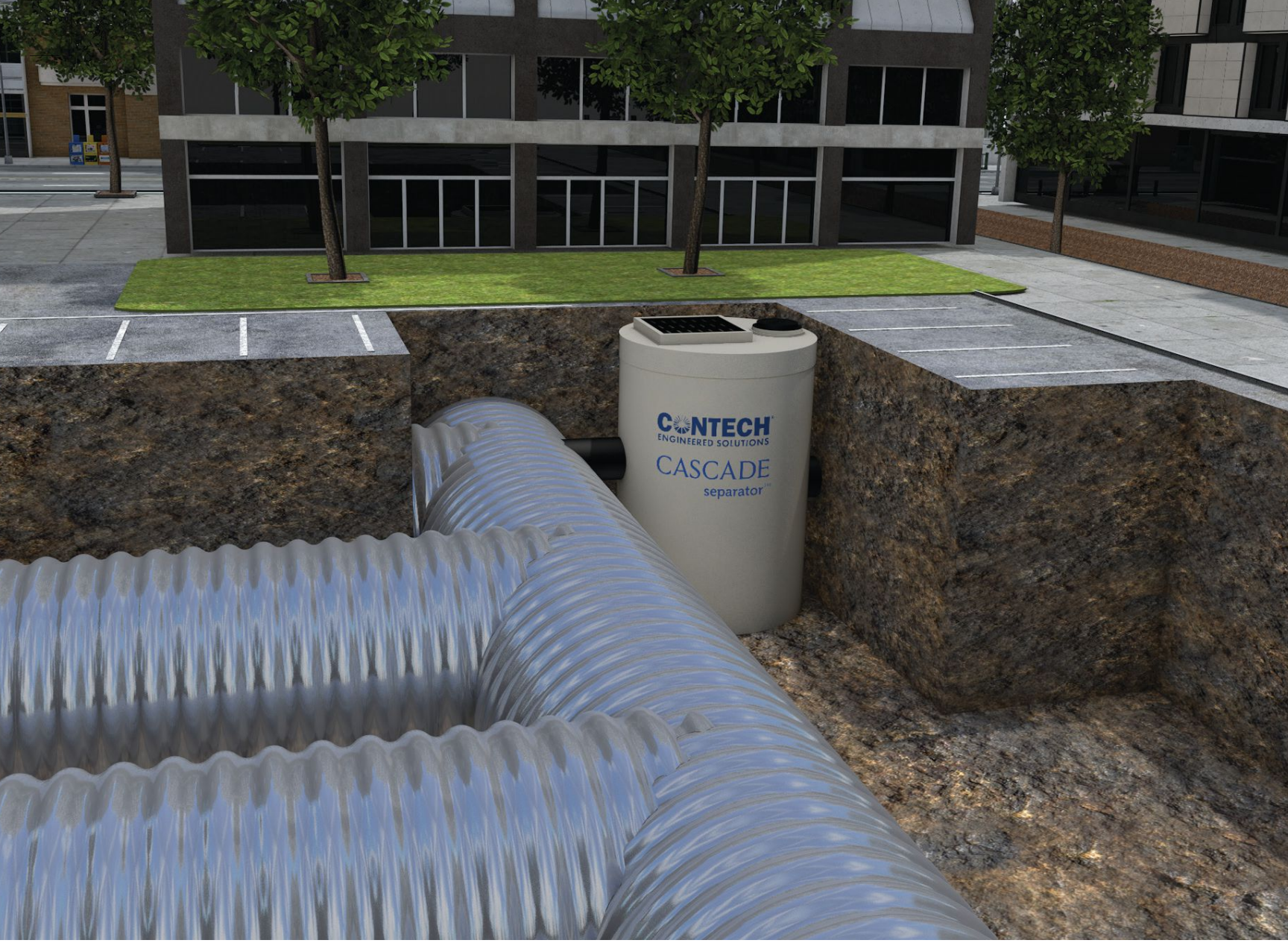

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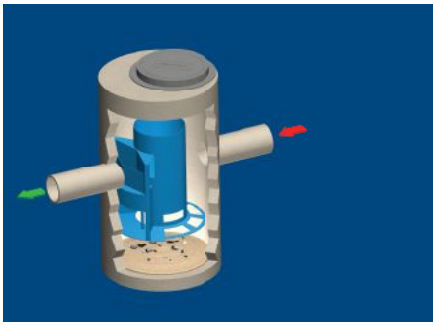

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