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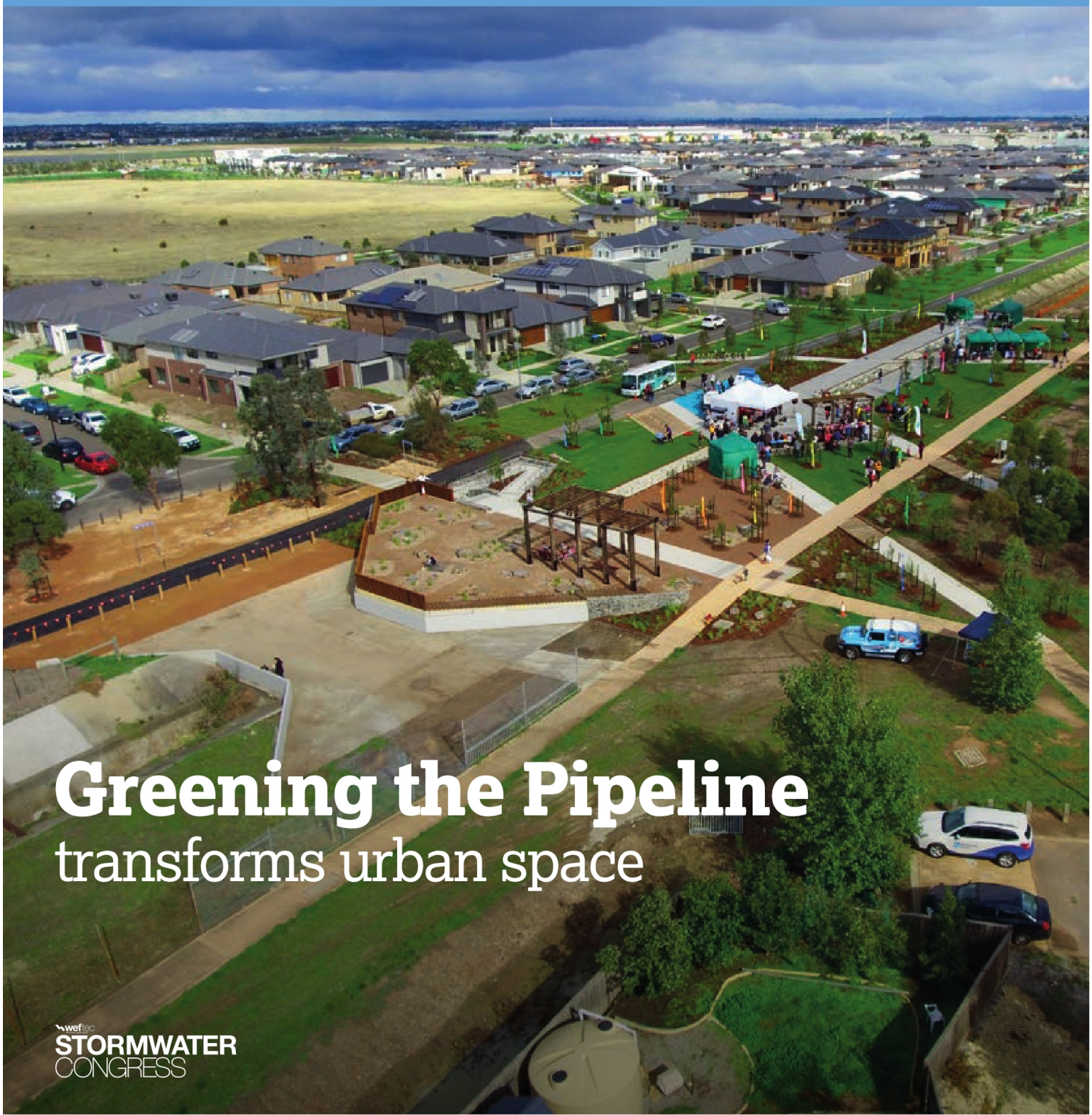

Greening the Pipeline transforms urban space

wefTEC STORMWATER CONGRESS

Bioretention key to natural, sustainable stormwater strategy in San José

The citywide implementation of green stormwater infrastructure (GSI) measures – such as tree well filters, bioretention basins, and permeable pavers – promises a climate-resilient, sustainable, and healthier future for San José, California, United States (US). By **Aaron Kinney**

Environmental inspector Brandon Massey surveyed a bioretention basin on Chynoweth Avenue, South San José, and extolled the benefits of California gray rush – one of the plants that enable this green stormwater infrastructure measure along the residential street to keep pollutants in stormwater runoff from flowing into storm drains and entering the nearby Guadalupe River.

Not only is the perennial native grass hardy and drought-tolerant, Massey explained, but it has the ability to absorb and store pollutants, such as hydrocarbons from automobiles and excessive nutrients from landscaping, when it draws water from the soil, a process known as phytoremediation.

Massey turned his attention to the most important element of any bioretention area: the soil. This 111.5-square-meter (m^2) (1,200-square-foot [ft^2]) bioretention basin, one of seven that were built as part of the Chynoweth Avenue Green Streets Project, contains a soil mix of 60-70 percent sand and 30-40 percent compost. It teems with beneficial microorganisms, fungi, insects, and earthworms. All these organisms work together to break down materials like motor oil or pesticides into constituent parts, allowing California gray rush and other plants to absorb and transform them.

"It's a really complex and diverse ecosystem," he said, gesturing to the vibrantly planted bioretention area, one of approximately 3,000 green stormwater infrastructure measures that use natural processes to capture, slow, and treat runoff in San José. "There's so much biological activity in soil that a healthy soil is essentially alive."

Massey is part of a five-person team within the San José Environmental Services Department (ESD) – home to more than 550 employees – that is responsible for inspecting and ensuring proper maintenance of more than 450 sites throughout the city that feature GSI devices such as tree well filters, bioretention areas, and permeable pavers.

In 2017, ESD's Watershed Protection Division formed the inspection team in response to a rapidly growing caseload. GSI measures are required in new developments and redevelopments in San José that exceed certain size thresholds. The team's workload will only increase in coming years with San José in the midst of a development boom, including the Google Transit Village, the tech giant's proposed new 32.4-hectare (80-acre) campus in downtown.

Treating stormwater is a big job in the nation's 10th largest city, which covers 466 square kilometers (180 square miles) and straddles six watersheds. There are approximately 32,000 storm drains in San José that empty into local waterways. These creeks and rivers flow into southern San Francisco Bay – a diverse estuary that supports dozens of birds and fish species, from bald eagles to leopard sharks.

Installing GSI measures throughout San José aligns with the city's climate action plan: Climate Smart San José. GSI has the potential to reduce the urban heat island effect, increase the local water supply, and mitigate flooding at a time when climate change is leading to extreme weather and threatening the state's water resources.

The large-scale implementation of GSI presents opportunities and challenges for the city. It's an opportunity to make San José greener and healthier, more sustainable, and climate resilient. The challenges include tracking, permitting, and monitoring the projects and educating the community about how to construct and maintain them, all of which require significant planning, oversight, and collaboration across multiple city departments.

"It's a huge undertaking to undo the

One of seven bioretention basins that were built as part of the Chynoweth Avenue Green Streets Project. Photo by ESD

Implementation of GSI measures in the Martha Gardens Green Alleys project significantly improved drainage. The images show conditions before (above) and after (right) project completion.
Photo by ESD

graying of our stormwater system that has taken place over the last 100 years and recreate more natural systems," said Kerrie Romanow, director of ESD and the city's chief sustainability officer. "But the health and environmental benefits are clear – especially, improved air and water quality."

The roadmap for achieving the transformation is the city's Green Stormwater Infrastructure Plan, developed by ESD staff in collaboration with several city departments and consultants and approved by the City Council in 2019.

Creating the plan was a massive undertaking driven by a separate team in ESD's Watershed Protection Division charged with facilitating the city's compliance with stormwater regulations. In addition to smaller, distributed GSI projects such as green streets, the GSI Plan considers regional projects that can centrally treat stormwater from several neighborhoods of San José as part of a comprehensive strategy. The city is currently pursuing funding to implement the GSI Plan.

In California, the State Water Resources Control Board regulates stormwater on behalf of the US Environmental Protection Agency. The board delegates that authority in the Bay Area to the San Francisco Bay Regional Water Quality Control Board, which issues National Pollution Discharge Elimination System permits to 76 municipalities and agencies that discharge stormwater into San Francisco Bay.

Since 2011, the city's Municipal Regional Stormwater National Pollutant Discharge Elimination System (NPDES) permit issued by the EPA has required the use of GSI measures in new developments and redevelopments that create or replace 465 to 929 m² (5,000 to 10,000 ft²) or more of impervious surface.

Developers build about 45 projects a year in San José that meet this threshold, with each site containing an average of eight GSI measures. That's a challenging pace for both of ESD's dedicated GSI teams, as well as the other involved city departments.

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Tracking progress

ESD Watershed Protection staff manage the large inventory of GSI measures by tracking development projects from plan review through construction completion in coordination with the Department of Public Works, which ensures GSI measures are installed properly during construction.

Monitoring so many projects proved unwieldy using simple spreadsheets. To ensure more effective data management, the city repurposed and customized an existing Oracle database to compile and organize the information. Staff also revamped their internal process for handling the data, installing checks in the system to improve accuracy. These changes have enabled the city to better ensure data is up to date and accurate, not only as projects move from the planning to construction phase but also throughout the operations and maintenance of the GSI measures.

"It's a very in-depth, robust process to track all of this data," said acting stormwater program manager Jeff Sinclair, who oversees the team responsible for managing the GSI inventory.

Achieving compliance

Once projects with GSI measures are completed, the inspection team assumes responsibility for inspecting the devices to ensure compliance. Doing so is not a straightforward task.

The Watershed Protection Division recently led a citywide effort to develop a detailed "San José Green Stormwater Infrastructure Maintenance Field Guide" to establish maintenance standards along with guidelines to meet those standards. ESD staff researched best practices and looked to other GSI programs across the country for inspiration on design and examples of guidelines and standards. ESD established a working group with departments that manage GSI maintenance to get their experience and input. The GSI inspection team played an integral role in determining standards to support consistency in their inspections and enforcement. The systematic guide includes photos, GSI measure cross sections, maintenance tool recommendations and checklists, taking an adaptive management approach to allow maintenance teams flexibility while meeting the standards set forth in the guide.

"It's been an exciting challenge to revamp the inspection program to be more comprehensive," said Massey. "It's a problem to solve, like a puzzle."

The inspectors spend most of their time out in the field, each with a case load of about 30 sites. The city's NPDES permit requires ESD to inspect an average of 20 percent of sites with GSI per year. Sites are selected based on the city's GSI Business Inspection Plan, which prioritizes sites based on several factors, including time since the last inspection and violation history. During the 2018-2019 fiscal year, ESD surpassed that mandate, inspecting more than 130 sites containing a total of more than 1,100 GSI measures.

Before conducting an inspection, inspectors review plans, site ownership, and historical records. At some sites, such as large retail

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complexes with multiple property owners, it can be a challenge to determine who exactly is responsible for maintaining the GSI measures. Inspectors must sometimes research property ownership through the California Secretary of State and Santa Clara County Assessor's Office online databases to make that determination.

Public education

Once those logistical details are sorted out, the work of education begins. Because GSI is a relatively new phenomenon in San José, and usually installed as part of a site's development permit, some property owners and managers don't know what the devices are, what they do, or how to keep them functioning properly.

ESD Inspector Brandon Massey at the Chynoweth Avenue Green Streets Project. Photo by ESD

THERE ARE APPROXIMATELY 32,000 STORM DRAINS IN SAN JOSÉ THAT EMPTY INTO LOCAL WATERWAYS.

When devices don't meet the city's maintenance standards, inspectors work with the responsible parties to get the devices into compliance and adequately maintained into the future. The inspectors have become resources for property owners and managers, dispensing knowledge on subjects ranging from plant health and coverage and mulch types to flow dissipation and soil ecology.

"One of the things I really enjoy about being an inspector," Massey said, "is talking to people and helping them understand the importance of these systems and how to maintain them well."

The GSI inspection team also coordinates with other city departments – including Parks and Recreation, Transportation, Public Works, and Mineta San José International Airport – regarding GSI measures on property those agencies manage.

Though GSI has yet to penetrate the mainstream, San José residents who have seen the projects firsthand have enjoyed the benefits. The city has developed several GSI pilot projects on public property over the past few years, including the Chynoweth Avenue project.

In the Shasta/Hanchett Park neighborhood, for instance, ESD and Public Works collaborated to create 604 m² (6,501 ft²) of curbside bioretention areas and 260 m² (2,800 ft²) of permeable pavers. Benefits of the project, which received US$859,000 in Proposition 84 grant funding through the California State Water Resources Control Board, included neighborhood beautification, traffic calming, and improved walkability.

"We were pleased to see the Park Avenue Green Streets project take shape and add climate resilient benefits to an area that was in need of streetscape improvement," said Helen Chapman, president of the Shasta/Hanchett Park Neighborhood Association. "The improvements also aligned with our goals of making the area more pedestrian-friendly and active."

As the city implements the GSI Plan, ESD and other departments will continue to engage with the community about the importance of these measures, why they are needed, and the many public health and environmental benefits they will bring to San José.

Author's Note

Aaron Kinney is a senior public information representative in the Environmental Services Department for the City of San José, California, US. For more information about the City of San José GSI program, visit www.sanjoseca.gov/GSI. For resources on GSI operation and maintenance, visit www.sanjoseca.gov/stormwatertreatmentmeasures.