The Municipal Pipeline
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City of Toronto deploys Vortex Flow® insert technology to tame stormwater surge energy

Background

The City of Toronto manages stormwater run-off throughout its jurisdiction. The scope and challenges involved in this mandate often require novel design and advanced technologies. The storm management system upgrade at Earl Bales Park in the Township of North York highlights such a case.

> A good one so far; we did not have any issues. It's the first one of its size we built, so, fortunately, we've had a good contractor, a good consultant company, and good product, too.
>
> **Kumar Sivakumaran**
> Senior Project Manager, City of Toronto

A Big Challenge

This upgrade project posed a sizeable hydraulic challenge for the designers — how to direct collected surface water flowing out of one pipe to a stormwater trunk line buried 12 meters (39.4 feet) below it. Normal practice for such an application is to install a conventional drop structure. However, flow surges up to 10,000 liters/second (228 MGD), coupled with the nearly four-story drop, created a high-energy dissipation challenge demanding a more robust solution.

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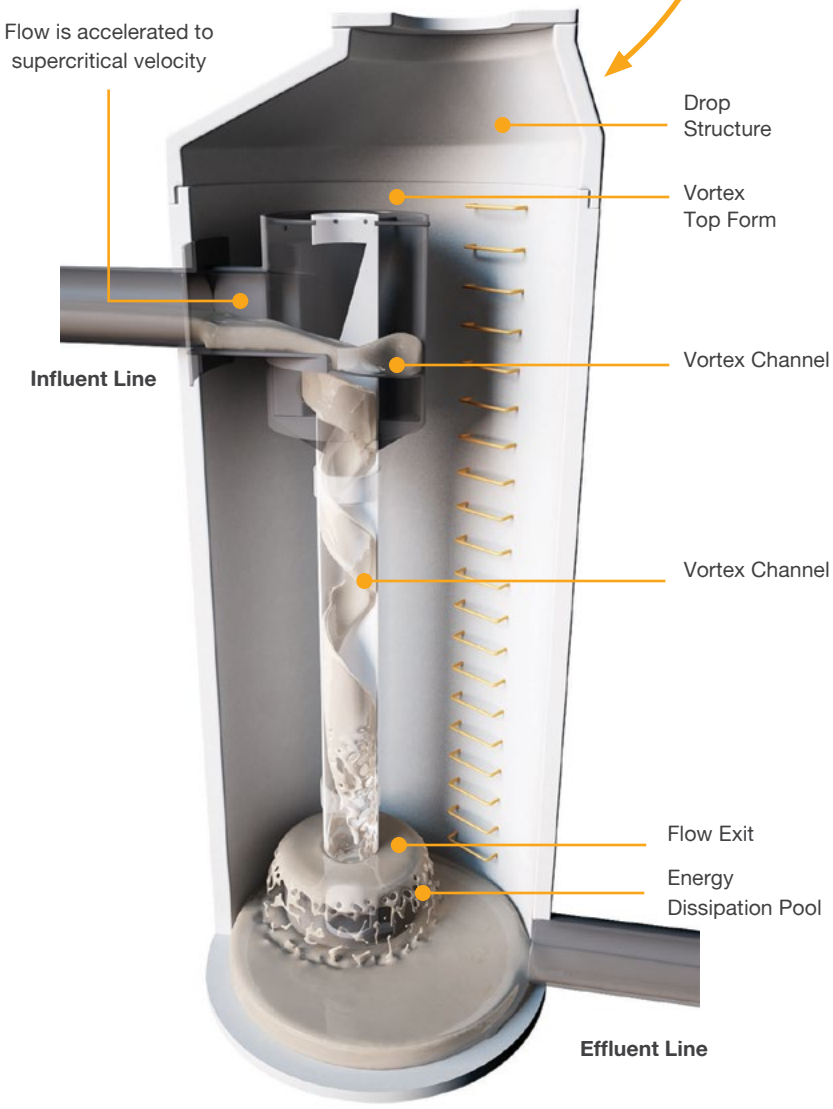
The Only Acceptable Answer

The City and its engineering consultant MMM Group (now WSP) enjoyed close communication and design and installation support with IPEX and its Vortex Flow Insert (VFI) technology on several smaller sanitary sewer applications. For the Earl Bales project, two outstanding VFI benefits attracted the City's attention:

- **Flow Energy Dissipation** (the City's primary concern) — As stormwater enters the top of the VFI, flow is directed around and down a channel of diminishing radius, accelerating its velocity as it drops into the vortex drop shaft. Centrifugal forces cause the flow to hug the walls of the shaft in a spiral flow pattern, efficiently dissipating flow energy as it descends.

- **Flow Aeration and Odor Control** — The downward spiral flow induces negative pressure in its core, drawing air (and any spurious corrosive and odorous gases) down the drop shaft and through the energy dissipation pool at the bottom. This action entrains these components in the downstream flow, aerating the water and mitigating odor and corrosion concerns associated with foul gases. The receiving body of water benefits from such aerated discharge flows, helping the City fulfil its environmental stewardship responsibilities.



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Designing a Record-Breaking Solution

The City and its consultant concluded that VFI technology was the only viable solution for this application. However, the flow characteristics involved were way beyond anything IPEX had designed for previously. Employing computational fluid dynamics modeling, IPEX design engineers sized and configured the largest VFIs they had ever undertaken — but another design challenge loomed.

The maximum flow rate for these massive VFIs was 5,000 liters/second (114 MGD). Peak flow was double this rate, requiring two VFIs operating in parallel. This meant the City had to modify its design to split flow from one large diameter stormwater collection pipe to two smaller 1800 mm and 1500 mm diameter pipes devised to accept half the peak flow. Despite the higher costs to implement this solution, the City was determined to capture the benefits only VFI technology offered.

The initial layout included two 5 m (16.4 ft) diameter manhole structures, one for each inlet pipe and VFI. However, the installation contractor, Dom Meridian Construction, suggested a more cost-effective solution that also reduced the footprint—constructing one 8 m (26.2 ft) diameter manhole housing both VFIs and their inlet pipes. Although a few American installations employed this multiple-VFI-in-one-manhole concept, this project represented the largest such installation by far and would be a first for the City.

IPEX split fabrication of the VFI components between their Mississauga and Michigan plants. Close inter-departmental collaboration and skilful project coordination resulted in a smooth build and timely delivery. Transporting the massive VFI components to the site required five semi-trailers loads and a great deal of planning and on-site coordination to offload and position everything.

> "I thought it was a positive experience; everything went pretty smoothly."
>
> **Jordan Strauss, P.Eng.,**
> Project Engineer, Land Development Ontario

Dom Meridian had never worked with VFI technology before. IPEX experts skilfully assisted the contractor during all phases of the installation. The VFI portion of the project was assembled, installed, and commissioned in July 2016.

Great Experience, Great Expectations

Commencing construction in 2014 with completion slated for December 2018, the Earl Bales project is a critical City undertaking to expand infrastructure in lockstep with the present and future needs of a growing population.

Based upon the trust developed over the years using IPEX expertise and support, the City and its consultant are confident the VFI technology will again deliver stellar performance for this project.

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