A Freese and Nichols White Paper

FREESE AND NICHOLS

Innovative approaches
Practical results
Outstanding service

TUNNELING

An Innovative Approach to Moving Stormwater

Since the U.S. Army Corps of Engineers in the 1940s planned a North and South Canal across the growing city, generations of Houstonians have recognized the need to move stormwater. As Houston's population has grown more than 10 times over the last 80 years, once-feasible routes for a surface diversion canal are no longer possible. Urban sprawl also makes new detention structures more difficult inside the Beltway 8 loop, despite that area's significant structural flooding issues.

Tunneling is inherently low-impact and can move and store stormwater with very little effect on the surface, benefiting communities and addressing environmental concerns. Incorporating tunneling into Houston's stormwater portfolio could significantly reduce flood damages and improve the reliability of existing conveyance and detention infrastructure.

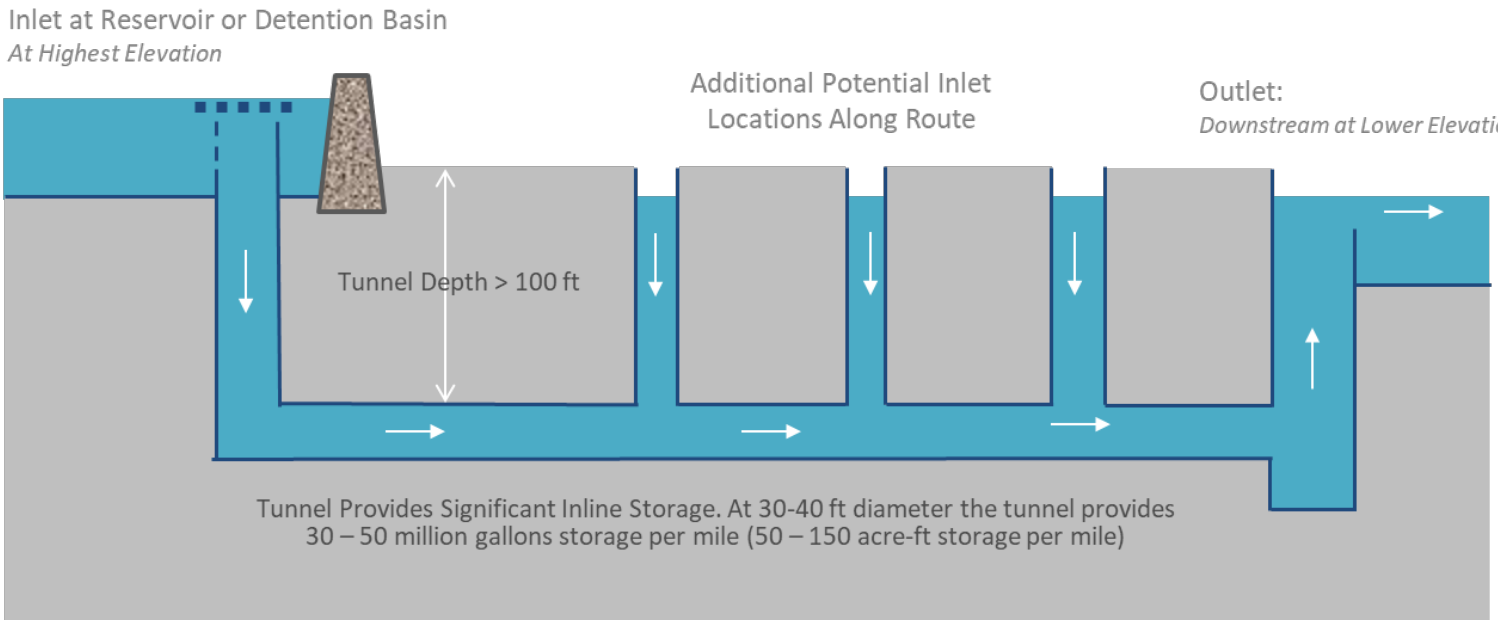
WHY TUNNELING WORKS?

- ✓ COST EFFECTIVE
- ✓ LOW IMPACT
- ✓ CONSTRUCTABLE
- ✓ PROVEN CONCEPT
- ✓ ENVIRONMENTALLY FRIENDLY

Tunneling technology has improved dramatically in the last 30 years. Projects once deemed impossible are now possible.

Tunnels get water to the Bay faster to prevent flooding

HOW IT WORKS – RELIABLE GRAVITY FLOW



Tunneling has effectively managed stormwater across Texas and the U.S. in cities like Houston, including:

- **Chicago**, which also lies on a flat coastal plain, began building tunnels in the 1970s after significant flooding and now has a network of 109 miles of 30-foot-diameter tunnels.
- **Washington, D.C.**, which also has clayey geology and high ground water, has finished two 5-mile-long tunnels and is building a third, totaling 15 miles of 26-foot-diameter tunnel for flood and pollution control.

Mill Creek Tunnel

20,000 cubic feet per second
5 miles long
35 foot diameter
$206 million

San Antonio River Tunnel

6,700 cubic feet per second
3 miles long
24 foot diameter
$230 million (2018$)

Waller Creek Tunnel

7,400 cubic feet per second
1.1 miles long
20-26 foot diameter
$163 million

Tunneling Works. An experienced contractor pool and better project risk management have driven down tunneling costs and improved success rates. As urban centers grow, the need to move infrastructure underground grows with it.

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