What is a Backflow Preventer?
- Backflow means the undesirable reversal of flow upstream
- A Backflow Preventer is a device designed to prevent backflow from happening
  - At stormwater detention basin outfall to preserve detention capacity
  - At downstream end of a water quality pipe to detain captured water quality volume
  - At outfall of a storm sewer to prevent channel flow from going upstream thru the storm sewer
  - At coastal area to protect upland against high tide and storm surge
Typical Backflow Preventers in HCFCD Projects

- Cast Iron / HDPE Flap Gates
- TideFlex Check Valves
- Inline Check Valves

Cast Iron / HDPE Flap Gates

- Commonly used in projects
- Based on material, subject to vandalism
- Heavy – Need a crane for maintenance operation

Tideflex Check Valve

- Susceptible to damage
- Maintenance access
- Exposure to site conditions
Inline Check Valves

- Can be expensive
- Can be used in new and existing pipes
- Customizable
  - Opening/closing pressures
  - Valve materials

Source: WaPro and Municipal Valve & Equipment Company

Case Studies: Lauder Stormwater Detention Basin

- Background
- Flap Gate Options and Comparison
  - Material
  - Type

The project is being constructed in phases:
- Phase 1 is already complete
- Phase 2 is under design
Flap Gate Options and Comparison

- Material
  - Cast Iron
  - High Density Polyethylene (HDPE)
  - Rubber / EPDM (ethylene propylene diene monomer rubber)
  - Silicone
  - Polyurethane

- Type
  - End of pipe
  - Inline

Flap Gates Comparison

- Evaluated in July 2017 for Lauder SWDB Phase 1 design
- Focused on evaluation of:
  - Rubber Duckbill Check Valve
  - HDPE Flap Gate
  - Inline Check Valves
- Contacted several vendors when making comparisons

HDPE Flap Gates

- Lightweight
- Corrosion Resistant
- Low Opening Pressure
- Lower cost:
  - 48” estimated: $12,600.00
  - 48” in bid: $5,660.00
- Long service life:
  - 100 years expected

Source: ROSS Valve, WaPro
**Inline Check Valves**

- Flexible
- No crane needed for inspection
- Opening Pressure:
  - At least one inch
- Lower cost:
  - 48" rubber check valve: Vendor estimated: $34,500.00
- Service life:
  - UV concern
  - 30 years expected

Source: Red Valve Company, Inc.

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**Location of Flap Gates in Phase 1**

- Outfall to Greens Bayou
- Diversion structure from P136-00-00 for Water Quality

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**Flap Gates Designed for Phase 1**

- HDPE flap gates to prevent backflow from Greens Bayou and preserve detention capacity
- Access path and platform designed for crane operation to maintain flap gates
Flap Gates Designed for Phase 1

- Modified headwall apron to allow flap gate operation
- Added a 5" steel cross pipe to allow manual lifting of flap gate without a crane

K = Top of Headwall to Top of Outfall Pipe
H = Headwall Height

Flap Gates Designed for Phase 1

- Water quality pipes to retain captured water quality volume

Location of Flap Gate in Phase 2

- HDPE flap gates to prevent backflow from Greens Bayou and preserve detention capacity
Case Studies: Z100-X280 Projects

- Background
  - Inline Valve Evaluated and Design in P500-01-00-Y008
  - K129-00-00-X011 Analysis of Flap Gate Needs

General Drainage System Repairs North Projects

- Z100-00-00-X280

Repair or Re-design

- Repair to restore the channel to latest design?
- Redesign to utilize full ROW with larger channel?
- Permitting concern
- Repair erosion
- Desilt to restore capacity
- Additional armoring
- Restore/New backslope swale/interceptor system
Channel Pipe Repairs

- HCFCD 2019 Guidelines on Replacing Failed CMPs
- New manhole required at HCFCD ROW

**P135-00-00-X006**

- Repair of failed concrete channel lining or retaining wall
- Bottom scour
- Rotational slope failure

**Case Studies:**
Z100-X280 Projects

- Inline Valve Evaluated and Design in P500-01-00-Y008
Nonfunctioning Backflow Preventer

- 60" backflow preventer
- Wooden and narrow channel

Tideflex Duckbill Check Valve

- Susceptible to damage
- Improper installation
- Material fatigue

Inline Check Valves

- Components
  - Valve housing
  - Valve membrane
  - Mounting hardware
- Material
  - EPDM
  - Silicone
  - Polyurethane

Source: https://www.redvalve.com/industries/stormwater-and-sewers/backflow-prevention

**Inline Check Valves**

- Design Considerations
  - Opening Pressure
  - Closing Pressure
  - Maximum Back Pressure
  - Material selection
  - Pipe end treatment

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**Case Studies: Z100-X280 Projects**

- K129-00-00-X011 Analysis of Flap Gate Needs

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**K129-00-00-X011**

- Flap gate found missing in Nov. 2019
- Conducted an analysis to determine if flap gate needed to be replaced
No H&H models available

Conducted frequency analyses using flood elevations at K100-00-00 HEC-RAS XS near K129-00-00 Confluence

Level of service changing from about 11 years without a flap gate to 106.6 years with a flap gate

Recommended to re-install a flap gate

Level of Service without a Flap Gate

Lowest ground elevation near Grand Valley Drive = 94.9 ft.

Lessons Learned

HCFCD Backflow Preventer Guidance

Specifications

HCFCD Backflow Preventer Guidance

End-of-Pipe Flex Gate

Flap Gate

In-line Flex Gate

Three types of backflow preventor mentioned:
Thank You!

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Questions