BEACON ENGINEERING LLC
23318 Cedar Lane · Georgetown, DE 19947 · 302.864.8825
info@beaconengineeringllc.com

October 3, 2023

Town of Dewey Beach
105 Rodney Avenue
Dewey Beach, Delaware 19971

Attn: Mr. Bill Zolper, Town Manager

Re: Read Avenue Drainage Improvements – Letter Report
Town of Dewey Beach, Lewes & Rehoboth Hundred
Sussex County, Delaware
Project No. DEW01-01(1)

Dear Bill:

Thank you for meeting with me on September 7th and September 27th to review the lingering flooding conditions that occur at the west end of Read Avenue. Briefly, this area is subject to a myriad of site specific conditions that result in frequent flooding which, in several recent instances, forced the closure of Coastal Highway. Despite significant financial effort by the Town, a reliable solution has not been implemented. The purpose of this letter report would be to provide a brief explanation of our observations and provide an implementation program with opinions of probable cost for your consideration.

According to the 2013 Stormwater Master Plan, the Read Avenue Watershed consists of approximately 20.5 acres of land. Refer to Exhibit I. The Master Plan further published that the stormwater culverts along Read Avenue, west of Coastal Highway, range in size from 15" – 24" diameter. A new outfall was constructed in collaboration with the Center for Inland Bays which consists of triple 36" diameter culverts. Though the outfall was constructed with in-line check valves, all three valves were removed because the shifting sands in this part of Rehoboth Bay reportedly blocked the valves which prevented proper and reliable operation. Further, the installed location of these valves was not conducive to performing maintenance to keep the valves in a serviceable condition. During several observations by Town Staff, the southernmost valve appeared to be the only consistently functioning valve. Refer to an EagleView Aerial photo, Exhibit II, that appears to have been captured during an April 2021 low tide event where a plunge pool appears to have formed down slope of the southerly culvert. The appearance of a plunge pool suggests that tidewater and stormwater are likely flowing through this culvert.

Though a detailed stormwater analysis is not part of this evaluation, a crude, order-of-magnitude runoff estimate was prepared for this watershed using the USGS Streamstats web application to understand the order of magnitude of runoff that may reach this outfall. The results of that analysis are enclosed in Exhibit III. Both Sussex County and DelDOT standards for stormwater

conveyance require stormwater collection systems be designed to convey the 10-year peak runoff rate. The Streamstats resulting 10-year rate is approximated to be 20.6 cfs. Putting this rate into perspective, a single 36" diameter culvert would be capable of conveying this rate, flowing full, under gravity flow conditions. Therefore, it seems reasonable that only 1 check valve would reliably function which is in harmony with your observations and recently collected aerial imagery.

During our site meetings, it was requested that multiple options be considered. We discussed the following:

- Installation of an outfall structure with a weir set at an elevation that would prevent a normal high tide from backing up into the system, yet allow stormwater runoff to overflow the weir
- Installation of a reliable backwater valve style to replace the in-line check valve
- Installation of a pump system to manage runoff during periods of high tide
- Extend the 36" diameter culverts to reach deeper water to minimize siltation of the outfall

Outfall Structure with Internal Weir: This option was eliminated from consideration because the normal full moon high tide elevation of 2.5 is 1.3 feet above the rim elevation of inlet RE-10.

Backwater Valve: Several backwater valve styles are presently on the market and are manufactured using several different materials. Given the marine environment at this location, corrosion resistant materials are desired. Two styles of backwater valves, flap valves and in-line valves, would be recommended in this location, and each have advantages and disadvantages. Refer to product literature found in Exhibit IV.

Flap Valves are essentially a hinged plate that seal against a seat when a seating head is applied. These valves are generally more effective when higher seating and unseating heads are applied. In lower head conditions such as those that are present at this location, flap valves have difficulty sealing properly and tend to leak. Flap valves also require maintenance to ensure that the valve is not blocked by sedimentation or debris on either side of the valve.

Though in-line valves require less head to form a water tight seal, they can also be subject to maintenance to remove debris that are trapped behind the valve. Certain in-line valves have been reported to be subject to sedimentation preventing in-line valves from opening; however, the in-line valve provided in Exhibit IV is reported to scour sediment from the seat when as little as 1 inch of differential pressure is applied. In practice, at least 6 inches of differential pressure is desired to develop the scour velocity needed for this valve to self-clean downstream sediment from the valve seat.

Regardless of the style backwater valve to be installed, this type of device would prevent stormwater runoff during high tide events. Therefore, on-street flooding would not be mitigated until the high tide ebbs.

Pump System: Installation of a pump at the outfall structure in tandem with a backwater valve would be an effective solution that would allow street flooding to be mitigated in a reasonable time period, regardless of the tide cycle, storm surge, etc. In particular, Dewey Beach already has an effective pump system elsewhere in its collection system, and this solution is a proven technology.

Culvert Extension: Though it may be technically feasible to extend the outfall farther into the Bay, this option was not considered in this report because of the cost associated with extending the culverts. The existing culverts are corrugated HDPE, and it would be a reasonable assessment to use HDPE to extend the culverts. However, HDPE is a buoyant material, therefore, the pipe would require anchoring at regular intervals using pile bents.

Recommendations

Given the estimated peak runoff rate and the cost of implementation, Beacon recommends a step-wise solution be implemented such that infrastructure is field tested and verified by repeated success through multiple tide cycles and precipitation events. Beacon also recommends that an HDPE flap valve or a Tideflex Checkmate In-Line check valve be deployed. Subject to final design and confirmation of the analysis prepared by others to develop the methodology that 3, 36" culverts are warranted at this location, Beacon recommends that only 1 culvert remain open for conveyance of stormwater runoff.

Step 1: Remove the flared end sections and safety grates and install 1 flap valve and seal off the other 2 outfall culverts using HDPE caps at an estimated cost of $44,300. If a bubble tight seal is desired, then an in-line valve at an estimated cost of $52,000 should be considered.
Step 2: If the sedimentation issue is not mitigated by forcing all runoff through 1 culvert, install a gabion wall across the mouth of the rip-rap basin and increase the plunge pool depth at an approximate additional cost of $26,700.
Step 3: If trapped stormwater runoff does not dissipate within an acceptable period resulting from extended periods of storm surge, install 1, 4" non-clog submersible pump in the last structure at an approximate additional cost of $49,300.

Therefore, the stepwise solution recommended by Beacon would range in cost between $44,300 and $128,000 depending upon which valve solution is implemented, whether sedimentation continues to be a maintenance issue, and whether dewatering of floodwaters following a rain event is desired. Following your review, please call with any questions.

Respectfully submitted,

Robert J. Palmer, P.E.
President | Senior Engineer

Enclosures

BEACON ENGINEERING LLC
23318 Cedar Lane | Georgetown | Delaware | 19947
Phone: 302.864.8825 | Email: info@beaconengineeringllc.com

Project: Read Ave Outfall Improvements
Subject: Engineering Fee Breakdown
Date: 10/23/2023 Revised:
Project Number: DEW01-01(1) Revised:
Tax Map:

Option 1 - HDPE Flap Valve

Step	Base Estimate	Bidding Services	Construction Administration	Inspection	Total	Engineering Included in Base Estimate
1	$ 44,300	$ 4,400	$ 4,800	$ 1,300	$ 54,800	$ 4,600
2	$ 26,700			$ 1,300	$ 28,000	$ 2,100
3	$ 49,300			$ 2,600	$ 51,900	$ 5,100
Totals	$ 120,300	$ 4,400	$ 4,800	$ 5,200	**$ 134,700 Grand Total Option 1**	$ 11,800
Add Per Valve	$ 17,825		$ 1,500	$ 650	$ 19,975	

Option 2 - In-Line Check Valve

Step	Base Estimate	Bidding Services	Construction Administration	Inspection	Total	Engineering Included in Base Estimate
1	$ 52,000	$ 4,400	$ 4,800	$ 1,300	$ 62,500	$ 5,400
2	$ 26,700			$ 1,300	$ 28,000	$ 2,100
3	$ 49,300			$ 2,600	$ 51,900	$ 5,100
Totals	$ 128,000	$ 4,400	$ 4,800	$ 5,200	**$ 142,400 Grand Total Option 2**	$ 12,600
Add Per Valve	$ 22,925		$ 1,500	$ 650	$ 25,075	

EXHIBIT I

READ DRAINAGE BASIN LOCATION MAP

4-2 Schedule of Existing Elements

NAME	CONDITION	LARGEST PIPE IN DIA.	PIPE OUT DIA.	RIM ELEV. (FT)	LOWEST INVERT IN ELEV. (FT)	INV OUT ELEV. (FT)
MC-1	CLEAN	-	15 RCP	3.89	-	1.64
MC-2	CLEAN	-	15 RCP	3.75	-	1.85
MC-3	OBSTRUCTED	-	24 RCP	3.42	-	1.22
EX-CB	CLEAN	8 PVC	15 RCP	3.59	1.54	1.55
RE-1	OBSTRUCTED	-	18 RCP	3.59	-	1.37
RE-2	CLEAN	18 RCP	24 RCP	3.69	0.94	0.84
RE-3	CLEAN	24 RCP	24 RCP	2.98	-0.53	-0.64
RE-4	CLEAN	-	18 RCP	4.01	1.21	0.39
RE-5	INUNDATED	24 RCP	18 RCP	3.16	-0.09	-0.19
RE-6	INUNDATED	18 RCP	18 RCP	2.94	-0.46	-0.40
RE-7	OBSTRUCTED	-	15 RCP	1.54	-	0.07
RE-8	INUNDATED	18 RCP	15 RCP	1.05	-1.37	-1.30
RE-9	OBSTRUCTED	-	15 RCP	1.40	-	-0.45
RE-10	INUNDATED	-	15 RCP	1.20	-	-0.87

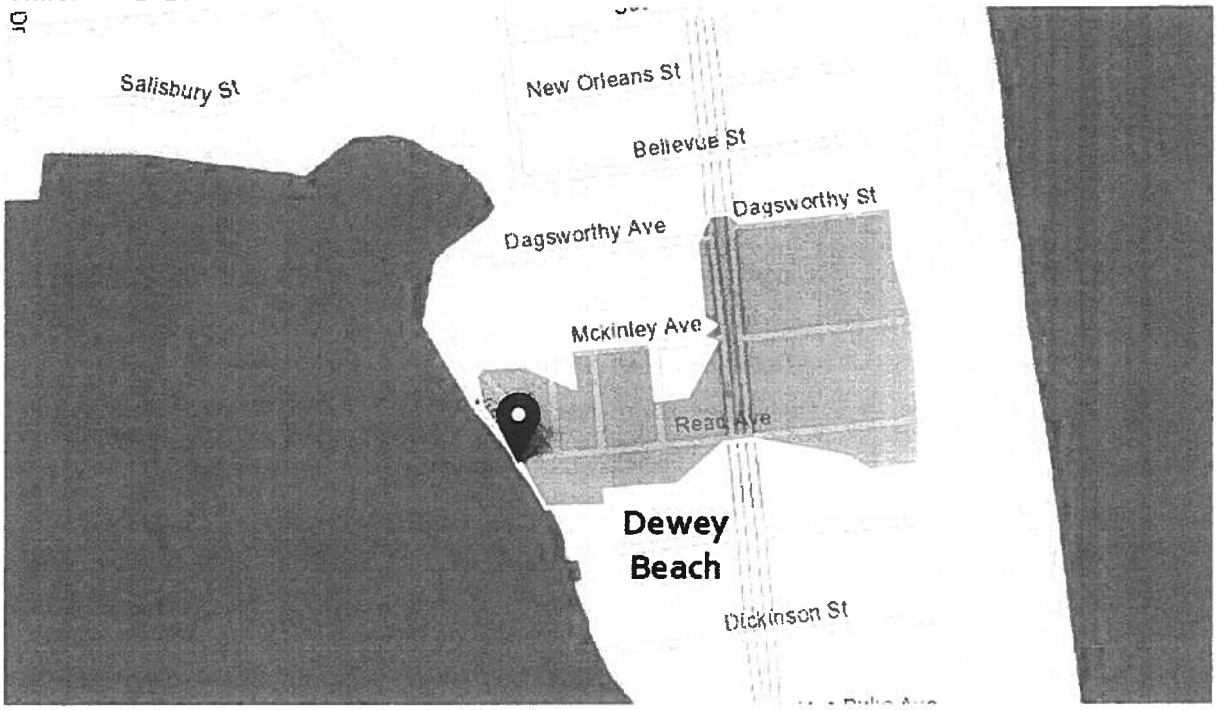
4/23/21

EXHIBIT II

EXHIBIT III

StreamStats Report

Region ID: DE
Workspace ID: DE20231003221059730000
Clicked Point (Latitude, Longitude): 38.69153, -75.07741
Time: 2023-10-03 18:11:35 -0400



Collapse All

General Disclaimers

This watershed has been edited, computed flows and basin characteristics may not apply. For more information, submit a support request from the 'Help' button in the upper-right of the screen, attach a pdf of this report and request assistance from your local StreamStats regional representative.

Peak-Flow Statistics

Peak-Flow Statistics Parameters [DE Peakflow Coastal Plain 2022 5005]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	0.0328	square miles	0.5	112.3
BSLDEM3M	Mean basin slope from 3 meter dem	2.54	percent	1.4	6.5

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	0.0328	square miles	0.5	112.3
BSLDEM3M	Mean basin slope from 3 meter dem	2.54	percent	1.4	6.5
SOILA	Percent Hydrologic Soil Type A	0.5185	percent	0	82.4

Peak-Flow Statistics Disclaimers [DE Peakflow Coastal Plain 2022 5005]

One or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errors

Peak-Flow Statistics Flow Report [DE Peakflow Coastal Plain 2022 5005]

Statistic	Value	Unit
50-percent AEP flood	6.36	ft^3/s
20-percent AEP flood	13.8	ft^3/s
10-percent AEP flood	20.6	ft^3/s
4-percent AEP flood	31.4	ft^3/s
2-percent AEP flood	41	ft^3/s
1-percent AEP flood	52.3	ft^3/s
0.5-percent AEP flood	65.4	ft^3/s
0.2-percent AEP flood	85.7	ft^3/s

Peak-Flow Statistics Citations

John C. Hammond, Edward J. Doheny, Jonathan J.A. Dillow, Mark R. Nardi, Peter A. Steeves, and Daniel L. Warner2021, Peak-Flow and Low-Flow Magnitude Estimates at Defined Frequencies and Durations for Nontidal Streams in Delaware, U.S. Geological Survey Scientific Ivestigations Report 2022-5005 (https://pubs.er.usgs.gov/publication/sir20225005)

Low-Flow Statistics

Low-Flow Statistics Parameters [DE LowFlow Coastal Plain 2022 5005]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	[redacted]	square miles	2	104.3
SOILD	Percent Hydrologic Soil Type D	0.1799	percent	1.5	92.6

Low-Flow Statistics Disclaimers [DE LowFlow Coastal Plain 2022 5005]

One or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errors

Low-Flow Statistics Disclaimers [DE LowF[redacted]stal Plain 2022 5005]

SOILD Percent Hydrologic Soil Type 0.1799 percent 1.5 92.6

One or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errors.

Low-Flow Statistics Flow Report [DE LowFlow Coastal Plain 2022 5005]

Statistic	Value	Unit
7 Day 2 Year Low Flow	0.0142	ft^3/s
7 Day 10 Year Low Flow	0.0039	ft^3/s
7 Day 20 Year Low Flow	0.00215	ft^3/s
14 Day 2 Year Low Flow	0.0169	ft^3/s
14 Day 10 Year Low Flow	0.0054	ft^3/s
14 Day 20 Year Low Flow	0.00323	ft^3/s
30 Day 2 Year Low Flow	0.0233	ft^3/s
30 Day 10 Year Low Flow	0.00827	ft^3/s
30 Day 20 Year Low Flow	0.00538	ft^3/s

Low-Flow Statistics Citations

John C. Hammond, Edward J. Doheny, Jonathan J.A. Dillow, Mark R. Nardi, Peter A. Steeves, and Daniel L. Warner2021, Peak-Flow and Low-Flow Magnitude Estimates at Defined Frequencies and Durations for Nontidal Streams in Delaware, U.S. Geological Survey Scientific Ivestigations Report 2022-5005 (https://pubs.er.usgs.gov/publication/sir20225005)

Bankfull Statistics

Bankfull Statistics Parameters [Atlantic Plain D Bieger 2015]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	0.0328	square miles	0.30888	1086.8715

Bankfull Statistics Parameters [USA Bieger 2015]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	[redacted]	square miles	0.07722	59927.7393

Bankfull Statistics Parameters [VA MD Coastal Plain bankfull SIR2007 5162]

Bankfull Statistics Parameters [VA MD Coastal Plain bankfull SIR2007 5162]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	[redacted]	square miles	0.28	113

Bankfull Statistics Disclaimers [Atlantic Plain D Bieger 2015]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	0.0328	square miles	0.28	113

Bankfull Statistics Disclaimers [Atlantic Plain D Bieger 2015]

One or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errors.

Bankfull Statistics Flow Report [Atlantic Plain D Bieger 2015]

Statistic	Value	Unit
Bieger_D_channel_width	2.98	ft
Bieger_D_channel_depth	0.355	ft
Bieger_D_channel_cross_sectional_area	1.05	ft^2

Bankfull Statistics Disclaimers [USA Bieger 2015]

One or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errors.

Bankfull Statistics Flow Report [USA Bieger 2015]

Statistic	Value	Unit
Bieger_USA_channel_width	3.72	ft
Bieger_USA_channel_depth	0.582	ft
Bieger_USA_channel_cross_sectional_area	2.7	ft^2

Bankfull Statistics Disclaimers [VA MD Coastal Plain bankfull SIR2007 5162]

One or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errors.

Bankfull Statistics Flow Report [VA MD Coastal Plain bankfull SIR2007 5162]

Statistic	Value	Unit
Bankfull Width	3	ft
Bankfull Depth	0.45	ft
Bankfull Area	1.35	ft^2
Bankfull Streamflow	3.66	ft^3/s

Bankfull Statistics Flow Report [Area-Averaged]

Statistic	Value	Unit
Bieger_D_channel_width	2.98	ft

Bankfull Statistics Flow Report [Area-Averaged]

Statistic	Value	Unit
Bieger_D_channel_width	2.98	ft
Bieger_D_channel_depth	0.355	ft
Bieger_D_channel_cross_sectional_area	1.05	ft^2
Bieger_USA_channel_width	3.72	ft
Bieger_USA_channel_depth	0.582	ft
Bieger_USA_channel_cross_sectional_area	2.7	ft^2
Bankfull Width	3	ft
Bankfull Depth	0.45	ft
Bankfull Area	1.35	ft^2
Bankfull Streamflow	3.66	ft^3/s

Bankfull Statistics Citations

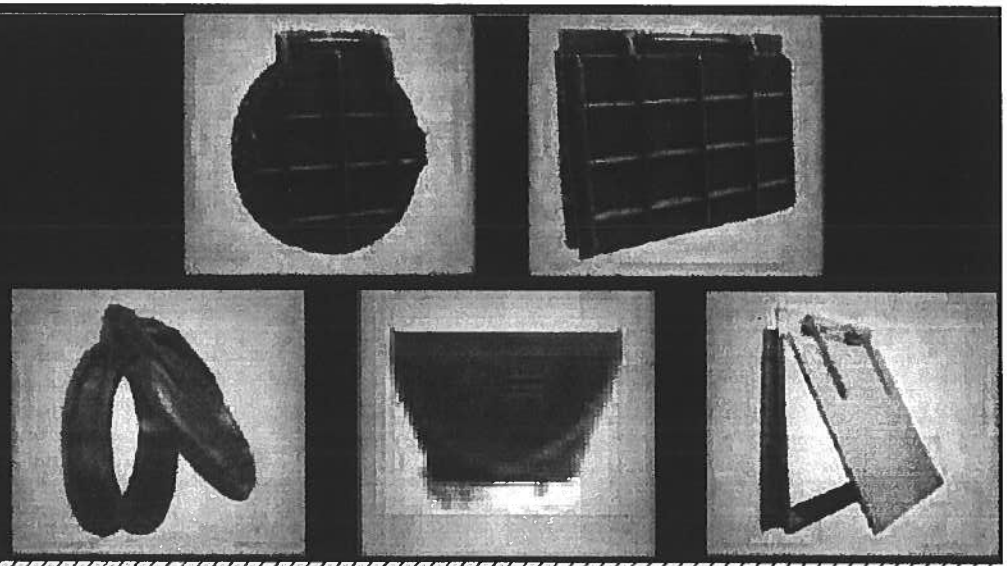
Bieger, Katrin; Rathjens, Hendrik; Allen, Peter M.; and Arnold, Jeffrey G.,2015, Development and Evaluation of Bankfull Hydraulic Geometry Relationships for the Physiographic Regions of the United States, Publications from USDA-ARS / UNL Faculty, 17p. (https://digitalcommons.unl.edu/usdaarsfacpub/1515?utm_source=digitalcommons.unl.edu%2Fusdaarsfacpub%2F1515&utm_medium=PDF&utm_

Krstolic, J.L., and Chaplin, J.J.2007, Bankfull regional curves for streams in the non-urban, non-tidal Coastal Plain Physiographic Province, Virginia and Maryland: U.S. Geological Survey Scientific Investigations Report 2007–5162, 48 p. (https://pubs.usgs.gov/sir/2007/5162/pdf/SIR2007-5162.pdf)

Application Version: 4.17.0
StreamStats Services Version: 1.2.22
NSS Services Version: 2.2.1

EXHIBIT IV

HF SERIES
HDPE FLAP VALVE



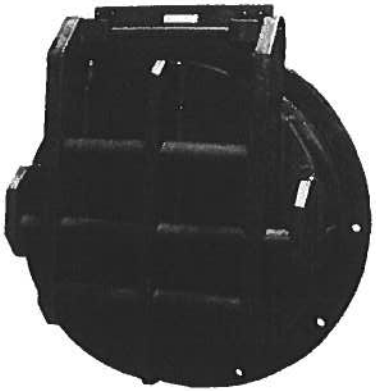
USA Waterworks Group
4335 Moorfield Place
Cumming, GA 30040
770-870-8700

Over 30 years of experience in valve manufacturing, testing and installation

USA Waterworks Group
4335 Moorfield Place
Cumming, GA 30040
770-870-8700

HF SERIES
HDPE Flap Valve

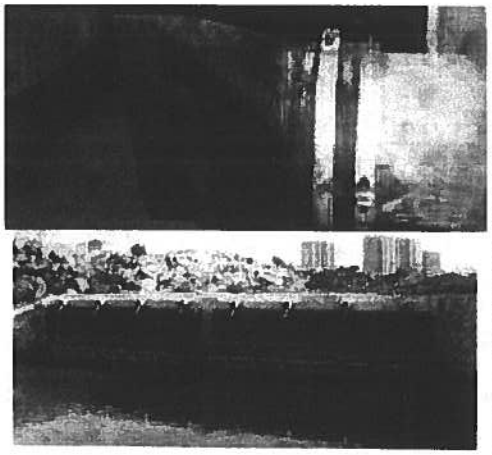
Product Description:



HDPE valves work exceptionally well over a wide range of pressures and offer flexibility to meet the requirements of any project. Constructed of High Density Polyethylene, HDPE is an extremely rugged thermplastic that provides a high strength-to-weight ratio and anti corrosion properties. Making these valves suitable for decades of service in both raw water and waste water industries.

Product Applications:

Sewage, raw water, fresh water and sea water



Product Structure and Features:

1) Thermoplatic Material

a) Reduced weight compared to similar metal valves

- The reduced weight of HDPE allow for greater response to a wider range of pressures compared to a similar metal valves, which generally require large pressure build up before opening. Causing higher losses, larger pump requirements and/or more complex design (i.e. double hinge.

b) Corrosion resistance

- The high corrosion resistance prop the necessity of protective coating as well provides a lower maintenance valve.

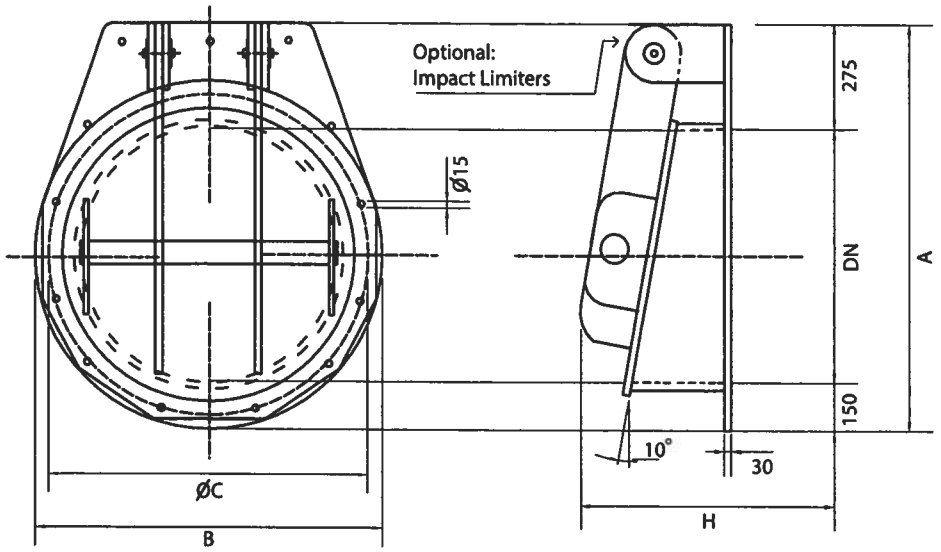
c) Design flexibility

- Being a plastic material, HDPE gains the advantages of injection moulding manufacturing. Allowing more flexibility in valve design changes in order to meet the requirements of each individual project.

2) Slotted Hinges

- All HDPE valves are incorporated with slotted hinges, allowing for self alignment of the valve after each cycle as well as providing more flexibility in operation to meet the conditions of both low and high pressure operations.

Sample Specification (HF Series):

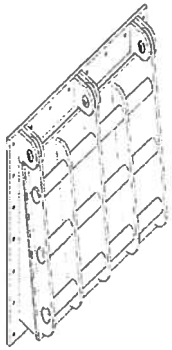


DN	A	B	ØC	H	WT. (KG)
700	1125	1000	900	460	55
800	1225	1100	1000	480	60
900	1325	1200	1100	495	75
1000	1425	1300	1200	510	85
1200	DIMENSIONS AND RELEVANT DATA AVAILABLE UPON REQUEST				
1250					
1500					
2000					
2500					
3000					
3600					

ITEM	DESCRIPTION	MATERIAL
1	FLANGED FRAME	HDPE - 300
2	DISC	HDPE - 300
3	SEAT	EPDM
4	DISC HINGE PIN	STAINLESS 316

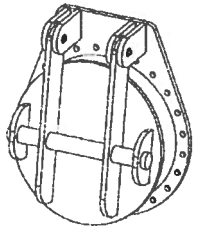
TECHNICAL SPECIFICATIONS:
1. Design and Testing per EN1074
2. Standard Operating Pressure: 6m

Other Available Options:



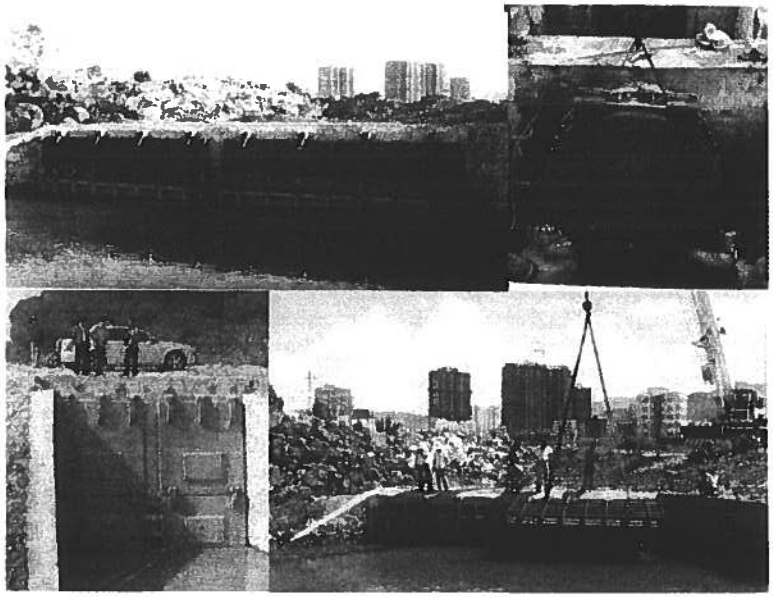
Shapes:
- Square
- Rectangle
- Oval

Sizes:
Up to 1000 mm



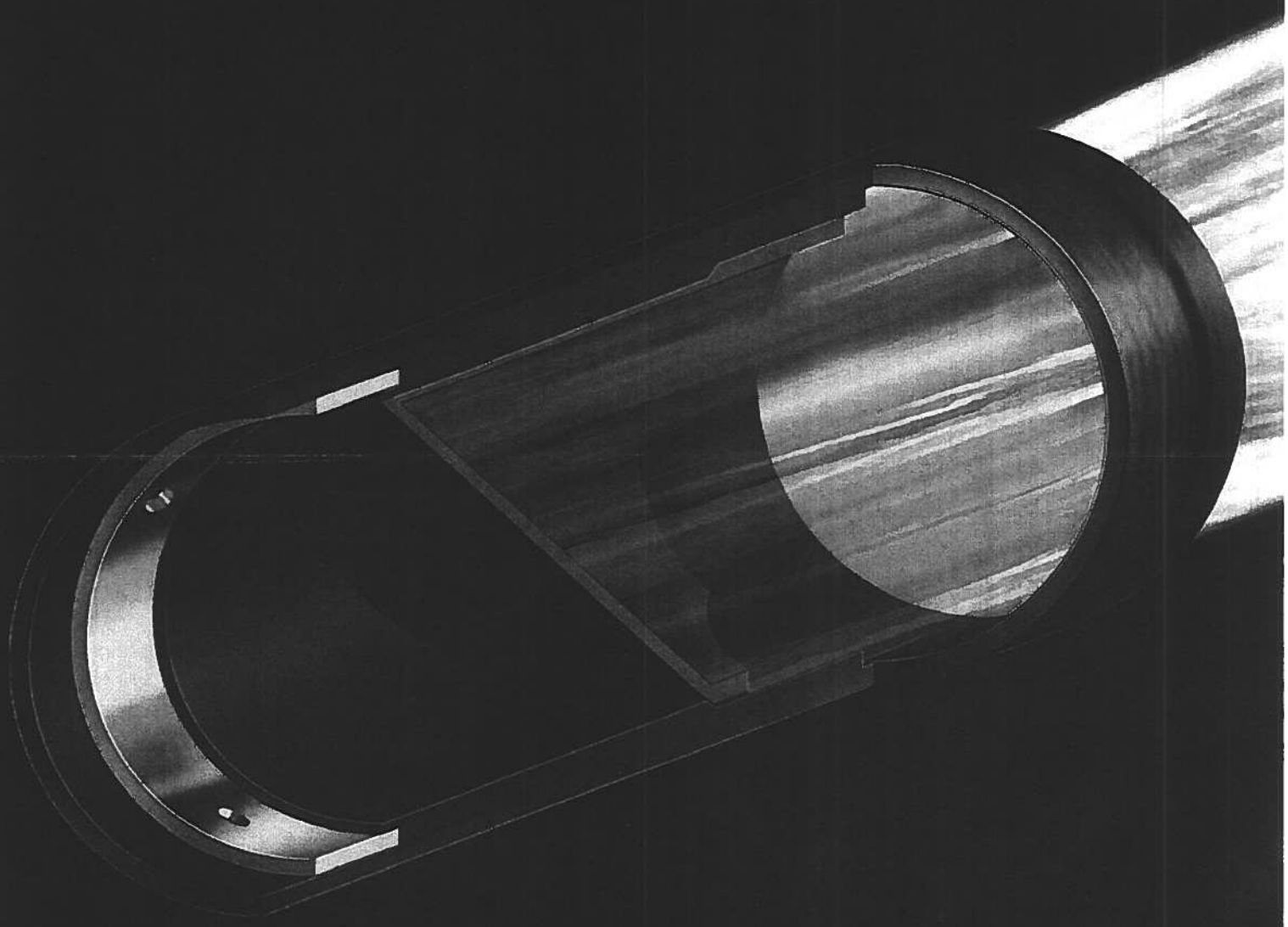
Flange Mounting:
All HF Series Available in flange mounting bolt pattern

Project Showcase:



Red Valve®

The World's Most Reliable Check Valve
Engineering Guide

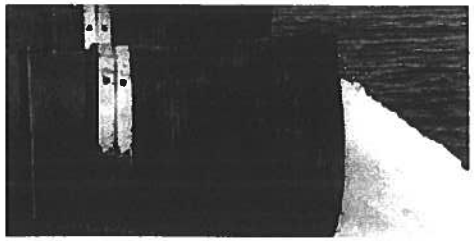


Continuing a Legacy of Innovation, Leadership and Customer Service

More than 60 years ago, Red Valve Company was founded on a simple promise: provide the highest quality engineered valves backed by an unsurpassed level of technical innovation and customer service. With that promise began a legacy of leadership—and a never-ending quest to solve the world's toughest flow control challenges while exceeding our customers' expectations.

As the world leader in Pinch Valve and Check Valve technology, that legacy lives on every day at Red Valve Company, and the innovative CheckMate® Inline Check Valve is proof. The CheckMate® Inline Check Valve is rooted in the same superior understanding of elastomer technology as the legendary Tideflex® Check Valve, one of the most well-known valves proven for providing reliable long-lasting backflow prevention, across the globe.

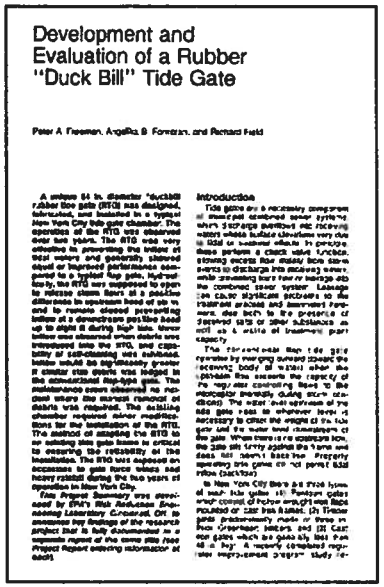
Being a world leader in valve technology is more than a slogan—it's a promise, carried forward by the hundreds of dedicated Red Valve employees and sales representatives around the world. Call us any time. We are ready to speak with you personally—right now.



The patented CheckMate® Inline Check Valve is rooted in the same superior understanding of elastomer technology as the legendary Tideflex® Check Valve, one of the most well-known valves in the world.

A Pioneer in the Check Valve Industry

In 1984, the United States Environmental Protection Agency (EPA) commissioned Red Valve Company to develop and test an alternative to tide gate valves. In their report, Development and Evaluation of a Rubber "Duck Bill" Tide Gate, the EPA states, "Increasing the reliability and performance of tide gates has a beneficial impact on the general pollution abatement program for the nation's waterways."



Development and Evaluation of a Rubber "Duck Bill" Tide Gate

Peter A. Freeman, Angelika B. Forrestal, and Richard Field

Introduction

In response, Red Valve Company developed and patented its elastomer "duckbill" Tideflex® Check Valve to eliminate the operational and maintenance problems associated with flapgate check valves, including corrosion of mechanical parts, freezing open or shut, warping and clogging due to entrapped debris.

The EPA rigorously tested the Tideflex® Check Valve for two years and found that the valve showed, "Significant improvement over flapgate valves in terms of leakage inflow, entrapment of debris, capability to self clean and susceptibility to marine fouling."

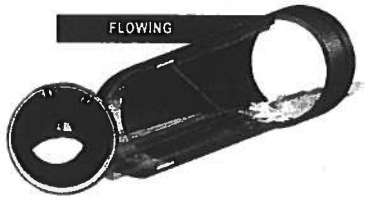
Since the creation of the Tideflex® Check Valve in 1984, years of research and development, testing and proven performance has led to the globalization of the TF-2 Tideflex® Check Valve and the next generation Tideflex® TF-1. With improved flow efficiency characteristics and the latest technology in elastomers, Red Valve continues to deliver on its promise of staying on the forefront of technology and new product development. The Tideflex® name is respected and recognized around the world as the most reliable valve for backflow prevention. It is also worth noting that the first Tideflex® Check Valve sold in 1984 is still in service today, with more than 700,000 Tideflex® Check Valves in service around the world, reliably solving inflow and intrusion problems.

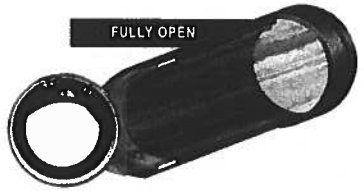
CheckMate® Valve Solves City's Odor Problem

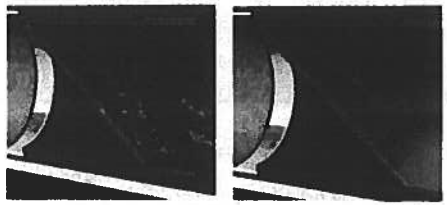
When foul odors were plaguing a soybean producing town in Illinois, officials turned to Red Valve for the most reliable, cost-effective solution.

A chemical deodorizing system and a pump station were also evaluated, but far exceeded budget constraints. The CheckMate® Inline Check Valve proved to be the perfect solution.

The CheckMate® Inline Valve was installed in 2012 and has worked flawlessly ever since, completely blocking the backdraft of the odor. Best of all, there has been zero maintenance expense. According to a public works official, ***"This is one of the most cost-effective solutions to a nagging quality of life problem the City has ever implemented. We are now looking at other parts of the combined sewer system that has a few small odor problems due to escaping sewer gas."***

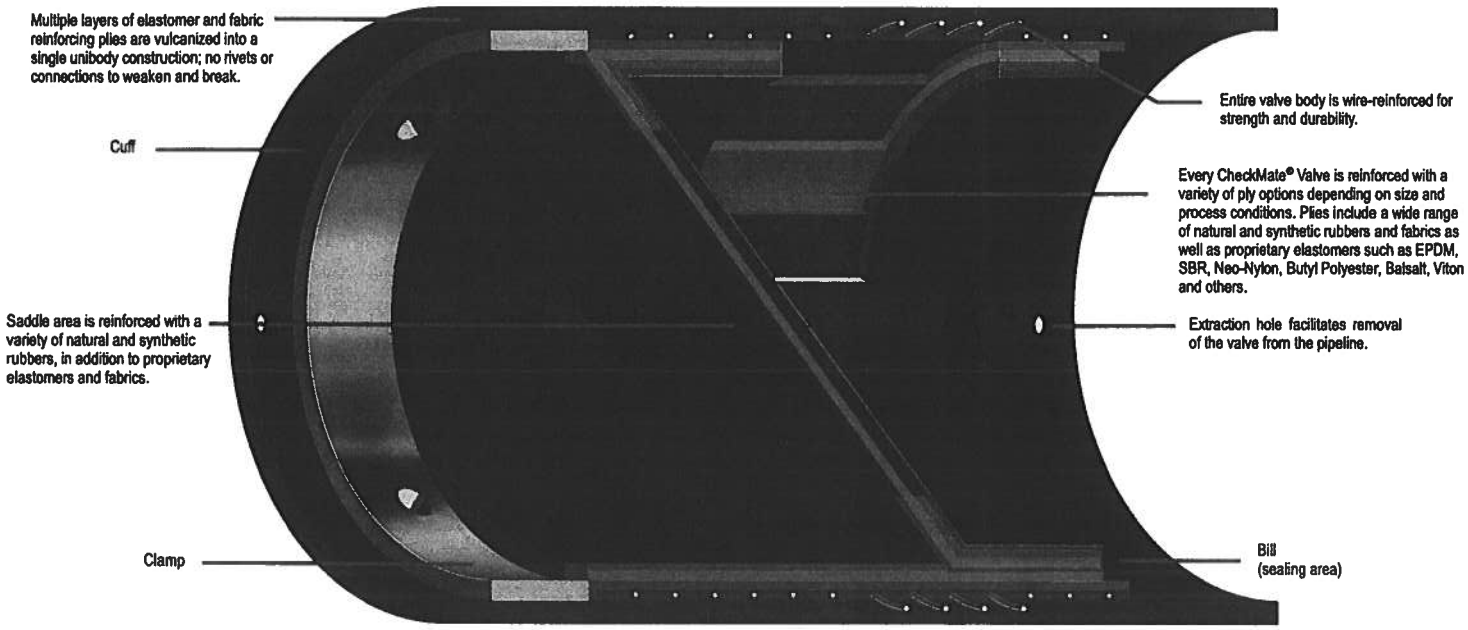


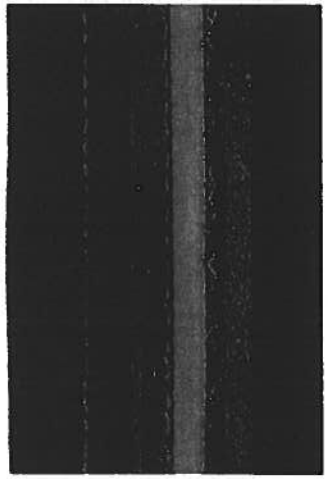




For an animated demonstration of the CheckMate® in operation, please visit: http://www.tideflex.com/checkmate

There Is Only One CheckMate® Inline Valve!



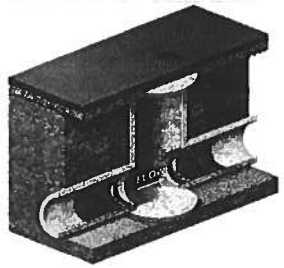


Red Valve's legendary elastomer technology and knowledge is the real story behind the CheckMate® Valve's unrivaled performance. Every CheckMate® Valve is reinforced with various natural and synthetic plies, specifically engineered for your specific application.

The CheckMate® Inline Check Valve: Accept No Substitutes!

The innovative CheckMate® Inline Check Valve has quickly become the specified choice for inline residential, municipal and commercial areas where complete, dependable backflow prevention is critical. It has also become the valve of choice for municipal and industrial applications such as storm water, wastewater, highway runoff, CSO, SSO and flood control by preventing unwanted backflow that can cause surges and flooding. The CheckMate® Inline Check Valve minimizes damage to wetlands, beaches and residential areas and eliminates hydraulic surges to wastewater treatment plants, saving municipalities millions of dollars in maintenance and treatment costs.

One of the keys to the CheckMate® Valve's exceptional dependability and longevity is Red Valve's unmatched elastomer experience—experience, application knowledge and engineering know-how. Every CheckMate® Inline Check Valve is hand-fabricated, made of multiple layers of varying natural and synthetic elastomers, wire and fabric-reinforced plies, all of which are vulcanized into a robust unibody valve. Unlike competing designs, there are no molded parts or mechanical fasteners and rivets that will loosen, act as catch points, break or corrode—ever. The key to CheckMate® Valve's longevity, performance and low headloss characteristics is the design and construction.



CheckMate® Inline Check Valves use state-of-the-art elastomers and fabric technology with no metal hinges, rivets, fasteners or moving parts. The valve's unibody construction is ideally suited for CSO and diversion chamber applications and installed inside the pipeline on either the upstream or downstream side of a diversion chamber.

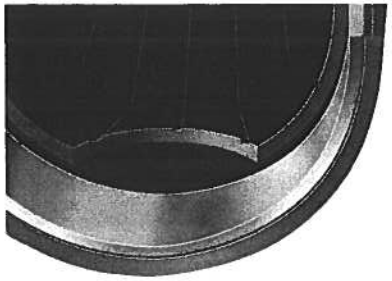
Introducing UltraFlex®: the Next Generation in CheckMate® Technology!

Unmatched Elastomer Research, Innovation and Knowledge

The patented CheckMate UltraFlex® Inline Check Valve features drastically improved hydraulic and performance characteristics to its predecessor, the original CheckMate® Check Valve. Strategically placed reinforcing ribs, segmented pads and the "Arc Notch" bill combine to significantly improve flow efficiency with significantly reduced headloss, while providing absolute backflow protection.

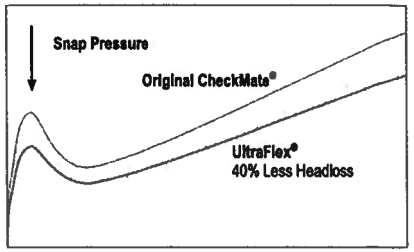
Once upstream head pressure reaches a specific level, CheckMate® Inline Check Valves are designed to "snap" or "pop" open, allowing the rapid discharge of flow. The new UltraFlex®, with its patented "Arc Notch" and optimized construction, allows the next generation CheckMate® Valve to open 40% sooner. As a result, the pipeline and entire collection system drains up to 40% faster. Because the UltraFlex® Valve "snaps" or "pops" open with less head pressure, pipeline capacity is significantly increased while the chance for standing water to collect upstream of the valve is totally eliminated.

Patent Pending



Strategically placed reinforcing ribs, segmented pads and the bill's unique "Arc Notch" combine to significantly improve flow efficiency with significantly reduced headloss while providing absolute backflow protection.

UltraFlex® Boasts 40% Lower "Snap Pressure"



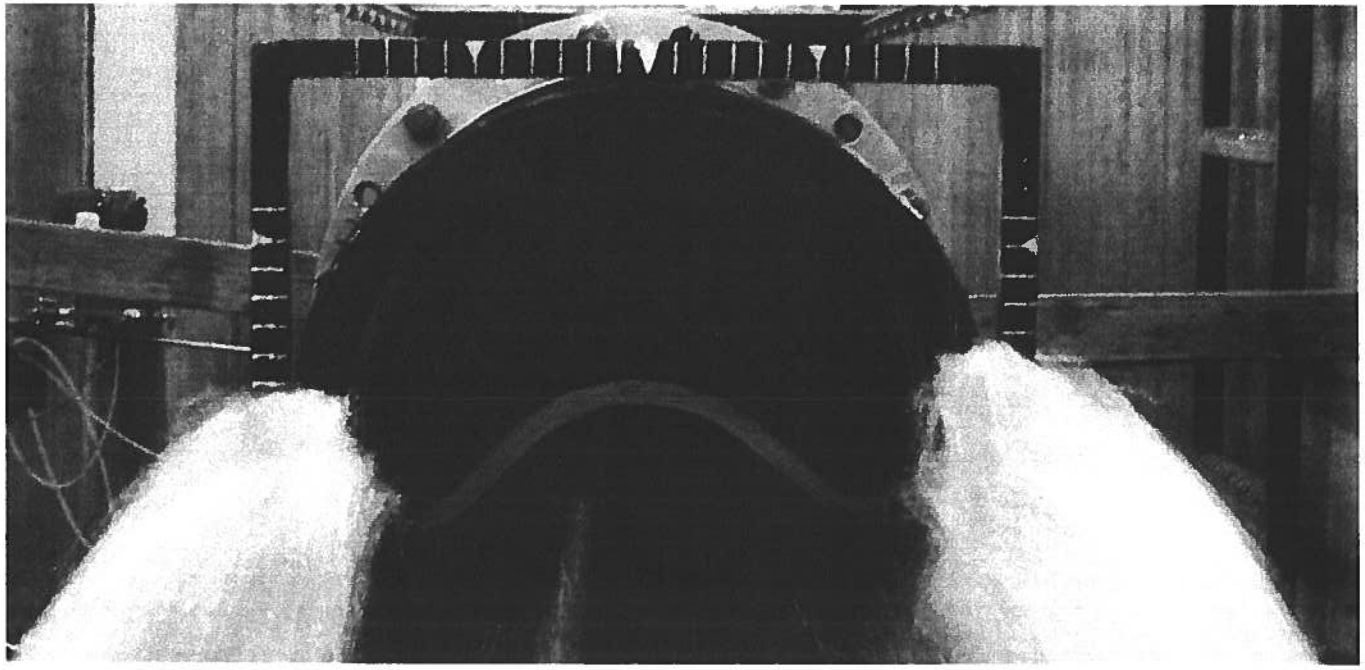
The new CheckMate UltraFlex® Valve boasts a 40% lower snap pressure requirement to open or unseat the valve, without compromising the valve's ability to seal. This greatly improves capacity in pipelines and the rapid drainage of upstream flow through the valve. With its patented "Arc Notch" design, the CheckMate UltraFlex® Inline Check Valve boasts a significantly improved flow efficiency, due to reduced head pressure levels required to "snap" open the valve.

When upstream head reaches 50-75% of pipe diameter (for example, 9" head in a 12" valve), the UltraFlex® bill "snaps" open into a concave shape, allowing substantially more flow with the same amount of head. The valve will progressively open with increased head and flow. Picture shows moment when the valve "snaps" open.

The CheckMate® Valve will crack open and flow with as little as 1" of head pressure.

Once the CheckMate® Valve "snaps" open, it achieves rapid discharge of flow.

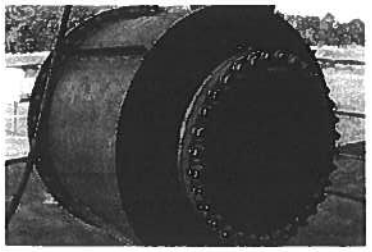
Independently Tested, Field Validated



Independent Hydraulic Testing

CheckMate® Inline Check Valves are independently tested to determine their hydraulic characteristics in both free and submerged discharge applications. Published hydraulic data is validated through this independent testing, and Finite Element Analysis data is also provided to ensure the CheckMate® Valve meets your exact specifications. CheckMate® Valves are ideally suited for interceptor, manhole and outfall pipelines because they allow flow to discharge with very little headloss and prevent backflow. The CheckMate® Valve's innovative inline design allows it to be easily installed without modifications to existing structures, making it the perfect choice for both municipalities and commercial property owners.

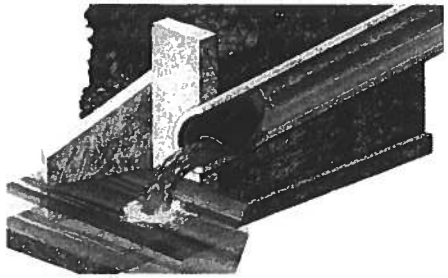
To supplement independent hydraulic testing, Red Valve continually conducts research and development and additional in-house testing to improve existing products and develop new products. ▶



Thousands of CheckMate® Inline Check Valves are currently in service around the globe.

Features and Benefits of CheckMate®

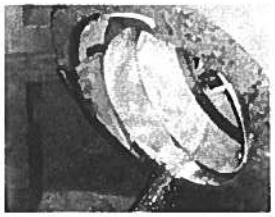
- Extremely Low Headloss
- No Moving Mechanical Parts to Corrode, Catch Debris or Fail
- Heavy Duty Elastomer Unibody Construction
- Quick and Easy Installation
- Seals Around Debris
- Operates on Differential Pressure, Totally Passive
- Virtually No Maintenance
- Self-draining, 1" of Cracking Pressure
- Silent, Non-slamming
- Available in Sizes 3" (75 mm) to 84" (2100 mm)
- Extensive Independent Hydraulic Testing

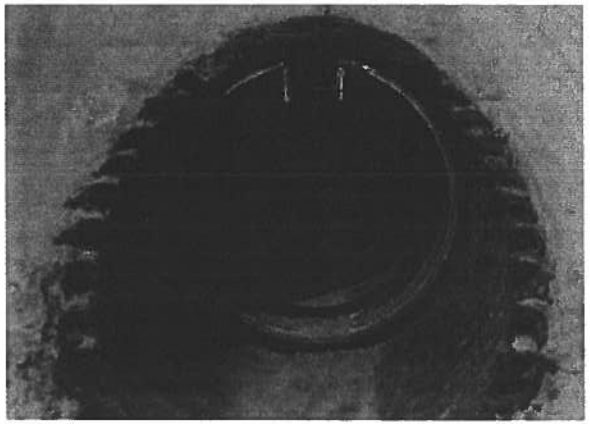


CheckMate® Valves are ideally suited for interceptor, manhole and outfall pipelines, because they maximize pipeline storage and capacity while preventing backflow into upstream pipelines, collection systems and sewage treatment plants.

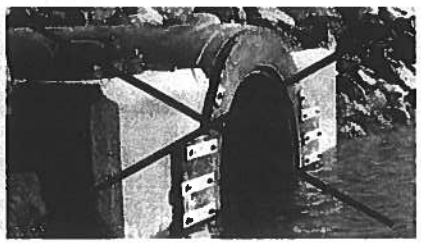
Simple Design for Simple Installation

The CheckMate® Inline Check Valve is extremely easy to install, regardless of the existing environment or piping. Its inherent design makes it the most user-friendly inline check valve on the market today. From the upstream or downstream end of the pipe, simply insert the valve into position and clamp it into place. Typically, no modification to the pipe or structure is required to install the CheckMate®. Because the CheckMate® is recessed inside of the pipe, additional permitting is not required. The results are construction cost savings, reduced installation time, and reduced operational costs.





CheckMate® Valves are easily installed regardless of difficult pipe end geometry or pipes in poor end condition. There is no need to rebuild headwalls.



There is no need to rebuild headwalls, as is required with less advanced inline check valves (above)

A Wide Range of Shapes and Sizes

Elliptical, Arch and Rectangular Pipes

Elliptical, Arch and Rectangular Pipes for drainage and flood prevention projects have become popular, particularly in high water table areas with shallow surface gradients. CheckMate® Inline Check Valves are the perfect solution as they can be customized to meet your specifications.

Elliptical Pipe CheckMate®

Arch Pipe CheckMate®

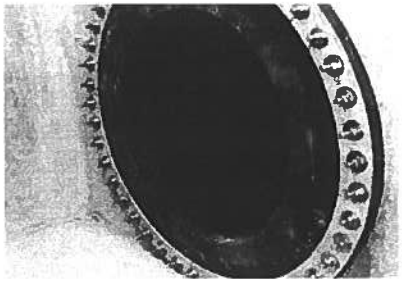
Rectangular Pipe CheckMate®

Rubber Flanged

Rubber Flanged CheckMate® Valves can be manufactured with an integral rubber upstream or downstream flange. The flanged CheckMate® gets inserted into the host pipe, then can be bolted to a mating flange or anchored to a concrete headwall. The flange can be circular with standard drilling, or circular, square or rectangular with custom flange drilling. The valve is supplied with retaining rings for mounting.

Thimble Inserts

A CheckMate® Thimble Insert is simply a CheckMate® Valve that is factory installed, clamped and pinned into flanged or plain-end pipe. The thimble insert assembly can either be inserted into the I.D. of the host pipe, or can be mounted to a mating flange or concrete headwall and extend beyond the pipe. Plain end thimble inserts are inserted into the host pipe and non-shrink grout is placed between the thimble insert O.D. and host pipe I.D. to form the seal.



Upstream Flanged CheckMate®

CheckMate® Thimble Insert

Red Valve Company, Inc.

Tide Technologies

600 N. Bell Ave.
Carnegie, PA 15106

PHONE
412/279-0044

FAX
412/279-7878

www.redvalve.com

"Rely on Red" for a Total System Solution to Your Water and Wastewater Treatment Challenges

No other company can match Red Valve's "Total System Solution" for water and wastewater treatment plants and municipal collection and distribution systems.

Since 1953, Red Valve has provided products for each phase of collection, distribution, separation, aeration, treatment and final discharge. Our complete product line provides customers with one source for on/off and control valves, check valves, pressure measurement, expansion compensation, air diffusers and effluent diffusers. All Red Valve products are designed to handle the rigors of handling raw sewage, sludge, scum and grit with abrasion-resistant, non-clogging designs.

Contact us today for a free copy of our new "Total System Solution" brochure for Municipal Collection and Distribution, or our comprehensive Valve Selection Guide for Wastewater Treatment.

BEACON ENGINEERING LLC
23318 Cedar Lane | Georgetown | Delaware | 19947
Phone: 302 864-8825 | Email: info@beaconengineeringllc.com

Project: Read Ave Outfall Improvements
Subject: Option 1 - HDPE Flap Valve
Date: 10/3/2023 Revised:
Project Number: DEW01-01(1) Revised:
Tax Map:

This option consists of removal and salvage to the Town of existing HDPE flared end sections and split couplings, installation of 2 HDPE caps, and installation of 1 HDPE flap valve.

Add options
- Installation of additional valves if warranted to ensure storm convey
- Installation of a gabion wall to mitigate sand migration and maintain depth of plunge pool at outfall
- Installation of 150 GPM pump and float control installed in last existing structure

Item No.	Description	Quantity	Unit	Cost / Unit	Total Price
1	Mobilization (Maximum 5% of Total Cost)	1	EA	$1,600	$1,600
2	USA Waterworks 36" HDPE Flap Valve	1	EA	$11,100	$11,100
3	36" HDPE End Cap & Split Coupling	2	EA	$2,500	$5,000
4	Daily Labor Rate	2	DAY	$3,800	$7,600
5	Dump Truck	2	DAY	$665	$1,330
6	Excavator	2	DAY	$1,700	$3,400
7	Pickup-Crew Truck	2	DAY	$210	$420
8	FlatBed Trailer	2	DAY	$350	$700

Total Items	$30,500
Engineering & Construction Admin	$4,600
Contractor Admin	$3,100
Contingency	$6,100
Total Base Estimate	**$44,300**
Add Option for Additional Valves (per Valve)	**$17,825**

EXHIBIT V

BEACON ENGINEERING LLC
23318 Cedar Lane | Georgetown | Delaware | 19947
Phone: 302.864.8825 | Email: info@beaconengineeringllc.com

Project: Read Ave Outfall Improvements
Subject: Option 1 - HDPE Flap Valve
Date: 10/3/2023 Revised:
Project Number: DEW01-01(1) Revised:
Tax Map:

Gabion Wall Budget

Item No.	Description	Quantity	Unit	Cost / Unit	Total Price
1	Mobilization (Maximum 5% of Total Cost)	1	EA	$1,000	$1,000
2	Furnish & Install 54" x 36" Gabion Wall	12	SY	$500	$6,000
3	Daily Labor Rate	2	DAY	$3,800	$7,600
4	Dump Truck	2	DAY	$665	$1,330
5	Excavator	2	DAY	$1,700	$3,400
6	Pickup-Crew Truck	2	DAY	$210	$420
7	FlatBed Trailer	2	DAY	$350	$700

Total Items	$20,500
Contractor Admin	$2,100
Contingency	$4,100
Add Option for Gabion Wall	**$26,700**

Float Controlled Sump Pump

Item No.	Description	Quantity	Unit	Cost / Unit	Total Price
1	Mobilization (Maximum 5% of Total Cost)	1	EA	$1,700	$1,700
2	150 gpm Non-Clog Submersible Pump	1	EA	$6,500	$6,500
3	Float Control	1	LS	$1,500	$1,500
4	Remove and Install New Structure Top Slab	1	LS	$3,500	$3,500
5	Furnish & Install 4" PVC Force Main	40	LF	$50	$2,000
6	Daily Labor Rate	4	DAY	$3,800	$15,200
7	Dump Truck	1	DAY	$665	$665
8	Excavator	1	DAY	$1,700	$1,700
9	Pickup-Crew Truck	4	DAY	$210	$840
10	FlatBed Trailer	1	DAY	$350	$350

Total Items	$34,000
Engineering & Construction Admin	$5,100
Contractor Admin	$3,400
Contingency	$6,800
Add Option for Sump Pump	**$49,300**

Assumptions:

1. Cost basis taken from recent projects of similar scope and size, RS Means national average prices, etc. and was adjusted for inflation.
2. Cost Estimate does not consider use of State or Federal Prevailing Wage scales, if required.
3. Cost estimate assumes that last existing structure is capable of housing 1 4" submersible pump.

BEACON ENGINEERING LLC
23318 Cedar Lane | Georgetown | Delaware | 19947
Phone: 302.864.8825 | Email: info@beaconengineeringllc.com

Project: Read Ave Outfall Improvements
Subject: Option 2 - Tideflex In Line Check Valve
Date: 10/3/2023 Revised:
Project Number: DEW01-01(1) Revised:
Tax Map:

This option consists of removal and salvage to the Town of existing HDPE flared end sections and split couplings, installation of 2 HDPE caps, and installation of 1 Tideflex Checkmate In-Line check valve.

Add options
- Installation of additional valves if warranted to ensure storm convey
- Installation of a gabion wall to mitigate sand migration and maintain depth of plunge pool at outfall
- Installation of 150 GPM pump and float control installed in last existing structure

Item No.	Description	Quantity	Unit	Cost / Unit	Total Price
1	Mobilization (Maximum 5% of Total Cost)	1	EA	$1,800	$1,800
2	TideFlex Checkmate In-Line Check Valve	1	EA	$16,200	$16,200
3	36" HDPE End Cap & Split Coupling	2	EA	$2,500	$5,000
4	Daily Labor Rate	2	DAY	$3,800	$7,600
5	Dump Truck	2	DAY	$665	$1,330
6	Excavator	2	DAY	$1,700	$3,400
7	Pickup-Crew Truck	2	DAY	$210	$420
8	FlatBed Trailer	2	DAY	$350	$700

Total Items	$35,800
Engineering & Construction Admin	$5,400
Contractor Admin	$3,600
Contingency	$7,200
Total Base Estimate	**$52,000**
Add Option for Additional Valves (per Valve)	**$22,925**

BEACON ENGINEERING LLC
23318 Cedar Lane | Georgetown | Delaware | 19947
Phone: 302.864.8825 | Email: info@beaconengineeringllc.com

Project: Read Ave Outfall Improvements
Subject: Option 2 - Tideflex In Line Check Valve
Date: 10/3/2023 Revised:
Project Number: DEW01-01(1) Revised:
Tax Map:

Gabion Wall Budget

Item No.	Description	Quantity	Unit	Cost / Unit	Total Price
1	Mobilization (Maximum 5% of Total Cost)	1	EA	$1,000	$1,000
2	Furnish & Install 54" x 36" Gabion Wall	12	SY	$500	$6,000
3	Daily Labor Rate	2	DAY	$3,800	$7,600
4	Dump Truck	2	DAY	$665	$1,330
5	Excavator	2	DAY	$1,700	$3,400
6	Pickup-Crew Truck	2	DAY	$210	$420
7	FlatBed Trailer	2	DAY	$350	$700

Total Items	$20,500
Contractor Admin	$2,100
Contingency	$4,100
Add Option for Gabion Wall	**$26,700**

Float Controlled Sump Pump

Item No.	Description	Quantity	Unit	Cost / Unit	Total Price
1	Mobilization (Maximum 5% of Total Cost)	1	EA	$1,700	$1,700
2	150 gpm Non-Clog Submersible Pump	1	EA	$6,500	$6,500
3	Float Control	1	LS	$1,500	$1,500
4	Remove and Install New Structure Top Slab	1	LS	$3,500	$3,500
5	Furnish & Install 4" PVC Force Main	40	LF	$50	$2,000
6	Daily Labor Rate	4	DAY	$3,800	$15,200
7	Dump Truck	1	DAY	$665	$665
8	Excavator	1	DAY	$1,700	$1,700
9	Pickup-Crew Truck	4	DAY	$210	$840
10	FlatBed Trailer	1	DAY	$350	$350

Total Items	$34,000
Engineering & Construction Admin	$5,100
Contractor Admin	$3,400
Contingency	$6,800
Add Option for Sump Pump	**$49,300**

Assumptions:

1. Cost basis taken from recent projects of similar scope and size, RS Means national average prices, etc. and was adjusted for inflation.
2. Cost Estimate does not consider use of State or Federal Prevailing Wage scales, if required.
3. Cost estimate assumes that last existing structure is capable of housing 1 4" submersible pump.