Key Considerations for Choosing Underground Detention & Manufactured Water Quality Systems

Dana Hinaman – Stormwater Consultant
Chris Allen – Region Regulatory Manager

Agenda

- Underground Detention Solutions
  - Cost-Effectiveness
  - Site Considerations
  - Maintenance
- Hydrodynamic Separation (HDS)
  - Site Considerations
  - Maintenance
  - Case Study
- Filtration
  - Proper Sizing
  - Site Considerations
  - Maintenance
  - Case Study
- Resources

The Contech Way

STORMWATER SOLUTIONS

PIPE SOLUTIONS

STRUCTURES SOLUTIONS

Contech provides innovative, cost-effective site solutions to engineers, contractors and developers on projects across North America. Our portfolio includes bridges, drainage, erosion control, retaining wall, sanitary sewer and stormwater management products.

The experts you need to solve your stormwater challenges

Contech is the leader in stormwater solutions, helping engineers, contractors and owners with infrastructure and land development projects for over a century.

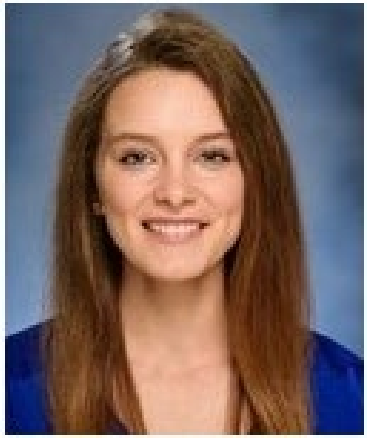
CONTECH ENGINEERED SOLUTIONS

Your Local Stormwater Team

Northern Ohio

STORMWATER CONSULTANT

I work with you to recommend the best solution to meet permitting requirements



STORMWATER DESIGN ENGINEER

I help develop your final design deliverables

REGULATORY ASSOCIATE

I understand the local stormwater regulations and what solutions will be approved

SALES ENGINEER

I make sure our solutions meet the needs of the contractor during construction

Your Local Stormwater Team

Southern Ohio

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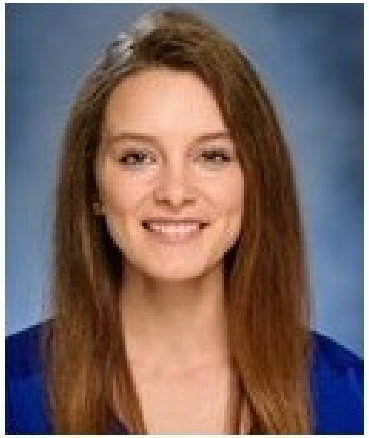

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Innovative, cost - effective site solutions across North America

DESIGN

Provides engineers with technically focused recommendations

- Preliminary product recommendations
- Feasibility screening
- Layout assistance
- Cost estimates and options analysis

SPECIFICATION

Helps engineers develop an efficient solution

- Engineering calculations
- Specifications
- Site-specific drawings
- Submittal packages

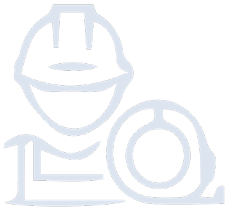
PERMITTING

Makes sure all recommendations are approved locally

- Product approvals
- Regulatory stakeholder engagement
- Field and lab evaluation
- Project-specific regulatory support

INSTALLATION

Supports contractors and owners through the entire process



- Pricing and value engineering assistance
- Project coordination
- Installation guidance
- Issue resolution
- Customer service

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Material Choices

Corrugated Metal Pipe

DuroMaxx

ChamberMaxx

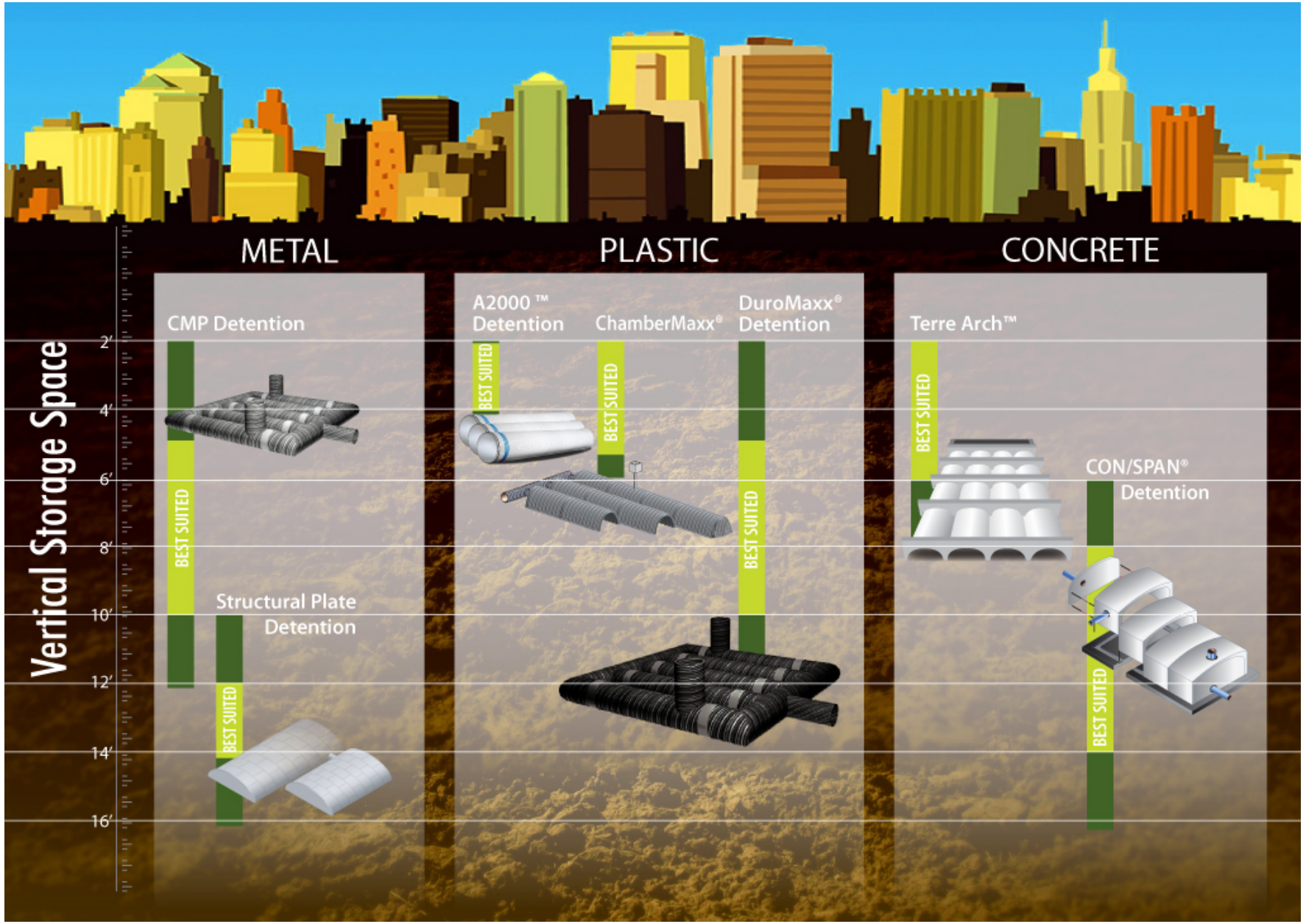
Terre Arch

CON/SPAN

Key Considerations

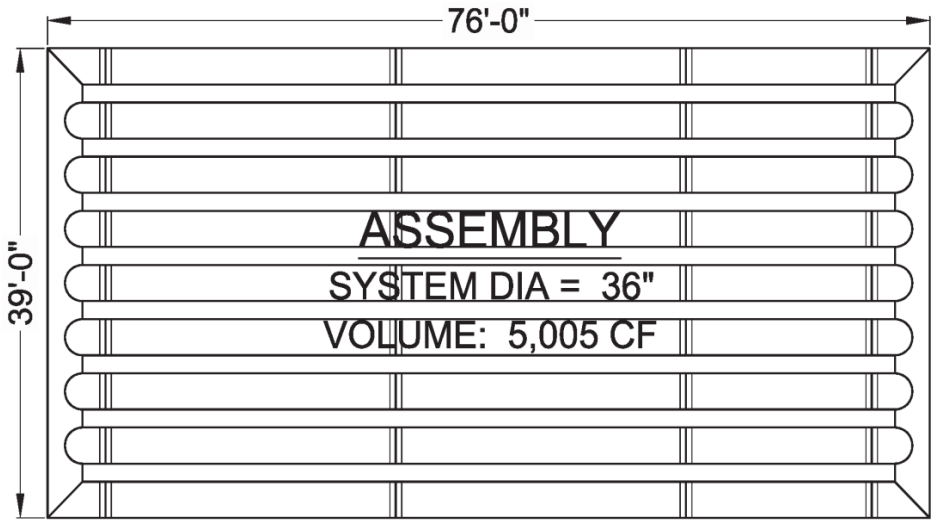
- Effective depth
- Limiting widths/lengths
- Infiltration opportunities
- Minimizing footprint
- Maintenance

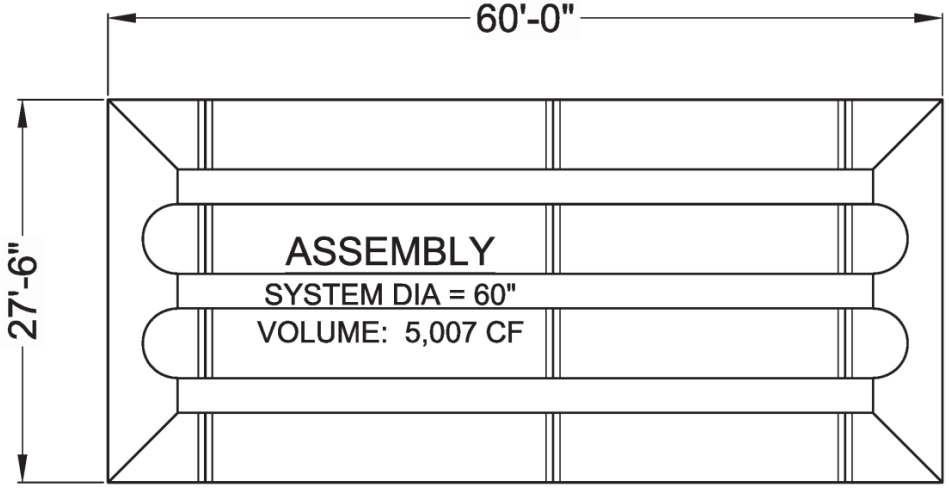
Detention Solutions



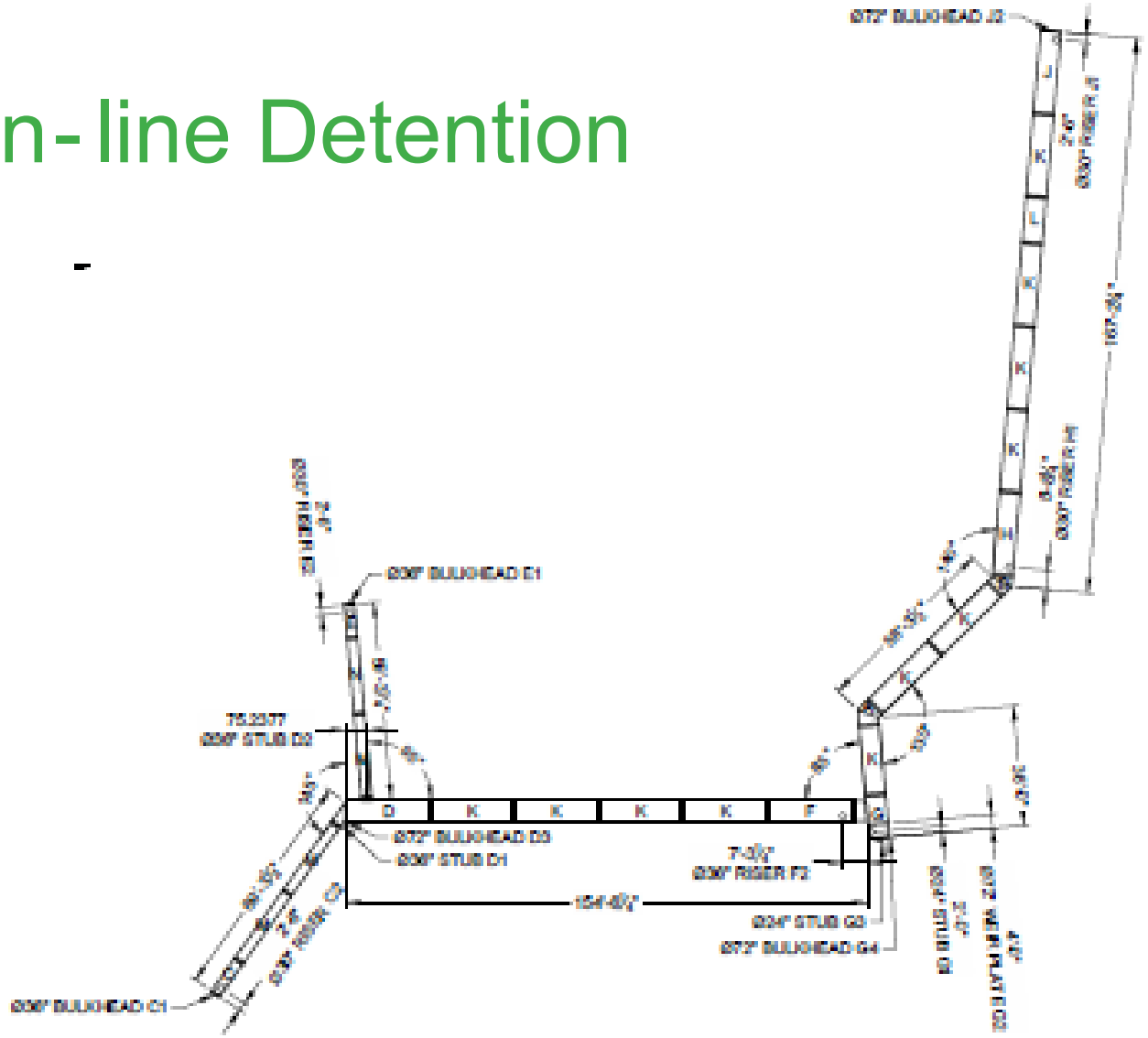
Maximizing Depth

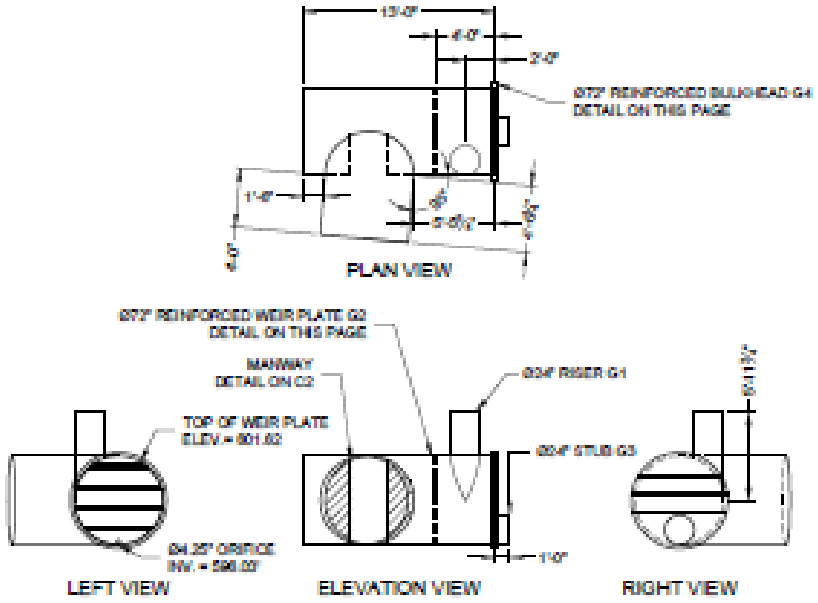
- Cost Saving Factors
  - Maximizing depth
  - Minimizing excavation / footprint of system





In-line Detention





Open Systems: Using Stone for Storage

- Utilize void space of the stone backfill to store water
- Generally accepted: 40% void space
  - Some municipalities are decreasing allowable void space
  - Some requiring additional volume for sediment storage

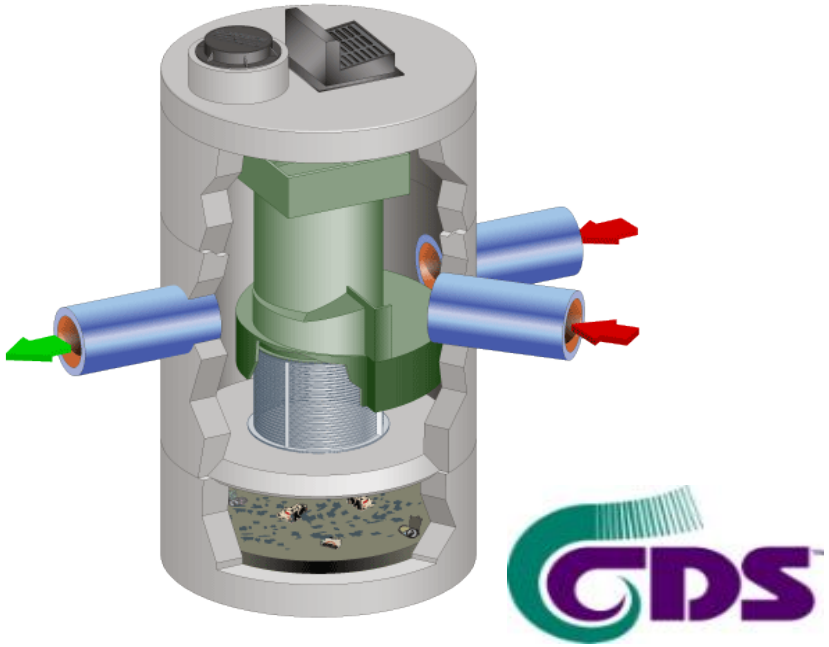
Inspection & Maintenance

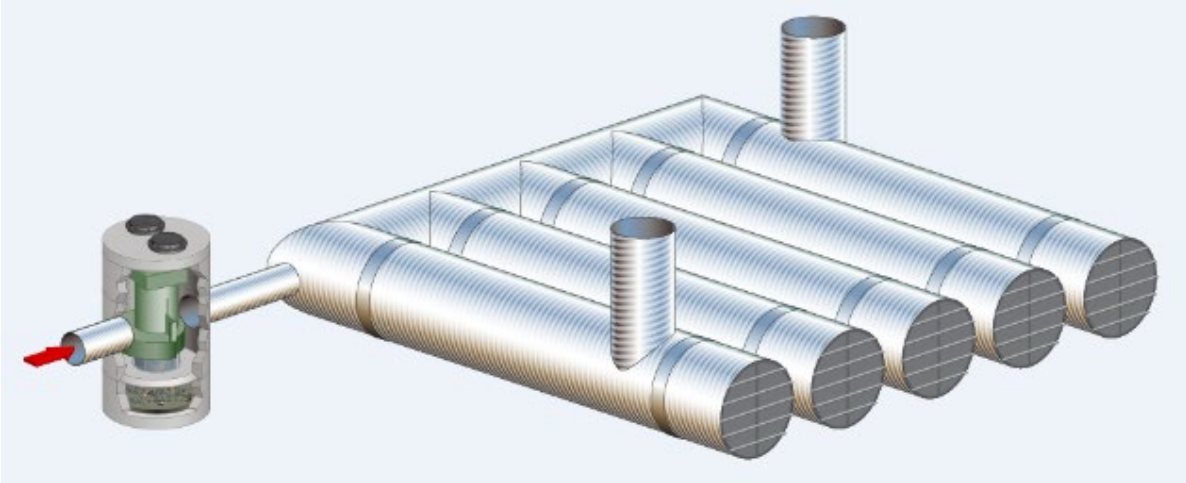
- Address during design
- Inspection Protocol
  - How will the system be visually inspected?
  - Are ample access points provided?
  - Can someone physically access the system if needed?
  - Inspection frequency – quarterly, semi-annual, annually
- Maintenance
  - Determine appropriate maintenance frequency based on inspections
  - Determine appropriate maintenance methods

Inspection & Maintenance

Pretreatment

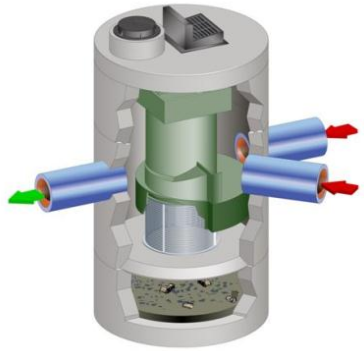
- Protects outlet control structures
- Remove sediment prior to entering system
- Consolidate sediment in one location
  - Water Quality Structures are easier to maintain
- Maintain stone voids in perforated system
- Increase service life of system
- Meet local regulations





So Many Choices…

	Hydrodynamic Separation	Filtration
Pollutants of Concern	TSS	TSS, Nutrients, Metal
Target Particle Size Distribution	> 50 micron	< 50 micron
Recognized Testing Protocol	• Lab Testing: NJDEP • Fieldtesting: TARP Tier II	• Lab Testing: NJDE • Fieldtesting: TAPE or TARP Tier II
Placement Relative to Detention	• Upstream for effective performance	• Upstream or downstream



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Hydrodynamic Separator Fundamentals

Organize inflow energy & turbulence into a stable flow pattern

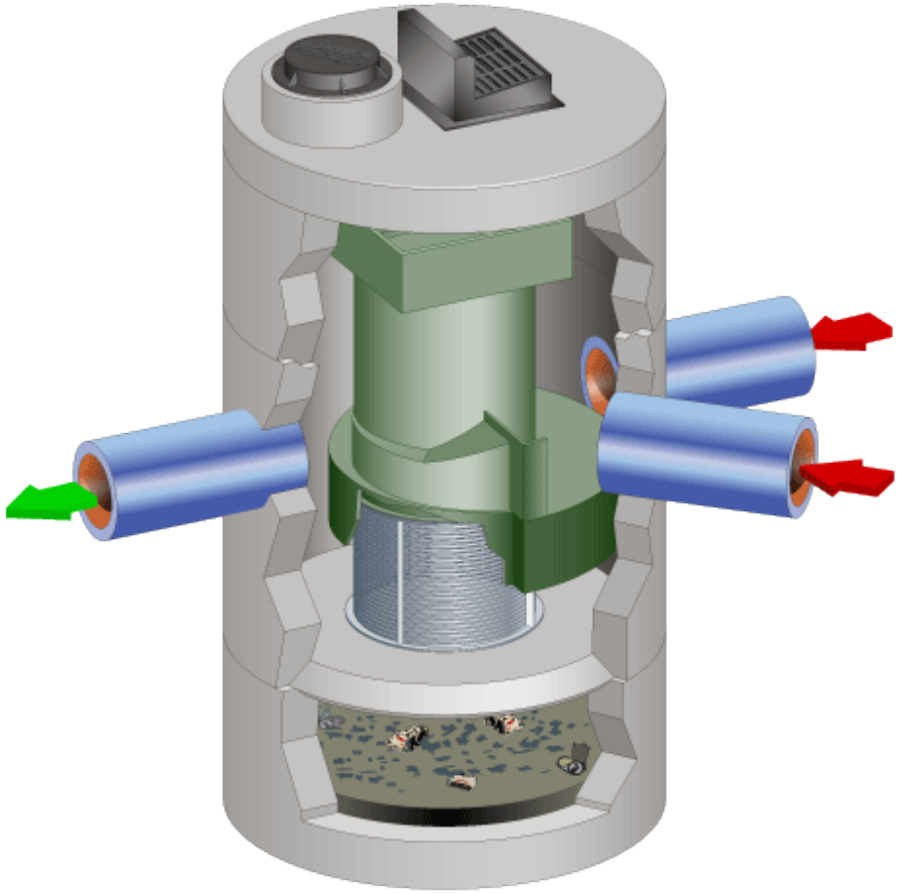
Swirl Concentration

Gravity Separation

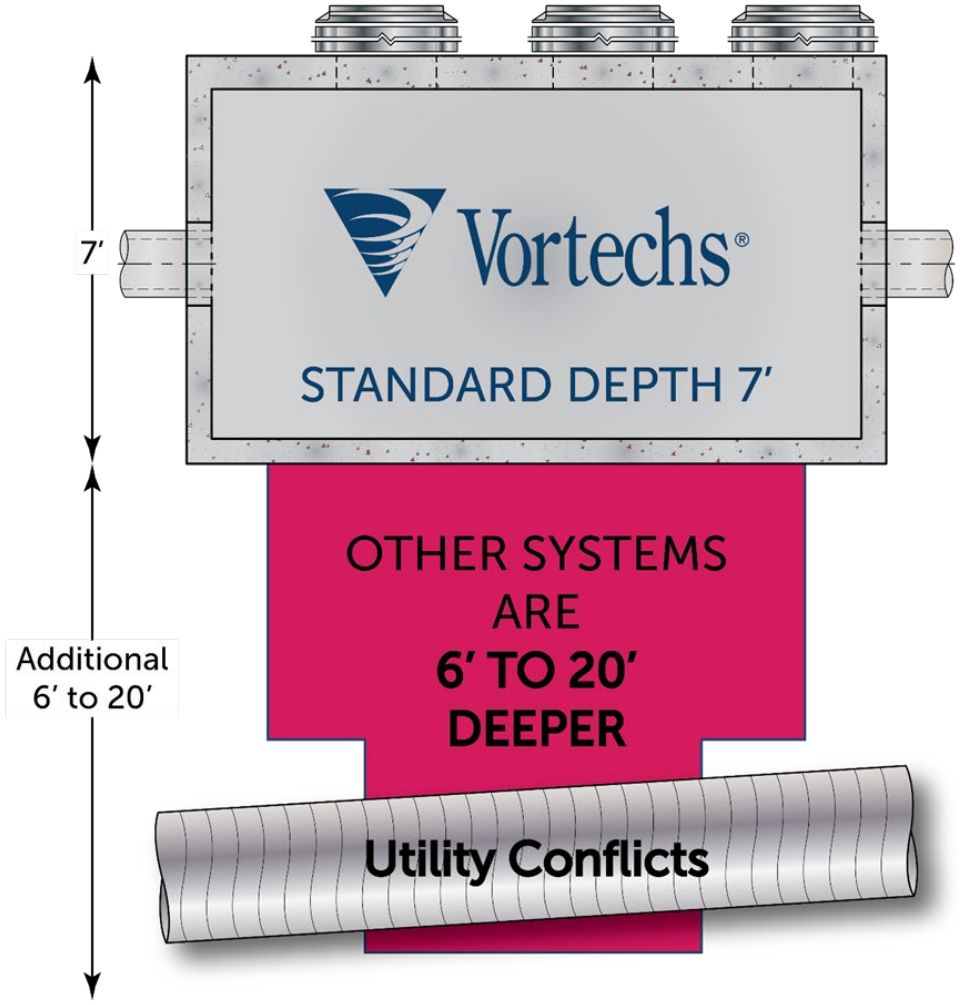
Flow Controls

Site Considerations for Selection

- Additional features in some HDS devices:
  - Junction Structure
  - Catch Basin
  - Hydrocarbons, FOGs
  - Trash/Neutrally Buoyant Materials

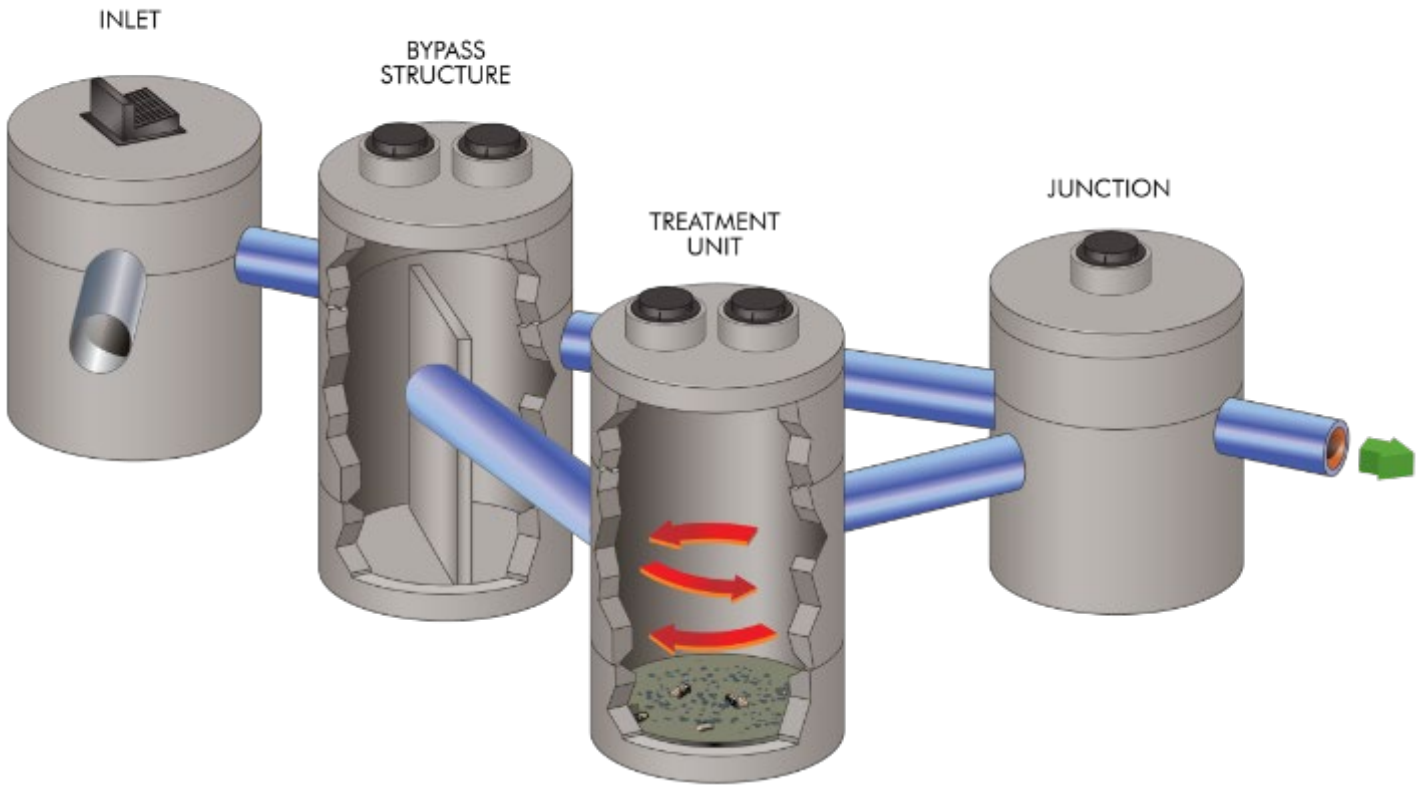


Site Considerations for Selection - Depth



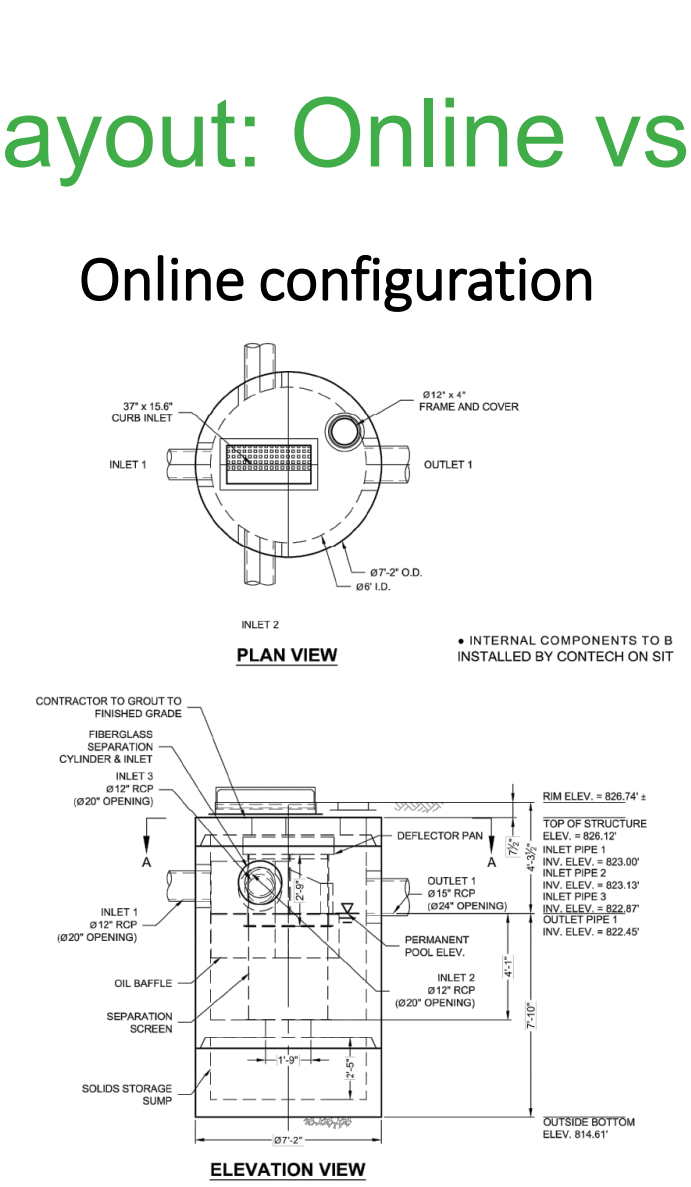
Layout: Online vs. Offline Positioning

Typical HDS system layout

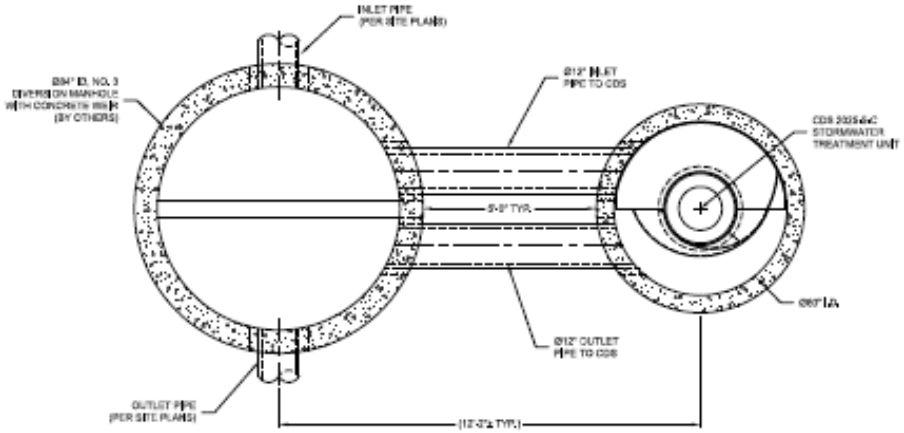


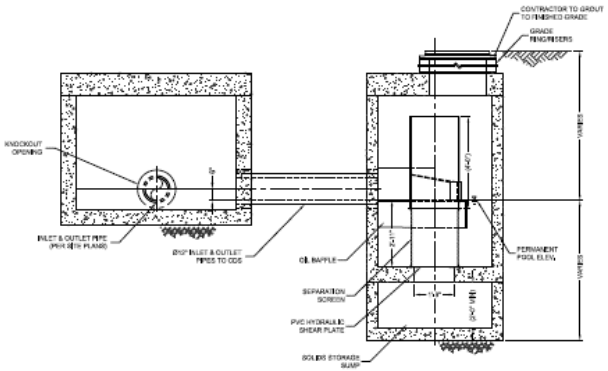
Layout: Online vs. Offline Positioning

Online configuration



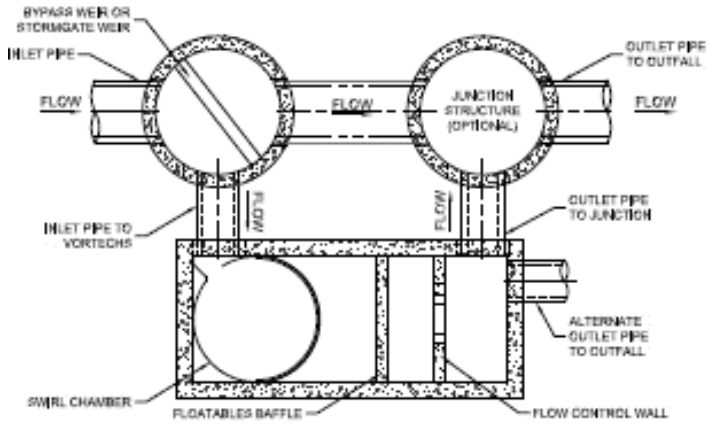
Offline configuration – Single Diversion/Junction Structure

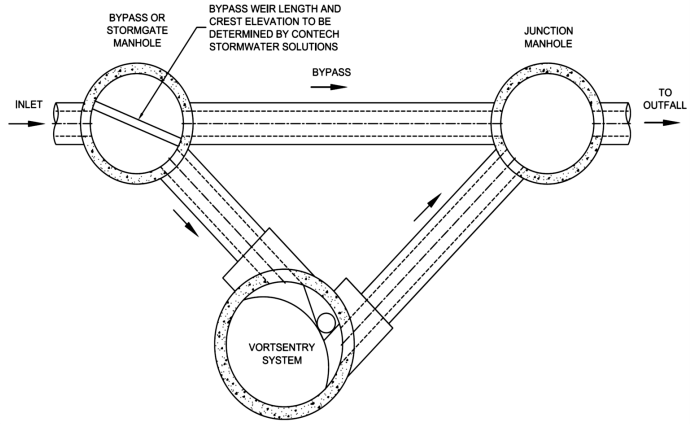


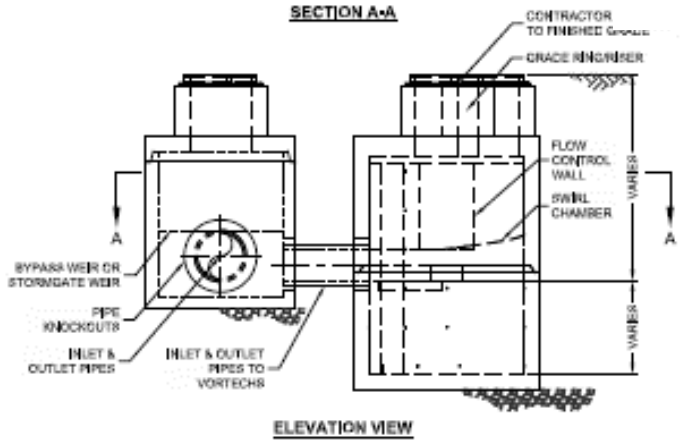


Layout: Alternate Offline Positioning

Offline configuration – Separate Diversion and Junction Structures



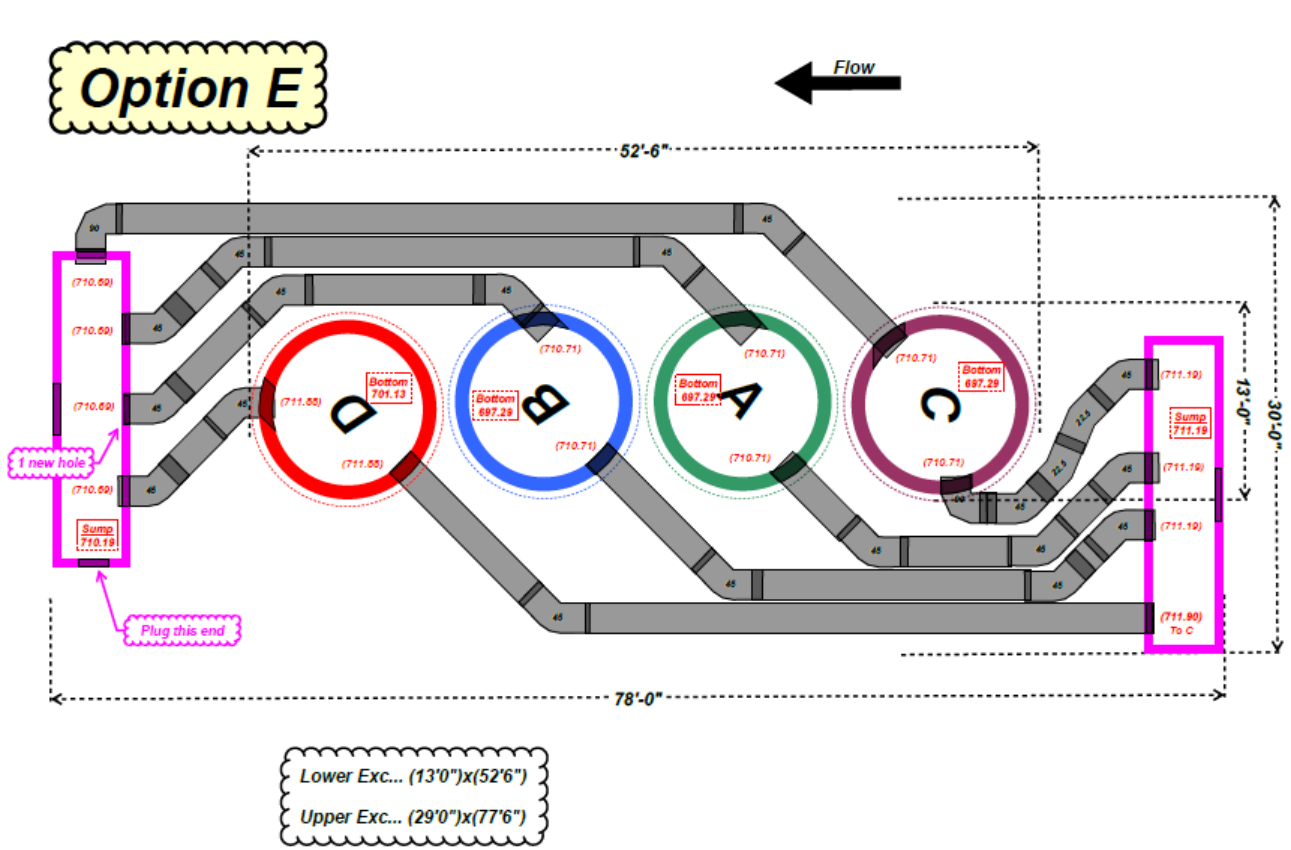




Inspection & Maintenance: HDS

Start

Finish



ODOT I-71/70 Interchange

Four 10-foot diameter CDS units were used to provide water quality treatment for 75 cfs of stormwater. Using the ODOT QPL for sizing and a placing the CDS units in parallel configuration provided large treatment capacity in a narrow footprint.

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Filtration Fundamentals

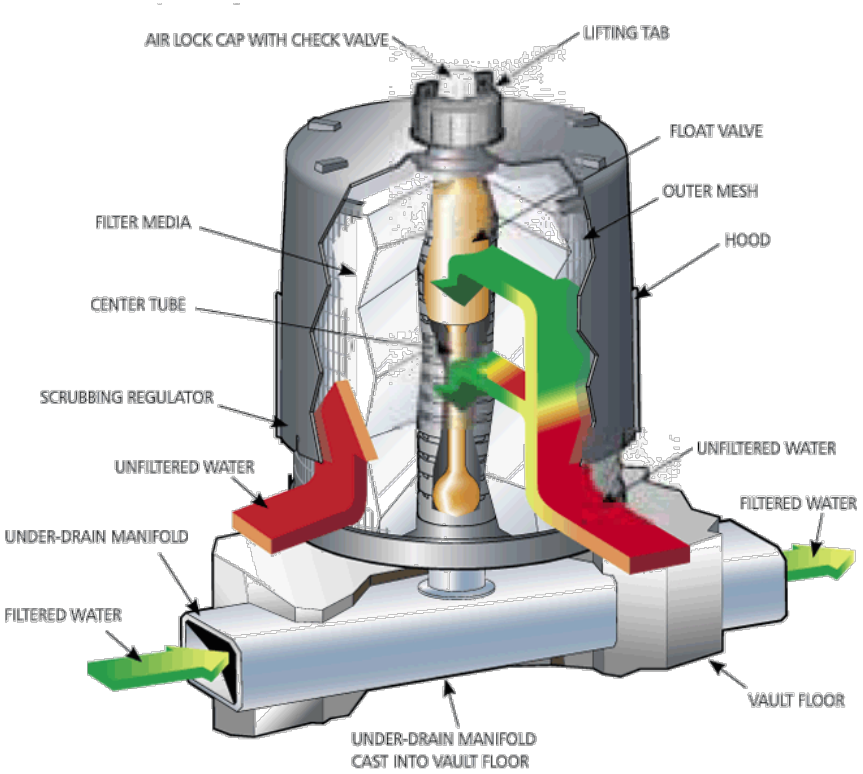
Filter Capabilities

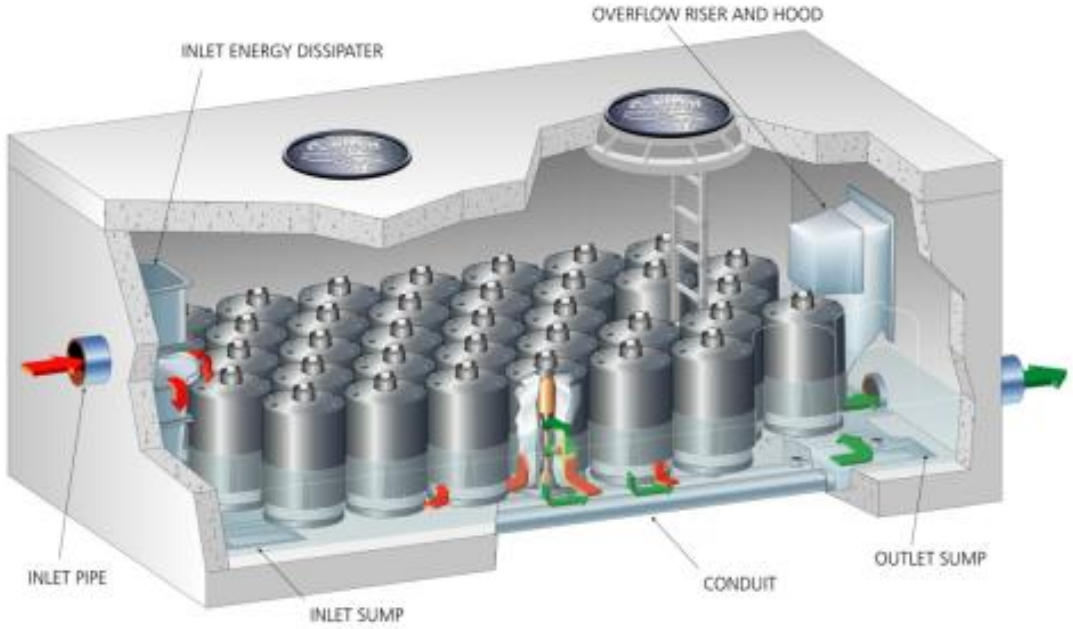
- Fine particle removal (<50 microns)
- Dissolved pollutant removal
- Customizable media to target specific pollutants

Typical Filter Applications

- Standalone Treatment
  - New Development
  - Redevelopment
- LID Pretreatment
  - Subsurface Infiltration
  - Rainwater Harvesting
- Polishing Treatment
  - Downstream of Detention

Innovative Media Filtration



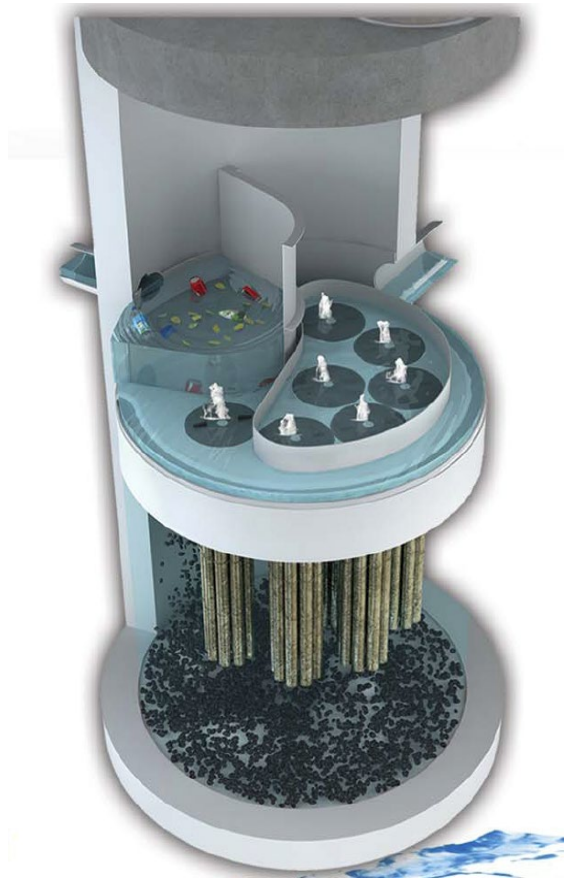


Innovative Membrane Filtration

Pleated Membrane Filter

Evolution of Filter Technology

Maximum Surface Area in
Compact System



Jellyfish Filter

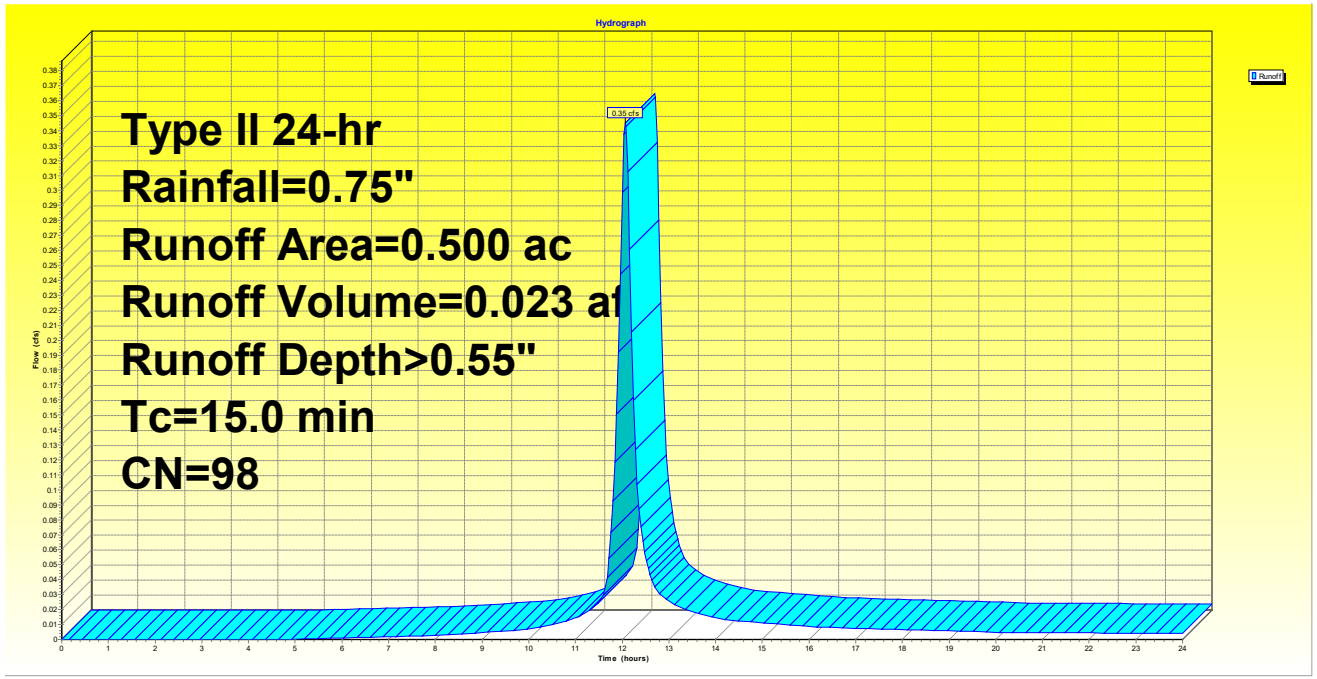
Basic Filter Properties

- Peak flow conveyance (ex: 0.05 cfs)
- Pollutant capacity prior to maintenance (ex. 54 lbs)
- Headloss and driving head required for filter to flow at published flow rate

Flow Based Filtration

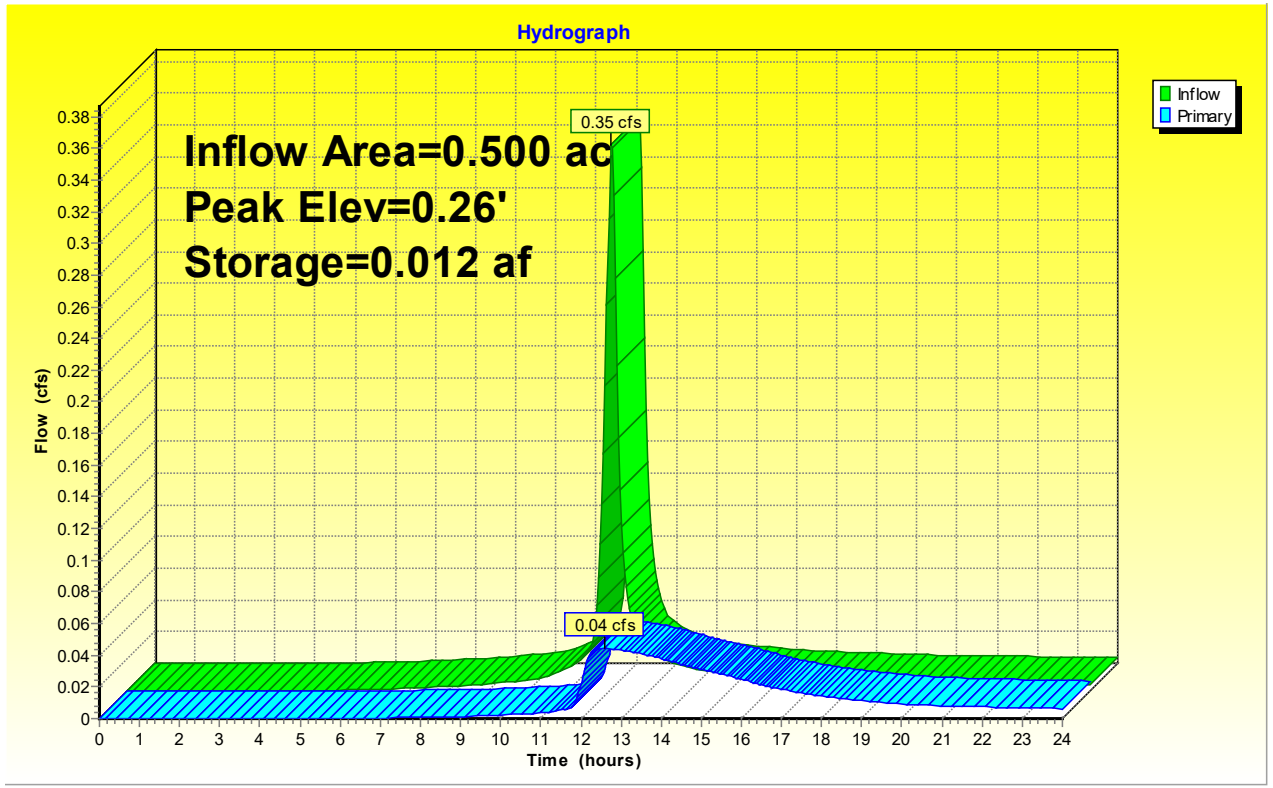
- Example:
  - Drainage Area: 0.5 acres
  - WQ Flow: 0.36 cfs

- Use: 8 StormFilter cartridges to treat 0.36 cfs



Volume Based Filter Sizing

- Post detention flow rate 0.04 cfs
  - Still treating the same runoff volume at a lower flow rate.
- Use: 1 StormFilter cartridge to treat 0.04 cfs



Mass Based Filter Sizing

- Post Same Site (0.5 acres)
  - 36 inches of rain annually (assumed)
  - Event mean concentration of pollutants (70 mg/l)

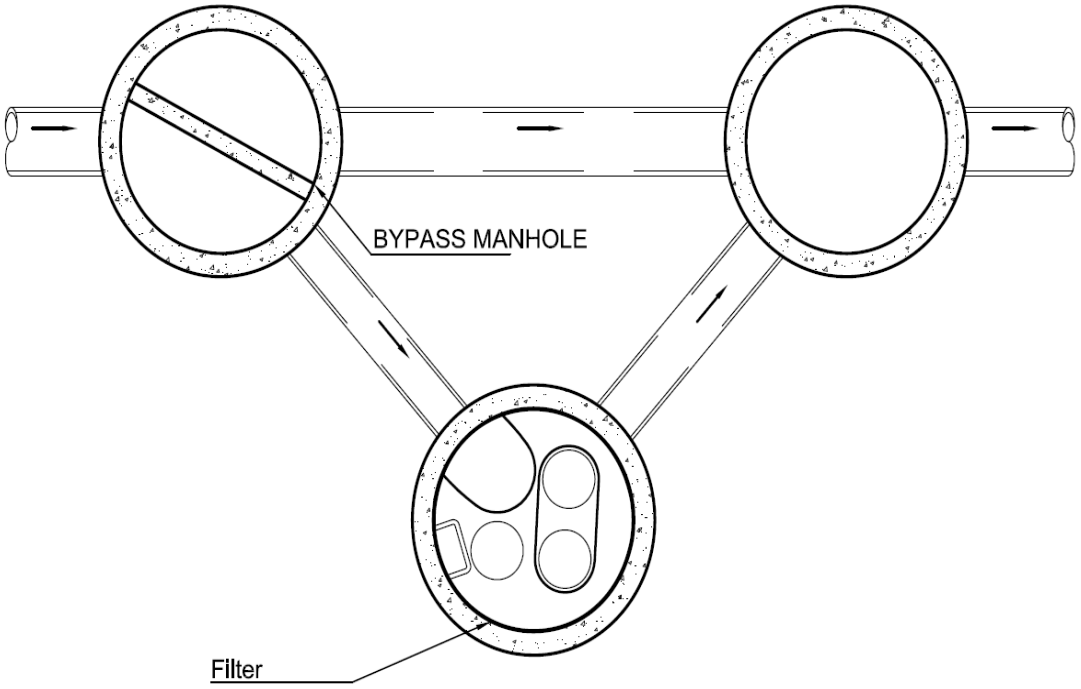
- 36”over 0.5 acres → 65,340 cf of water annually

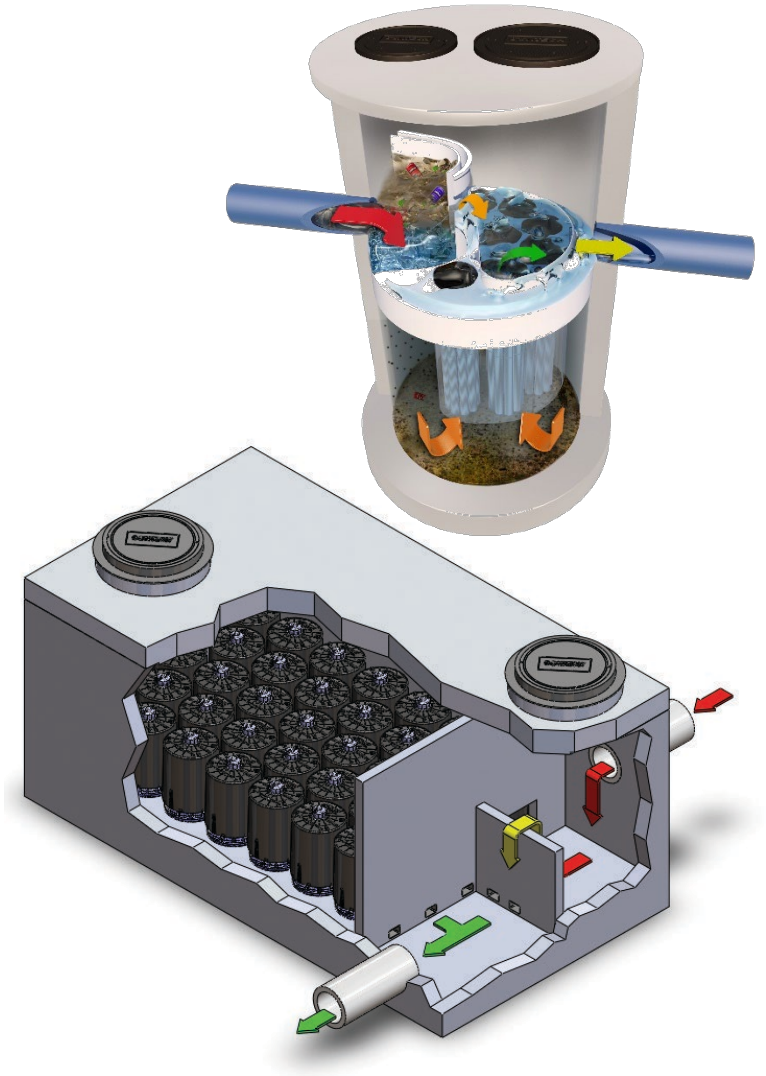
- 65,340 cf of water with a pollutant concentration of 70 mg/l → 285 lbs of pollutants annually

- $\frac{285\ lbs}{54\ lbs/cartridge}$ → 6 StormFilter cartridges

Filter Layouts

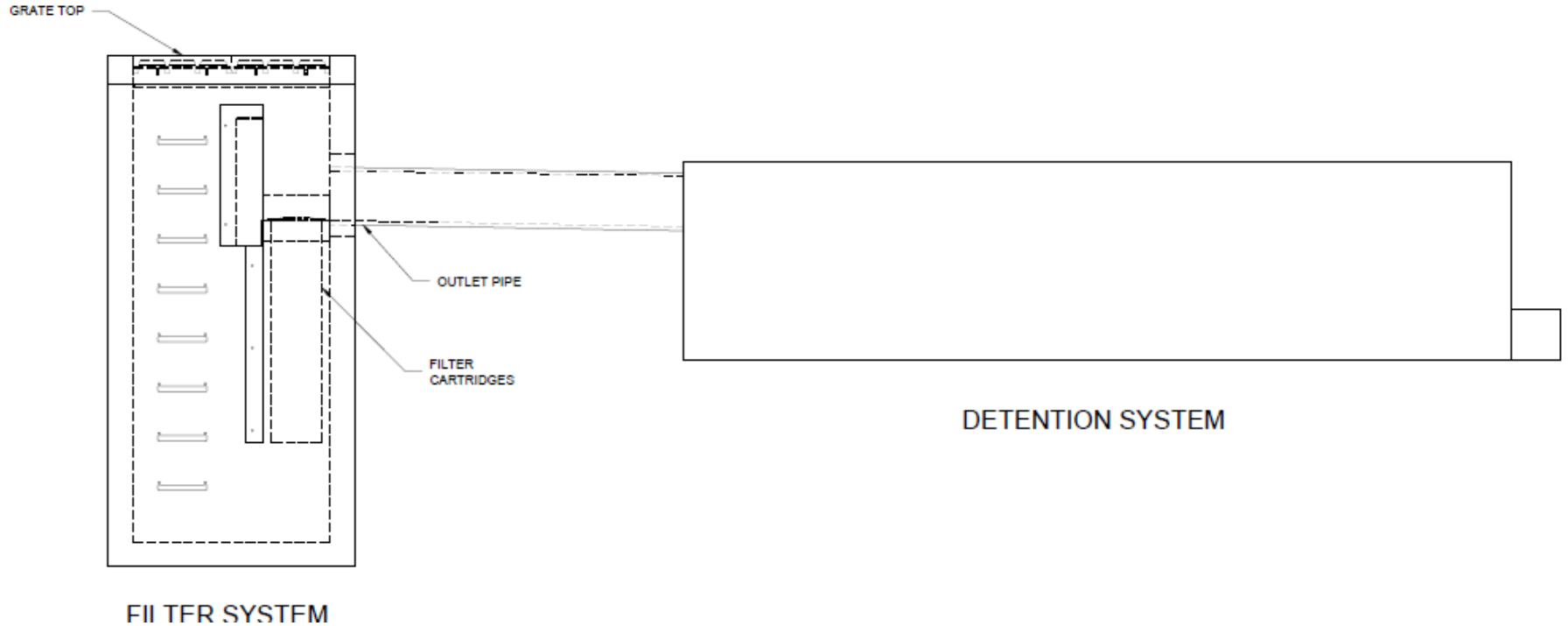
- Offline / Online





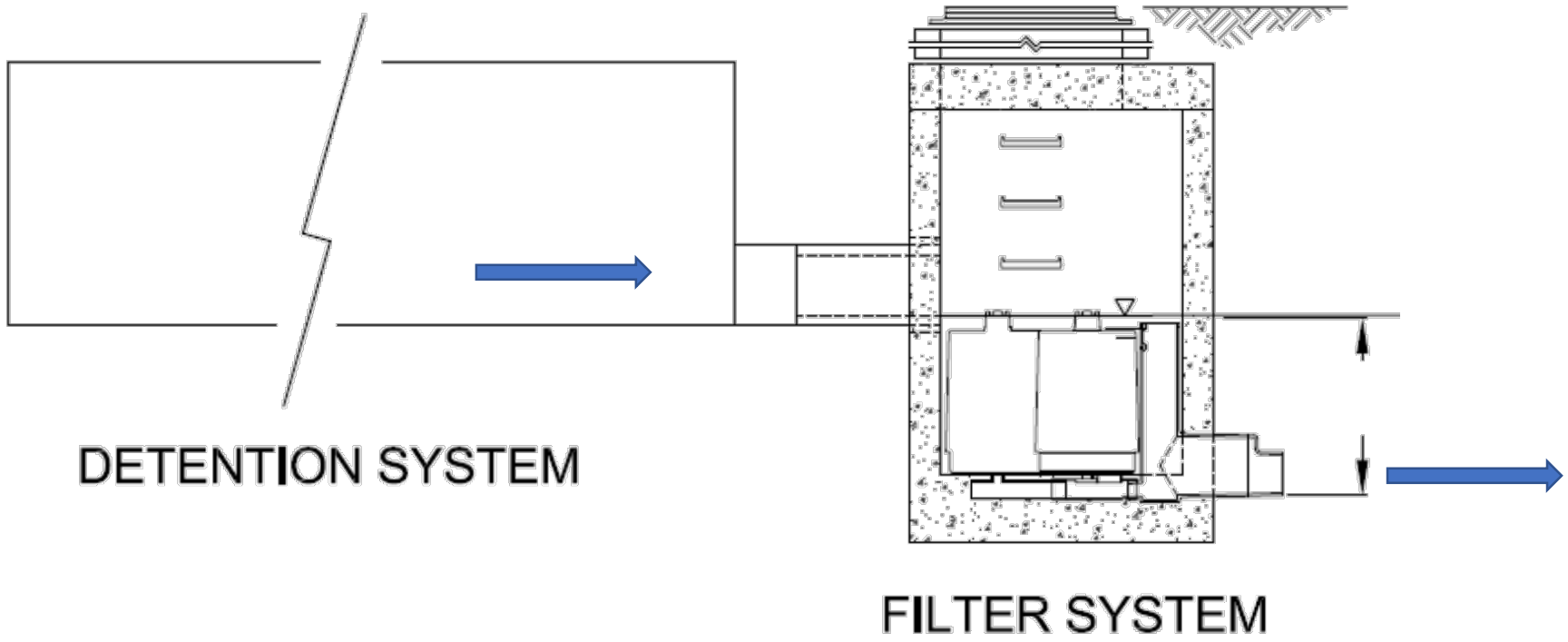
Filter Layouts

- Upstream of Detention
  - Pretreatment
  - Flow based



Filter Layouts

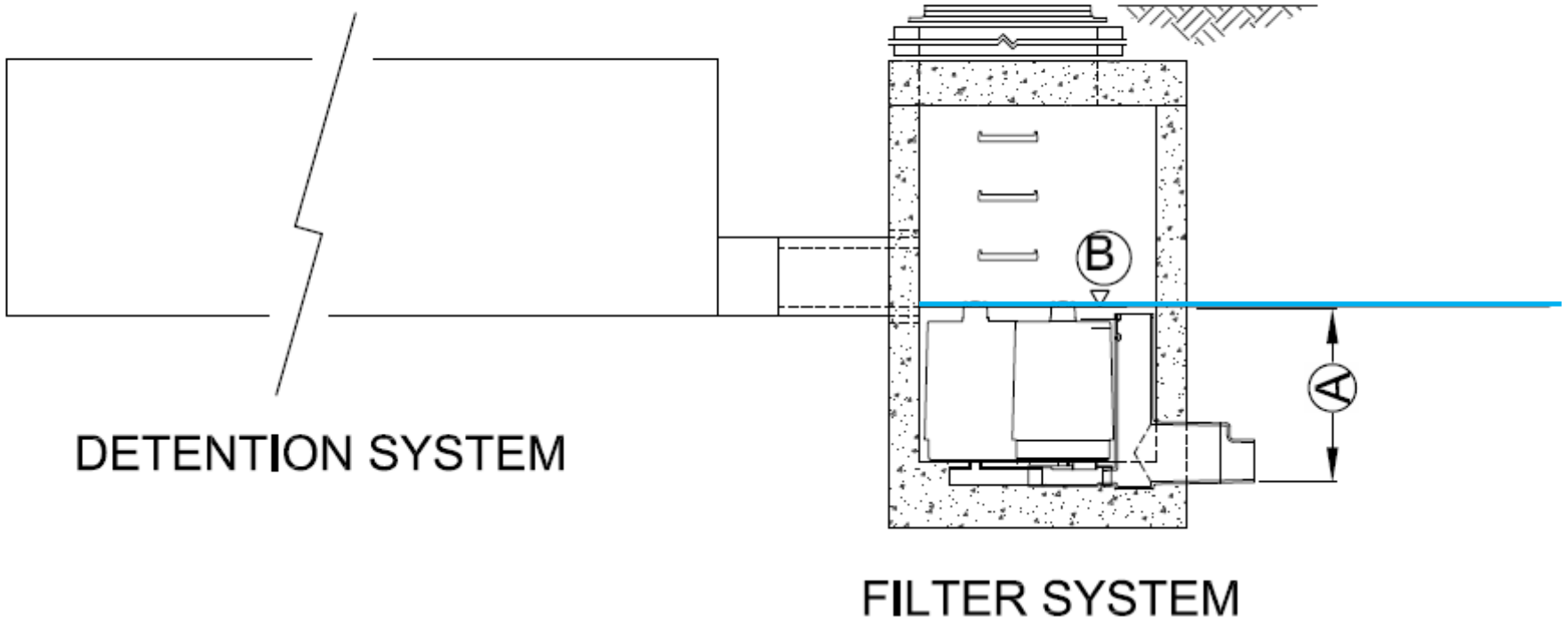
- Downstream of Detention
  - Decreased flow rate
  - Volume/mass based sizing
- Consider headloss associated with filter



Filter Layout Downstream of Detention

A) Head required for filter to operate at published flow rate

B) Water surface elevation during water quality storm



Filter Layout Downstream of Detention

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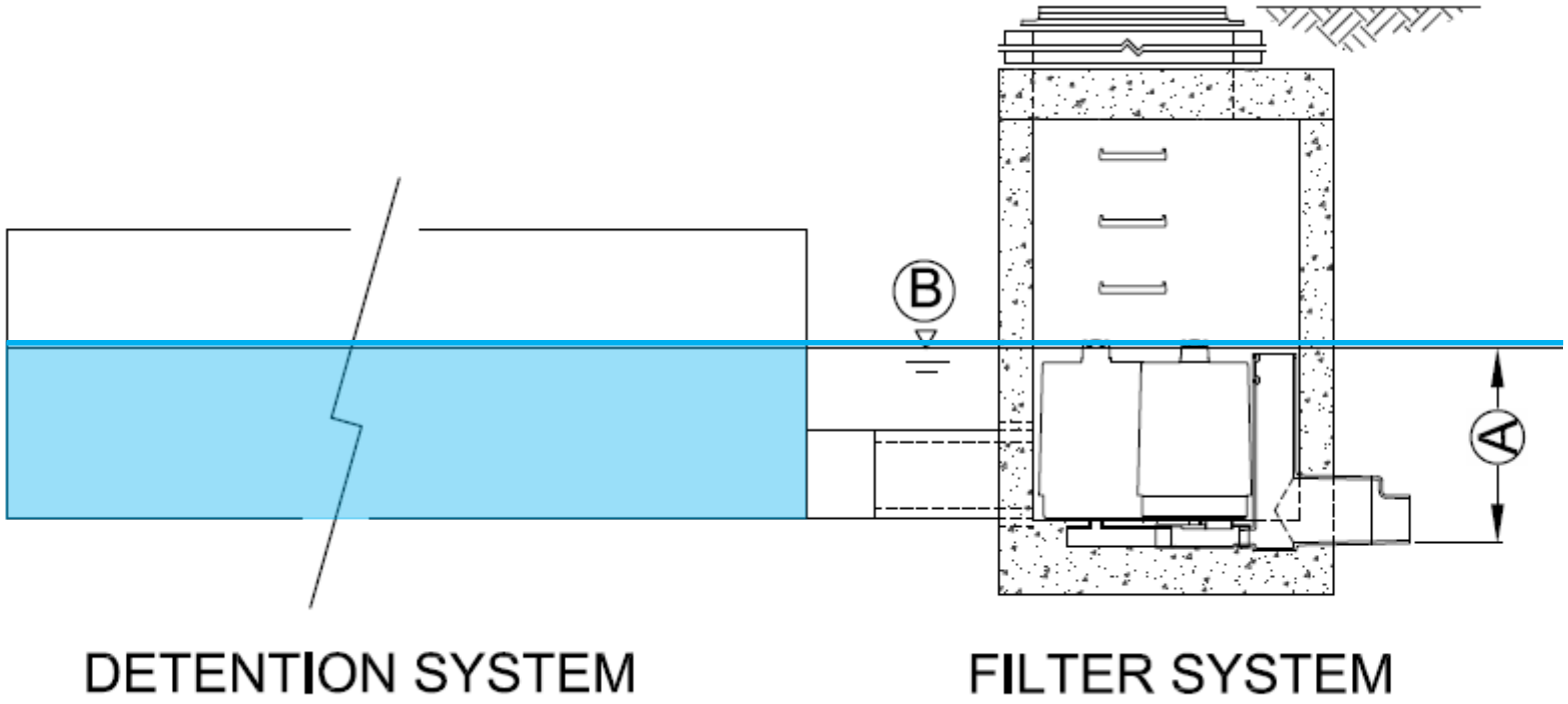
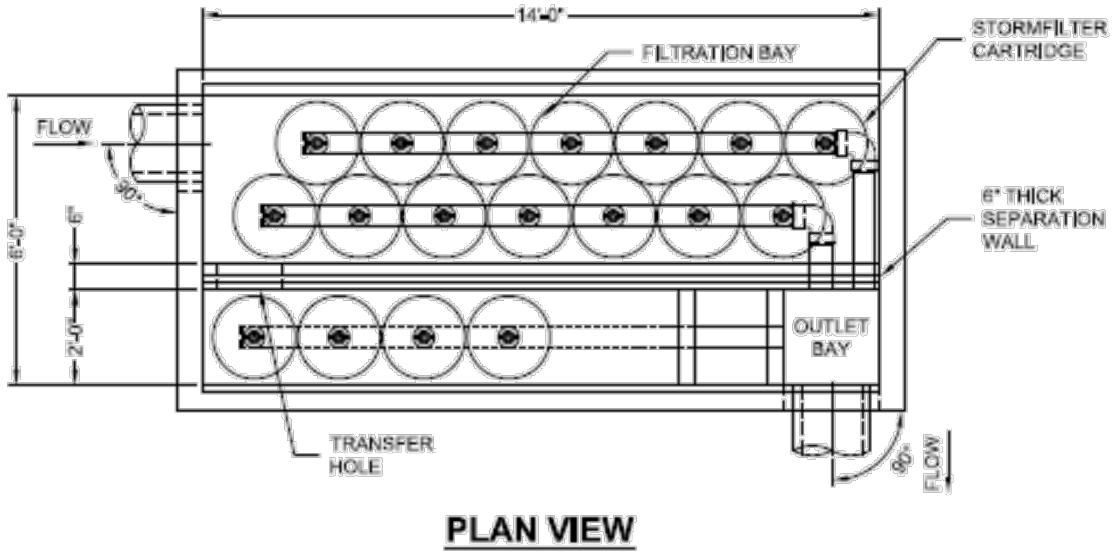


Inspection & Maintenance: Filter

- All filters will clog eventually!
- Things to consider:
  - Is the filter system easily accessible with a vac-truck?
  - Is there direct access to filter trough top slab openings?
  - Are the filter components easily replaceable without excavation of entire system

Inspection & Maintenance: Filter



PLAN VIEW

Alliance Hospitality – Cleveland, OH

A Linear Grate StormFilter equipped with (18) 18” tall cartridges provided water quality treatment for 0.57cfswhile meeting the tight depth and footprint constrictions. A grated top was used to eliminate an upstream catch basin.

CONTECH ENGINEERED SOLUTIONS

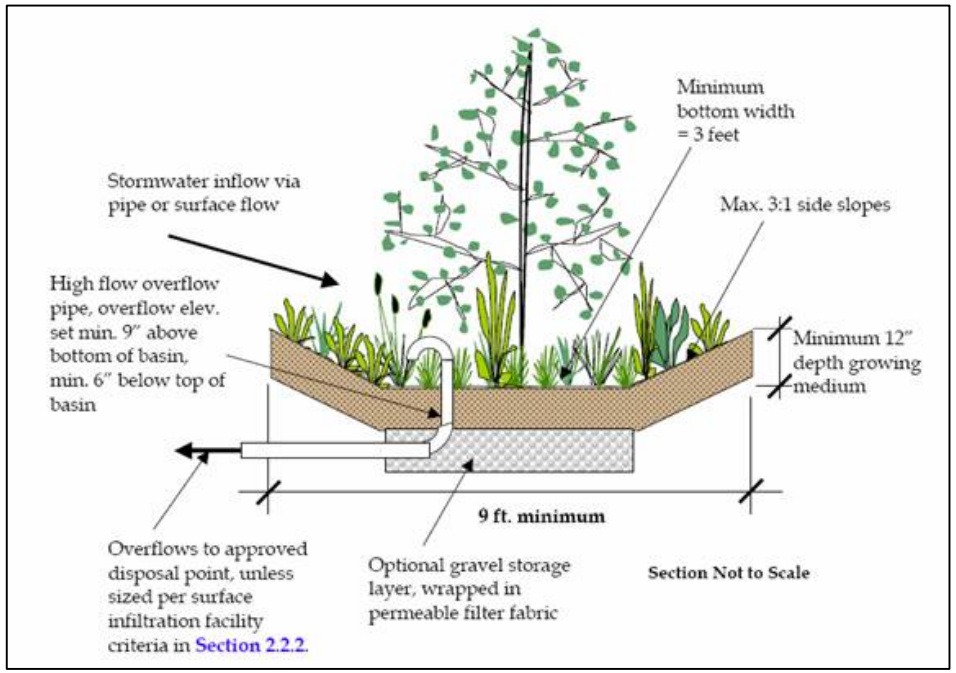
Bioretention

Benefits

- Provides volume reduction, detention and water quality benefits
- Adaptable to nearly every site
- Provides ancillary benefits like habitat, aesthetic appeal, heat island effect mitigation

Challenges

- Opportunities for failure abound
- Media sourcing and composition critical but QC often lacking
- Can be maintenance intensive



High Performance Biofiltration

- High Flow Media
  - Same principles as traditional biofiltration
  - 100+ inches/hr flowrate
  - Reduced footprint – typically 1% of tributary drainage area
  - Quality control of media composition

filterra
Bioretention Systems

Bioretention Sizing

- FSA: DA (Filter Surface Area : Drainage Area)
  - Volume based sizing
  - Example: 0.463%

- Flow Based
  - Example: 140 in/hr

Bioretention Configuration

- Traditional

Bioretention Configuration

- FilterraBioScape

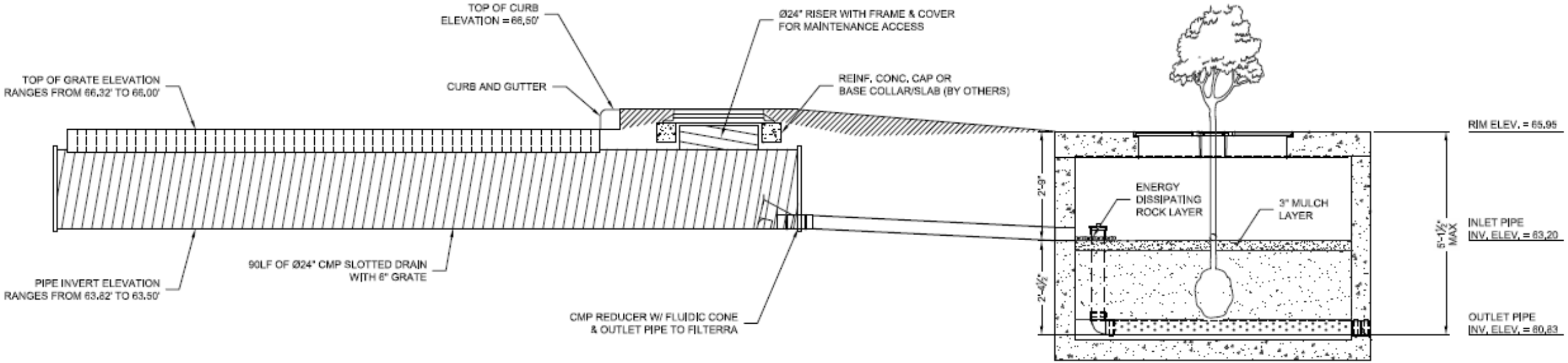
- Offline Filterra

Bioretention Configuration

- Pretreatment

Bioretention Configuration

- Downstream of slotted drain / detention pipe



Maintenance

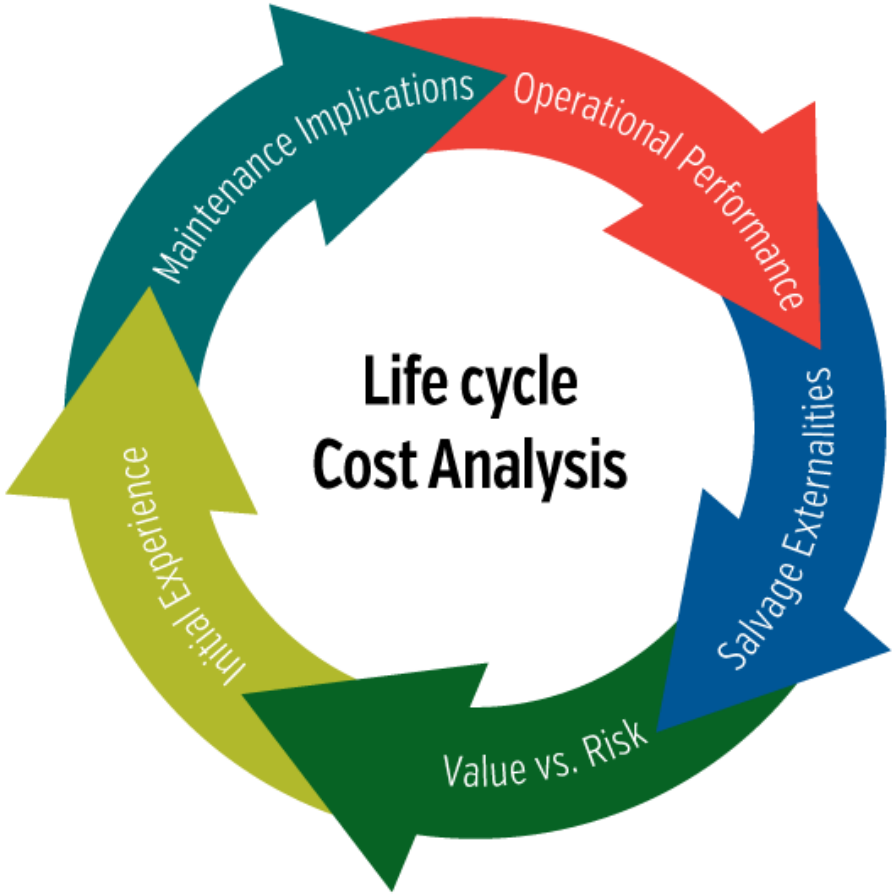
- Remove tree grate
- Remove debris, trash &mulch
- Replace mulch

Promedica – Toledo, OH

System was required to treat the first flush (0.75”) volume. The solution resulted in twelve offline Filterra units sized on a volume based design in accordance with the water quality flow.

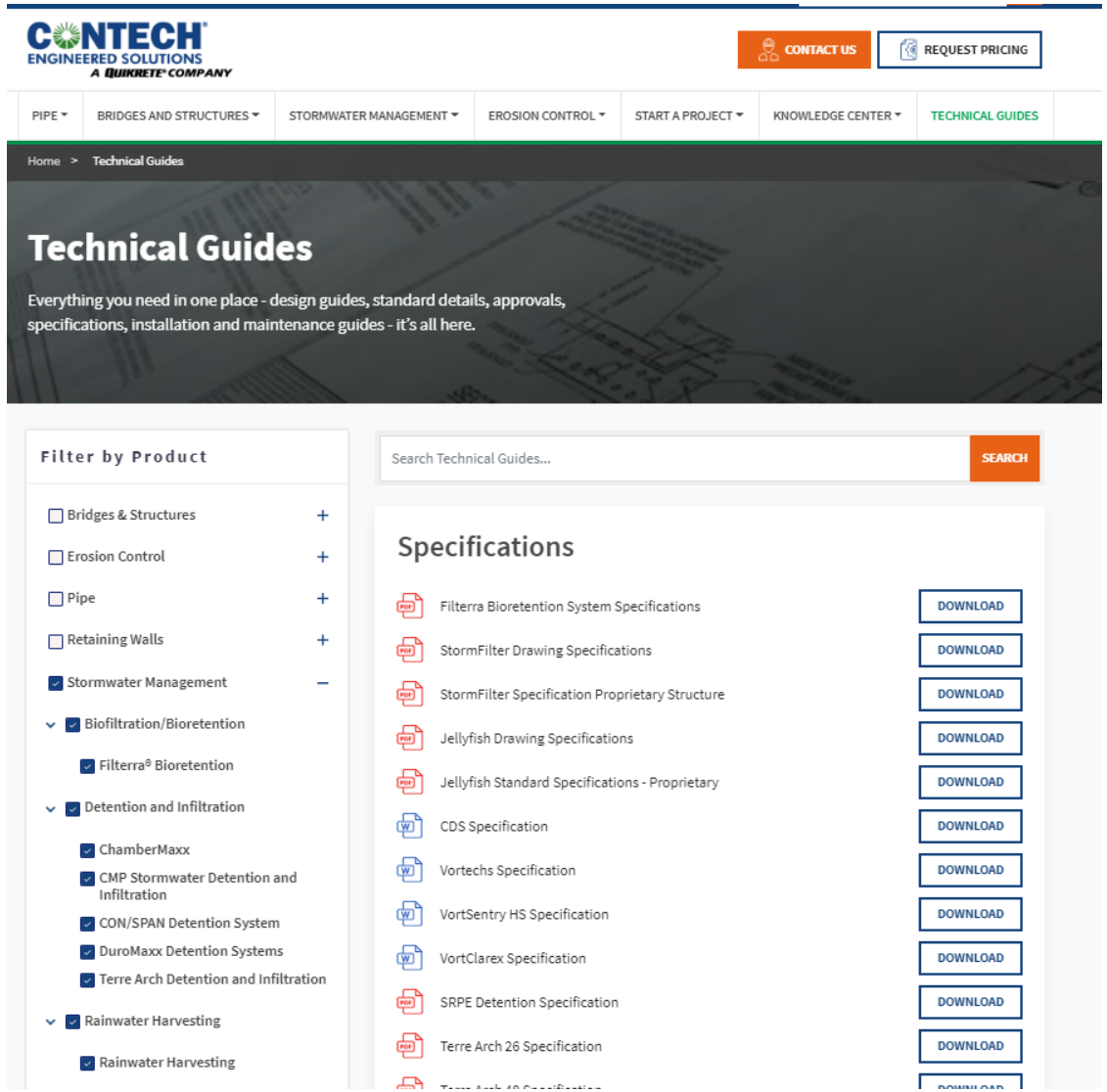
The Value of MTD's

- Business case where ponds are an amenity
  - May make sense for quality control, if not for quantity
- Costs for consideration in life cycle analysis
  - Material
  - Installation
  - Inspection
  - Maintenance
  - Maintenance intervals
  - Replacement
- Verified performance



Resources

- www.ContechES.com
  - Design your own tools
  - Product design worksheets
  - Technical documents
  - PDH articles
  - Case studies
  - Blogs
  - Certified maintenance providers
  - Local resources



Thank you!

Questions?