Pipelines as Preferential Pathways: Use of Materials for Construction Which Can Seal or Treat Potential Leaks or Voids

November 2015

*** Unique stone-core design**

AquaBlok®
Composite Particle System

www.aquablok.com

Presentation Outline

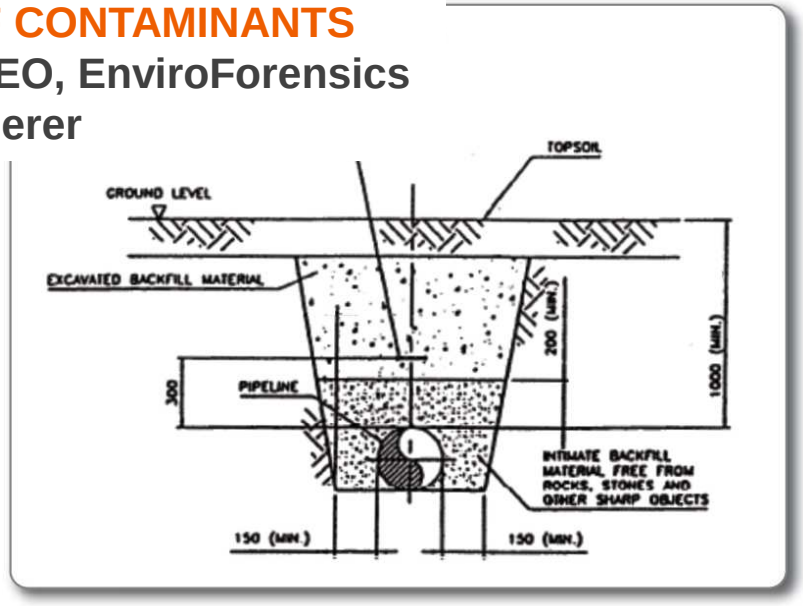
- Problem Statement – Preferential Pathways
- Introduction to AquaBlok / AquaGate
- Overview of applications
- Summary/Questions/Discussion

Problem – Preferential Pathways

PREFERENTIAL PATHWAYS; UNDERGROUND PIPES AND UTILITY LINES CAN BE CONDUITS FOR THE MIGRATION OF CONTAMINANTS

Written by Stephen R. Henshaw, P.G., President & CEO, EnviroForensics

As seen in the March 2013 issue of Cleaner & Launderer



Typical Pipeline Construction

Preferential Flow Pathways:
Conduits for Groundwater Contamination

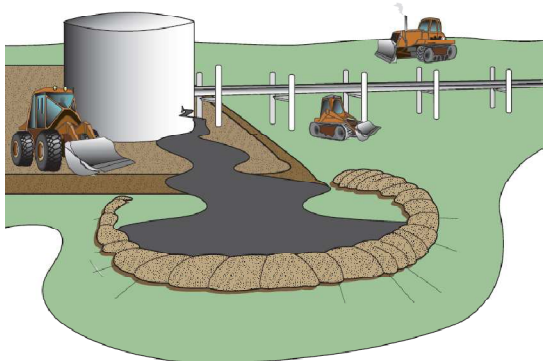
by Lisa Weatherford

Tuesday, February 18th, 2014

"New research by the U.S. Geological Survey USGS) concerning the vulnerability of our nation's underground drinking water supplies offers a better understanding of how contamination can occur and what we can do to stop it. Yesterday we reviewed three basic measures for drinking water analysis and today we will look at the importance of preferential flow pathways contribute to groundwater contamination."

Problem – Preferential Pathways

Spill Prevention, Control, and Countermeasure (SPCC)



SPCC rules are intended to prevent a discharge of oil into navigable waters or adjoining shorelines.

Pipe Penetrations as Failure Point in Berm/Dike

Low-Permeability Materials for Flood Control

AquaBlok Technology Platform

Composite Particle Coating Approach:

A Delivery Method for Uniform Placement of Small Quantities of High-Value Materials

- Uniform Distribution
- Flexible/Rapid Installation (Low Cost)
- Custom Blends for Targeted Designs
- Can Vary/Control Permeability
- Placement through Deep Water
- Marine & Freshwater Blends

powder coating

+

aggregate core

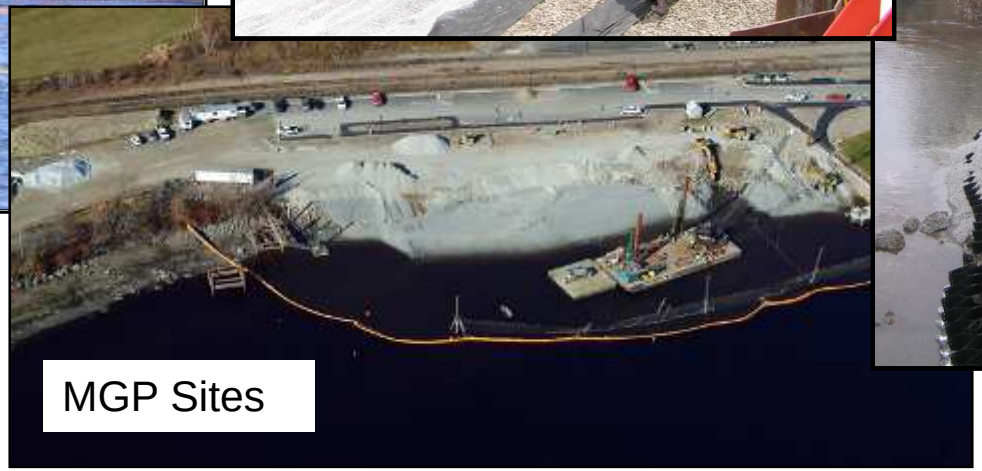
=

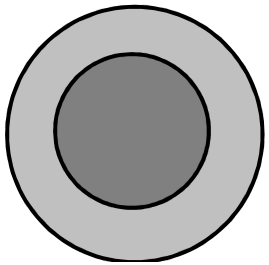
AquaGate+ “composite particle”

AquaBlok®
Composite Particle System

Low-Permeability for Sealing and Chemical Isolation Barriers

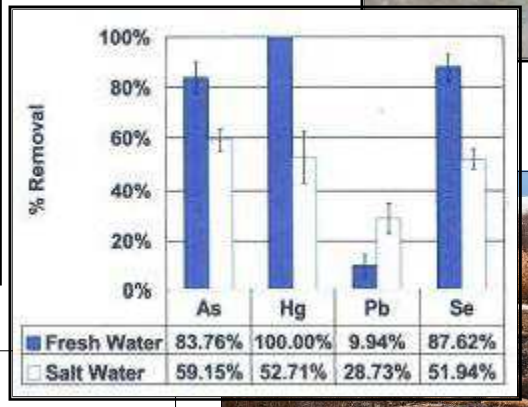
Applied *through* standing water or in the dry

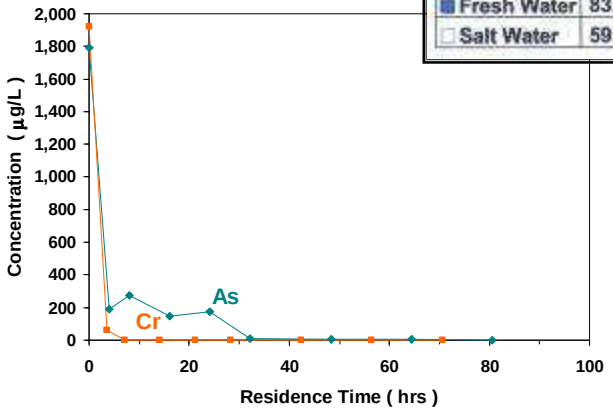


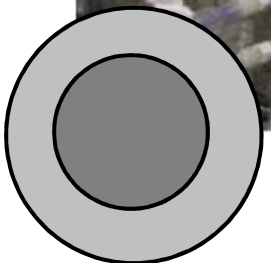


Permeable Materials for In-Situ Treatment & Remediation Applications

Refinery/PAH Sites







Adsorptive Material – Petroleum Based Contaminants

Aquagate+ **ORGANOCLAY**™

REMEDIATION TECHNOLOGIES
Technical Data

CETCO

Aggregate: Nominal AASHTO #8 (1/4-3/8") or custom-sized to meet project-specific need * Limestone or non-calcareous substitute, as deemed project-appropriate

Binder: Cellulosic polymer

Permeability: 1 x 10^{-2} to 1 x 10^{-5} cm/sec

Dry Bulk Density: 65 – 85 lbs/ft^3

Moisture: 10 – 20% (maximum)

ORGANOCLAY® P

ORGANIC ADSORPTION MEDIA (POWDER GRADE)

Product Description:

Organoclay® P is a proprietary powder adsorption media effective in removing oils, greases other non-aqueous phase liquids (NAPL) and other dissolved high molecular weight/low solubility organic contaminants.

Characteristics:

- Hydrophobic; will not absorb water or swell when wetted
- Non-toxic to marine and benthic organisms
- High adsorption capacity of oils, greases and other NAPL
- Demonstrates noncompetitive sorption—can sorb multiple contaminants

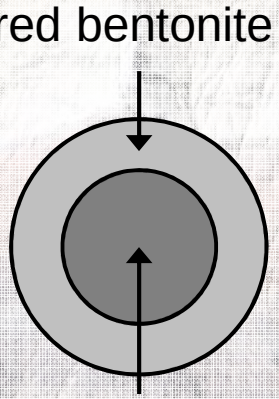
Properties:

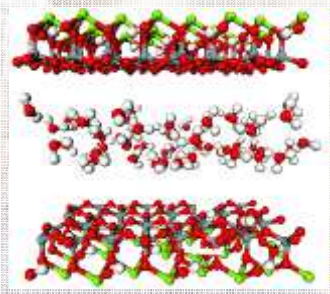
Property	Value	Test Method
Particle Size	70% Min. passing 200 mesh sieve	CETCO Test Method
Bulk Density	50-54 lbs/ft^3	CETCO Test Method
Oil Adsorption Capacity	0.5 lb/lb Min.	CETCO Test Method
Quaternary Amine Content	25% Min.	CETCO Test Method

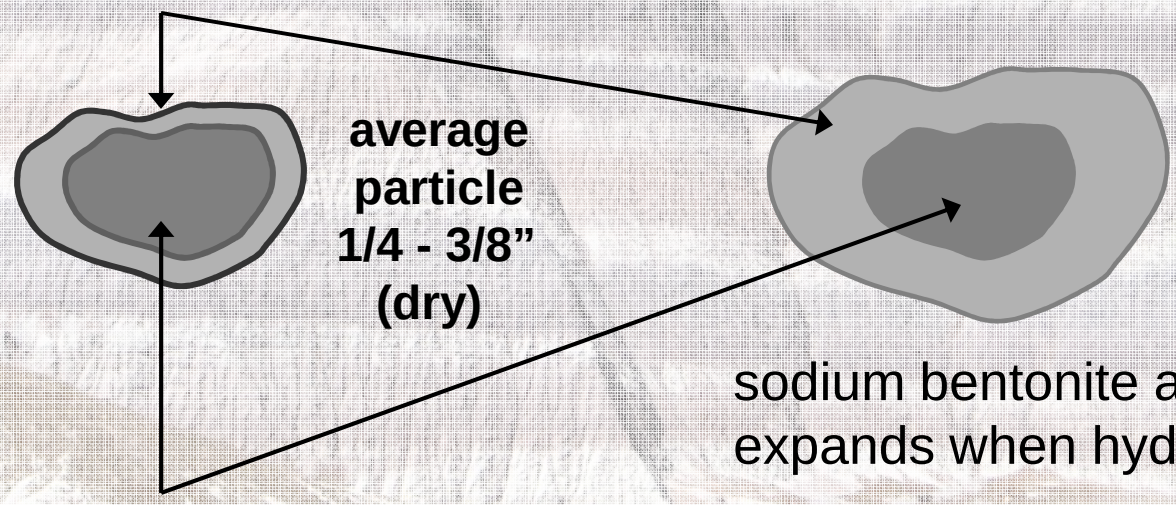
BENTONITE: 101

Swell + Compaction = Low Permeability

- Naturally Occurring
- High Swell







AquaBlok
1 min post hydration

time

AquaBlok
24 hr post hydration

Extreme low-permeability ($5x10^{-8}$ cm/sec)
result of consistent swell and self-compaction

Values & Technical Advantages

- **Offers Targeted Placement** – can be placed ***through*** or ***directly into flowing water*** - will not drift or dissipate, minimal dusting
- **Easy to Handle/Install** – like stone aggregate
  - install using standard construction equipment
  - no field blending/mixing required
  - ***no mechanical compaction*** the material required
- **Durable**
  - Self-healing (even through drying and re-hydration)
  - Compressive strength (due to internal aggregate core)
- **Safety** – no trench boxes needed

Nature's Duct Tape.
Simple. Unique. Versatile. Effective.

AquaBlok®

Examples of Applications: Ponds, Basins & Liner Repair

Preferential Pathways Formed by Debris in Subsurface

Repair Enhanced with Aggregate Cover Over AquaBlok Layer

AquaBlok®

Dams, Berms & Levees

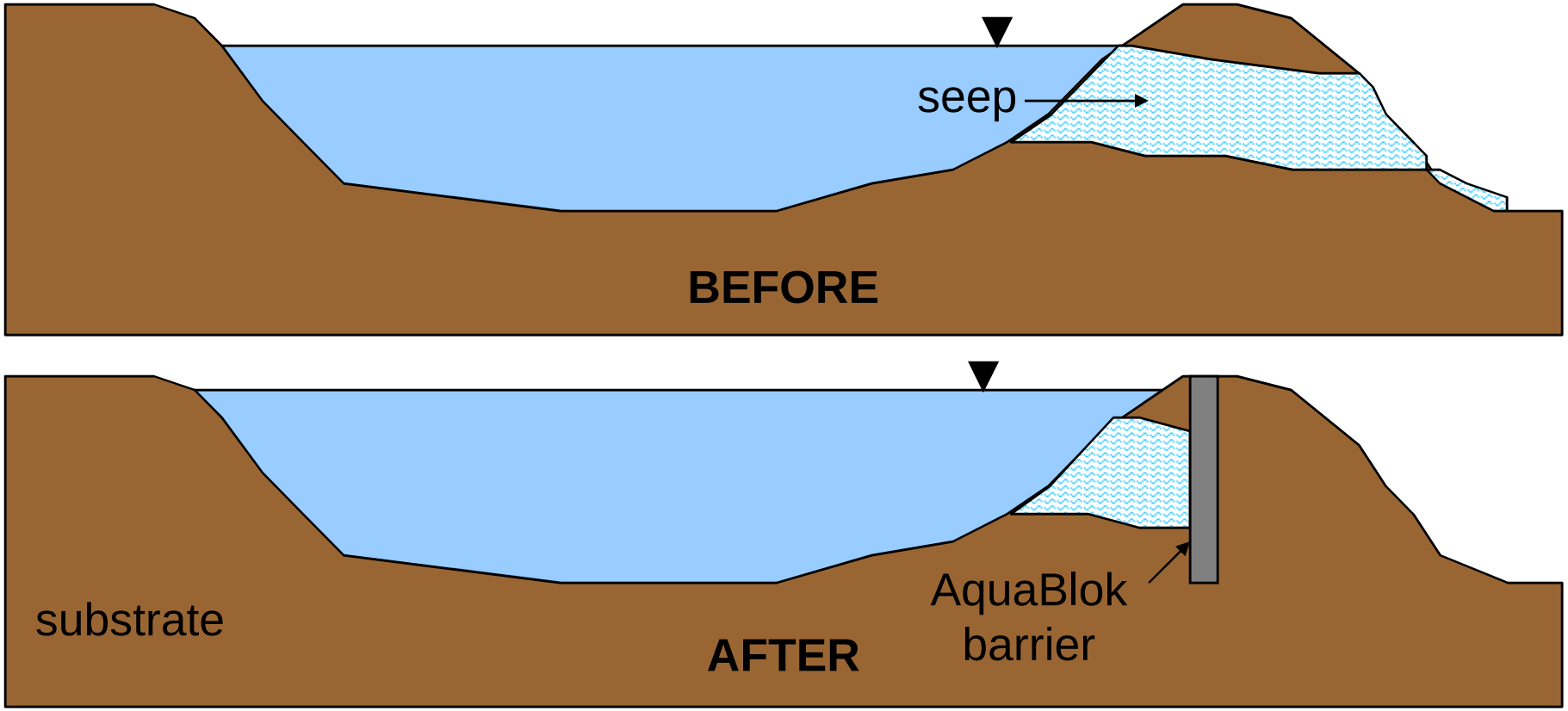
Vertical Barrier Trench Construction

Application Example

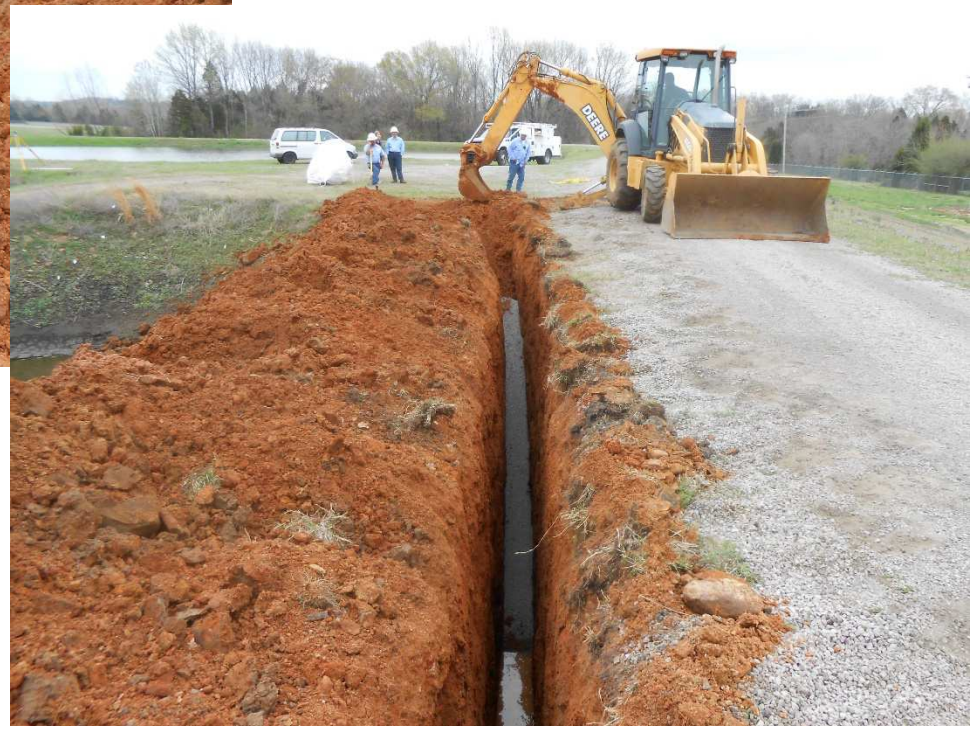
Fort Smith, AR – Water Treatment Detention Basin

Application Example

Vertical Barrier Trench



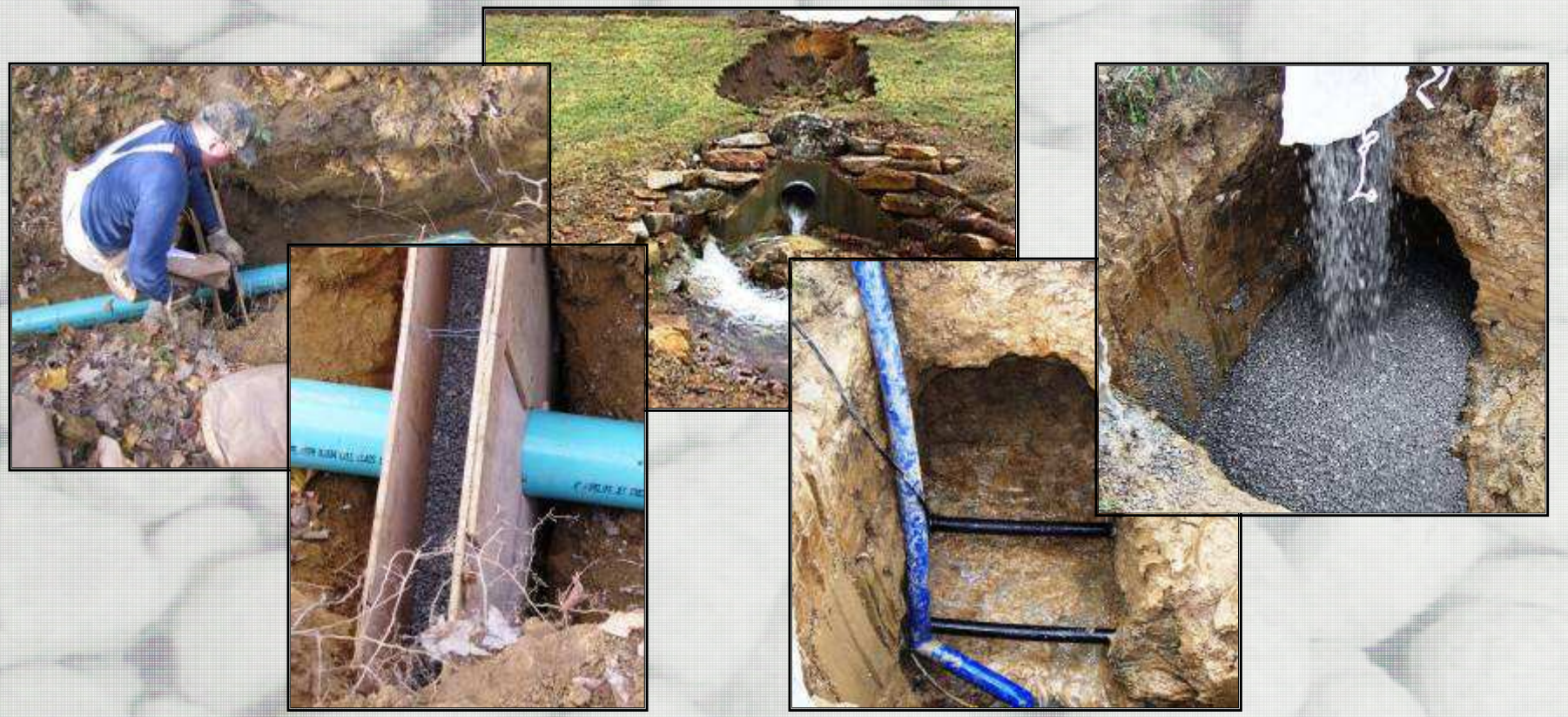
not to scale



Post-Repair Water Elevation Returned to Design Levels

Application Examples

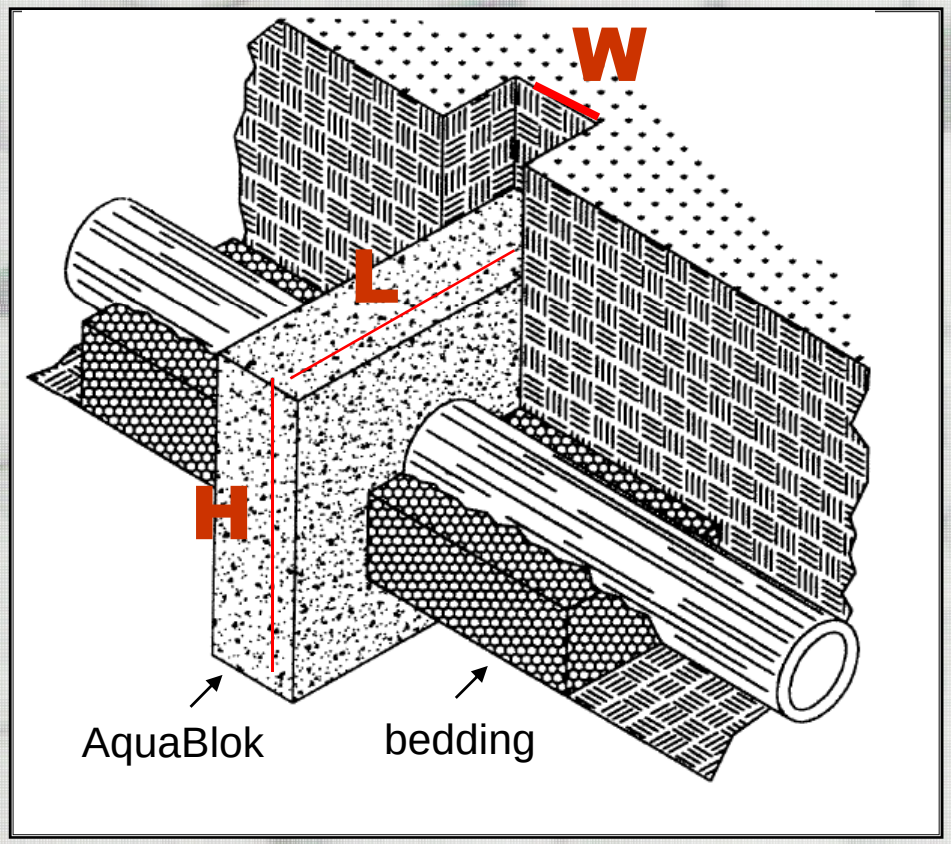
Preferential Pathway - Flow Along Pipes



Anti-Seep Collar – Flowing Water

Application Examples

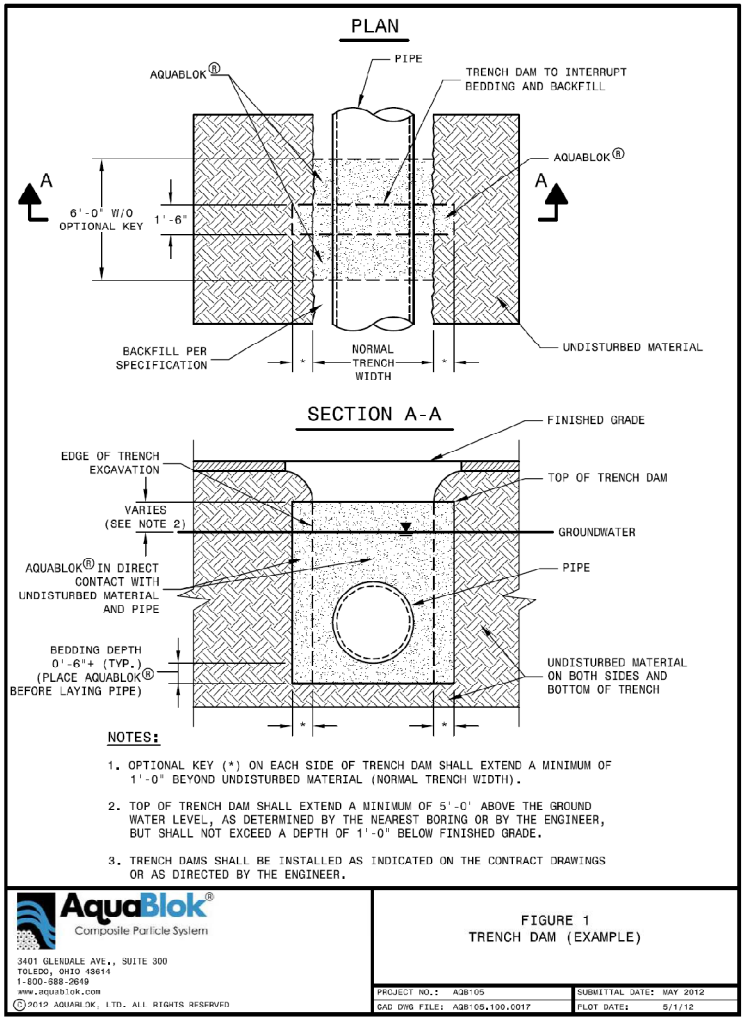
Pipeline & Utility-related Applications



Trench Dams/Anti-Seep Collars

Design/Installation of Anti-Seep Collar

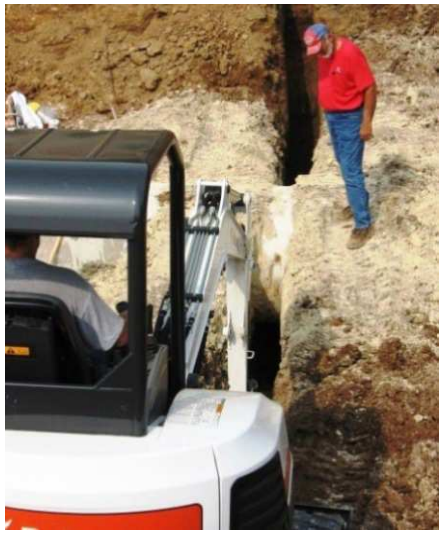
Elimination of Pipe Bedding as Preferential Pathway



Installation: Anti-Seep Collar/Berm Stability

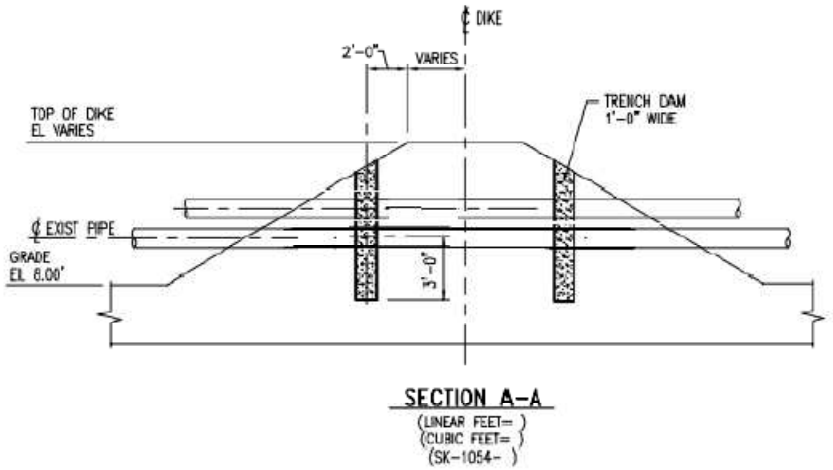
Location: West Norriton, Pennsylvania
Setting: Retention/Detention Basin

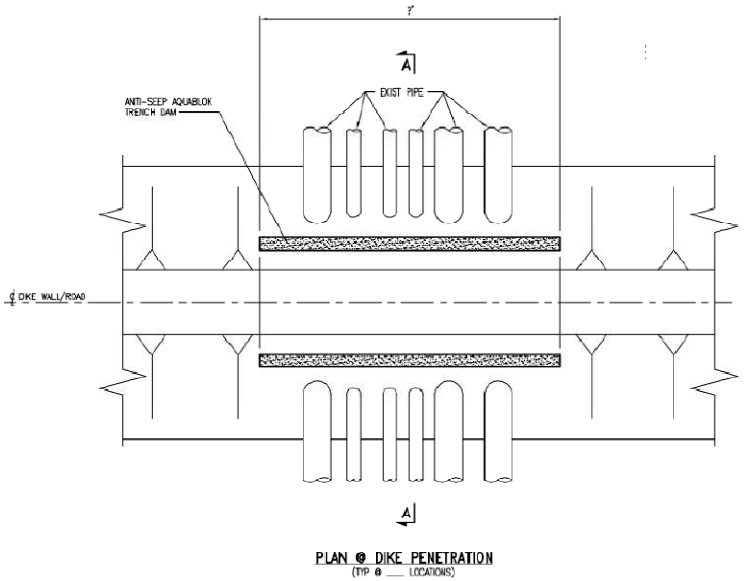
Right: AquaBlok placement from a bulk bag by excavator – note discharge snout directing product into trench cut perpendicular to the overflow discharge pipe.



Left: Mini excavator used (narrow bucket) to create trench for AquaBlok placement.
Right: Completed anti-seep collar around pipe.

Trench Dam
Construction Considerations -





1. **Width of Dam** – 6-inch thickness will provide hydraulic conductivity of approximately $5x10^{-8}$ in hydrated state.
2. **Bedding Depth / Distance Under Pipes** – Typically recommended to be a minimum of 6-inch.
3. **Trench Width** – Where collars are keyed into surrounding soils, it is recommended that AquaBlok extend a minimum of 1-ft beyond undisturbed material.

Application Examples

Preferential Pathway - Flow Along Pipes

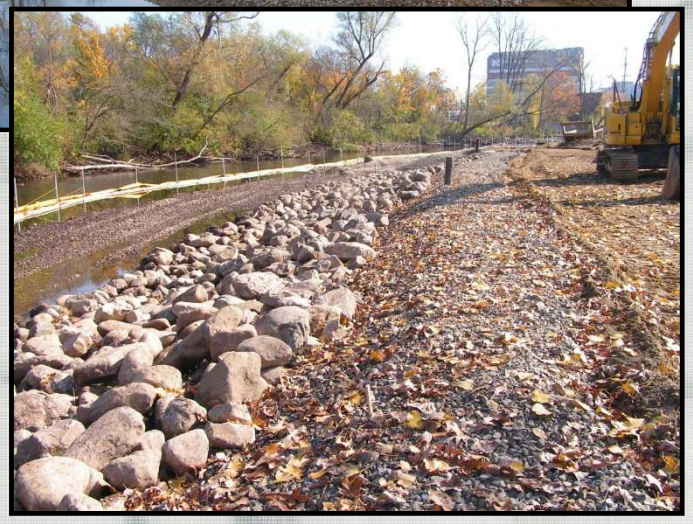
Setting / Purpose: Pipeline cap and Anti-Seep Collar. Objective was to cut off site contaminant pathways during excavation and installation of natural gas pipeline.

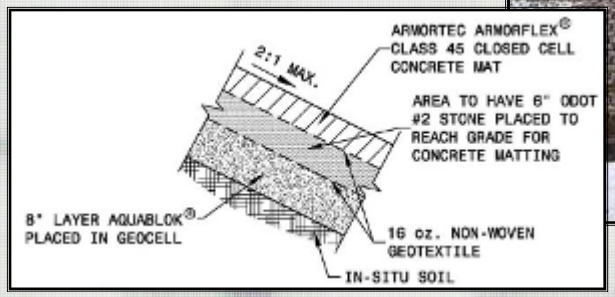
Installation Notes:

- Coffer Dam approach used to isolate pipe trench from surrounding soil
- Continuous measurement of AquaBlok performed to insure design thickness of cap
- AquaBlok placed in lifts with each layer hydrated to insure hydraulic conductivity
- No additional anti-seep collars were placed along pipeline

Application Examples

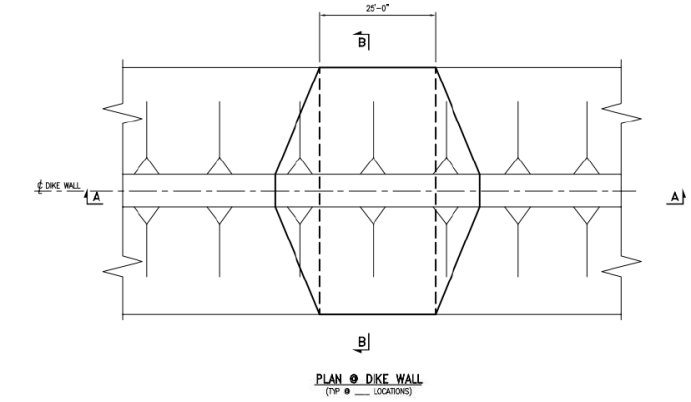
Berms, Banks & Slope Stability



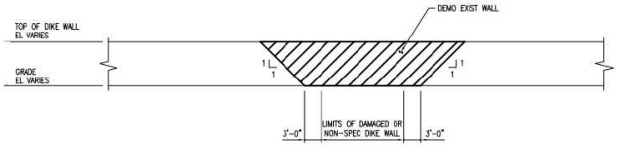


Cellular Confinement/Slope Protection

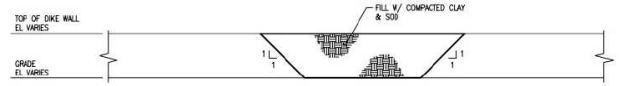
Dike Wall / Berm Repairs – Alternative Construction Approach



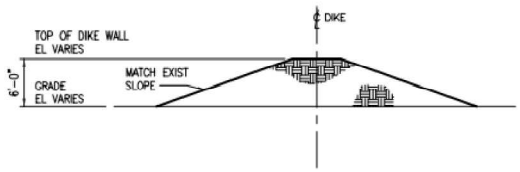
PLAN @ DIKE WALL
(TYP @ ___ LOCATIONS)



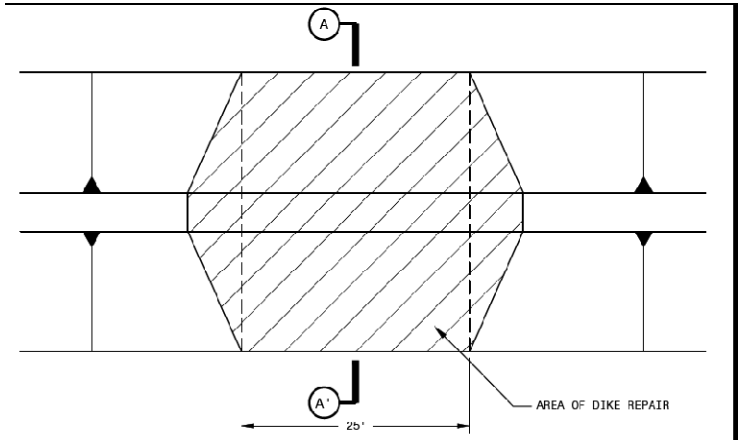
SECTION A–A DEMOLITION
(LINEAR FEET=)
(CUBIC FEET=)
(SK-1054-)



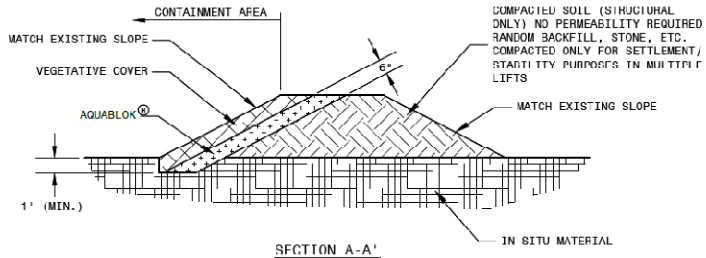
SECTION A–A REBUILD
(LINEAR FEET=)
(CUBIC FEET=)
(SK-1054-)



SECTION B–B
(LINEAR FEET=)
(CUBIC FEET=)
(SK-1054-)



PLAN AT DIKE WALL
NOT TO SCALE



SECTION A-A'
NOT TO SCALE

NOTE:

FILL SIDESLOPES WITH AQUABLOK® AND VEGETATIVE SOIL CONCURRENTLY WITH COMPACTED SOIL.

AquaBlok®
Composite Particle System

105 WOODLAND AVENUE
SWANTON, OHIO 43558
1-419-825-1325
www.aquablok.com

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ALTERNATIVE DIKE REPAIR DETAILS

PROJECT NO.: AQD100	SUBMITTAL DATE: MAY 2015
CAD DWG FILE: AQB105.100.3020	PLOT DATE: 5/18/15

Handling/Installation Factors

Handling / Installation Advantages:

- Place directly through water column
- Self-compacts on bottom – hydration fills voids to create stable erosion resistant cap layer
- Conventional construction equipment used for placement
- Easy to confirm uniformity of installation (core samples)
- Handles like sand or gravel
- Can be manufactured on-site for significant cost savings

AquaBlok®

Composite Particle System

better Bentonite

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