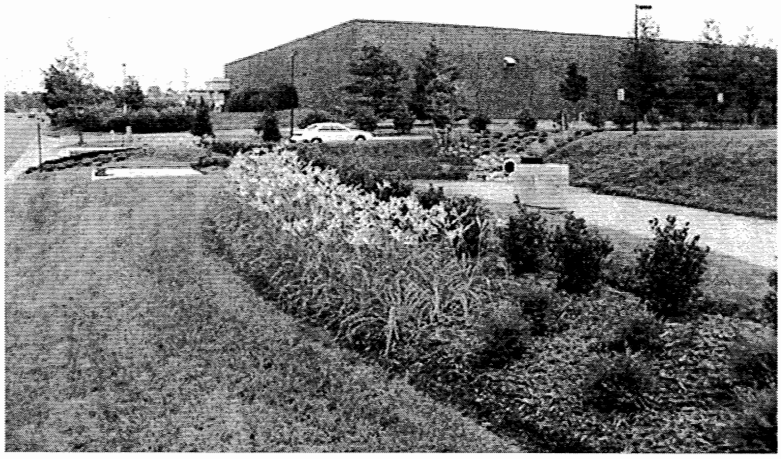
Dry Extended Detention Pond

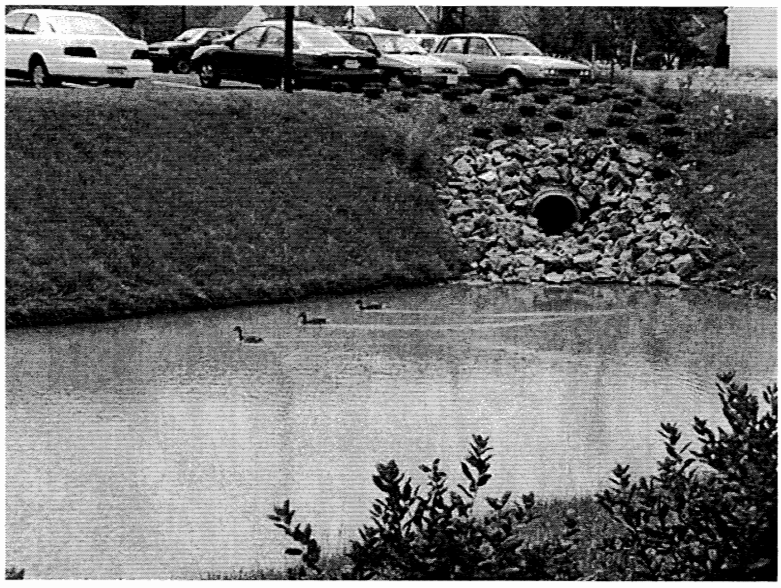
Retention Pond

Pond Upstream of Treatment Unit

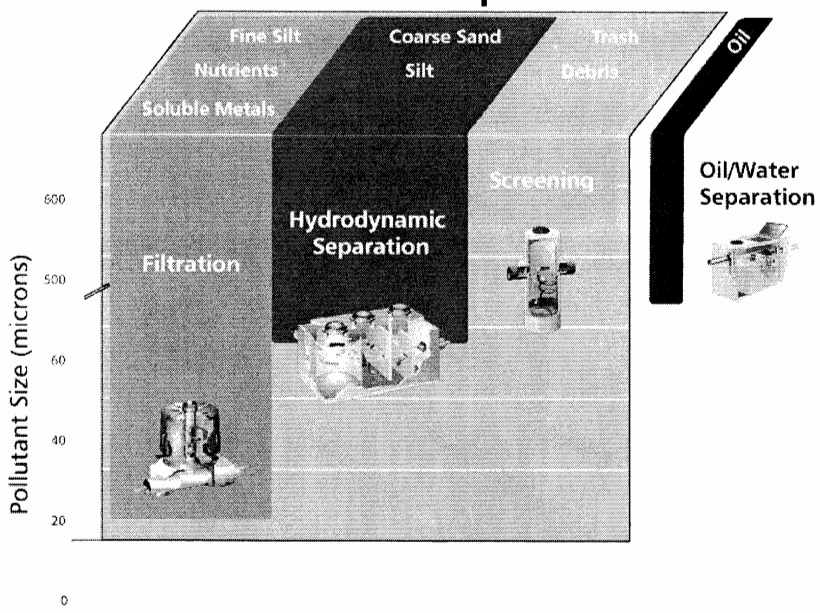
Richmond VA



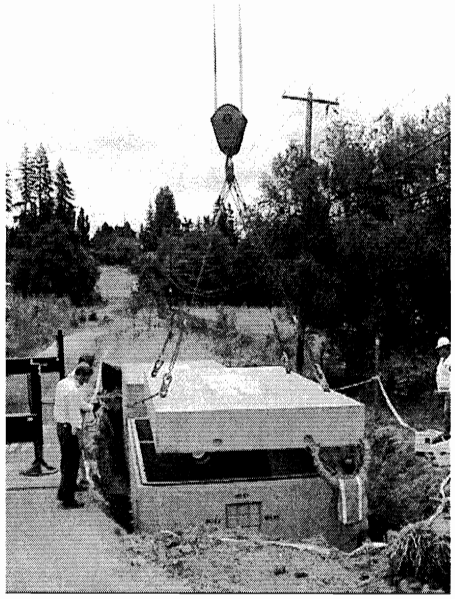
Pond Upstream of Treatment Unit



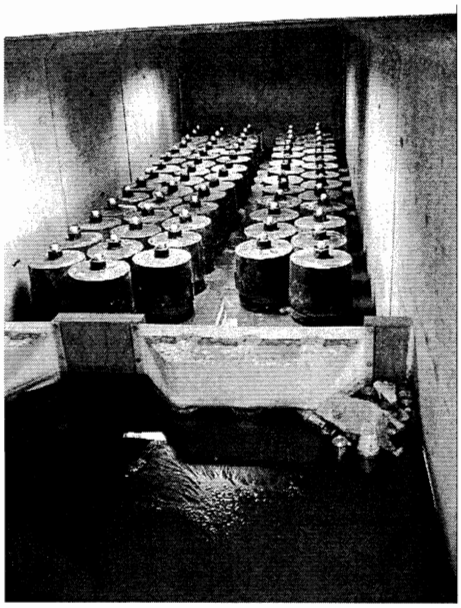
Treatment Options



Treatment Unit Installation

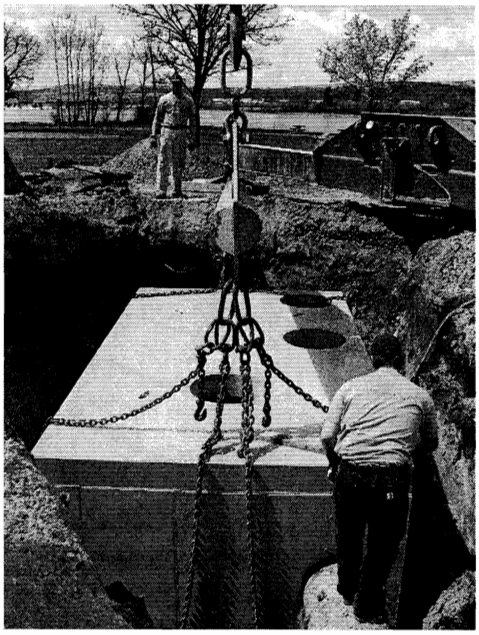


Treatment Unit

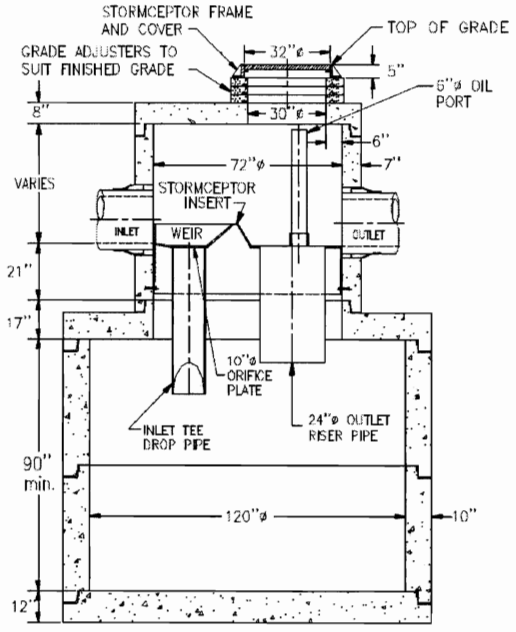


Treatment Unit

Vortechnics Treatment Unit

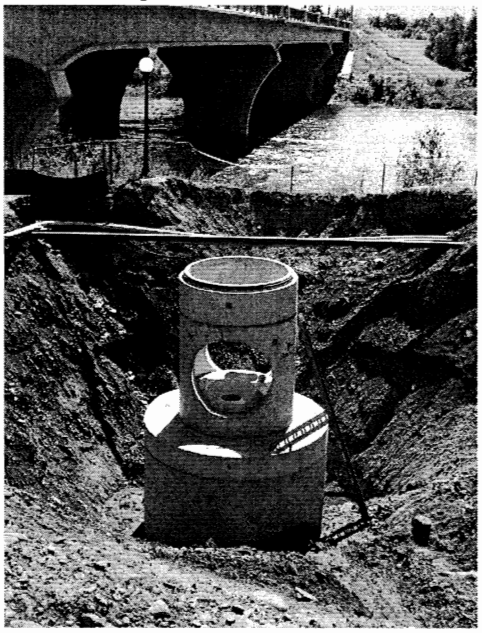


Stormceptor® Treatment Unit



SECTION THRU CHAMBER

Stormceptor® Treatment Unit



Stormceptor® Treatment Unit

Underground Detention Facilities

- Underground detention facilities typically consist of pipes buried under parking lots (usually steel, some HDPE)
- Often discharge to soil rather than surface water
- Advantages include:
  - Retains above ground use of the site and value of the land
  - Ease of installation
  - Flexible configurations
  - Limited liability compared to other "attractive nuisances"
  - Can be cost effective

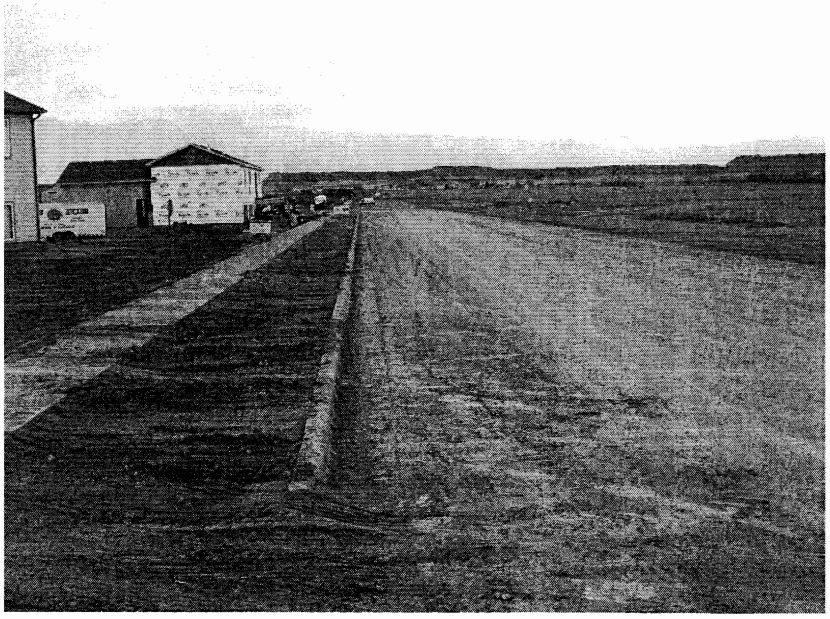
Underground Detention Facilities

- Design process includes:
  - Select pipe dimensions and develop stage-storage relationship
  - Design flow regulator (if surface water discharge) and develop the stage-discharge relationship
  - Route the inflow hydrograph through the structure and modify flow regulator or amount of storage as necessary
- Pipes can include sand as a filter media or simply be perforated and surrounded by stone backfill to infiltrate into the ground

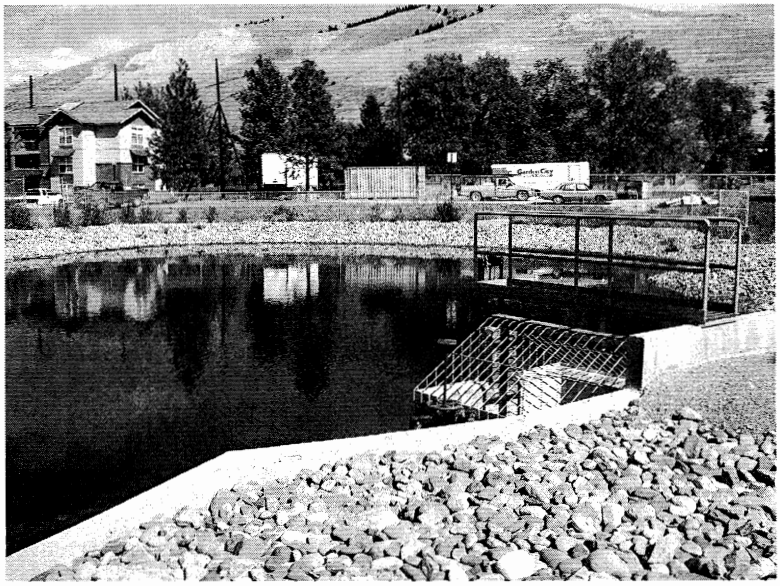
Maintenance Considerations

- Inspections for erosion of pond banks or bottom
- Monitor sediment accumulation and remove sediment regularly
- Inspect inlet and outlet devices for debris
- Mow side slopes (if grassed)
- Seed or sod damaged areas
- Frequency of inspections can be on a regular basis but also need to include inspections after significant runoff events
- Ponds used for infrequent events can serve dual purposes - such as ballfields
- Ponds built early in project development can serve as temporary sediment control

Maintenance Considerations



Maintenance Considerations



Hazards - West Nile Virus

- West Nile Virus (WNV) is primarily a bird virus transmitted to other animals and humans by a mosquito of the Culex species
- WNV can cause flu-like symptoms and, rarely, encephalitis (inflammation of the brain or membrane protecting the brain) in humans
- Chances of becoming seriously ill from WNV is very small. Most humans are able to overcome infection from WNV by the normal response of immune system
- In 2002 - WNV infected 4156 people and killed 284. 2003 – 9858 and 262; 2004 – 2282 and 77; 2005 – 3000 and 119; 2006 – 3830 and 119.
- Most species require 1-2 weeks of standing water to complete life cycle.

Hazards - West Nile Virus

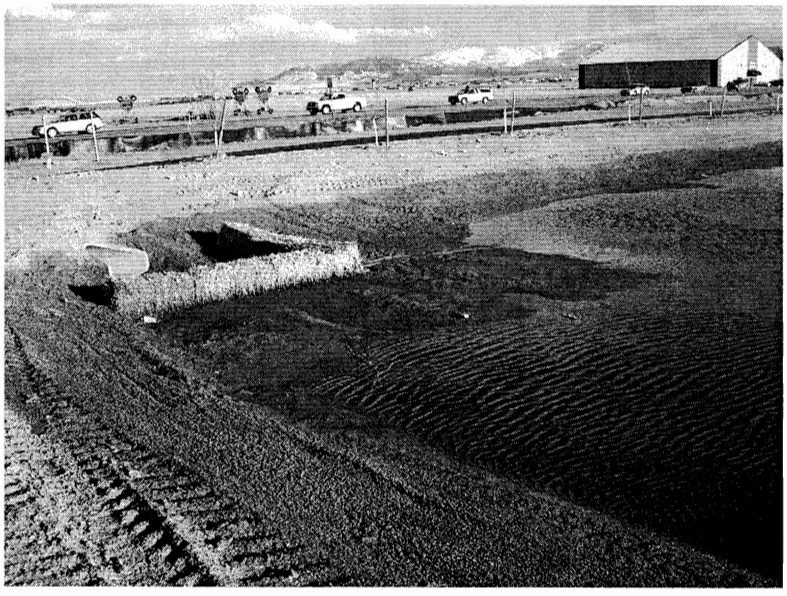
- Mosquitoes prefer to breed in shallow (< 1 ft deep), stagnant, vegetated pools and puddles.
- Stormwater wet ponds generally do not offer ideal conditions as mosquito breeding habitat. They should have a normal depth of 3-4 feet or more, are flushed of stagnant water during each storm event and should be clear of large stands of vegetation. Mosquitofish (a small, guppy-like fish that is tolerant to harsh conditions and feed almost exclusively on mosquito larvae) can be used in some parts of the country. Good shoreline habitat can promote predators - dragonflies, frogs, spiders, birds, bats. Regular maintenance to limit mosquito breeding habitat is critical.

Hazards - West Nile Virus

- Dry ponds are much more likely to be good habitat, especially dry extended-detention ponds.
- Designs need to reduce/eliminate areas that water will stand in for extended time periods. Outlet pipe should be at (or even below) invert of pond. Pond needs to be sloped so it will drain. If infiltration can be used, the low area of the pond should be designed to promote infiltration. Removal of sediment and thick vegetation is critical, even in lined ponds.
- Underground facilities have been identified as breeding habitat.

Hazards - West Nile Virus - Flat Pond Bottom

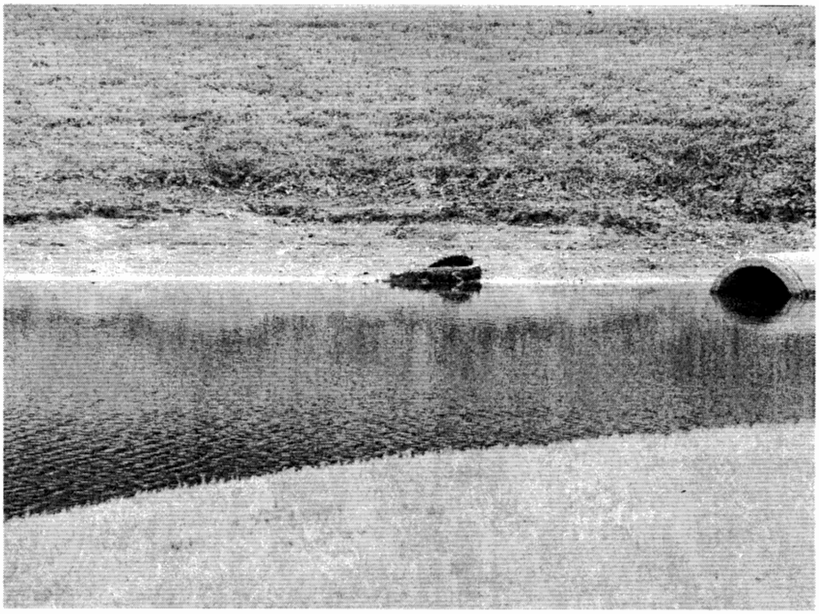
Hazards - West Nile Virus - Flat Pond Bottom



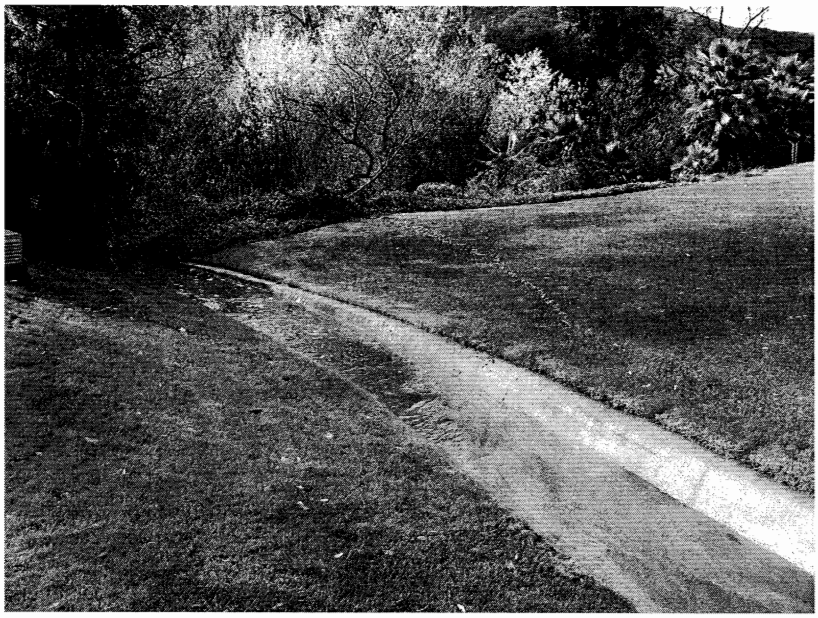
Other Hazards

- Can be ugly, especially if poorly maintained
- Can be a prime area for noxious weeds
- Water depth can be a significant hazard for small children - how high should a fence be?
- Water and mud can easily make for an "attractive nuisance" for children
- Can collect debris and a wide variety of other undesirable items - Florida has reported snakes and alligators, Oregon has reported beavers
- Location needs to have careful consideration, especially in residential areas and at downstream end of basins
- Analysis needs to always have "no build" as an option if it doesn't serve intended need

Other Hazards



Risks



Risks

- All designs based on hydrology have some risk
- Level of risk depends on what is flooded when design event is exceeded
- Frequency of risk may exceed that calculated by return intervals
- 100-year return period events can occur in consecutive years (Yellowstone River at Livingston - 70 years of record prior to 1996 and 1997 floods, 3551 sq.mi.)
- ALL designs must provide for consideration of what happens when runoff exceeds design event
- Locations in floodplains?

Software

- MIDUSS – Alan A. Smith Inc, Dundas, Ontario, Canada
  - www.miduss.com
  - Data Entry and File Manipulation (such as saving) is not always intuitively obvious
  - Appears to yield answers similar to hand method
  - Provides a series of help videos to walk new users through program
  - Price $895

Software

- StormNET – BOSS Int'l, Madison, WI
  - www.bossintl.com
  - Can use the SCS Method but not the Rational Method
  - Data Entry is not intuitively obvious
  - Tutorial walks user through an example to assist with program use
  - Appears to yield answers similar to hand method
  - Can size a pond or analyze existing pond
  - Price $1090-5090

Software

- Storm Water Management Model (SWMM), USEPA, version 5.0.013
  - http://www.epa.gov/ednnrmrl/models/swmm/index.htm
  - Data Entry is generally straightforward
  - Appears to yield answers similar to hand method
- CivilStorm – Haestad Methods, Watertown, CT
  - http://www.haestad.com
  - Data Entry is not intuitively obvious
  - Claims to be very powerful program
  - Price $7000-$25,000 depending on size of system to analyze

Software

- WinTR-55 – available on NRCS website
  - http://www.wsi.nrcs.usda.gov/products/W2Q/H&H/Tools_Models/WinTR55.html
- HEC-HMS – available on Corps on Engineers website
  - http://www.hec.usace.army.mil/
- HydroCAD – http://www.hydrocad.net/
  - $195 to $1595

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