Storm Water Management for Industrial Site Development

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FIDS Water Resources Symposium

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Presentation outline

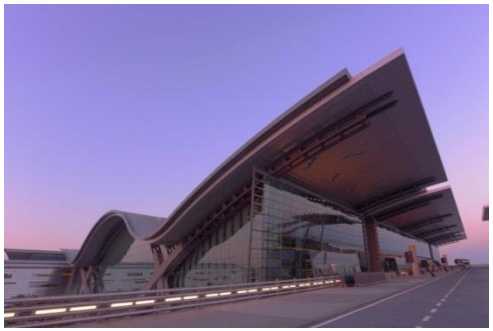
- About Bechtel
- Maryland Storm Water Regulations
- Storm Water Management During Construction (Temporary)
- Storm Water Management During Operation (Permanent)
- Conclusions

About Bechtel

- Bechtel is a global engineering, construction, and project management company with more than a century of experience on complex projects in challenging locations. Privately owned with headquarters in San Francisco, we have offices around the world and 53,000 employees.

What We Do

- Roads and rail systems
- Airports and seaports
- Environmental cleanup projects
- Communications networks
- Pipelines
- Defense and aerospace facilities
- Fossil and nuclear power plants
- Refineries and petrochemical facilities
- Mines and smelters
- Oil and gas field development



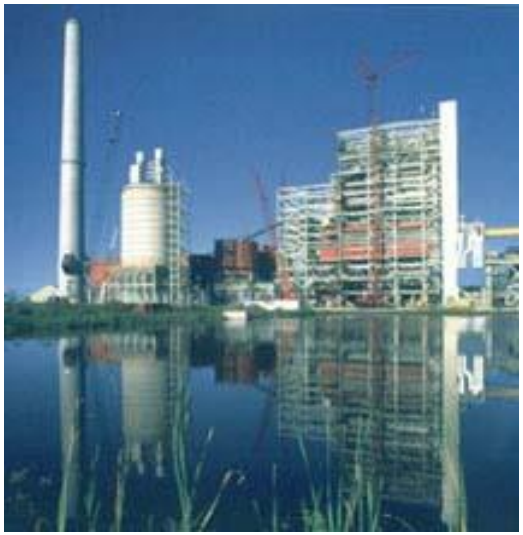
Bechtel Signature Projects

Signature Projects

Alma Aluminum Smelter
Athens Metro
Bay Area Rapid Transit System
Boston Central Artery/Tunnel
Browns Ferry Restart
Channel Tunnel
High Speed 1
Hong Kong International Airport
Hoover Dam
Iraq Infrastructure Reconstruction Program
Jamnagar Refinery
Kuwait Reconstruction
Tacoma Narrows Bridge
West Coast Route Modernization

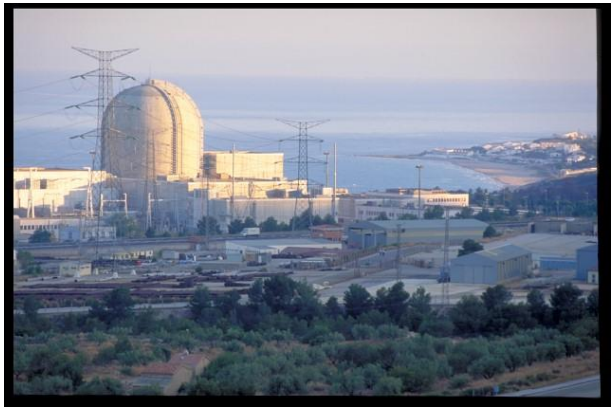
Bechtel Power

- Fossil & Combined Cycle Plants

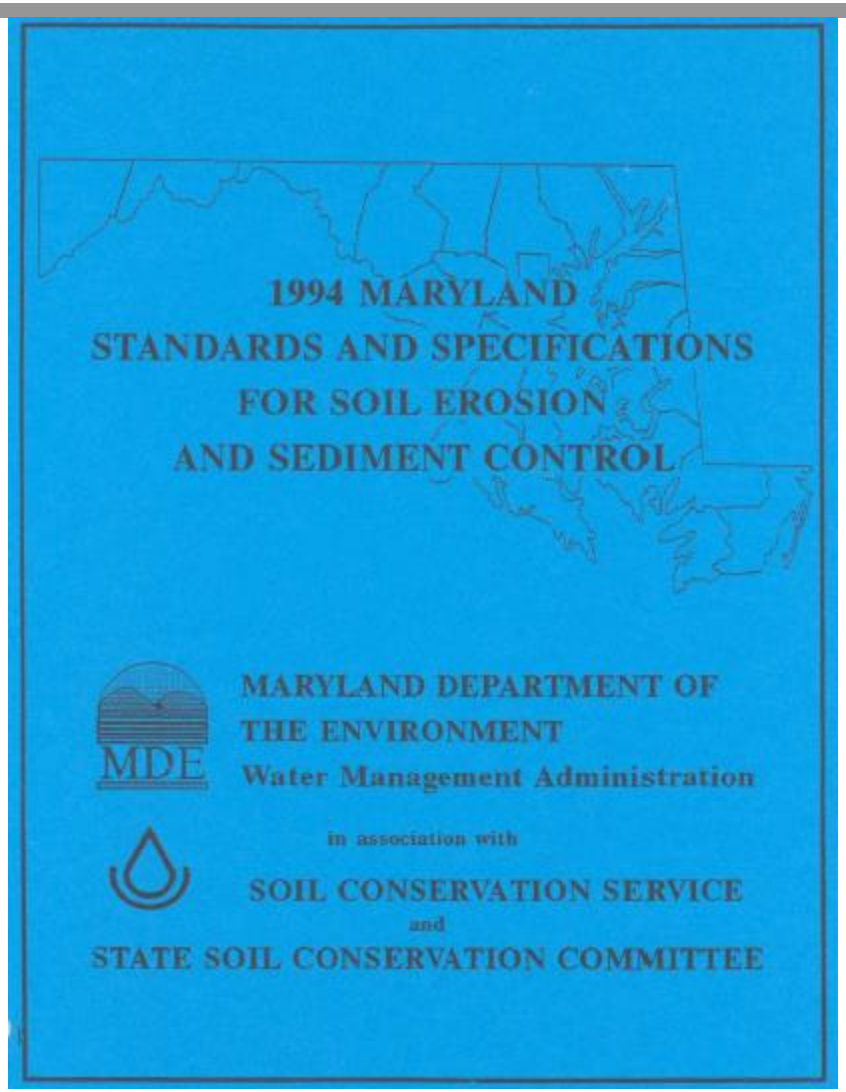


- Solar

- Nuclear Plants

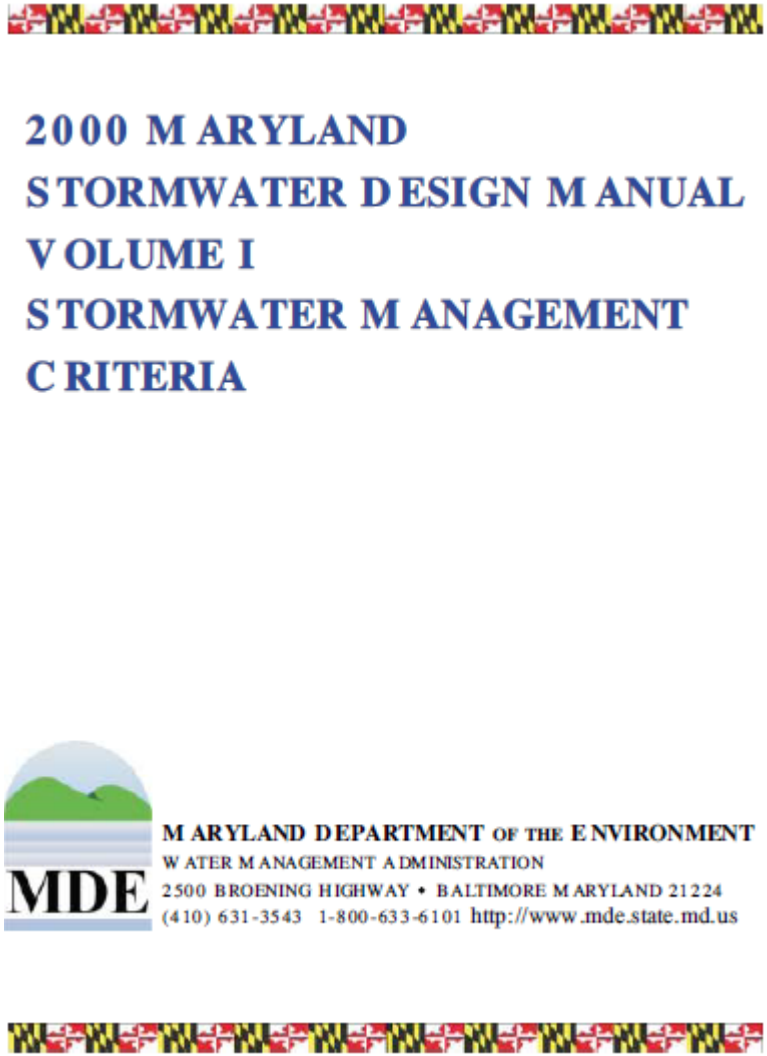


SWM Regulations for Maryland



- Reference for Sediment & Erosion Control Facility (BMP) Design

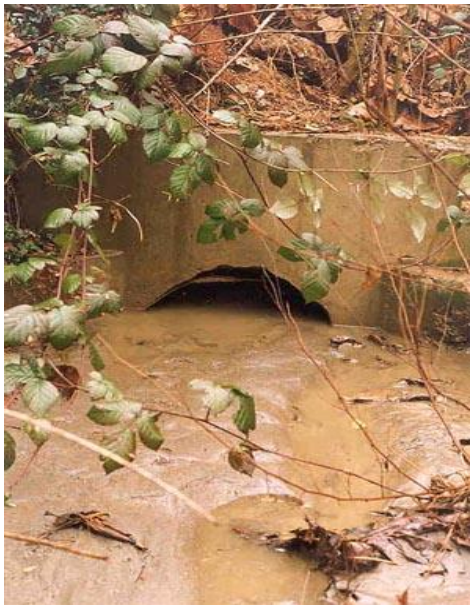
SWM Regulations for Maryland



- Reference for Permanent Storm Water Facility Design
- Also used Calvert County SWM regulations where applicable

Storm Water Management During Construction

- Sediment & Erosion Control Measures:
  - Silt Fence / Super Silt Fence
  - Perimeter Berm
  - Gabion Basket (up to 1.5 acres)
  - Sediment Traps (up to 10 acres)
  - Sediment Basins (> 10 acres)



- Detailed phasing plan was developed to demonstrate the sequence of sediment & erosion control measures

Sediment Basin/Traps

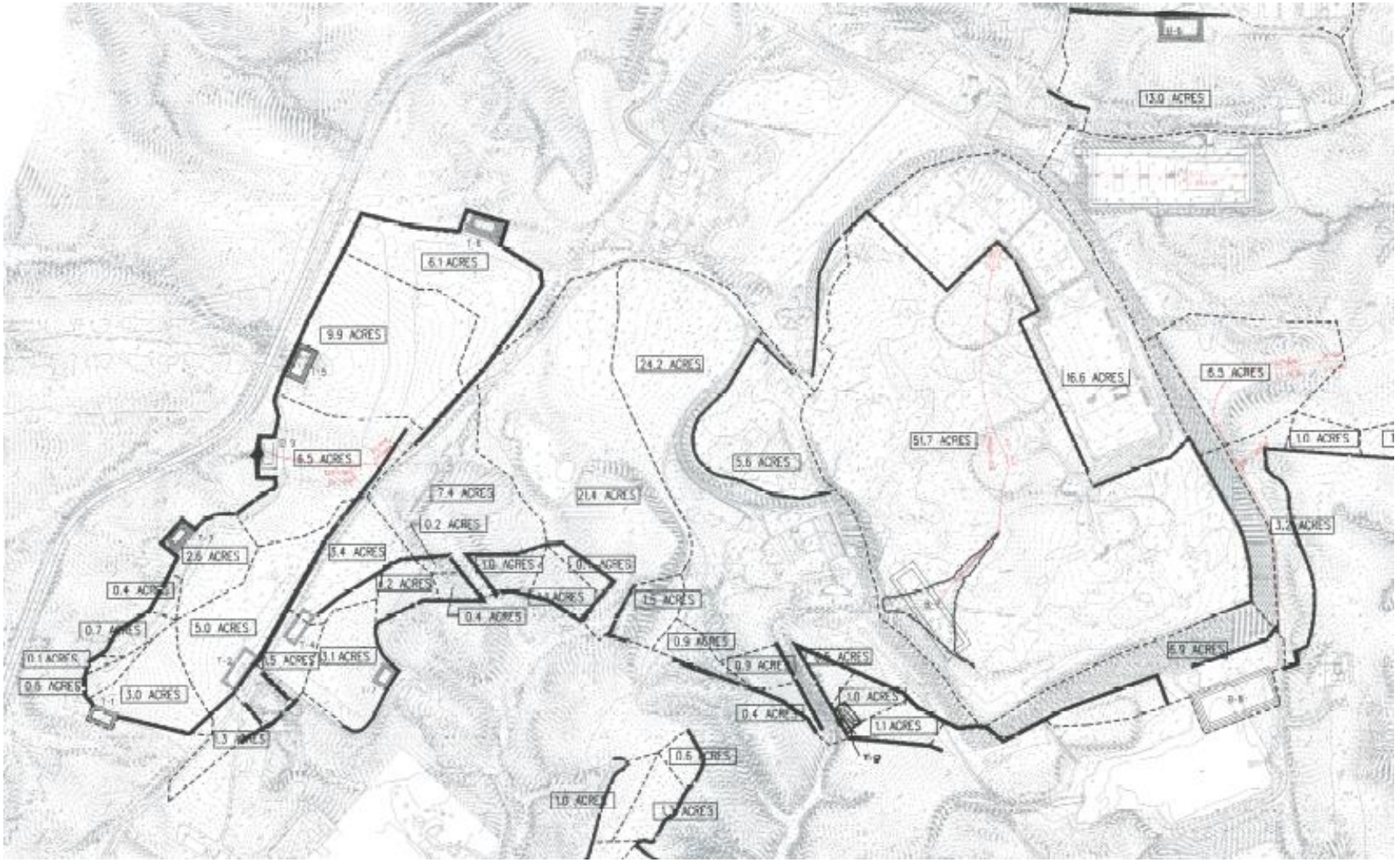
- Provide a minimum total storage volume of 3,600 cubic feet in the basin/trap for each acre drained
- Provide a wet storage volume of 1,800 cubic feet for each acre drained

The project has adopted more stringent criteria to sediment basin and trap sizing in order to make sure that the site is protected. The criteria used are:

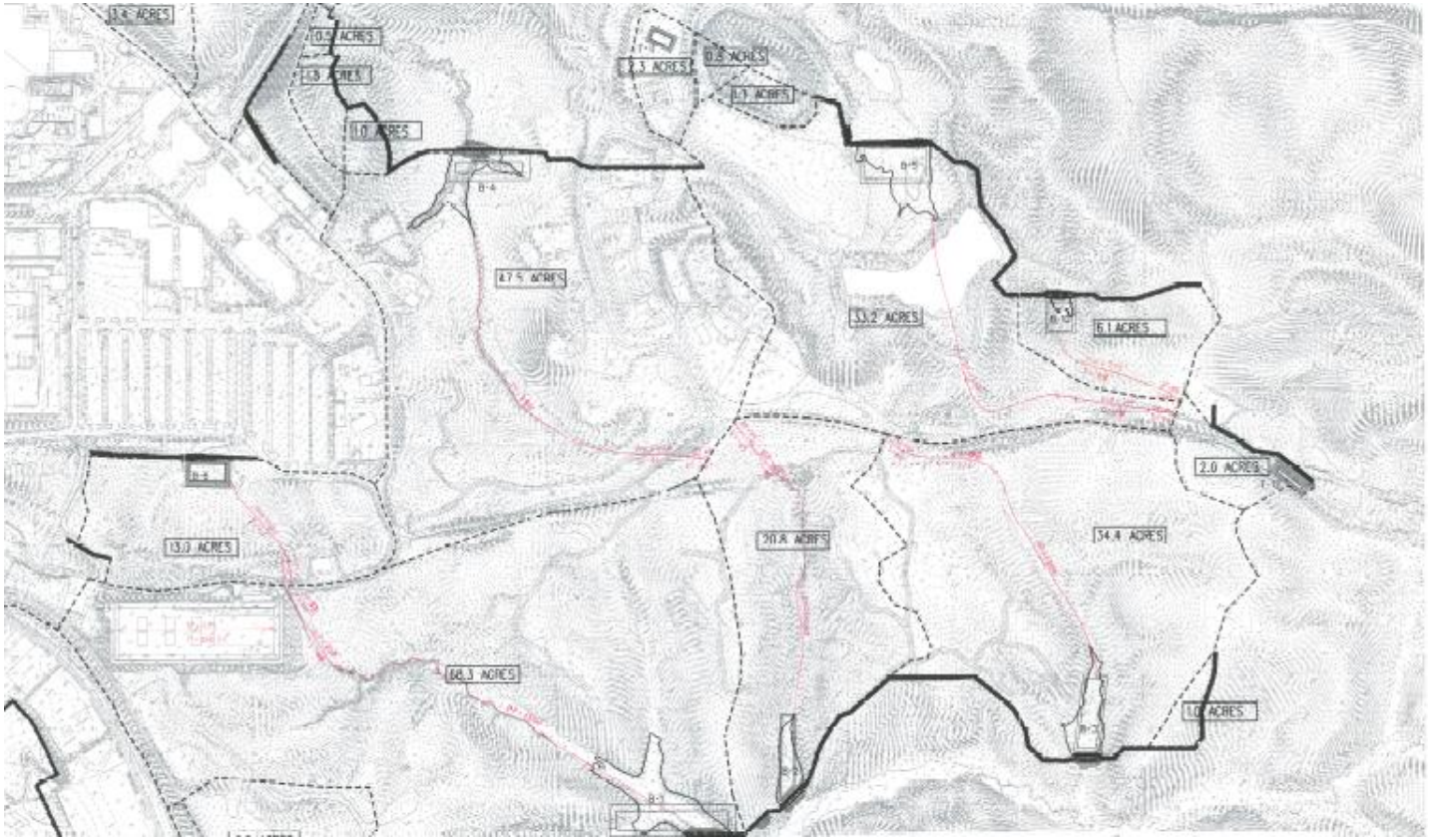
Provide a minimum total storage volume of 5808 cubic feet (derived from 1 year runoff) in the basin/trap for each acre drained

- Provide a wet storage volume of 2904 cubic feet for each acre drained
- The outlet structures for the temporary sediment basins are sized to have minimum 1 foot freeboard during 10-year, 24-hour storm, and to pass the 25-year, 24-hour storm safely.

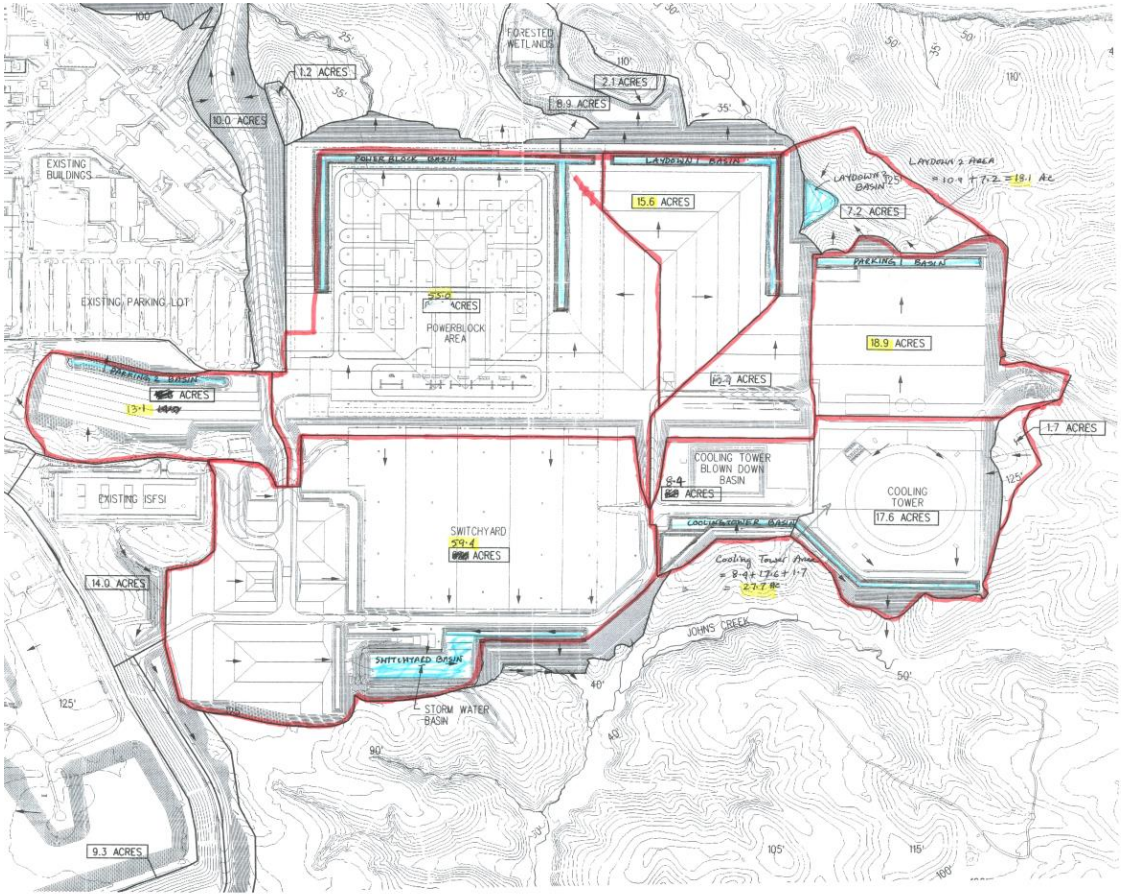
Sediment & Erosion Control at Initial Phase



Sediment & Erosion Control at Initial Phase



Sediment & Erosion Control at Rough Grading Phase



Permanenet Storm Water Management

- Permanent Storm Water Management facilities (BMP) include:

- Storm Water Basins
- Rock filled Trenches
- Sand Filters
- Forested Wetland
- Roadside Ditches
- Grass Buffer Area
- Discontinuing the roof top runoff

SWM Regulations for Maryland -Permanent

- In Maryland, storm water management ordinances set the following criteria for sizing the storm water management BMPs:

a. The water quality requirement (WQv) is the treatment volume generated from 1 inch rainfall multiplied by the volumetric runoff coefficient and site drainage area.

- Surface sand filter facilities and storm water basins are designed to provide WQv.

b. The recharge volume (Rev) is calculated based on the average annual recharge rate of the hydrological soil group present in the site.

- Rev is provided in the sand filter facilities and also in the power block rock filled trenches.

SWM Regulations for Maryland - Permanent

c. The channel protection storage volume (Cpv) is required to protect channels from erosion. This volume is set to be generated from 1-year 24-hour storm event. The drawdown requirement for the channel protection volume is 24 hours.

- The outlet orifices are sized to maintain the extended detention drawdown time. This requirement is waived for tidal discharges.

d. The over bank flood protection volume (Qp) is provided by setting allowable release rates for given frequency storm events to equal the watershed's pre-developed rates in order to maintain discharge quantity requirement.

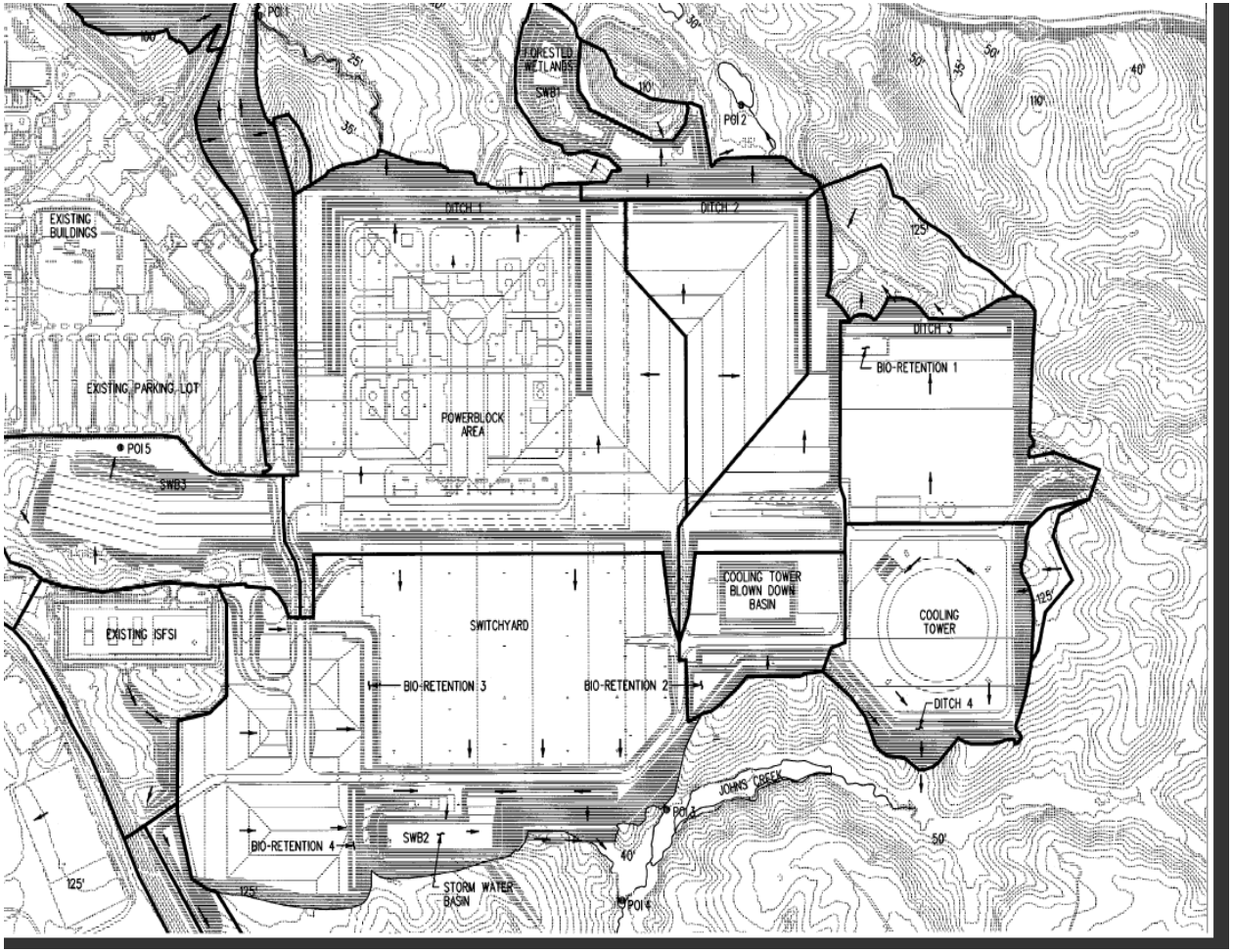
- The storm water basins are sized to maintain post-development peak discharges at or below pre-development peak discharge rates for the 10-year, 24-hour storm. This requirement is waived for direct tidal discharges.

e. The spillways for all the basins are sized to pass the 100 year 24 hour storm keeping 1 foot of freeboard.

SWM Regulations for Maryland -Permanent

- The storm water management for the access road, haul road, and the intake structure area are addressed by the following ways:
- Road side grass ditches are provided to take grass channel credit to fulfill the WQv and Rev criteria by keeping velocities in the grass channels below 1 ft/sec.
- The Cpv requirement for the access road is addressed by providing storm water basin where the discharge exceeds 2 cfs.
- The Cpv requirement for the haul road is waived because of direct tidal discharge
- Grass buffer area is provided for the access road where road side ditch is not feasible to supplement the water quality and quantity requirements.
- Intake area storm water management is provided by discontinuing the roof top runoff. The runoff will sheet flow to adjacent grass areas (pervious) before reaching the storm water system.

SWM Design-Permanent



Thank you

Questions?