

# DESIGN CONSIDERATIONS FOR PERMEABLE PAVEMENTS

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**OMNI**  
ASSOCIATES

# PERMEABLE PAVEMENT DESIGN

- Why & When to Avoid It
- Resources
- Calculations Overview (Quality, Quantity)
- Component Design (Asphalt, Aggregate Storage, Subgrade & Underdrains)

## **WHY USE PERMEABLE PAVEMENT?**

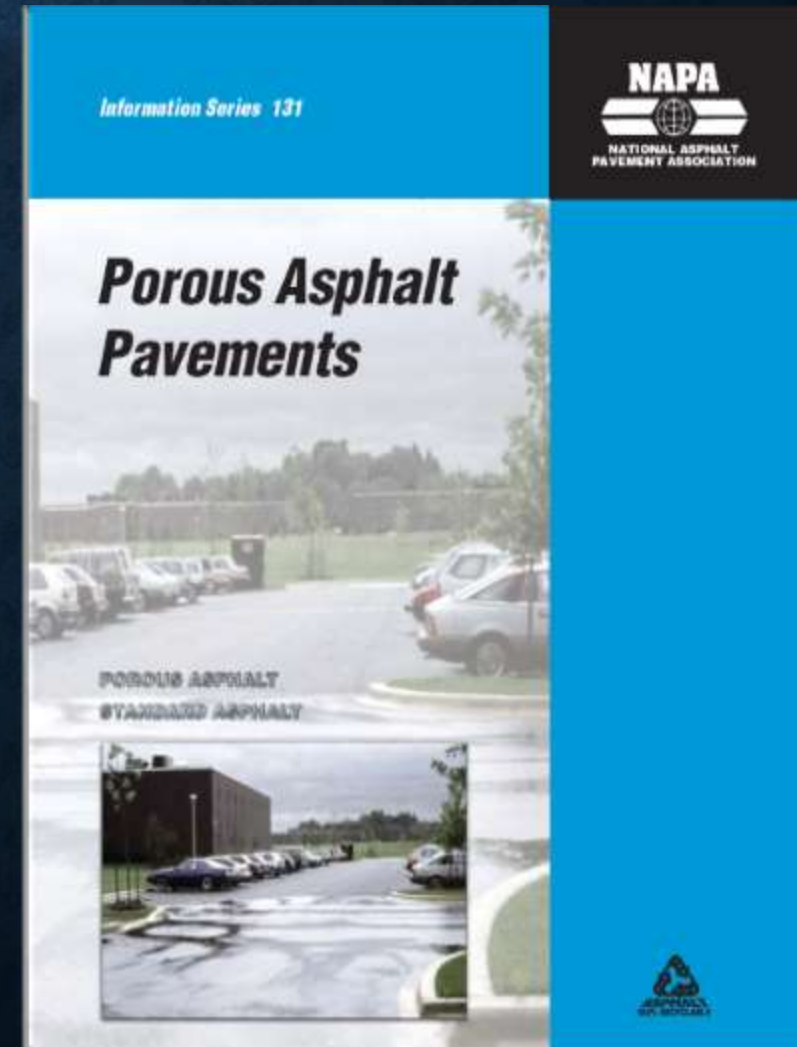
- Reduce TSS
- Reduce TP
- Infiltrate
- Reduce Runoff Rates
- Can reduce/eliminate storm sewer
- Can deal with stormwater under the pavement

# WHEN TO AVOID PERMEABLE PAVEMENT

- See Tech. Standard 1002
- High groundwater
- High bedrock
- Within 25' of POWTS
- Within 10' of building foundation
- Dirty sites

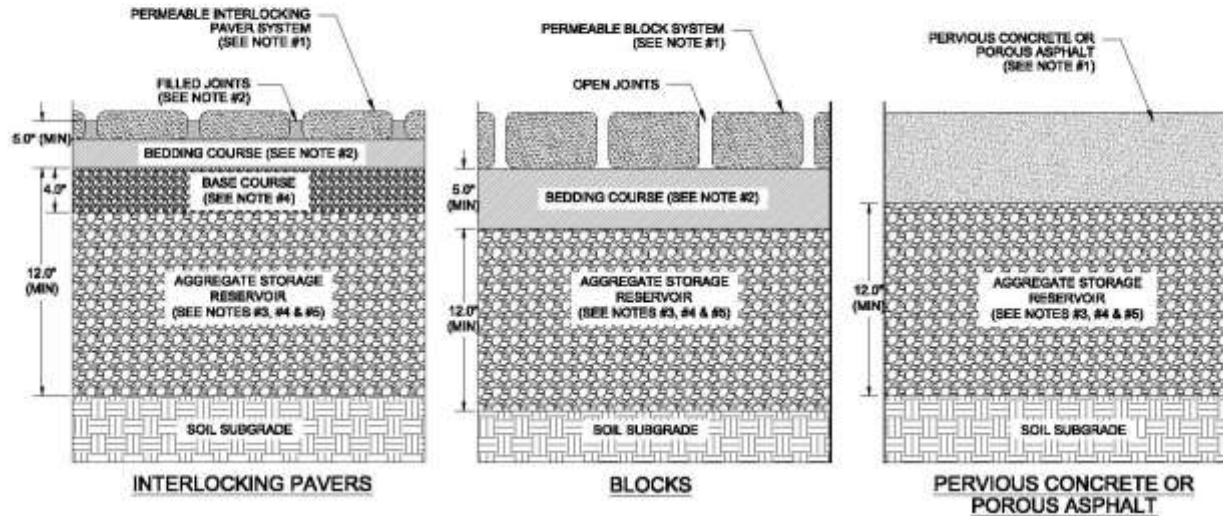
# GENERAL DESIGN RESOURCES

- American Concrete Institute
- National & WI Redimix Association
- National & Wisconsin Asphalt Pavement Association
- Interlocking Concrete Pavement Institute



# PERMEABLE PAVEMENT (1008)

FIGURE 1. CRITERIA FOR UNDERDRAIN DISCHARGE AND INFILTRATION PRETREATMENT CREDITS



**NOTES:**

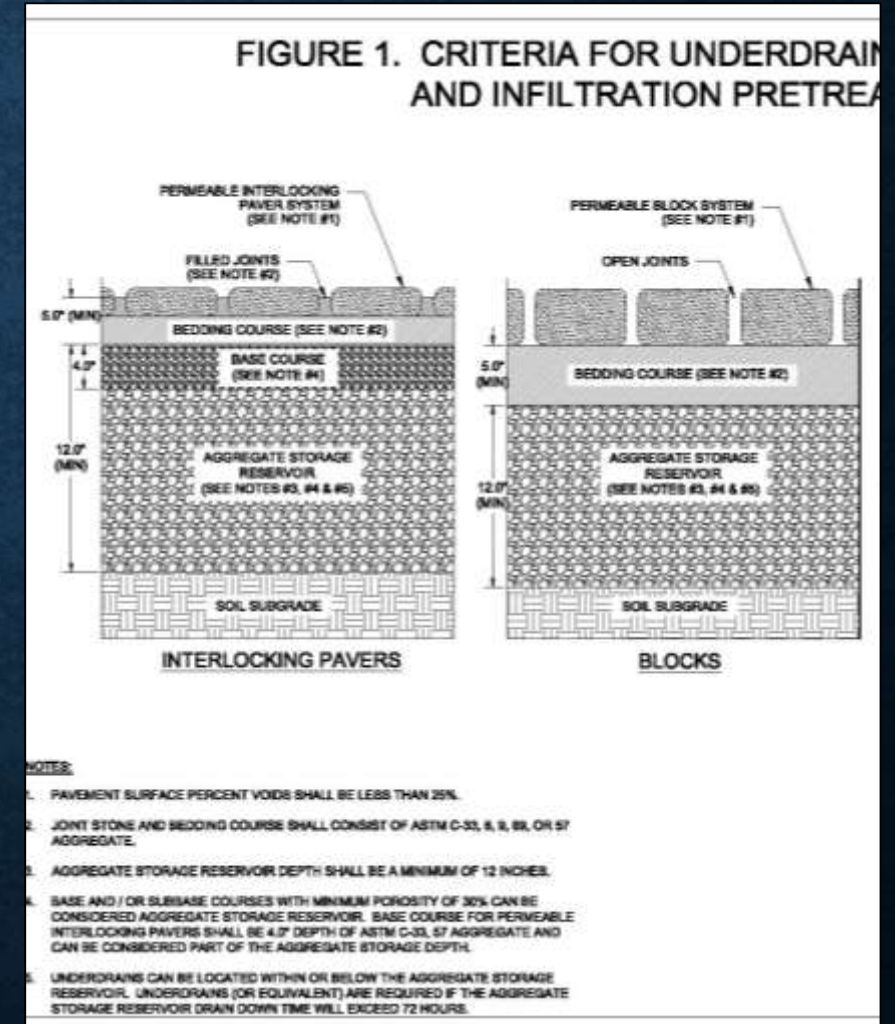
1. PAVEMENT SURFACE PERCENT VOIDS SHALL BE LESS THAN 25%.
2. JOINT STONE AND BEDDING COURSE SHALL CONSIST OF ASTM C-33, 8, 9, 88, OR 57 AGGREGATE.
3. AGGREGATE STORAGE RESERVOIR DEPTH SHALL BE A MINIMUM OF 12 INCHES.
4. BASE AND / OR SUBBASE COURSES WITH MINIMUM POROSITY OF 30% CAN BE CONSIDERED AGGREGATE STORAGE RESERVOIR. BASE COURSE FOR PERMEABLE INTERLOCKING PAVERS SHALL BE 4.0" DEPTH OF ASTM C-33, 57 AGGREGATE AND CAN BE CONSIDERED PART OF THE AGGREGATE STORAGE DEPTH.
5. UNDERDRAINS CAN BE LOCATED WITHIN OR BELOW THE AGGREGATE STORAGE RESERVOIR. UNDERDRAINS (OR EQUIVALENT) ARE REQUIRED IF THE AGGREGATE STORAGE RESERVOIR DRAIN DOWN TIME WILL EXCEED 72 HOURS.



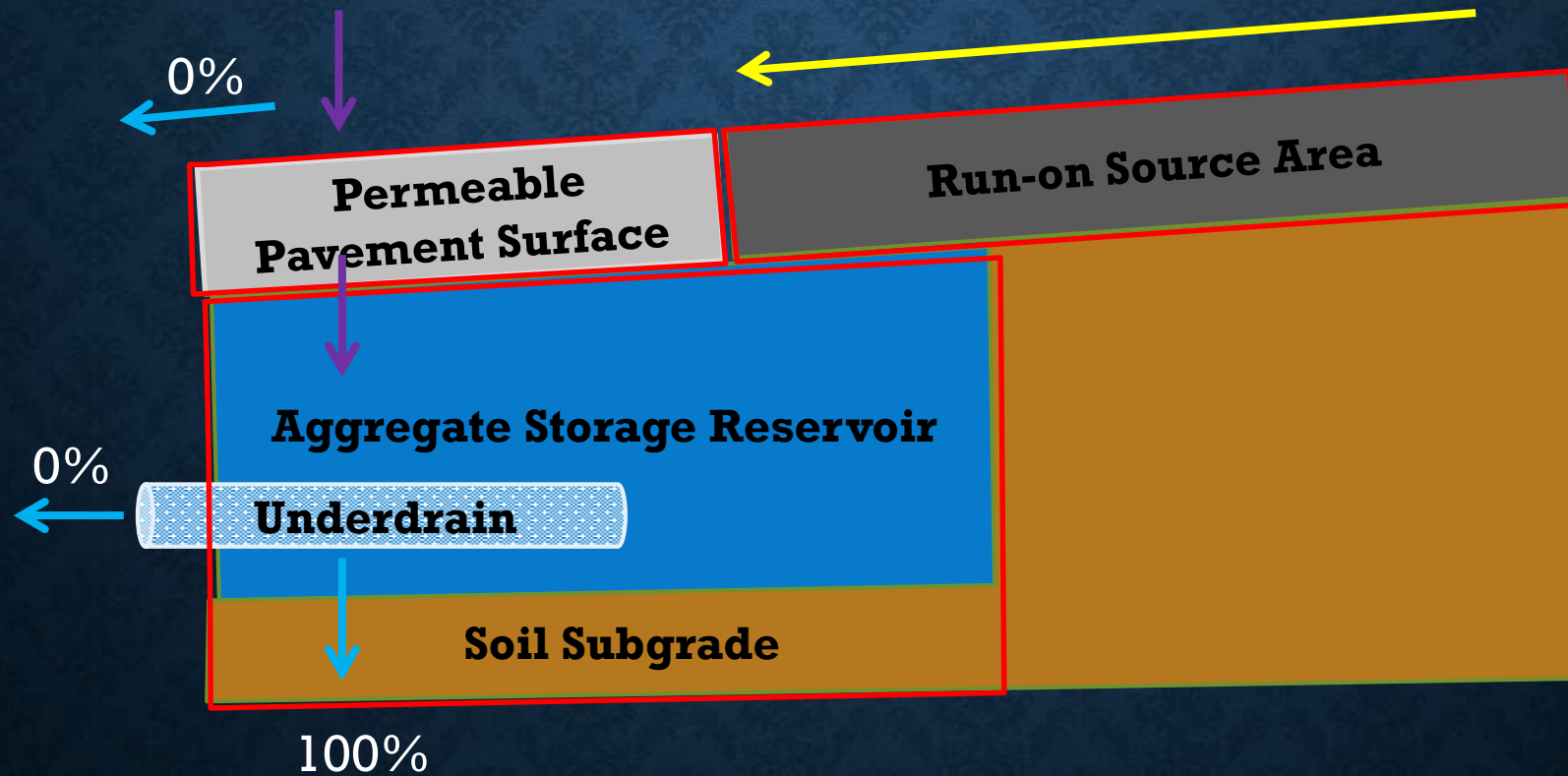
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# DNR INFILTRATION PRETREATMENT REQUIREMENTS

- Pavement 25% max voids or
- Drains through 5" of stone  
ASTM C-33, No. 8, 89, 9 or 57  
aggregate in the paver  
joints or below the pavers
- 12" minimum aggregate  
storage layer.



# INFILTRATION CREDITS



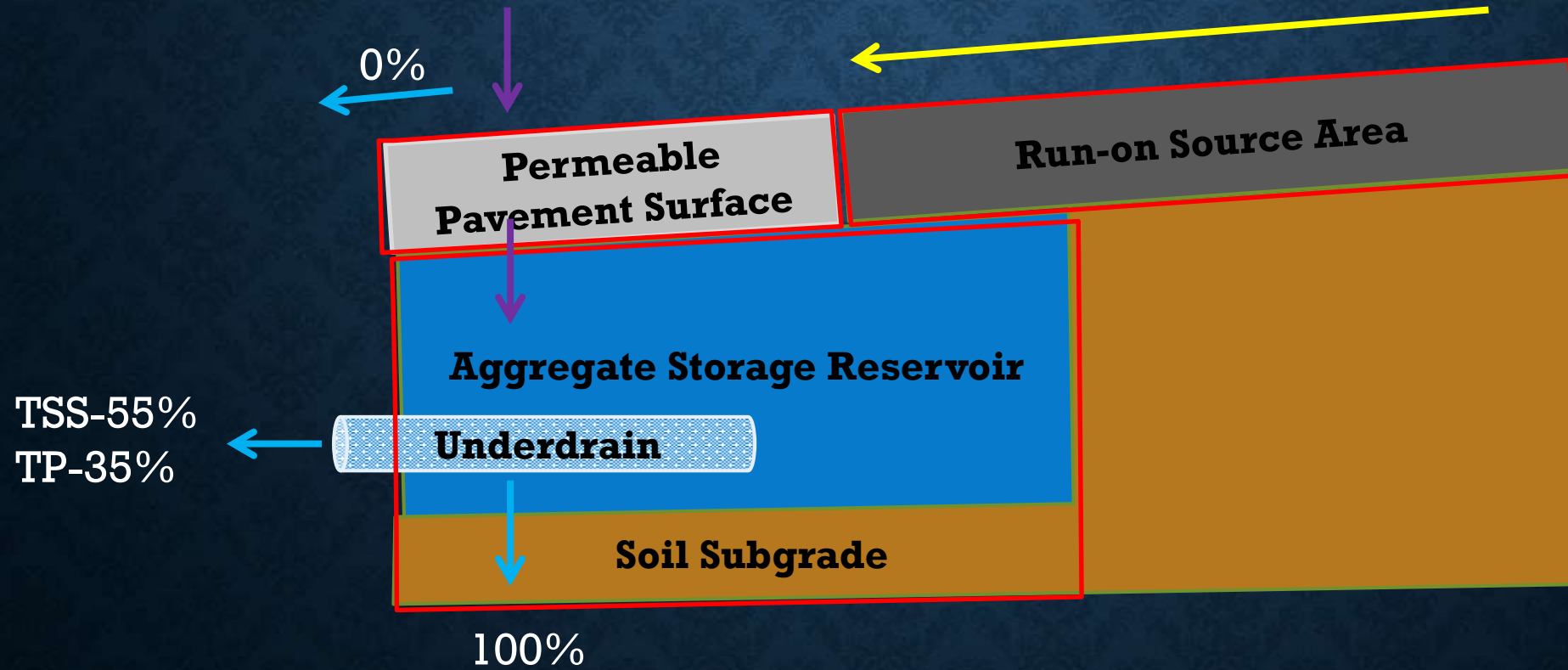


## **WATER QUALITY CREDITS**

Water through permeable pavement and aggregate storage (to underdrain).

- 55% TSS reduction
- 35% TSS reduction
- 100% Water infiltrated

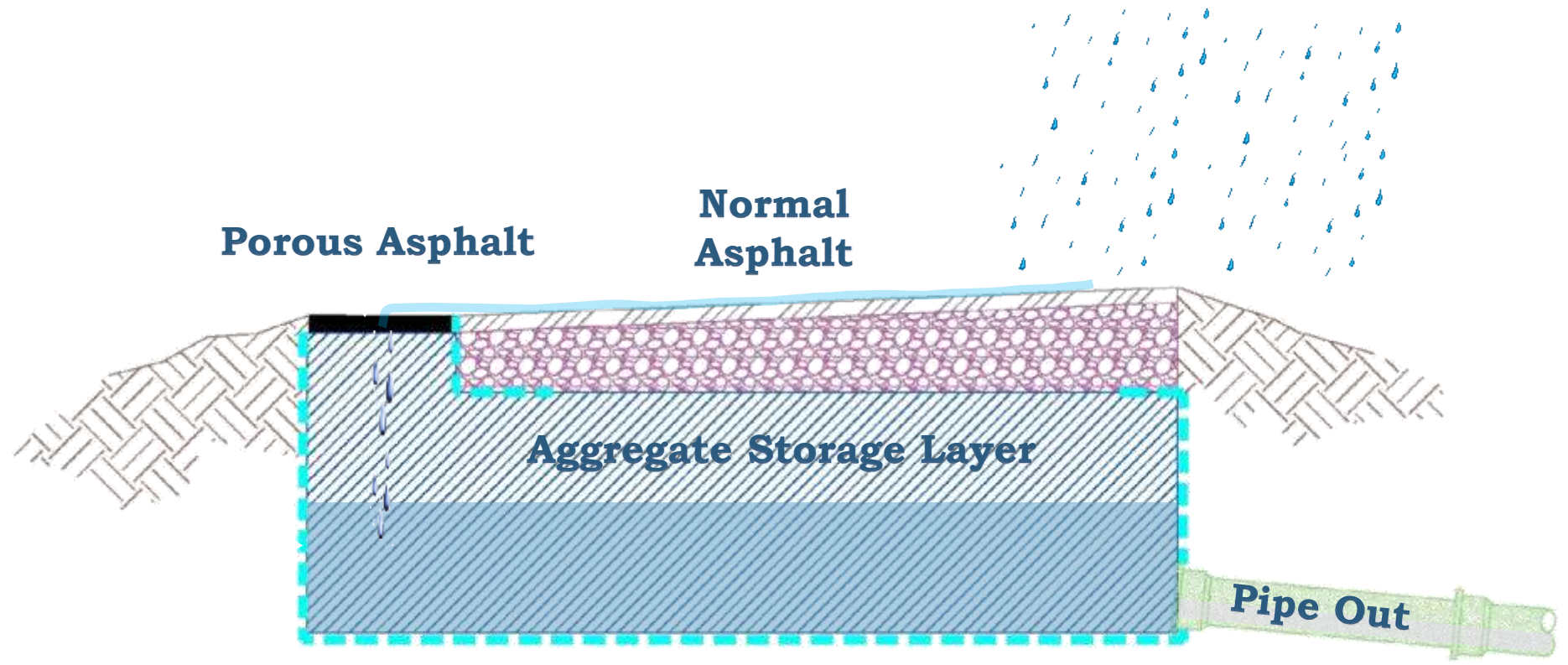
# WATER QUALITY CREDITS

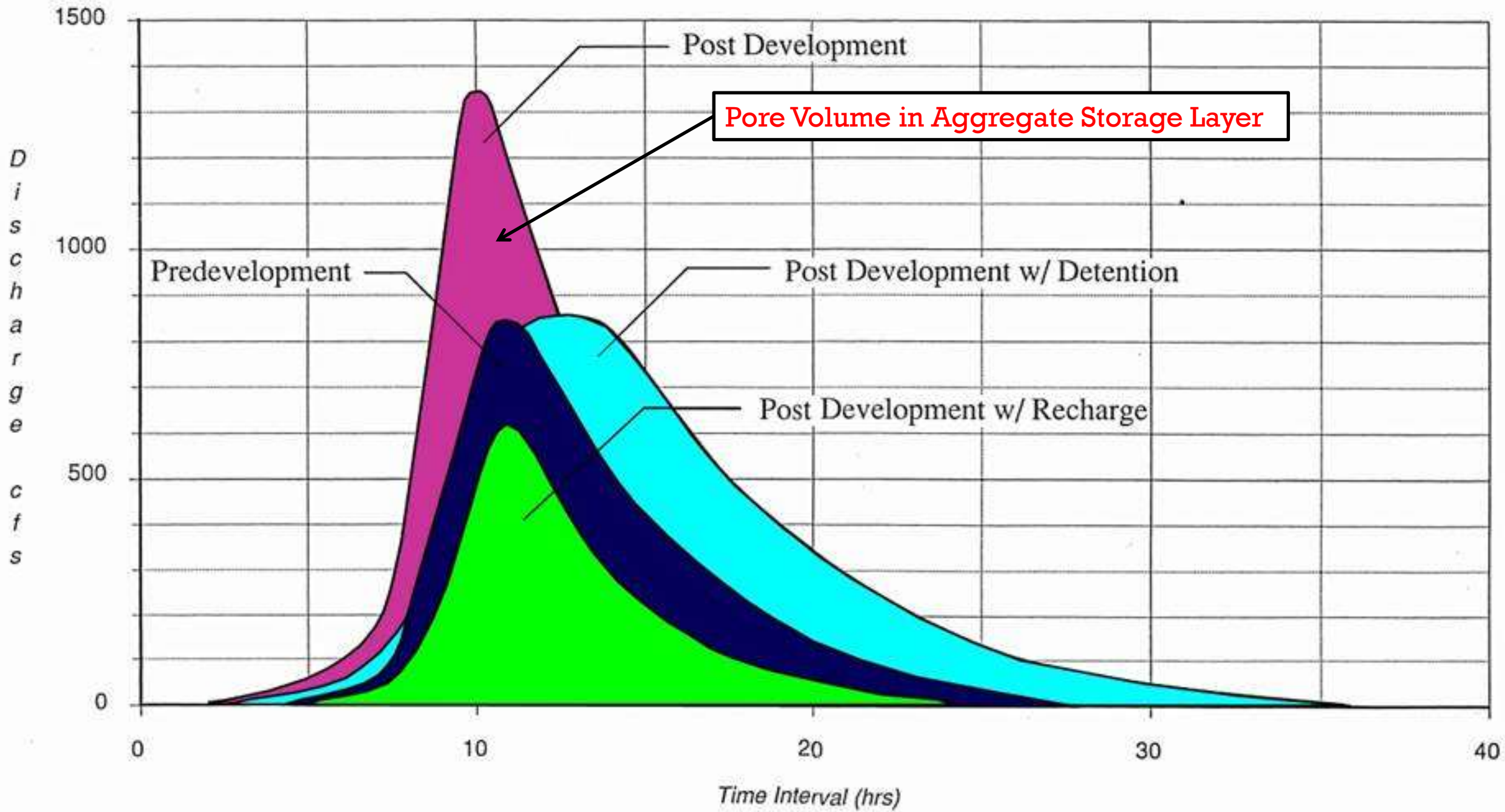


# WATER QUANTITY DESIGN

- Same as Detention Pond
- Volume = Pore Space
- Inflow Hydrograph
- Storage Indication Pond Routing
- Metrics: 33% Porosity Under All Pavement & 24-hour rainfall
  - 12" aggregate can store 4" of runoff from pavement above (+/-25-year recurrence interval)
  - 18" of aggregate can store 6" of runoff from pavement above (+/- 100-year recurrence interval)

# ROUTING GRAPHIC





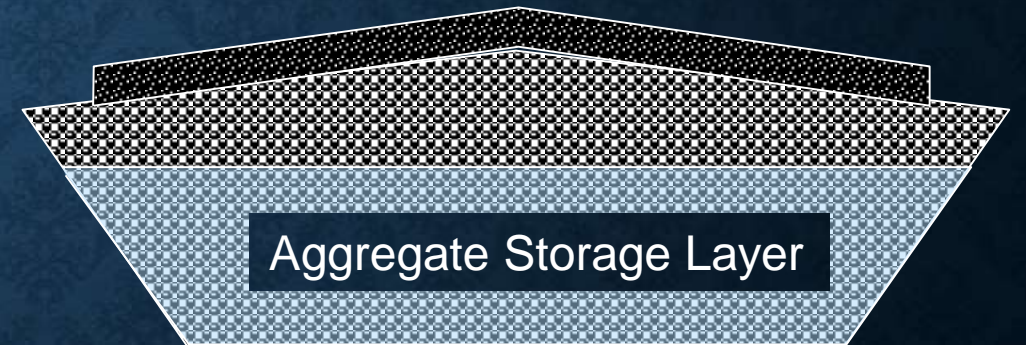
# SUBGRADE DESIGN

- Standard Allows 2% Bottom
- Recommend Flat Bottom
- Soil Separation Fabric in Silt & Clay
- Liner?



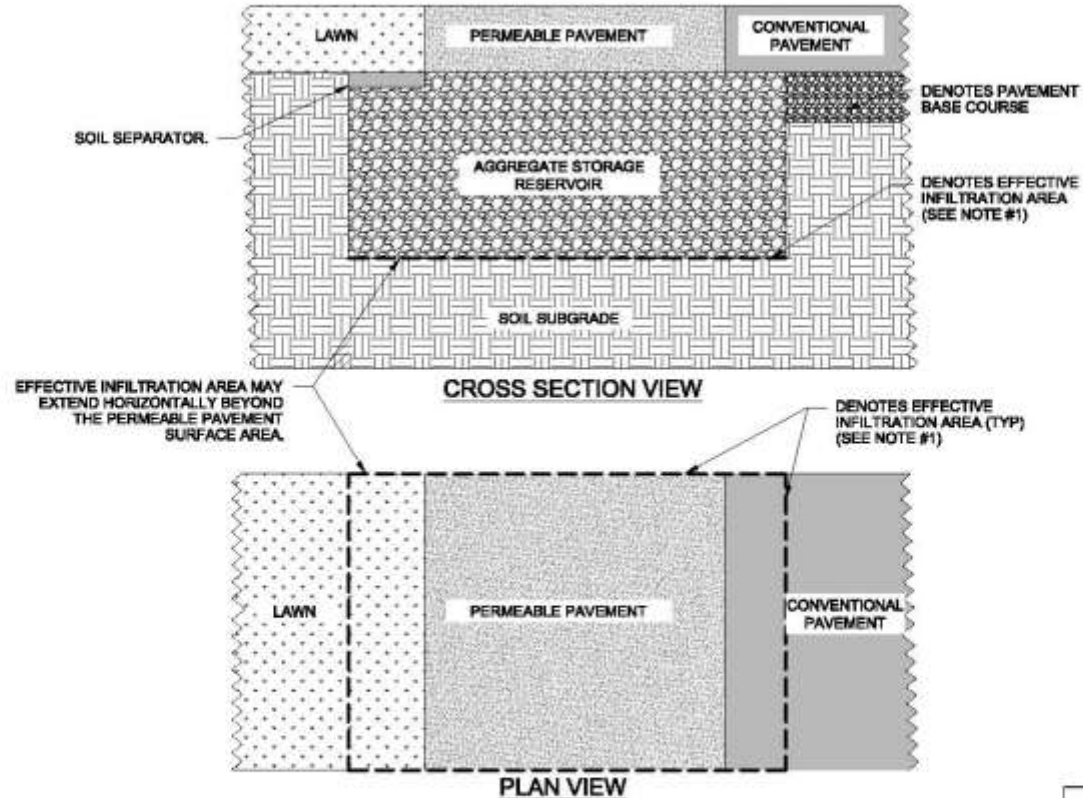
# AGGREGATE STORAGE LAYER DESIGN

- Clear stone
- 5% Max. passing #200 sieve (consider 2%)
- Minimum porosity 30%
- Typical 40%
- Recommend design of 33%
- Comply with WisDOT soundness, wear, etc. standards
- Consider covering top of storage layer until paving



# AGGREGATE STORAGE LAYER DESIGN

FIGURE 2. EFFECTIVE INFILTRATION AREA



**NOTES:**

1. THE EFFECTIVE INFILTRATION AREA CAN BE INCREASED BY EXTENDING THE AGGREGATE STORAGE RESERVOIR UNDER CONVENTIONAL PAVEMENT SURFACES OR IN OTHER APPROPRIATE AREAS, SUCH AS LAWNS WITH SOIL SEPARATOR (e.g., FILTER FABRIC).
2. EFFECTIVE INFILTRATION AREA IS THE AREA USED TO INFILTRATE RUNOFF INTO THE SOIL SUBGRADE AS DEFINED IN s. NR 151.002(12) OF THE WIS. ADM. CODE.
3. FOR PERMEABLE PAVEMENT SYSTEMS THAT WILL RECEIVE RUN-ON FROM ROAD AND / OR PARKING LOT SOURCE AREAS, THE RATIO OF RUN-ON AREA TO EFFECTIVE INFILTRATION AREA SHALL BE NO GREATER THAN 3:1.

**3:1 Run-on to Effective Infiltration Area**



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# PROTECT STORAGE LAYER DURING CONSTRUCTION



# PAVEMENT DESIGN-ASPHALT

- Asphalt Pavement = Rocks and Liquid Asphalt
- 6% Liquid Asphalt
- 3/8" Stone
- 18% Voids
- Minimize Fine Particles
- Drain Down Concern



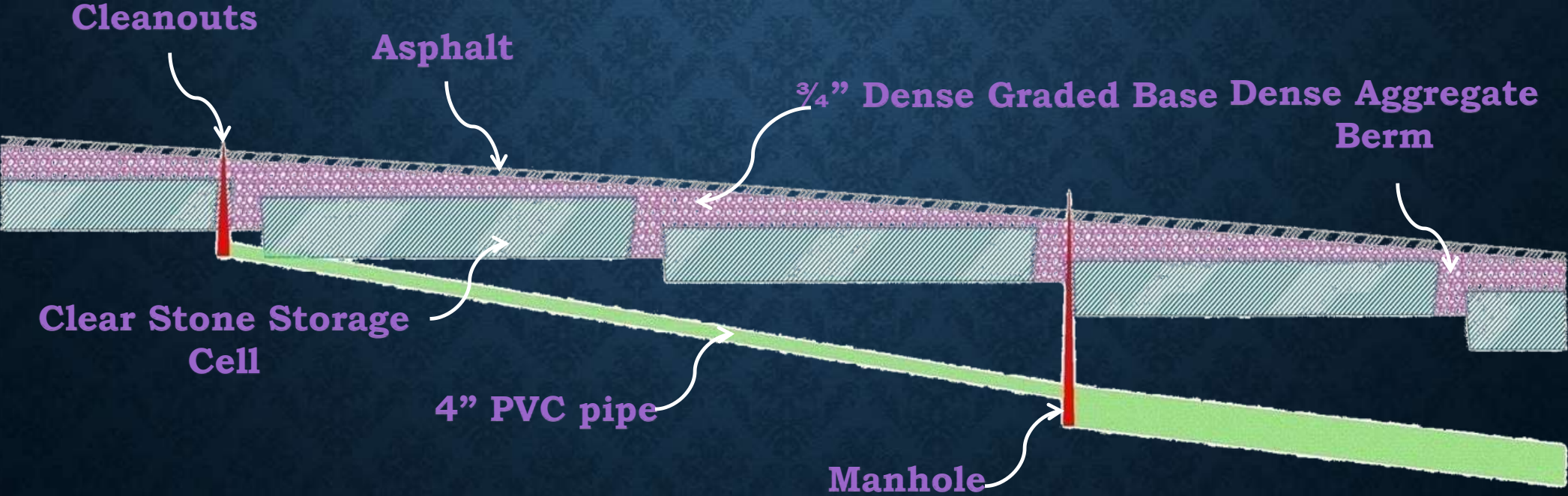
# PAVEMENT DESIGN-ASPHALT

- Little Asphalt Compaction
- Tender Initially
- Stiffens in about 7 Days
- Protect From Landscapers

# UNDERDRAINS – IF NEEDED

- 4” Minimum Perforated Pipe
- Location
  - Bottom of aggregate storage – silt/clay soils
  - Higher in Other Soils
  - 4” Minimum Stone Around pipe
- Drain down in 72 hours
- One observation well per acre
- No socks!

# WHAT ABOUT SLOPED INSTALLATIONS



# SUMMARY

- Follow Tech Std & Use Industry Guidance
- Model Quantity/Quality/Infiltration
- Get a Good Materials Engineer to Help
- Design Specifics for Asphalt, Aggregates & Subgrade

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