

Design Standards

for Bioretention Facilities

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Topics

- 💧 Why such emphasis on bioretention?
- 💧 Criteria for hydrologic performance and NPDES compliance
 - 💧 Area and volume requirements
 - 💧 Discharge orifice requirements and outlet design
 - 💧 Soil specification
- 💧 Additional Design Specifications
 - 💧 Gravel and underdrain
 - 💧 Plantings
 - 💧 Structural



Why Bioretention?



Area and Volume Criteria

- ◆ Sizing Factor for Treatment Only

- ◆ $A \geq 0.04$

- ◆ Sizing Factors for Treatment + Flow Control

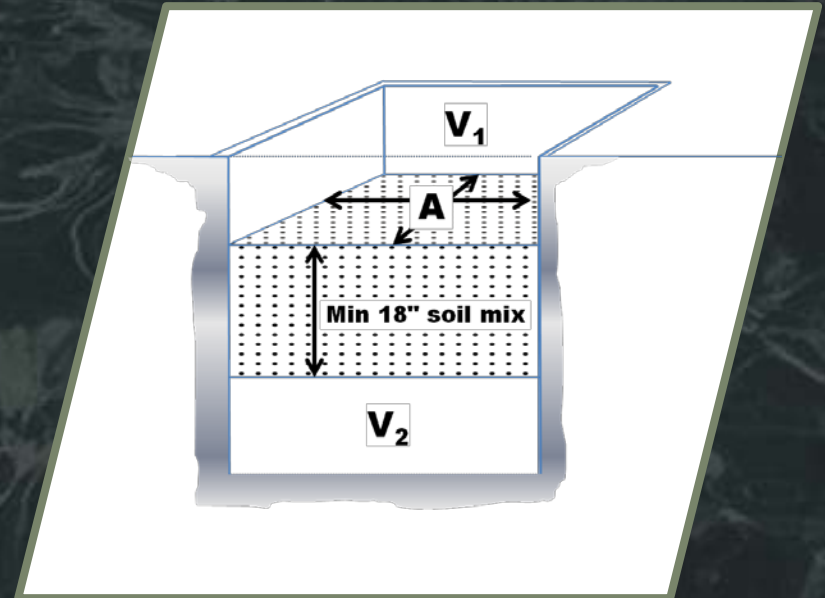
- ◆ 3 factors

- ◆ Vary with soil type and rainfall record (location)

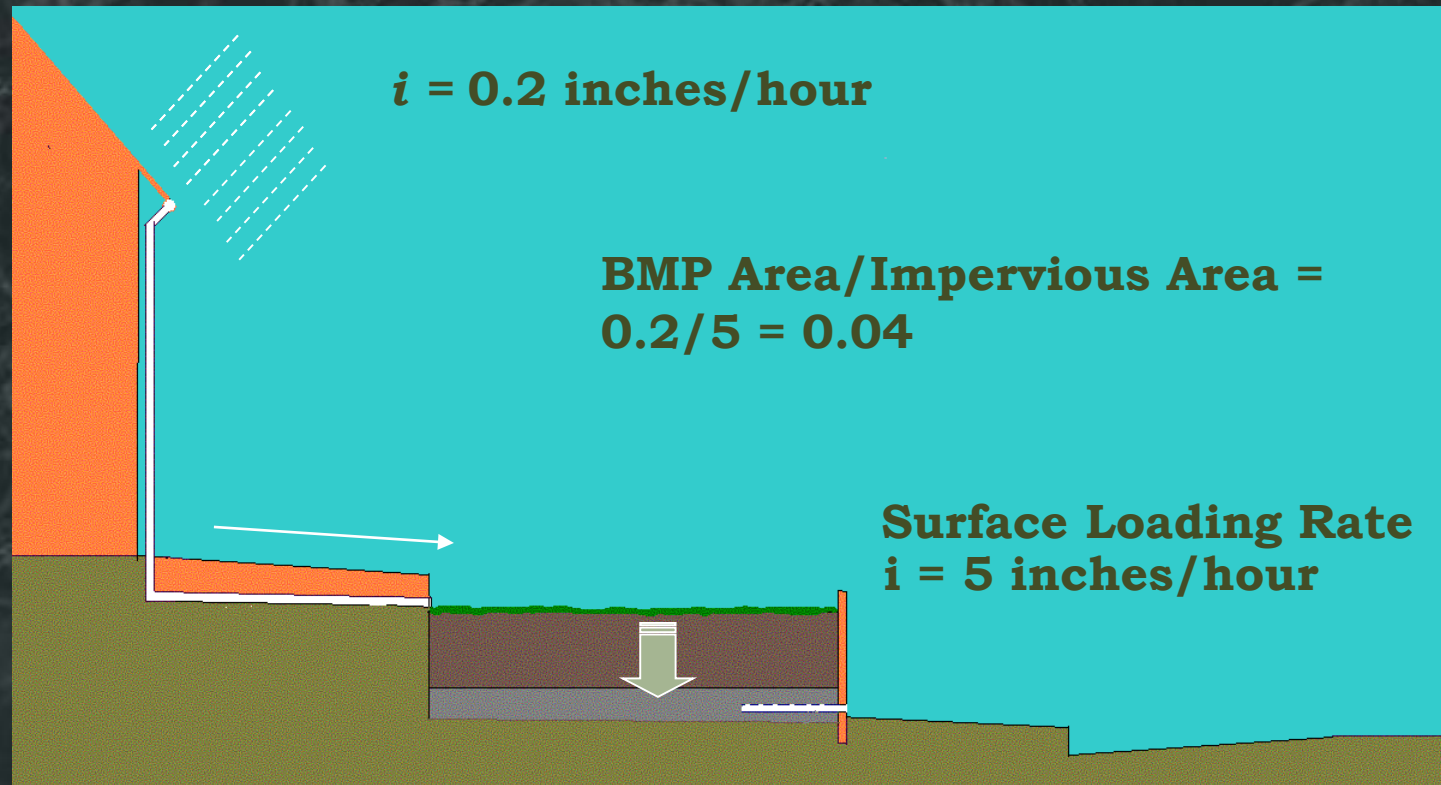
- ◆ **A** is the wetted surface area of the bioretention soil mix

- ◆ **V₁** is the surface storage at overflow stage

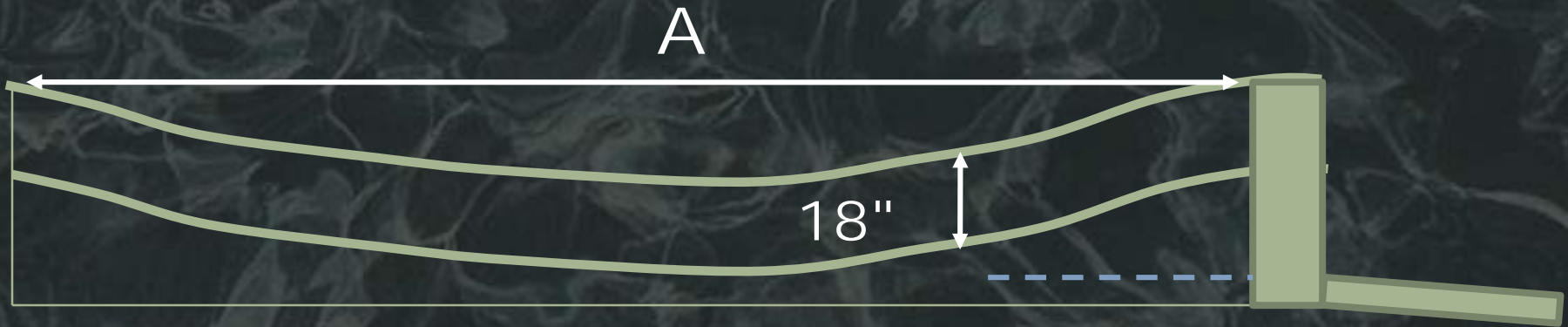
- ◆ **V₂** is the free volume within the gravel layer



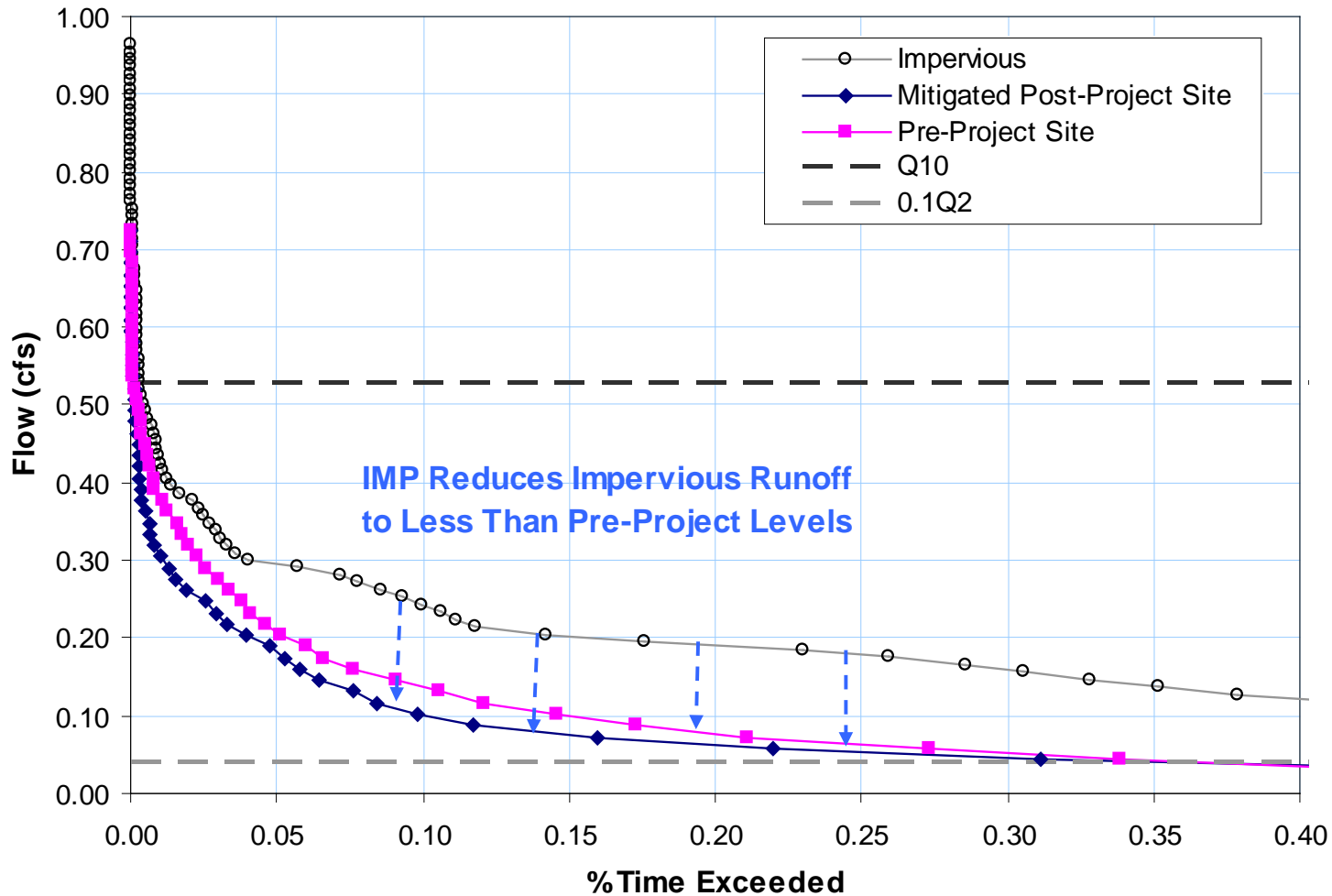
Treatment-Only Criterion



Section – Treatment Only



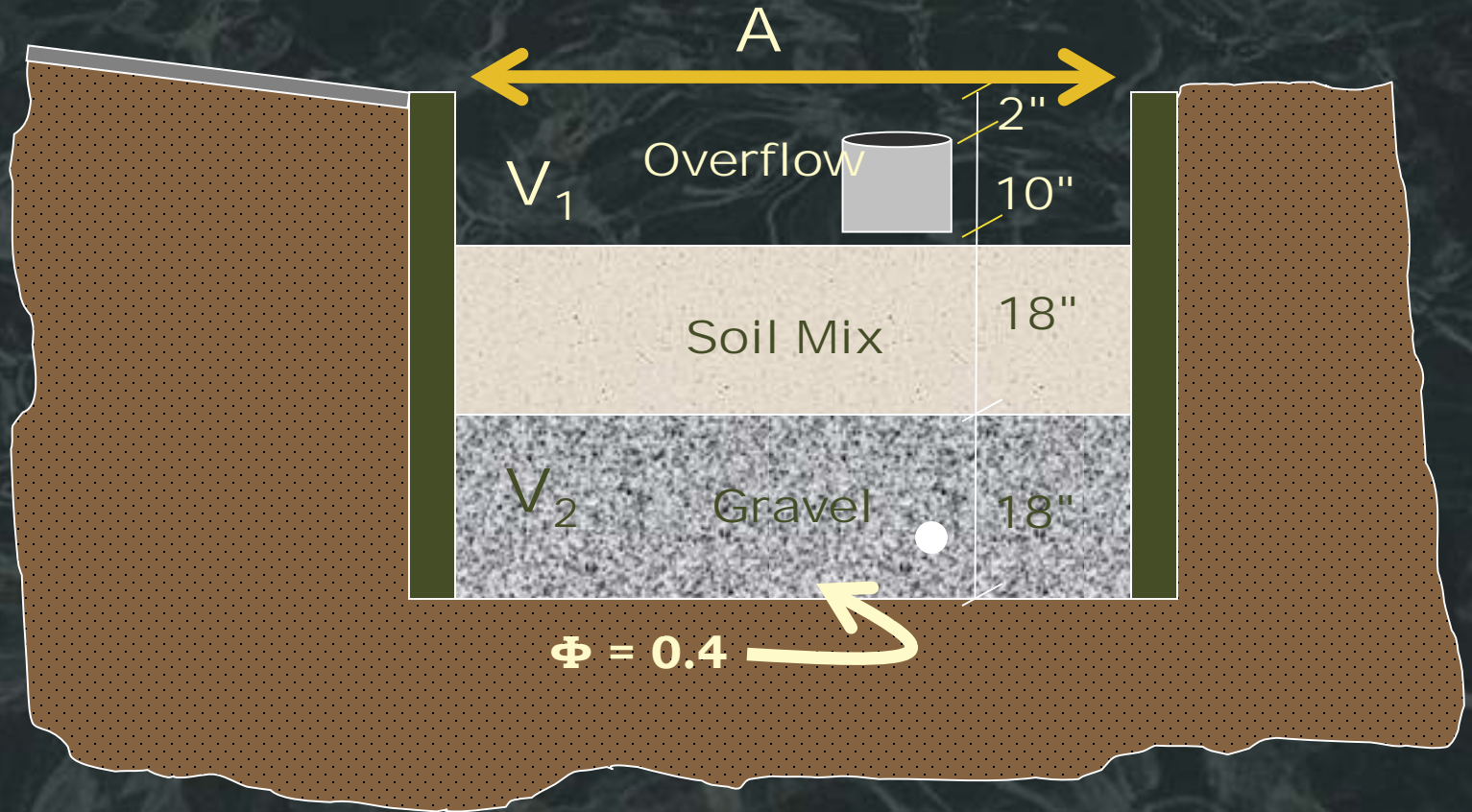
Flow-Control Criteria



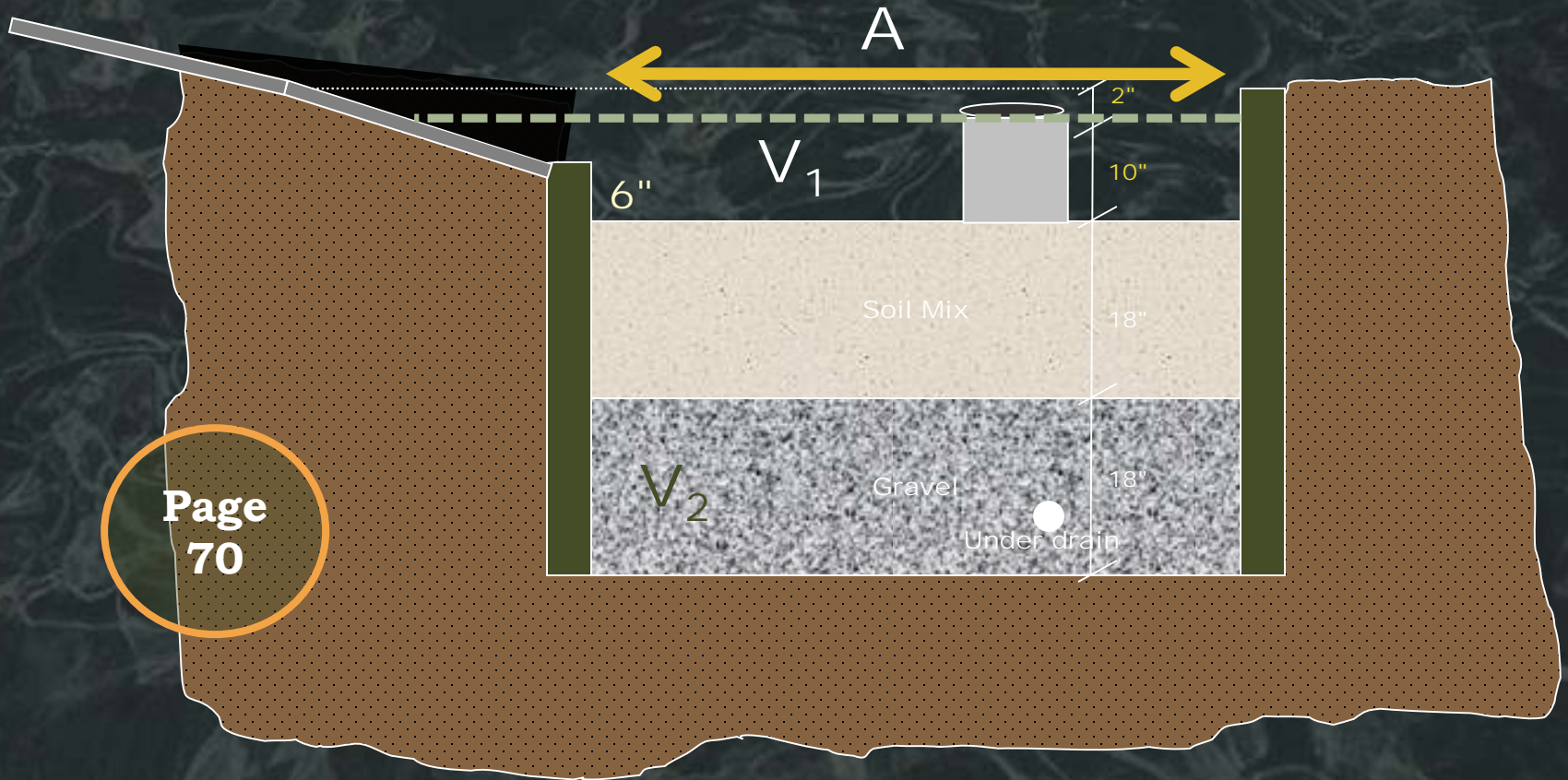
Sizing Factors

Facility Design	Soil Group	Area A (ft ² /ft ²)	Volume V₁ (ft ³ /ft ²)	Volume V₂ (ft ³ /ft ²)	Rainfall Adjustment for Surface Area	Rainfall Adjustment for Storage Volume	Maximum Release Rate
Bioretention Facility	A	0.07	0.058	No min.	Eq. 4-6	Eq. 4-6	No orifice
	B	0.11	0.092	No min.	Eq. 4-7	Eq. 4-7	No orifice
	C	0.06	0.050	0.066	Eq. 4-8	Eq. 4-8	Eq. 4-10
	D	0.05	0.042	0.055	Eq. 4-9*	Eq. 4-9	Eq. 4-11
Flow-through Planter	A	Not permitted in "A" soils					
	B	Not permitted in "B" soils					
	C	0.06	0.050	0.066	Eq. 4-8	Eq. 4-8	Eq. 4-10
	D	0.05	0.042	0.055	Eq. 4-9*	Eq. 4-9	Eq. 4-11
Dry Well	A	0.05	0.130	N/A	Eq. 4-6	Eq. 4-6	No release
	B	0.06	0.204	N/A	Eq. 4-7	Eq. 4-7	No release
	C	Not permitted in "C" soils					
	D	Not permitted in "D" soils					
Cistern + Bioretention	A	0.020	0.193	N/A	Eq. 4-13	Eq. 4-6	Eq. 4-17
	B	0.009	0.210	N/A	Eq. 4-14	Eq. 4-7	Eq. 4-12
	C	0.013	0.105	N/A	Eq. 4-15	Eq. 4-8	Eq. 4-10
	D	0.017	0.063	N/A	Eq. 4-16	Eq. 4-9	Eq. 4-11
Bioretention + Vault	A	0.04	N/A	0.096	N/A	Eq. 4-6	No release
	B	0.04	N/A	0.220	N/A	Eq. 4-7	Eq. 4-12
	C	0.04	N/A	0.152	N/A	Eq. 4-8	Eq. 4-10
	D	0.04	N/A	0.064	N/A	Eq. 4-9	Eq. 4-11

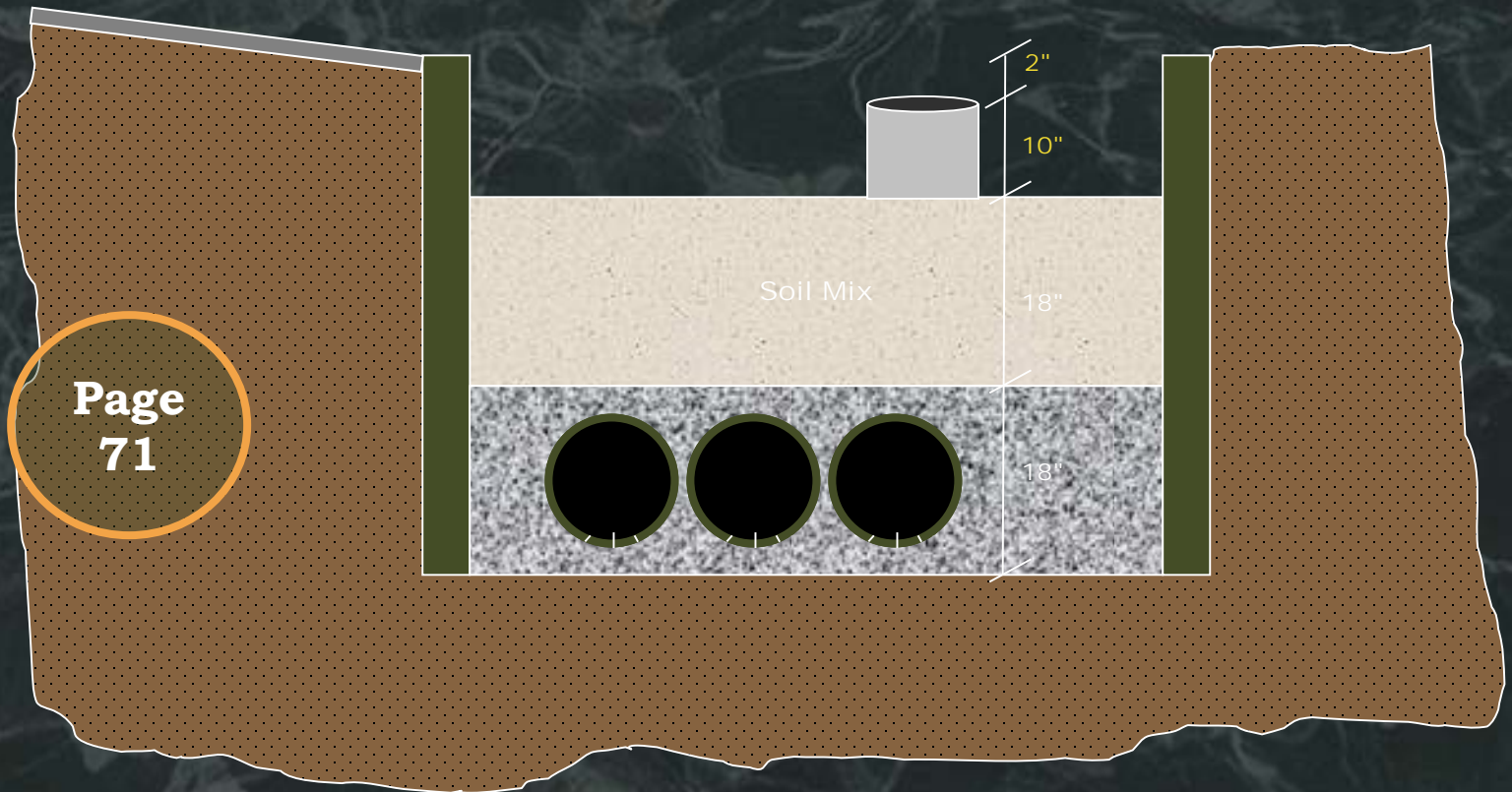
Standard Section



V_1 by flooding pavement



V_2 by large diameter pipes



Outlet Design

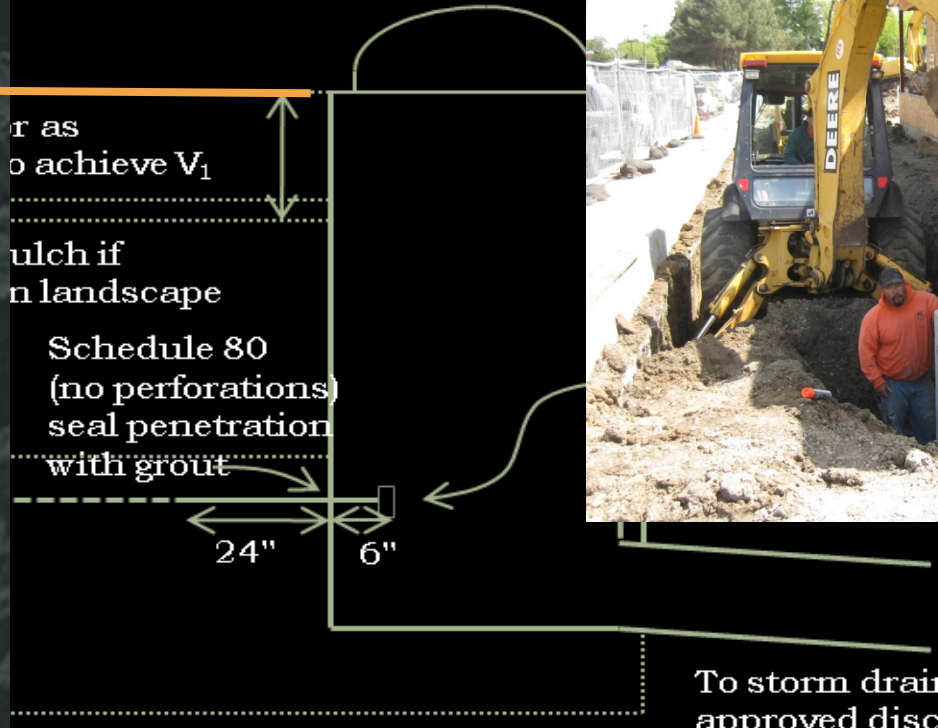
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Overflow structure
24" min x 36" min.
concrete drop inlet
or manhole with
frame and atrium
or beehive grate
¼" openings

Overflow
elevation

or as
to achieve V_1
mulch if
in landscape

Schedule 80
(no perforations)
seal penetration
with grout



Soil Specification

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- See Appendix B – Use Mix “B”
- 60-70% Sand
 - ASTM C33 for fine aggregate
- 30-40% Compost
 - Certified through US Composting Council Seal of Testing Assurance Program
- Issues since initiating a design specification
 - Suppliers may still be using a performance specification
 - Performance of non-spec materials starts out OK, then falls off with repeated wettings
 - Failures seem to correlate with observable presence of clays



Gravel and Underdrain

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- 💧 Class 2 permeable
 - 💧 Caltrans spec 68-1.025
 - 💧 Typical to be slightly off gradation spec on delivery
- 💧 No filter fabric
- 💧 Underdrain
 - 💧 PVC SDR 35 or equivalent
 - 💧 Holes facing downward
 - 💧 Solid pipe for 2' closest to outlet structure
 - 💧 Cleanout

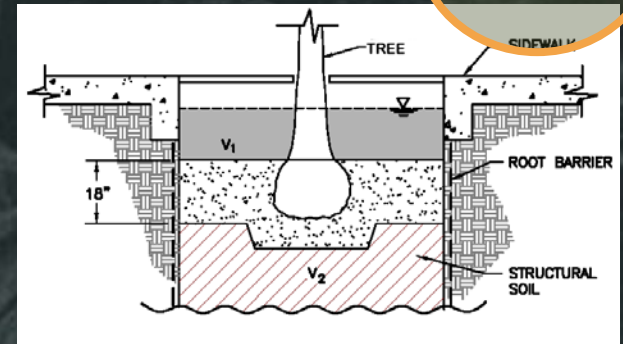


Plantings

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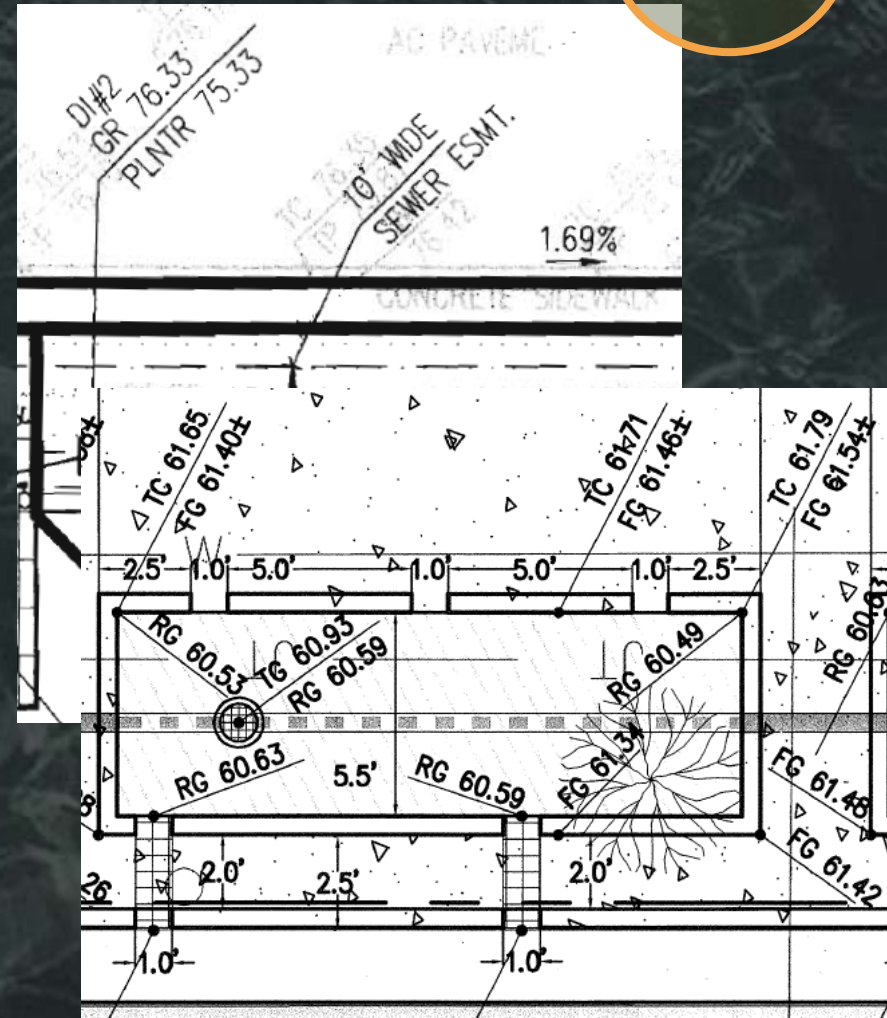
- List in Attachment B-1
 - Use experienced professionals
- Trees
 - Incorporate into bioretention facility
 - Account for surface roots
- Consider multi-purpose
 - Lawns or working gardens
 - Flooding is brief and only in winter



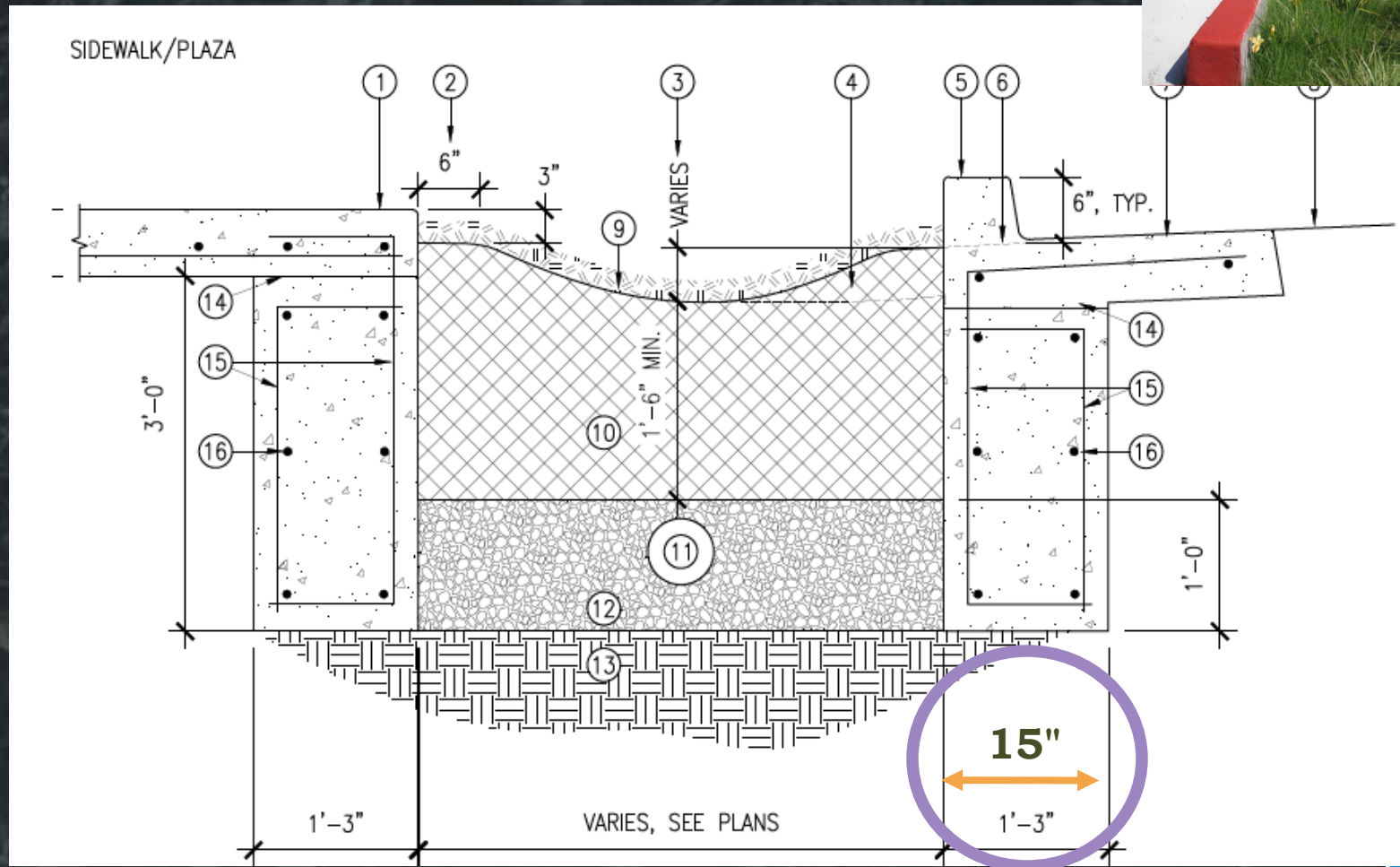
Call out elevations

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- Outlet structure
 - Top of overflow grate
 - Invert of subdrain
- Inlet
 - Flow line at inlet
 - Top of curb
 - Top of adjacent paving
- Soil layers
 - Top of soil layer
 - Bottom of gravel layer
 - Bottom of soil layer



Structural



Structural



11/03/2007



Inlets

