

LID Treatment Practices

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ASCE LID Conference

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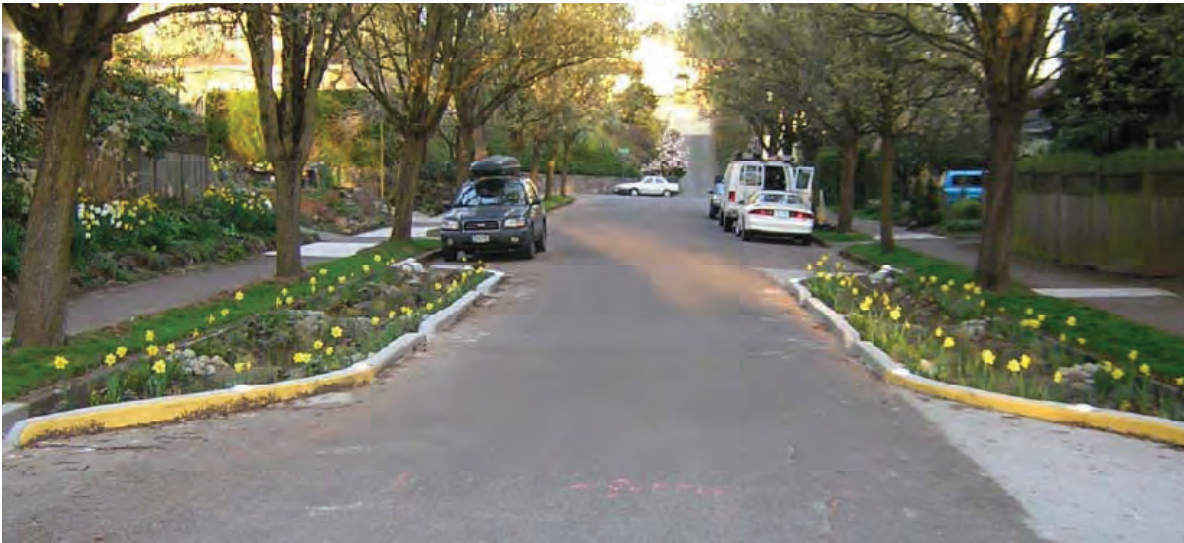
Overview

- Bioretention basics
- Bioretention cells
- Cisterns
- Permeable pavers/pervious concrete
- Disconnecting impervious area/vegetated swales
- Soil amendments
- Sustainable landscaping
- Rainwater harvesting
- Green roofs
- CASQA handbook

Bioretention Facilities

- Soil and plant-based filtration device
- Removal Mechanism
 - physical
 - biological
 - chemical

Bioretention along Streets



Flow Through Planters



Bioretention Examples



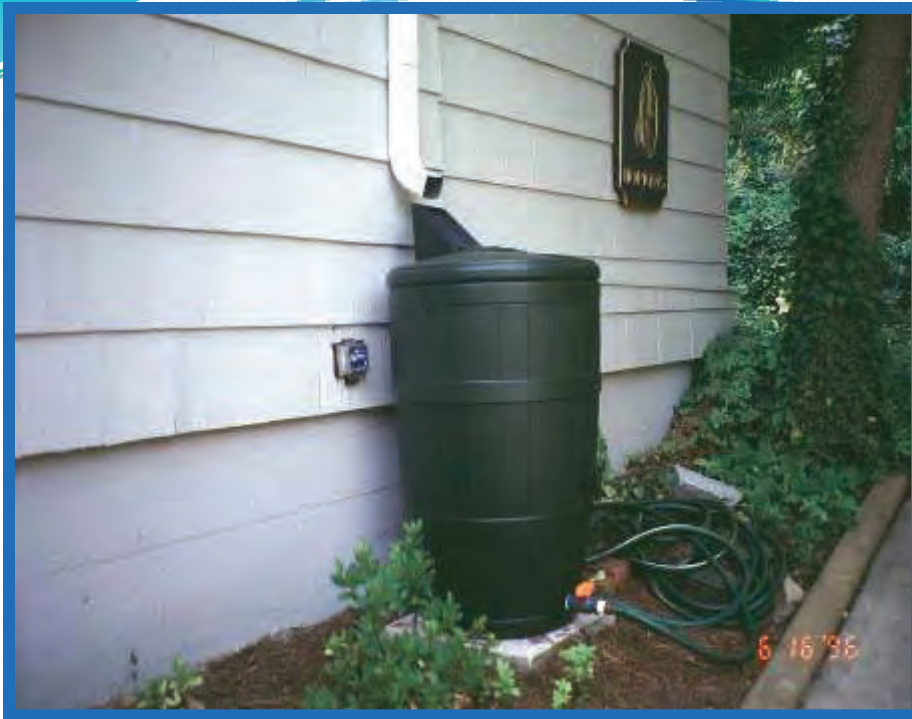
Commercial Installation



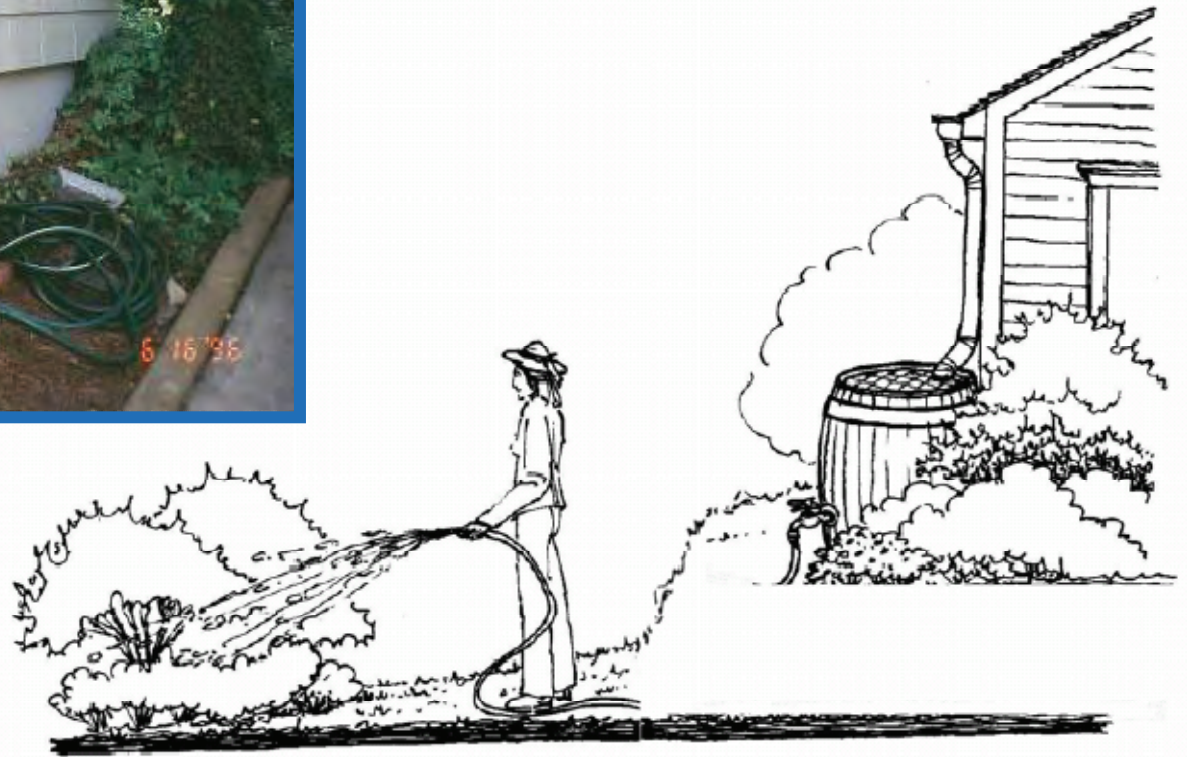
Residential



Cisterns



Roof Water Cisterns
Rain barrels



Rain Barrel

- Collect rooftop runoff
- Store it for reuse on the site



QUALITY ASSOCIATION

Rain Barrel



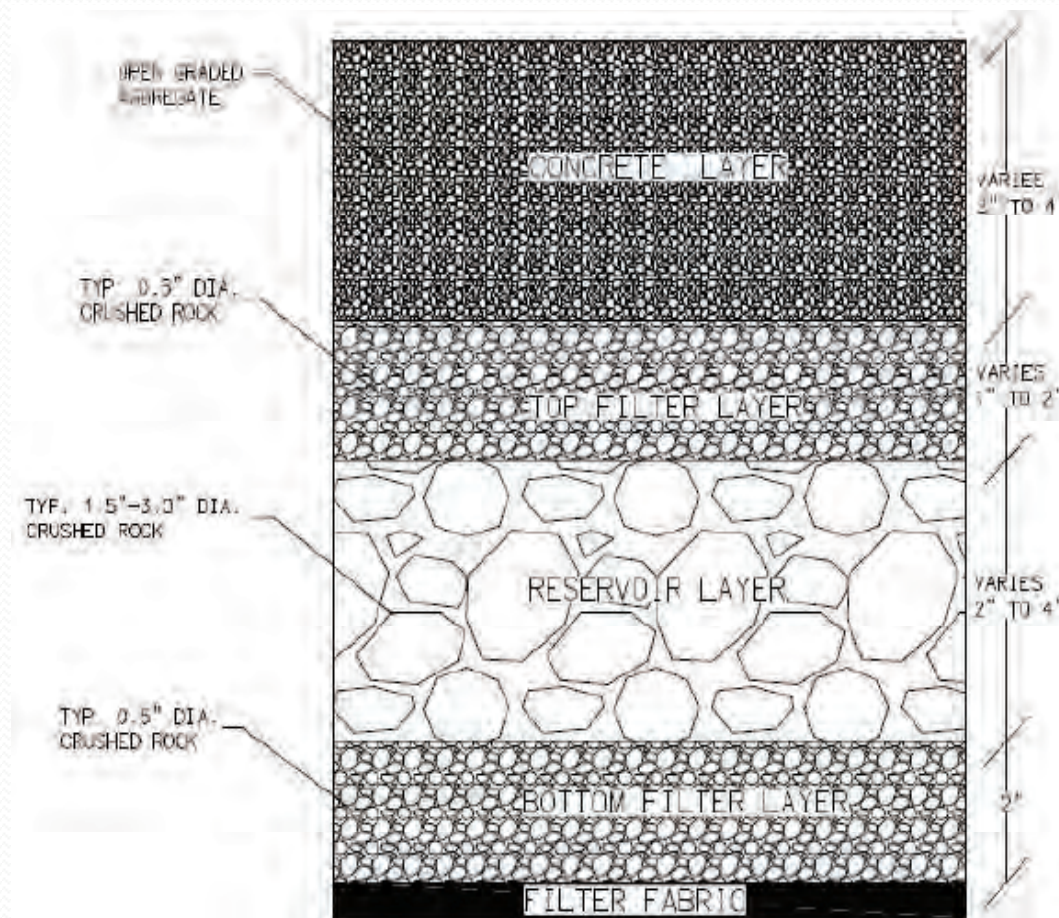
Design of Rain Barrel

- Sized based on WQV
- Screens on gutters and downspouts
- Drain for maintenance / reuse
- Not suitable for tar/ gravel/ asbestos/ treated cedar roofs

Porous Pavement

- Porous concrete
- Porous asphalt
- Permeable pavers
- Allow water to infiltrate into the ground
- Reduction in impervious surface areas at a project site.

Cross Section of Porous Pavement



Pervious Pavement



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Pervious Pavement



Pervious Pavement



Disconnecting Impervious Areas using Vegetated Swales and Strips



Grassy Swale – zero curb face



Grassy Swale – treat concentrated flow



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Grassy swales



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Swale vs Buffer Strips

- Swales
 - Designed to convey concentrated flow
 - Generally a flat bottomed channel
- Strips
 - Diffuse, shallow, sheet flow across a vegetated surface

Vegetated Strip

- Grassy slope
- Accepts sheet flow
- Removal Mechanism
 - Sedimentation
 - Infiltration



Neighborhood vegetated strip



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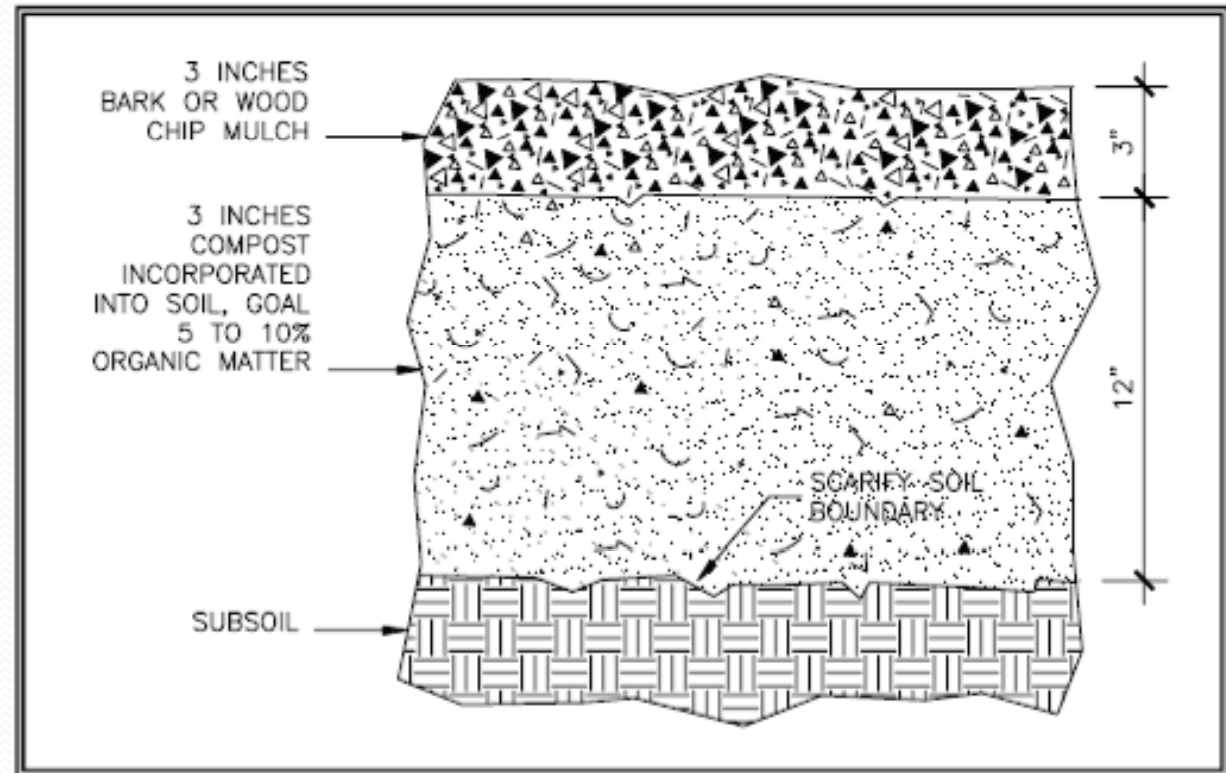
Soil Amendments WQ Benefits

- Holding more rainwater on-site
- Attenuates peak flows
- Decreases runoff
- Increase infiltration
- Adsorption of metals, uptake of nutrients
- Providing increased groundwater recharge through better infiltration and by maintaining the water on-site longer.
- Improving soil structure and stability, while increasing infiltration capacity and available storage within the soil.
- Increasing soil stability, leading to less runoff and erosion through improved cover conditions.



Soil Amendments

- Amendments to encourage native woody plants (WSDOT)





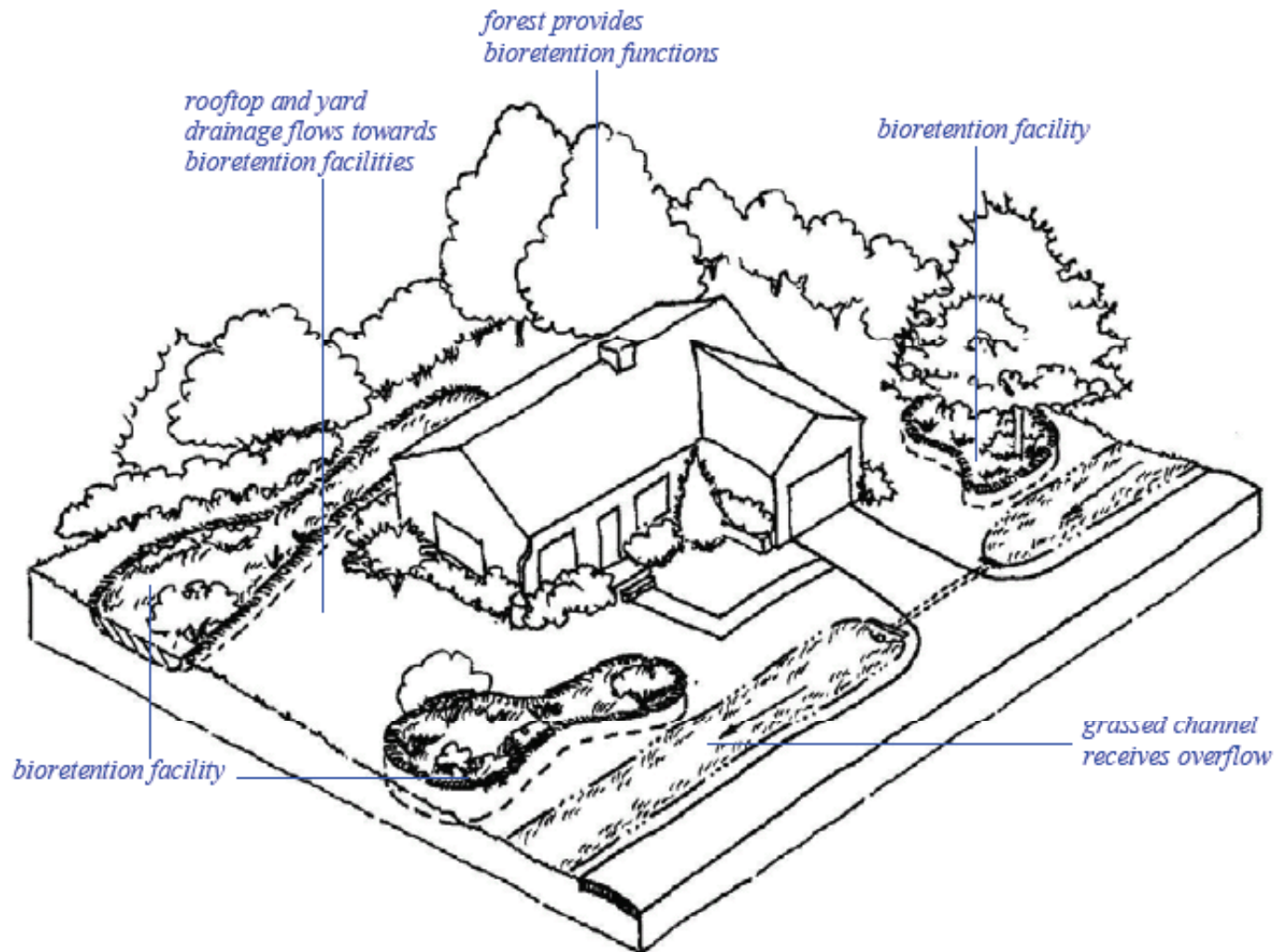
Sustainable Landscaping

Practices that enhance the quality and reduce the quantity of stormwater runoff using landscaping features.

Important to consider site conditions and select correct vegetation.



Landscaping



Bioretention

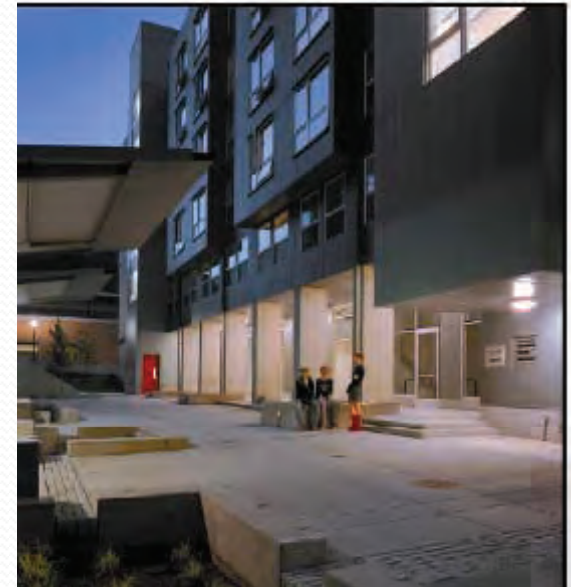


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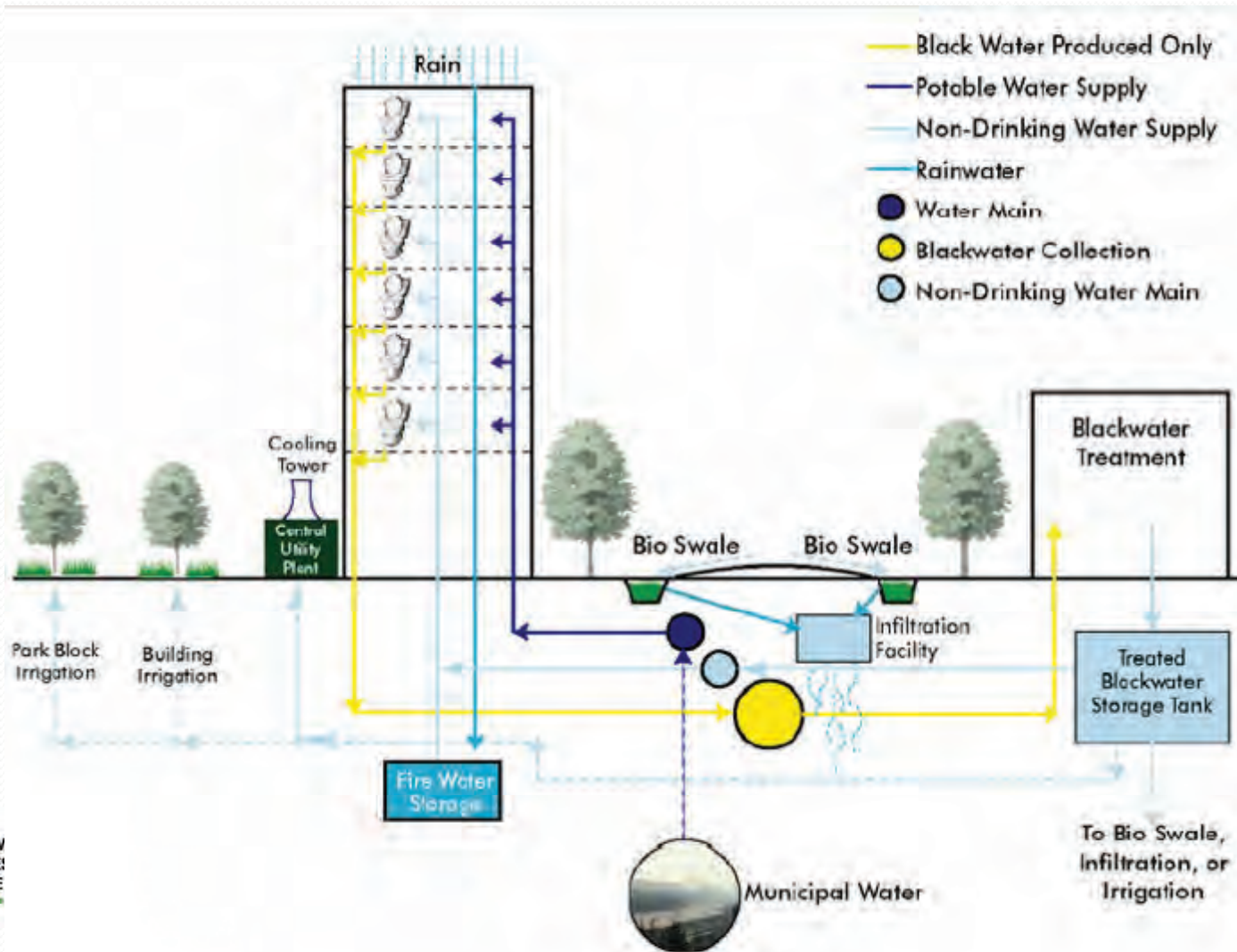
Sustainable Rainwater Harvesting

- Reuse for Irrigation
- Reuse for Cooling towers
- Reuse for Fire Suppression
- Reuse for toilet flushing



Source: Portland State University

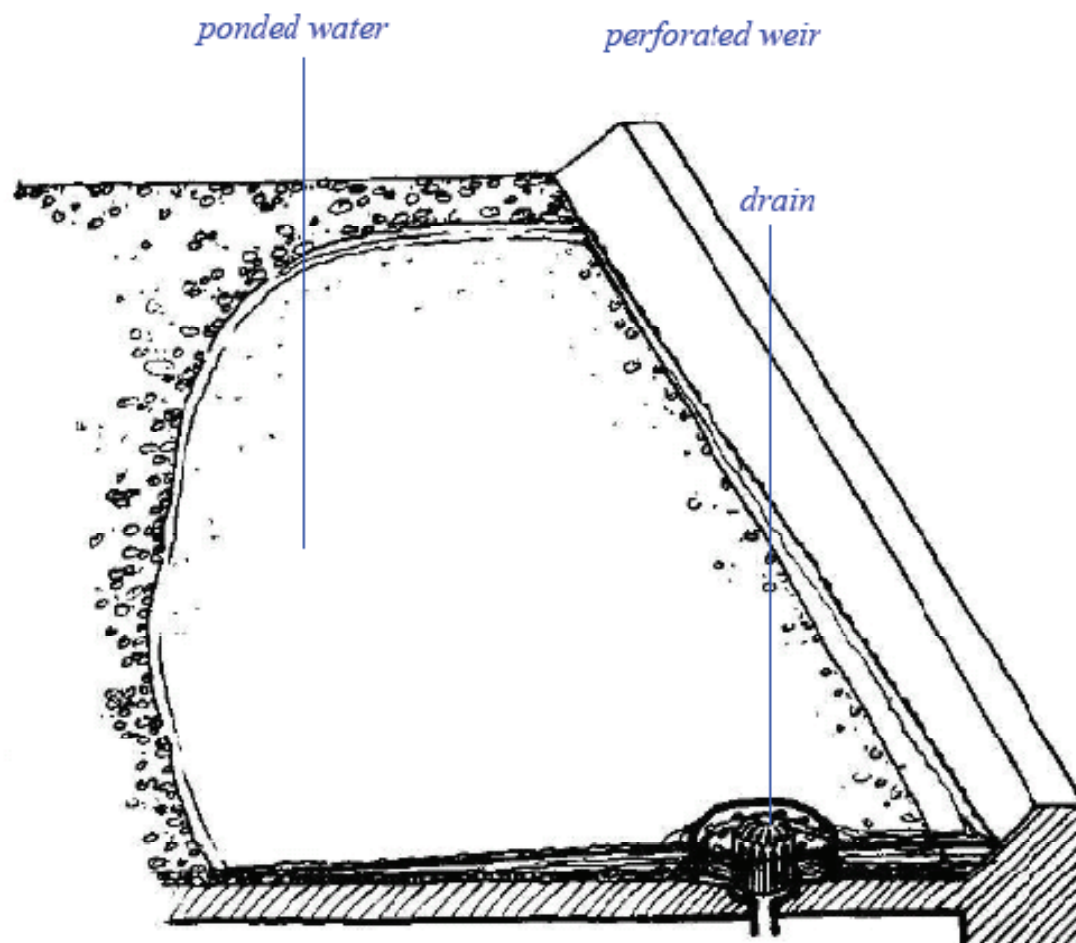
Building System Water Management



Reuse Regulations

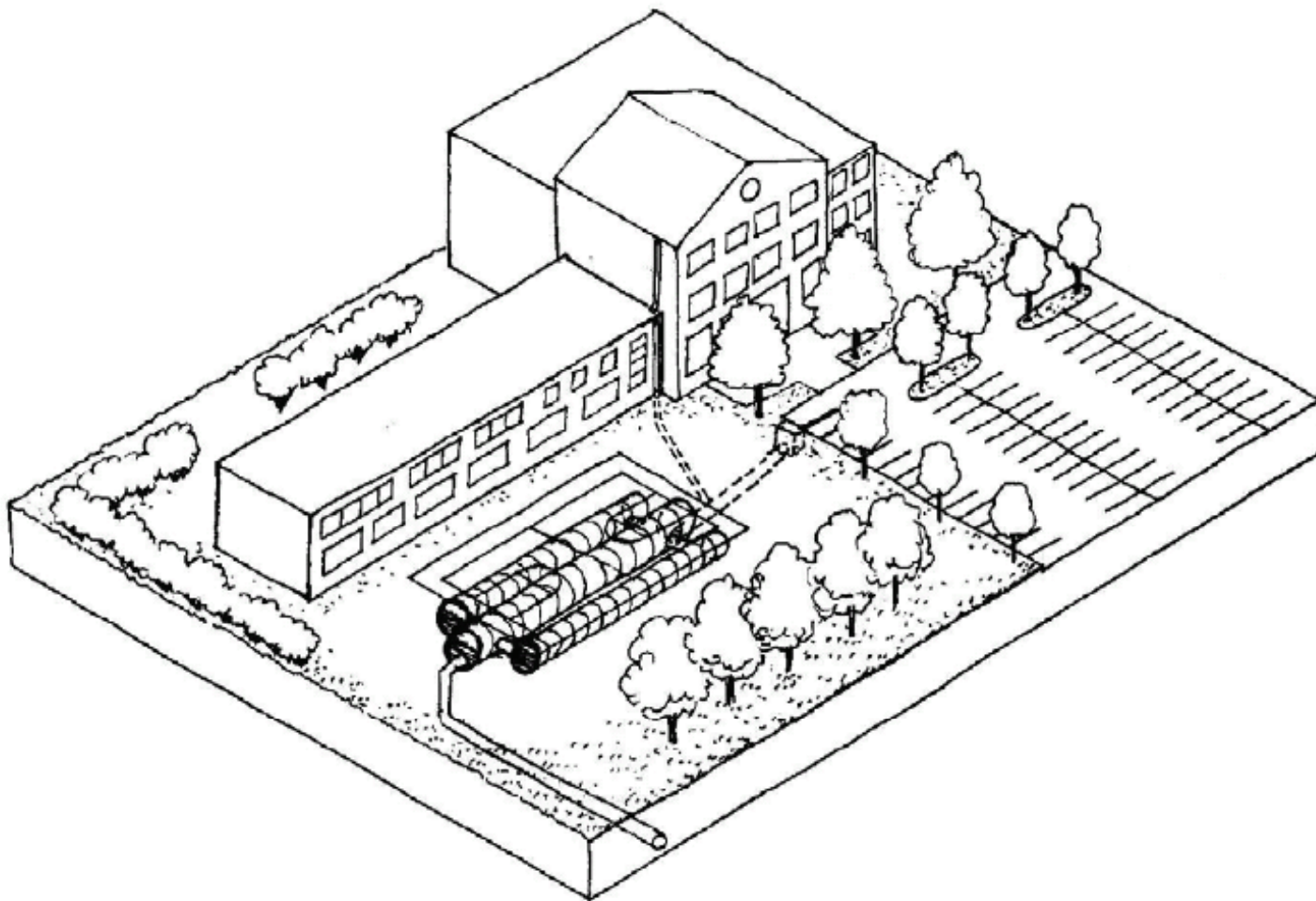
- Local
 - Regional Water Quality Control Board
 - Department of Public Health
- California Plumbing Code
 - Dual-plumbing for toilet use
 - Title 22
- Distribution System requirements
 - Pipes and outlets are marked
 - Signage throughout public access areas

Rainwater Harvesting



Roof Top Detention

Storage

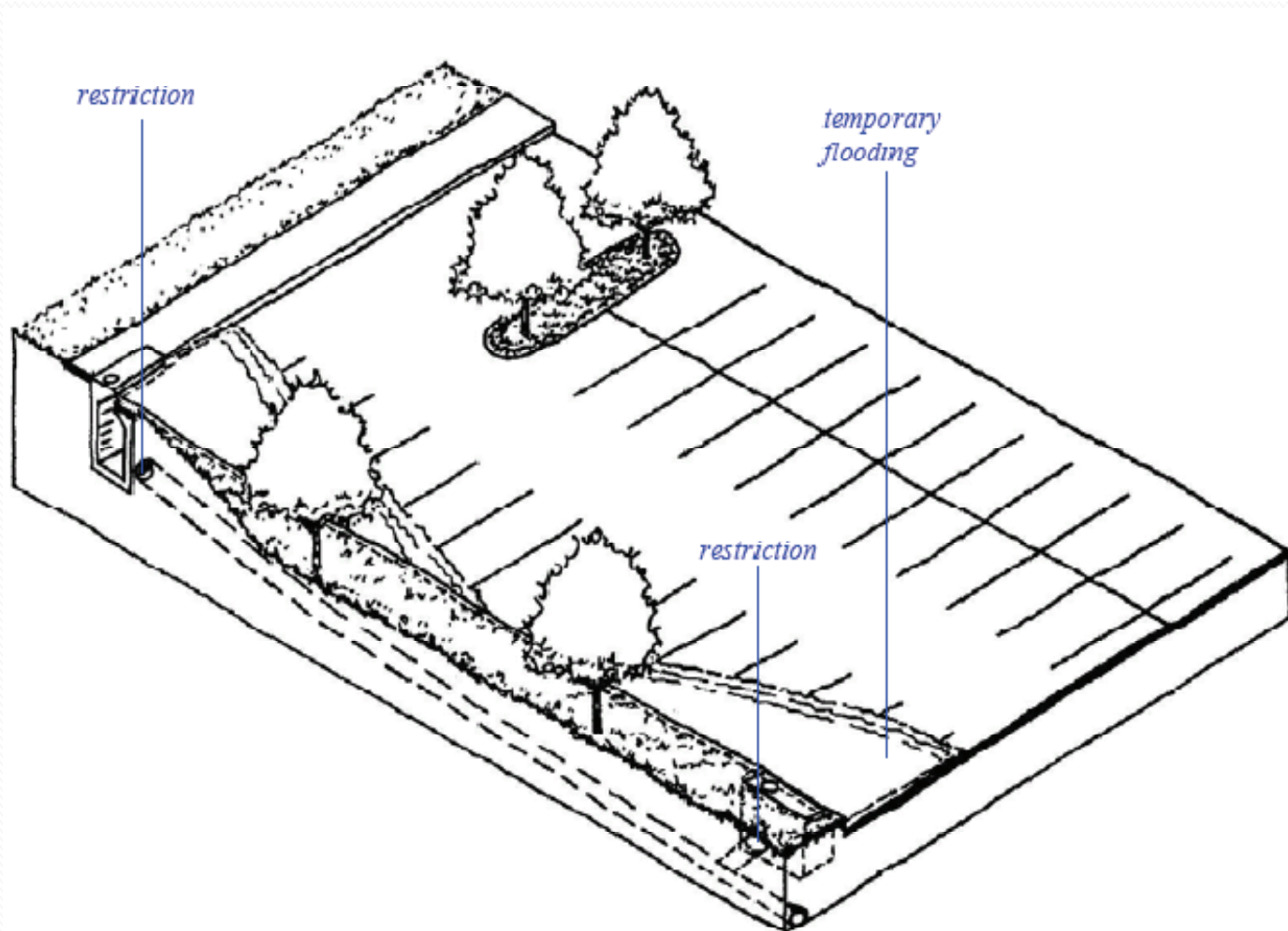


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Underground Storage



Storage



Inlet Restriction

Green Roof

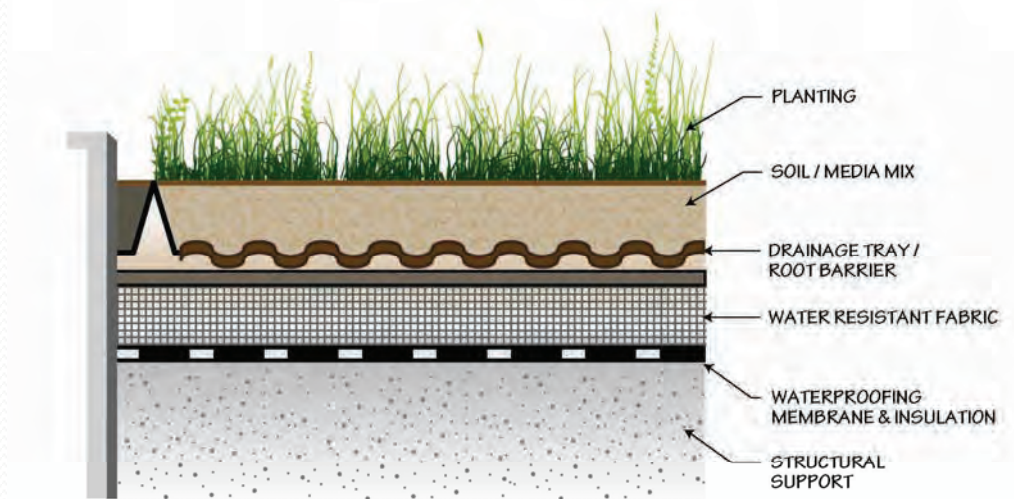
- Removal Mechanism
 - Filtering
 - Absorbing
 - Detaining
 - Evapotranspiring
- Lightweight soil media, drainage layer, and a high quality impermeable membrane (protects the building structure)
- Plants - harsh, dry, high temperature conditions on the roof → short periods of inundation from storm events.

Green Roof



Green Roof Cross Section

- 6-12 inches of soil matrix
- Use native drought tolerant vegetation (check with landscape architect)
- Irrigation for plant establishment



Green Roof



District Administration Office, Göppingen



Investment Bank, Potsdam





Green Roof (Gap Headquarters – San Bruno)

Performance

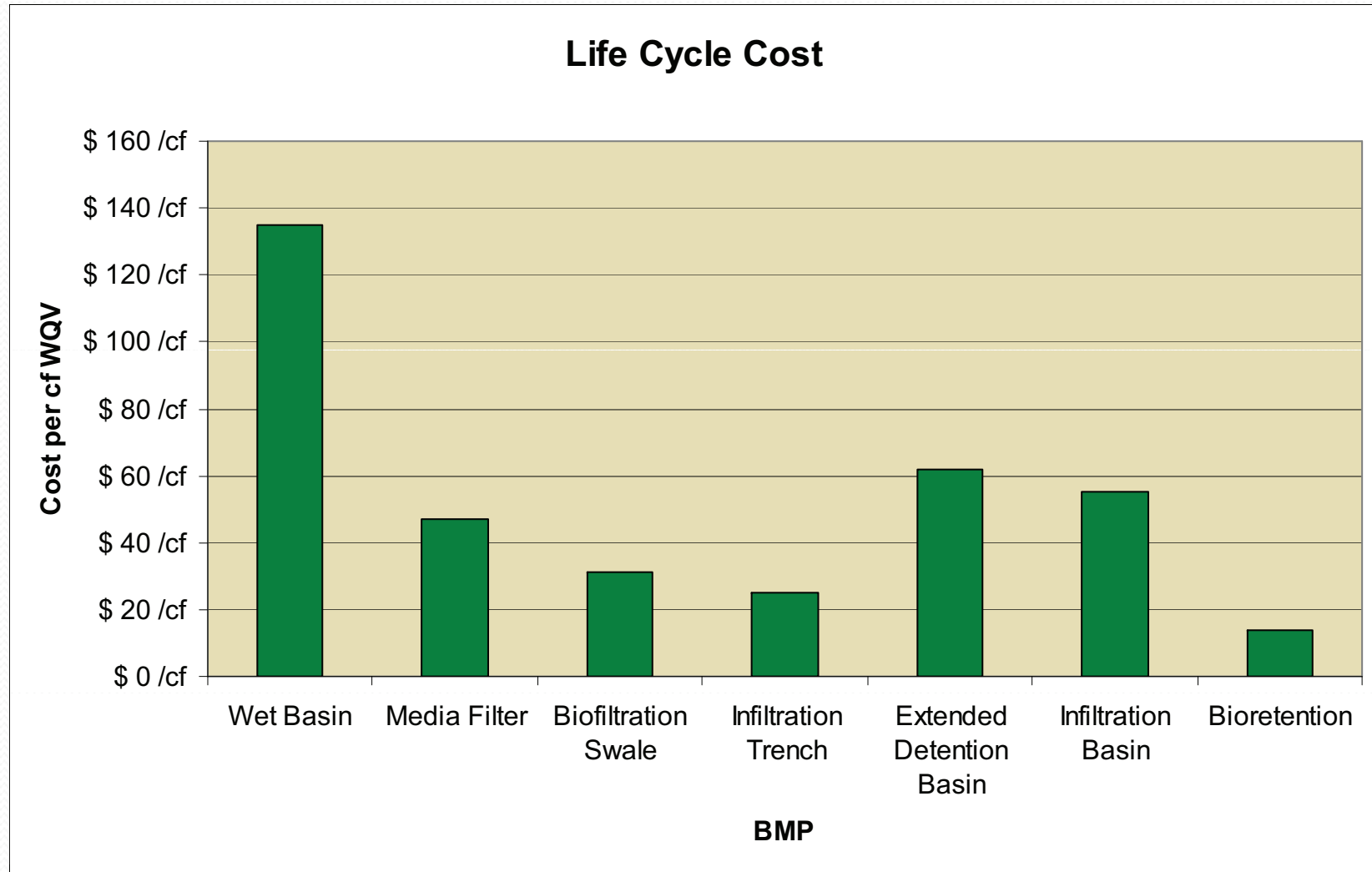
Device	Phosphorus	TKN	Metals	Sediment
Infiltration Trench	100%	100%	100%	100%
Infiltration Basin	100%	100%	100%	100%
Rain Barrel	100%	100%	100%	100%
Porous Pavement	100%	100%	100%	100%
Bioretention	70-85%	55-65%	90-95%	90-95%
Green Roof	Ukn	Ukn	90-95%	90-95%
Media Filter	40-50%	50-60%	70-80%	80-90%
Wet Pond	0-50%	40-50%	60-90%	20-90%
Swale	Input	60-70%	80-90%	70-80%
EDB	30-40%	10-20%	60-70%	70-80%
Wet Vault	30-40%	10-20%	60-70%	70-80%
Vegetated Strip	Input	Input	70-80%	60-70%
Vortex Separator	Minimal	Minimal	Minimal	60% of 50 micron



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Life Cycle Cost



Issues with LID Stormwater Practices

- Loss of Land to Buffers
- Long-term Sustainability
- Need for research
- Applicability in clay soils
- Property owner education
- Regional variability
- Ponding in yards (mosquitoes)
- Difficult to evaluate efficiency



Credits/References

- Low Impact Development IMP Guide – Prince George’s County
- Start at the Source – Design Guidance Manual for Stormwater Quality Protection – BASMAA
- CASQA BMP Handbooks www.casqa.org
- Low Impact Development Center www.lid.org
- Caltrans Stormwater Program
- EPA <http://epa.gov/nps/lid/>



California Stormwater Quality Association (CASQA) Handbooks

- www.casqa.org or www.cabmphandbooks.com



Stormwater Best Management Practice (BMP) Handbooks

The California Stormwater Best Management Practice Handbooks have provided excellent guidance to the stormwater community since their publication by the Stormwater Quality Task Force (SWQTF) in 1993. The SWQTF became the California Stormwater Quality Association (CASQA) in 2002 and in 2003 CASQA published an updated and expanded set of four BMP Handbooks. These Handbooks reflect the current practices, standards, and significant amount of knowledge gained since the early 90s about the effectiveness of BMPs. For additional information, please visit the [CASQA](http://www.casqa.org) website.

Click on the links below to view and download the individual handbooks.

[This website has been updated for access to the 2004 Errata of the Handbooks.](#)

The California Stormwater Quality Association (CASQA) is an independent advisory group. The statements, views, and contents of this site do not necessarily reflect those of the State Water Resources Control Board or the Regional Water Quality Control Boards.

New Development and Redevelopment



Construction



Industrial and Commercial



Municipal



Questions?

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