Regenerative Design Stormwater Management Strategies

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Inadequate Stormwater Planning…

- Increased runoff volume and velocity.
- Altered baseflow and storm hydrology.
- Increased pollutant mobilization, transport and loading.
- Degraded water quality.
- Impaired wetland, riparian and aquatic habitats.

Cumulative effect… compromised ecological functions and services

Hydrologic and Hydraulic Impacts

Flooding

Erosion

Pollutant Loading Impacts

Eutrophication

Environmental Degradation

Regenerative Stormwater Design

- Must be approached proactively, not reactively! Begins at the site planning stage.
- Site civil engineers need to understand that this is a critical part of design process.
- NOT CONSISTENT with your typical maximum yield approach to site design.
- Take time upfront to understand site's "opportunities and constraints".
- Especially critical in Highlands Region.

My Six Principles To Regenerative and Sustainable Stormwater Management

- Treat stormwater as a resource
- Capitalize on site conditions
- Turn down the volume
- Turn your project inside out
- Think small to achieve big results
- Use nature as your guide

1. Stormwater Is A Resource

- Change overall approach to site planning, site grading, and stormwater collection.
- Rather than "get rid" of stormwater as quickly as possible, approach stormwater as a resource rather than a waste.
  - Preserve site's existing time of concentration, hydrology and hydrologic properties,
  - Seek to recharge collected and treated runoff,
  - Look for opportunities to reuse runoff,
  - Integrate multiple BMPs into design.

2. Capitalize on Site Conditions

- Regenerative design and sustainable SW management dependent on integrating site development and ambient site conditions.
- Change zoning so that lot yield is not a priority, and sustainable designs are rewarded.
- Think “ecosystem bio-mimicry”
- Inventory site conditions…understand site constraints and site opportunities.
  - E.g., Very permeable soils, shallow depth to bedrock, highly functional riparian areas.

3. Turn Down the Volume- Part 1

- Reduce total volume of runoff.
- Volume based stormwater management starts with reducing total impervious cover.
- Revisit zoning and minimum site design requirements…
  - Minimize parking ratios
  - Minimize cart path width
  - Maximize allowable impervious cover
  - Revisit mandatory set backs
- Facilitate cluster and compact development designs.

3. Turn Down the Volume – Part 2

- Decrease post-development runoff volume…
  - Maximize recharge of runoff.
  - Make use of techniques that “scavenge”, capture and reuse runoff…e.g. irrigation cisterns, green roof technology.
  - Emphasize vegetated systems…plants are capable of using large amounts of collected runoff…evapotranspiration and retainage.
- The less volume conveyed downstream the less erosion, flooding and pollutant transport.

4. Turn Your Site Inside Out

- Avoid end of pipe solutions!
- Collect and treat runoff as close to point of generation as possible.
- Don't settle just for peak flow management, select and site BMPs for multiple uses.
  - Reduce volume
  - Decrease nutrients and sediment loads
  - Maximize recharge
  - Control runoff hydrograph (duration, volume, flow)
- Works for redevelopment and retrofit projects too.

5. Think Small For Big Results

- End of pipe solutions result in management of large volumes of runoff in one location.
- Large volumes of runoff decrease or limit successful implementation of BMPs, especially bioretention systems.
- Regenerative design focused on managing small catchments using “pocket BMPs”.
  - Loose volume along the way.
  - Piggy back BMPs, create “treatment train”.
- Integrate local efforts into regional solutions to meet flooding, recharge and pollutant control goals.

6. Let Nature Be Your Model

- Biodetention, Bioretention, Biofiltration, Environmental Landscaping… “Natural BMPs”.
- Put into play BMPs that collectively infiltrate, filter, promote bio-uptake and bioattenuation of pollutants.
- Ecosystem bio-mimicry…regenerative, sustainable design!

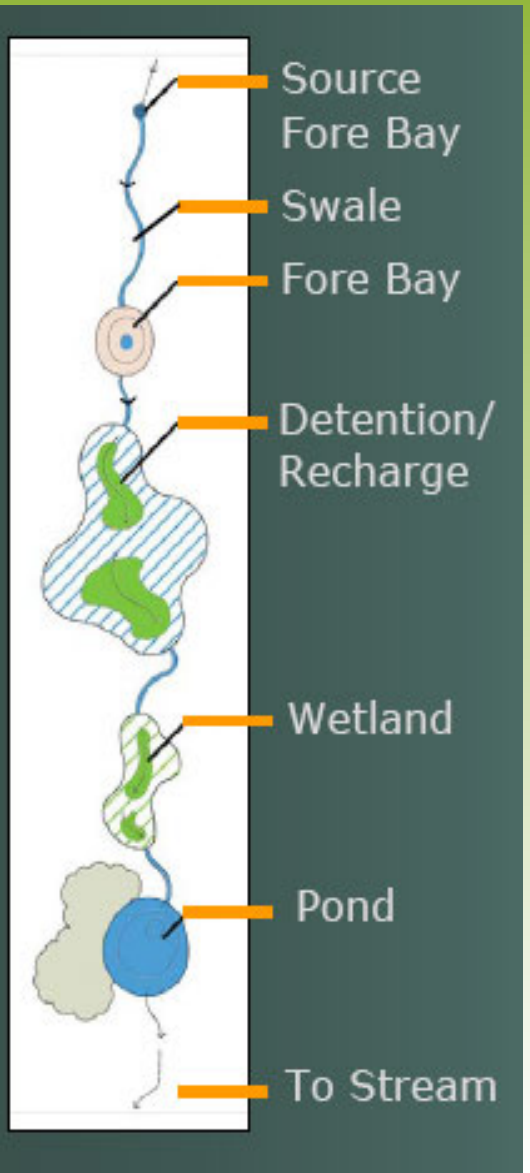
Know Your Site and Capitalize on Prevailing Site Conditions

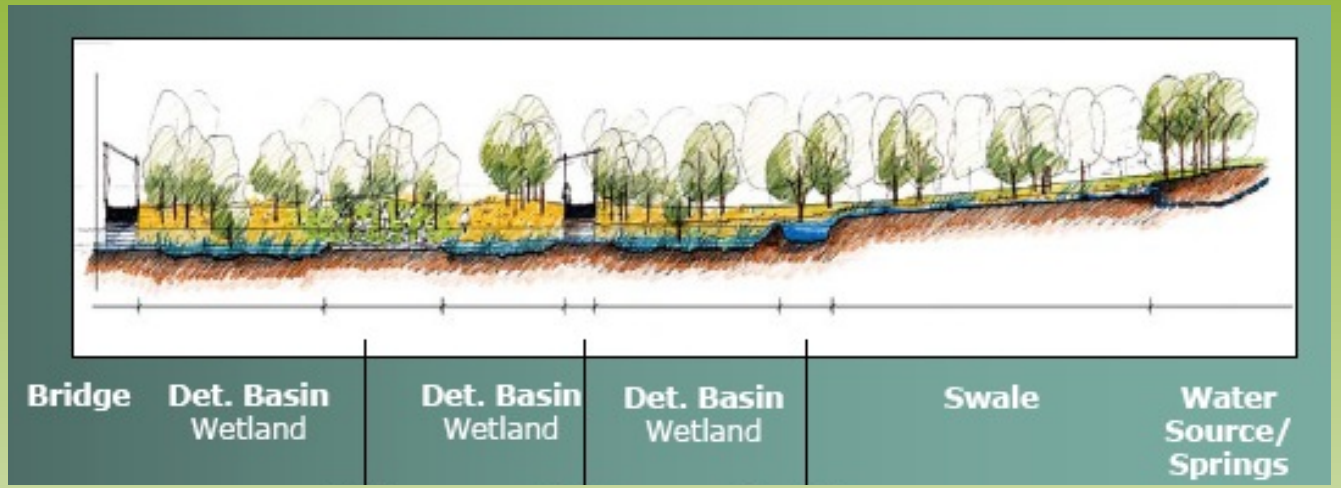
- Successful regenerative design predicated upon truly understanding your site.
- Must compile data critical to overall design goals (pre- and post-development conditions) …
  - Hydrology and hydraulics of runoff
  - Soils
  - Surficial geology
  - Topography
  - Land use and land cover
  - Existing natural systems

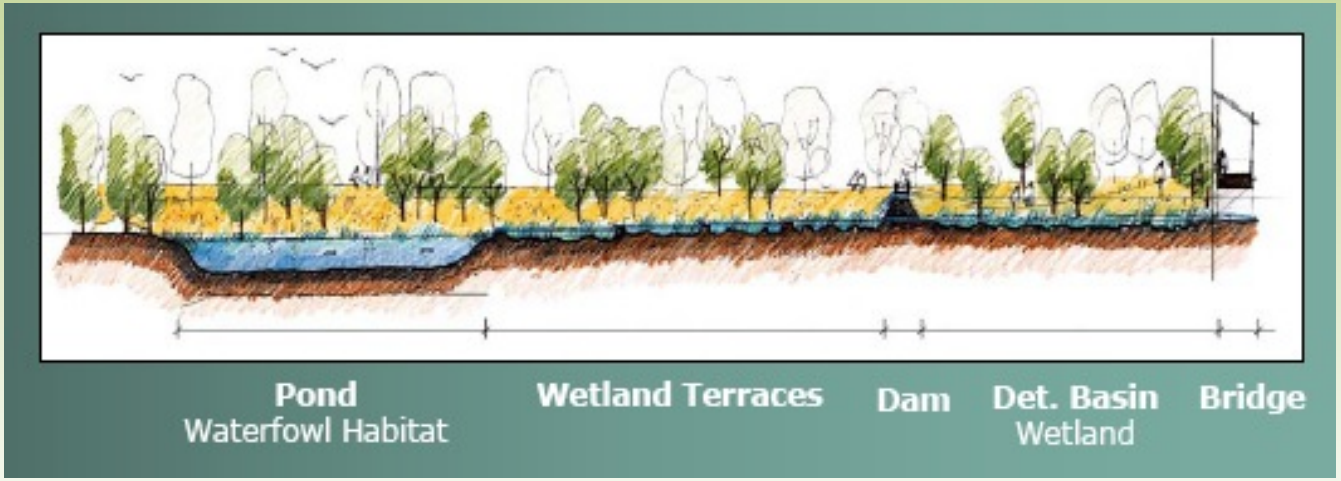
Pennswood Village

- Example of a sustainable stormwater management system, emphasizes volume retention and reduction.
- Created, functional riparian corridor / floodplain that integrates a number of standard BMPs in a creatively linked manner:
  - Sedimentation basin
  - Grassed waterway
  - Vegetated riparian buffers
  - Stormwater infiltration system
  - Created wetland/wet-pond

Overall Layout System







Adapted from Wells Appel Land Strategies

Functions As A Riparian Corridor

In Summary…

- Improperly managed stormwater causes numerous impacts.
- Standard, conventionally engineered approaches don't provide correct solution.
- Regenerative design especially well suited for implementation in Highlands Region.
- Emphasize BMPs that result in volume reduction and are integrated with site's resource attributes.

Thanks…

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