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Credit Valley Conservation inspired by nature

March 2026

The Pond–Wetland–Park Continuum:

Making Multi-Benefit Stormwater Work

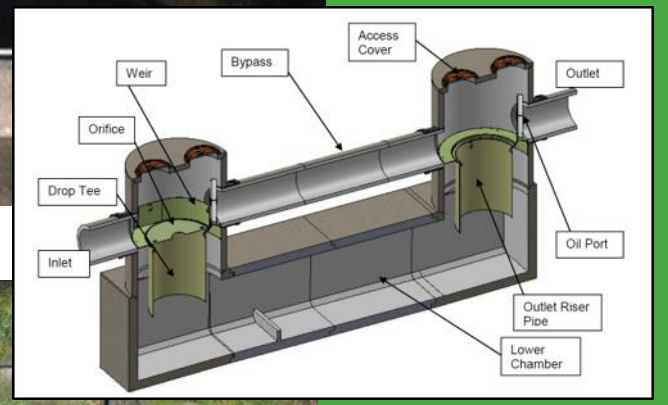
Anton Skorobogatov (Kerr Wood Leidal Associates Ltd.)
Bert van Duin (City of Calgary)

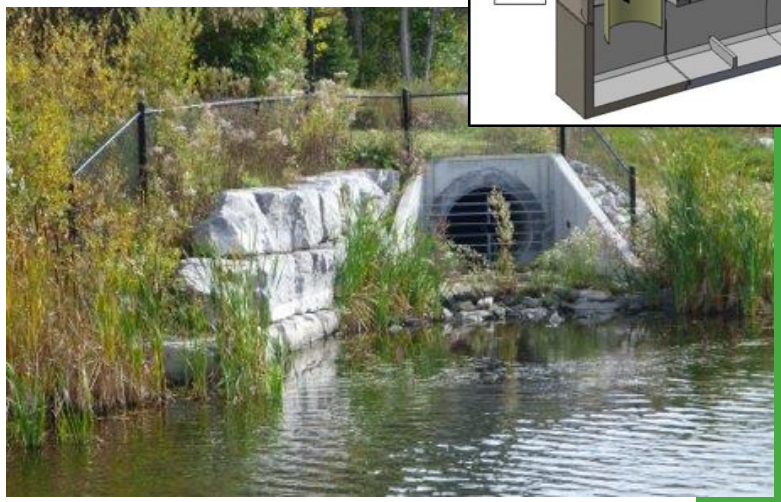
End-of-Pipe Facilities

- End-of-pipe ponds remain the dominant visible Storm Water Management Facility (SWMF) in many communities
- They carry expectations for flood control, water quality, and public safety
- Typically, not designed as integrated systems with habitat, amenity, and long-term maintenance fully aligned
- Over time, facilities may drift from their original design intent
- The question is not whether to replace ponds — it is how to make them work better within the source to stream framing

Alberta vs Ontario: How SWMFs Are Framed

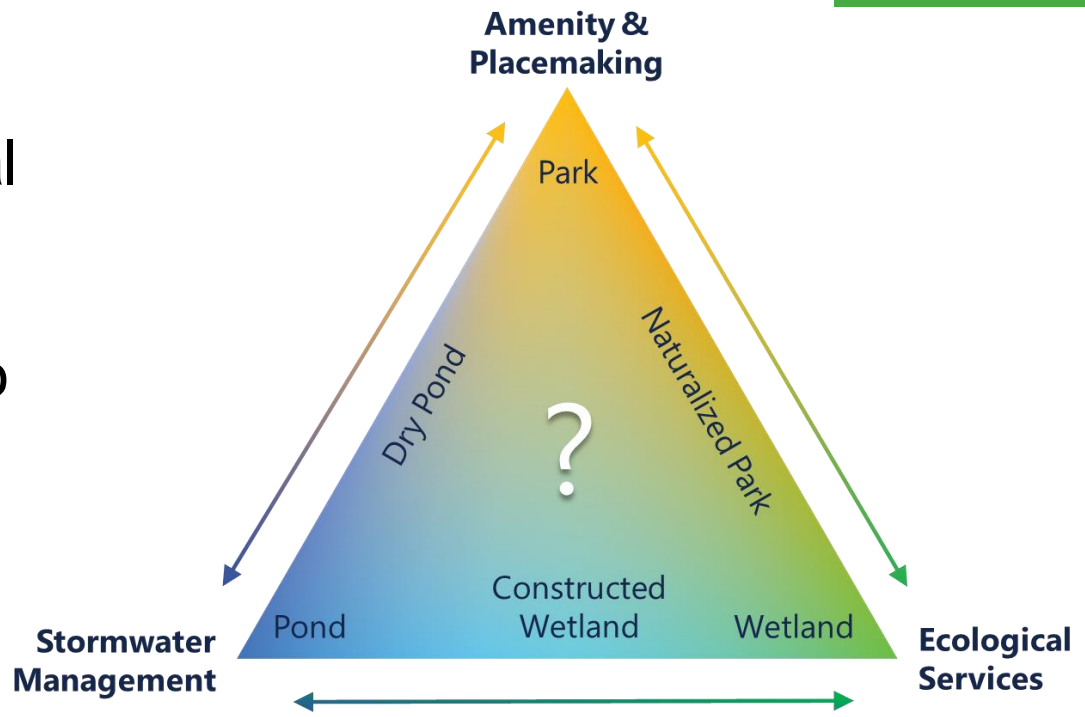
- Stringent allowable flow rates or unit area release rates (UARR)
- Large live/active storage volumes
- Facilities designed to hold more water for longer periods
- Irrigation use of captured runoff is attractive due to semi-arid conditions
- Submerged inlets (odours, ice dams)
- “Monster” Oil Grit Separator (OGS) Units
- Opportunities for multifunctional facilities





Pond – Wetland – Park Continuum

- Policies and guidelines are evolving
- Update of Chapter 6 of 2011 Manual initiated in 2022
- 2023 Stormwater Management Strategy sets out a clear direction to transform stormwater management
- "[P]*osition stormwater management as a valuable service that adds to Council priorities of community vibrancy, public health and safety, growth, and green communities*."



Link to 2011 City of Calgary Stormwater Management & Design Manual
https://publicaccess.calgary.ca/lldm01/livelink.exe?func=ccpa.general&msgID=KTTTTqeeKcW&msgAction=Download

2023 Stormwater Strategy

- Going beyond runoff rate and sediment management
- We know more, public wants more
- Continuum offers options

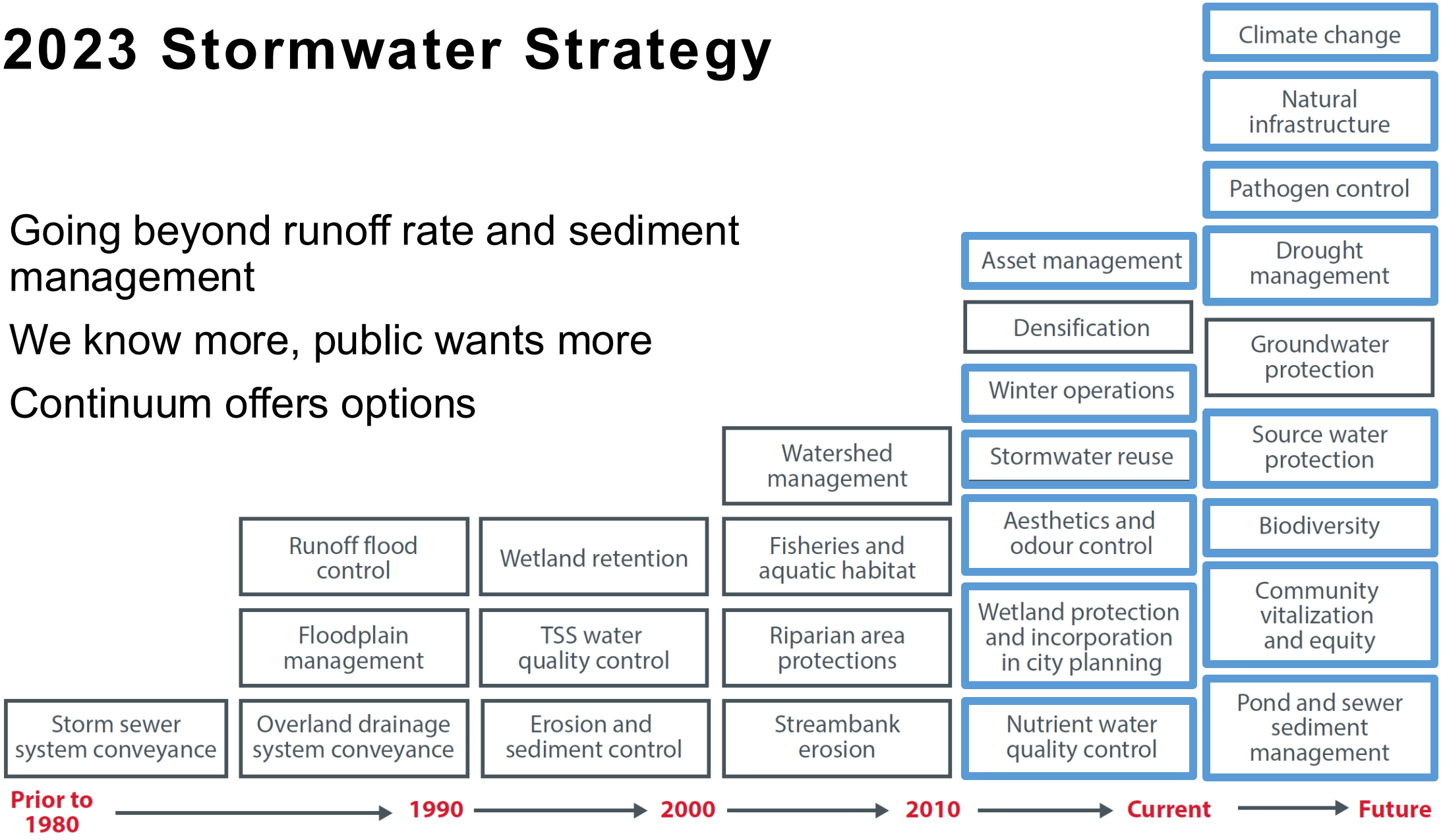


Figure 6: The evolution of stormwater management considerations

https://www.calgary.ca/planning/water/bonnybrook-wastewaste-treatment-plant-upgrade-and-expansions.html

https://tca.ca/conservation/flood-risk-management/infrastructure/

https://natural-history-journal.blogspot.com/2020/02/celebrate-biodiversity-on-world.html

https://www.re-thinkingthefuture.com/architectural-community/a9292-an-overview-of-urban-parks/

Expected to deliver multiple benefits:

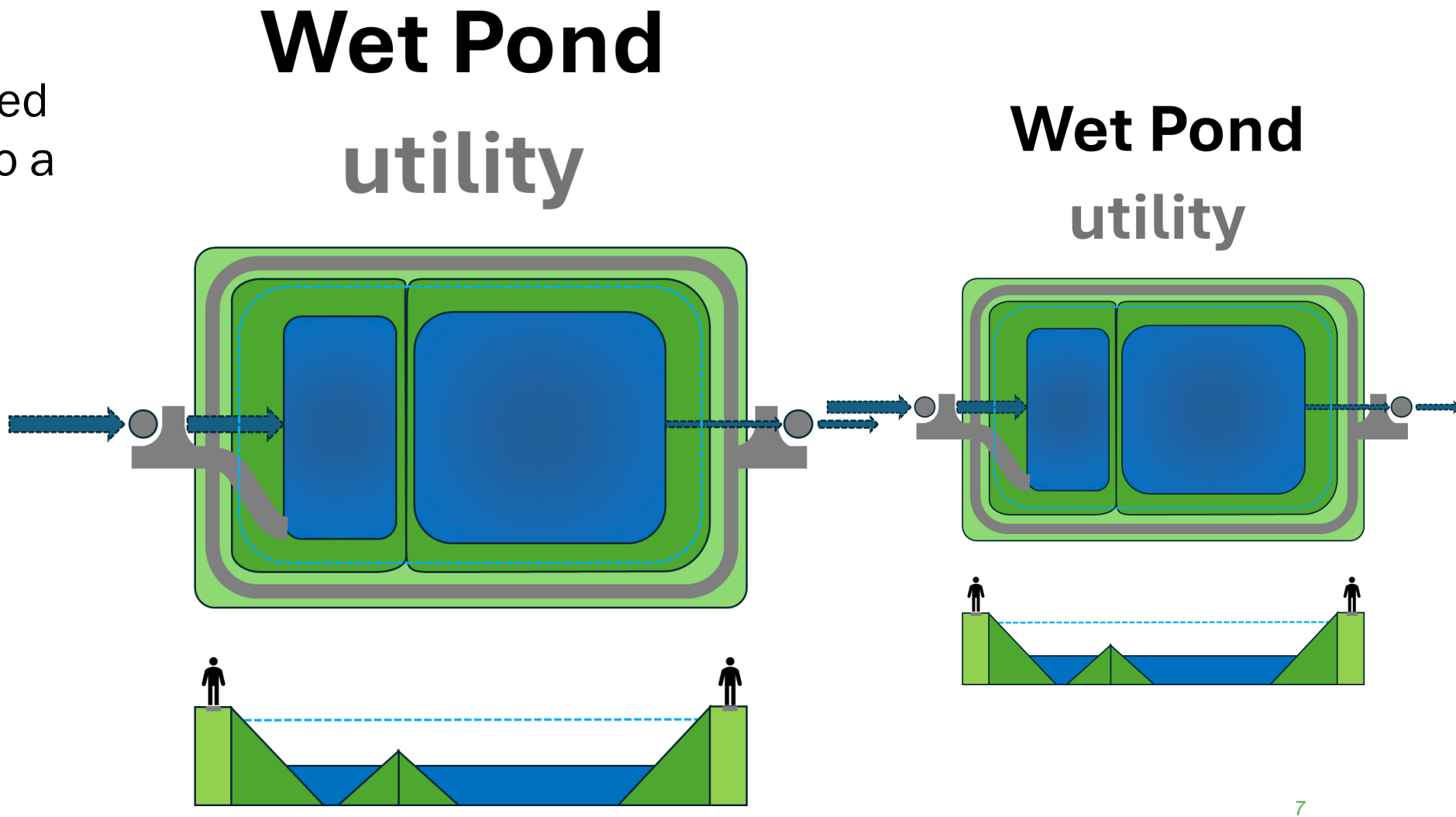
- Flood Control
- Water quality
- Habitat
- Amenity

Is it as good as a specialized facility?

- It depends

Introducing the Continuum

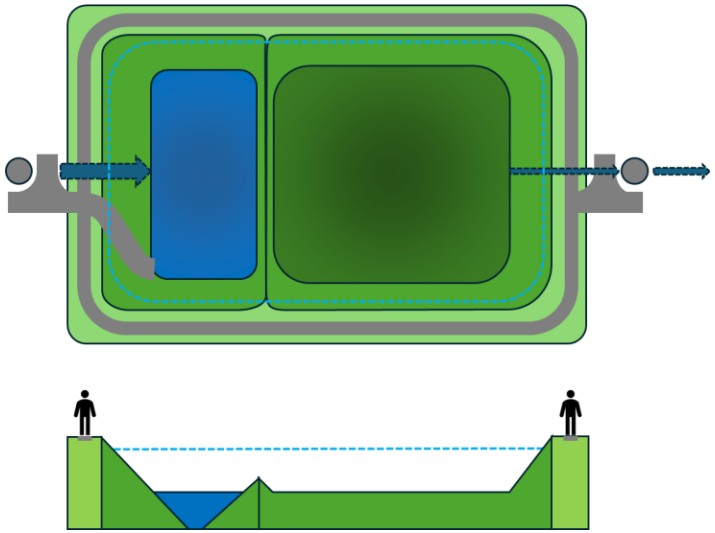
Transition from limited number of options to a continuum



Introducing the Continuum

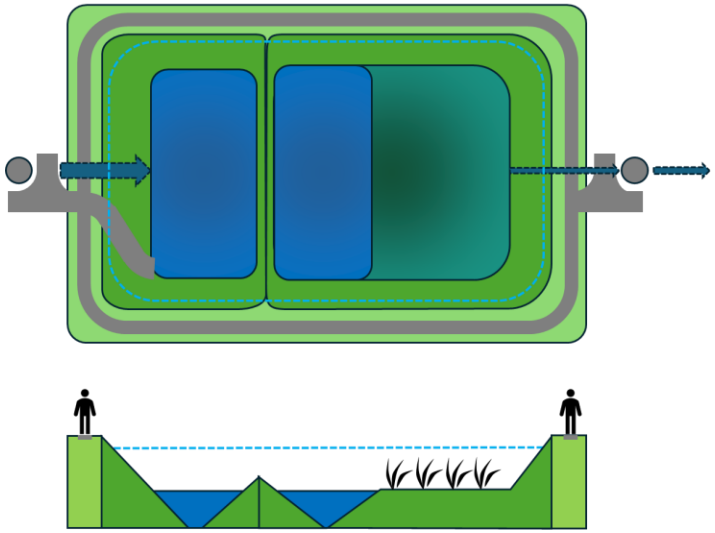
Dry Pond

utility



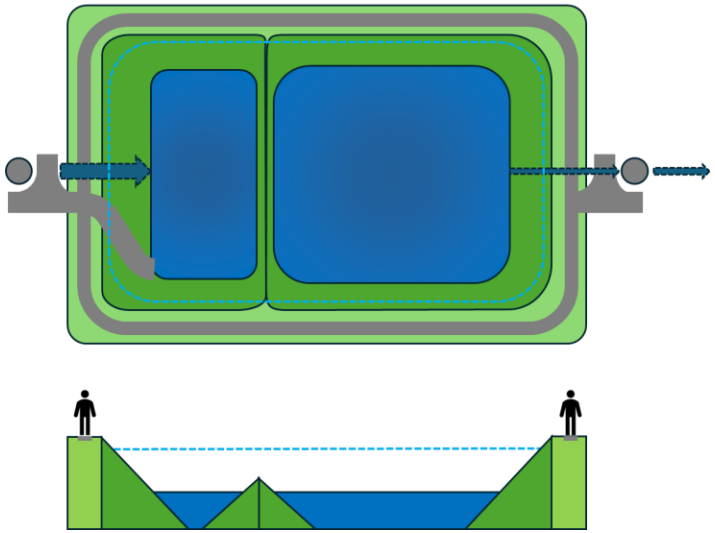
Wetland

utility

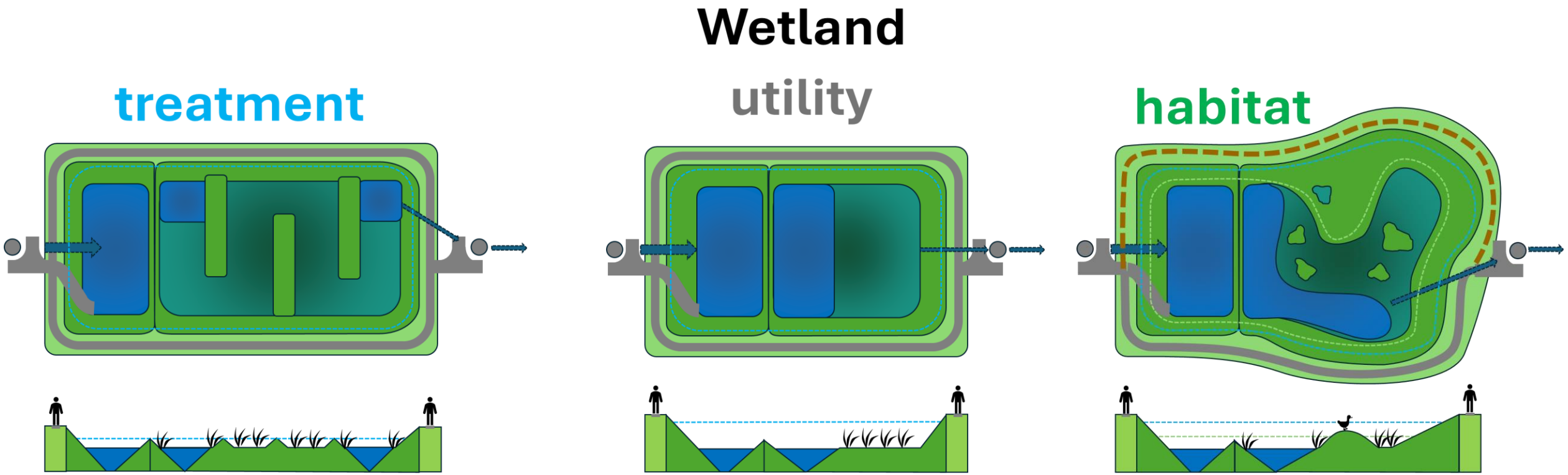


Wet Pond

utility



Constructed Wetlands



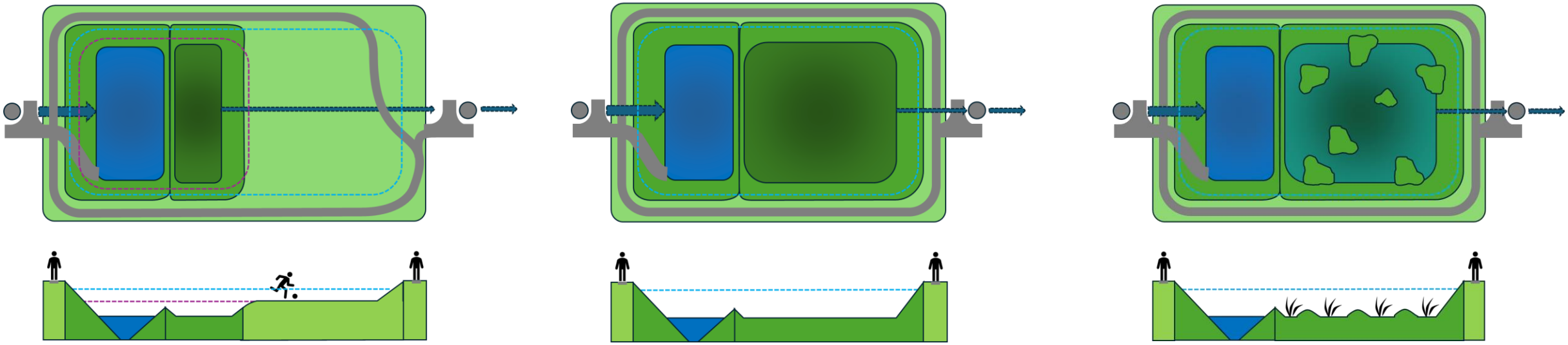
Dry Ponds

Dry Pond

amenity

utility

naturalized



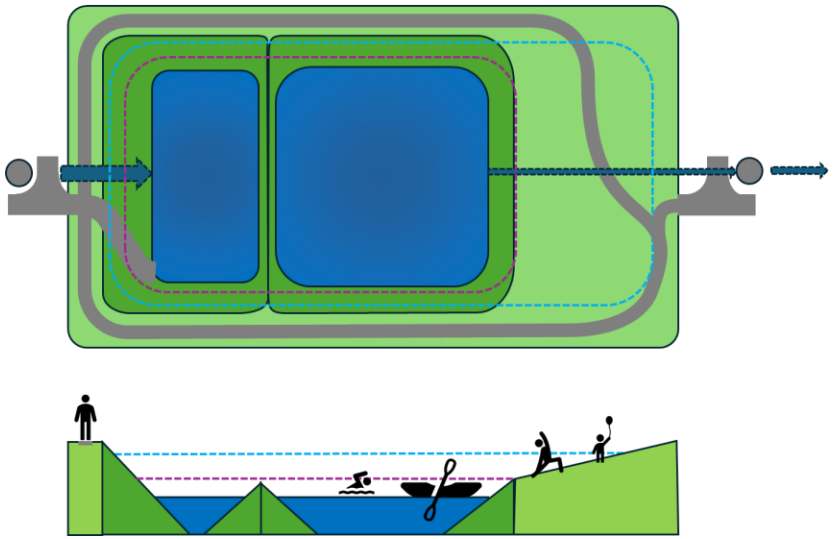
Wet Ponds

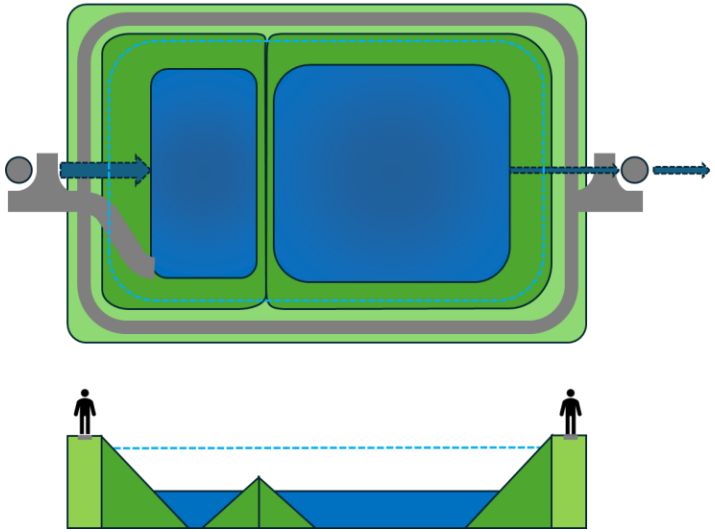
Wet Pond

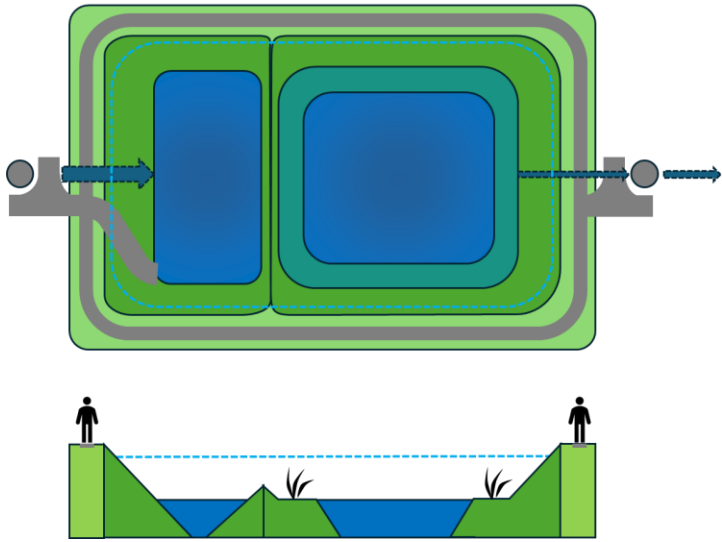
amenity

utility

naturalized



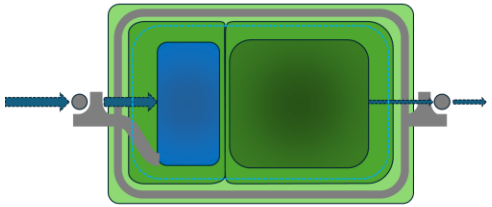




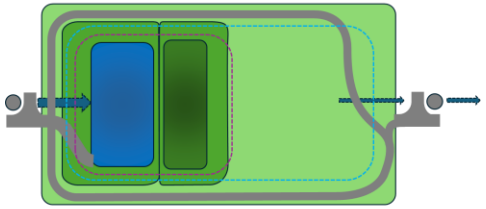
Constructed Facilities

Dry Pond

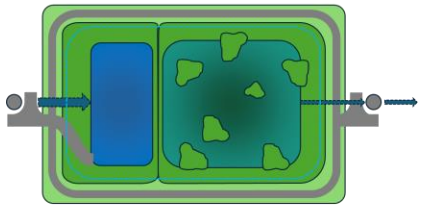
utility



amenity

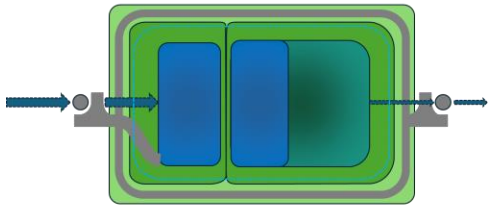


naturalized

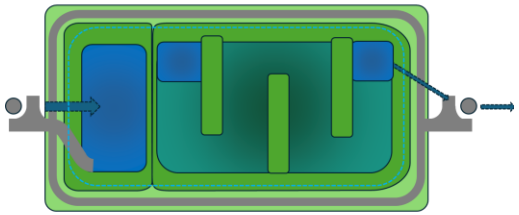


Wetland

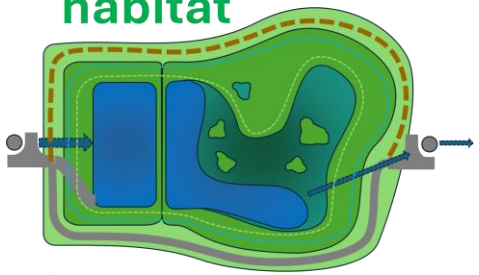
utility



treatment

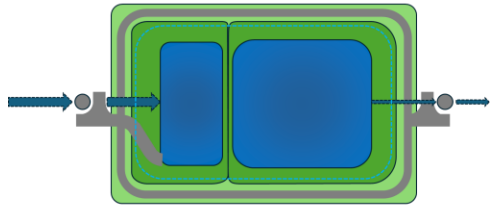


habitat

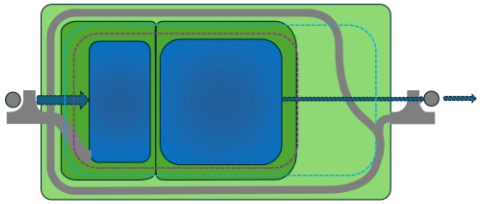


Wet Pond

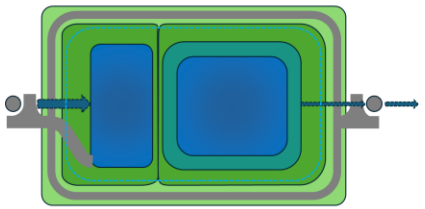
utility



amenity

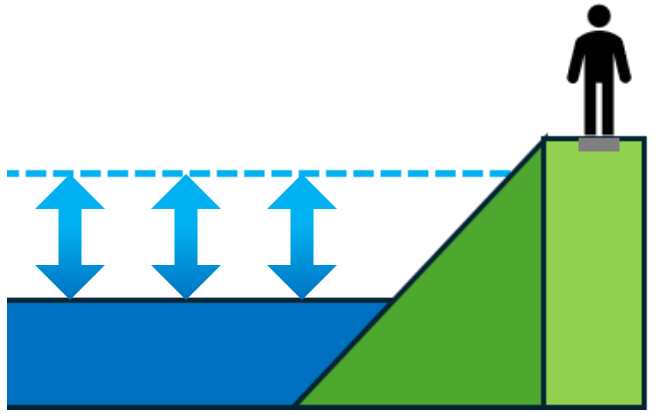


naturalized



Design Levers Across the Gradient

- Open Water Pool(s) - % coverage (0-100), depth, perimeter complexity, water quality
- Side Slope – rise/run, terraced or not, surface treatment, vegetation type
- Active Use Area(s) (pathways, play areas, etc) – inundation duration and frequency (e.g. never – frequent), intended use, safety consideration, contact recreation water quality
- Active Storage – depth : footprint ratio, inundation patterns, depth in relation to user – child, adult, wildlife (nesting and denning)

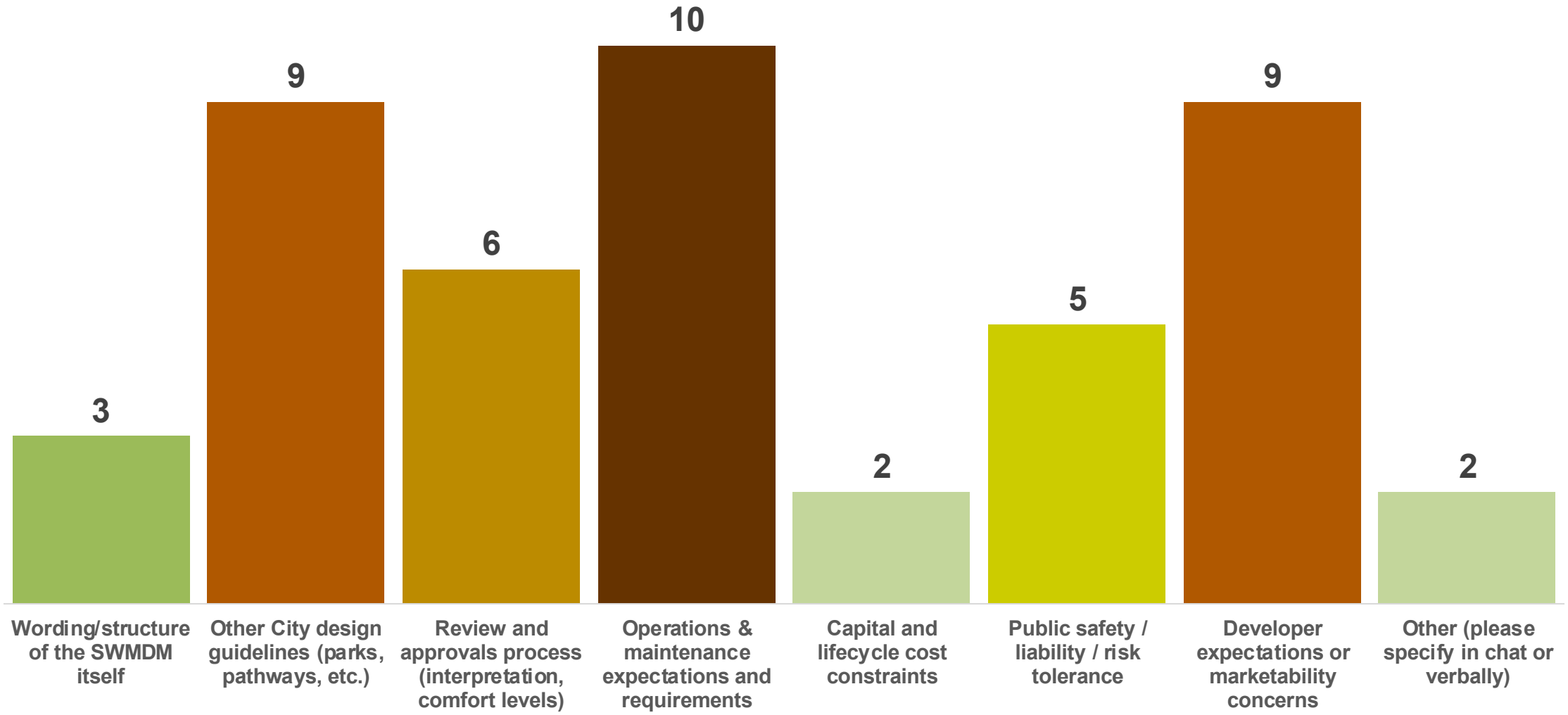


Maintenance Realities

- Multiple stormwater management facilities are approaching 20-25 year mark since construction and are in need of maintenance
- Sediment removal poses a costly challenge – **ability to isolate and dewater sediment storage areas independently from the main cells in the pond can be key**
- Surprising outcomes – navigating disturbance of what could now be considered habitat for sensitive species
- With additional complexity of function, additional maintenance will be required
- Natural(ized) ≠ maintenance-free

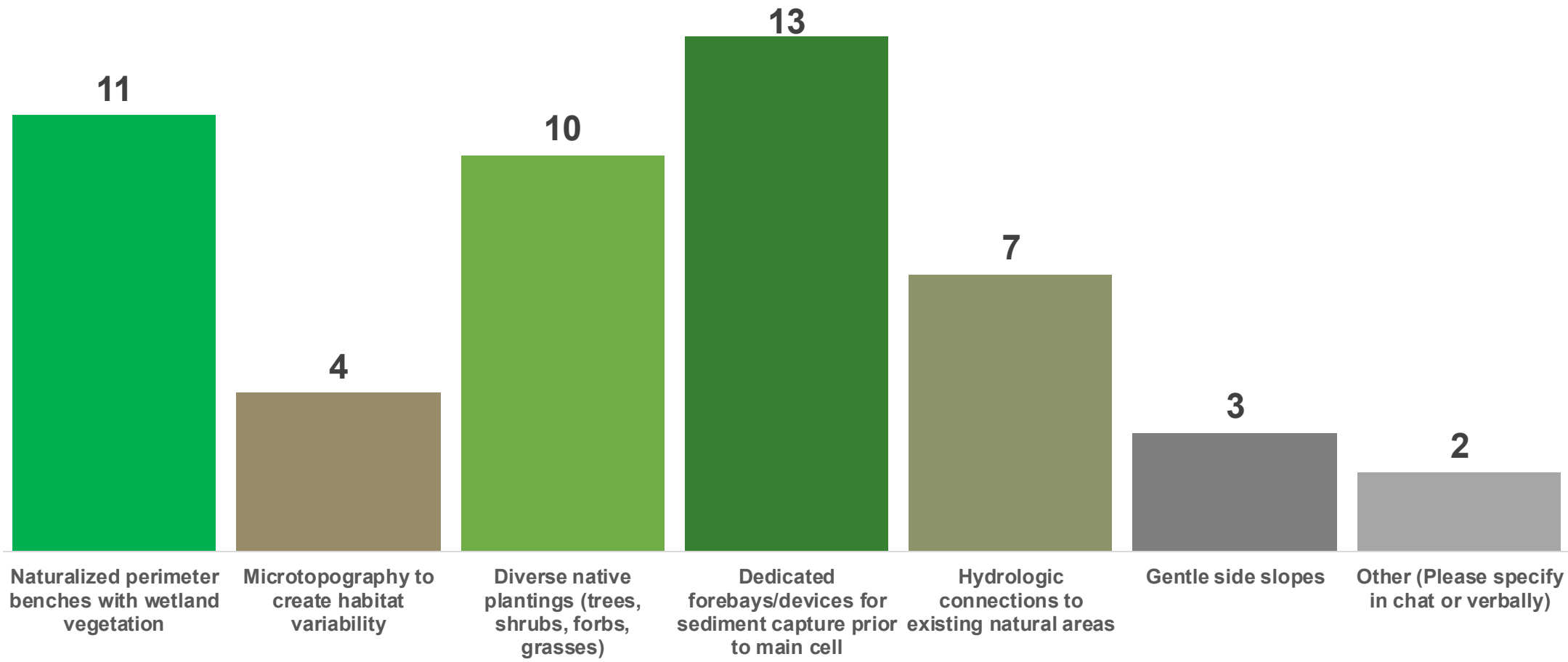
City of Calgary Workshop Outcomes

When standards **constrain multifunctional designs**, where do constraints come from?



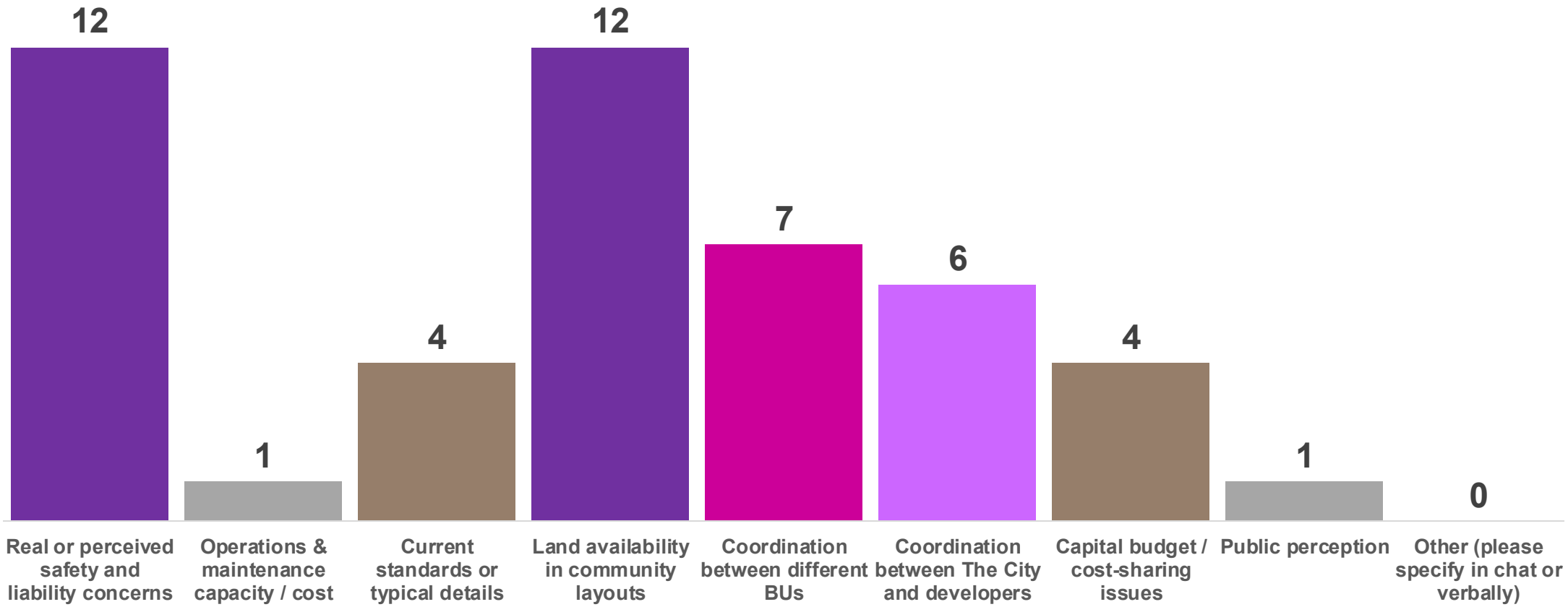
City of Calgary Workshop Outcomes

Which **design elements** do you see as the most effective at delivering **environmental benefits**?



City of Calgary Workshop Outcomes

What are the key **barriers to integrating amenity and open space functions** within SWMFs?



Summary

- Everyone supports the idea - the challenge is making it a reality;
- Today's priorities still default to flood risk, safety, and water quality;
- Main challenge - developing clear typologies, standards, and decision rules;
- Best-fit amenity uses are mostly passive - walking, seating, nature appreciation;
- Biggest barriers are O&M, safety/liability, land, and approval certainty;
- Work in progress – projected to wrap up by end of 2027.

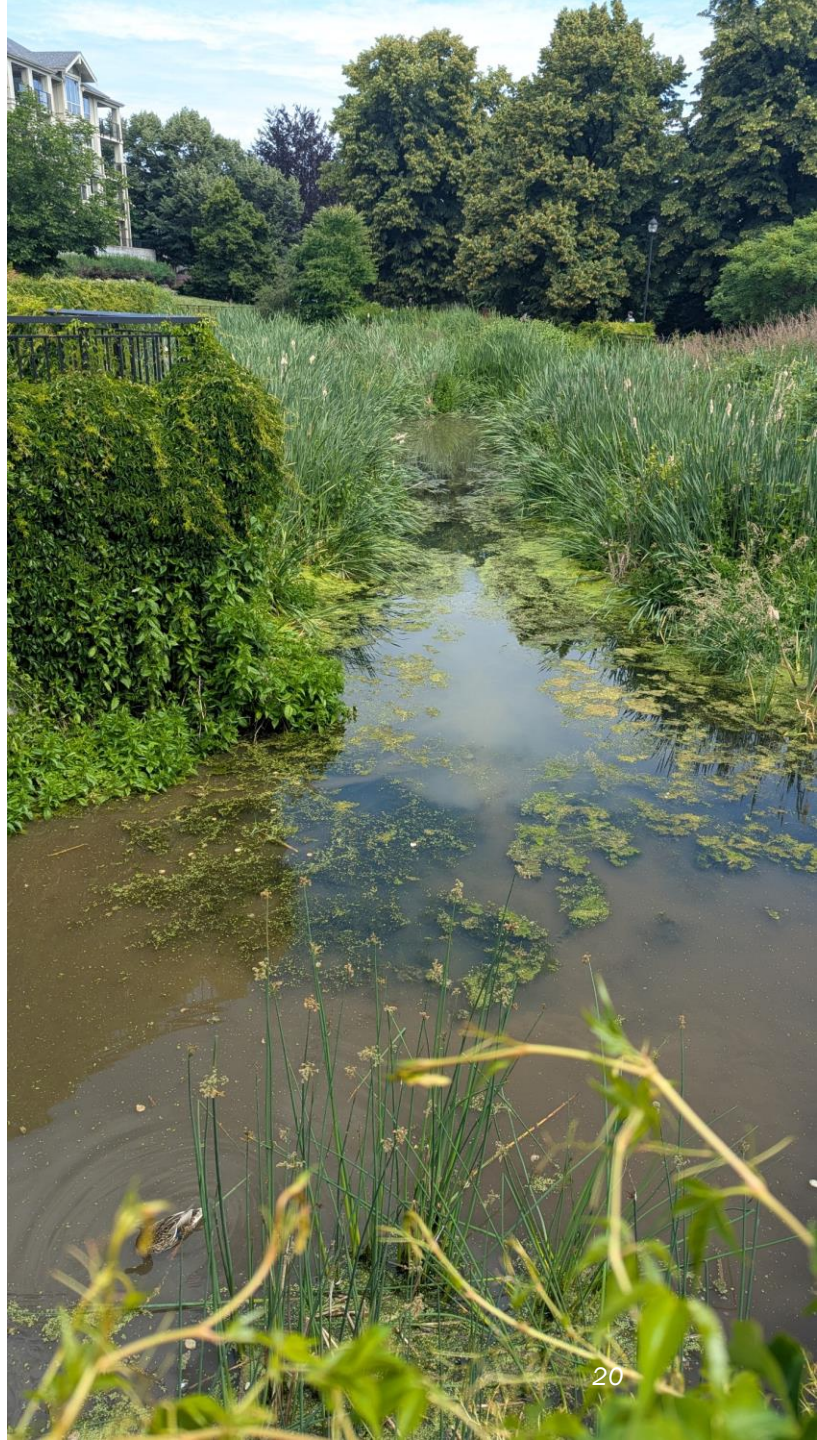
Four Case Studies Along the Continuum

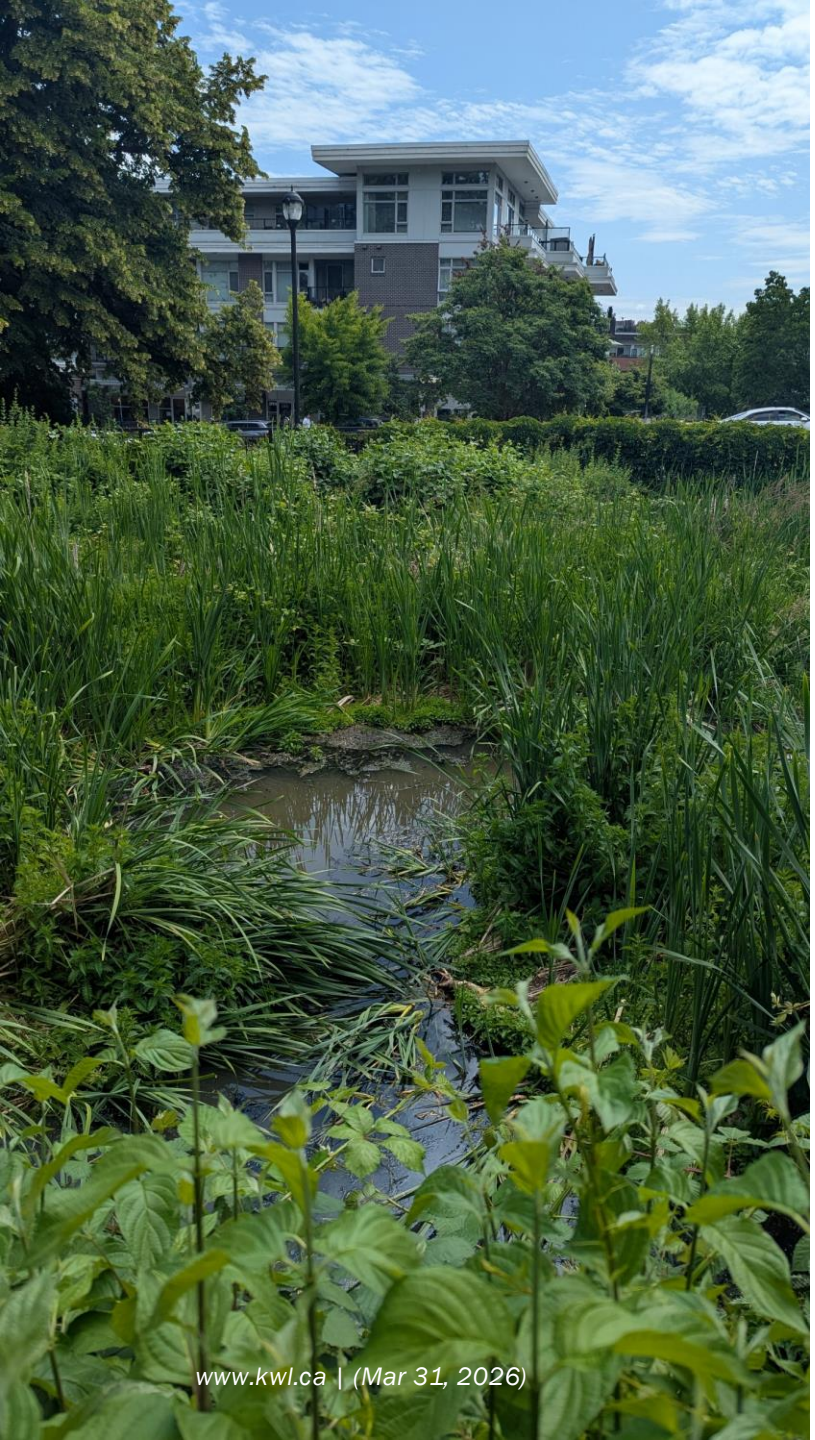
- Victoria Hill: wet pond drifting toward wetland
- Westlake Wetland: wetland adapted to stormwater management
- Livingston SWMF: purpose-built hybrid wetland facility
- Tuxedo Park: dry pond with amenity integration

What they show: multifunctionality is easiest to support when hydraulics, maintenance, and intended co-benefits are aligned from the start.

Victoria Hill — When a Wet Pond Becomes a Wetland

- Small, urban wet pond → evolved into a dense wetland condition over time
- The naturalized condition created habitat and visual co-benefits - but also stagnant areas, odour, and complaints
- To keep performing as a SWMF, the facility now needs sediment removal and functional restoration, which will disturb or remove those co-benefits





Victoria Hill — What it Teaches Us

- Maintenance access and sediment management need to be designed in from the start
- **Wetland-*ization*** may impact hydraulic performance and usable treatment volume
- Habitat co-benefits may be temporary if the facility has to function as stormwater infrastructure

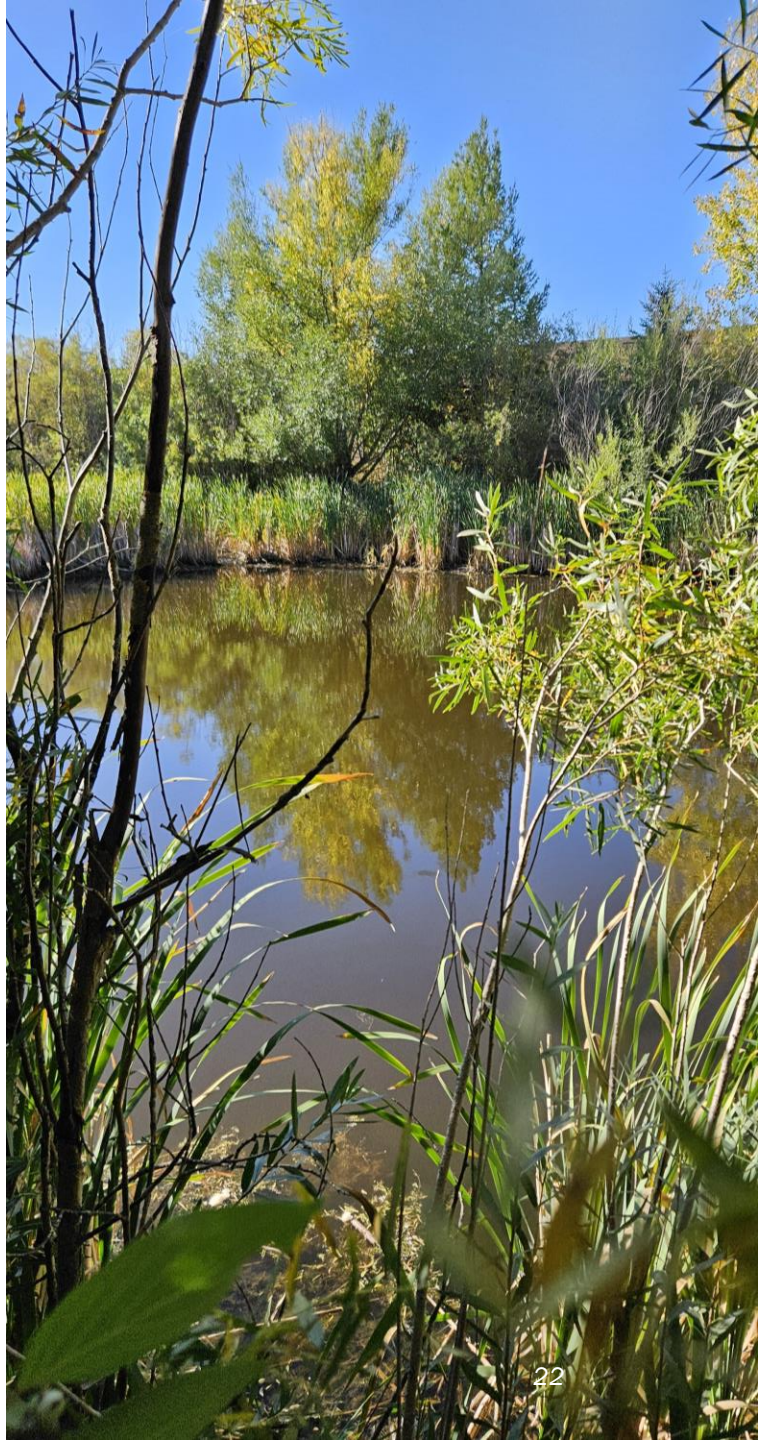
Continuum lesson:

If wetland/habitat functions are desirable, plan for how they will be sustained/maintained or periodically undone.

Westlake Wetland — Ecosystem "Outruns" SWMF Function

- Wetland basin fitted to do SWMF work (two inlets, OGS units, forebays), but key operational needs were not fully designed in as avoidance of disturbance was prioritized
- Sediment accumulation, suboptimal hydraulics, vegetation overgrowth, and signs of rising water levels
- The facility will require work to function better as a SWMF, and those fixes will alter wetland condition

Preserving wetland basin is not enough, stormwater function has to be deliberately engineered and maintainable.



Westlake Wetland — What it Teaches Us

- Access for inspection and sediment removal cannot be an afterthought
- Retrofitting function later can come at an ecological cost
- Wetland hydroperiod matters – not just footprint or vegetation cover

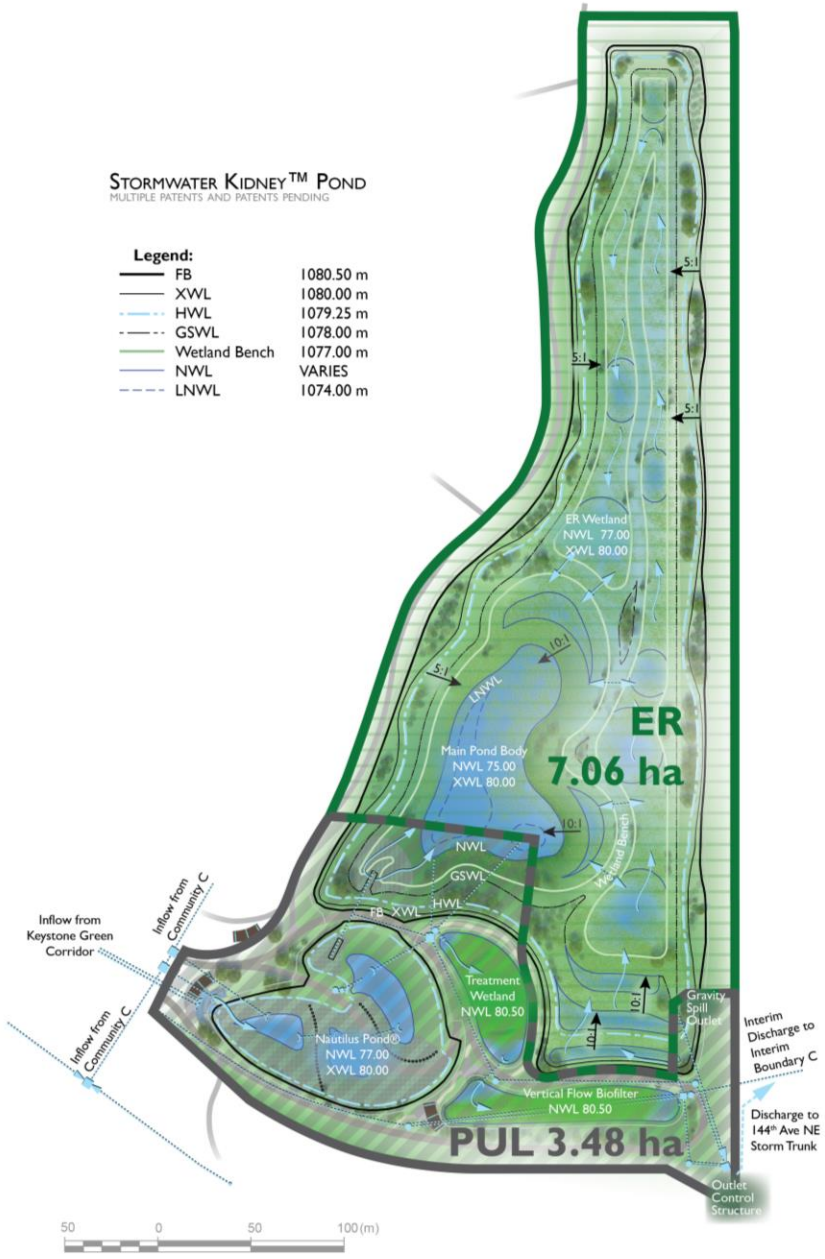
Continuum lesson:

A wetland used as a SWMF must be designed as both habitat and infrastructure, not just one or the other. We know more now than we did 20 years ago.

Livingston Pilot SWMF – Trying to Do it Right from Day 1

- Large hybrid facility with recirculation and a major constructed wetland component, designed intentionally for both SWMF and habitat outcomes;
- Unlike the earlier case studies, ecology was not just an emergent by-product; it was part of the design objective from the start;
- This approach creates the strongest potential for true multifunctionality, but also demands more coordination in approvals, design, and long-term management;

If habitat matters, the best chance of success is to design for it explicitly.



Hybrid SWMFs — What they Teach Us

- Hybrid facilities create opportunity, but also policy, design, and implementation complexity;
- Monitoring will tell us whether multiple benefits and functions are actually aligned;
- If habitat matters, it has to be designed in from the start;

Continuum lesson:

Compartmentalizing areas based on functionality and benefits may be the best approach.

Tuxedo Park — Dry “Surge” Pond as Public Open Space

- Can support amenity and open space functions without delivering habitat benefits
- Different multifunctionality - usable open space, visibility, access, safety and maintenance
- Model for integration where flood storage and open space programming functions need to be balanced

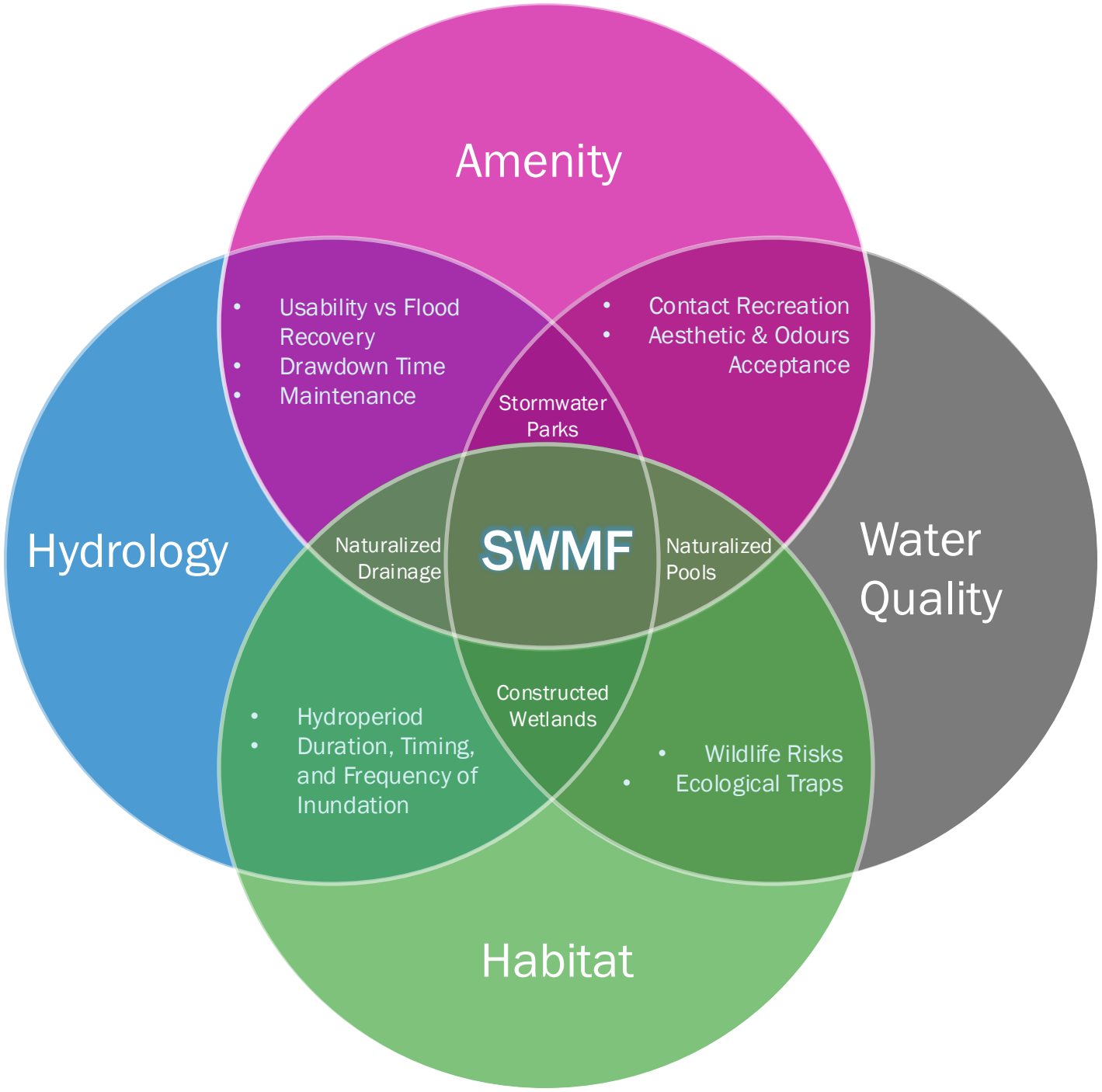
Not every integrated facility needs to be ecological first - dry ponds can deliver reliable utility plus amenity.

Tuxedo Park — What it Teaches Us

- If water quality enhancement is desired as well, special provisions need to be incorporated downstream of flow controls
- Future - provision of underground storage could further reduce impacts on programming

Continuum lesson:

Amenity integration may be easiest where the stormwater function is limited to flood control only.


Amenity
Hydrology
Water Quality
Habitat
SWMF
Stormwater Parks
Naturalized Drainage
Naturalized Pools
Constructed Wetlands
• Usability vs Flood Recovery
• Drawdown Time
• Maintenance
• Contact Recreation
• Aesthetic & Odours Acceptance
• Hydroperiod
• Duration, Timing, and Frequency of Inundation
• Wildlife Risks
• Ecological Traps

Summary

- Multifunctionality is not a “free upgrade”
- Co-benefits can emerge, but may not be durable
- Maintenance and stormwater function decide what survives
- Sustainable integrated facilities are intentional, not accidental
- Call to discussion – your thoughts are welcome!

Questions & Discussion

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