4. DESIGN PRINCIPLES FOR OPTIMAL CONSERVATION PRACTICES

The goal of the Ahead of the Storm (AOTS) Project, led by the Lewis Creek Association, is to define and implement Optimal Conservation Practices (OCPs) that establish treatment levels above permit requirements necessary to protect ecosystem functions where feasible and cost effective. Recent climate trends show increasing storm frequency, intensity, and magnitude[1][2]. AOTS recognizes a need for greater emphasis on water retention, infiltration and filtering. Recommended OCP practices will naturalize the movement of stormwater runoff across the land, enhance flood resiliency, and protect water quality in receiving lakes and streams. This approach is recommended for Vermont headwater forest protection [3] and is also applied here in the LaPlatte watershed region of the Champlain valley.

OCPs do a more complete job of slowing down runoff, spreading out runoff, and promoting infiltration[4].

SLOW IT DOWN	SPREAD IT OUT	SOAK IT IN
Increase Roughness of Land Surfaces	Disperse Flow Paths	Increase Infiltration
Decrease Slopes	Interrupt Flow Paths	Minimize Disturbance
Dissipate Energy	Direct to Infiltration	Minimize Impervious Surfaces & Soil Compaction

GUIDING PRINCIPLES IN DESIGNING OCPS FOR WATER QUALITY PROTECTION & FLOOD RESILIENCY

- ✓ Slow the rate of water flow
- ✓ Increase the amount of infiltration
- ✓ Reduce soil movement and erosion
- ✓ Enhance the capacity of naturally vegetated land to trap sediment
- ✓ Maintain water quality even during storm events
- ✓ Consider stream stability and water quality of the greater river system
- ✓ Reverse cumulative impacts from multiple problem areas
- ✓ Use practices known to reduce phosphorus-rich runoff
- ✓ Use practices that are cost-effective and feasible for landowners
- ✓ Go beyond the minimum design requirements to achieve OCPs

EXAMPLES

- 100-foot buffer from surface waters, instead of the minimum requirements
- When possible, design for larger stormwater flow volumes than are required by state permits
- Where possible, design for the channel protection volume (CPv) standards for optimizing the stormwater practice. These standards are designed to help avoid incremental impacts to the stability of nearby stream corridors by slowing and treating stormwater runoff on site.
- If redeveloping a site, account for the amount runoff from the entire impervious and natural areas.
- Design for no net water volume runoff when changing land use and land cover.

REFERENCES

[1] Armstrong, W. H., M. J. Collins, and N. P. Snyder, 2012. Increased Frequency of Low-Magnitude Floods in New England. Journal of The American Water Resources Association 48(2):306-320.

[2] Collins, M. J., 2009. Evidence for Changing Flood Risk in New England since the Late 20th Century. Journal of The American Water Resources Association 45(2):279-290.

[3] Underwood, K. L. and D. Brynn, 2015. Enhancing Flood Resiliency of Vermont State Lands (Draft). Prepared for Vermont Forests, Parks & Recreation by South Mountain Research & Consulting and Vermont Family Forests, Montpelier, VT.

[4] USEPA, 2014. Planning for Flood Recovery and Long-Term Resilience in Vermont: Smart Growth Approaches for Disaster-Resilient Communities. EPA 231-R-14-003. Office of Sustainable Communities, Smart Growth Program, U.S. Environmental Protection Agency, Washington, DC.

5. SITE ASSESSMENT & DESIGN PROCESS

The process and steps for any design process are similar and can be applied to solve problems across a large variety of site conditions and landuses. An AOTS demonstration site involves close participation with the property owner throughout the steps. The following is an overview of the site assessment and design process. Some advanced steps may not be required for a simple project.

PRE-PROJECT DEVELOPMENT

Before a project begins, it needs to be identified and landowners need to be willing to proceed. Steps might include:

- Identify a general problem area based on stream water quality, known flood problems, or other water related issues.
- Discuss possible benefits, project impacts, as well as long-term maintenance requirements with landowners and other stakeholders so that there is a mutual understanding of possible projects.
- Document project buy-in from landowners and move forward with next steps.

MAP CONTEXT & FEATURES WITH EXISTING DATA

During this desktop phase, preparation for a site visit is complete by compiling aerial photography and available data:

- Topography (elevation, peaks, and depressions; contours from LiDAR, if available)
- Soil Map: hydrologic soil groups (A, B, C, D) and floodable soils
- Existing wetlands
- Property lines
- Nearby water quality and subwatershed area
- River Corridors
- Fluvial Erosion Hazard Zones (FEH)
- FEMA floodplains and floodways
- Other known mapped data, possibly from a site plan or existing stormwater permit

SITE ASSESSMENT FIELD VISIT

Visit the site and use compiled basemap data to guide more detailed observations and record:

- Identify and draw arrows showing water flow paths including pipes, swales, and overland
- Record erosion — stream banks, rills, gullies
- Locate existing stormwater infrastructure — pipes, ditches, ponds, catchment areas
- Map impervious surfaces — buildings, parking areas, roads (paved and gravel)
- Note land type and/or ecosystems present — meadow, forest, lawn, paved, gravel
- Photograph site conditions
- Note site constraints such as utilities — electrical wires, poles, manholes, valves indicating water lines, etc.
- Note site opportunities for stormwater treatment (especially wet areas) and consider possible solutions
- Delineate larger subwatershed drainage area and boundaries which are typically drawn to encompass areas where treatment may be done
- Locate site information not otherwise noted, including water quality conditions of the subwatershed
- Record all information on mapping and in notes

DESIGN

Visit the site and use compiled basemap data to guide more detailed observations and record:

- Draw drainage area boundaries to all possible stormwater treatment areas
- Perform hydrology calculations based on soils, land use, and runoff patterns
- Choose and size OCPs based on target storms – maximize treatment capacity to address future climate
- Illustrate OCPs on design plans – include plan, section, profile, and details to define the specific action

IMPLEMENTATION

Discuss OCPs and costs with landowners and work with them on any remaining steps up to and including construction:

- Make plans for additional design and engineering, soils testing, survey, securing funding, and/or permitting, if needed
- Consider volunteer, donation, or education options
- Consider phases if more than one practice designed
- Construction, then ongoing maintenance