Shoreline Owners Management Workshop

SHORE FRIENDLY KITSAP

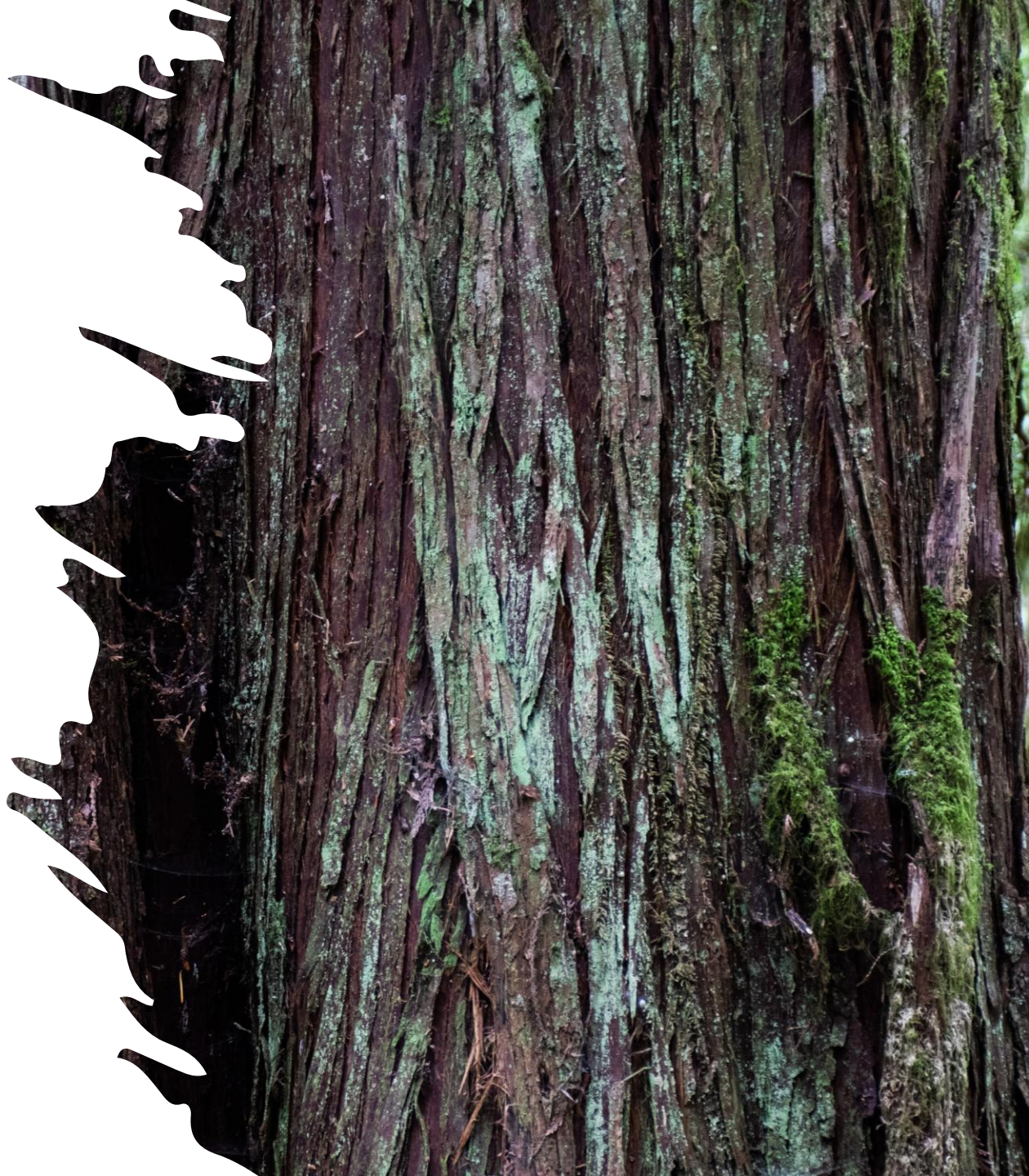
PENINSULA ENVIRONMENTAL

April 15th
Kingston, WA

Workshop Goals:

Coach shoreline landowners on making informed decisions for the long-term management of their property.

Promote responsible practices in site development, tree & view management, stormwater, and landscaping to reduce the acceleration of erosion and slope instability, while cultivating shoreline habitat and ecosystems.



John Bornsworth

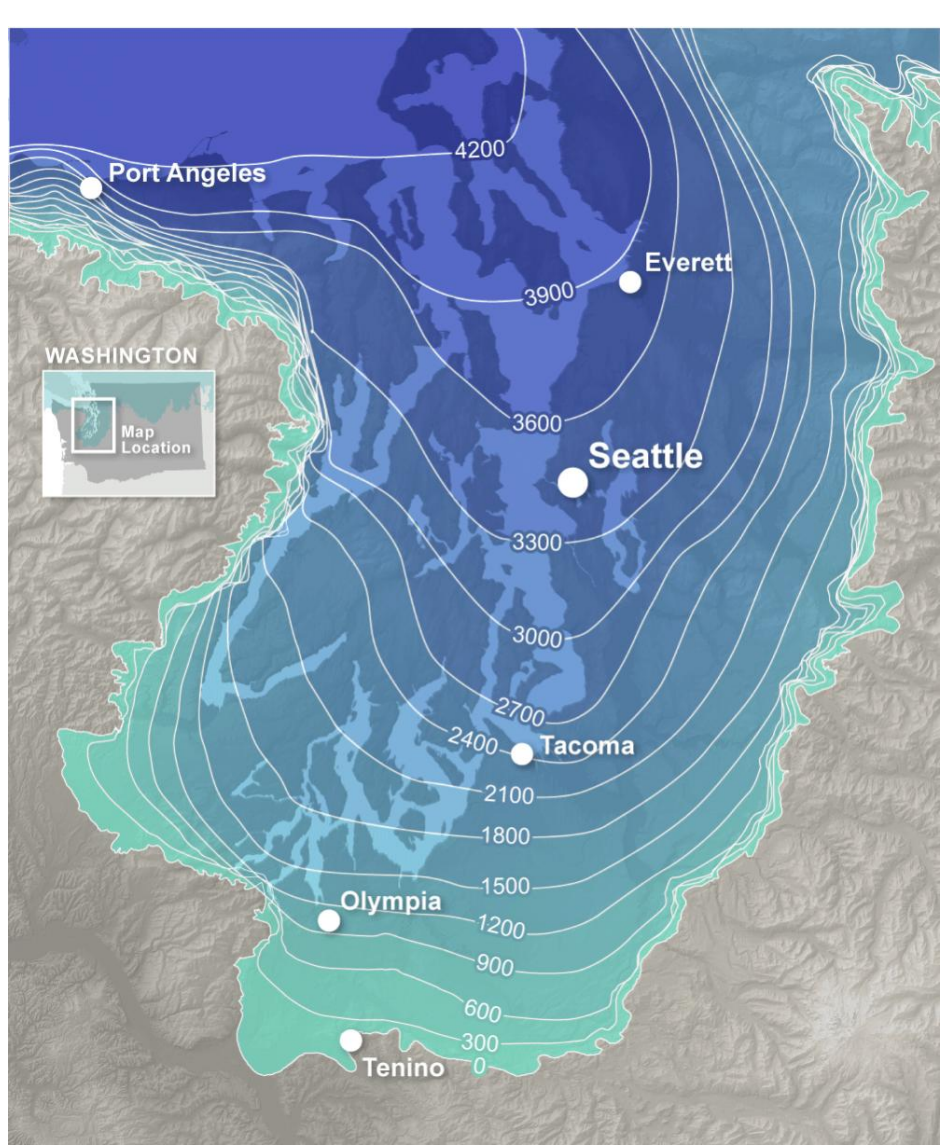
- Owner of Peninsula Environmental in Port Angeles
- Board Certified Master Arborist
- Registered Consulting Arborist
- 25 Years Restoration Ecology
- 15 Years Arborist
- 10 Years Consultant

Agenda

1. Shoreline Functions
2. Impacts of Development on Shoreline Functions
3. Shoreline Homeowner Best Practices
4. Drainage
5. Q&A

Glacial Legacy of Puget Sound

- Vashon glaciation: 13,000 - 16,000 years ago
- Sub-glacial meltwater scoured N-S trending basins
- Ice melted, sea levels rose, land uplifted (5000 ya)
- Shorelines we see today only stabilized in the last ~5,000 years.
- Balance between post-glacial rebound (uplifting) and sea levels rising.
- **1,000ft tall ice weighs 28-tons per sf.**

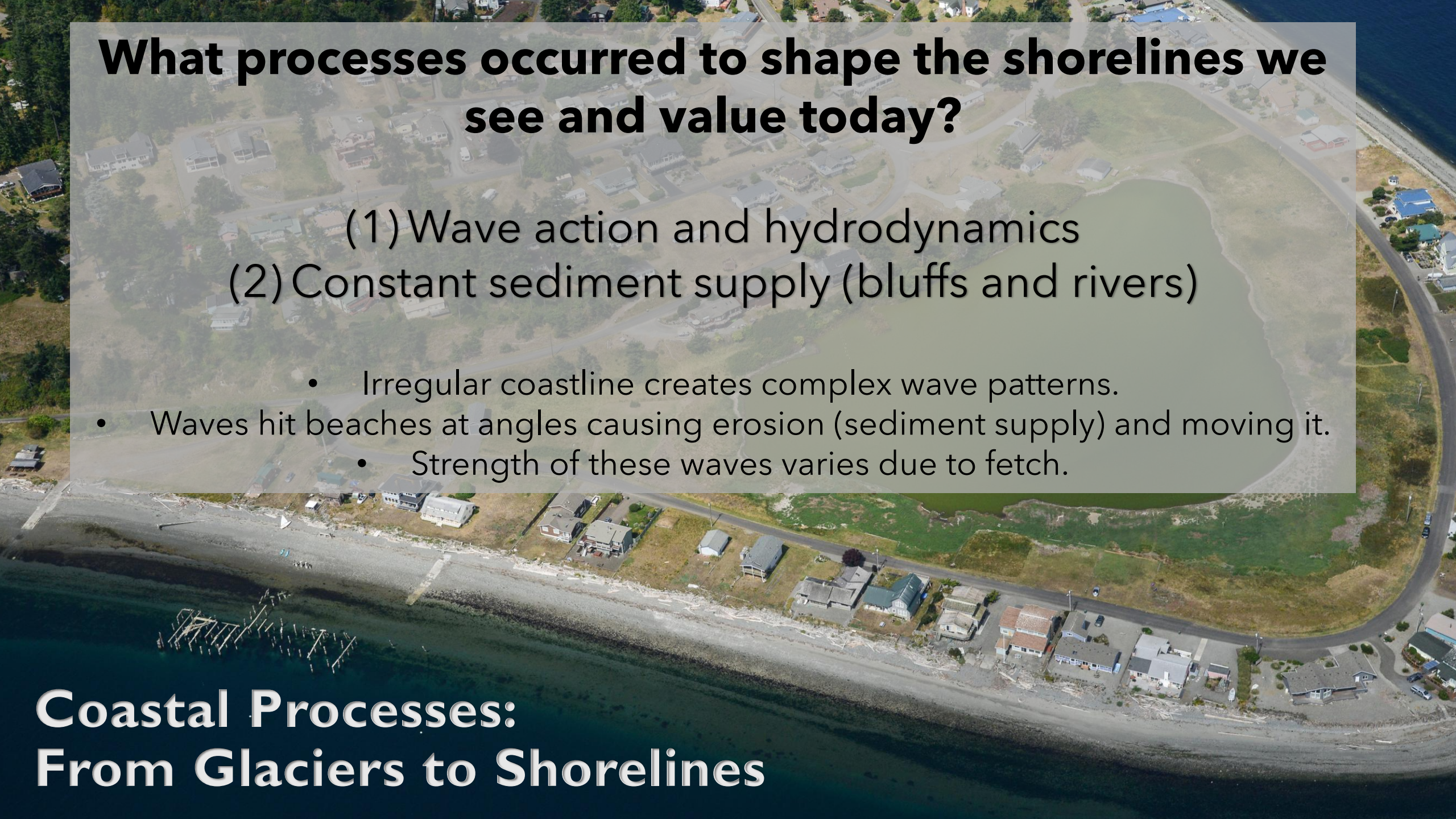


Glacial Till. Dense, low permeability, unsorted.

Glacial Outwash.
Loose, crumbly, drains well.

Sediments on Puget Sound Slopes

Glacial Outwash (Glaciofluvial)	**Till (Glacial Till)**
Formed by meltwater streams carrying and sorting sediment.	Left by subglacial fracturing of parent material. Exposed as glacier retreats.
Layered, sandy, and gravelly (stratified drift).	Mixed, compacted, unsorted (unstratified drift).
High permeability – water drains through easily.	Low permeability – water builds up on top, slick when wet.
Erodes quickly if runoff is concentrated (rills, gullies, washouts).	Resistant to erosion. High shear strength when not saturated.
Supports plant life readily.	Does not readily support plants – “hardpan” resists roots.
Challenges: erosion control, drainage, invasive plants.	**Challenges:** slope stability, water pressure buildup.



What processes occurred to shape the shorelines we see and value today?

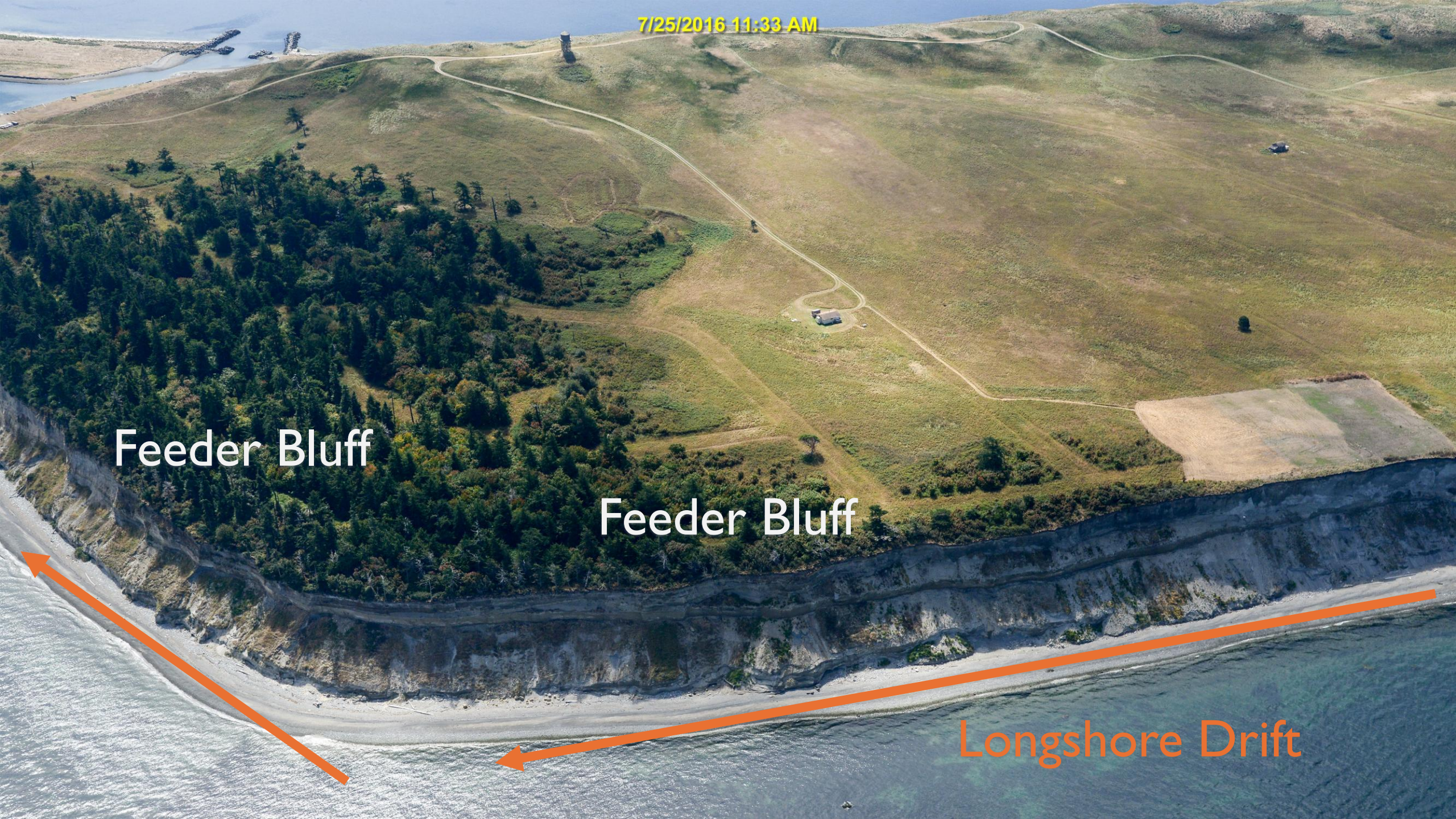
(1) Wave action and hydrodynamics
(2) Constant sediment supply (bluffs and rivers)

- Irregular coastline creates complex wave patterns.
- Waves hit beaches at angles causing erosion (sediment supply) and moving it.
- Strength of these waves varies due to fetch.

Coastal Processes: From Glaciers to Shorelines

Feeder Bluffs:

"Feeding" sediment to the beach


7/25/2016 11:33 AM
Feeder Bluff
Feeder Bluff
Longshore Drift

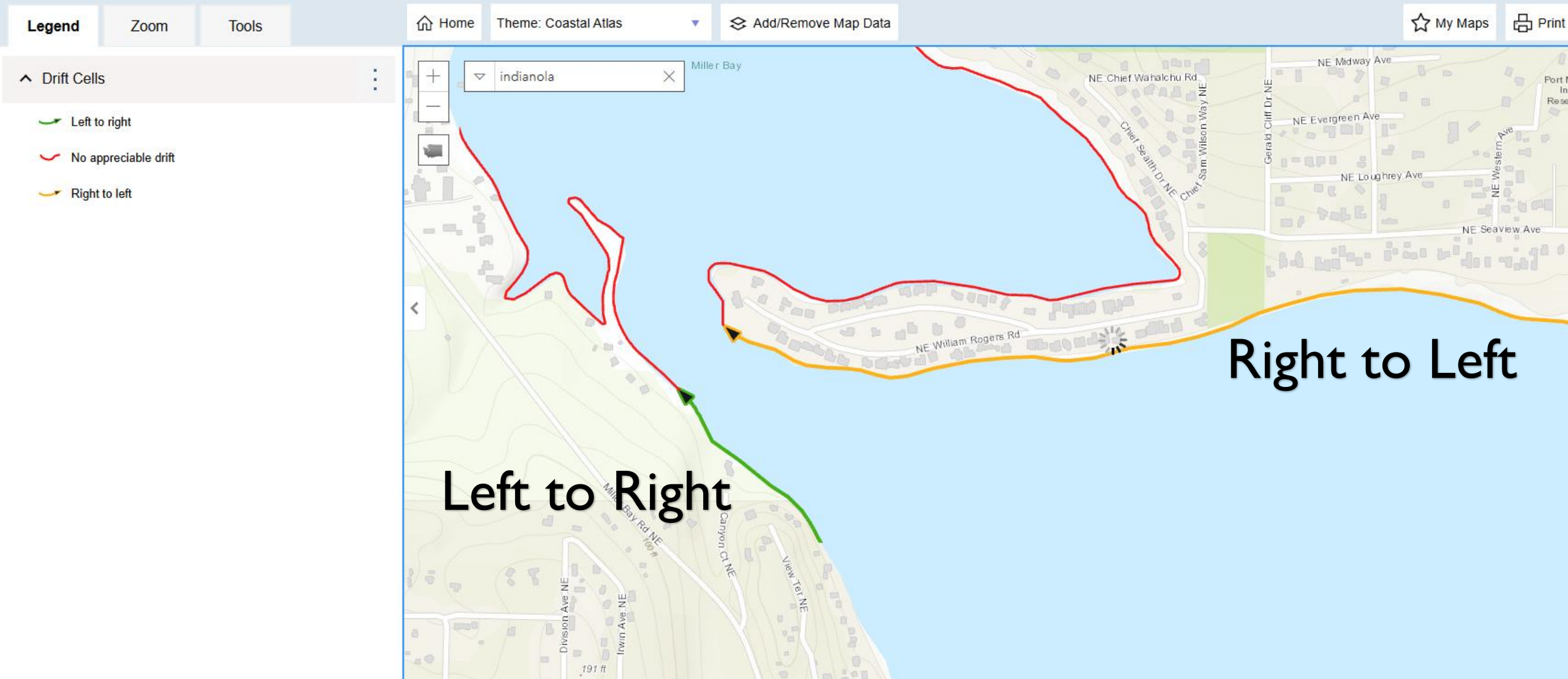

7/25/2016 11:33 AM
Transport Zone
Accretion Zone forms a spit and barrier beach
Feeder Bluff

LONGSHORE DRIFT

Photo credit: Lily M. Tang

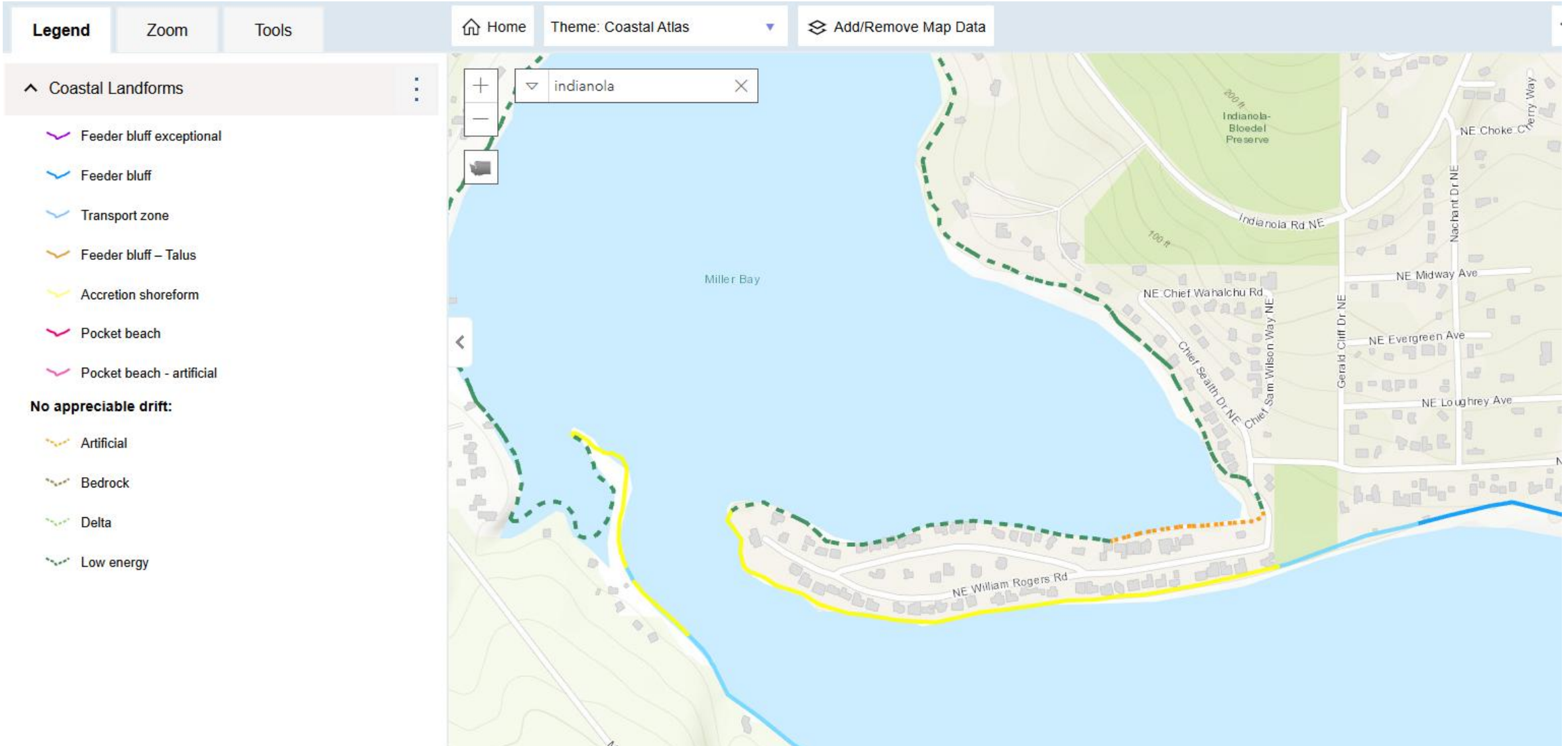
Drift Cells

https://apps.ecology.wa.gov/coastalatlas/



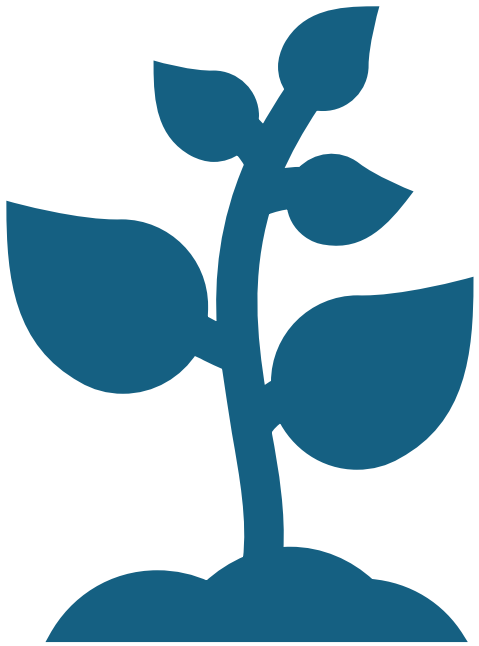
Coastal Landforms

https://apps.ecology.wa.gov/coastalatlas/



Functions of Plants on Shorelines

Hydrological, Mechanical, Ecological



Hydraulic Functions

- Rainfall interception
- Transpiration, evapotranspiration
- Soil dewatering
- Infiltration
- Soil pore connectivity

Tree & Shrub Leaves

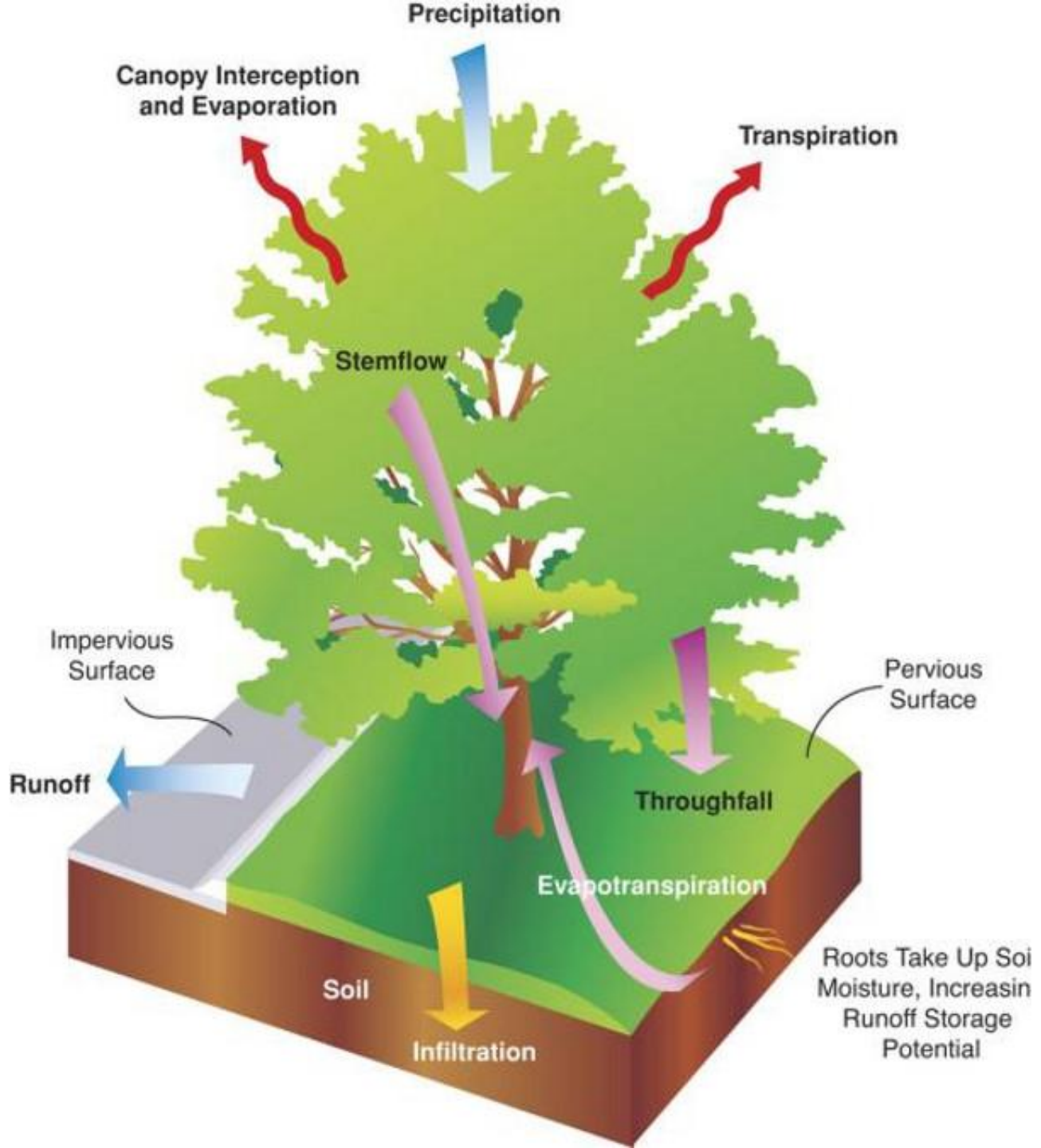
Canopy Interception & Evaporation

Transpiration

Evapotranspiration (Transpiration + Ground Evaporation)

Photosynthesis

Cellular Respiration



Interception & Transpiration

Evergreen plants = year-round interception & very little winter transpiration

Deciduous trees = interception only when leaves are present. Zero winter transpiration

During growing season, deciduous trees wick moisture from ground (transpiration) 4-6x more than evergreen.

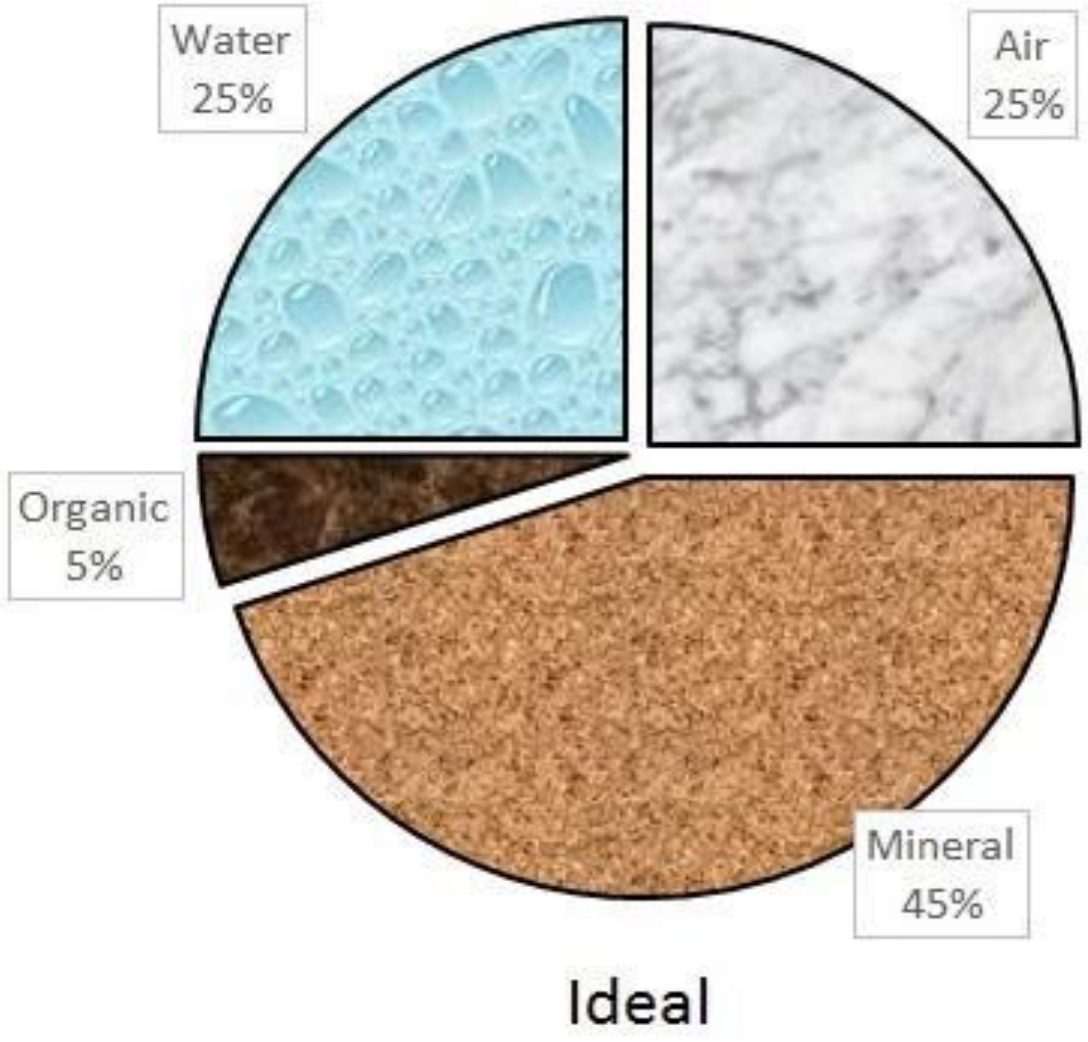
Evergreen trees may intercept 30-50% of winter precipitation reducing urgency for rapid soil infiltration

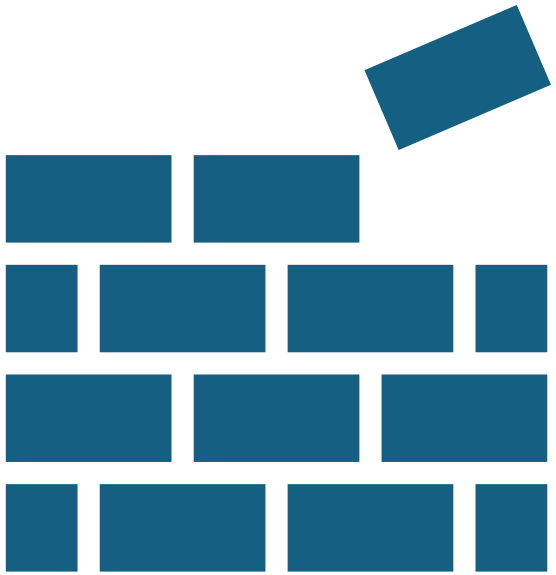
Deciduous trees have greater overall water modification than evergreen, when accounting for both transpiration & infiltration.

Forest soils are alive.

- Detritus/mulch absorbs rainfall and **slowly** releases it into soils. Sponge.
- Moisture and temperature regulation.
- Root and microorganism activity maintains soil porosity.
- Soil is constantly modified by roots, microbes, insects, fungi, decomposition. This process is carbon sequestration in soil.
- Activity promotes infiltration.

Typical composition of forest soils in PNW





Mechanical Functions

- Soil reinforcement
- Roughened soil surfaces
- Roots distribute loads applied by trees

Real tree roots.

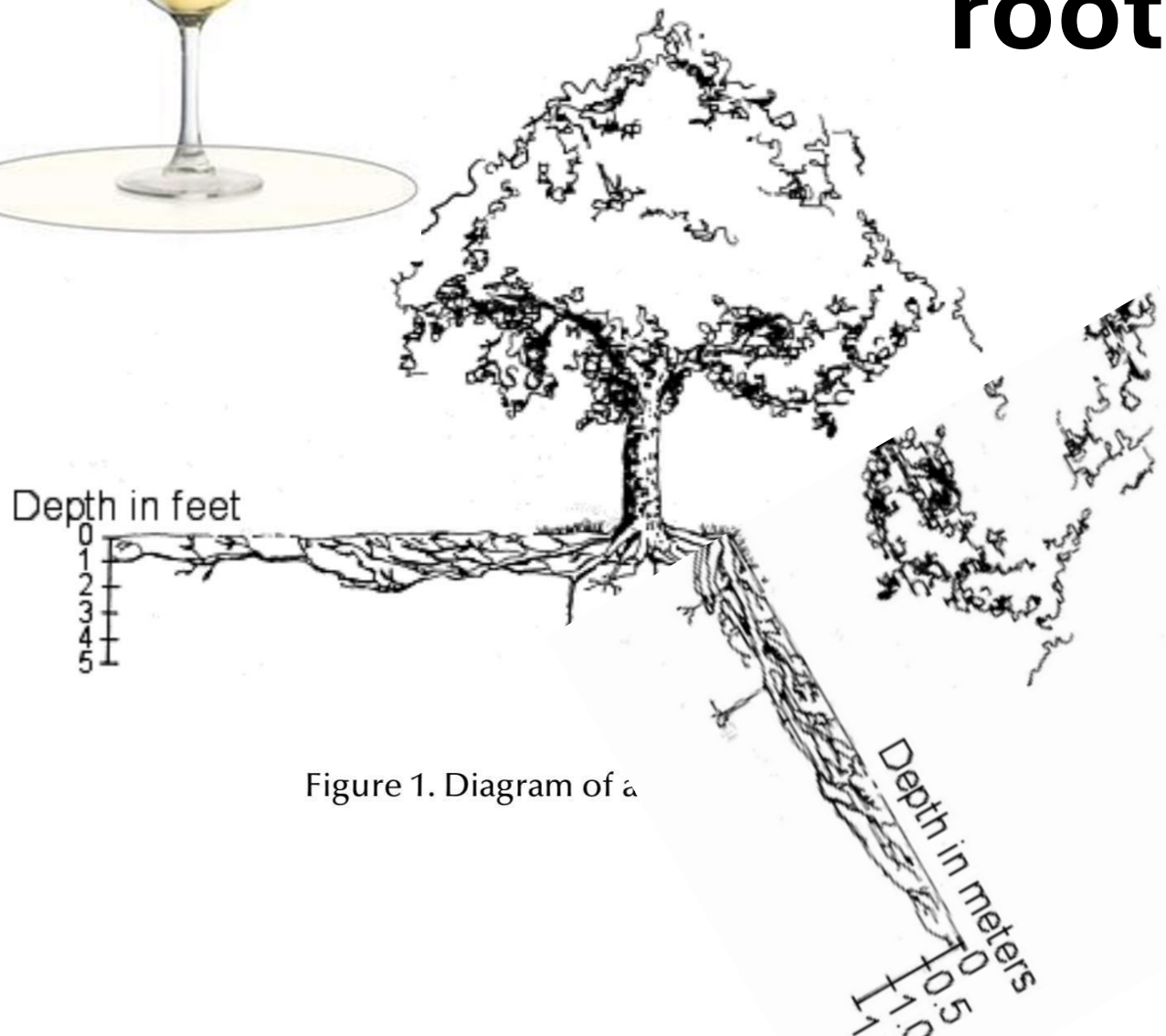


Figure 1. Diagram of a

Root Reinforcement

- **Tree roots mechanically bind your soils together!**
- Shear strength increase in cohesionless soils (glacial outwash, sand, gravel, topsoil).
- Vertical roots anchor
- Lateral roots cross shear planes
- Think rebar in cement
- Resist shallow landslides on non-vertical slopes.

Ecological Functions

- Habitat
- Food Source
- Chemical Cycling
- Carbon Sequestration

Wildlife

More than 500 species of animal, insect, fungi, and other organisms inhabit trees.

Retain those portions of trees that can be safely retained.

Bald eagles prefer trees with dead tops.

Living and dead riparian vegetation and LWD at toe of slope - **natural armoring.**

Don’t forget about the hardwoods.

- **Nutrient pulses** – seasonal leaf and litter fall feed marine and freshwater riparian systems.
- **Rapid decomposition** – hardwood leaves and small wood break down quickly, fueling detrital food webs.
- **Nitrogen fixation** – *Alnus*, *Salix*, *Populus*, *Lupinus*. 90%+ upon decay
- **Habitat support** – detrital outfall supports microorganisms, invertebrates, and amphibians.

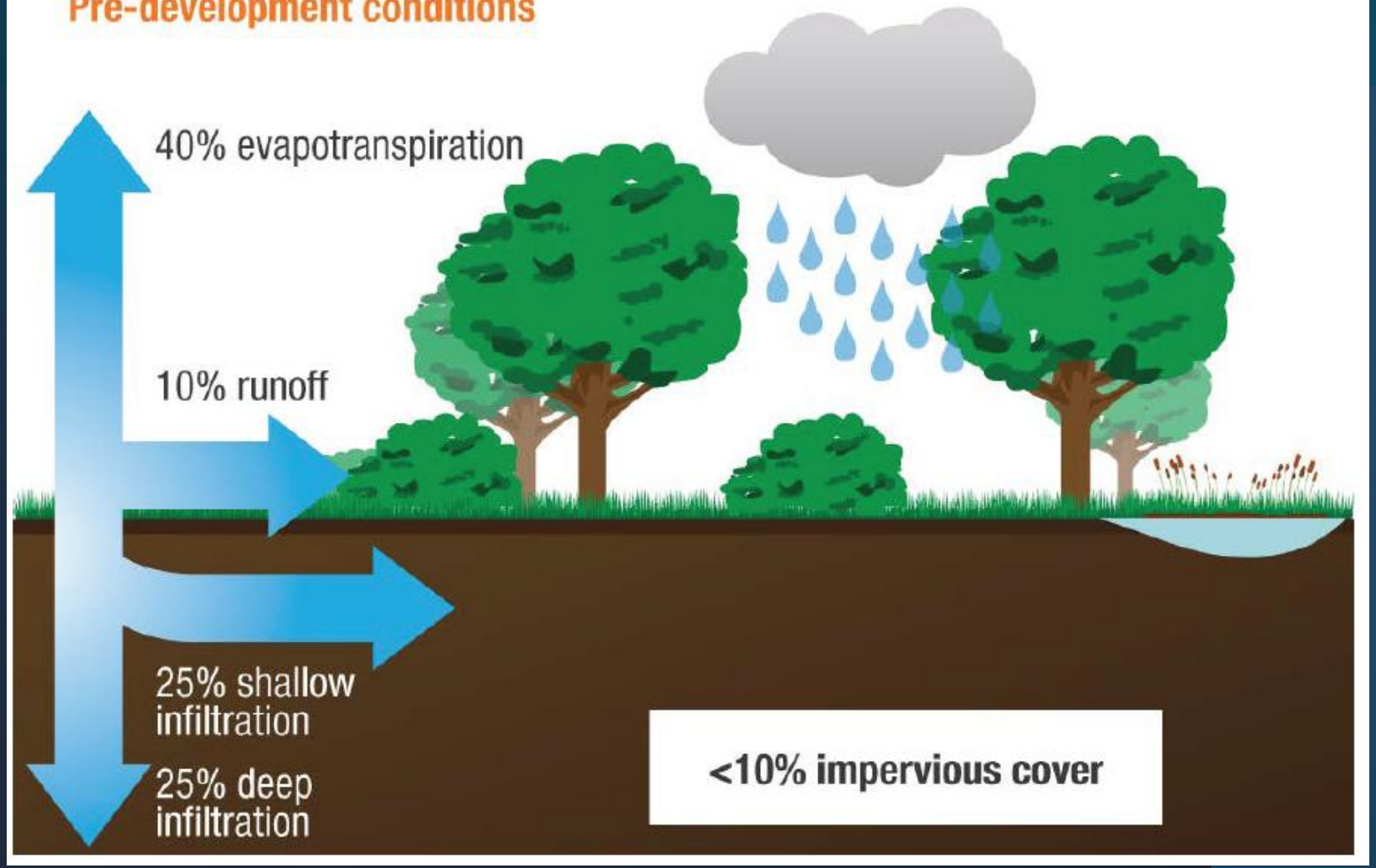
Impacts of Development Those Natural Functions

BEFORE


AFTER

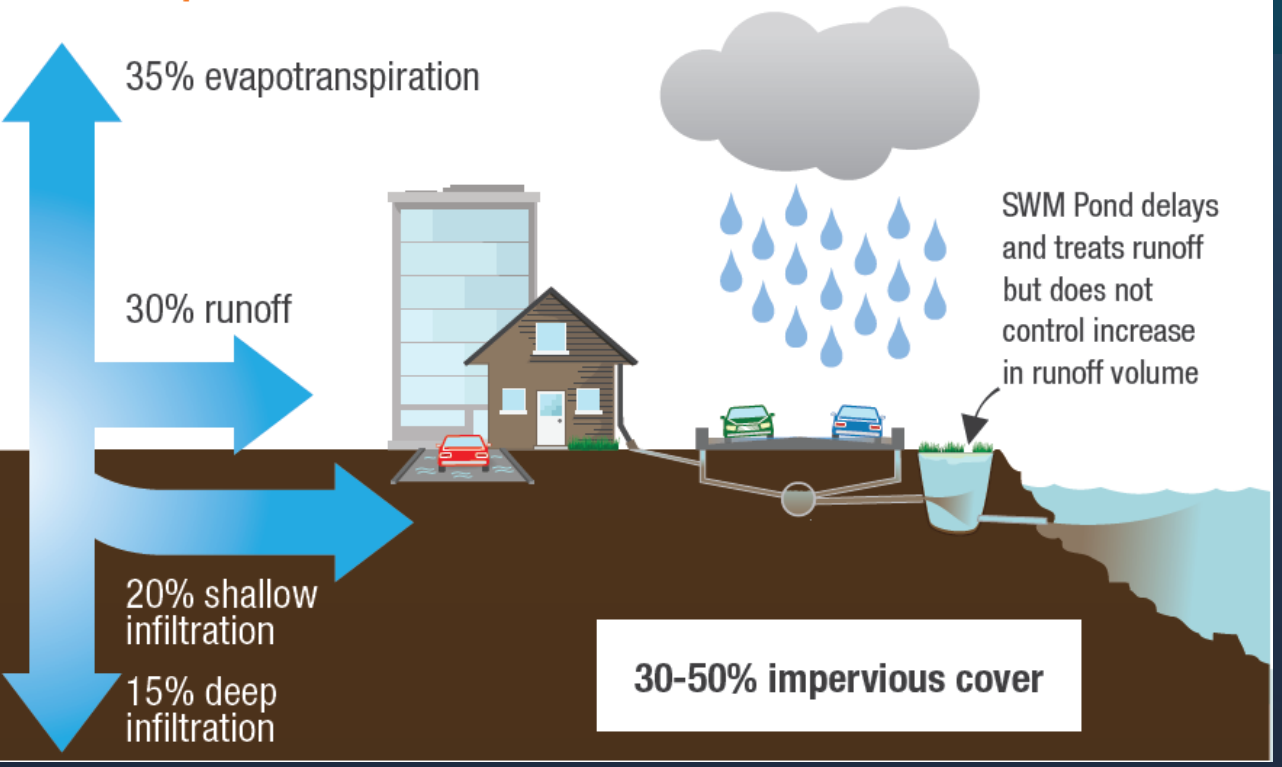
Natural Ground Cover

Pre-development conditions



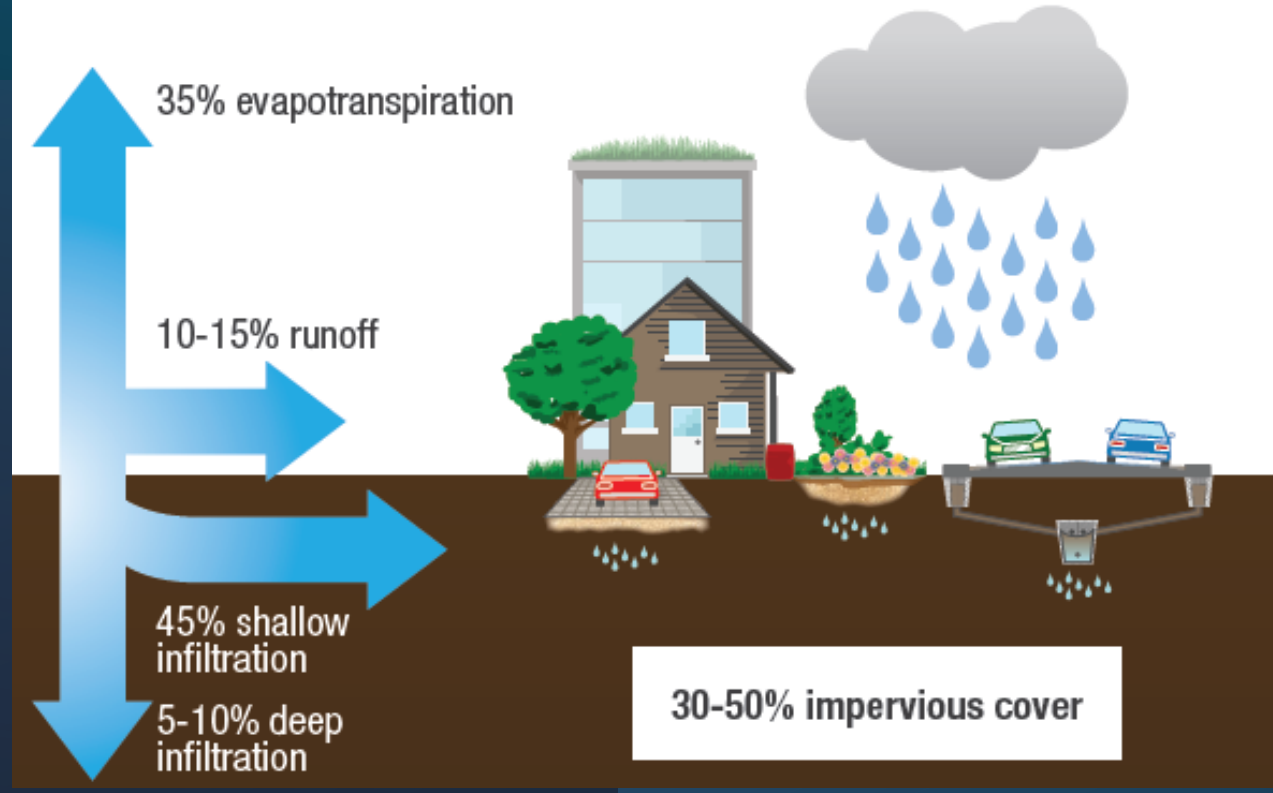
Urban Hydrology

Typical development: Stormwater management using End of Pipe SWM Pond



Urban Hydrology

Development with Low Impact Development



SHORELINE ARMOR IMPACTS

Shoreline armor does not prevent **coastal flooding** or **bluff erosion**.

- Habitat fragmentation
- Loss of habitat connectivity
- Burial of beach and forage fish spawning habitat

- Reduced sediment input
- Loss of beach wrack and LWD
- Impacts to littoral drift

Shoreline armoring prevents localized **toe erosion** and **landward retreat** at the immediate shoreline interface.

Illustrations courtesy of Simone Des Roches
https://www.simonedr.com/

The Coastal Squeeze

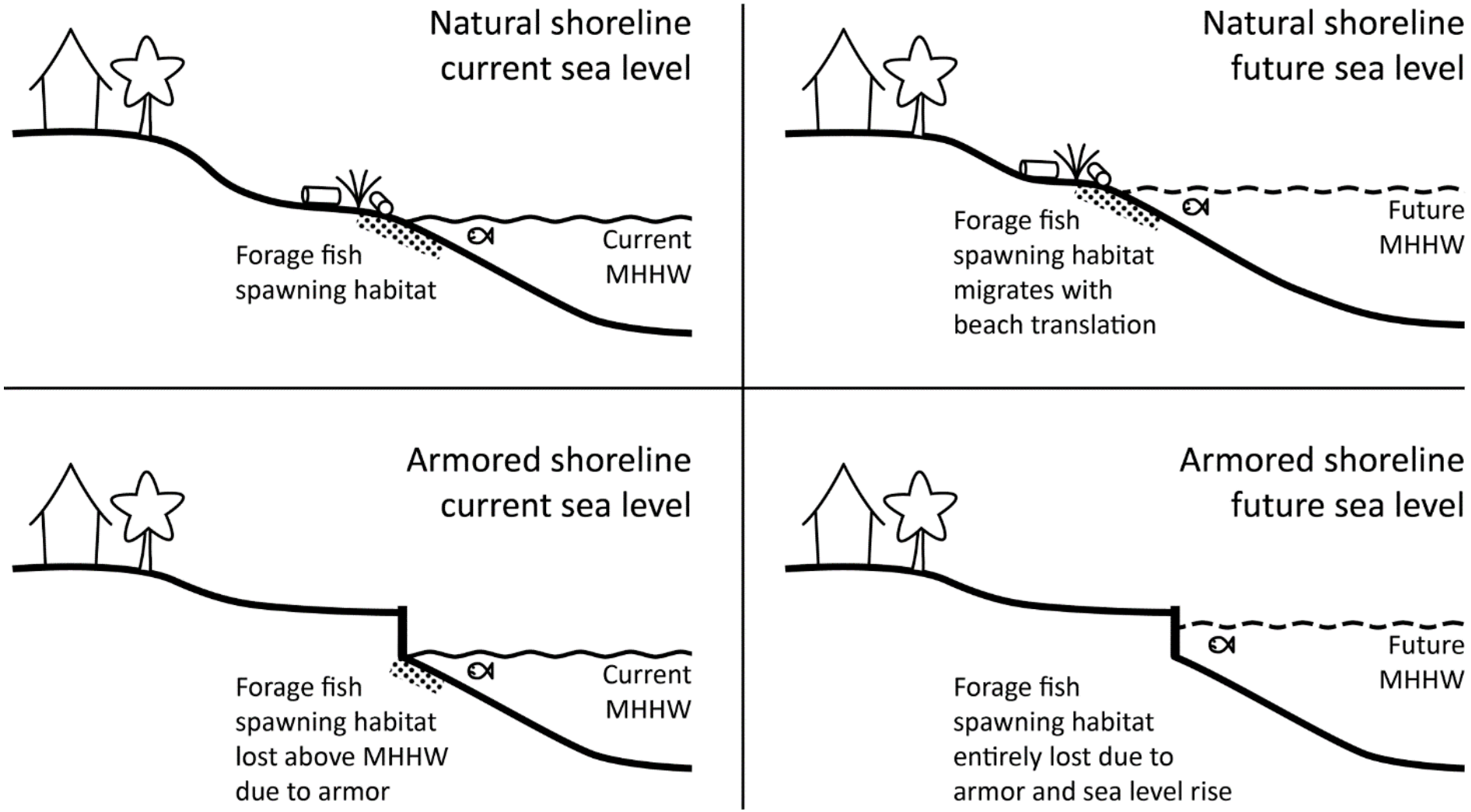
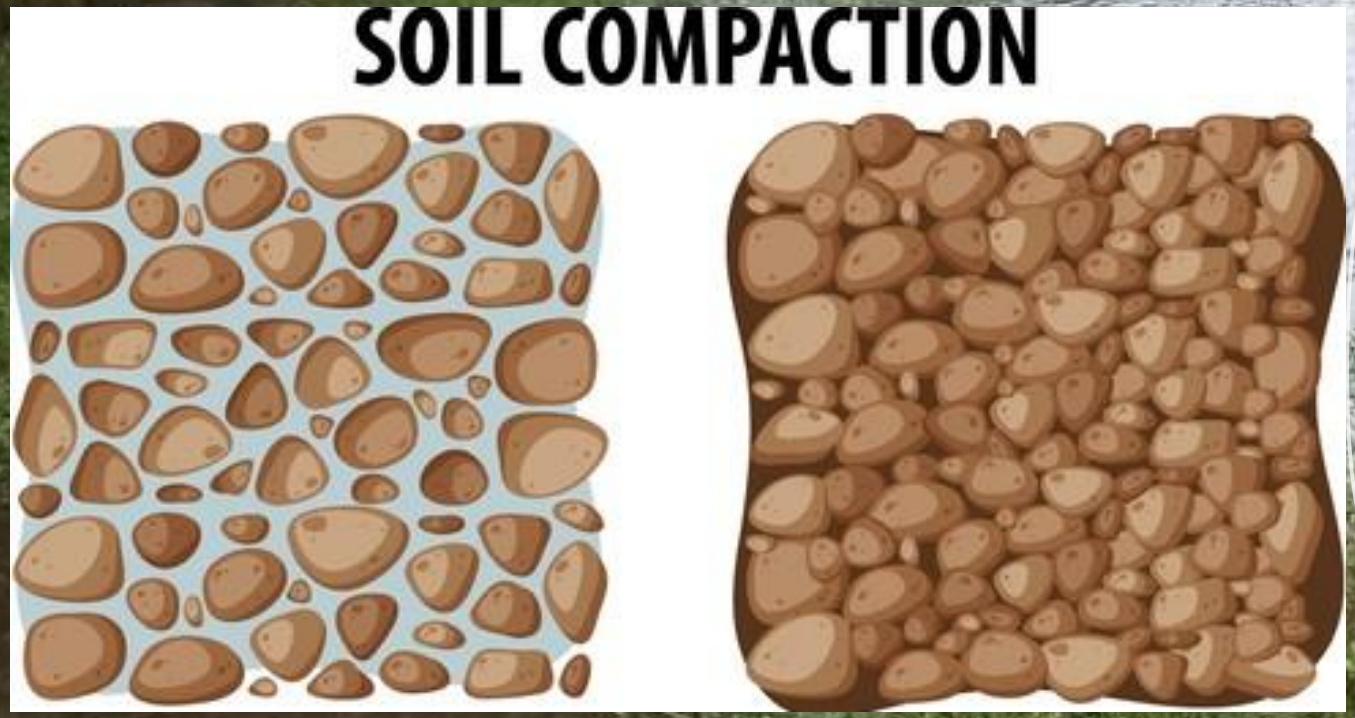
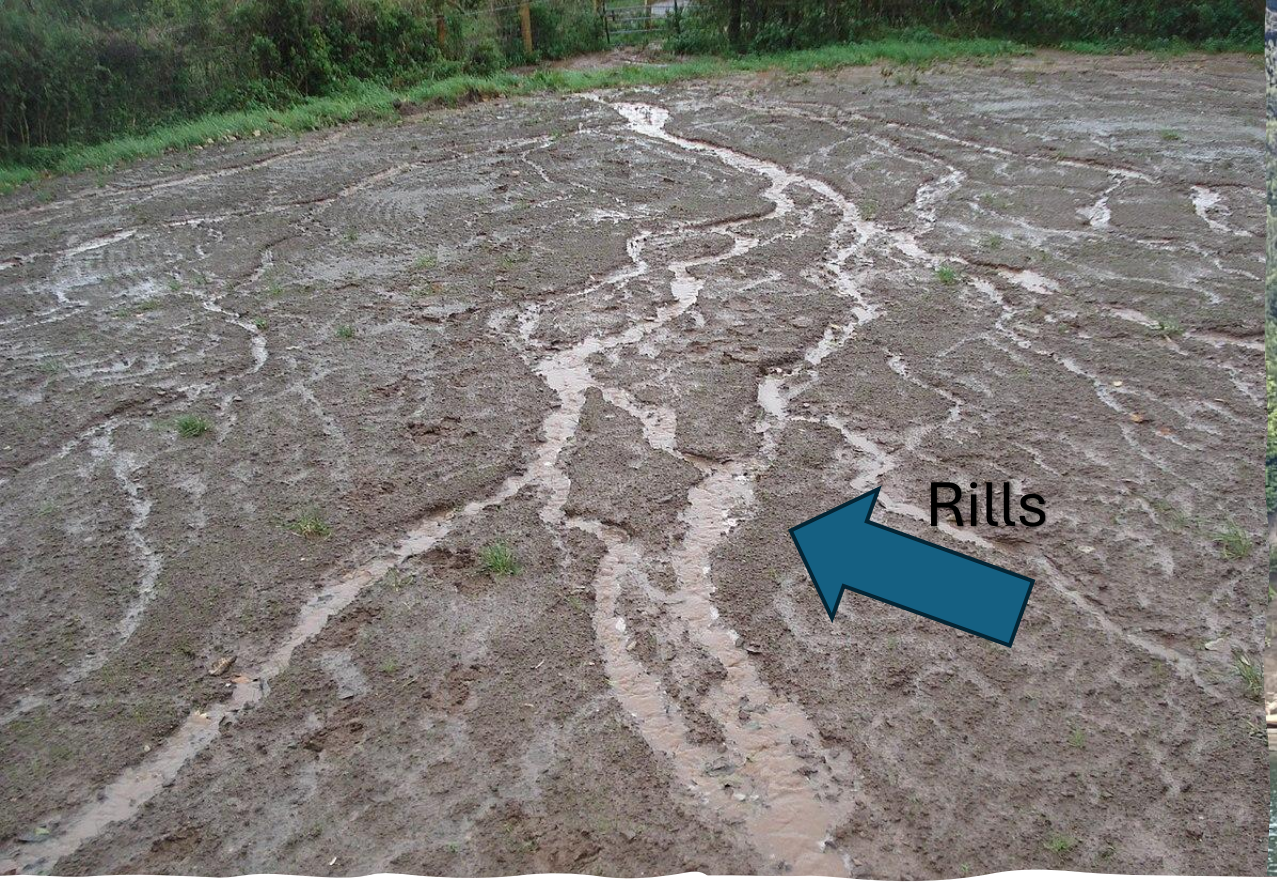


Figure from Coastal Geologic Services



Why do lawns and ball fields flood?

Why doesn’t the water infiltrate?



Surface Erosion

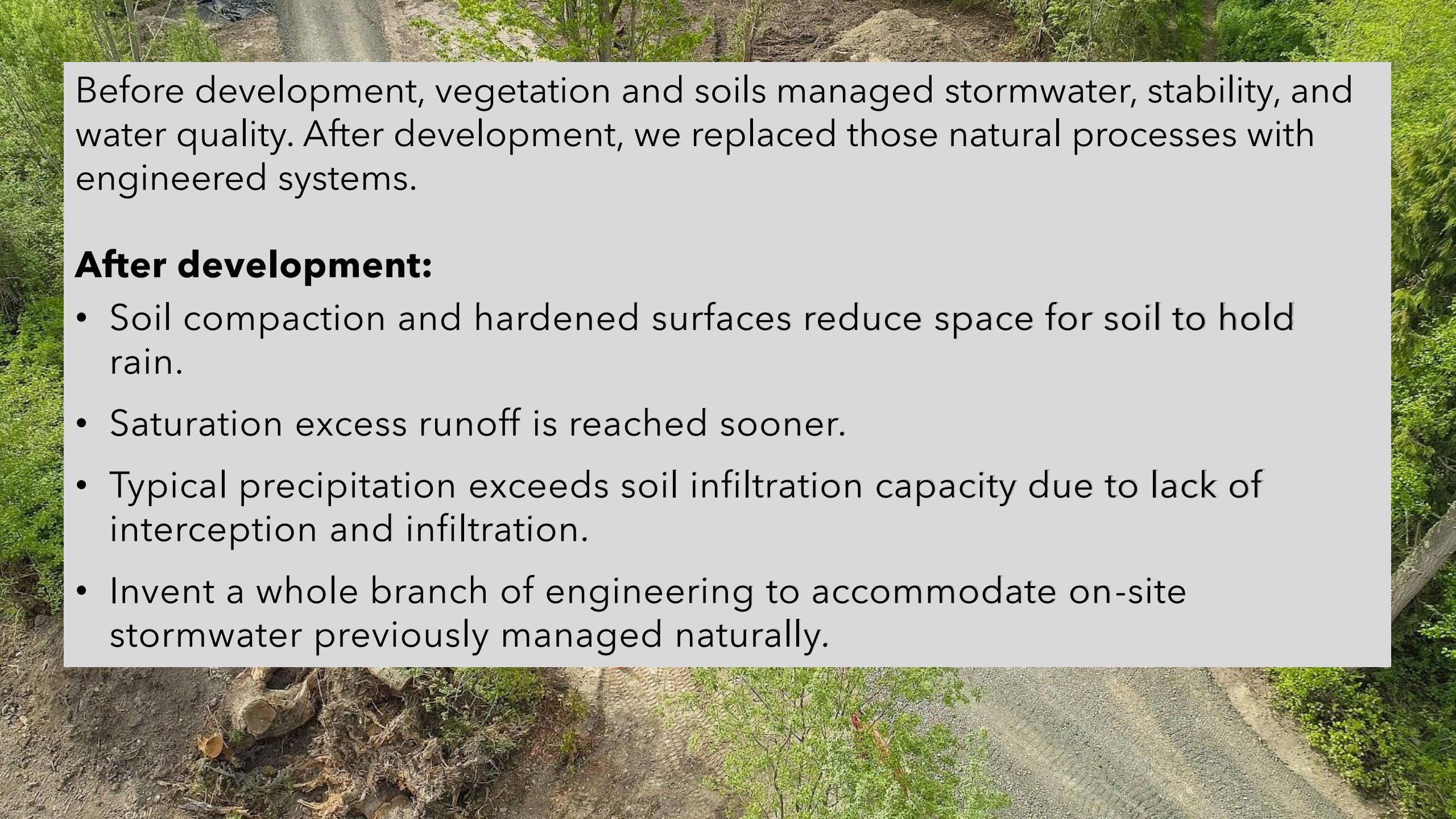
- Chronic, slow, gradual wearing away
- Water driven (rainfall, runoff, waves)

- Roots bind soils surfaces.
- Plant cover intercepts rainfall and slows surface flow (surface roughening).

Slope Failures

- Landslides, slumps, rotational, deep-seated failures
- Acute, sudden, episodic failures.
- Gravity-driven but *triggered* by other phenomena

- Large tree roots anchor soils and reinforce shear planes.
- Plants mitigate excessive soil saturation.



Before development, vegetation and soils managed stormwater, stability, and water quality. After development, we replaced those natural processes with engineered systems.

After development:

- Soil compaction and hardened surfaces reduce space for soil to hold rain.
- Saturation excess runoff is reached sooner.
- Typical precipitation exceeds soil infiltration capacity due to lack of interception and infiltration.
- Invent a whole branch of engineering to accommodate on-site stormwater previously managed naturally.

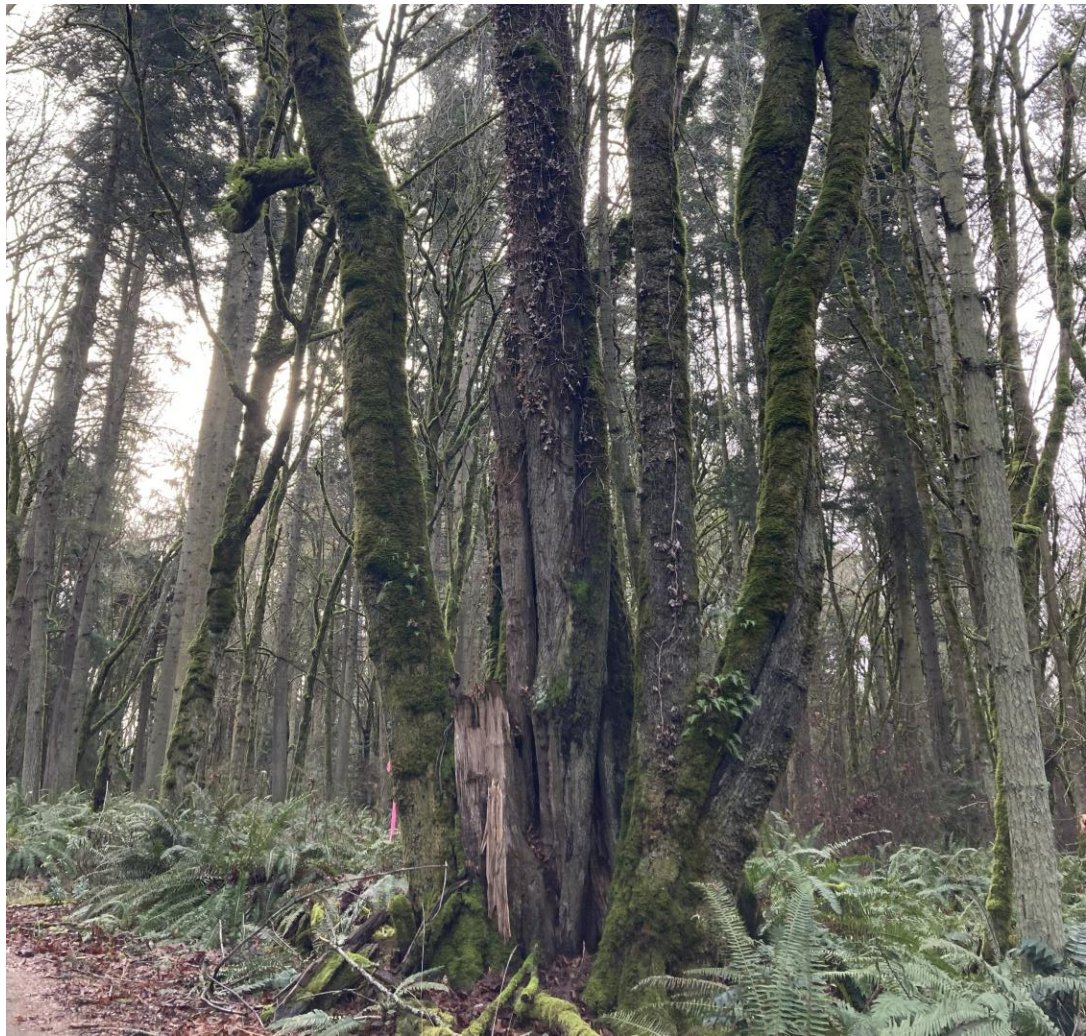
Best Practices for Homeowners

Safety

Be cautious of slope edges, undercuts and loose soil.

Coppicing

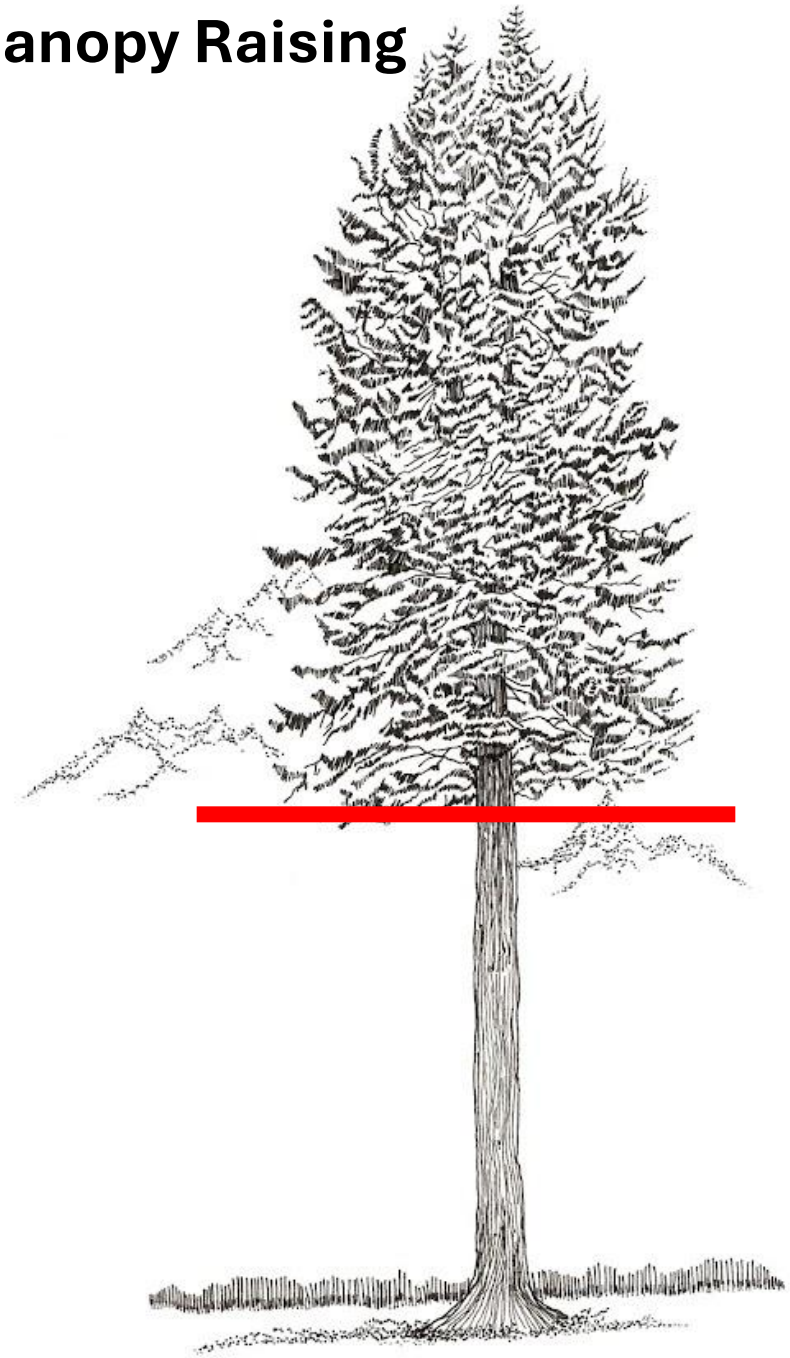
- Start small, young. <6” diameter.
- Don’t cut below original coppicing wound.
- Repeat every 3-8 years.
- Assess health of tree.



Coppiced Red Alder

Be

Canopy Raising




Not
Recommended.

Habitat Trees

Instead of tree removal.

- Retain perching branches if possible.
- Consider species and decay rate.
- Consider final height in relation to targets.
- Consider if location is habitable. Would you sleep in that tree near a busy road?

Natural area – failure good for beach.
No upland hazards.

Developed area – failure bad for septic.
Still good for the beach.
3-ft deep cavity under tree.

Don’t Dump Over the Bluff!

Photo: Peninsula Daily News

Overburdening

Root Collar Excavation

- Easy way to kill your trees.
- Find root crown.
- Candidate for vertical mulching.


Expectations vs reality
Historic,
Panoramic Views

Filtered Views

Select isolated views

Prune trees and plants for survival as well as view.

GOOD VIEW MANAGEMENT

Invasive Species

Himalayan blackberry
(Rubus armeniacus)

Grows year round.

Commonly harbors Norwegian rats.

UW study shows cutting takes ~10 years to kill roots.

Digging roots up on slope is not recommended.

Herbicide is best option for control.

English (and Irish) Ivy
(Hedera helix & H. hibernica)

Can conceal slope faces.

Grows across property boundaries. Becomes neighborhood endeavor.

Aerial ivy (growing on trees) can cause tree failure.

Poison hemlock
(Conium maculatum)

Entire plant is highly toxic. Seeds, leaves and sap are all toxic.

Looks similar to native wild carrot.

Poison hemlock has red blotches on the stem while wild carrot does not.

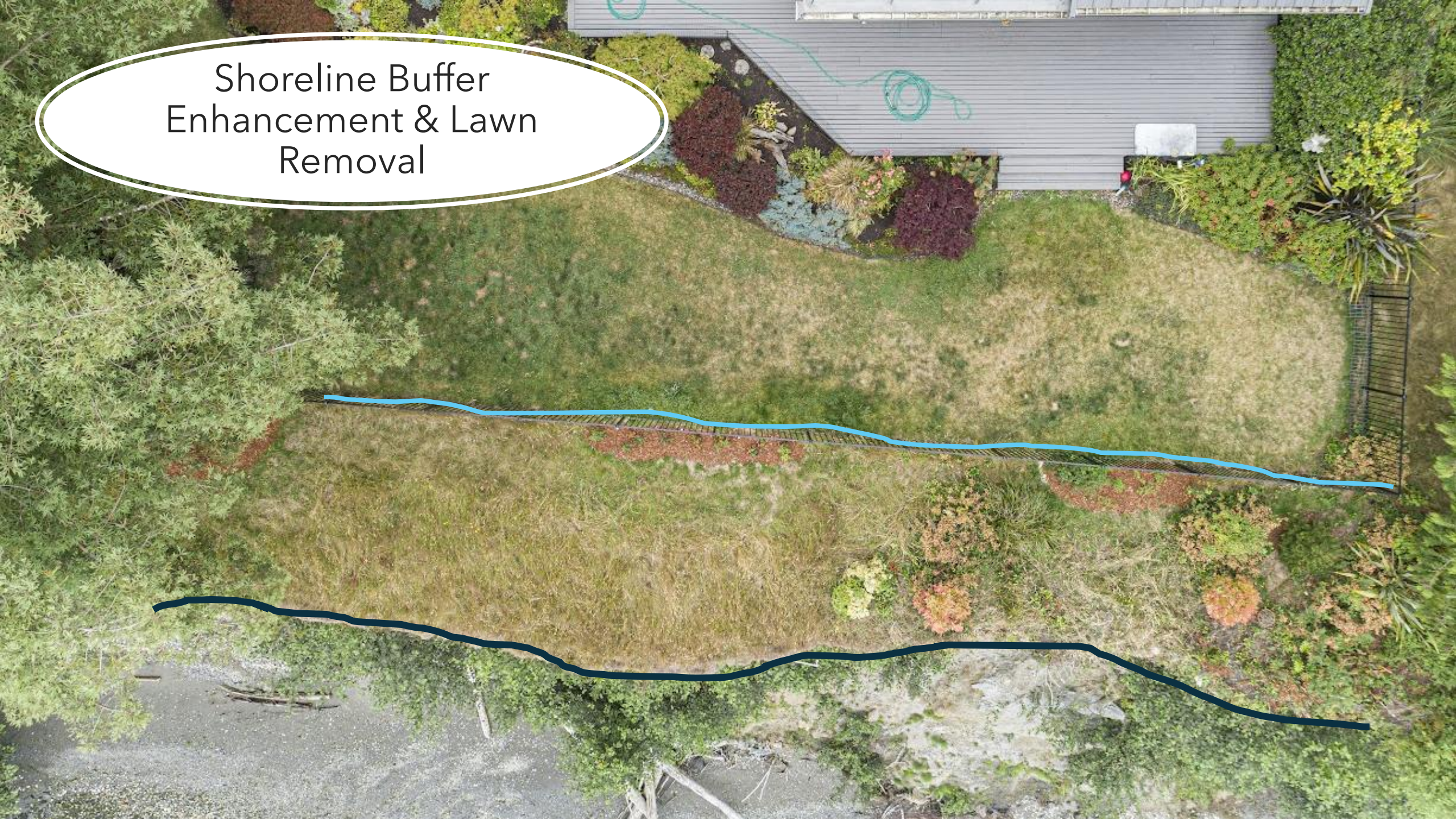
Disposal

Can generally be composted.

- Himalayan blackberry
- Scotch broom (if not seeding)
- English laurel
- English holly
- Butterfly bush
- Poison hemlock (with caution)

NO Compost – Bag and Trash

- Knotweed
- Bindweed
- English ivy


Shoreline Buffer Enhancement & Lawn Removal


Native Plant
Expectation


Formal Garden
This is OK. Not 100% preferred but an improvement from complete lawn.

Reasons to Call an Arborist

Use ISA Certified Arborists to prune living trees and to assess tree risk.

www.treesaregood.org

Stormwater Drainage Goals

Requires permits. Not a DIY project for most.

Collect everything in one discharge pipe.

Capture and convey stormwater to flat ground.

Infiltrate on beach, away from crest.

Reduce water velocity upon discharge.

Keep pipe on slope above ground and inspect annually.

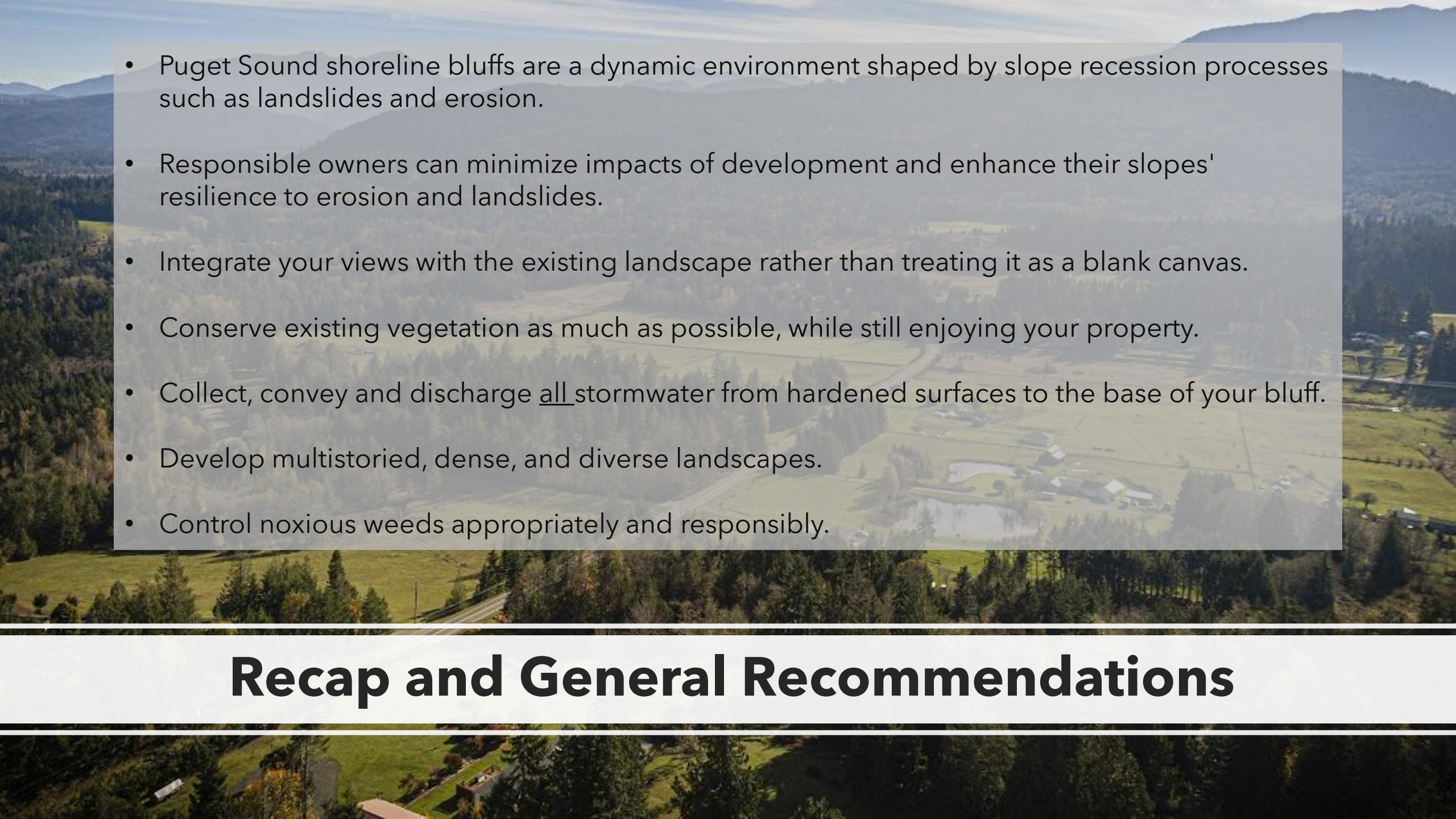
Temporary vs permanent


McELROY
McELROY

Landslide on Bainbridge Island – duct tapped corrugated pipe

Landslide in Bellingham from corrugated pipe.

Note the western redcedar.



- Puget Sound shoreline bluffs are a dynamic environment shaped by slope recession processes such as landslides and erosion.
- Responsible owners can minimize impacts of development and enhance their slopes' resilience to erosion and landslides.
- Integrate your views with the existing landscape rather than treating it as a blank canvas.
- Conserve existing vegetation as much as possible, while still enjoying your property.
- Collect, convey and discharge all stormwater from hardened surfaces to the base of your bluff.
- Develop multistoried, dense, and diverse landscapes.
- Control noxious weeds appropriately and responsibly.

Recap and General Recommendations

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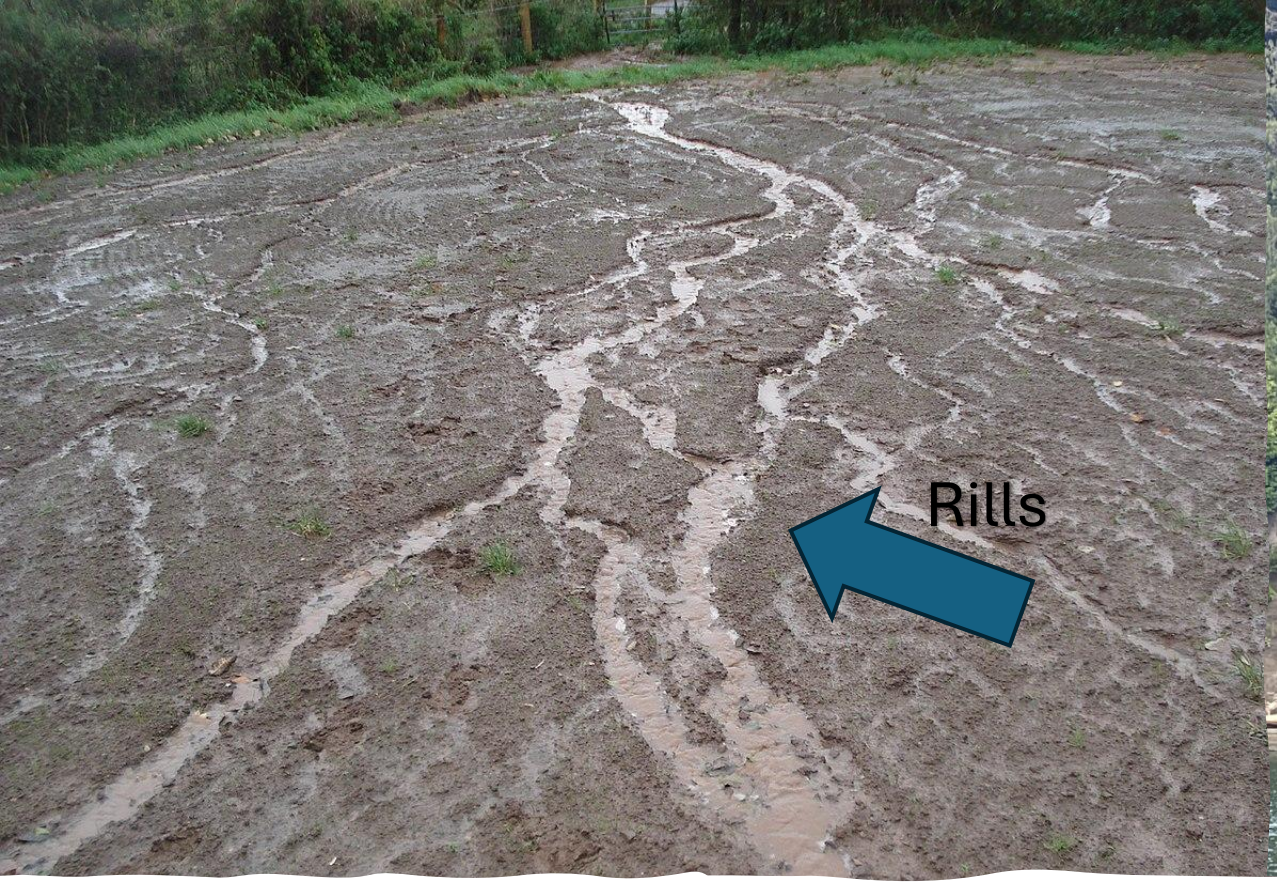
Questions?

john@peninsulaeg.com



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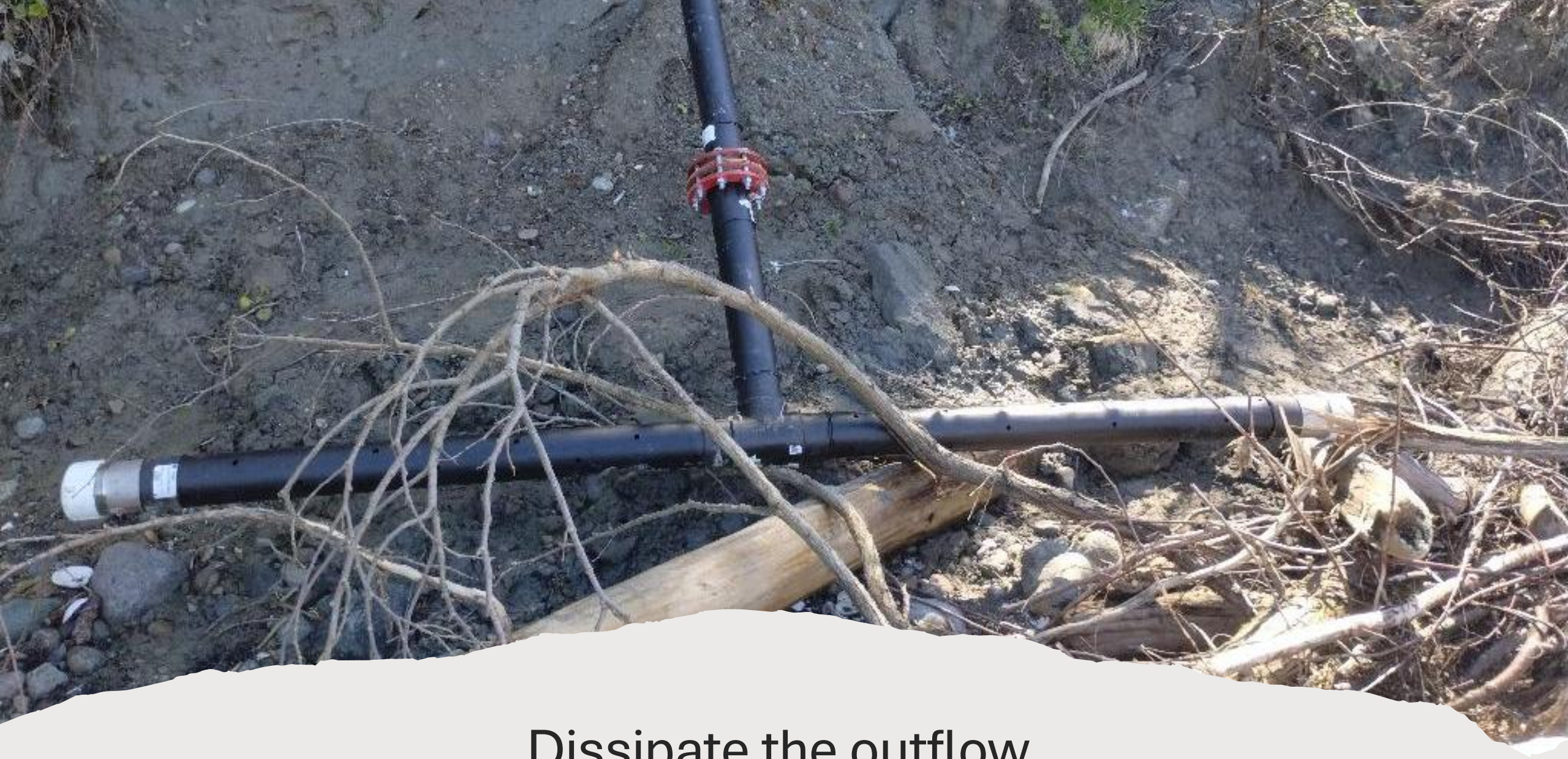
Obvious dead and declining trees.

Conks growing on trees

Collect Stormwater Water



Dissipate the outflow.

T-dissipator, pipe skid, rockery.

Verify your contractor!

Maintain Tightline

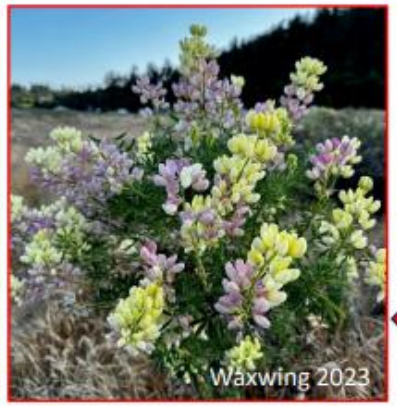
- Clean out catch basin.
- Unscrew end-cap from dispersion T and clean.

YELLOW BUSH LUPINE

Lupinus arboreus

INVASIVE

General: **widely branching shrub**, **3-6 ft tall**, deeply rooted, **thicket-forming**
Stems: **woody** and obscurely to **slightly hairy**
Leaves: leaflets 5-12, linear to oblanceolate, 1-3 in long, silky hairy
Flowers: **yellow** to white; hybrids may be mixed yellow/blue/purple



HYBRID

Images sourced from: Giblin, D.E. & B.S. Legler (eds.). 2003+. WTU Image Collection Web Site: Vascular Plants, MacroFungi, & Lichenized Fungi of Washington State. University of Washington Herbarium. Accessed 12 Dec 2023. https://burkherbarium.org/imagecollection/.

SEASHORE LUPINE

Lupinus littoralis

NATIVE

General: **sprawling** shrub, up to **1 ft tall, mat-forming**
Stems: **not woody**, with **long hairs** especially at nodes
Leaves: leaflets 5-9, 1-3 in long, upper surface hairless or hairy
Flowers: **pink to purple or blue** with white spots on the banner

*Yellow bush lupine can hybridize with other native lupine species that typically occur farther inland. **Bolded** text = important differences between seashore lupine and yellow bush lupine specifically.

Field bindweed
(Convolvulus arvensis)

Fragile, vining plant which is easy to pull.

BUT once established is very difficult to manage.

Often requiring a complete overhaul on landscape.

Stop it before it establishes!

Roots are deep.