



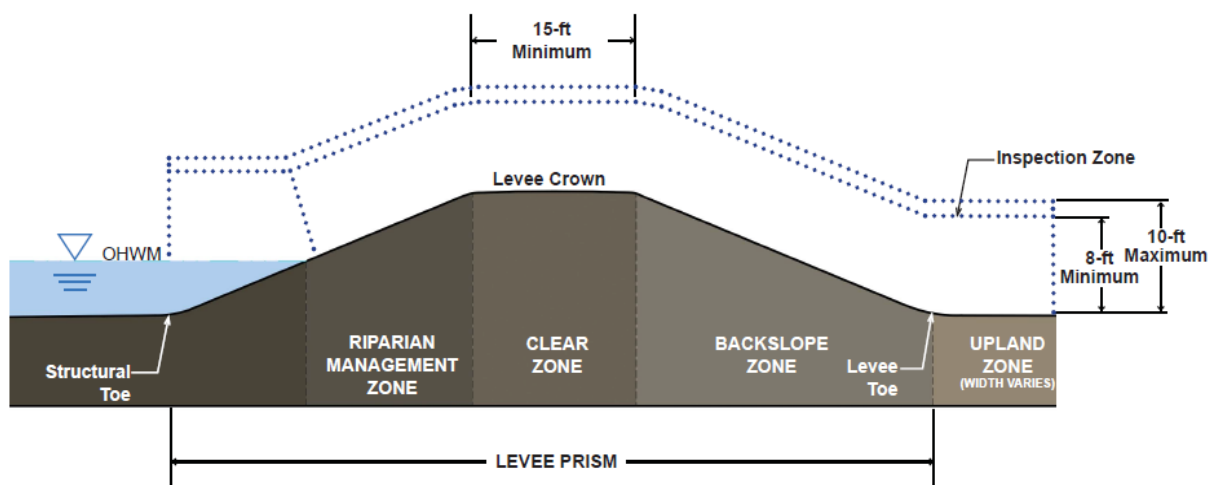
SWIF – VEGETATION MANAGEMENT CONCEPTS Proposed Levee Vegetation Maintenance Schematics

Rev.: November 10, 2015 - DRAFT

Proposed Levee Vegetation Maintenance Schematics

A “Vegetation Management Zone” will be provided across the levee prism, extending from the upland side of the levee down to the structural toe of the levee. This represents the area of vegetation management influence addressed in this strategy. The Vegetation Management Zone is divided into five (5) subzones to guide vegetation removal to five commonly encountered levee structure scenarios. The subzones are described as follows:

- **“Riparian Management Zone”** – This zone is defined as the waterward slope measured from the waterward edge of the crown extending to the levee toe, but never extending waterward of the ordinary high water mark. The width of this zone is variable depending upon the presence of a gravel bar, silt bench, paved trail or levee height.
- **“Clear Zone”** – This zone is defined as the crown of the levee. The Clear Zone will be maintained to insure adequate vehicular access for a minimum width of 15 feet.
- **“Backslope” Zone** – This area is defined as the landward slope measured from the landward edge of the crown extending down to the levee toe.
- **“Upland Zone”** – This zone is defined as the area landward of the landward of the levee toe.
- **“Inspection Zone”** – This zone is defined as the area extending 8-10 feet above the ground between the landward toe and the waterward extent of the Riparian Zone.



Levee Vegetation Management Sub Zones

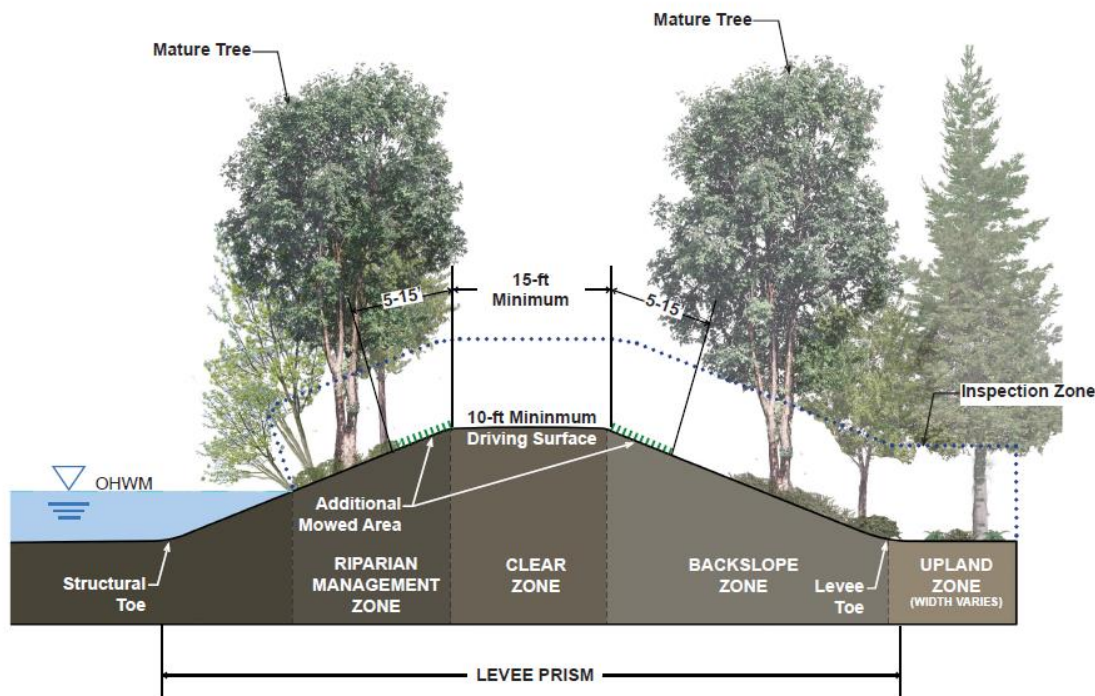
The following “Levee Maintenance Schematics” (Schematics A-E) depict how vegetation would be maintained on typical levee structure prisms, for each management zone, relative to level of risk and habitat considerations.

Levee Maintenance Schematic “A” – River Channel Adjacent to Levee (w/o silt bench)

This levee x-section depicts levees immediately adjacent to the river without a silt bench or floodplain bench area at the riverward toe of the levee. Type “A” levees have very limited space for balancing levee stability and safety risks, while maintaining some level of riparian vegetation function. Typically Type “A” levees are situated on a steep river bank that functions as the levee embankment.

The maintenance approach for Type “A” levee sections allows for the growth of native trees and shrubs in the “riparian management zone” adjacent to the river. Woody riparian vegetation is preserved as feasible on the riverside levee slope in order to provide moderate riparian functions including bank stability, roughness, cover, shade, wood and nutrient contribution, water quality filtering and moderation of water temperature. Vegetation will be managed to provide for visual inspection of the levee on a rotational basis based on degree of risk exhibited on that portion of the levee segment. (See “Levee Visual Inspection Standards” - TBD) Mature vegetation (“Mature Trees”) situated upon the levee area, that are not identified as a hazard tree of high risk, nor interferes directly with vehicular access requirements, will be preserved to the greatest extent feasible.

A “Clear Zone” is provided across the crest of the levee to remain clear of woody vegetation for vehicle access for purposes of maintenance work and in times of emergency. The Clear Zone will extend 5-15ft downslope of the Riparian and Backslope Zone as necessary to control growth of invasive plants and branches through routine mowing and limbing of tree branches that may crowd the clear zone. The backslope will be managed to provide visibility for inspection of possible seepage and structural integrity issues. An “Upland Zone” is provided beyond the landward toe as available for long-term enhancement and conservation protection.

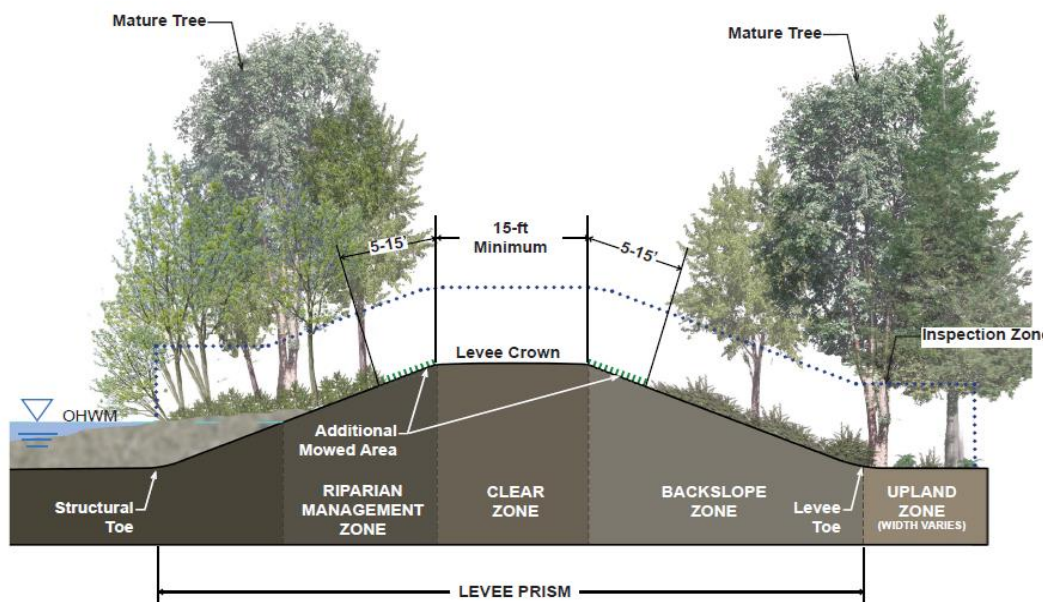


Levee Maintenance Schematic “B” – Levee with Silt Bench (on levee structure)

This levee x-section represents levees immediately adjacent to the river, with a silt bench on the riverward face of the levee. Type “B” levees also have limited space for balancing levee stability and safety risks, while maintaining some level of riparian function.

The maintenance approach for Type “B” levee sections preserves native trees and shrubs on the silt bench zone of the levee adjacent to the river. The silt benches are typically found in the middle to downstream reaches of the Puyallup River System and have built up over time due to long term sediment accretion along the river bank. Typically the silt benches result in over-steepened river banks that lie above the levee structural prism embankment. The silt bench is an area where native trees and shrubs have become established on silt deposits along the riverward slope of the levee. The silt provides a rooting zone on top of any riprap which may be present, which better protects the lower levee from potential tree impacts from uprooting. The vegetated silt bench along the levee may provide for further protection of the levee prism during high flow events. Levees with silt benches will be mapped for longer term protection. Woody riparian vegetation on the silt bench (below the levee prism) will be preserved in order to provide moderate riparian functions including bank stability, roughness, cover, shade, wood and nutrient contribution, water quality filtering and moderation of water temperature. Vegetation on the levee above the silt bench will be managed to provide for visual inspection of the levee on a rotational basis based on degree of risk exhibited on that portion of the levee segment (see Levee Visual Inspection Standards). Mature vegetation (“Mature Trees”) situated upon the levee area, above the silt bench, that are not identified as a hazard tree of high risk, nor interferes directly with vehicular access requirements, will be preserved to the greatest extent feasible.

A “Clear Zone” is provided across the crest of the levee to remain clear of woody vegetation for vehicle access for purposes of maintenance work and in times of emergency. The Clear Zone will extend 5-15ft downslope of the Riparian and Backslope Zone as necessary to control growth of invasive plants and branches through routine mowing and limbing of tree branches that may crowd the clear zone. The backslope will be managed to provide visibility for inspection of possible seepage and structural integrity issues. An “Upland Zone” is provided beyond the landward toe as available for long-term enhancement and conservation protection.

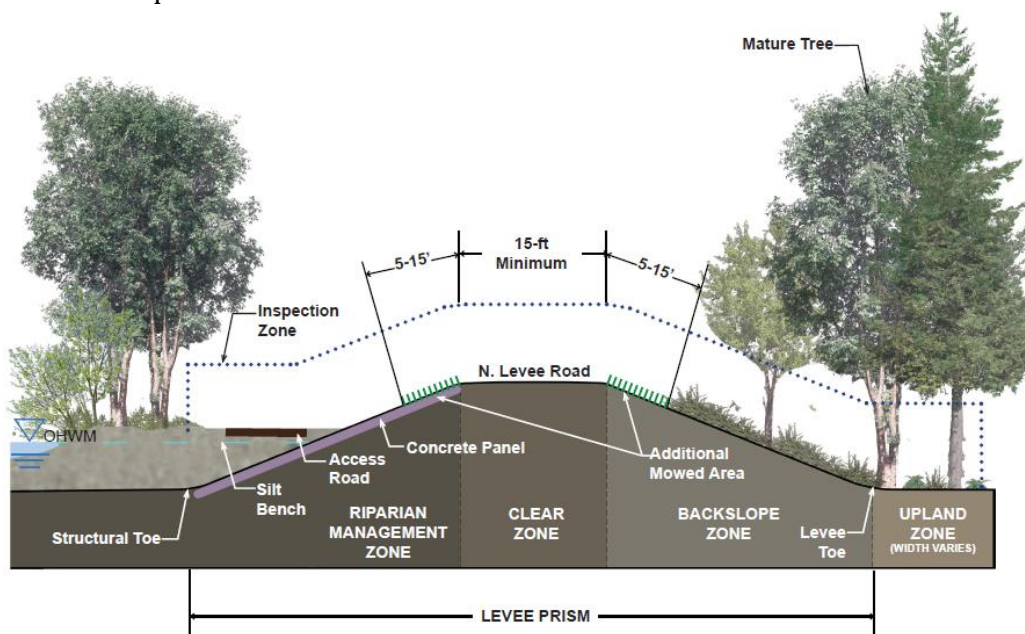


Levee Maintenance Schematic “C” - Concrete Panel Levee w Silt Bench/Access Road

This levee x-section represents levees that were constructed along the lower reaches of the Puyallup River constructed of local riverine gravel soil mix and armored with concrete panels extending down below OHW with a silt bench formed on top of brush mats lying in front of the levee concrete panels adjacent to the river. The silt bench provides a medium where riverine vegetation grows. A maintenance access road has been established on portions of the levee silt bench.

The maintenance approach for Type “C” levee sections preserves native trees and shrubs on the silt bench zone of the levee adjacent to the river, while allowing for visual inspection of the upper portions of the levee concrete panels above the silt bench. The silt benches are typically found in the lower reaches of the Puyallup River System and have built up over time due to long term sediment accretion along the river bank. The silt bench is an area where native trees and shrubs have become established on silt deposits along the riverward slope of the levee. The vegetation silt bench along the levee may provide for further protection of the levee concrete panels and levee prism during high flow events. Woody riparian vegetation on the silt bench (below the levee prism) will be preserved as feasible in order to provide moderate riparian functions including bank stability, roughness, cover, shade, wood and nutrient contribution, water quality filtering and moderation of water temperature. Vegetation on the levee above the silt bench will be managed to provide for vehicular access and visual inspection of the levee concrete panels. Mature vegetation (“Mature Trees”) situated upon the levee silt bench area, that are not identified as a hazard tree of high risk, nor interferes directly with vehicular access requirements, will be preserved to the greatest extent feasible.

A “Clear Zone” is provided across the crest of the levee down to the lower silt bench access road, to remain clear of woody vegetation for purposes of vehicular access for maintenance work and in times of emergency. The Clear Zone will extend 5-15ft downslope across the Riparian and Backslope Zone as necessary to control growth of invasive plants and branches through routine mowing and limbing of tree branches that may crowd the clear zone. The backslope will be managed to provide visibility for inspection of possible seepage and structural integrity issues. An “Upland Zone” is provided beyond the landward toe as available for long-term enhancement and conservation protection.

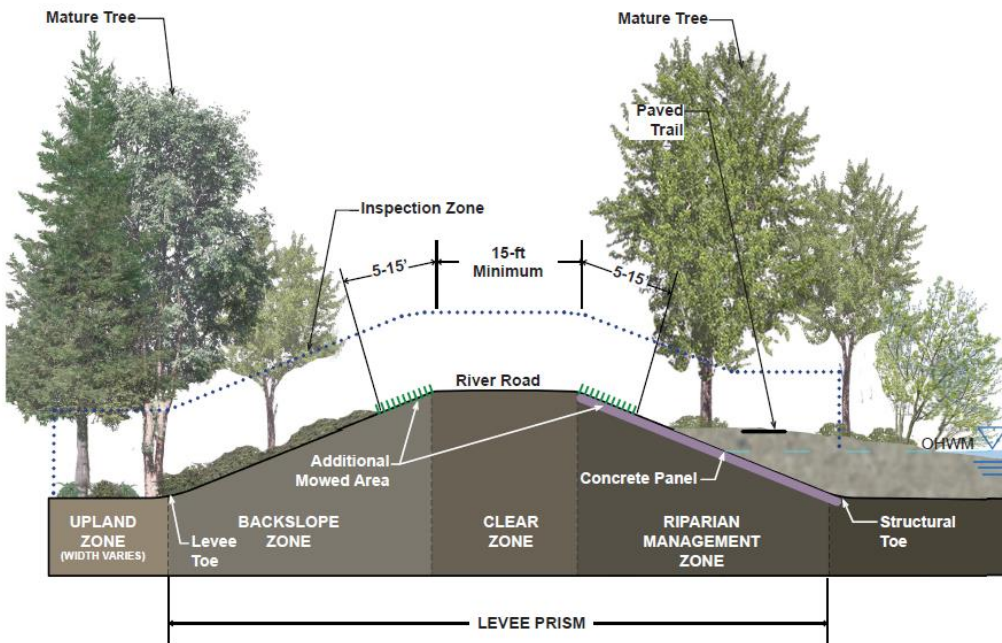


Levee Maintenance Schematic “D”- Concrete Panel Levee w/ Silt Bench and Trail

This levee x-section represents levees that were constructed along the lower - mid reaches of the Puyallup River constructed of local riverine gravel soil mix with a silt bench formed in front of the levee structure. In some locations, additional bank erosion controls have been provided along the silt bench, primarily around culvert/pipe discharge pipe outfalls. The silt bench provides a medium where riverine vegetation grows; including large deciduous trees. A levee trail and maintenance access road has been established on portions of the levee silt bench.

The maintenance approach for Type “D” levee sections preserves native trees and shrubs on the silt bench zone of the levee adjacent to the river, while allowing for visual inspection of the levee prism above the silt bench. The silt benches are typically found in the lower -mid reaches of the Puyallup River System and have built up over time due to long term sediment accretion along the river bank. The silt bench is an area where native trees and shrubs have become established on silt deposits along the riverward slope of the levee. Large, “Mature Trees” are typically found growing upon the well-established silt bench. The vegetated silt bench along the levee may provide for further protection of the levee prism during high flow events. Woody riparian vegetation on the silt bench (below the levee prism) will be preserved as feasible in order to provide moderate riparian functions including bank stability, roughness, cover, shade, wood and nutrient contribution, water quality filtering and moderation of water temperature. Vegetation upon the silt bench will be managed for maintenance access and pedestrian safety purposes. Vegetation on the levee structure above the silt bench will be managed to provide for vehicular access and visual inspection of the levee prism. Mature trees situated upon the levee silt bench area and upon the levee prism, that are not identified as a hazard tree of high risk, nor interferes directly with vehicular access requirements, will be preserved to the greatest extent feasible.

A “Clear Zone” is provided across the crest of the levee down to the lower silt bench access road, to remain clear of woody vegetation for purposes of vehicular access for maintenance work and in times of emergency. The clear zone will extend 5-15ft downslope across the Riparian and Backslope Zone as necessary to control growth of invasive plants and branches through routine mowing and limbing of tree branches that may crowd the clear zone. The backslope will be managed to provide visibility for inspection of possible seepage and structural integrity issues. An “Upland Zone” is provided beyond the landward toe as available for long-term enhancement and conservation protection.



Levee Maintenance Schematic “E” – Setback Levee with Floodplain Bench

This levee x-section depicts levees (known as setback levees) that are 50 feet or more back from the active river channel, with a floodplain “bench” at the riverward toe of the levee that is at least 50 feet wide. If the floodplain bench (vegetated bar) is less than 50 feet wide, Levee Maintenance Schematic “A” or “B” applies. Typically, these floodplain benches are associated with constructed “setback levees”, and reflect the furthest extent that levees can be constructed under current land use constraints. Upon these vegetated bars (floodplain bench), all woody vegetation, trees and native shrubs are preserved and provide riparian functions including bank stability, roughness, cover, shade, wood recruitment, nutrient contribution, water quality filtering and moderation of water temperature. The levee prism will be maintained in grass for routine maintenance and inspection purposes.

This approach recognizes that levees located 50 feet or more from the active channel provide for a greater level of riparian function compared to the other schematics, and can therefore be maintained in grass with less ecological impact. However, over time the river may migrate towards the levee and be less than 50 feet away, and vegetation maintenance may need to change accordingly. If the river migrates to within 50 feet of the levee toe, the maintenance practices switch to Section “A” or “B” methods. If the river migrates further than 50 feet away from the Type “A” or Type “B” levee embankment, maintenance practices switch to those for Type “E”.

The levee is maintained for ease of levee maintenance and for inspection purposes. A “Clear Zone” is provided across the crest of the levee to remain clear of woody vegetation for vehicle access for purposes of maintenance work and in times of emergency. The Clear Zone will extend to the toe of the slope or as necessary down the slope to control growth of invasive plants and branches through routine mowing and limbing of tree branches that may crowd the clear zone and for maintenance efficiency. The backslope will be managed to provide visibility for inspection of possible seepage and structural integrity issues. An “Upland Zone” is provided beyond the landward toe as available for long-term enhancement and conservation protection.

