



CITY OF KENT
BRISCOE/DESIMONE LEVEE REPAIR
King County Flood Control District
Advisory Committee Meeting

June 29, 2012

Lower Green River City of Kent Area Levees

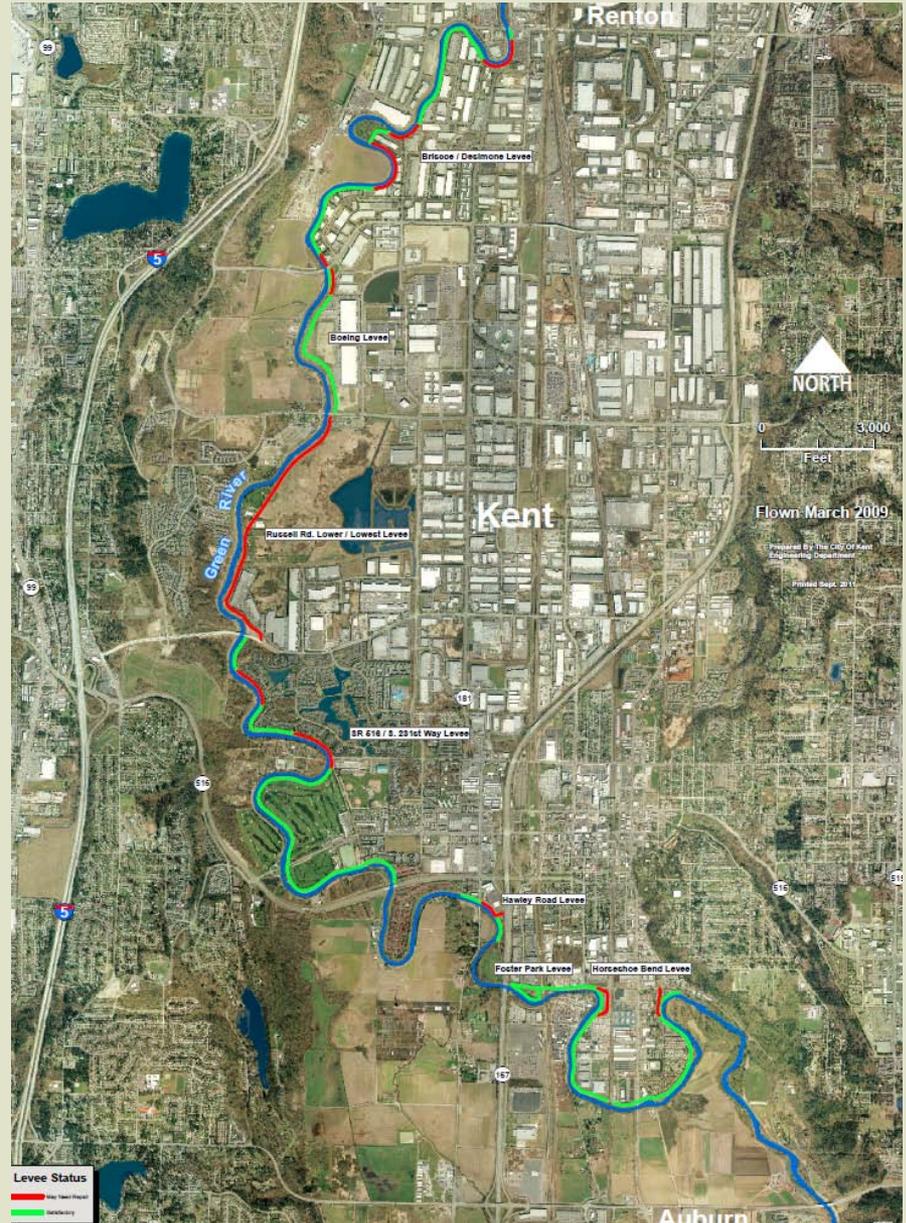
Levee Status



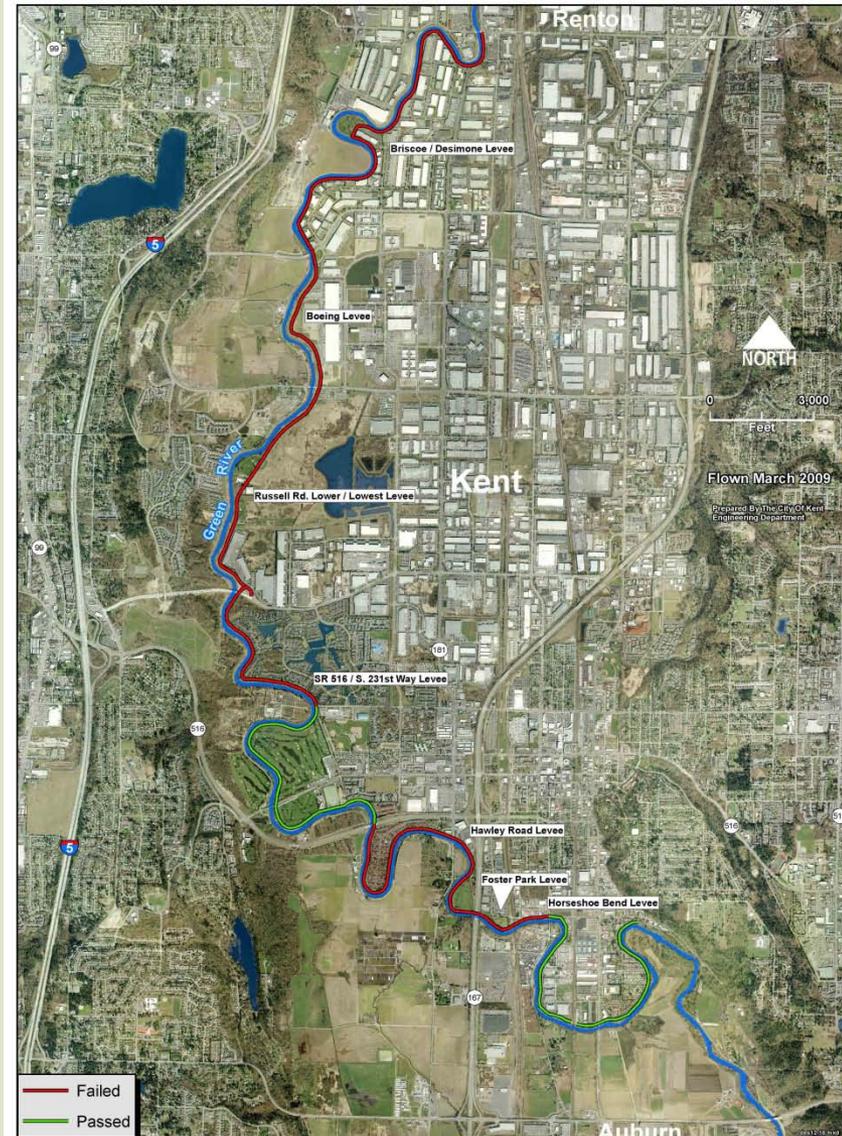
Needs Repair



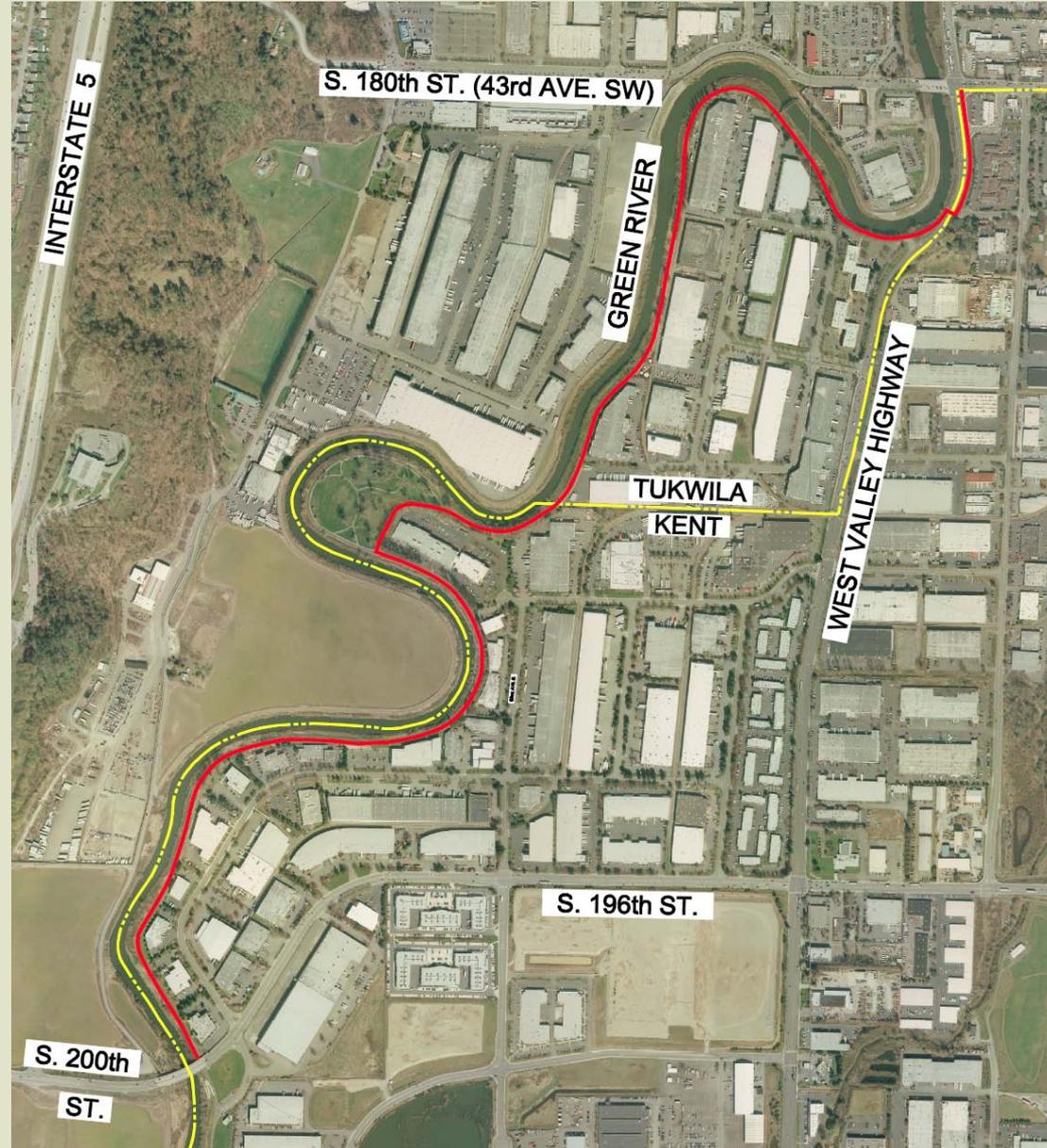
Satisfactory



City Levee segments that passed or failed Corps of Engineers inspections



Briscoe/Desimone Levee





Alberto Pujol, P.E., G.E.

Senior Principal Engineer, Vice President

- ▶ 32 years of experience.
- ▶ Responsible for numerous levee and dam design and evaluation projects
- ▶ Feather River setback levee, which received the "2010 Outstanding Flood Management" award from the American Society of Civil Engineers, Region 9.



Lee Wooten, P.E.

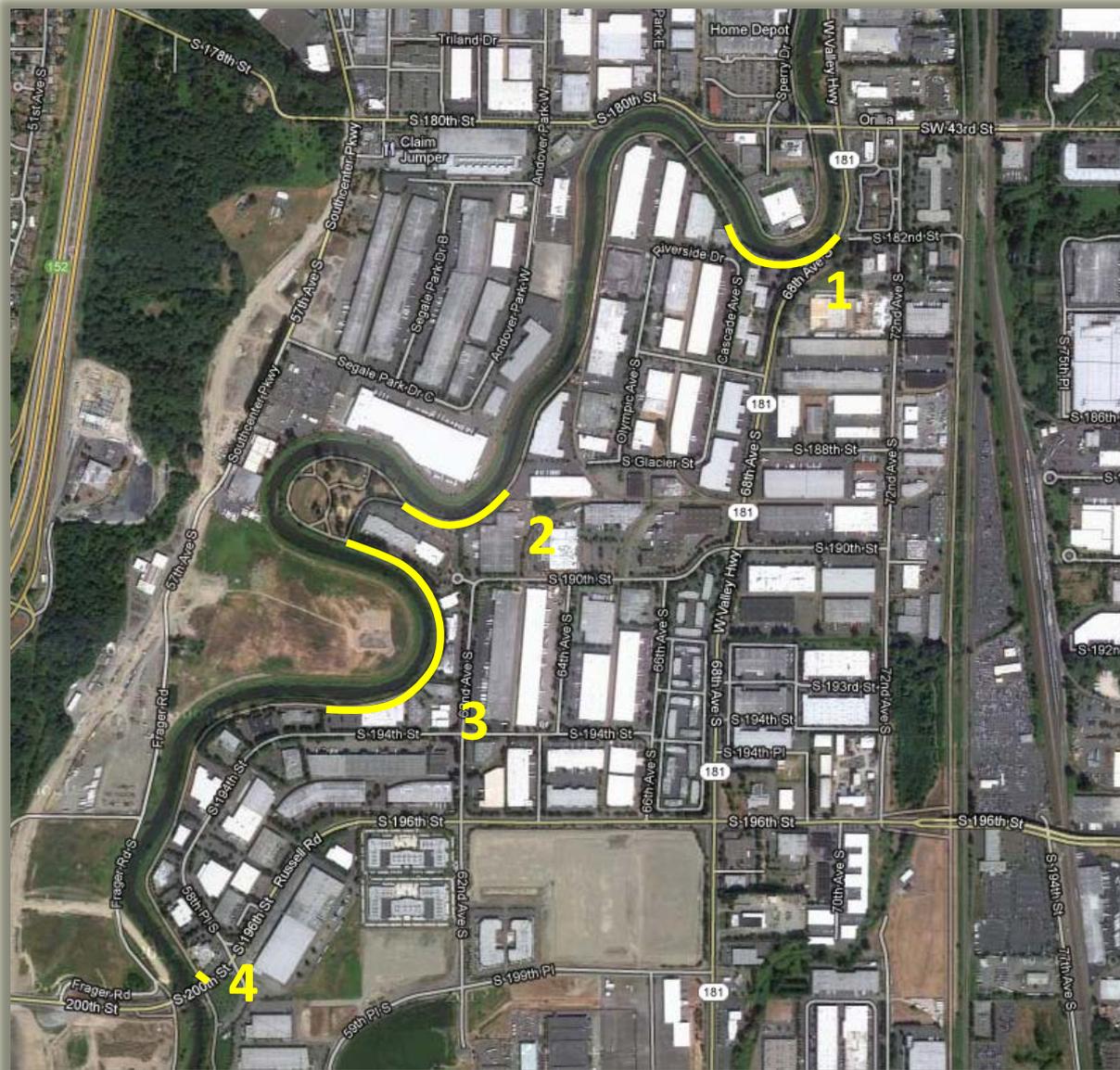
Principal, Vice President

- ▶ 32 years of experience
- ▶ Specializing in levee and dam evaluation
- ▶ Served on the ASCE New Orleans Levee Assessment Team
 - ▶ Hurricane Katrina
 - ▶ Hurricane Gustav
- ▶ Principal author "Reconnaissance of the New Orleans Hurricane and Storm Damage Risk Reduction System after Hurricane Gustav"

- National Firm
 - ▶ Founded in 1970
 - ▶ 450 person firm with 26 offices
- Levees, dams, and flood control are almost half our business
 - ▶ ENR Top 10 Dam Design Firm
- Recent Levee Projects:
 - ▶ Feather River Setback Levee, Yuba County, CA,
 - ▶ New London Hurricane Barrier, New London, CT,
 - ▶ Alameda County, CA,
 - ▶ City of Dubuque, IA,
 - ▶ City of Hartford, CT,
 - ▶ Town of East Hartford, CT,
 - ▶ City of Springfield, MA,
 - ▶ Town of West Springfield, MA,
 - ▶ City of Stamford, CT,
 - ▶ Bear River Setback Levee, Yuba County, CA
 - ▶ Urban Levee Evaluation, Central Valley, CA

- Engaged to perform independent evaluation
- Concluded 4 reaches do not meet Federal safety standards
 - ▶ 3 for riverside stability
 - ▶ 1 for freeboard
- Concluded that remainder of system substantially meets Federal safety standards (44CFR65.10)

Deficient Reaches - Location



City of Kent, Washington Briscoe-Desimone Levee System

Repair Reach 1:
(1140 feet)

Repair Reach 2:
(600 feet)

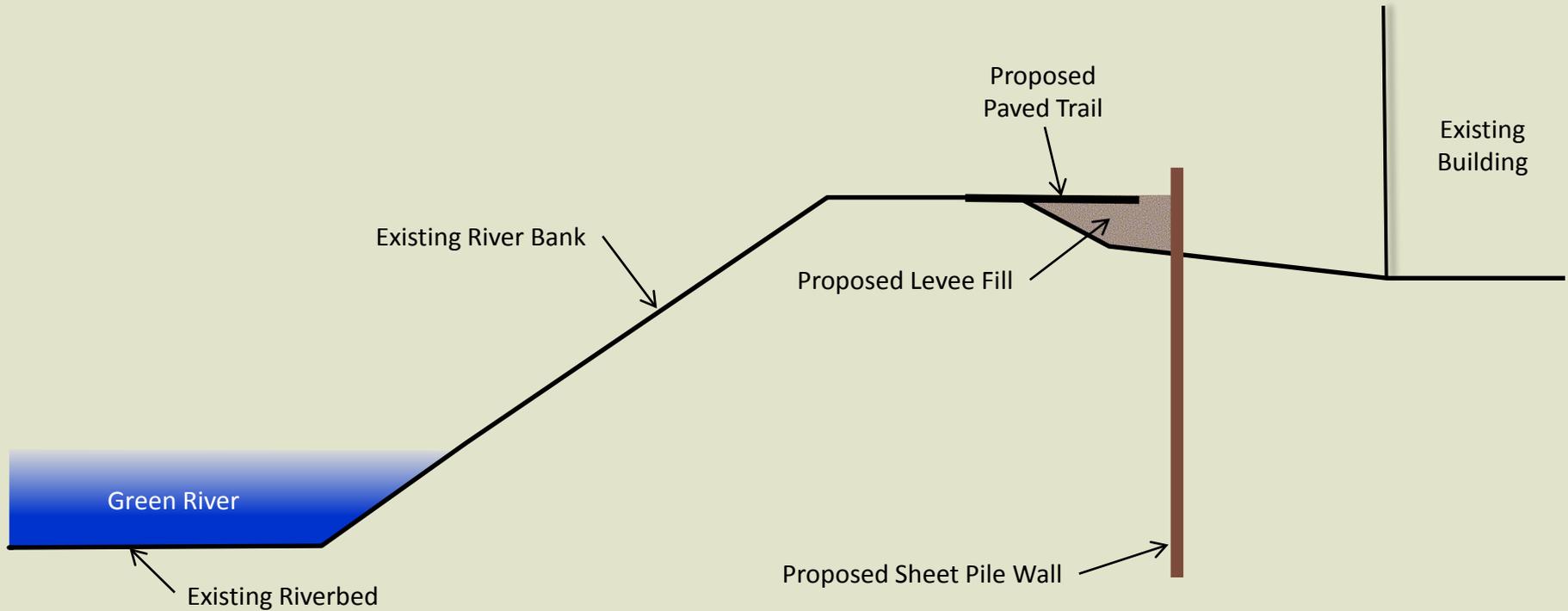
Repair Reach 3:
(2120 feet)

Repair Reach 4:
(200 feet)

- Evaluated repair alternative concepts including:
 - ▶ Bench slope and setback levee
 - ▶ Secondary levee
 - ▶ Various floodwall configurations

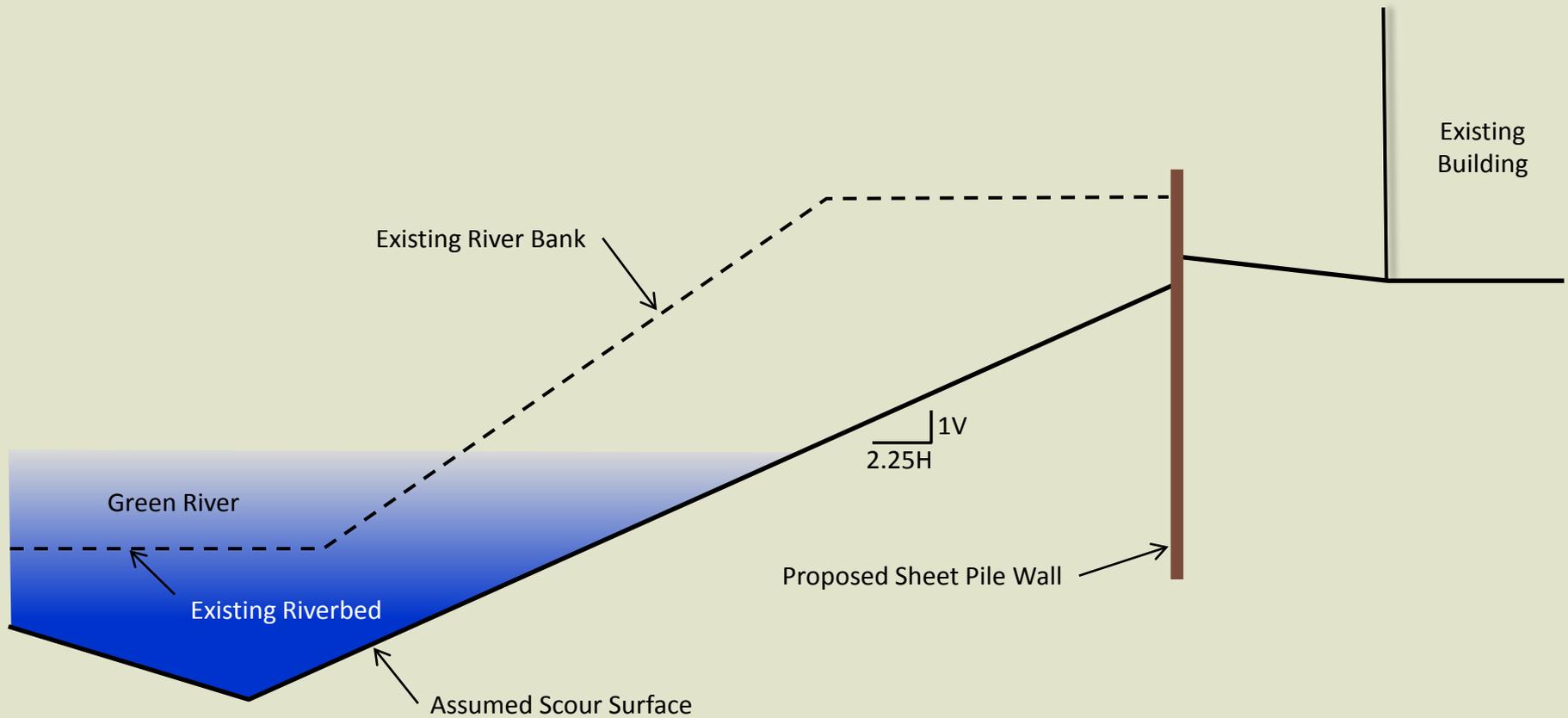
Current Design – Cross Section

Sheet Pile Wall Repair Schematic



Current Design – Cross Section

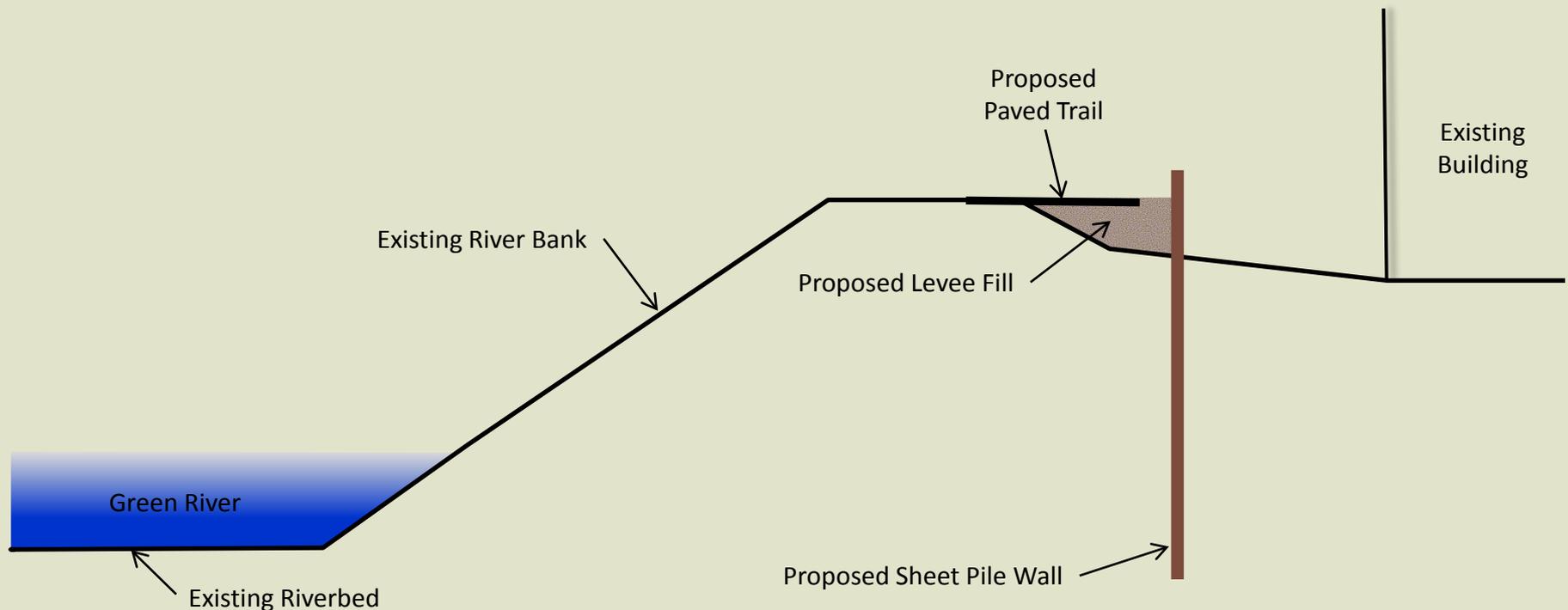
Sheet Pile Wall Design Schematic



- **Fixes four vulnerable weak links**
- Meets Federal Design Criteria for Levee Safety
 - ▶ Provides Certification to FEMA 100-year Standard
 - ▶ Provides Risk Reduction for 18,000+ jobs in Protected Area
- Quick Implementation
 - ▶ Financially feasible
 - ▶ Limited ROW Acquisition
 - ▶ Permitting feasible
 - ▶ Time is of the essence
- Minimal impact to existing businesses and buildings
- Allows planting of the river bank without limitation on vegetation (trees could remain or be added)

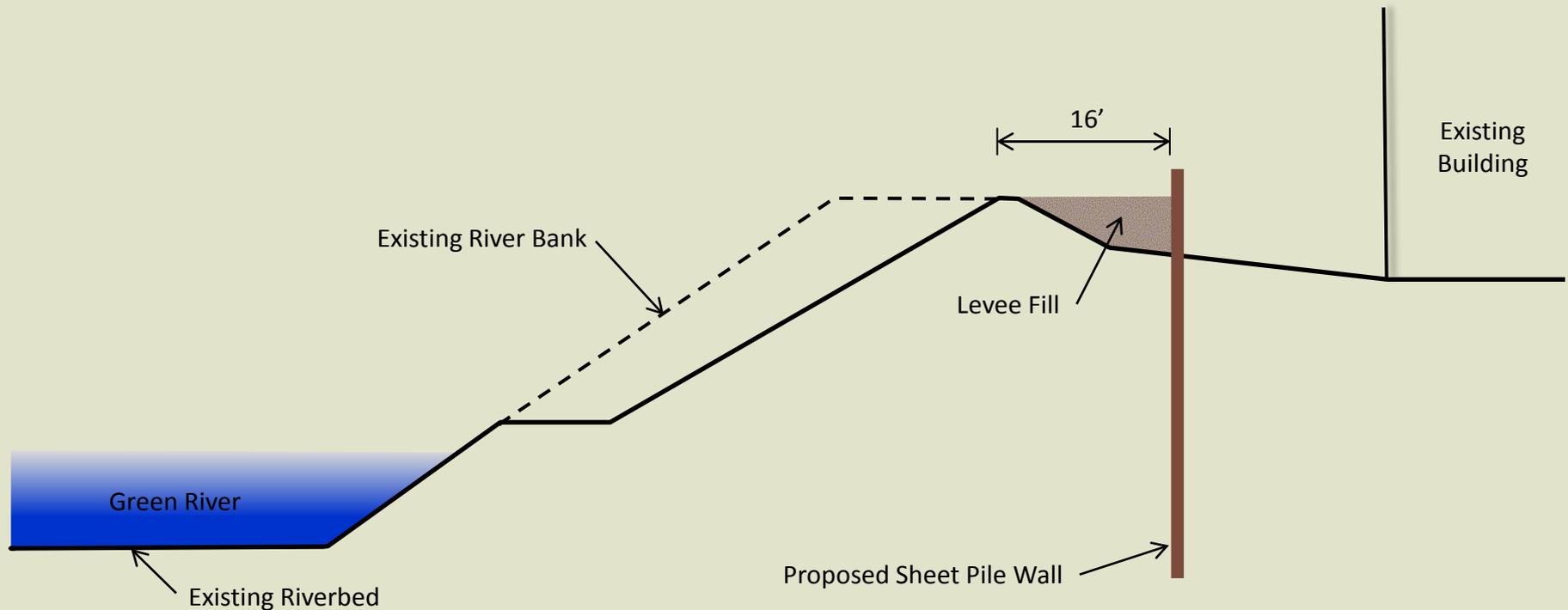
Setback Floodwall Benefits

- Provide redundancy to riverbank erosion
 - ▶ Act as backup system
 - ▶ Allow normal maintenance during summer season



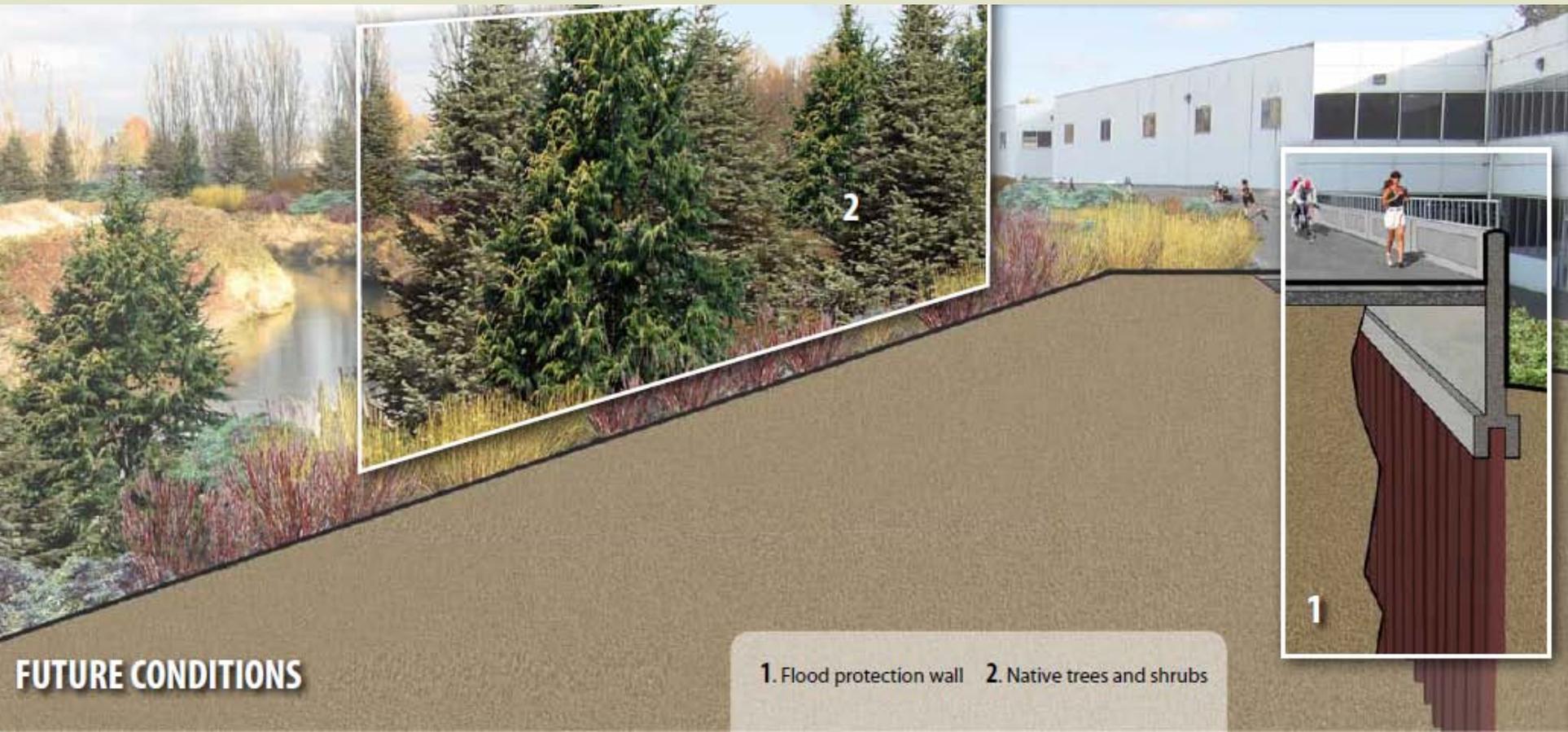
Setback Floodwall Benefits

- Allows flattening of the slope in future



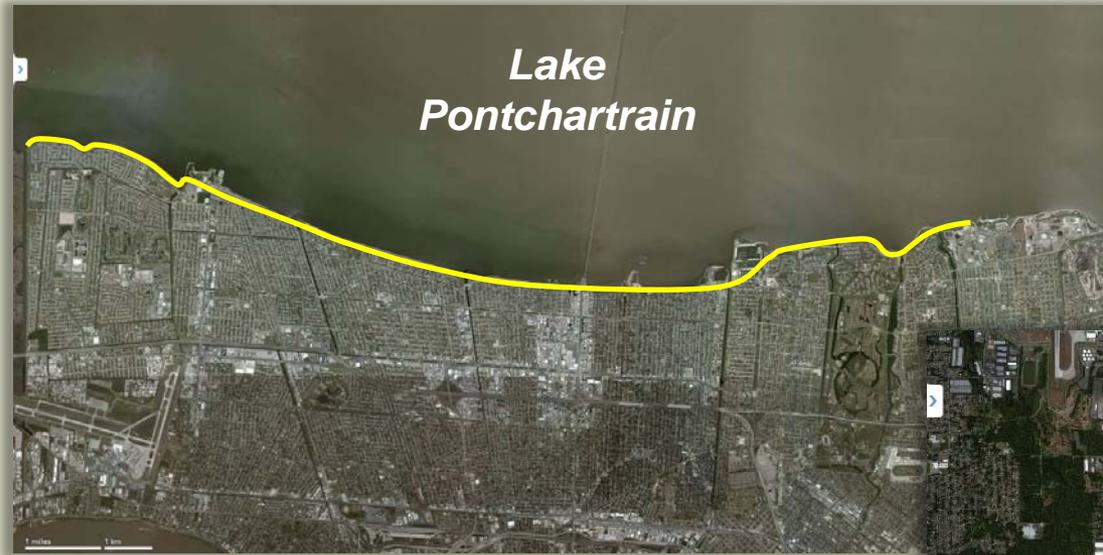
Setback Floodwall Benefits

- Minimize impacts on existing habitat
- Opportunity for increased habitat
- Vegetation will provide increased slope stability



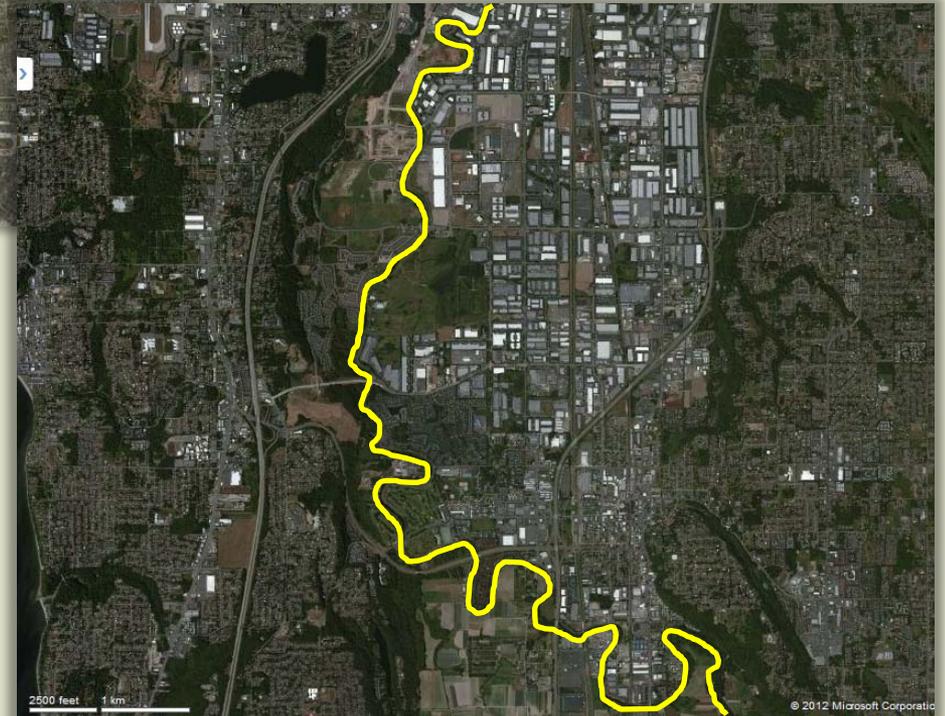
- Setback floodwall will result in **lower long-term maintenance costs.**
- Earth Embankments
 - ▶ Vegetation Control
 - ▶ Animal Control
- Vegetation control would not be required on **the riverbank slope**

New Orleans vs. Green River



New Orleans, Louisiana

Kent, Washington



- **System Type**
 - ▶ New Orleans – coastal hurricane protection system.
 - ▶ Green River – riverine flood protection system.
- **Size and Operation**
 - ▶ New Orleans – Very complex system with more than 350 miles of levee which were controlled and operated by multiple entities.
 - ▶ Green River – Comparatively small (22 river miles), simple system.

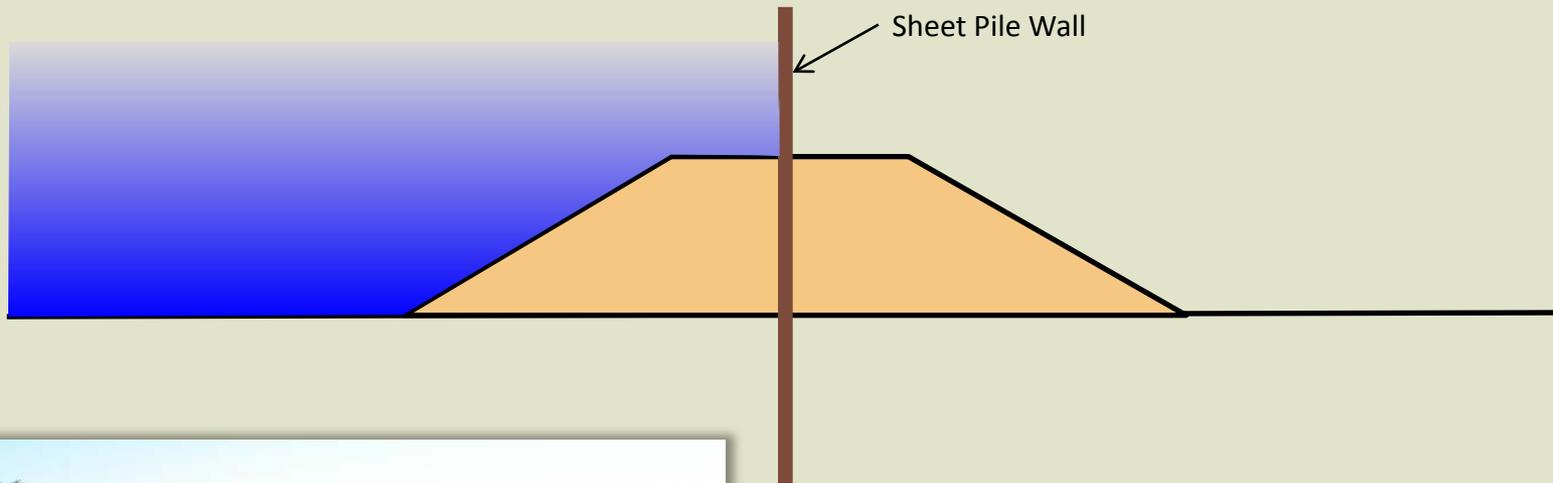
- Design Considerations
 - ▶ New Orleans Hurricane Risk Reduction System
 - Large storm surge
 - Dynamic forces from large hurricane wind-generated waves
 - ▶ Green River system
 - High water levels due to river flooding with negligible wind-generated waves
 - River flooding that is regulated and tempered by Howard Hanson Dam

New Orleans vs. Green River



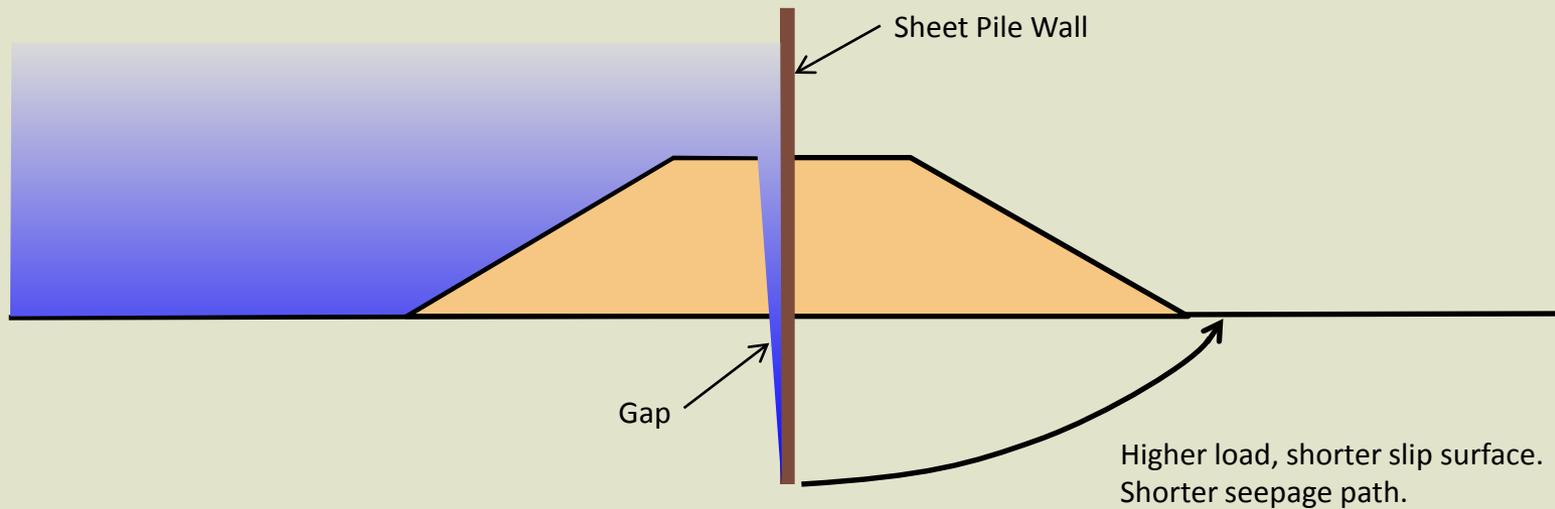
- Prior to Hurricane Katrina most of New Orleans 56 miles of floodwalls were I-walls.
- Most of the floodwall and levee embankment failures in New Orleans resulted from overtopping erosion.
- Special attention was given to I-walls because four I-wall sections failed prior to being overtopped.

Typical New Orleans I-Wall Section



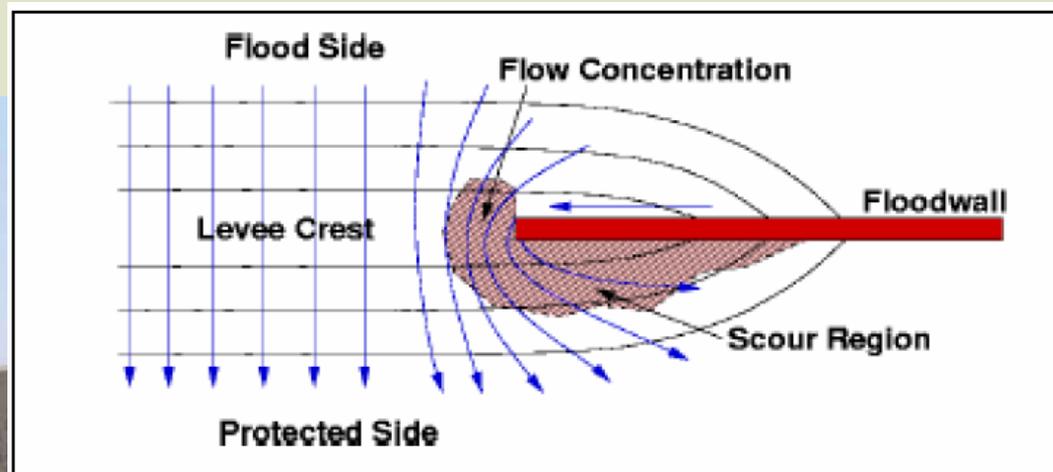
- Gap between I-wall and Foundation Soils
 - ▶ US Army Corps of Engineers (USACE) Interagency Performance Evaluation Taskforce (IPET) concluded I-wall foundation failures occurred because a gap formed between the waterside of the I-wall and the foundation soil.
 - ▶ Gap allowed water forces and seepage in excess of design.

What is "Water in Gap"

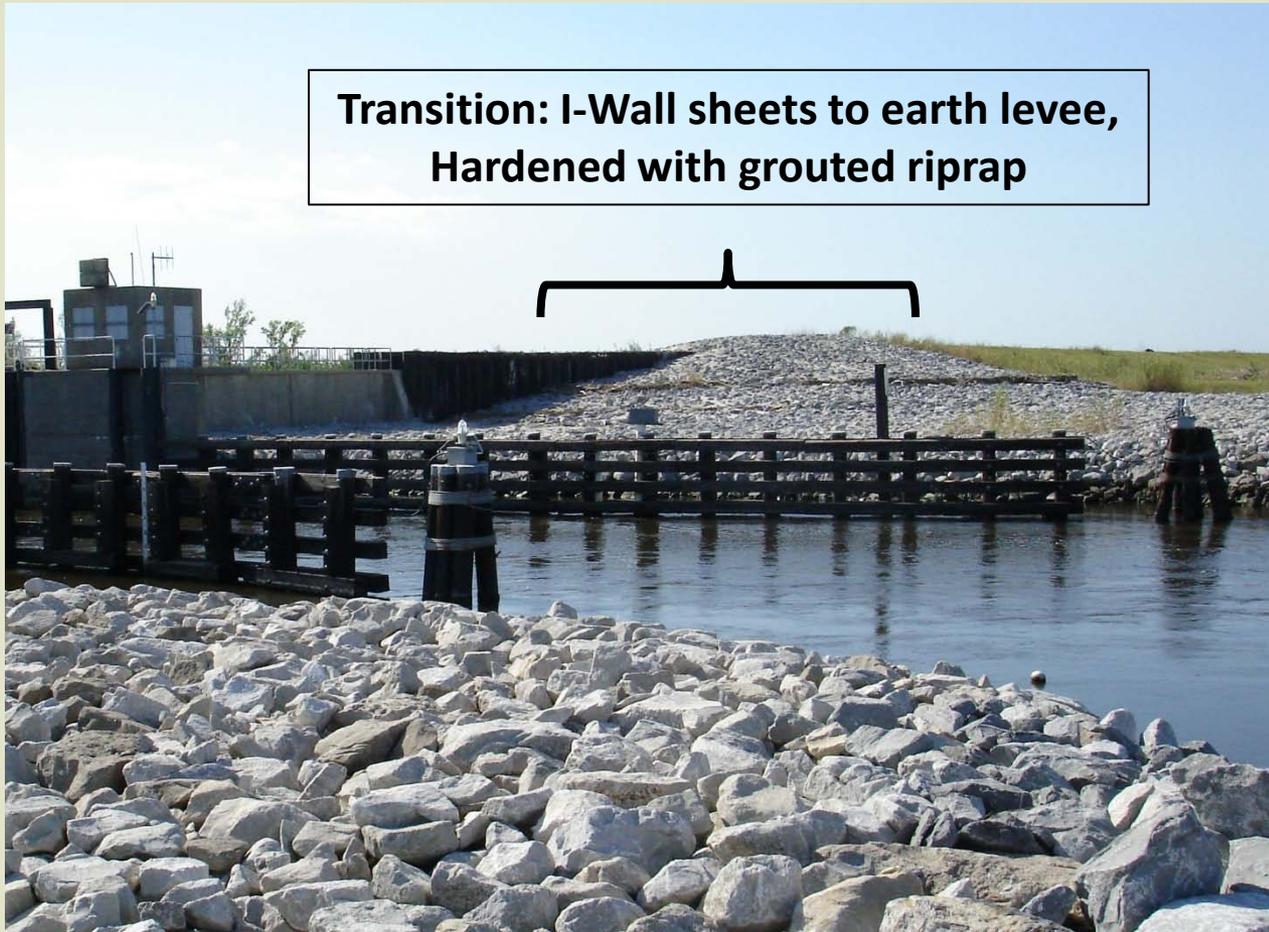


Hurricane Katrina Lessons Learned

- Erosion at transitions between floodwalls and earth embankments
 - ▶ IPET identified areas where earth embankment erosion occurred adjacent to the floodwall sections at transition points.
 - ▶ Erosion occurred from concentrated flow around the floodwall structures **after** the levee embankment was overtopped.



Lesson learned – provide for hardening at transitions Example of hardened transition at Bayou Dupree Gate (New Orleans)



Transitions

Transitions from Dubuque, IA



- Transitions between floodwalls and earth embankments (continued)
 - ▶ Transitions are unavoidable
 - ▶ New USACE guidance requires erosion protection at floodwall/ embankment transitions.
 - ▶ Erosion protection can be hidden from view to maintain levee aesthetics.

- King County engaged Dr. Joseph Wartman to review the 30% I-wall floodwall system prepared by GeoEngineers and the City of Kent and to compare it to a setback levee option. Dr. Wartman preferred setback levee option based on criteria provided by the County which did not include total cost.
- Agrees the I-Walls are technically feasible
 - ▶ Do perform well in locations across US
 - ▶ Would provide subsurface cutoff and reduce seepage problems
- Raised Concerns about Floodwall Design
 - ▶ Patchwork system
 - ▶ Transitions
 - ▶ Continued erosion of river banks resulting in greater O&M costs
- Only 30% Design was reviewed. Current design includes deeper sheeting (33 to 62 feet)

Reponses to Concerns

- Concern that the Floodwall remediation results in a patchwork system
- Responses:
 - ▶ All levee systems in our experience include different components (gates, levees, floodwalls) in order to accommodate community facilities. These different components do not constitute a weakness but rather adaptations to the setting and function.
 - ▶ Systems fail because of their weak links
 - ▶ The Floodwall remediation addresses the levee weak links so that the system can provide the protection required by Federal standards

Reponses to Concerns

- Concern about Transitions
- Responses:
 - ▶ All levee systems in our experience include transitions between different components (bridges, levees, floodwalls).
 - ▶ Transitions will be designed to prevent them from becoming a weak link or a location for scour

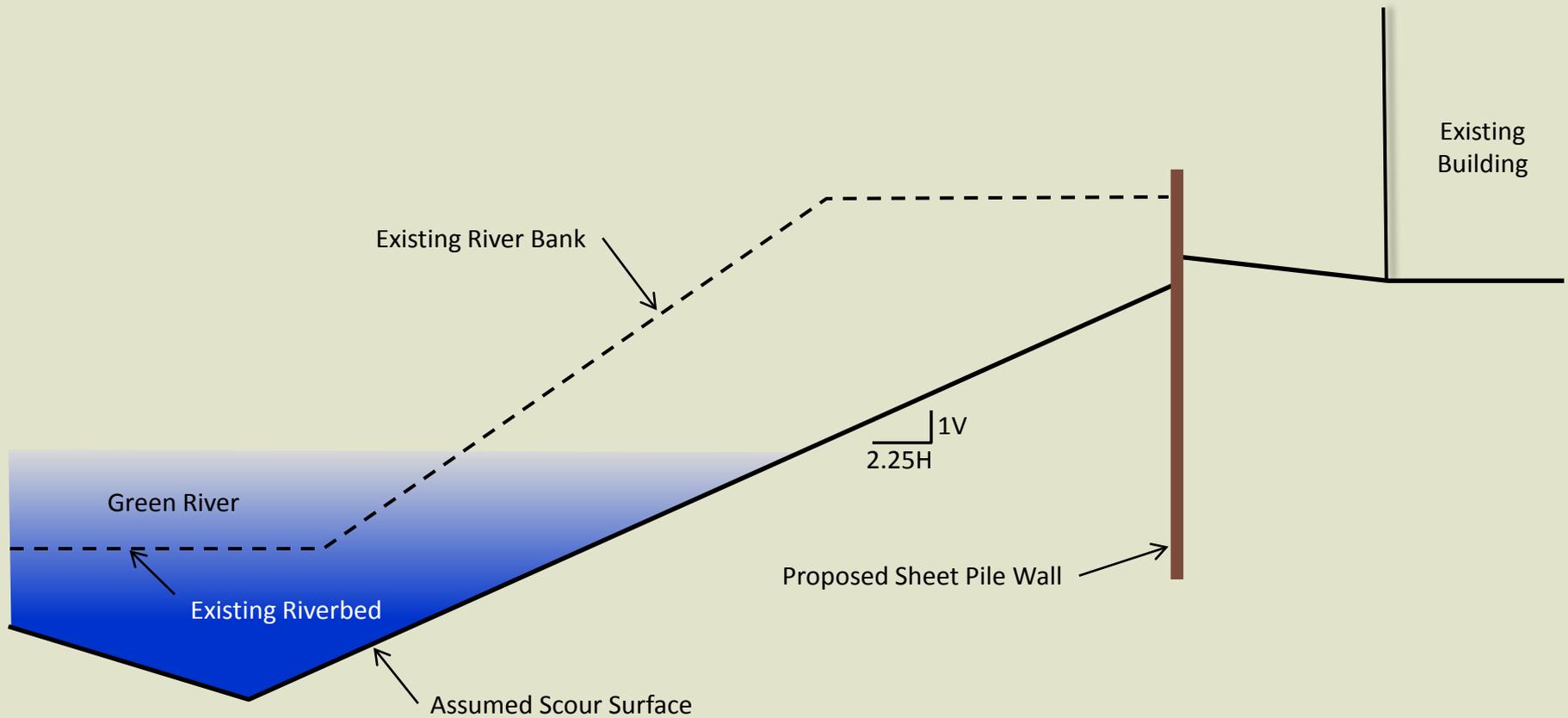


Reponses to Concerns

- Concern about Continued Erosion of River Banks and increased O&M costs
- Responses:
 - ▶ River banks will be planted to mitigate erosion
 - ▶ Root mass from vegetation holds surface together
 - ▶ The Floodwall Remediation is designed to accommodate loss of the river banks
 - ▶ River banks can be repaired if loss becomes significant

Current Design – Cross Section

Sheet Pile Wall Design Schematic



- Dr. Wartman indicated that the County's proposed **setback option** *“is the **more costly** [initial capital cost] of the two schemes and also potentially **disruptive** to existing business”* and the *“planned **timeframe** for the work is **longer than the floodwall** scheme and therefore leaves the community with **higher vulnerability** over the shortterm”*
- Dr. Wartman notes that **I-walls** *“are **not inherently unstable systems**. Indeed, **with proper engineering** and use of an adequate margin of safety against failure, these **can and do perform quite well** at locations across the United States.”*

Note: Bolding and text in brackets by GEI

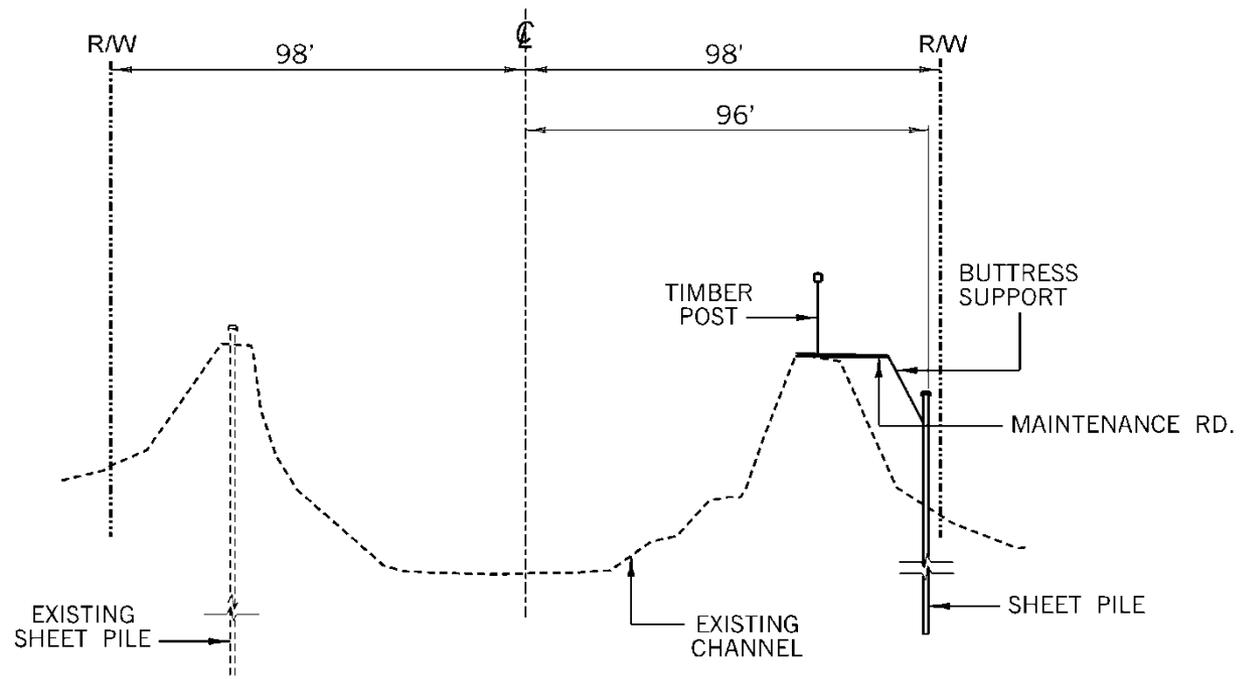
- The proposed floodwall design is:
 - ▶ Technically viable
 - ▶ Several times less expensive than a setback levee
 - ▶ Significantly quicker to implement
- We are committed to designing the levee system in accordance with new USACE guidance for I-wall design to provide a safe floodwall.

Recent Sheet Pile Floodwall Examples

- East Garden Grove-Wintersburg Channel, Orange County, CA



(Source: Orange County Flood Control District)

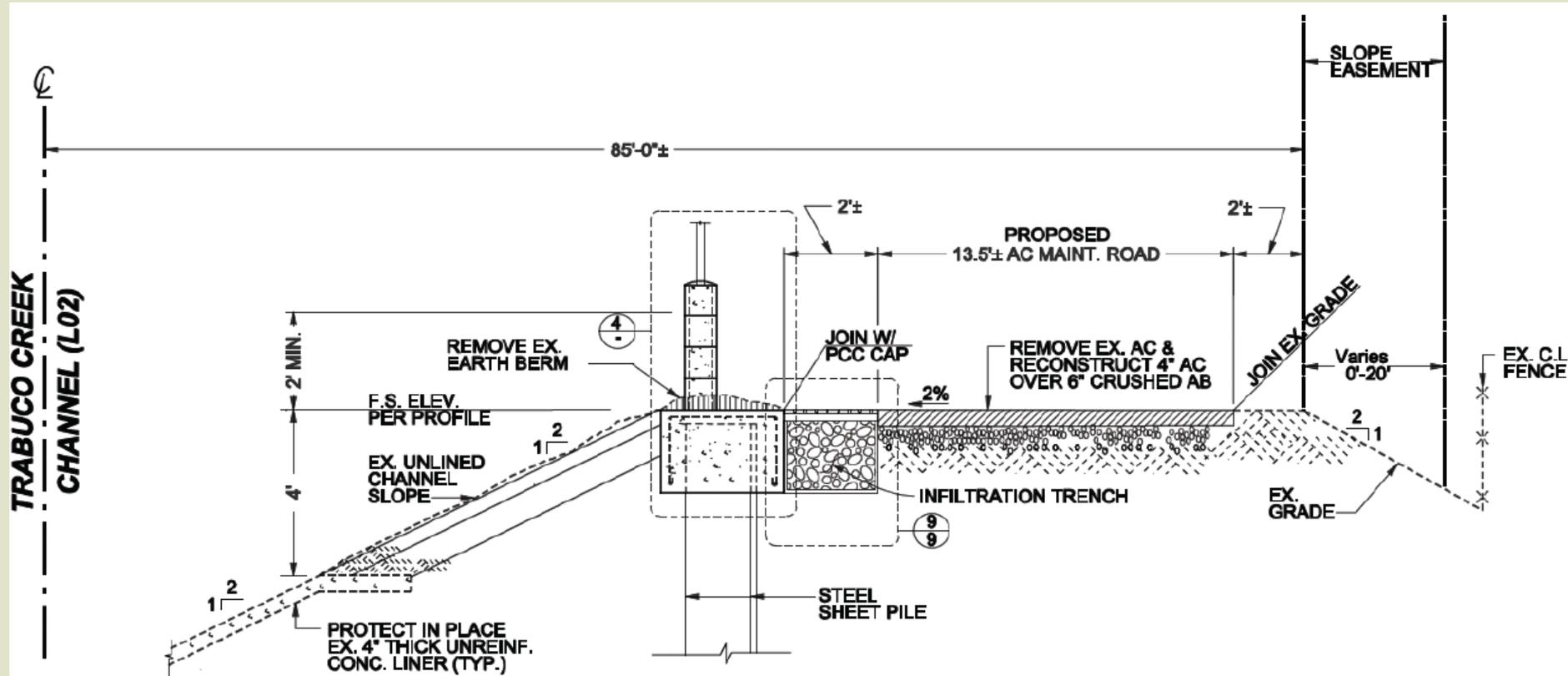


- Pinole Creek Sheet Pile Wall, City of Pinole, Contra Costa County, CA



Recent Sheet Pile Floodwall Examples

- Trabuco Creek Levee Protection Project , Orange County, CA



(Source: Orange County Flood Control District)

- Quaker Oats Flood Protection, Cedar Rapids, Iowa



(Source: HR Green, Inc)

Briscoe/Desimone Levee



Briscoe/Desimone Levee



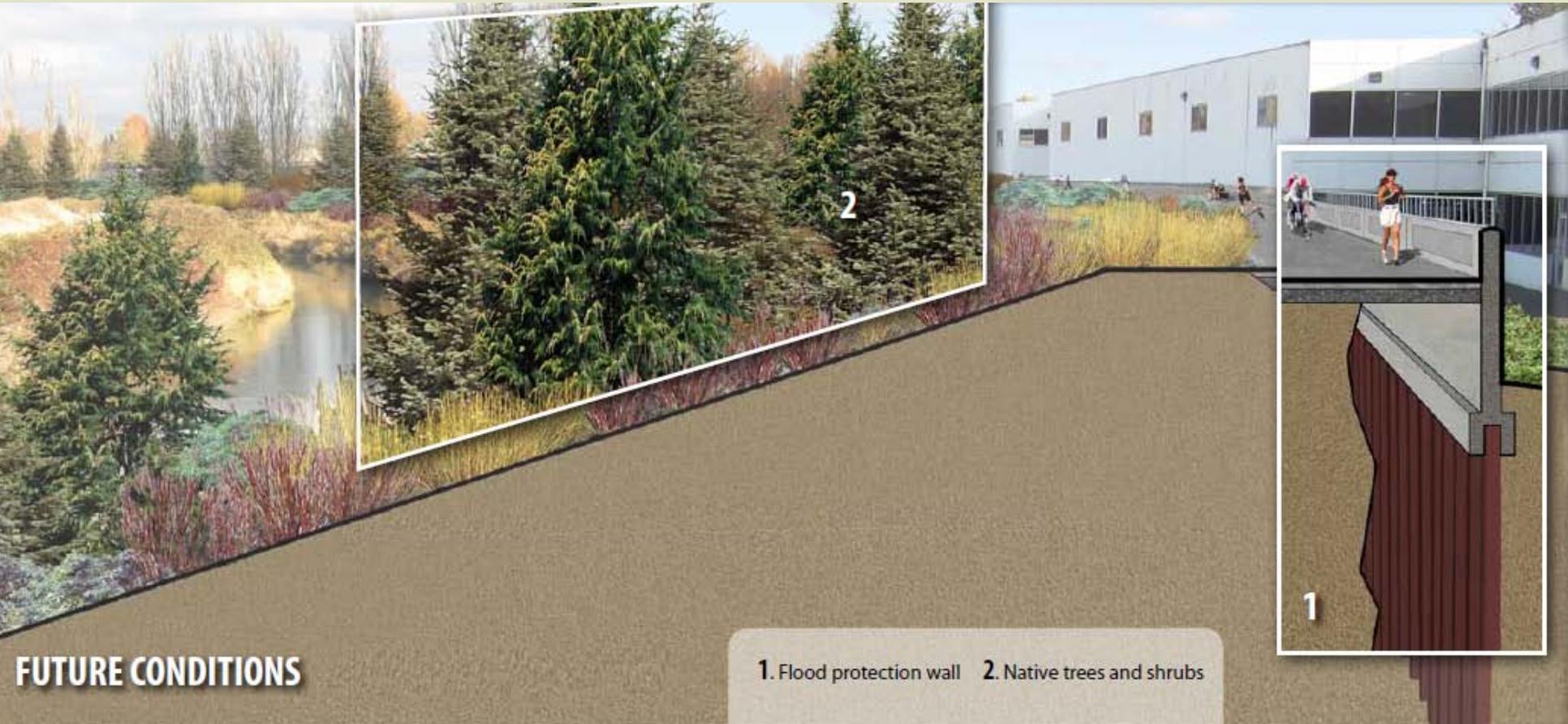
- \$17 million will repair four determined weak points to bring the entire levee system above federal standards.
- City Cost Estimate Basis:
 - ▶ Recent City of Kent Levee Repair Projects
 - ▶ East Hartford FEMA Accreditation Repair Project
 - ▶ Feather River Setback Levee Project

- \$7 million state jobs grant
 - ▶ Must be obligated by July 1, 2013
- \$14.5 million currently budgeted by Flood Control District through 2017
- Implementation Timing (could be constructed in one year with available funding)
 - ▶ Levee system is vulnerable until repairs are made
 - ▶ Longer time frame = increased risk

- Floodwall system in-line with King County Flood Hazard Management Plan
- Setback Levee system does not contemplate purchase or relocation of businesses
- Floodwall system similar to previously adopted template at Briscoe No. 4 but provides for superior stability from deeply embedded sheeting

- Floodwall system provides
 - ▶ Most cost effective system (several times less expensive than a setback levee)
 - ▶ Timely flood protection solution for the existing community
 - ▶ Exceeds Federal safety standards

Questions?



FUTURE CONDITIONS

- 1. Flood protection wall
- 2. Native trees and shrubs