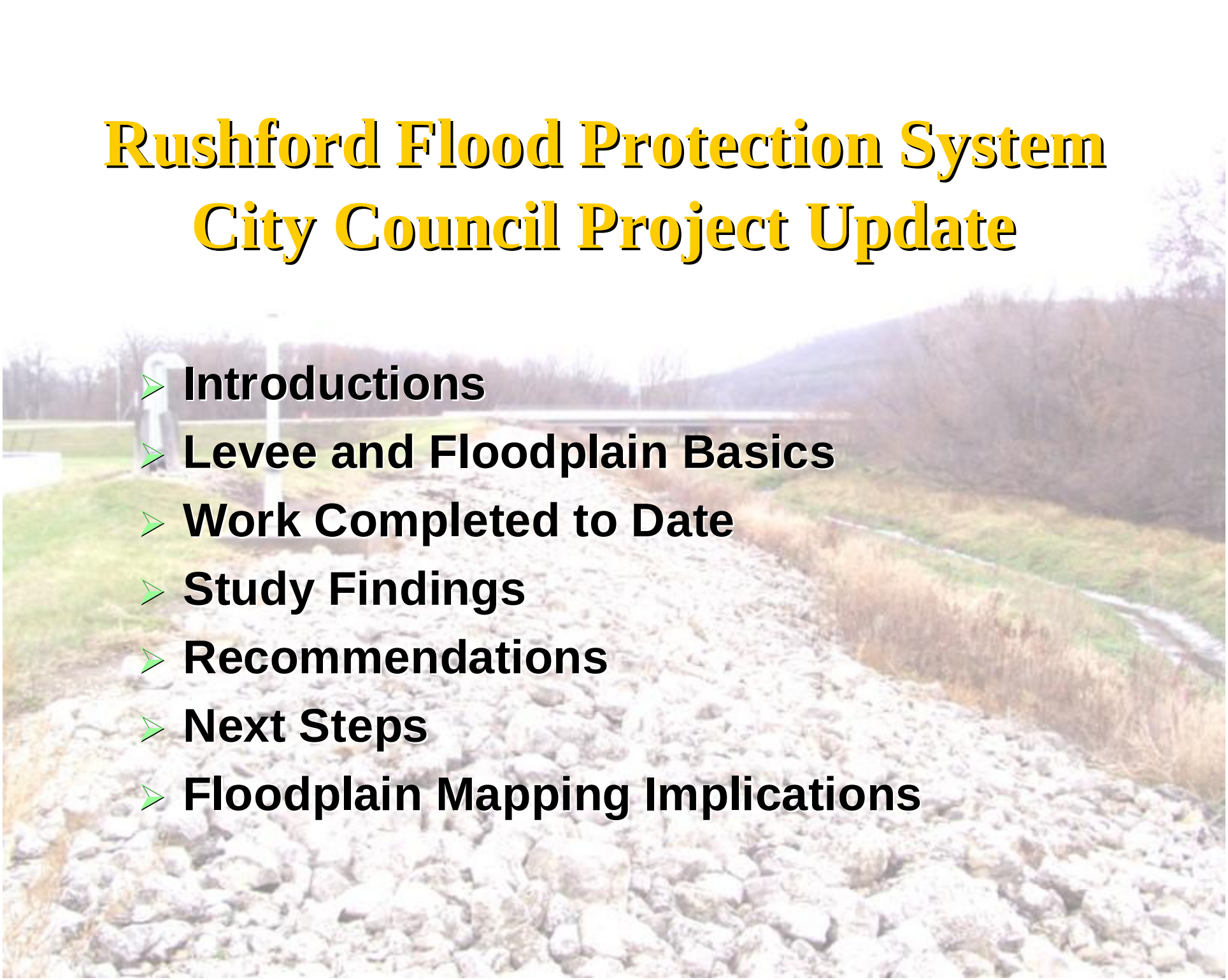
Rushford Flood Protection System
City Council Project Update



- Introductions
- Levee and Floodplain Basics
- Work Completed to Date
- Study Findings
- Recommendations
- Next Steps
- Floodplain Mapping Implications

Introductions

- URS Corporation
  - Art Kalmes, PE, Project Manager
  - Tom Johnson, PE, Sr. Water Resources Engineer
- American Engineering Testing (AET)
  - Jim Rudd, PE, Principal Engineer
  - Joe Bentler, PE, Geotechnical Engineer

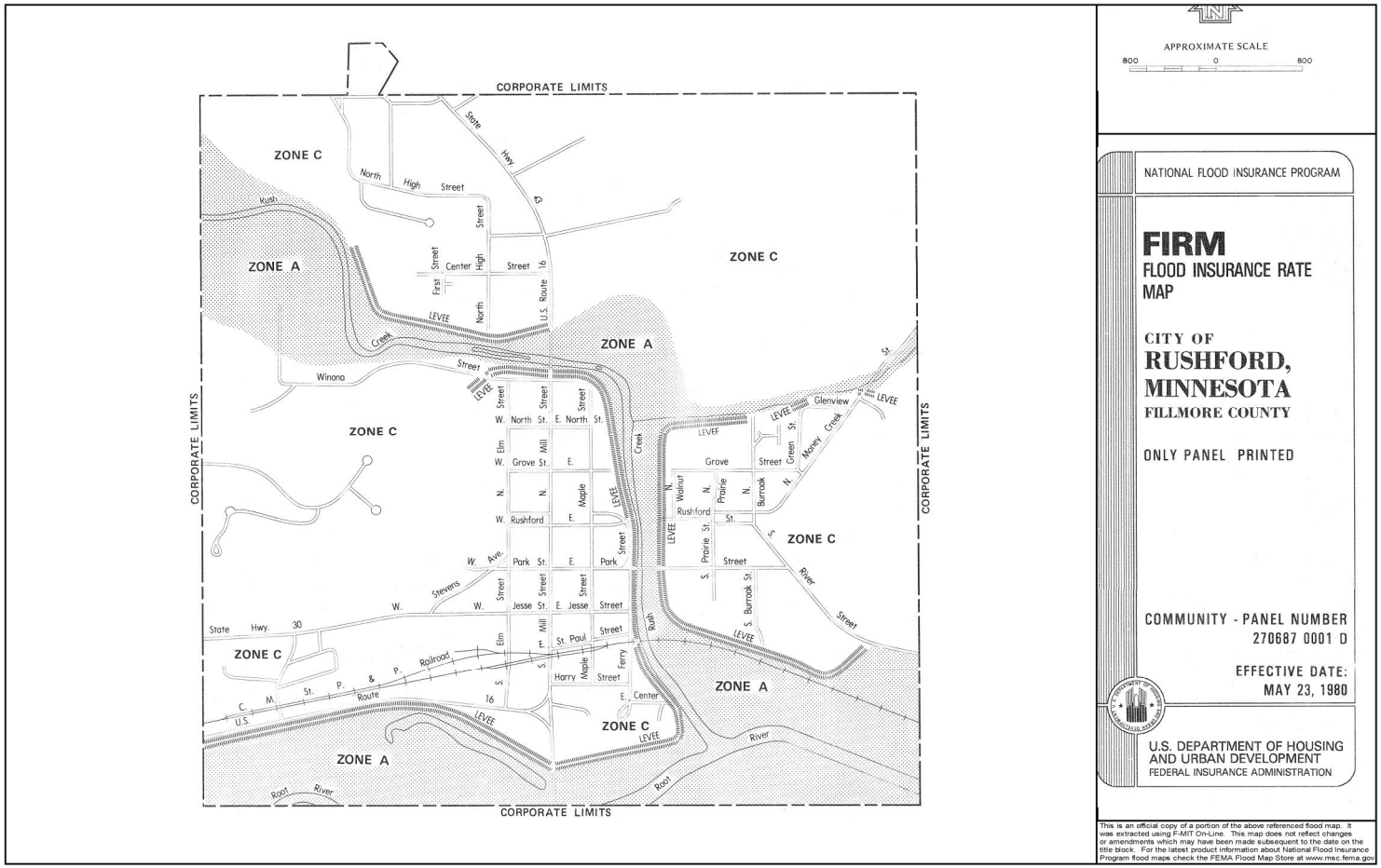
Levee and Floodplain Basics

Rushford Flood Protection System

- Three levee systems
- Drainage system w/ closures
- Two pump stations
- Interior flood storage
- Rush Creek channel

Levee and Floodplain Basics

- FEMA Floodplain Maps of Rushford



Levee and Floodplain Basics

- Rushford Flooding History
  - Many large floods during the early 1950's and early 1960's on both Rush Creek and the Root River
  - Flood Protection System completed by Corps of Engineers in 1967
  - No large flooding events during the 1970's and 1980's
  - Corp's estimates of flood damage prevention:
    - $ 840 k in 1993
    - $1,327 k in 2000
    - $1,695 k in 2004
    - $1,400 k in 2008

Levee and Floodplain Basics

- August 2007 Flood
  - This was an extreme event with the highest recorded rainfall in State.
  - Flow on Rush Creek (132 sq. miles) exceeded the highest ever recorded in 100 years on the Root River (1,250 sq. miles)
  - Levees several feet higher to contain this flood.
  - Flood caused erosion and levee overtopping which is currently being repaired through the Corps of Engineers ($ 678,000)

Levee and Floodplain Basics

- FEMA's Recent Focus on Levees
  - Hurricane Katrina levee failures and others
  - National Committee on Levee Safety is reviewing levee policy and making recommendations to congress
  - Most levees were constructed many decades ago - rehabilitation and upgrading are necessary on many levees
  - Map Modernization Program is updating floodplain maps throughout the U.S.
  - The Map Modernization Program reviews areas protected by levees when map is updated

Levees are Provisionally Accredited

- City received PAL letter on May 27, 2009
- Updated maps show area protected by levee as “This area is shown as being protected from the 1-percent-annual-chance or greater flood by a levee system that has been provisionally accredited. Overtopping or failure of any levee system is possible...”
- City has until August 25, 2011 to provide documentation to FEMA that it meets current flood protection standards

Levee and Floodplain Basics

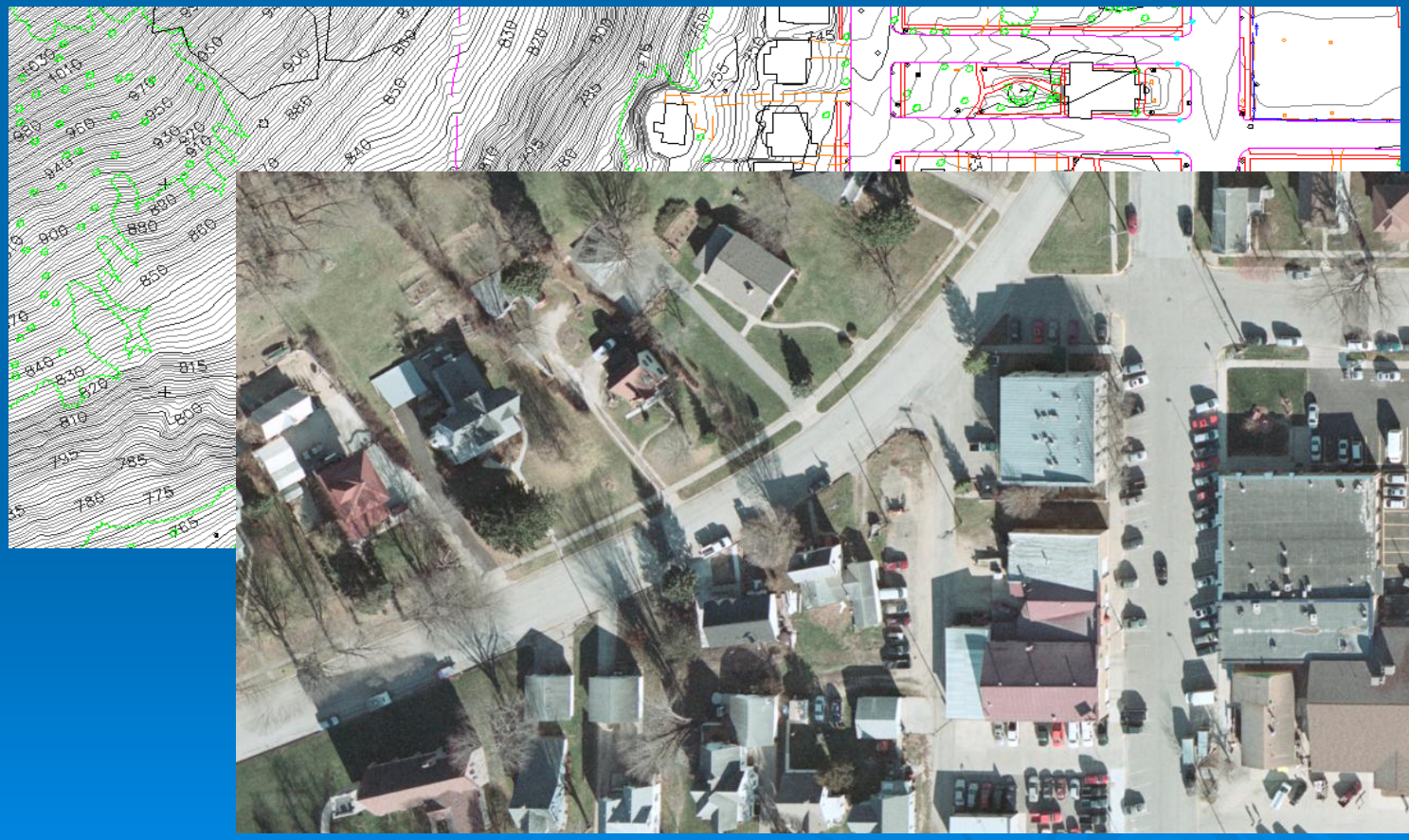
- FEMA's Current Levee Standards
  - Standard of protection is 1-percent-annual-chance (100-year) flood.
  - Freeboard Protection (3 feet, more at bridges)
  - Slope stability
  - Seepage and under seepage
  - Levee Settlement
  - Interior Drainage
  - Closure Operation and Maintenance
  - Operation and Maintenance Plan Update – Public authority has to oversee
  - Embankment Protection (e.g. riprap)

Work Completed to Date

- Rushford Received State Grant for review if its levee system.
- The consulting firms URS, AET, and BDM are working with the City and Corps of Engineers on the project.
- Project Goal: provide information to FEMA that will document that the project meets current FEMA standards.

Work Completed to Date

- New topographic map and aerial photo



Work Completed to Date

- Evaluation of freeboard protection (is the levee high enough)
- Interior Drainage (removing water from the inside of the levee)
- Operation and Maintenance Plan Update
- Corps of Engineers repair of damages

Work Completed to Date

- Soil Borings and Testing

AET Field Equipment

Study Findings - Geotechnical

Typical Soil Boring

ENGINEERING TESTING, INC.

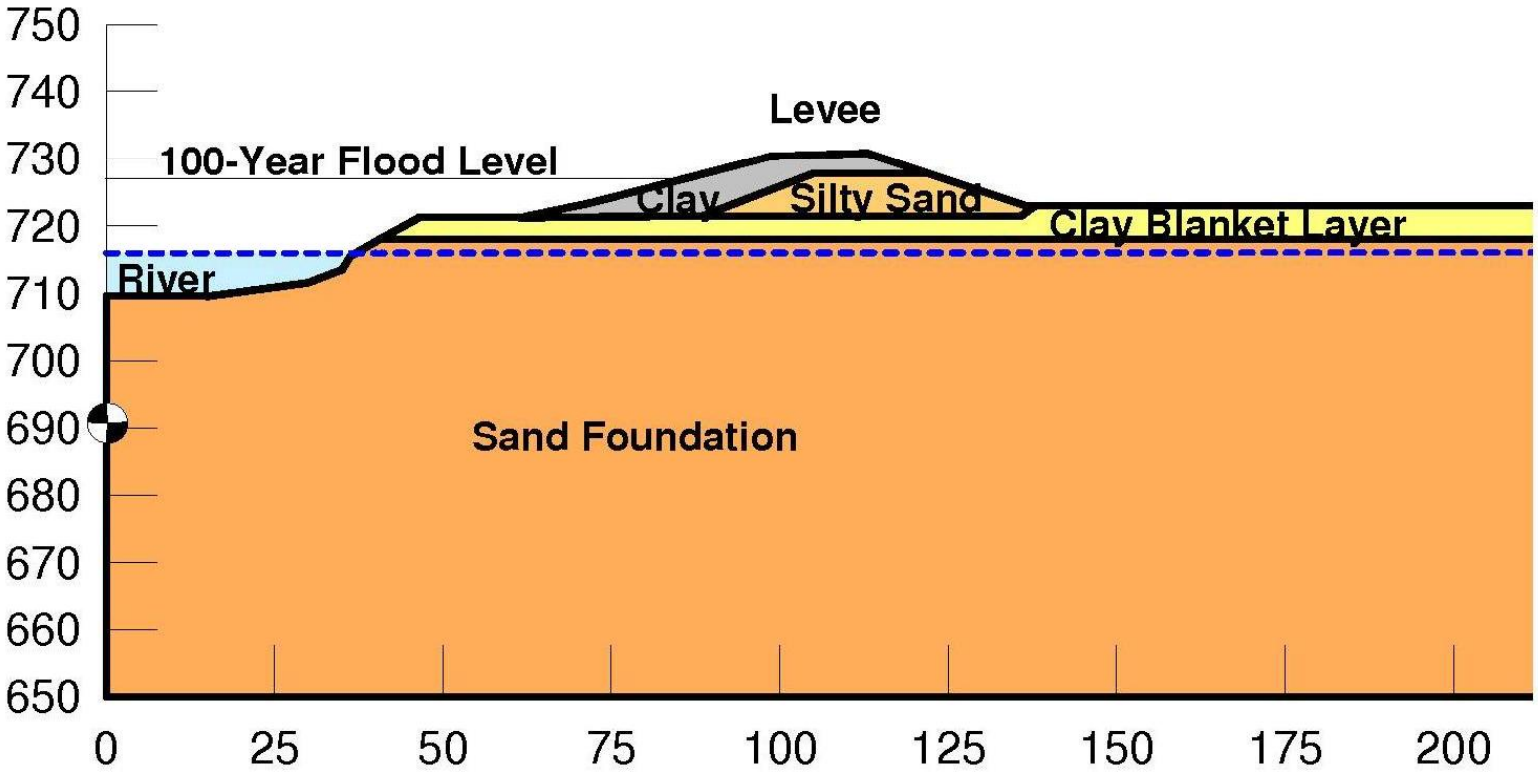
SUBSURFACE BORING LOG

AET JOB NO: **01-04319** LOG OF BORING NO. **B-22 (p. 1 of 1)**

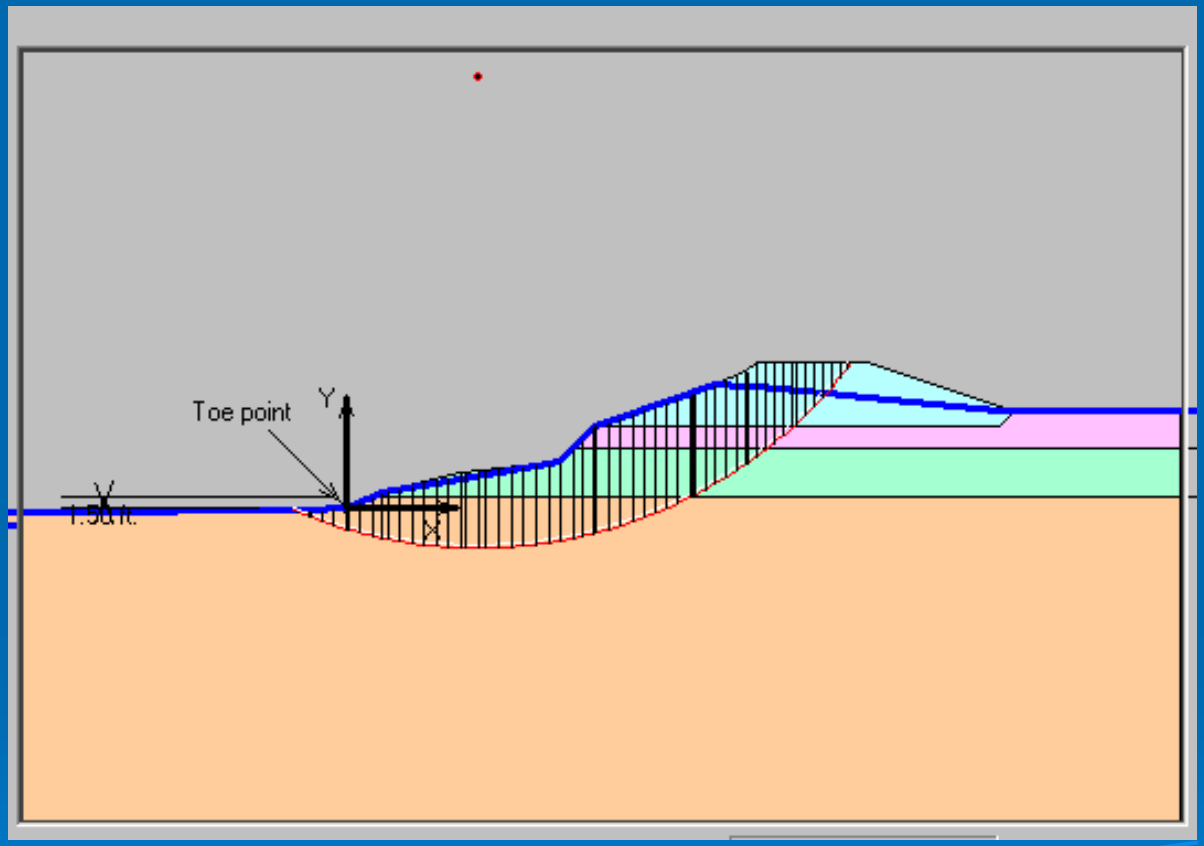
PROJECT: **Levees; Rushford, MN**

DEPTH IN FEET	SURFACE ELEVATION: / MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	%-#20
1	FILL, mixture of lean clay with sand and sandy silt, trace roots, dark brown	FILL	15	M	SS	6	18				
3	FILL, mostly lean clay, trace roots, brown and dark brown		11	M	SS	12	17 19				
5	FILL, mixture of clayey sand and sandy silt, dark brown		20	M	SS	12	13	118.4			50
8	FILL, mostly silty sand, grayish brown		21	M	SS	12	20				
10	FILL, mixture of silty sand and silt, slightly organic, gray, brown and dark brown		15	M	SS	12					18
13	LEAN CLAY, slightly organic, dark brown, firm (CL)	FINE ALLUVIUM OR SWAMP DEPOSIT	8	M	SS	6	32				90
15			5	M	SS	12	41		48	25	
18	SILTY SAND, trace shells, fine grained, dark gray, a little brown, moist, very loose (SM)	COARSE ALLUVIUM									
20			3	M	SS	12					29
24	SAND, fine to medium grained, brown, waterbearing, medium dense (SP)										
25			12	M	SS	6					3
26	**END OF BORING**										

Typical Levee Cross Section

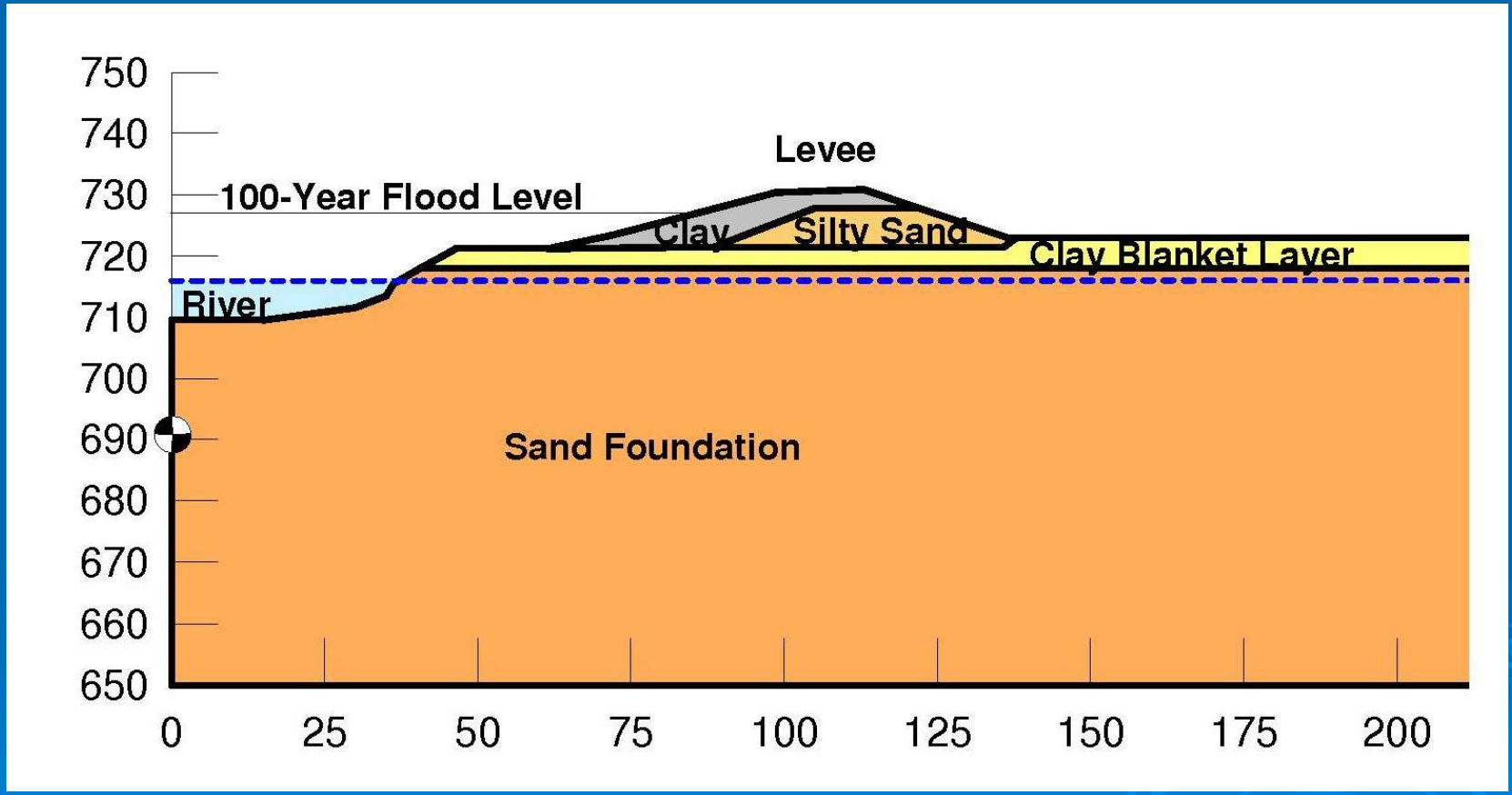


Levee Slope Stability Analysis

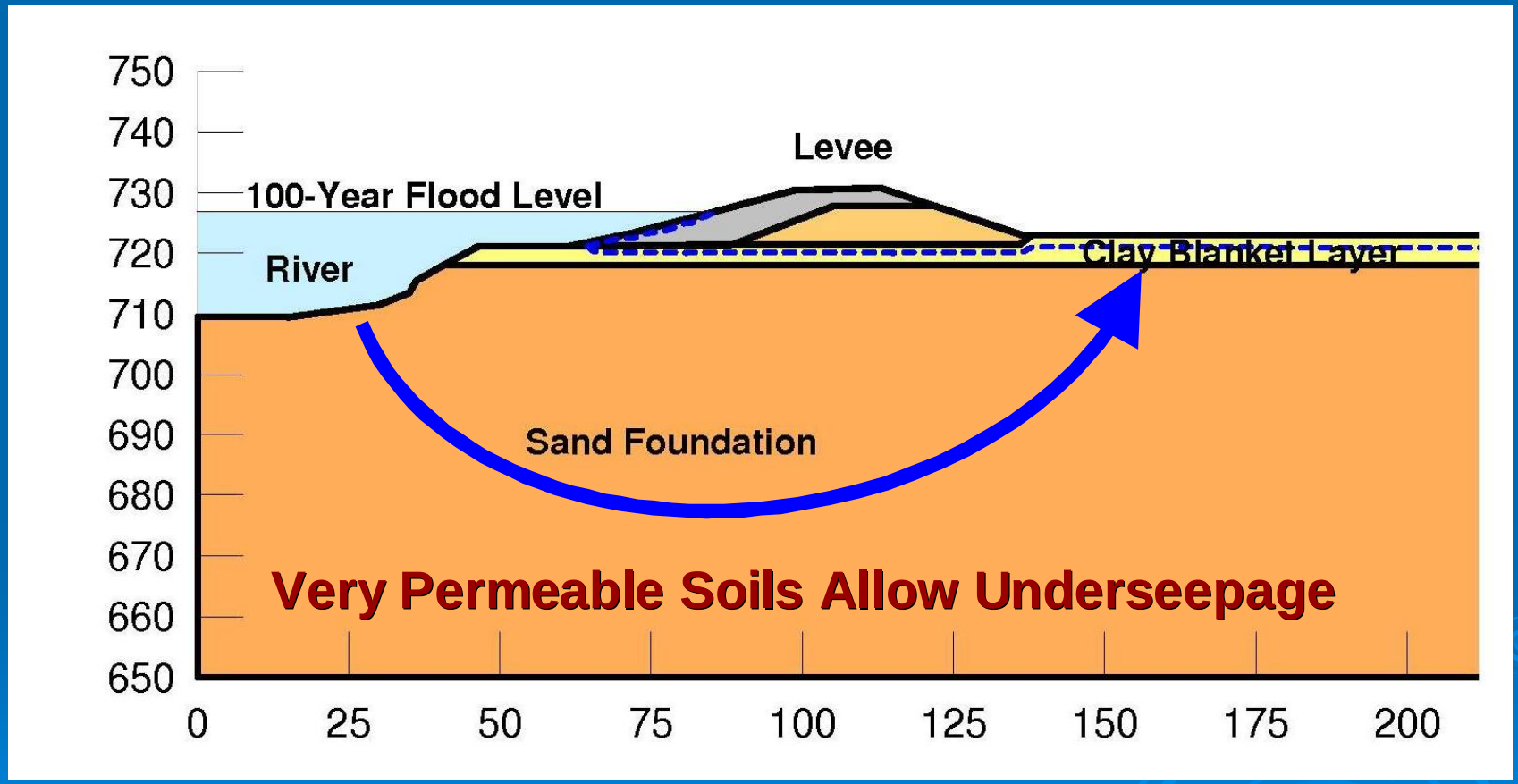


Factor of Safety is Acceptable

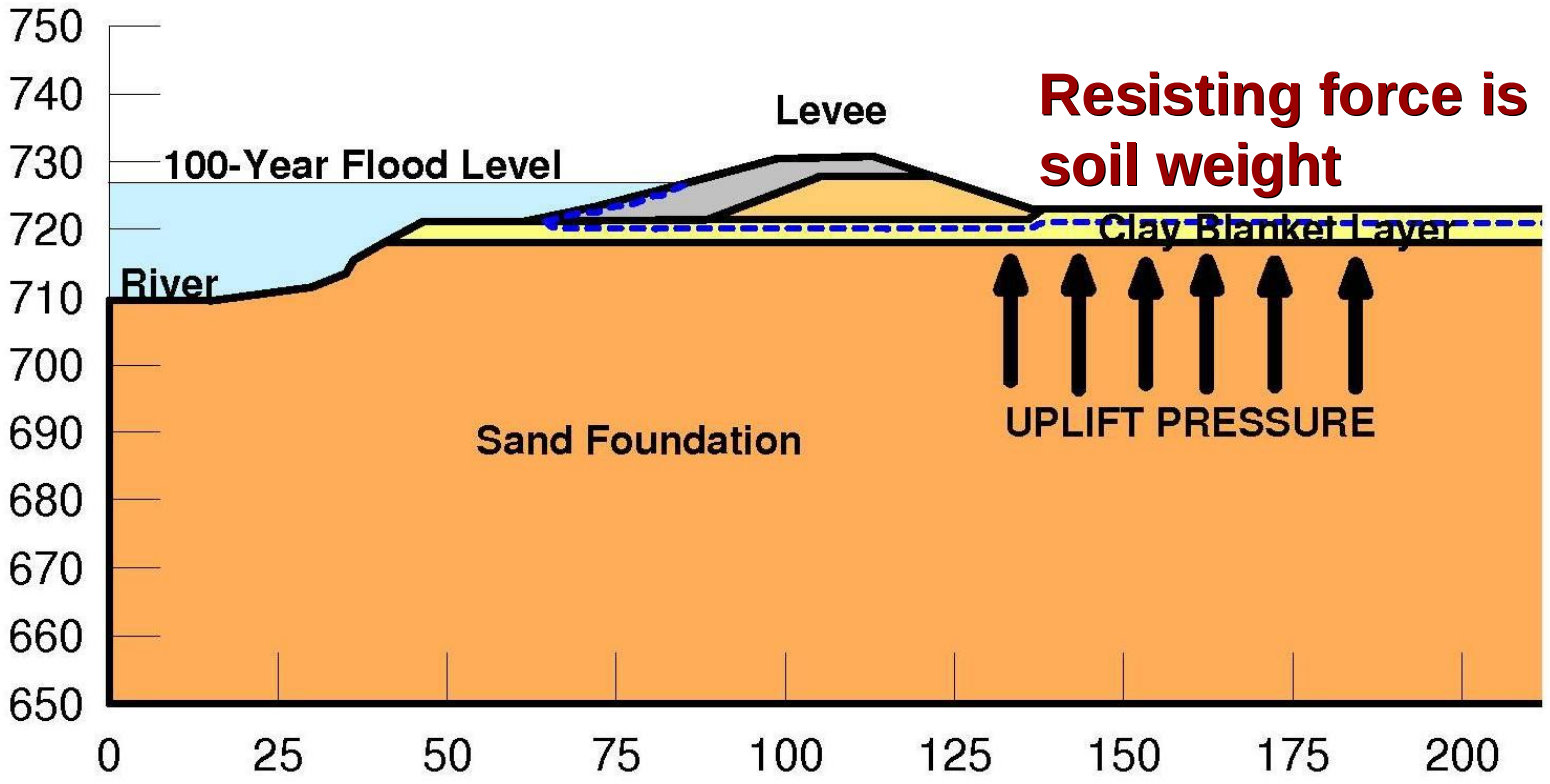
Typical Levee Cross Section



Flood Situation



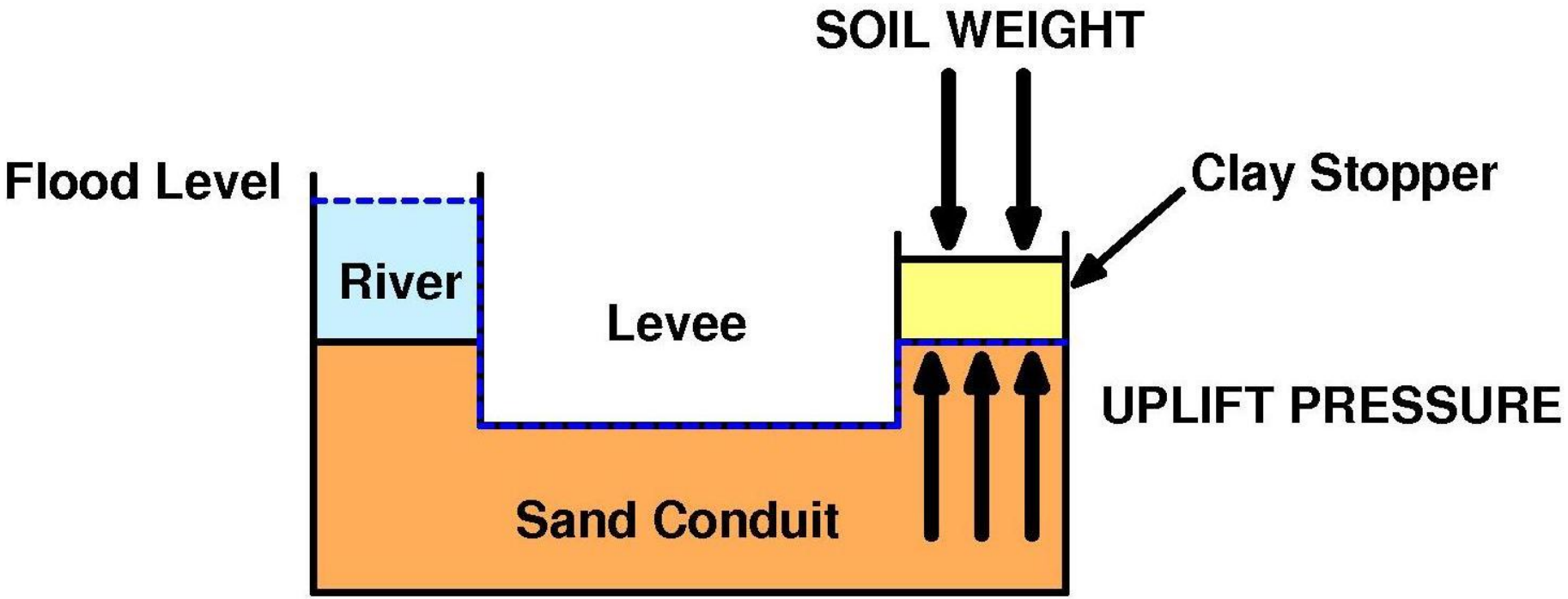
Seepage/Uplift during Flood



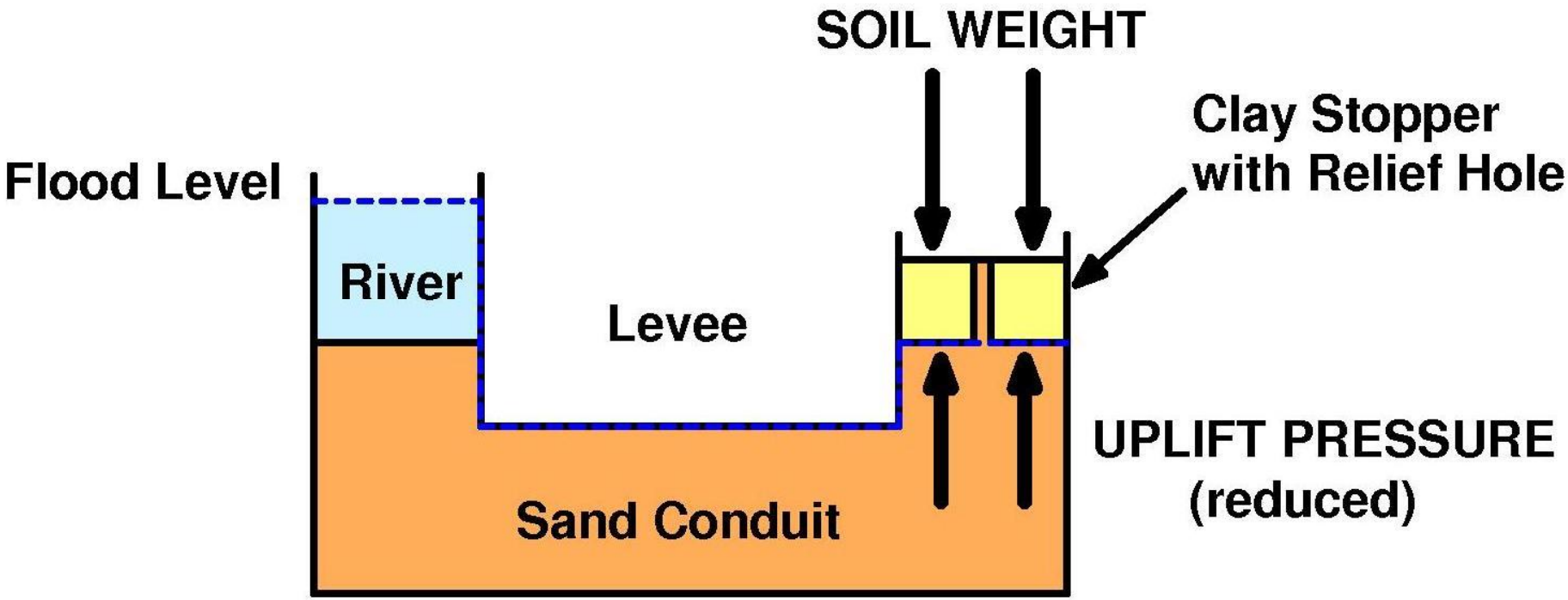
Study Findings – Seepage Analysis

- Seepage/uplift at landside toe generally does not meet FEMA standards
- No areas shown to be in failure condition
- Required criteria include a margin of safety, so not meeting FEMA standard is different from being “unsafe”
- Corrective measures needed to improve seepage conditions for levees and meet FEMA standards

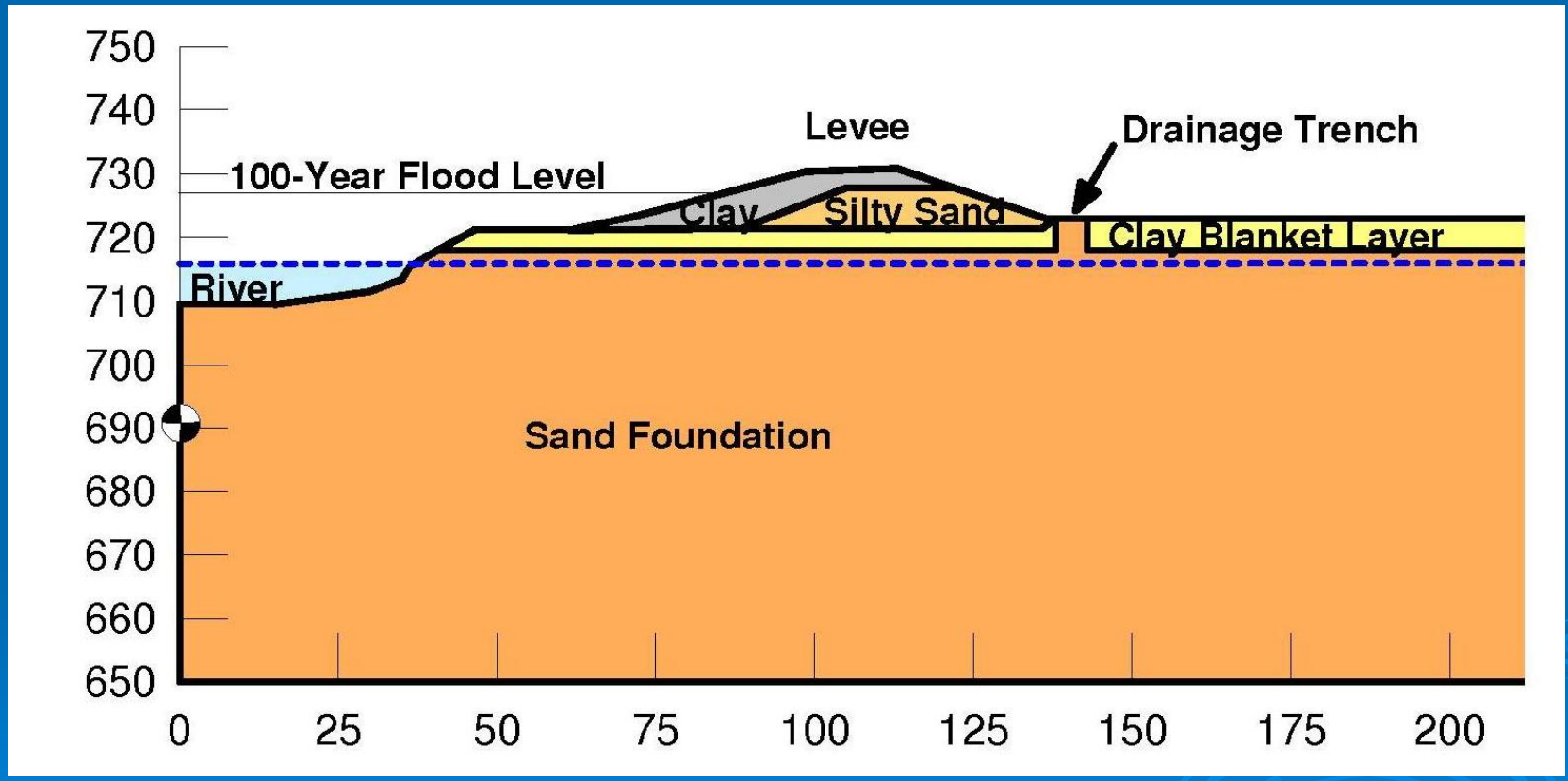
Seepage/Uplift Analogy



Seepage/Uplift Analogy



Proposed Solution to Meet Seepage Criteria



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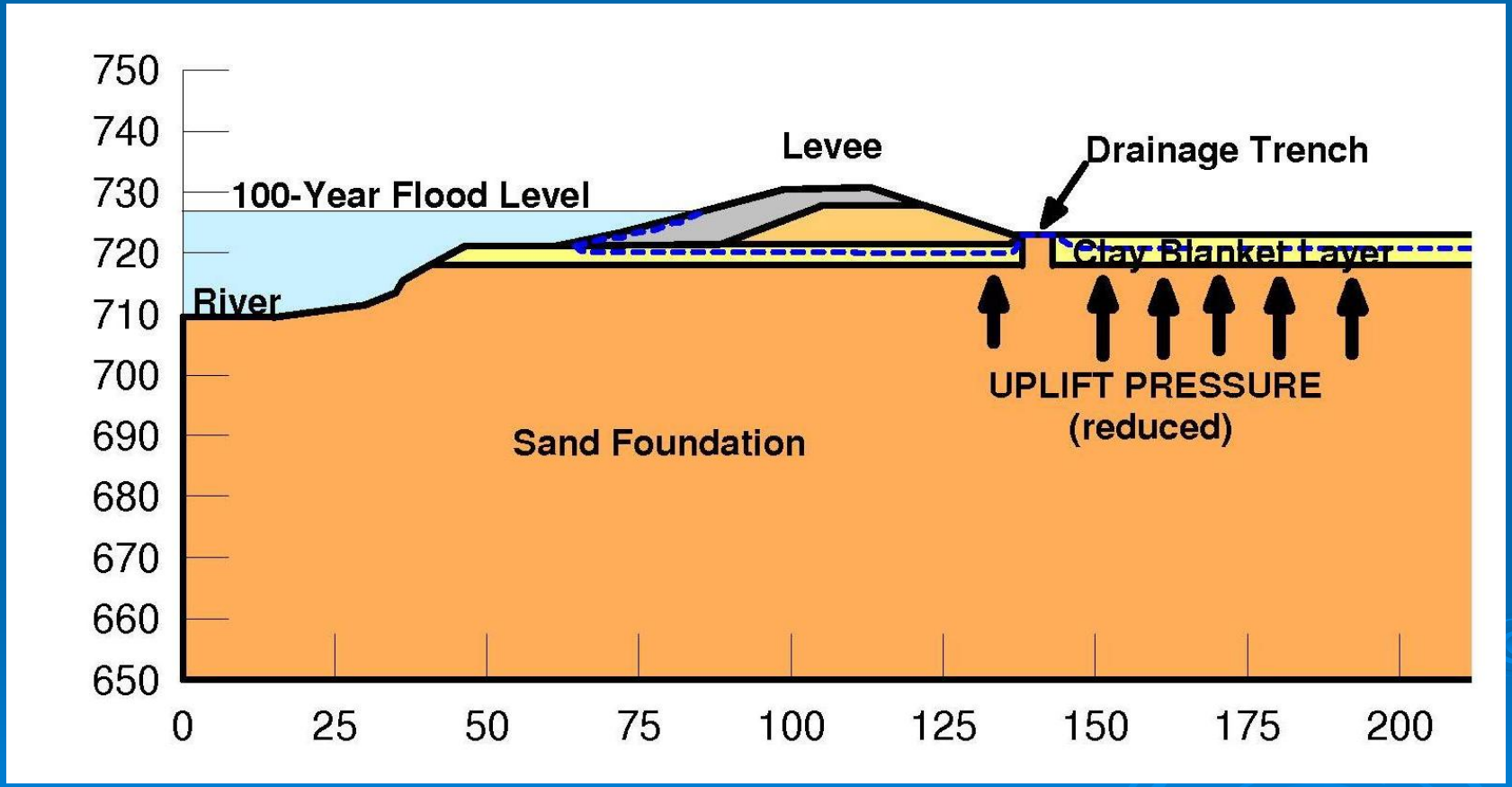


Study Findings – Seepage Analysis

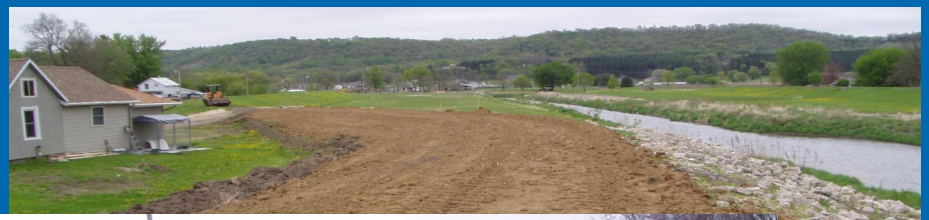
- Basements may still be subject to seepage and groundwater flooding after corrective measures
- The evaluation of the interior drainage system should consider the seepage
- Additional soil borings are needed to confirm evaluation and design system

Study Findings – Freeboard

- Highway 43 north of Rush Creek is a part of the levee system.
- Approximately 800 feet of the roadway is too low to meet FEMA freeboard standards

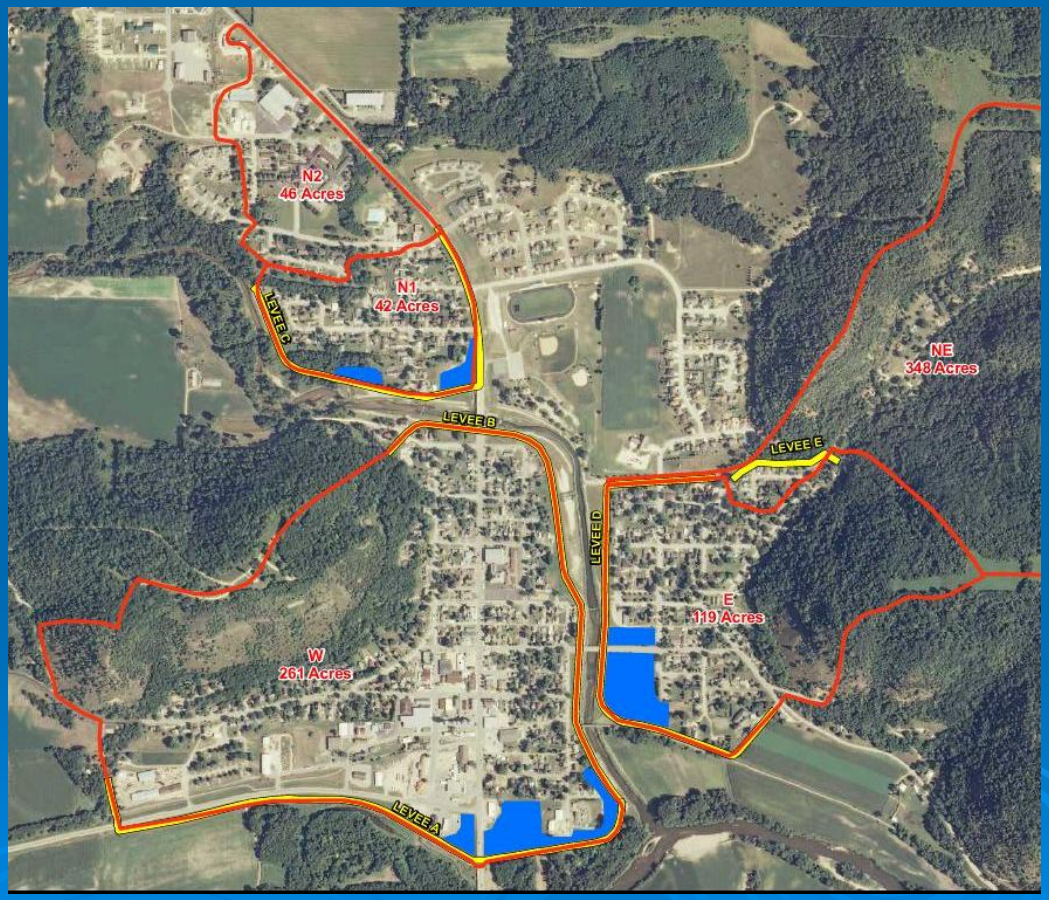
Study Findings – Freeboard

- Part of Rush Creek levee is being raised by Corps of Engineers
- Root River Levee meets freeboard standards
- Highway 16 ditch towards Lanesboro requires sandbagging



Study Findings – Interior Drainage

- Evaluation of interior flooding is ongoing
- Considers seepage and rainfall
- Maps of each interior area will be prepared



Study Findings – DNR Trail Bridge

- Did not cause flooding of Rushford during 2007 (levee would have overtopped without bridge)
- Does not unduly affect flood levels during the 100-year flood
- Withstood 2007 flood with minor abutment erosion
- Documentation of erosion repair
- Possibly explore other long-term solutions with DNR

Recommendations

- Work with Mn/DOT to raise Highway 43
- Keep doing Operation and Maintenance
- Consider portable pump system
  - replace pump damaged in 2007 flood
  - help reduce interior drainage flood levels
  - provide backup pump capacity during power outages

Recommendations

- Perform more soil borings to help in design of seepage correction
- Encourage residents to purchase flood insurance
  - Flood Insurance can cover risks – City flood protection system does not provide complete protection
  - Current rates are reasonable because homes are not shown in “floodplain”
  - Grandfathering of rates if maps change in the future

Next Steps

- Evaluate and design seepage control system
- Pursue funding for corrective measures
  - Consider state Flood Damage Reduction program and Federal assistance

Concerns if Flood Protection System is not Certified

- Wastewater Treatment Plant is protected by the levee – flood proofing or relocation may be needed if MPCA relies on FEMA maps
- Flood Insurance rates for residents and businesses would increase (grandfather clause)
- Repair/improvement of existing structures would be restricted if greater than 50% of market value
- New structures would need to be elevated / flood-proofed.

Questions