FEMA Floodplain Levee Certification
We Energies Pleasant Prairie Ash Landfill Floodplain Levee Certification
Pleasant Prairie, Wisconsin
June 5, 2013

Appendix A

Cover Page – General Information

Cover Page – General Information

Date of submittal: June 29, 2012

Levee owner point of contact: Mr. Timothy C. Muehlfeld, P.E.

Name of levee owner: We Energies

Levee owner point of contact:

Name: Mr. Timothy C. Muehlfeld, P.E.

Address: We Energies, 333 West Everett Street
Milwaukee, WI 53203

Phone number: (414) 221-2206

Fax number: (414) 221-2020

E-mail address: Tim.Muehlfeld@we-energies.com

Name of levee system: Pleasant Prairie Ash Landfill Floodplain Levee

County: Kenosha

City: Pleasant Prairie

State: Wisconsin

Most recent letter of map revision case number, if applicable: N/A

Name of submitting engineer(s) for 65.10(b) certifications:

John M. Trast, P.E.

End of 24-month PAL documentation period (certification submittal deadline): August 11, 2012

Have risk and uncertainty modeling approaches been used for the freeboard analysis? No

DFIRM panel number(s) (preliminary or final): 192 (Map No. 55059CO192D)

Tab 1

44 CFR 65.10(b); Operation and Maintenance Systems

44 CFR 65.10(b) Tab

For levee (NAME of Levee) to be recognized by FEMA, evidence that adequate design and operation and maintenance systems are in place to provide reasonable assurance that protection from the base flood exists is provided here forth in this submission.

Note: According to 44 CFR 65.2, *"(b) For the purpose of this part, a certification by a registered professional engineer or other party does not constitute a warranty or guarantee of performance, expressed or implied. Certification of data is a statement that the data is accurate to the best of the certifier's knowledge. Certification of analyses is a statement that the analyses have been performed correctly and in accordance with sound engineering practices. Certification of structural works is a statement that the works are designed in accordance with sound engineering practices to provide protection from the base flood. Certification of ''as built'' conditions is a statement that the structure(s) has been built according to the plans being certified, is in place, and is fully functioning.*

P.E. Signature: ______________________

P.E. Name: John M. Trast, P.E.

P.E. License Number and State: 31792-6 WI

44 CFR 65.10 (c) and (d)			Is this 44 CFR 65.10 Subpart Applicable to Your Levee System? (Y/N)	If applicable, please cite where document(s) address this 44 CFR 65.10 Subpart criteria. Please include page number.
Operation Plans and Criteria [44 CFR, 65.10(c)]. For a levee system to be recognized, the operational criteria must be as described below. All closure devices or mechanical systems for internal drainage, whether manual or automatic, must be operated in accordance with an officially adopted operation manual, a copy of which must be provided to FEMA by the operator when levee or drainage system recognition is being sought or when the manual for a previously recognized system is revised in any manner. All operations must be under the jurisdiction of a Federal or State agency, an agency created by Federal or State law, or an agency of a community participating in the NFIP.	**(1) Closures.** Operation plans for closures must include the following:	**(i)** Documentation of the flood warning system, under the jurisdiction of Federal, State, or community officials, that will be used to trigger emergency operation activities and demonstration that sufficient flood warning time exists for the completed operation of all closure structures, including necessary sealing, before floodwaters reach the base of the closure.	N	
		(ii) A formal plan of operation including specific actions and assignments of responsibility by individual name or title.	N	
		(iii) Provisions for periodic operation, at not less than one-year intervals, of the closure structure for testing and training purposes.	Y	Appended Operation and Maintenance Plan Page 1
	(2) Interior drainage systems. Interior drainage systems associated with levee systems usually include storage areas, gravity outlets, pumping stations, or a combination thereof. These drainage systems will be recognized by FEMA on NFIP maps for flood protection purposes only if the following minimum criteria are included in the operation plan:	**(i)** Documentation of the flood warning system, under the jurisdiction of Federal, State, or community officials, that will be used to trigger emergency operation activities and demonstration that sufficient flood warning time exists to permit activation of mechanized portions of the drainage system.	N	
		(ii) A formal plan of operation including specific actions and assignments of responsibility by individual name or title.	Y	Appended Operation and Maintenance Plan Page 1
		(iii) Provision for manual backup for the activation of automatic systems.	N	
		(iv) Provisions for periodic inspection of interior drainage systems and periodic operation of any mechanized portions for testing and training purposes. No more than one year shall elapse between either the inspections or the operations.	Y	Attached Operation and Maintenance Plan Page 1
	(3) Other operation plans and criteria. Other operating plans and criteria may be required by FEMA to ensure that adequate protection is provided in specific situations. In such cases, sound emergency management practice will be the standard upon which FEMA determinations will be based.		N	

Maintenance Plans and Criteria [44 CFR, 65.10(d)]. For levee systems to be recognized as providing protection from the base flood, the maintenance criteria must be as described herein. Levee systems must be maintained in accordance with an officially adopted maintenance plan, and a copy of this plan must be provided to FEMA by the owner of the levee system when recognition is being sought or when the plan for a previously recognized system is revised in any manner. All maintenance activities must be under the jurisdiction of a Federal or State agency, an agency created by Federal or State law, or an agency of a community participating in the NFIP that must assume ultimate responsibility for maintenance. This plan must document the formal procedure that ensures that the stability, height, and overall integrity of the levee and its associated structures and systems are maintained. At a minimum, maintenance plans shall specify the maintenance activities to be performed, the frequency of their performance, and the person by name or title responsible for their performance.	Y	Attached Operation and Maintenance Plan Page 2

Name of Levee System:

Date of Operations Plan: May 25, 2012

Date of Maintenance Plan (if separate document): NA

Name of Levee Owner and/or Sponsor Responsible for Operation and Maintenance of Levee System: We Energies, Timothy C. Muehlfeld, P.E., Facility Manager

By signing this form, you acknowledge the information provided is accurate and complete according to 44 CFR 65.10 (c) and (d).

Levee Owner and/or Sponsor Signature:

Levee Owner and/or Sponsor Name: Timothy C. Muehlfeld, P.E.

Revision 1
May 25, 2012

We Energies
Pleasant Prairie Ash Landfill
Floodplain Levee

Operation and Maintenance Plan

Background:

The Pleasant Prairie Ash Landfill Floodplain Levee was constructed in 2000 to prevent a portion of We Energies owned property, permitted as landfill space, from being mapped within the 100-year floodplain. Designation of this property within the floodplain would prevent landfill development within the designated area. Construction of the levee was coordinated with SEWRPC and the Village of Pleasant Prairie, in accordance with applicable permits. An aerial view of the levee is included as Attachment 1.

This Maintenance Plan was prepared to comply with 44 CFR 65.10 and NR 116.17(2)(a)6.

Operations:

In the event that flood elevations in the Unnamed Tributary No. 2 to Jerome Creek approach the FEMA 1% annual chance flood elevation, the owner shall be responsible for installing temporary sandbag flood protection along the west 95 feet of the Pleasant Prairie Ash Landfill Floodplain Levee up to elevation 685.0. This protection shall remain in place until flood waters recede.

Annual Inspections:

The entire length of the levee and all four culverts will be inspected at least once annually each spring (April through June). The inspection will be conducted by the We Energies Facility Manager for the Pleasant Prairie Power Plant Ash Landfill, or his designee. The annual inspections will consist of the following activities:

> Levee: Inspect both sides and the top of the levee over the entire length. Note any soil erosion, bare spots (lack of vegetation), cracks, evidence of seepage, slumping or any other sign of structural degradation.
>
> Culverts: Inspect culvert inlets for obstructions, inspect inside of culverts for blockages or structural damage, inspect inlets and outlets for scouring or evidence of seepage and inspect check valves for obstructions and proper operation.

Document inspections and note required maintenance activities on the Inspection Form, included as Attachment 2.

Maintenance:

The We Energies Facility Manager will coordinate all maintenance items identified on the Inspection Form so that all identified maintenance items are completed no later than October 31 of the year the maintenance item was identified.

In addition to any maintenance item identified on the Inspection Form, the We Energies Facility Manger will arrange to have the levee mown at least once a year in order to facilitate inspections and to promote vigorous vegetative growth.

Annual Report:

An annual summary report will be prepared by the We Energies Facility Manager and submitted to the Wisconsin Department of Natural Resources and the Village of Pleasant Prairie by March 31 of the following year. The annual report will include the site inspection documentation and a description of any maintenance work or other site related activities for the year. The annual report will be certified by a professional engineer registered in Wisconsin.

ATTACHMENTS

Attachment 1: Pleasant Prairie Ash Landfill Floodplain Levee
Attachment 2: Pleasant Prairie Ash Landfill Floodplain Levee Inspection Form

Attachment 1

Pleasant Prairie Power Plant Ash Landfill Floodplain Levee

Attachment 1

Source: Kenosha County NAIP imagery, 2008

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Pleasant Prairie Ash Landfill
Floodplain Levee

ANNUAL INSPECTION FORM

Inspection Date:

Inspectors:

Weather:

Levee: Inspect both sides and the top of the levee over the entire length. Note any soil erosion, bare spots (lack of vegetation), cracks, evidence of seepage, slumping or any other sign of structural degradation. Indicate coordinates of any area requiring attention in US State Plane 1983.

Culvert 1: Check inlet and outlet for obstructions or erosion. Check inside for blockages or damage. Check that the Tideflex checkvalve is free to operate.

Culverts 2, 3 & 4: Check inlet and outlet for obstructions or erosion. Check inside for blockages or damage. Manually operate the Fontaine flap gate valves to ensure they open freely and reset securely.

Culvert 2:

Culvert 3:

Culvert 4:

Action Items: Summarize all items identified above that require maintenance.

Note: Attach inspection and maintenance photos to Form.

Tab 2

44 CFR 65.10(b)(1)(i); Riverine Levee Freeboard

Tab 2

44 CFR 65.10(b) (1) (i) Tab

(1) *Freeboard.* (i) Riverine levees must provide a minimum freeboard of three feet above the water-surface level of the base flood. An additional one foot above the minimum is required within 100 feet in either side of structures (such as bridges) riverward of the levee or wherever the flow is constricted. An additional one-half foot above the minimum at the upstream end of the levee, tapering to not less than the minimum at the downstream end of the levee, is also required.

P.E. Signature: ______________________

Non Applicable: ______________________

P.E. Name: John M. Trast, P.E.

P.E. License Number and State: 31792-6 WI

CALCULATION SHEET

Page 1 **Of** 1
Project No. 60218395

Client	We Energies	**Subject**	Freeboard	**Prepared By**	CF	**Date**	05/13
Project	Pleasant Prairie Ash			**Reviewed By**	JXT	**Date**	05/13
Landfill Floodplain Levee Cert				**Approved By**	JXT	**Date**	06/13

FREEBOARD ANALYSIS

Objective

Verify that the Pleasant Prairie Ash Landfill Floodplain Levee meets the requirements of 44 CFR 65.10(b) (1) Freeboard (i) Riverine, which states:

Riverine levees must provide a minimum freeboard of three feet above the water-surface level of the base flood. An additional one foot above the minimum is required within 100 feet in either side of structures (such as bridges) riverward of the levee or wherever the flow is constricted. An additional one-half foot above the minimum at the upstream end of the levee, tapering to not less than the minimum at the downstream end of the levee, is also required.

Assumptions

1. The base flood elevation listed in the draft Flood Insurance Study effective June 19, 2012 (FIS) will remain unchanged upon adoption of the study.

Calculations

Freeboard
The base flood elevation for the main channel adjacent to the Pleasant Prairie Ash Landfill Floodplain Levee ranges from 680.5 to 681.0 according to Table 9 of the FIS (Unnamed Tributary No. 2 to Jerome Creek Cross-Sections A-F and Unnamed Tributary No. 3 to Jerome Creek Cross-Section G). The minimum elevation of the top of the levee is 685.3 according to surveys performed by AECOM in November and December 2011. The topographic maps generated from the surveys are provided as Drawings 1-4 As-Built Drawings/Site Conditions, Plan & Profile Stations 0+00 to 15+00, Plan & Profile Stations 15+00 to 30+00, and Plan & Profile Stations 30+00 to 41+93. Based on the survey information the floodplain levee provides a minimum of 4.3 feet of freeboard, with one exception. Approximately 13 feet of levee on the southwest end tapers to meet existing grade at the site access road and does not meet the minimum freeboard requirement. This condition was outlined in the Levee Certification Questionnaire and evaluated by FEMA prior to the issuance of the PAL.

Conclusions

The Pleasant Prairie Ash Landfill Floodplain Levee satisfies 44 CFR 65.10(b) (1) (i) with the exception of the 26 feet of levee on the southwest end which tapers to meet existing grade as shown on Drawings 1 As-Built Drawings/Site Conditions and Drawing 4 – Plan & Profile Stations 30+00 to 41+93.

References

Federal Emergency Management Agency. (2012). *Flood Insurance Study – Kenosha County, Wisconsin and Incorporated Areas, Effective June 19, 2012*. Federal Emergency Management Agency. Retrieved January 19, 2012 from: ftp://ftp.wi.gov/DNR/shared/floodplain/Temporary/To_Kenosha/FIS

FIGURE

Figure 01 – Pleasant Prairie Landfill Levee Freeboard Requirement

Project Management Initials: Designer: RLD Checked: TR Approved: TR ANSI A 8.5" x 11"

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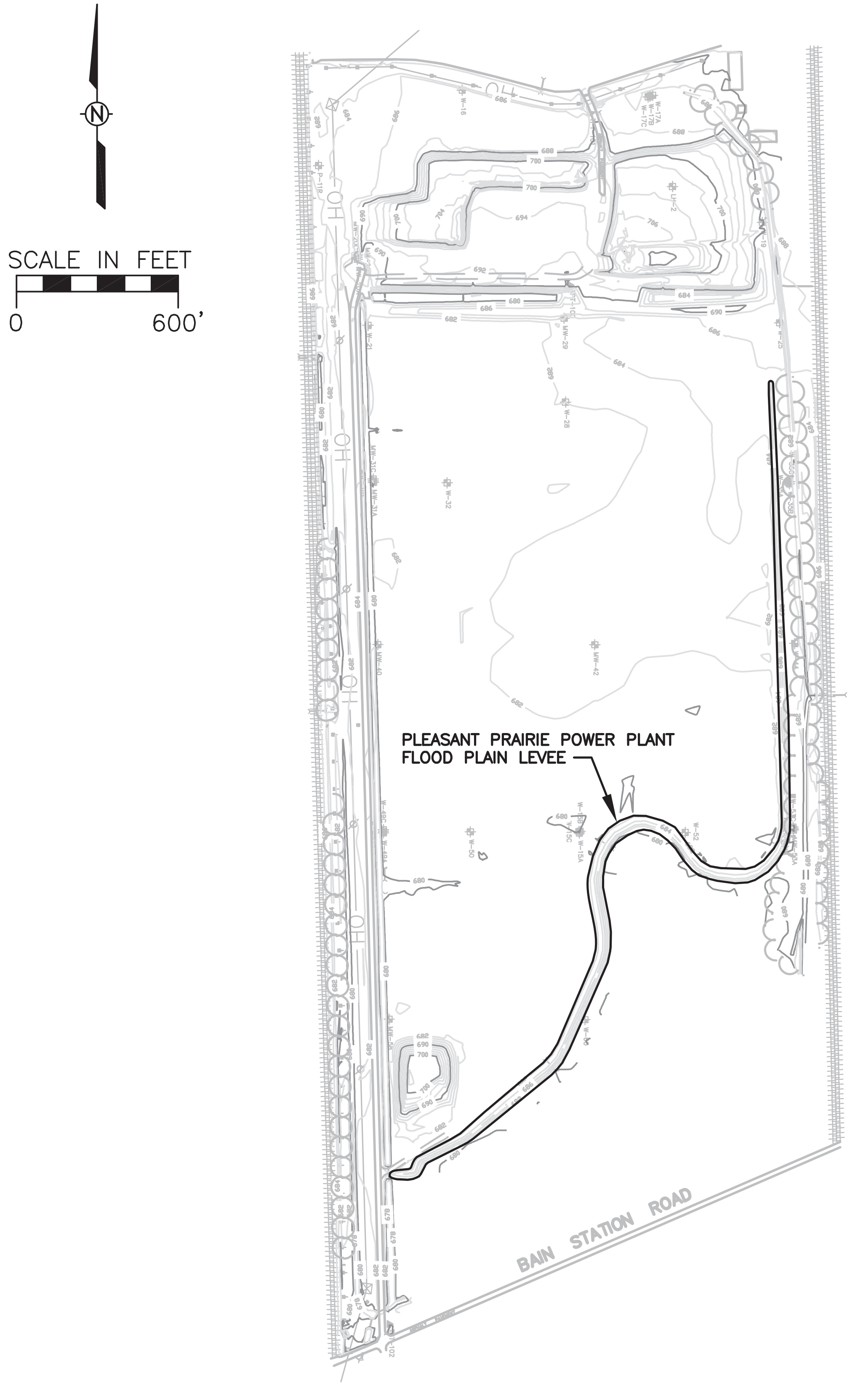


Pleasant Prairie Power Plant
Landfill Flood Plain Levee Certification
We Energies, Pleasant Prairie, WI
Project No.: 60218395 2012-02

SITE MAP

AECOM

FIGURE 2

APPENDIX

EXCERPTS FROM KENOSHA COUNTY FIS

FLOOD INSURANCE STUDY

VOLUME 1 OF 2

KENOSHA COUNTY, WISCONSIN,

AND INCORPORATED AREAS

Community Name	Community Number
Bristol, Village of	550595
*Genoa City, Village of	550465
Kenosha, City of	550209
Kenosha County, Unincorporated Areas	550523
Paddock Lake, Village of	550073
Pleasant Prairie, Village of	550613
Silver Lake, Village of	550210
Twin Lakes, Village of	550211

*No Special Flood Hazard Areas Identified

EFFECTIVE:
June 19, 2012

U.S. DEPARTMENT OF HOMELAND SECURITY

Federal Emergency Management Agency
FLOOD INSURANCE STUDY NUMBER
55059CV001A

TABLE 6 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-PERCENT ANNUAL CHANCE	2-PERCENT ANNUAL CHANCE	1-PERCENT ANNUAL CHANCE	0.2-PERCENT ANNUAL CHANCE
UNNAMED TRIBUTARY NO. 2 TO DES PLAINES RIVER					
At Confluence with Des Plaines River	0.6	149	229	268	*
UNNAMED TRIBUTARY NO. 2 TO JEROME CREEK					
At Confluence with Jerome Creek	0.3	36	41	43	*
UNNAMED TRIBUTARY NO. 2 TO SALEM BRANCH BRIGHTON CREEK					
At Confluence with Salem Branch Brighton Creek	0.8	69	97	110	*
UNNAMED TRIBUTARY NO. 3 TO DUTCH GAP CANAL					
At Confluence with Dutch Gap Canal	3.5	63	106	129	*
UNNAMED TRIBUTARY NO. 3 TO JEROME CREEK					
At Confluence with Jerome Creek	0.7	19	23	25	*
Just upstream of divergence with Unnamed Tributary No. 2 to Jerome Creek	*	35	39	41	*
UNNAMED TRIBUTARY NO. 3 TO SALEM BRANCH BRIGHTON CREEK					
At Confluence with Salem Branch Brighton Creek	0.7	34	48	55	*
UNNAMED TRIBUTARY TO NO. 4 TO DUTCH GAP CANAL					
At Confluence with Dutch Gap Canal	1.6	35	62	77	*

FLOODING SOURCE		FLOODWAY				1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD 88)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	WIDTH REDUCED FROM PRIOR STUDY (FEET)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
UNNAMED TRIBUTARY NO. 2 TO DES PLAINES RIVER (CONTINUED)									
K	8,380[1]	31	53	1.8	0	704.1	704.1	704.1	0.0
UNNAMED TRIBUTARY NO. 2 TO JEROME CREEK						588.9			
A	1,961[2]	33	107	0.4	0	680.8	680.8	680.8	0.0
B	2,109[2]	29	92	0.6	0	680.8	680.8	680.8	0.0
C	2,468[2]	93	260	0.3	0	680.9	680.9	680.9	0.0
D	2,780[2]	162	262	0.3	0	680.9	680.9	680.9	0.0
E	3,440[2]	172	217	0.3	0	680.9	680.9	680.9	0.0
F	4,000[2]	142	178	0.2	0	681.0	681.0	681.0	0.0
UNNAMED TRIBUTARY NO. 2 TO SALEM BRANCH BRIGHTON CREEK									
A	100[3]	*	*	*	*	752.1	*	*	*
B	950[3]	*	*	*	*	763.1	*	*	*
C	1,352[3]	*	*	*	*	768.3	*	*	*
D	1,621[3]	*	*	*	*	768.6	*	*	*
E	1,874[3]	*	*	*	*	772.7	*	*	*
F	2,767[3]	*	*	*	*	780.6	*	*	*
G	3,216[3]	*	*	*	*	789.1	*	*	*

[1] FEET ABOVE CONFLUENCE WITH UNNAMED TRIBUTARY NO. 1E TO DES PLAINES RIVER, [2] FEET ABOVE CONFLUENCE WITH JEROME CREEK, [3] FEET ABOVE CONFLUENCE WITH SALEM BRANCH BRIGHTON CREEK, *DATA NOT AVAILABLE

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

KENOSHA COUNTY, WI

AND INCORPORATED AREAS

FLOODWAY DATA

UNNAMED TRIBUTARY 2 TO DES PLAINES RIVER - UNNAMED TRIBUTARY NO. 2 TO JEROME CREEK - UNNAMED TRIBUTARY NO. 2 TO SALEM BRANCH BRIGHTON CREEK

FLOODING SOURCE		FLOODWAY				1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD 88)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	WIDTH REDUCED FROM PRIOR STUDY (FEET)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
UNNAMED TRIBUTARY NO. 3 TO JEROME CREEK									
A	1,950[1]	5	11	2.3	0	680.5	680.5	680.5	0.0
B	2,200[1]	40	98	0.3	0	680.5	680.5	680.5	0.0
C	2,395[1]	4	12	2.1	0	680.5	680.5	680.5	0.0
D	2,515[1]	4	17	1.4	0	680.5	680.5	680.5	0.0
E	2,556[1]	4	15	1.6	0	588.9	680.6	680.6	0.0
F	2,946[1]	20	40	0.8	0	680.7	680.7	680.7	0.0
G	4,429[1]	3	9	4.8	0	681.0	681.0	681.0	0.0
H	4,504[1]	3	10	4.3	0	681.9	681.9	681.9	0.0
I	4,984[1]	472	302	0.2	0	682.3	682.3	682.3	0.0
J	6,879[1]	37	33	1.7	0	683.4	683.4	683.4	0.0
K	7,059[1]	122	38	1.8	0	684.0	684.0	684.0	0.0
L	7,185[1]	130	56	1.0	0	684.3	684.3	684.3	0.0
M	7,755[1]	8	19	2.2	0	687.7	687.7	687.7	0.0
UNNAMED TRIBUTARY NO. 3 TO SALEM BRANCH BRIGHTON CREEK									
A	201[2]	*	*	*	*	756.8	*	*	*
B	623[2]	*	*	*	*	762.8	*	*	*
C	898[2]	*	*	*	*	769.2	*	*	*
D	1,119[2]	*	*	*	*	771.0	*	*	*
E	1,463[2]	*	*	*	*	775.4	*	*	*
F	2,656[2]	*	*	*	*	789.9	*	*	*

[1]FEET ABOVE CONFLUENCE WITH JEROME CREEK, [2]FEET ABOVE CONFLUENCE WITH SALEM BRANCH BRIGHTON CREEK, *DATA NOT AVAILABLE

TABLE 9

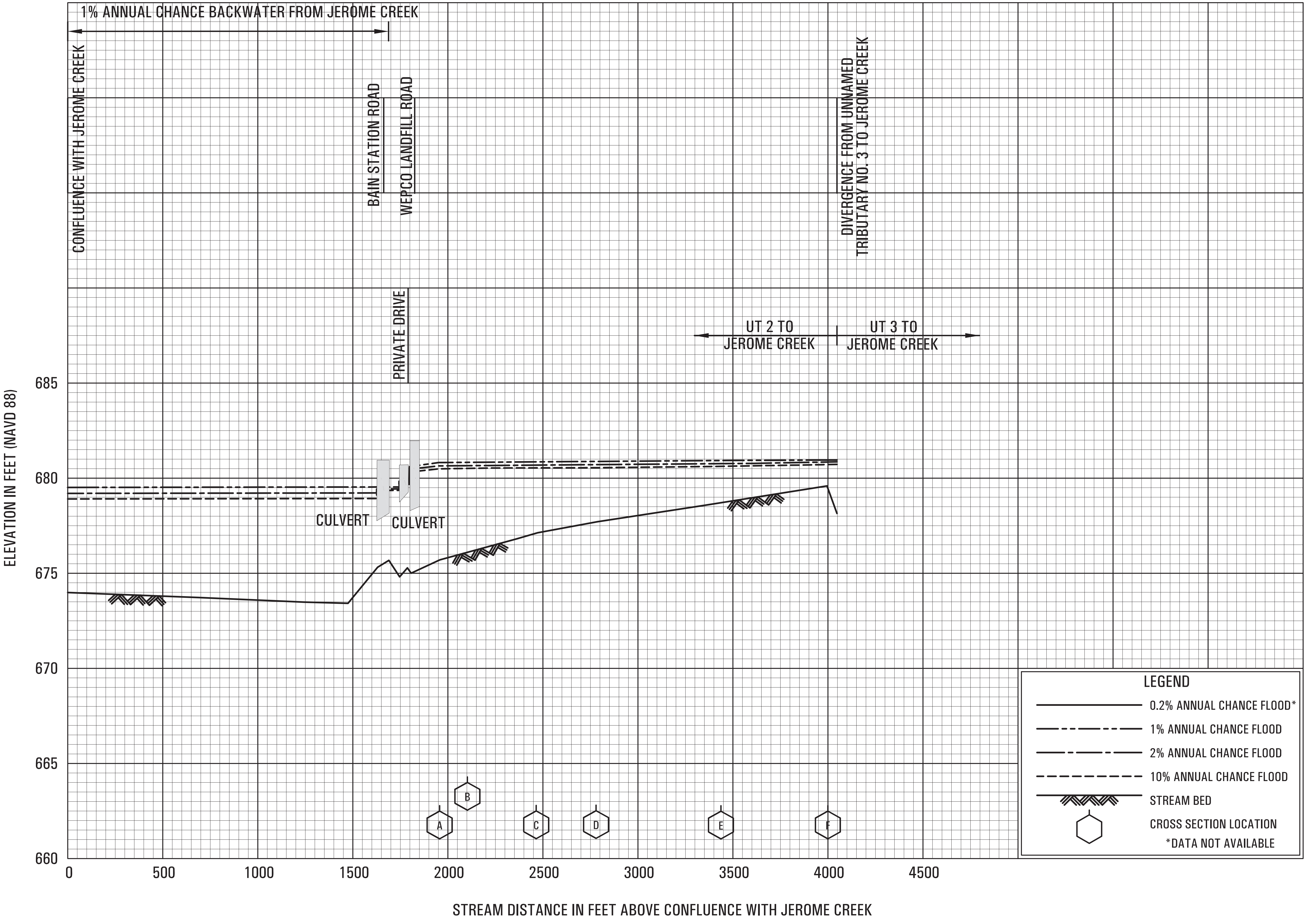
FEDERAL EMERGENCY MANAGEMENT AGENCY

KENOSHA COUNTY, WI

AND INCORPORATED AREAS

FLOODWAY DATA

UNNAMED TRIBUTARY NO. 3 TO JEROME CREEK - UNNAMED TRIBUTARY NO. 3 TO SALEM BRANCH BRIGHTON CREEK



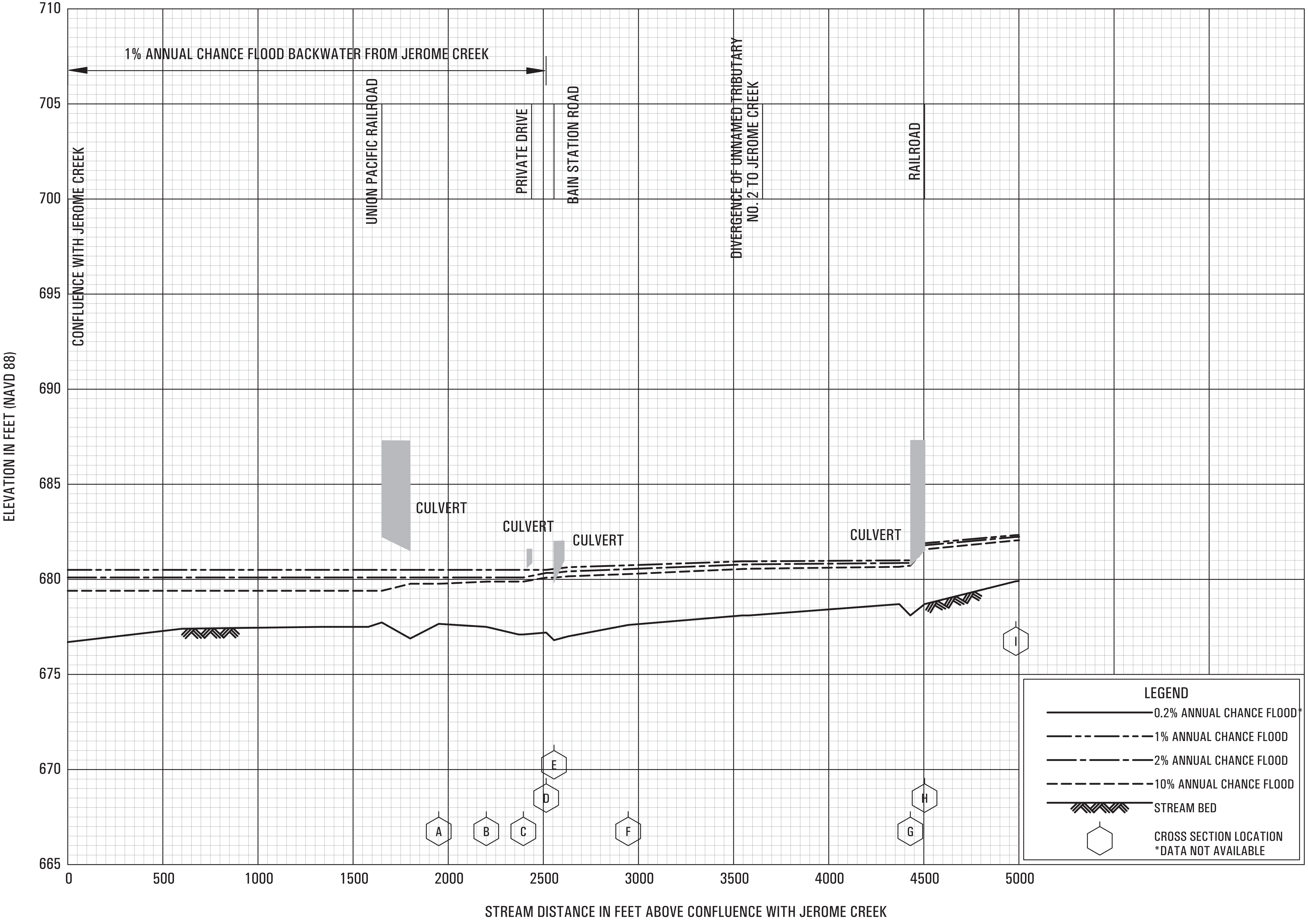
FLOOD PROFILES

UNNAMED TRIBUTARY NO. 2 TO JEROME CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

KENOSHA COUNTY, WI

AND INCORPORATED AREAS



FLOOD PROFILES

UNNAMED TRIBUTARY NO. 3 TO JEROME CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

KENOSHA COUNTY, WI

AND INCORPORATED AREAS

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) Report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS Report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study Report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study Report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study Report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 16N. The **horizontal datum** was NAD 83, GRS 1980 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713- 3242**, or visit its website at http://www.ngs.noaa.gov.

Base map information shown on this FIRM was derived from the National Agriculture Imagery Program's (NAIP) digital orthoimagery produced by the USDA, Farm Service Agency. The orthophoto was collected in the summer of 2005 and produced at a resolution of 1 meter.

The **profile baselines** depicted on this map represent the hydraulic modeling baselines that match the flood profiles in the FIS report. As a result of improved topographic data, the **profile baseline**, in some cases, may deviate significantly from the channel centerline or appear outside the SFHA.

Based on updated topographic information, this map reflects more detailed and up-to-date **stream channel configurations and floodplain delineations** than those shown on the previous FIRM for this jurisdiction. As a result, the Flood Profiles and Floodway Data tables for multiple streams in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on the map. Also, the road to floodplain relationships for unrevised streams may differ from what is shown on previous maps.

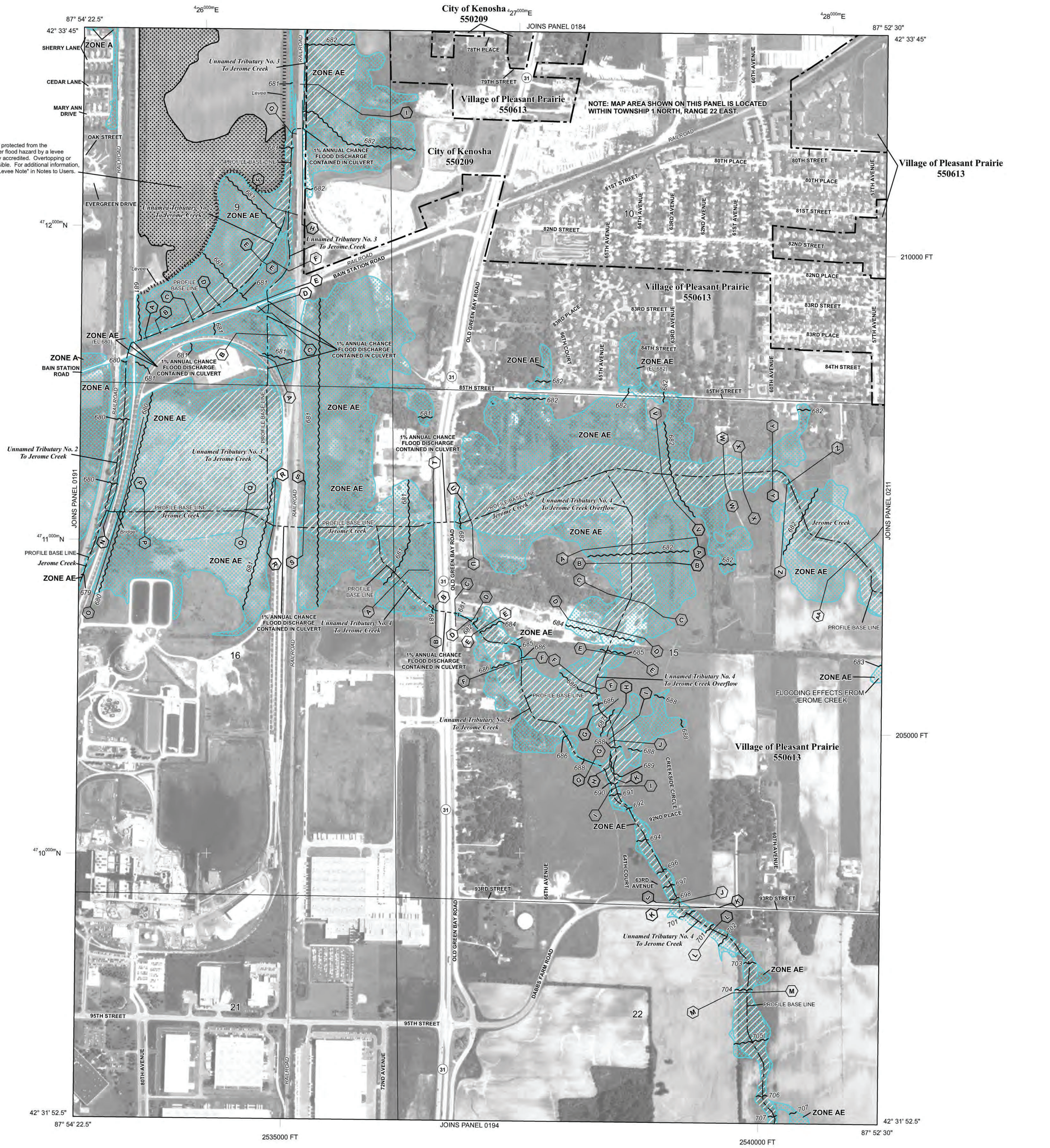
Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

For information on available products associated with this FIRM visit the **Map Service Center** (MSC) website at http://msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the MSC website.

If you have **questions about this map**, how to order products or the National Flood Insurance Program in general, please call the FEMA Map Information eXchange (FMIX) at **1 -877-FEMA-MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip.

Provisionally Accredited Levee Notes to Users: Check with your local community to obtain more information, such as the estimated level of protection provided (which may exceed the 1-percent-annual-chance level) and Emergency Action Plan, on the levee system shown as providing protection for areas on this panel. To maintain accreditation, the levee owner or community is required to submit the data and documentation necessary to comply with Section 65.10 of the NFIP regulations by August 11, 2012. If the community or owner does not provide the necessary data and documentation or if the data and documentation provided indicate the levee system does not comply with Section 65.10 requirements, FEMA will revise the flood hazard and risk information for this area to reflect de-accreditation of the levee system. To mitigate flood risk in residual risk areas, property owners and residents are encouraged to consider flood insurance and floodproofing or other protective measures. For more information on flood insurance, interested parties should visit the FEMA website at ww.fema.gov/business/nfip/index.shtm.



Note: This area is shown as being protected from the 1-percent-annual-chance or greater flood hazard by a levee system that has been provisionally accredited. Overtopping or failure of any levee system is possible. For additional information, see the "Provisionally Accredited Levee Note" in Notes to Users.

LEGEND

▨ SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Areas formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

▨ FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

▩ OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

□ OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

▧ COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

▧ OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

———	1% Annual Chance Floodplain Boundary
———	0.2% Annual Chance Floodplain Boundary
— —	Floodway boundary
— — —	Zone D boundary
• • • • • • • •	CBRS and OPA boundary
▨ ←	Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths, or flood velocities.
~~ 513 ~~~	Base Flood Elevation line and value; elevation in feet*
(EL 987)	Base Flood Elevation value where uniform within zone; elevation in feet*

*Referenced to the North American Vertical Datum of 1988

(A)———(A)	Cross section line
(23)- - - - -(23)	Transect line
	Culvert
	Bridge
45° 02' 08", 93° 02' 12"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83) Western Hemisphere
3100000 FT	5000-foot ticks: Wisconsin State Plane South Zone (FIPS Zone 4803), Lambert Conformal Conic projection
$^{49}89^{000m}$ N	1000-meter Universal Transverse Mercator grid values, zone 16N
DX5510 ×	Bench mark (see explanation in Notes to Users section of this FIRM panel)
• FT1,000	River Station

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
June 19, 2012

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

250	0	500	1000 FEET
150	0	150	300 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0192D

FIRM
FLOOD INSURANCE RATE MAP
KENOSHA COUNTY, WISCONSIN
AND INCORPORATED AREAS

PANEL 192 OF 331
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
KENOSHA, CITY OF	550209	0192	D
PLEASANT PRAIRIE, VILLAGE OF	550613	0192	D

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
55059C0192D

EFFECTIVE DATE
JUNE 19, 2012

Federal Emergency Management Agency

Tab 3

44 CFR 65.10(b)(1)(ii); Riverine Levee Freeboard Exception

44 CFR 65.10(b) (1) (ii) Tab

(ii) Occasionally, exceptions to the minimum riverine freeboard requirement described in paragraph (b)(1)(i) of this section, may be approved. Appropriate engineering analyses demonstrating adequate protection with a lesser freeboard must be submitted to support a request for such an exception. The material presented must evaluate the uncertainty in the estimated base flood elevation profile and include, but not necessarily be limited to an assessment of statistical confidence limits of the 100-year discharge; changes in stage-discharge relationships; and the sources, potential, and magnitude of debris, sediment, and ice accumulation. It must be also shown that the levee will remain structurally stable during the base flood when such additional loading considerations are imposed. Under no circumstances will freeboard of less than two feet be accepted.

P.E. Signature: ______________________

Non Applicable: ______________________

P.E. Name: John M. Trast, P.E.

P.E. License Number and State: 31792-6 WI

CALCULATION SHEET

Page 1 **Of** 1
Project No. 1325060
Client We Energies **Subject** Freeboard Exceptions Analysis **Prepared By** CEF **Date** 05/13
Project Pleasant Prairie Ash Landfill Floodplain Levee Cert **Reviewed By** JXT **Date** 05/13
Approved By JXT **Date** 06/13

FREEBOARD EXCEPTIONS ANALYSIS

Objective

Verify that the Pleasant Prairie Ash Landfill Floodplain Levee meets the requirements of 44 CFR 65.10(b) (1) (ii) which states:

"Occasionally, exceptions to the minimum riverine freeboard requirement described in paragraph (b)(1)(i) of this section, may be approved. Appropriate engineering analyses demonstrating adequate protection with a lesser freeboard must be submitted to support a request for such an exception. The material presented must evaluate the uncertainty in the estimated base flood elevation profile and include, but not necessarily be limited to an assessment of statistical confidence limits of the 100-year discharge; changes in stage-discharge relationships; and the sources, potential, and magnitude of debris, sediment, and ice accumulation. It must be also shown that the levee will remain structurally stable during the base flood when such additional loading considerations are imposed. Under no circumstances will freeboard of less than two feet be accepted."

Assumptions

1. The base flood elevation listed in the draft Flood Insurance Study effective June 19, 2012 (FIS) will remain unchanged upon adoption of the study.

Calculations

Exceptions to Freeboard

The west 13 feet of the Pleasant Prairie Ash Landfill Floodplain Levee does not meet the freeboard requirement described in 44 CFR 65.10(b)(1)(i). According to 44 CFR 65.10(b)(1)(i), the minimum freeboard is 3.0 feet for the main levee and 4.0 feet within 100 feet of structures. The west 13 feet of the Pleasant Prairie Ash Landfill Floodplain Levee is within 100 feet of a structure and the Base Flood Elevation is 680.5. Therefore, the minimum elevation to meet the 4.0 foot freeboard requirement required under 44 CFR 65.10(b)(1)(i) is 684.5.

The following language shall be included in the operation and maintenance plan for the Pleasant Prairie Ash Landfill Floodplain Levee:

"In the event that flood elevations in the Unnamed Tributary No. 2 to Jerome Creek approach the FEMA 1% annual chance flood elevation, the owner shall be responsible for installing temporary sandbag flood protection along the west 13 feet of the Pleasant Prairie Ash Landfill Floodplain Levee up to elevation 684.5. This protection shall remain in place until flood waters recede."

This temporary sandbag protection required by the operation and maintenance plan will ensure a minimum of 4.0 feet of freeboard during the Base Flood event.

Conclusions

The Pleasant Prairie Ash Landfill Floodplain Levee satisfies 44 CFR 65.10(b)(1)(ii) with the inclusion of temporary sandbag protection in the operation and maintenance plan for the part of the levee that does not satisfy 44 CFR 65.10(b)(1)(i).

CALCULATION SHEET

Page 2 **Of** 1

Project No. 1325060

Client We Energies **Subject** Freeboard **Prepared By** CEF **Date** 05/13

Project Pleasant Prairie Ash Exceptions Analysis **Reviewed By** JXT **Date** 05/13

Landfill Floodplain Levee Cert **Approved By** JXT **Date** 06/13

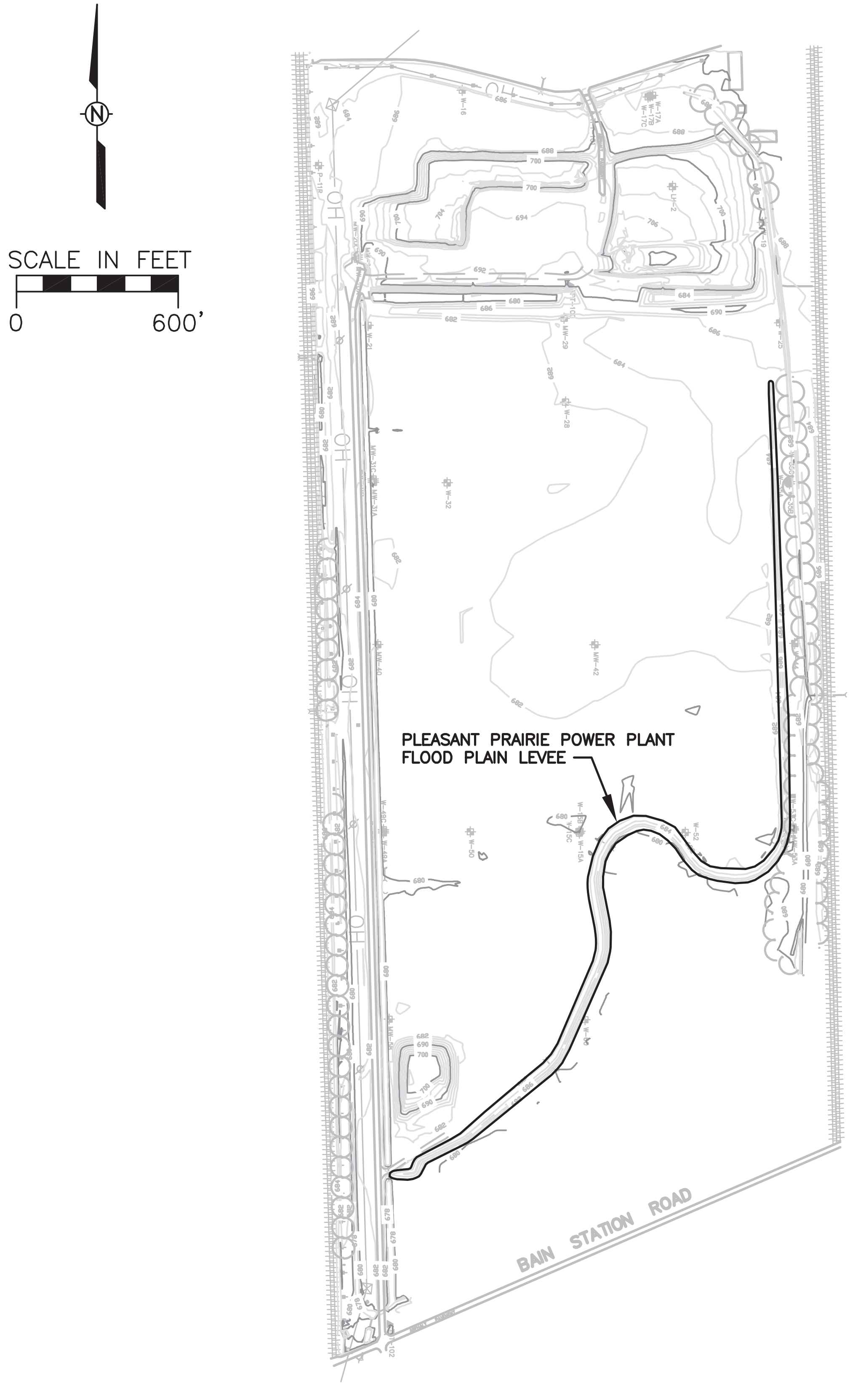
References

Federal Emergency Management Agency. (2012). *Flood Insurance Study – Kenosha County,* Wisconsin and Incorporated Areas, Effective June 19, 2012. Federal Emergency Management Agency. Retrieved January 19, 2012 from: ftp://ftp.wi.gov/DNR/shared/floodplain/Temporary/To_Kenosha/FIS

FIGURES

Project Management Initials: Designer: RLD Checked:TR Approved:TR ANSI A 8.5" x 11"

Last saved by: DUCKARTR(2012-01-27) Last Plotted: 2012-01-27
Filename: X:\PROJECTS\WE_ENERGIES_P4\DWG\60218395_FIG-2.DWG



Pleasant Prairie Power Plant
Landfill Flood Plain Levee Certification
We Energies, Pleasant Prairie, WI
Project No.: 60218395 2012-02

SITE MAP

AECOM

FIGURE 2

APPENDIX

EXCERPTS FROM KENOSHA COUNTY FIS

FLOOD INSURANCE STUDY

VOLUME 1 OF 2

KENOSHA COUNTY, WISCONSIN,

AND INCORPORATED AREAS

Community Name	Community Number
Bristol, Village of	550595
*Genoa City, Village of	550465
Kenosha, City of	550209
Kenosha County, Unincorporated Areas	550523
Paddock Lake, Village of	550073
Pleasant Prairie, Village of	550613
Silver Lake, Village of	550210
Twin Lakes, Village of	550211

*No Special Flood Hazard Areas Identified

EFFECTIVE:
June 19, 2012

U.S. DEPARTMENT OF HOMELAND SECURITY

Federal Emergency Management Agency
FLOOD INSURANCE STUDY NUMBER
55059CV001A

TABLE 6 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-PERCENT ANNUAL CHANCE	2-PERCENT ANNUAL CHANCE	1-PERCENT ANNUAL CHANCE	0.2-PERCENT ANNUAL CHANCE
UNNAMED TRIBUTARY NO. 2 TO DES PLAINES RIVER					
At Confluence with Des Plaines River	0.6	149	229	268	*
UNNAMED TRIBUTARY NO. 2 TO JEROME CREEK					
At Confluence with Jerome Creek	0.3	36	41	43	*
UNNAMED TRIBUTARY NO. 2 TO SALEM BRANCH BRIGHTON CREEK					
At Confluence with Salem Branch Brighton Creek	0.8	69	97	110	*
UNNAMED TRIBUTARY NO. 3 TO DUTCH GAP CANAL					
At Confluence with Dutch Gap Canal	3.5	63	106	129	*
UNNAMED TRIBUTARY NO. 3 TO JEROME CREEK					
At Confluence with Jerome Creek	0.7	19	23	25	*
Just upstream of divergence with Unnamed Tributary No. 2 to Jerome Creek	*	35	39	41	*
UNNAMED TRIBUTARY NO. 3 TO SALEM BRANCH BRIGHTON CREEK					
At Confluence with Salem Branch Brighton Creek	0.7	34	48	55	*
UNNAMED TRIBUTARY TO NO. 4 TO DUTCH GAP CANAL					
At Confluence with Dutch Gap Canal	1.6	35	62	77	*

FLOODING SOURCE		FLOODWAY				1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD 88)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	WIDTH REDUCED FROM PRIOR STUDY (FEET)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
UNNAMED TRIBUTARY NO. 2 TO DES PLAINES RIVER (CONTINUED)									
K	8,380[1]	31	53	1.8	0	704.1	704.1	704.1	0.0
UNNAMED TRIBUTARY NO. 2 TO JEROME CREEK						588.9			
A	1,961[2]	33	107	0.4	0	680.8	680.8	680.8	0.0
B	2,109[2]	29	92	0.6	0	680.8	680.8	680.8	0.0
C	2,468[2]	93	260	0.3	0	680.9	680.9	680.9	0.0
D	2,780[2]	162	262	0.3	0	680.9	680.9	680.9	0.0
E	3,440[2]	172	217	0.3	0	680.9	680.9	680.9	0.0
F	4,000[2]	142	178	0.2	0	681.0	681.0	681.0	0.0
UNNAMED TRIBUTARY NO. 2 TO SALEM BRANCH BRIGHTON CREEK									
A	100[3]	*	*	*	*	752.1	*	*	*
B	950[3]	*	*	*	*	763.1	*	*	*
C	1,352[3]	*	*	*	*	768.3	*	*	*
D	1,621[3]	*	*	*	*	768.6	*	*	*
E	1,874[3]	*	*	*	*	772.7	*	*	*
F	2,767[3]	*	*	*	*	780.6	*	*	*
G	3,216[3]	*	*	*	*	789.1	*	*	*

[1] FEET ABOVE CONFLUENCE WITH UNNAMED TRIBUTARY NO. 1E TO DES PLAINES RIVER, [2] FEET ABOVE CONFLUENCE WITH JEROME CREEK, [3] FEET ABOVE CONFLUENCE WITH SALEM BRANCH BRIGHTON CREEK, *DATA NOT AVAILABLE

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

KENOSHA COUNTY, WI

AND INCORPORATED AREAS

FLOODWAY DATA

UNNAMED TRIBUTARY 2 TO DES PLAINES RIVER - UNNAMED TRIBUTARY NO. 2 TO JEROME CREEK - UNNAMED TRIBUTARY NO. 2 TO SALEM BRANCH BRIGHTON CREEK

FLOODING SOURCE		FLOODWAY				1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD 88)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	WIDTH REDUCED FROM PRIOR STUDY (FEET)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
UNNAMED TRIBUTARY NO. 3 TO JEROME CREEK									
A	1,950[1]	5	11	2.3	0	680.5	680.5	680.5	0.0
B	2,200[1]	40	98	0.3	0	680.5	680.5	680.5	0.0
C	2,395[1]	4	12	2.1	0	680.5	680.5	680.5	0.0
D	2,515[1]	4	17	1.4	0	680.5	680.5	680.5	0.0
E	2,556[1]	4	15	1.6	0	588.9	680.6	680.6	0.0
F	2,946[1]	20	40	0.8	0	680.7	680.7	680.7	0.0
G	4,429[1]	3	9	4.8	0	681.0	681.0	681.0	0.0
H	4,504[1]	3	10	4.3	0	681.9	681.9	681.9	0.0
I	4,984[1]	472	302	0.2	0	682.3	682.3	682.3	0.0
J	6,879[1]	37	33	1.7	0	683.4	683.4	683.4	0.0
K	7,059[1]	122	38	1.8	0	684.0	684.0	684.0	0.0
L	7,185[1]	130	56	1.0	0	684.3	684.3	684.3	0.0
M	7,755[1]	8	19	2.2	0	687.7	687.7	687.7	0.0
UNNAMED TRIBUTARY NO. 3 TO SALEM BRANCH BRIGHTON CREEK									
A	201[2]	*	*	*	*	756.8	*	*	*
B	623[2]	*	*	*	*	762.8	*	*	*
C	898[2]	*	*	*	*	769.2	*	*	*
D	1,119[2]	*	*	*	*	771.0	*	*	*
E	1,463[2]	*	*	*	*	775.4	*	*	*
F	2,656[2]	*	*	*	*	789.9	*	*	*

[1] FEET ABOVE CONFLUENCE WITH JEROME CREEK, [2] FEET ABOVE CONFLUENCE WITH SALEM BRANCH BRIGHTON CREEK, *DATA NOT AVAILABLE

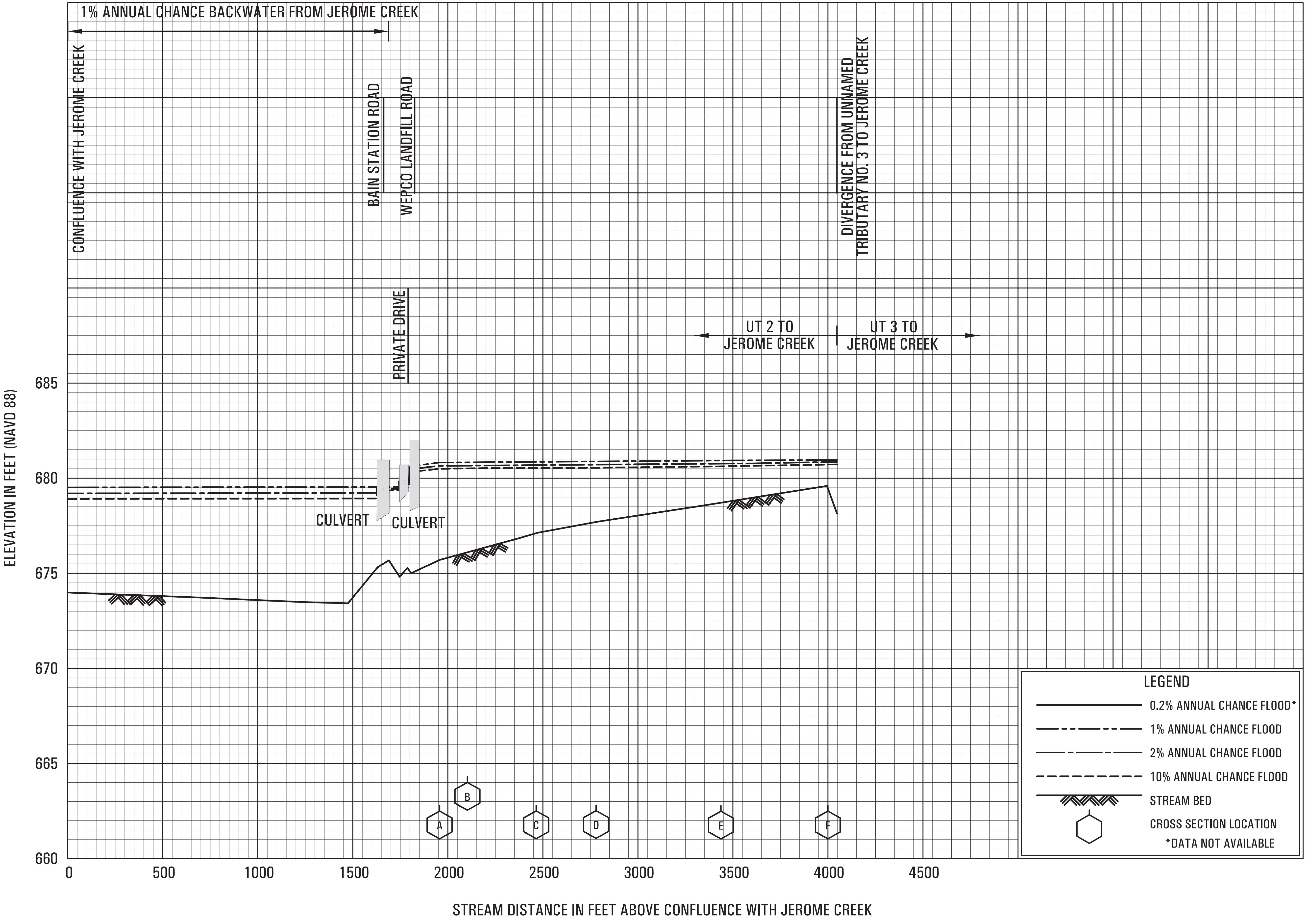
TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

KENOSHA COUNTY, WI
AND INCORPORATED AREAS

FLOODWAY DATA

UNNAMED TRIBUTARY NO. 3 TO JEROME CREEK - UNNAMED TRIBUTARY NO. 3 TO SALEM BRANCH BRIGHTON CREEK



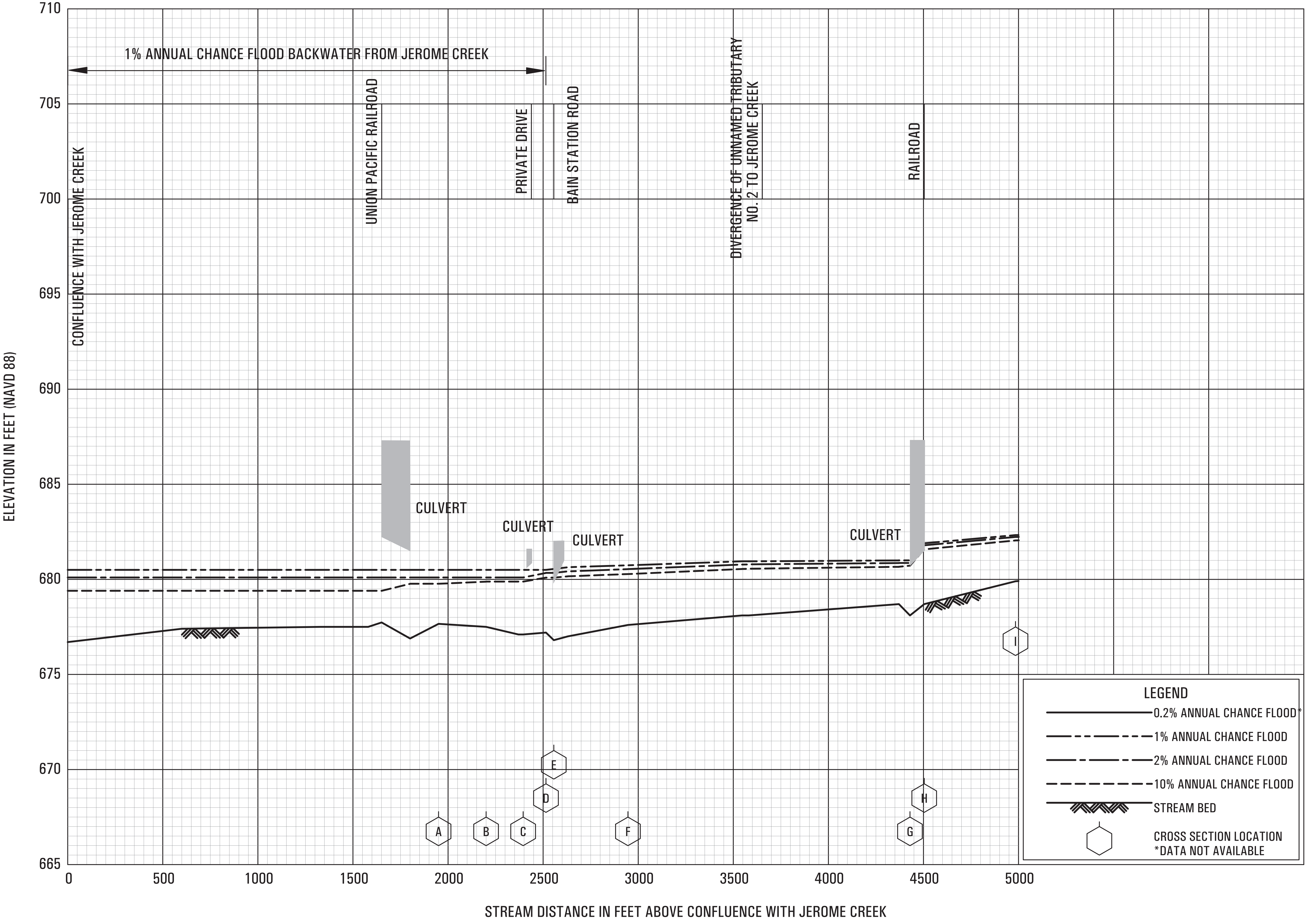
FLOOD PROFILES

UNNAMED TRIBUTARY NO. 2 TO JEROME CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

KENOSHA COUNTY, WI

AND INCORPORATED AREAS



FLOOD PROFILES

UNNAMED TRIBUTARY NO. 3 TO JEROME CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

KENOSHA COUNTY, WI

AND INCORPORATED AREAS

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) Report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS Report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study Report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study Report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study Report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 16N. The **horizontal datum** was NAD 83, GRS 1980 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713- 3242**, or visit its website at http://www.ngs.noaa.gov.

Base map information shown on this FIRM was derived from the National Agriculture Imagery Program's (NAIP) digital orthoimagery produced by the USDA, Farm Service Agency. The orthophoto was collected in the summer of 2005 and produced at a resolution of 1 meter.

The **profile baselines** depicted on this map represent the hydraulic modeling baselines that match the flood profiles in the FIS report. As a result of improved topographic data, the **profile baseline**, in some cases, may deviate significantly from the channel centerline or appear outside the SFHA.

Based on updated topographic information, this map reflects more detailed and up-to-date **stream channel configurations and floodplain delineations** than those shown on the previous FIRM for this jurisdiction. As a result, the Flood Profiles and Floodway Data tables for multiple streams in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on the map. Also, the road to floodplain relationships for unrevised streams may differ from what is shown on previous maps.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

For information on available products associated with this FIRM visit the **Map Service Center** (MSC) website at http://msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the MSC website.

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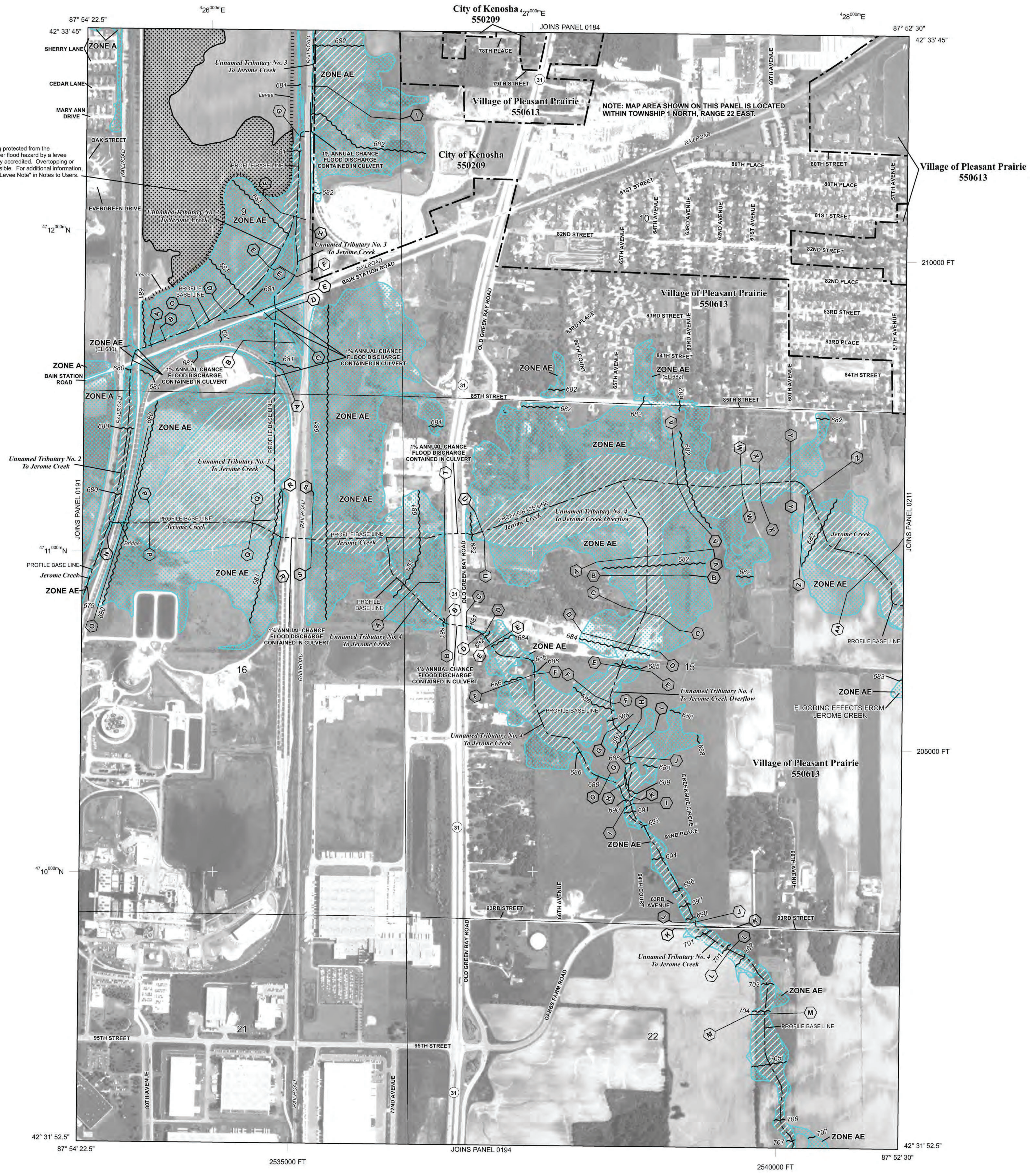

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LEGEND

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▨ FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

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☐ OTHER AREAS

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ZONE D	Areas in which flood hazards are undetermined, but possible.

▨ COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

▨ OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

———	1% Annual Chance Floodplain Boundary
———	0.2% Annual Chance Floodplain Boundary
— —	Floodway boundary
— — —	Zone D boundary
• • • • • • • • • • • • •	CBRS and OPA boundary
▨ ←	Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths, or flood velocities.
~~ 513 ~~~	Base Flood Elevation line and value; elevation in feet*
(EL 987)	Base Flood Elevation value where uniform within zone; elevation in feet*

*Referenced to the North American Vertical Datum of 1988

A ——— A	Cross section line
23 - - - - - 23	Transect line
- - - - - -	Culvert
	Bridge
45° 02' 08", 93° 02' 12"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83) Western Hemisphere
3100000 FT	5000-foot ticks: Wisconsin State Plane South Zone (FIPS Zone 4803), Lambert Conformal Conic projection
$^{49}89^{000m}$ N	1000-meter Universal Transverse Mercator grid values, zone 16N
DX5510 ×	Bench mark (see explanation in Notes to Users section of this FIRM panel)
• FT1,000	River Station

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
June 19, 2012

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

N

MAP SCALE 1" = 500'

250 0 500 1000 FEET
150 0 150 300 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0192D

FIRM
FLOOD INSURANCE RATE MAP
KENOSHA COUNTY, WISCONSIN
AND INCORPORATED AREAS

PANEL 192 OF 331
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
KENOSHA, CITY OF	550209	0192	D
PLEASANT PRAIRIE, VILLAGE OF	550613	0192	D

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
55059C0192D

EFFECTIVE DATE
JUNE 19, 2012

Federal Emergency Management Agency

Tab 4

44 CFR 65.10(b)(1)(iii); Coastal Levee Freeboard

44 CFR 65.10(b) (1) (iii) Tab

(iii) For coastal levees, the freeboard must be established at one foot above the height of the one percent wave or the maximum wave runup (whichever is greater) associated with the 100-year stillwater surge elevation at the site.

P.E. Signature: ______________________

Non Applicable: ______________________

P.E. Name: John M. Trast, P.E.

P.E. License Number and State: 31792-6 WI

TAB 4: 44 CFR 65.10(b)(1)(iii) – Coastal Levee Freeboard

44 CFR 65.10(b)(1)(iii) – Coastal Levee Freeboard

The Pleasant Prairie Ash Landfill Floodplain Levee was constructed in 2000 to prevent a portion of the We Energies owned property, permitted as landfill space, from being mapped within the 100-year floodplain of the Unnamed Tributary No. 2 and No. 3 to Jerome Creek. It is a riverine levee and the coastal levee freeboard requirements and exceptions are not applicable.

Tab 5

44 CFR 65.10(b)(1)(iv); Coastal Levee Freeboard Exception

44 CFR 65.10 (b) (1) (iv)

(iv) Occasionally, exceptions to the minimum coastal levee freeboard requirement described in paragraph (b)(1)(iii) of this section, may be approved. Appropriate engineering analyses demonstrating adequate protection with a lesser freeboard must be submitted to support a request for such an exception. The material presented must evaluate the uncertainty in the estimated base flood loading conditions. Particular emphasis must be placed on the effects of wave attack and overtopping on the stability of the levee. Under no circumstances, however, will a freeboard of less than two feet above the 100-year stillwater surge elevation be accepted.

P.E. Signature: ______________________

Non Applicable: ______________________

P.E. Name: John M. Trast, P.E.

P.E. License Number and State: 31792-6 WI

TAB 5: 44 CFR 65.10(b)(1)(iv) – Coastal Levee Freeboard Exception

44 CFR 65.10(b)(1)(iv) – Coastal Levee Freeboard Exception

The Pleasant Prairie Ash Landfill Floodplain Levee was constructed in 2000 to prevent a portion of the We Energies owned property, permitted as landfill space, from being mapped within the 100-year floodplain of the Unnamed Tributary No. 2 and No. 3 to Jerome Creek. It is a riverine levee and the coastal levee freeboard requirements and exceptions are not applicable.

Tab 6

44 CFR 65.10(b)(2); Closures

Tab 6

44 CFR 65.10 (b) (2) Tab

(2) *Closures.* All openings must be provided with closure devices that are structural parts of the system during operation and design according to sound engineering practice.

P.E. Signature: ______________________________

Non Applicable: ______________________________

P.E. Name: John M. Trast, P.E.

P.E. License Number and State: 31792-6 WI

TAB 6: 44 CFR 65.10(b)(2) – Closures

44 CFR 65.10(b)(2) – Closures

The Pleasant Prairie Ash Landfill Floodplain Levee includes four culverts to provide interior drainage. The outlet of each culvert is equipped with a self-closing valve. Culvert 1 has a Tideflex check valve. Culverts 2, 3, and 4 have Fontaine flap gate valves. Descriptions and photos of the closure devices are provided with the Annual Inspection Report which is appended to the Operations and Maintenance Plan provided in Tab 1: 44 CFR 65.10(b); Operation and Maintenance Systems. All closure devices are structural parts of the levee system and designed according to sound engineering practice.

Tab 7

44 CFR 65.10(b)(3); Embankment Protection

44 CFR 65.10 (b) (3) Tab

(3) *Embankment protection.* Engineering analyses must be submitted that demonstrate that no appreciable erosion of the levee embankment can be expected during the base flood, as a result of either currents or waves, and that anticipated erosion will not result in failure of the levee embankment or foundation directly or indirectly through reduction of the seepage path and subsequent instability. The factors to be addressed in such analyses include, but are not limited to: Expected flow velocities (especially in constricted areas); expected wind and wave action; ice loading; impact of debris; slope protection techniques; duration of flooding at various stages and velocities; embankment and foundation materials; levee alignment, bends, and transitions; and levee side slopes.

P.E. Signature: ______________________________

Non Applicable: ______________________________

P.E. Name: John M. Trast, P.E.

P.E. License Number and State: 31792-6 WI

AECOM

CALCULATION SHEET

Page 1 **Of** 5
Project No. 60218395
Client We Energies **Subject** Embankment Protection 44 CFR 65.10(b)(3)
Project Pleasant Prairie Ash Landfill Floodplain Levee Cert.
Prepared By MAB **Date** 04/2012
Reviewed By BKS **Date** 04/2012
Approved By JXT **Date** 05/2012

EMBANKMENT PROTECTION ANALYSIS

Objective

Verify that the Pleasant Prairie Ash Landfill Floodplain Levee meets the requirements of 44 CFR 65.10(b) (3) Embankment Protection:

Engineering analyses must be submitted that demonstrate that no appreciable erosion of the levee embankment can be expected during the base flood, as a result of either currents or waves, and that anticipated erosion will not result in failure of the levee embankment or foundation directly or indirectly through reduction of the seepage path and subsequent instability. The factors to be addressed in such analyses include, but are not limited to: Expected flow velocities (especially in constricted areas); expected wind and wave action; ice loading; impact of debris; slope protection techniques; duration of flooding at various stages and velocities; embankment and foundation materials; levee alignment, bends, and transitions; and levee side slopes.

Assumptions

1. The base flood elevation and velocities listed in the draft Flood Insurance Study effective June 2012 (FIS) will remain unchanged upon adoption of the study.

Calculations

Expected Flow Velocities
According to the FIS, flow velocities along the Pleasant Prairie Ash Landfill Floodplain Levee are less than 0.6 ft/s at all locations except where a 36-inch diameter culvert discharges near the levee to the northeast. The Pleasant Prairie Ash Landfill Floodplain Levee is constructed of compacted and vegetated native silty clay soil. According to Chow (1959), the maximum permissible velocity for bare compacted silty clay soil is approximately 3 ft/s. Therefore, no erosion of the Pleasant Prairie Ash Landfill Floodplain Levee is expected due to channel velocities.

The velocity at the outlet of the 36-inch diameter culvert may be calculated by:

$$Q=\frac{1.49}{n}R^{2/3}S_o^{1/2}A$$

Where:
Q = flowrate (cfs) = 41(from FIS)
n = Manning's number = 0.01 (concrete pipe)
R = hydraulic radius (ft)
S_o = friction slope (ft/ft) = 0.0068 (pipe slope from AECOM survey)
A = flow area (ft^2)

Solving iteratively for R and A yields:
R = 0.79 ft
A = 3.91 ft^2

Using the relationship V=Q/A yields a velocity of approximately 10.5 ft/s. A HEC-RAS computer model (USACE, 2010) was created to determine the approximate velocity at the Pleasant Prairie Ash Landfill Floodplain Levee due to this flow. The model required several input parameters including the ground geometry, flow expansion rate, starting conditions, and Manning's roughness values.

The model geometry was obtained from the AECOM survey.

A conservative assumption for the expansion rate of this flow is 4:1 (i.e. the width of flow increases 1 foot for every 4 feet along the direction of flow on each side of the culvert).

The downstream starting condition was assumed to be critical depth. This assumption resulted in the most conservative velocity calculation. The upstream starting condition and flow rate were determined from the pipe flow calculations above.

Manning's roughness values were determined from the HEC-RAS user's manual (USACE, 2010).

The velocity at the Pleasant Prairie Ash Landfill Floodplain Levee due to culvert discharge was determined to be approximately 2.87 ft/s. This velocity is not expected to cause erosion of the levee. Detailed HEC-RAS output is provided as Appendix A.

Wave Runup

Wave run-up is a function of several variables including wind speed, basin fetch, basin depth, and embankment slope.

The basin fetch for the Pleasant Prairie Ash Landfill Floodplain Levee is calculated as 0.44 miles or 2,325 feet as shown in Figure 2.

Wind speed in the vicinity of the levee is assumed to be similar to the one hour average wind speeds available from the Milwaukee International Airport. Data at this site from 1931 through 2008 was obtained from the Midwest Regional Climate Center. A Log-Pearson Type III distribution (USDA, 1998) was used with this data to determine the one hour wind speed for several recurrence intervals as shown on Table 1. From this table, the 1% annual chance wind speed was estimated to be 29.8 m/s which is approximately 97.8 ft/s or 66.7 miles/hr.

According to Figure 6-31 from Roberson et. al. (1998), the minimum time duration for wind to generate a wave acting in a reservoir with a fetch of 0.44 miles is approximately 8 minutes. According to the United Stated Army Corps of Engineers (USACE) Coastal Engineering Manual (2002) Figure II-2-1, wind speed for a given time duration in seconds, t, can be related with the following equation:

$$U_t/U_{1hr} = 1.277 + 0.296 \tanh \{0.9 \log_{10} (45/t)\}$$

For U_{1hr} = 66.7 miles/hr and t = 480 seconds (8 minutes), the revised design wind velocity is 70.8 miles/hr or 103.8 ft/s. The significant wave height, H, for this velocity is approximately 2.2 ft according to Figure 6-31 from Roberson et. al. (1998) as shown in Appendix B.

Before calculating run-up of the significant wave, the wind setup must first be established. According to Roberson et. al. (1998), vertical setup height, S, is defined as:

CALCULATION SHEET

Page 3 **Of** 5
Project No. 60218395

Client We Energies **Subject** Embankment Protection **Prepared By** MAB **Date** 04/2012
Project Pleasant Prairie Ash Landfill Floodplain Levee Cert. 44 CFR 65.10(b)(3) **Reviewed By** BKS **Date** 04/2012
Approved By JXT **Date** 05/2012

$$S=2.025 \times 10^{-6} \times \frac{V^2F}{gD}$$

Where:

V = Wind Velocity (ft/s) = 103.8
F = Fetch (ft) = 2,325
g = Gravitational Acceleration (ft/s^2) = 32.2
D = Average Basin Depth (ft) = 2 (from AECOM survey)

This equation yields a wind setup of 0.79 ft.

Wave runup is also a function of wave period (T) and wave length (L). These parameters are defined by Roberson et. al. (1998) as:

$$T=\frac{0.429V^{0.44}F^{0.28}}{g^{0.72}}$$

And

$$L = 0.159gT^2$$

Solving these equations for the problem parameters yields a wave period of 2.38 seconds and a wave length of 29.0 feet.

Figure 6-33 from Roberson et. al. (1998), shows the relationship between embankment slope, H/L, and relative runup (R/H), where R is equal to the vertical runup height. The embankment slope of the Pleasant Prairie Ash Landfill Floodplain Levee is approximately 1:3 based on the AECOM survey. H/L is calculated as 0.076 based on the problem parameters. Using Figure 6-33, the relative runup is determined to be:

$$R/H = 1.45$$

As shown in Appendix B. Therefore:

$$R = 1.45H = 1.45(2.2) = 3.19 \text{ ft}$$

The total runup distance for the Pleasant Prairie Ash Landfill Floodplain Levee is the runup plus the setup:

Total Runup Height = 3.19 + 0.79 = 3.98 ft

The minimum height of the Pleasant Prairie Ash Landfill Floodplain Levee is approximately 4.3 feet.

Other Erosive Factors

Ice Loading: Due to the low flow rate in the vicinity of the Pleasant Prairie Ash Landfill Floodplain Levee during normal conditions, it is highly unlikely that significant ice loading will occur near the Levee.

Impact of Debris: The unnamed tributary that runs adjacent to the Pleasant Prairie Ash Landfill Floodplain Levee is restricted at the upstream end by a culvert. This culvert will tend to prevent significant debris from being transported downstream to the vicinity of the levee.

Slope Protection: The Pleasant Prairie Ash Landfill Floodplain Levee Slopes are composed of native soil with grass vegetation. Due to the low velocities described above, no additional protection is required.

Duration of Flooding: Flood water duration is not expected to contribute to the erosion of the Pleasant Prairie Ash Landfill Floodplain Levee as the water is not predicted to reach elevations where significant seepage would occur, nor will it be flowing at erosive velocities.

Levee Materials and Geometry: The levee is composed of native clay that is not expected to erode at predicted flow velocities. Although the levee has many bends, the low velocities are not expected to produce significant eddy currents that would cause erosion of the levee. The side slopes of the levee are 1H:3V or flatter and are not expected to erode at the low predicted flow velocities.

Conclusions

These calculations have analyzed the potential erosion of the Pleasant Prairie Ash Landfill Floodplain Levee due to flow velocities, wind and wave action, and other minor factors. The calculations have shown that the Pleasant Prairie Ash Landfill Floodplain Levee should not experience significant erosion under expected conditions.

References

Chow, V.T. (1959). *Open-Channel Hydraulics*. New York, New York: McGraw-Hill.

Federal Emergency Management Agency. (2012). *Flood Insurance Study – Kenosha County, Wisconsin and Incorporated Areas, Effective June 2012*. Federal Emergency Management Agency. Retrieved January 19, 2012 from ftp://ftp.wi.gov/DNR/shared/floodplain/Temporary/To_Kenosha/FIS

Roberson, J.A., Cassidy, J.J., & Chaudhry, M.H. (1998). *Hydraulic Engineering, 2nd Edition.* New York, New York: John Wiley and Sons, Inc.

United States Army Corps of Engineers. (2002). *Coastal Engineering Manual* (EM 1110-2-1100). Washington, DC: United States Army Corps of Engineers.

United States Army Corps of Engineers. (2010). *HEC-RAS River Analysis System User's Manual.* Davis, California: United States Army Corps of Engineers – Hydraulic Engineering Center.

United States Department of Agriculture. (1998). *Tables of Percentage Points of the Pearson Type III Distribution – Technical Release 38.* United States Department of Agriculture.

TABLES

Table 1
Milwaukee Airport Wind Data - Log Pearson Type III Analysis

Milwaukee Wind Data		
Date	Speed (m/s)	Log(Speed)
1931	22.5	1.352
1932	18.9	1.276
1933	18.9	1.276
1934	20.3	1.307
1935	20.7	1.316
1936	20.3	1.307
1937	20.3	1.307
1938	20.3	1.307
1939	18.0	1.255
1940	30.6	1.486
1941	19.4	1.288
1942	21.6	1.334
1943	24.3	1.386
1944	23.4	1.369
1945	27.5	1.439
1946	24.3	1.386
1947	26.1	1.417
1948	24.7	1.393
1949	21.1	1.324
1950	25.2	1.401
1951	18.5	1.267
1952	23.2	1.365
1953	22.1	1.344
1954	22.7	1.356
1955	22.1	1.344
1956	20.6	1.314
1957	19.6	1.292
1958	20.1	1.303
1959	17.5	1.243
1960	20.6	1.314
1961	18.0	1.255
1962	14.9	1.173
1963	20.6	1.314
1964	18.0	1.255
1973	15.5	1.190

Milwaukee Wind Data		
Date	Speed (m/s)	Log(Speed)
1974	19.6	1.292
1975	20.1	1.303
1976	17.0	1.230
1977	25.8	1.412
1978	18.5	1.267
1979	25.8	1.412
1980	19.6	1.292
1981	16.5	1.217
1982	20.6	1.314
1983	19.1	1.281
1984	19.1	1.281
1985	16.5	1.217
1986	15.5	1.190
1987	18.0	1.255
1988	17.0	1.230
1989	19.6	1.292
1990	17.5	1.243
1991	16.0	1.204
1992	15.5	1.190
1993	17.0	1.230
1994	15.5	1.190
1995	15.5	1.190
1996	18.5	1.267
1997	17.5	1.243
1998	22.7	1.356
1999	18.5	1.267
2000	14.4	1.158
2001	18.5	1.267
2002	12.9	1.111
2003	16.5	1.217
2004	16.0	1.204
2005	15.5	1.190
2006	15.9	1.201
2007	16.5	1.217
2008	14.4	1.158

Statistics		
Mean	S.D.	Skew
1.284	0.075	0.275

Log Pearson Analysis (Speed=10^(Mean+S.D.*K_T)				
	10-yr	50-yr	100-yr	500-yr
K_T	1.30732	2.19820	2.52658	3.21381
Speed (m/s)	24.1	28.1	29.8	33.6

APPENDIX A

HEC-RAS Output

```
                         HEC-RAS Version 4.1.0 Jan 2010
                          U.S. Army Corps of Engineers
                         Hydrologic Engineering Center
                               609 Second Street
                               Davis, California

            X     X  XXXXXX    XXXX        XXXX       XX      XXXX
            X     X  X        X    X       X   X     X  X    X
            X     X  X        X            X   X    X    X   X
            XXXXXXX  XXXX     X       XXX  XXXX     XXXXXX    XXXX
            X     X  X        X            X  X     X    X        X
            X     X  X        X    X       X   X    X    X        X
            X     X  XXXXXX    XXXX        X    X   X    X   XXXXX



PROJECT DATA
Project Title: Culvert
Project File : Culvert.prj
Run Date and Time: 5/25/2012 10:24:38 AM

Project in English units



PLAN DATA

Plan Title: Plan 01
Plan File : g:\01dept03\Users\BakerMichael\60218395\HEC-RAS\Culvert.p01

           Geometry Title: geometry
           Geometry File : g:\01dept03\Users\BakerMichael\60218395\HEC-RAS\Culvert.g01

           Flow Title    : steady
           Flow File     : g:\01dept03\Users\BakerMichael\60218395\HEC-RAS\Culvert.f01

Plan Summary Information:
Number of:  Cross Sections =    7    Multiple Openings  =    0
            Culverts       =    0    Inline Structures  =    0
            Bridges        =    0    Lateral Structures =    0

Computational Information
    Water surface calculation tolerance  =  0.01
    Critical depth calculation tolerance =  0.01
    Maximum number of iterations         =  20
    Maximum difference tolerance         =  0.3
    Flow tolerance factor                =  0.001

Computation Options
    Critical depth computed only where necessary
    Conveyance Calculation Method: At breaks in n values only
    Friction Slope Method:         Average Conveyance
    Computational Flow Regime:     Mixed Flow



FLOW DATA

Flow Title: steady
Flow File : g:\01dept03\Users\BakerMichael\60218395\HEC-RAS\Culvert.f01

Flow Data (cfs)

  River           Reach           RS                   PF 1
  culvert         culvert         114                    41


Boundary Conditions

  River           Reach           Profile                      Upstream                 Downstream

  culvert         culvert         PF 1                     Known WS = 683.39         Known WS = 682.1
```

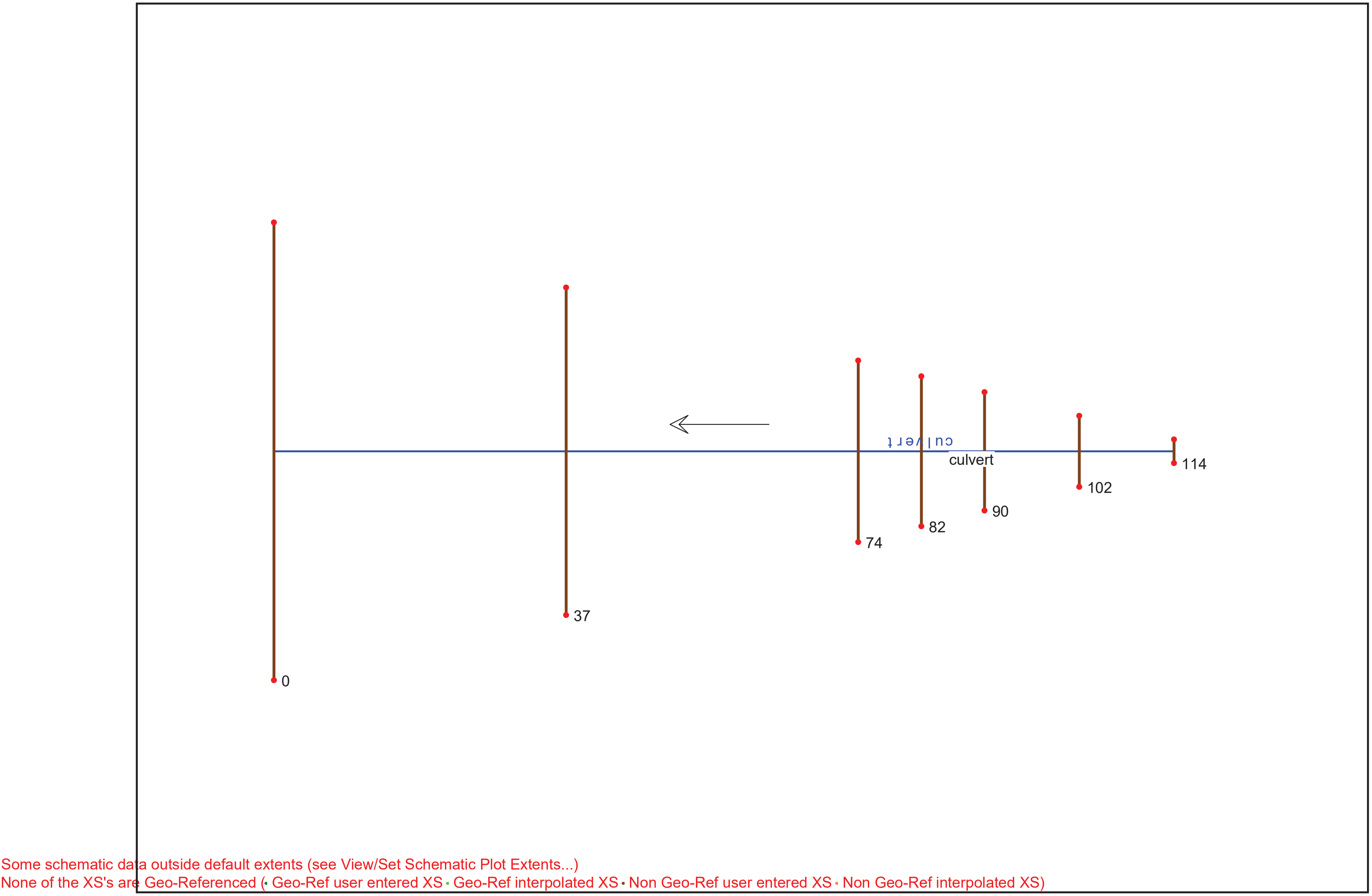
```
GEOMETRY DATA

Geometry Title: geometry
Geometry File : g:\01dept03\Users\BakerMichael\60218395\HEC-RAS\Culvert.g01

CROSS SECTION


RIVER: culvert
REACH: culvert            RS: 114

INPUT
Description: 114
Station Elevation Data    num=      33
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0     685       0  683.26      .1  682.72      .2  682.51      .3  682.36
      .4  682.24      .5  682.14      .6  682.06      .7  681.99      .8  681.93
      .9  681.89       1  681.85     1.1  681.81     1.2  681.79     1.3  681.77
     1.4  681.76     1.5  681.76     1.6  681.76     1.7  681.77     1.8  681.79
     1.9  681.81       2  681.85     2.1  681.89     2.2  681.93     2.3  681.99
     2.4  682.06     2.5  682.14     2.6  682.24     2.7  682.36     2.8  682.51
     2.9  682.72       3  683.26       3     685

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .03       0     .03       3     .03

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
             0       3               12      12      12             .3      .5

CROSS SECTION OUTPUT  Profile #PF 1

  E.G. Elev (ft)            685.10    Element                   Left OB    Channel   Right OB
  Vel Head (ft)               1.71    Wt. n-Val.                            0.030
  W.S. Elev (ft)            683.39    Reach Len. (ft)            12.00      12.00      12.00
  Crit W.S. (ft)            683.88    Flow Area (sq ft)                      3.90
  E.G. Slope (ft/ft)      0.061993    Area (sq ft)                           3.90
  Q Total (cfs)              41.00    Flow (cfs)                            41.00
  Top Width (ft)              3.00    Top Width (ft)                         3.00
  Vel Total (ft/s)           10.50    Avg. Vel. (ft/s)                      10.50
  Max Chl Dpth (ft)           1.63    Hydr. Depth (ft)                       1.30
  Conv. Total (cfs)          164.7    Conv. (cfs)                           164.7
  Length Wtd. (ft)           12.00    Wetted Per. (ft)                       4.97
  Min Ch El (ft)            681.76    Shear (lb/sq ft)                       3.04
  Alpha                       1.00    Stream Power (lb/ft s)      3.00       0.00       0.00
  Frctn Loss (ft)                     Cum Volume (acre-ft)                   0.06
  C & E Loss (ft)                     Cum SA (acres)                         0.08


CROSS SECTION


RIVER: culvert
REACH: culvert            RS: 102

INPUT
Description: 102
Station Elevation Data    num=       3
     Sta    Elev     Sta    Elev     Sta    Elev
       0   680.1     4.5     680       9   680.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .03       0     .03       9     .03

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
             0       9               12      12      12             .1      .3

CROSS SECTION OUTPUT  Profile #PF 1

  E.G. Elev (ft)            682.85    Element                   Left OB    Channel   Right OB
  Vel Head (ft)               0.04    Wt. n-Val.                            0.030
  W.S. Elev (ft)            682.81    Reach Len. (ft)            12.00      12.00      12.00
  Crit W.S. (ft)            680.91    Flow Area (sq ft)                     24.81
  E.G. Slope (ft/ft)      0.000540    Area (sq ft)                          24.81
  Q Total (cfs)              41.00    Flow (cfs)                            41.00
  Top Width (ft)              9.00    Top Width (ft)                         9.00
  Vel Total (ft/s)            1.65    Avg. Vel. (ft/s)                       1.65
```

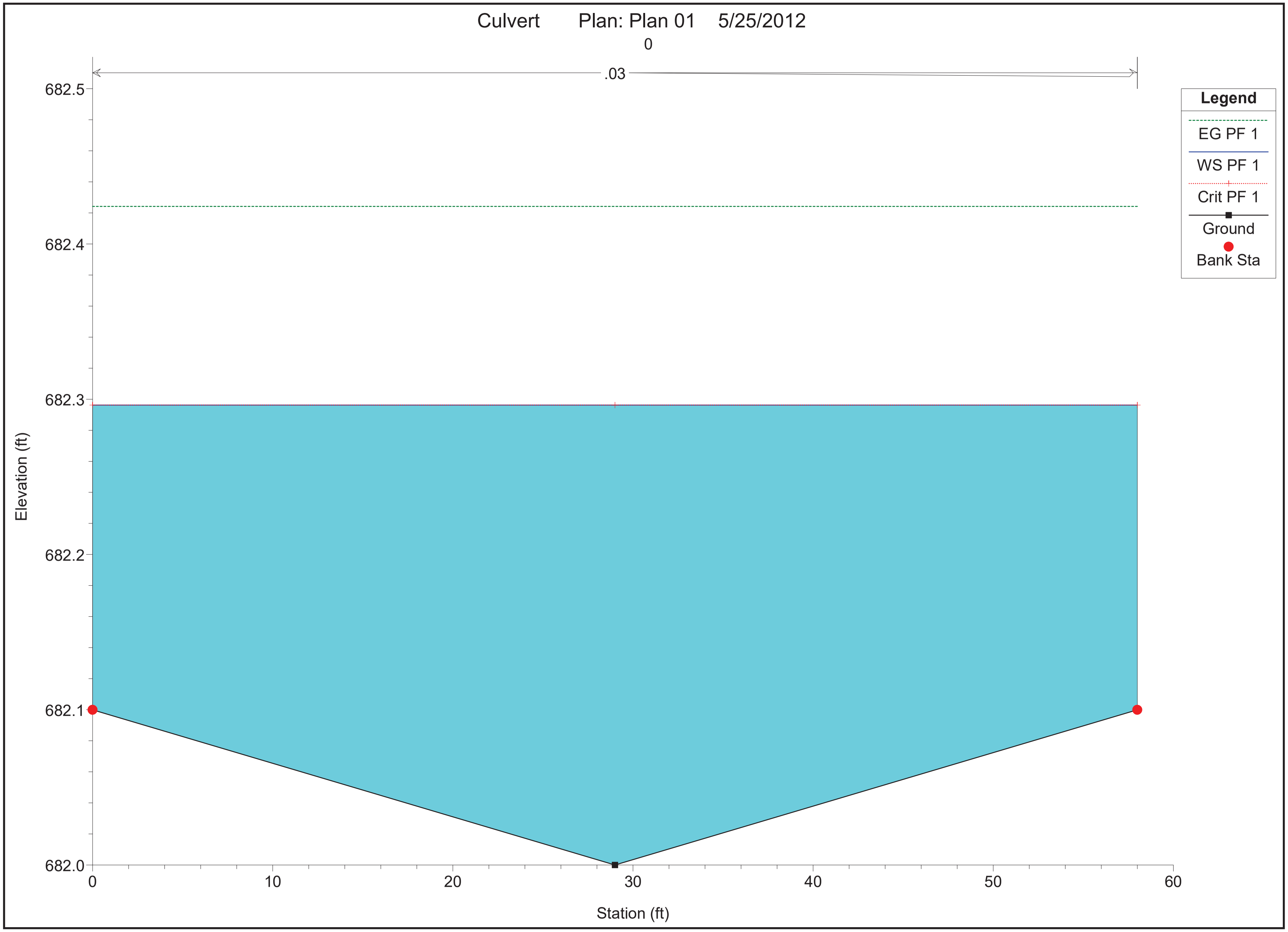
```
  Max Chl Dpth (ft)           2.81    Hydr. Depth (ft)                       2.76
  Conv. Total (cfs)         1764.6    Conv. (cfs)                          1764.6
  Length Wtd. (ft)           12.00    Wetted Per. (ft)                      14.42
  Min Ch El (ft)            680.00    Shear (lb/sq ft)                       0.06
  Alpha                       1.00    Stream Power (lb/ft s)      9.00       0.00       0.00
  Frctn Loss (ft)             0.00    Cum Volume (acre-ft)                   0.06
  C & E Loss (ft)             0.01    Cum SA (acres)                         0.08


Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or
greater than 1.4.
          This may indicate the need for additional cross sections.
Note:    Hydraulic jump has occurred between this cross section and the previous upstream section.

CROSS SECTION


RIVER: culvert
REACH: culvert            RS: 90

INPUT
Description: 90
Station Elevation Data    num=       3
     Sta    Elev     Sta    Elev     Sta    Elev
       0   680.1     7.5     680      15   680.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .03       0     .03      15     .03

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
             0      15                8       8       8             .1       .3

CROSS SECTION OUTPUT  Profile #PF 1

  E.G. Elev (ft)            682.84    Element                    Left OB    Channel   Right OB
  Vel Head (ft)               0.02    Wt. n-Val.                             0.030
  W.S. Elev (ft)            682.82    Reach Len. (ft)             8.00       8.00       8.00
  Crit W.S. (ft)                      Flow Area (sq ft)                     41.58
  E.G. Slope (ft/ft)      0.000154    Area (sq ft)                          41.58
  Q Total (cfs)              41.00    Flow (cfs)                            41.00
  Top Width (ft)             15.00    Top Width (ft)                        15.00
  Vel Total (ft/s)            0.99    Avg. Vel. (ft/s)                       0.99
  Max Chl Dpth (ft)           2.82    Hydr. Depth (ft)                       2.77
  Conv. Total (cfs)         3306.4    Conv. (cfs)                          3306.4
  Length Wtd. (ft)            8.00    Wetted Per. (ft)                      20.45
  Min Ch El (ft)            680.00    Shear (lb/sq ft)                       0.02
  Alpha                       1.00    Stream Power (lb/ft s)     15.00       0.00       0.00
  Frctn Loss (ft)             0.00    Cum Volume (acre-ft)                   0.05
  C & E Loss (ft)             0.00    Cum SA (acres)                         0.08


Warning: The cross-section end points had to be extended vertically for the computed water surface.

CROSS SECTION


RIVER: culvert
REACH: culvert            RS: 82

INPUT
Description: 82
Station Elevation Data    num=       3
     Sta    Elev     Sta    Elev     Sta    Elev
       0   680.1     9.5     680      19   680.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .03       0     .03      19     .03

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
             0      19                8       8       8             .1       .3

CROSS SECTION OUTPUT  Profile #PF 1

  E.G. Elev (ft)            682.83    Element                    Left OB    Channel   Right OB
  Vel Head (ft)               0.01    Wt. n-Val.                             0.030
  W.S. Elev (ft)            682.83    Reach Len. (ft)             8.00       8.00       8.00
```

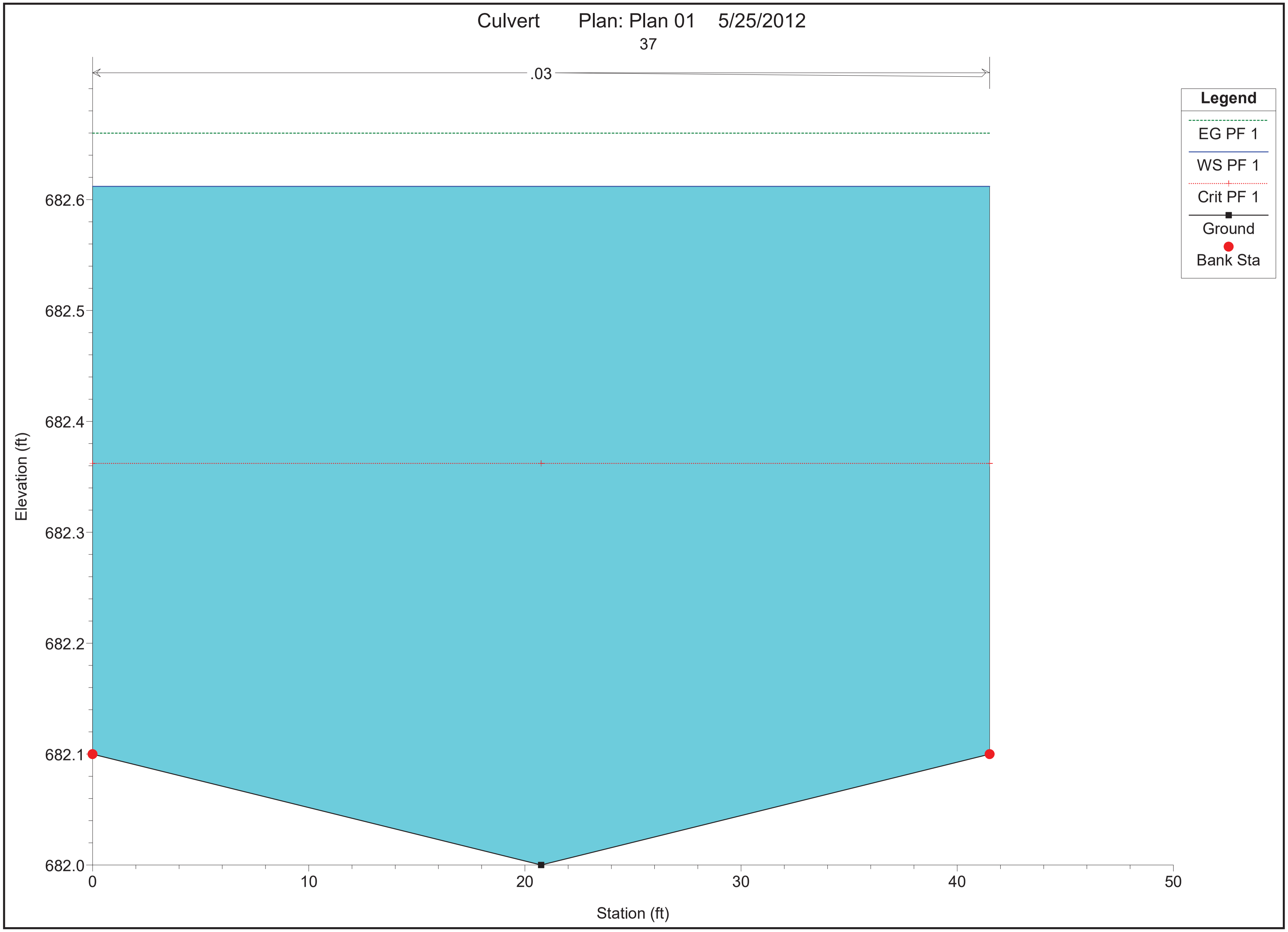
```
  Crit W.S. (ft)                      Flow Area (sq ft)                     52.73
  E.G. Slope (ft/ft)      0.000088    Area (sq ft)                          52.73
  Q Total (cfs)              41.00    Flow (cfs)                            41.00
  Top Width (ft)             19.00    Top Width (ft)                        19.00
  Vel Total (ft/s)            0.78    Avg. Vel. (ft/s)                       0.78
  Max Chl Dpth (ft)           2.83    Hydr. Depth (ft)                       2.78
  Conv. Total (cfs)         4359.6    Conv. (cfs)                          4359.6
  Length Wtd. (ft)            8.00    Wetted Per. (ft)                      24.45
  Min Ch El (ft)            680.00    Shear (lb/sq ft)                       0.01
  Alpha                       1.00    Stream Power (lb/ft s)     19.00       0.00       0.00
  Frctn Loss (ft)             0.00    Cum Volume (acre-ft)                   0.04
  C & E Loss (ft)             0.01    Cum SA (acres)                         0.07


Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or
greater than 1.4.
          This may indicate the need for additional cross sections.

CROSS SECTION


RIVER: culvert
REACH: culvert            RS: 74

INPUT
Description: 74
Station Elevation Data    num=       3
     Sta    Elev     Sta    Elev     Sta    Elev
       0   682.1    11.5     682      23   682.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .03       0     .03      23     .03

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
             0      23               37      37      37             .1       .3

CROSS SECTION OUTPUT  Profile #PF 1

  E.G. Elev (ft)            682.82    Element                   Left OB    Channel   Right OB
  Vel Head (ft)               0.11    Wt. n-Val.                            0.030
  W.S. Elev (ft)            682.71    Reach Len. (ft)            37.00      37.00      37.00
  Crit W.S. (ft)                      Flow Area (sq ft)                     15.14
  E.G. Slope (ft/ft)      0.005597    Area (sq ft)                          15.14
  Q Total (cfs)              41.00    Flow (cfs)                            41.00
  Top Width (ft)             23.00    Top Width (ft)                        23.00
  Vel Total (ft/s)            2.71    Avg. Vel. (ft/s)                       2.71
  Max Chl Dpth (ft)           0.71    Hydr. Depth (ft)                       0.66
  Conv. Total (cfs)          548.0    Conv. (cfs)                           548.0
  Length Wtd. (ft)           37.00    Wetted Per. (ft)                      24.22
  Min Ch El (ft)            682.00    Shear (lb/sq ft)                       0.22
  Alpha                       1.00    Stream Power (lb/ft s)     23.00       0.00       0.00
  Frctn Loss (ft)             0.14    Cum Volume (acre-ft)                   0.03
  C & E Loss (ft)             0.02    Cum SA (acres)                         0.07


Warning: The cross-section end points had to be extended vertically for the computed water surface.

CROSS SECTION


RIVER: culvert
REACH: culvert            RS: 37

INPUT
Description: 37
Station Elevation Data    num=       3
     Sta    Elev     Sta    Elev     Sta    Elev
       0   682.1   20.75     682    41.5   682.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .03       0     .03    41.5     .03

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
             0    41.5               37      37      37             .1       .3

CROSS SECTION OUTPUT  Profile #PF 1
```

```
  E.G. Elev (ft)            682.66    Element                   Left OB    Channel   Right OB
  Vel Head (ft)               0.05    Wt. n-Val.                            0.030
  W.S. Elev (ft)            682.61    Reach Len. (ft)            37.00      37.00      37.00
  Crit W.S. (ft)            682.36    Flow Area (sq ft)                     23.32
  E.G. Slope (ft/ft)      0.002807    Area (sq ft)                          23.32
  Q Total (cfs)              41.00    Flow (cfs)                            41.00
  Top Width (ft)             41.50    Top Width (ft)                        41.50
  Vel Total (ft/s)            1.76    Avg. Vel. (ft/s)                       1.76
  Max Chl Dpth (ft)           0.61    Hydr. Depth (ft)                       0.56
  Conv. Total (cfs)          773.9    Conv. (cfs)                           773.9
  Length Wtd. (ft)           37.00    Wetted Per. (ft)                      42.52
  Min Ch El (ft)            682.00    Shear (lb/sq ft)                       0.10
  Alpha                       1.00    Stream Power (lb/ft s)     41.50       0.00       0.00
  Frctn Loss (ft)             0.23    Cum Volume (acre-ft)                   0.02
  C & E Loss (ft)             0.01    Cum SA (acres)                         0.04

Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or
greater than 1.4.
          This may indicate the need for additional cross sections.

CROSS SECTION


RIVER: culvert
REACH: culvert            RS: 0

INPUT
Description: 0
Station Elevation Data    num=       3
     Sta   Elev      Sta    Elev     Sta    Elev
       0   682.1      29     682      58   682.1

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .03       0     .03      58     .03

Bank Sta: Left   Right    Coeff Contr.   Expan.
             0      58             .1       .3

CROSS SECTION OUTPUT  Profile #PF 1

  E.G. Elev (ft)            682.42    Element                   Left OB    Channel   Right OB
  Vel Head (ft)               0.13    Wt. n-Val.                            0.030
  W.S. Elev (ft)            682.30    Reach Len. (ft)
  Crit W.S. (ft)            682.30    Flow Area (sq ft)                     14.28
  E.G. Slope (ft/ft)      0.021969    Area (sq ft)                          14.28
  Q Total (cfs)              41.00    Flow (cfs)                            41.00
  Top Width (ft)             58.00    Top Width (ft)                        58.00
  Vel Total (ft/s)            2.87    Avg. Vel. (ft/s)                       2.87
  Max Chl Dpth (ft)           0.30    Hydr. Depth (ft)                       0.25
  Conv. Total (cfs)          276.6    Conv. (cfs)                           276.6
  Length Wtd. (ft)                    Wetted Per. (ft)                      58.39
  Min Ch El (ft)            682.00    Shear (lb/sq ft)                       0.34
  Alpha                       1.00    Stream Power (lb/ft s)     58.00       0.00       0.00
  Frctn Loss (ft)                     Cum Volume (acre-ft)
  C & E Loss (ft)                     Cum SA (acres)


Warning: User specified water surface is not possible for the specified flow regime. The program used
critical depth as the
         starting water surface.



SUMMARY OF MANNING'S N VALUES

River:culvert

      Reach          River Sta.       n1        n2        n3

 culvert              114                .03       .03       .03
 culvert              102                .03       .03       .03
 culvert              90                 .03       .03       .03
 culvert              82                 .03       .03       .03
 culvert              74                 .03       .03       .03
 culvert              37                 .03       .03       .03
```

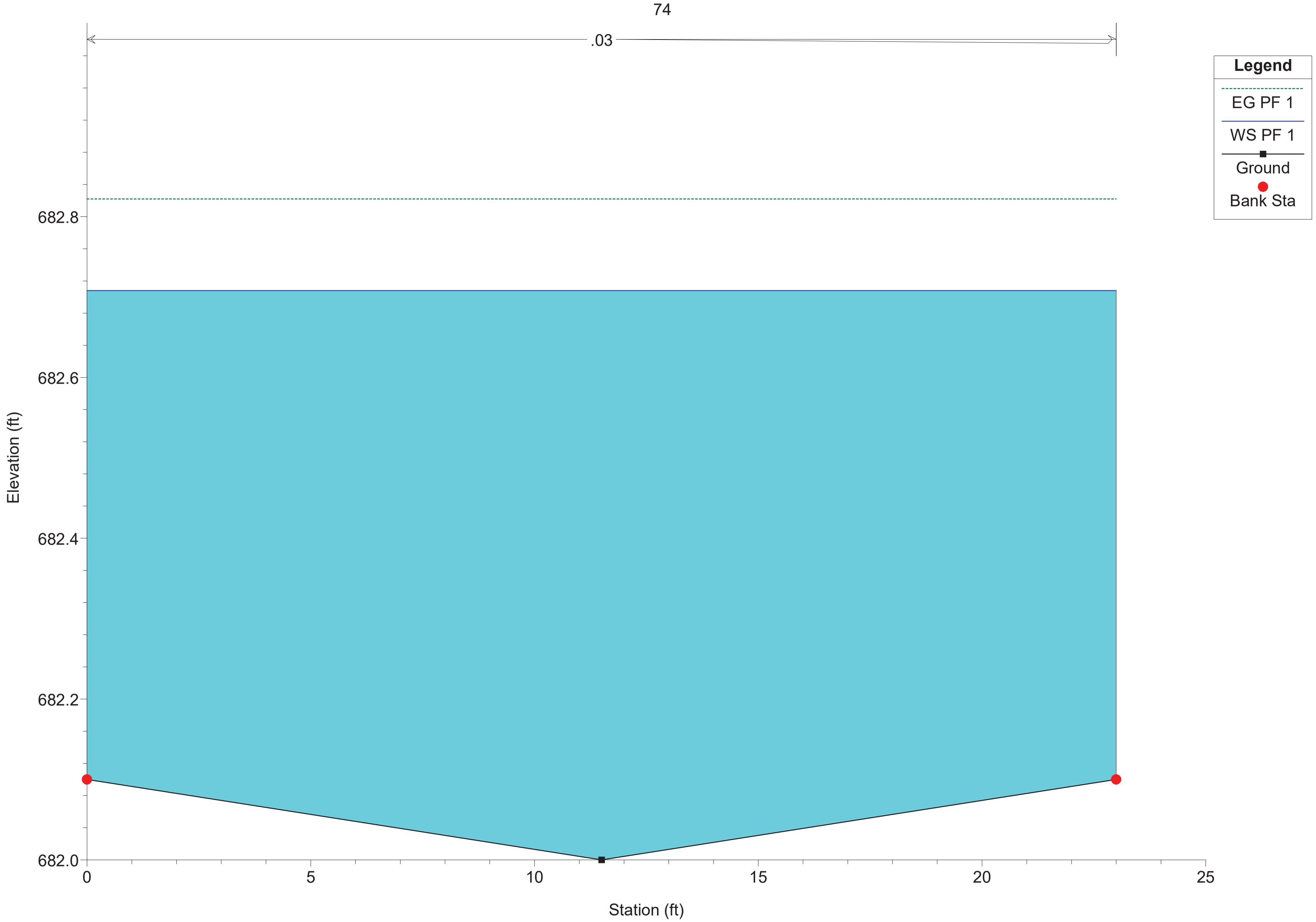
```
 culvert              0                   .03       .03       .03



SUMMARY OF REACH LENGTHS

River: culvert

      Reach          River Sta.      Left     Channel    Right

 culvert              114                  12        12        12
 culvert              102                  12        12        12
 culvert              90                    8         8         8
 culvert              82                    8         8         8
 culvert              74                   37        37        37
 culvert              37                   37        37        37
 culvert              0



SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: culvert


      Reach          River Sta.     Contr.    Expan.

 culvert              114              .3        .5
 culvert              102              .1        .3
 culvert              90               .1        .3
 culvert              82               .1        .3
 culvert              74               .1        .3
 culvert              37               .1        .3
 culvert              0                .1        .3
```

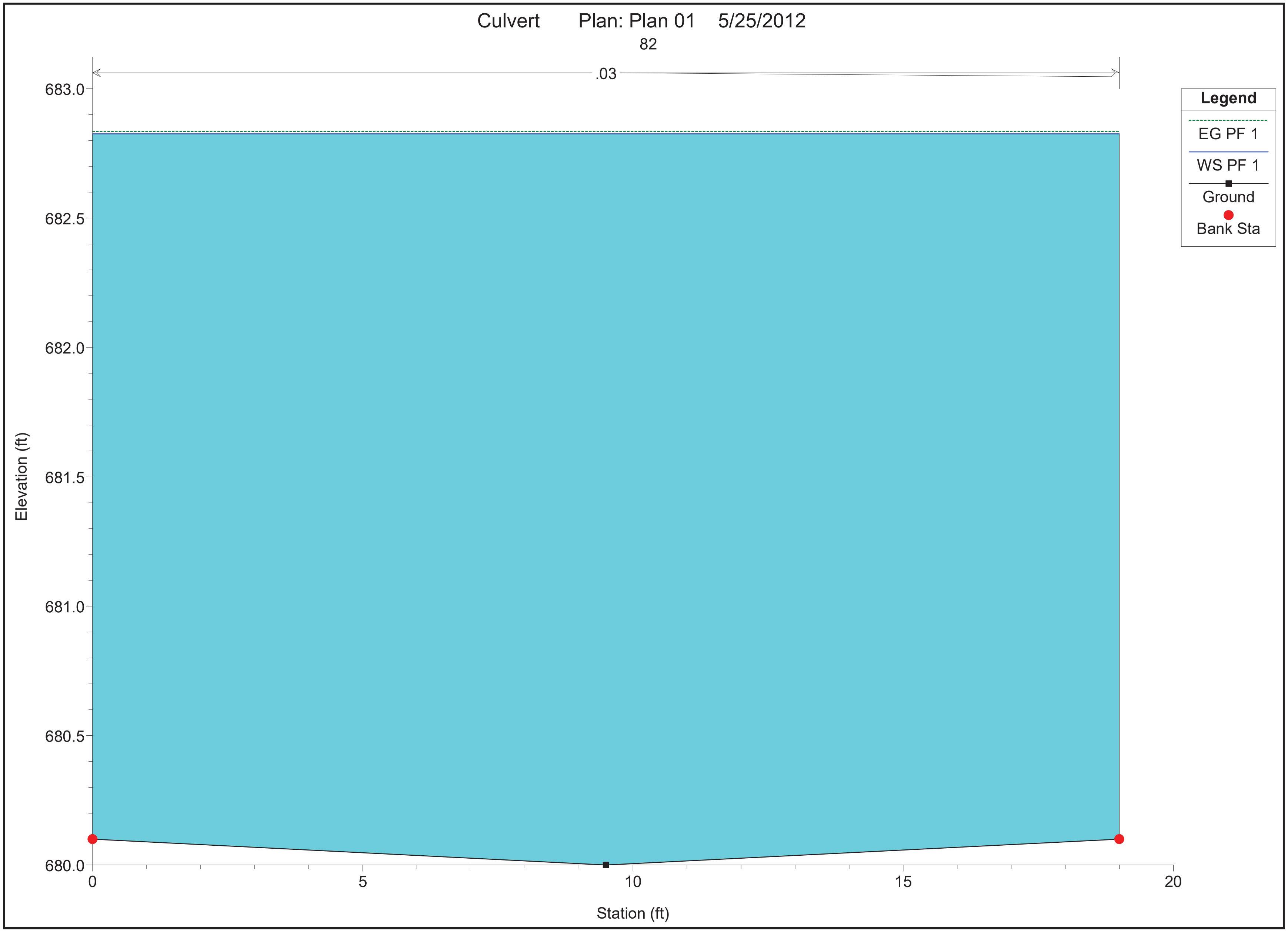

0
37
74
82
90
102
114
culvert
culvert
Some schematic data outside default extents (see View/Set Schematic Plot Extents...)
None of the XS's are Geo-Referenced (Geo-Ref user entered XS · Geo-Ref interpolated XS · Non Geo-Ref user entered XS · Non Geo-Ref interpolated XS)


Culvert Plan: Plan 01 5/25/2012


Culvert Plan: Plan 01 5/25/2012
37
.03
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
682.6
682.5
682.4
682.3
682.2
682.1
682.0
0
10
20
30
40
50
Station (ft)

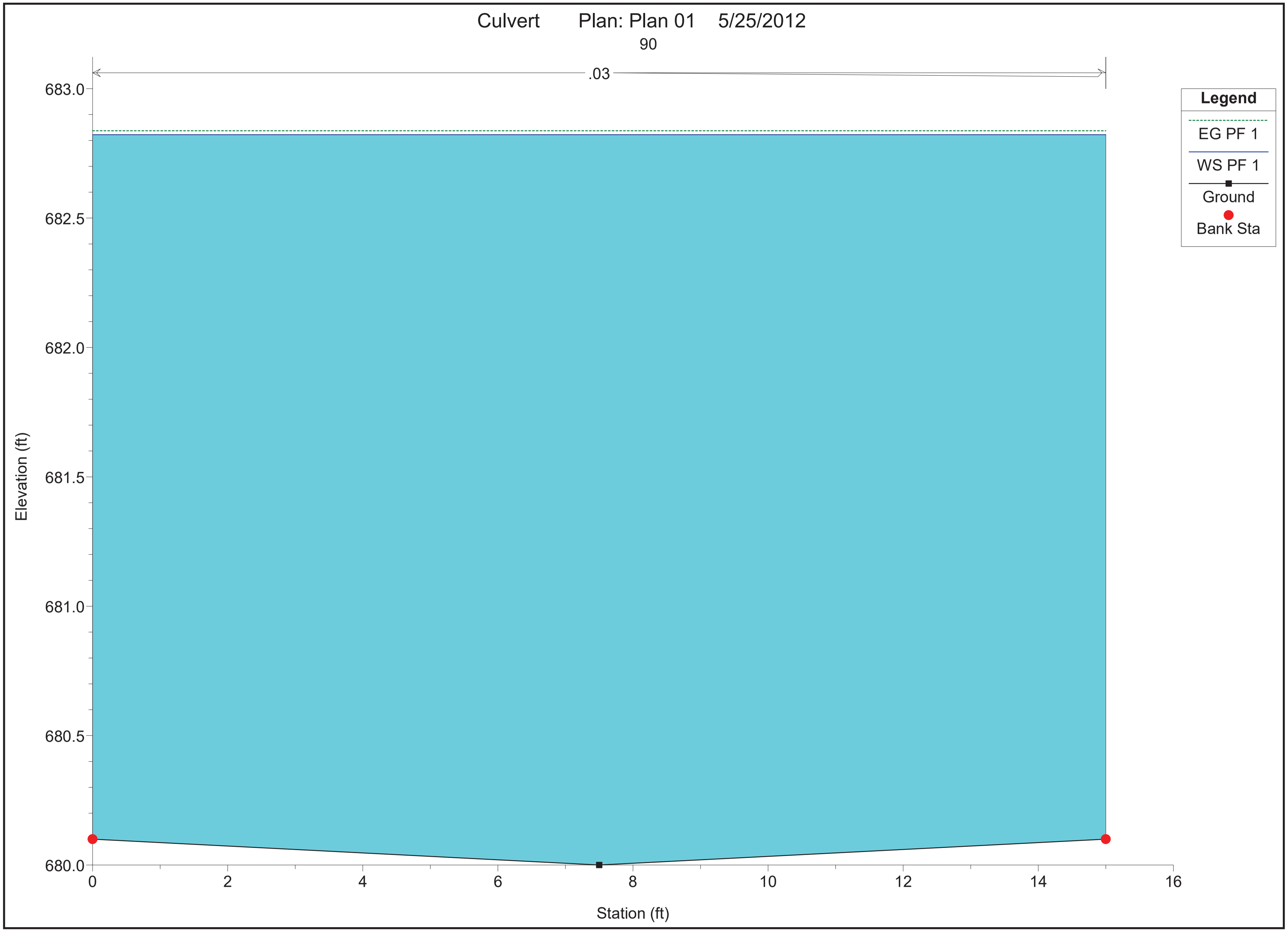
Culvert Plan: Plan 01 5/25/2012





Culvert Plan: Plan 01 5/25/2012

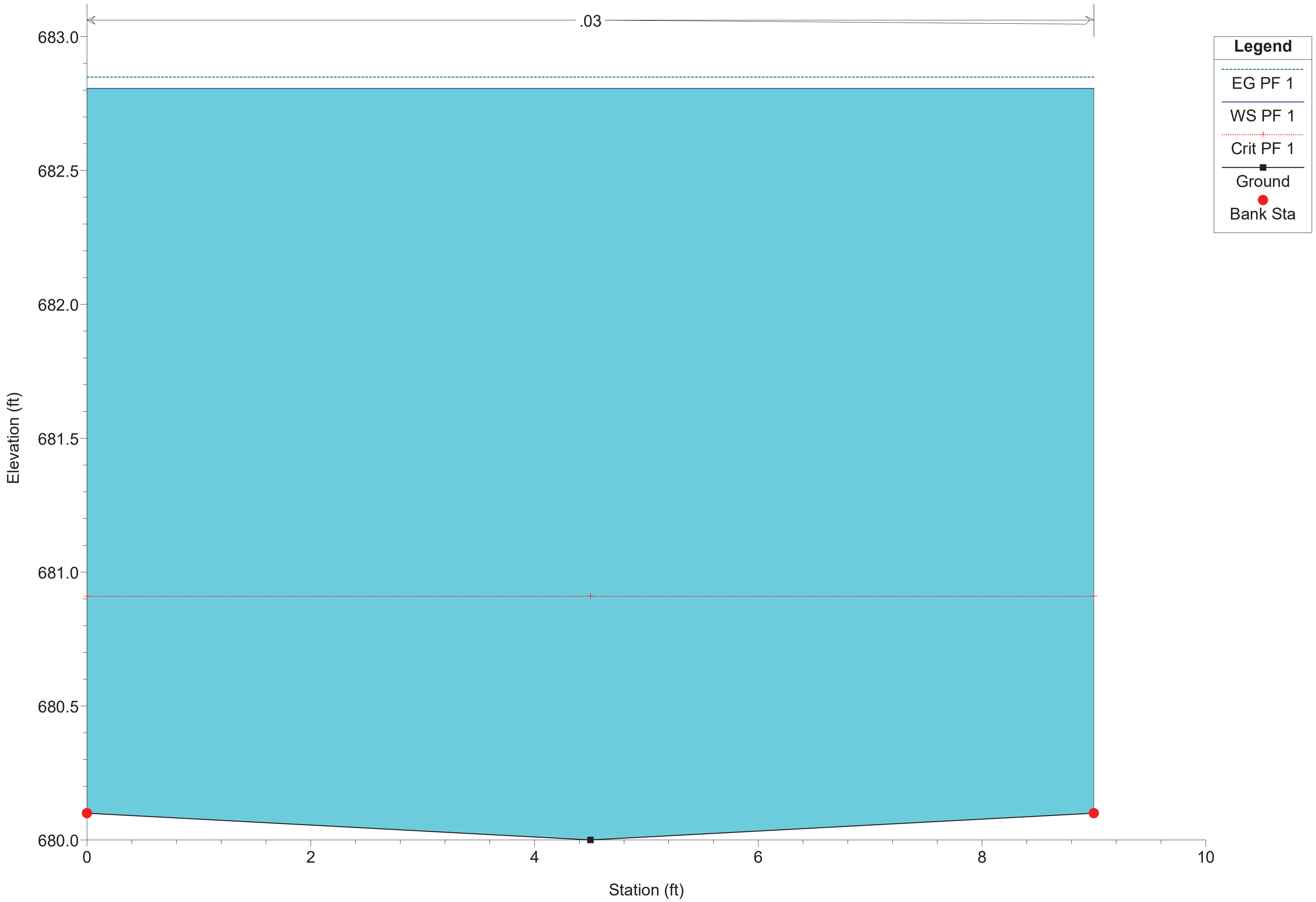
82


Culvert Plan: Plan 01 5/25/2012

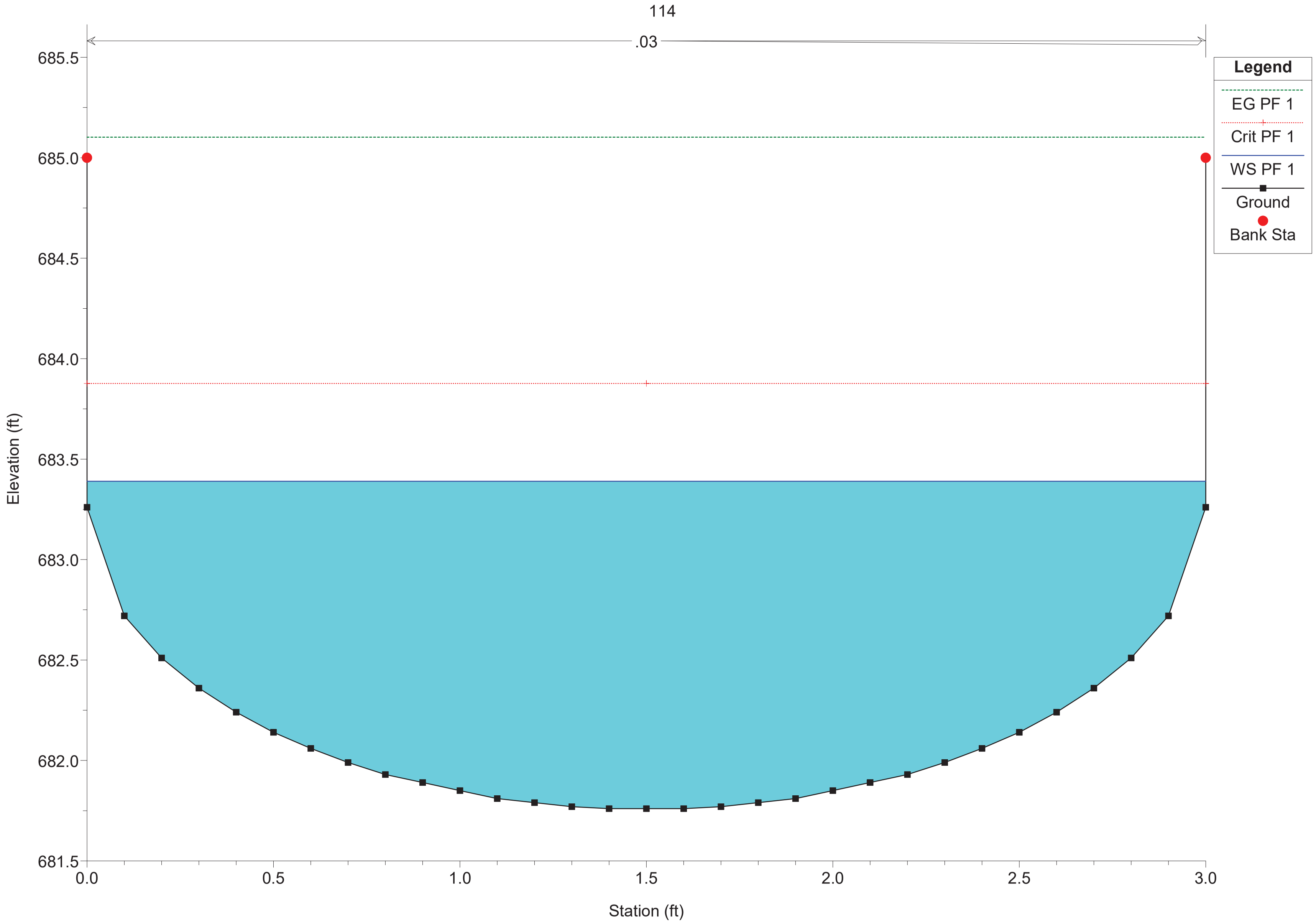
90

Culvert Plan: Plan 01 5/25/2012

102



Culvert Plan: Plan 01 5/25/2012



APPENDIX B

WAVE RUNUP CALCULATION FIGURES

Last saved by: BAKERM(2012-04-19) Last Plotted: 2012-04-19 Project Management Initials: Designer: RLD Checked:MAB Approved:MAB ANSI A 8.5" x 11"
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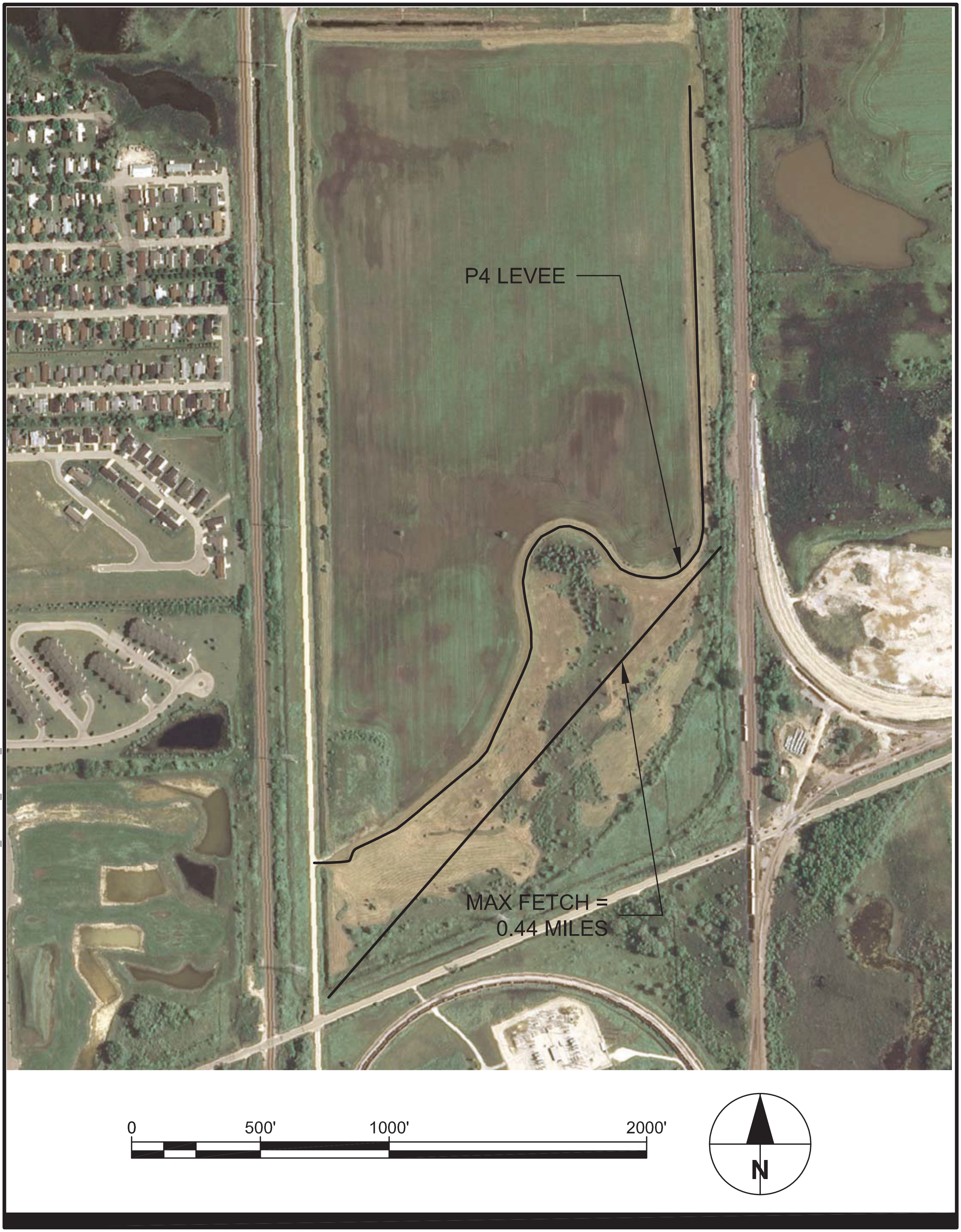


Pleasant Prairie Power Plant
Landfill Flood Plain Levee Certification
We Energies, Pleasant Prairie, WI
Project No.: 60218395 2012-04

Fetch Calculation

AECOM

FIGURE 02

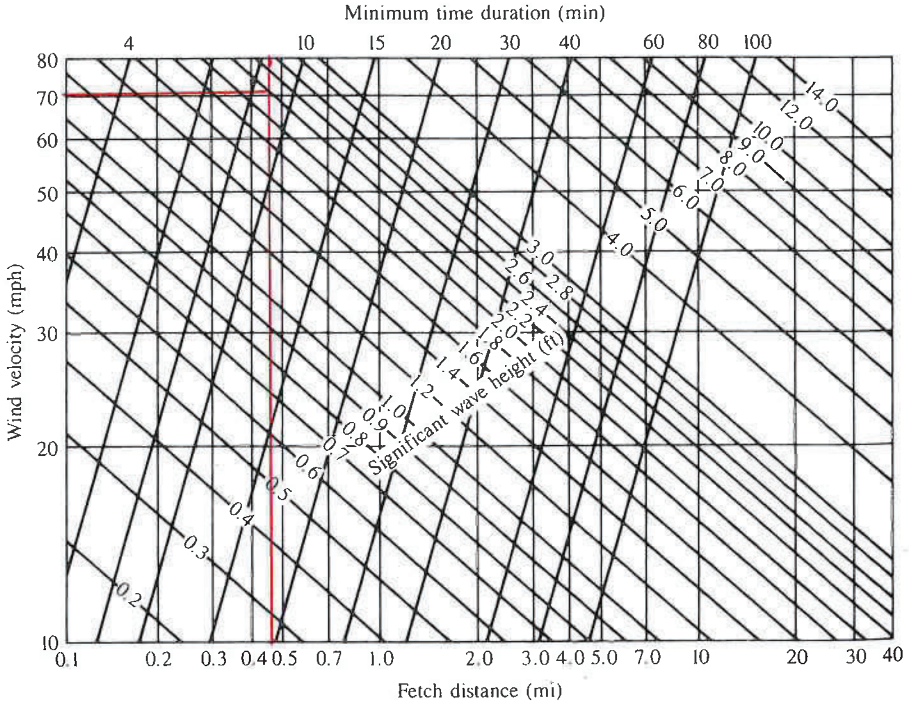


Figure 6-31 Significant wave height, H_s, as a function of wind speed and fetch (15)

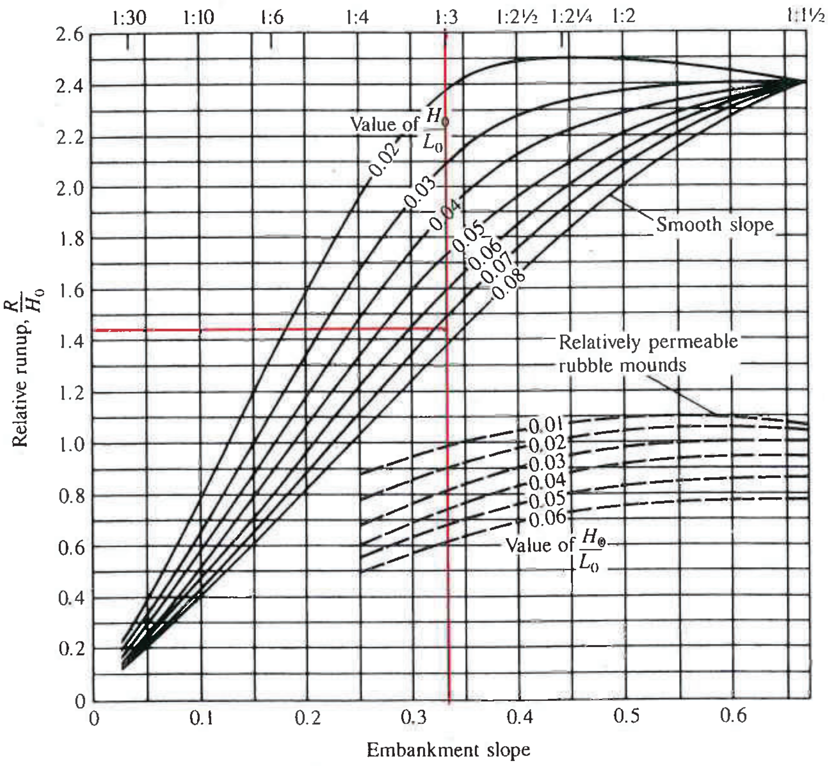


Figure 6-33 Wave runup ratios versus wave steepness and embankment slopes (15)

APPENDIX C

EXCERPTS FROM KENOSHA COUNTY FIS

FLOOD INSURANCE STUDY

VOLUME 1 OF 2

KENOSHA COUNTY, WISCONSIN,

AND INCORPORATED AREAS

Community Name	Community Number
Bristol, Village of	550595
*Genoa City, Village of	550465
Kenosha, City of	550209
Kenosha County, Unincorporated Areas	550523
Paddock Lake, Village of	550073
Pleasant Prairie, Village of	550613
Silver Lake, Village of	550210
Twin Lakes, Village of	550211

*No Special Flood Hazard Areas Identified

EFFECTIVE:
June 19, 2012

Federal Emergency Management Agency
FLOOD INSURANCE STUDY NUMBER
55059CV001A

TABLE 6 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs)			
		10-PERCENT ANNUAL CHANCE	2-PERCENT ANNUAL CHANCE	1-PERCENT ANNUAL CHANCE	0.2-PERCENT ANNUAL CHANCE
UNNAMED TRIBUTARY NO. 2 TO DES PLAINES RIVER					
At Confluence with Des Plaines River	0.6	149	229	268	*
UNNAMED TRIBUTARY NO. 2 TO JEROME CREEK					
At Confluence with Jerome Creek	0.3	36	41	43	*
UNNAMED TRIBUTARY NO. 2 TO SALEM BRANCH BRIGHTON CREEK					
At Confluence with Salem Branch Brighton Creek	0.8	69	97	110	*
UNNAMED TRIBUTARY NO. 3 TO DUTCH GAP CANAL					
At Confluence with Dutch Gap Canal	3.5	63	106	129	*
UNNAMED TRIBUTARY NO. 3 TO JEROME CREEK					
At Confluence with Jerome Creek	0.7	19	23	25	*
Just upstream of divergence with Unnamed Tributary No. 2 to Jerome Creek	*	35	39	41	*
UNNAMED TRIBUTARY NO. 3 TO SALEM BRANCH BRIGHTON CREEK					
At Confluence with Salem Branch Brighton Creek	0.7	34	48	55	*
UNNAMED TRIBUTARY TO NO. 4 TO DUTCH GAP CANAL					
At Confluence with Dutch Gap Canal	1.6	35	62	77	*

FLOODING SOURCE		FLOODWAY				1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD 88)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	WIDTH REDUCED FROM PRIOR STUDY (FEET)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
UNNAMED TRIBUTARY NO. 2 TO DES PLAINES RIVER (CONTINUED)									
K	8,380[1]	31	53	1.8	0	704.1	704.1	704.1	0.0
UNNAMED TRIBUTARY NO. 2 TO JEROME CREEK						588.9			
A	1,961[2]	33	107	0.4	0	680.8	680.8	680.8	0.0
B	2,109[2]	29	92	0.6	0	680.8	680.8	680.8	0.0
C	2,468[2]	93	260	0.3	0	680.9	680.9	680.9	0.0
D	2,780[2]	162	262	0.3	0	680.9	680.9	680.9	0.0
E	3,440[2]	172	217	0.3	0	680.9	680.9	680.9	0.0
F	4,000[2]	142	178	0.2	0	681.0	681.0	681.0	0.0
UNNAMED TRIBUTARY NO. 2 TO SALEM BRANCH BRIGHTON CREEK									
A	100[3]	*	*	*	*	752.1	*	*	*
B	950[3]	*	*	*	*	763.1	*	*	*
C	1,352[3]	*	*	*	*	768.3	*	*	*
D	1,621[3]	*	*	*	*	768.6	*	*	*
E	1,874[3]	*	*	*	*	772.7	*	*	*
F	2,767[3]	*	*	*	*	780.6	*	*	*
G	3,216[3]	*	*	*	*	789.1	*	*	*

[1] FEET ABOVE CONFLUENCE WITH UNNAMED TRIBUTARY NO. 1E TO DES PLAINES RIVER, [2] FEET ABOVE CONFLUENCE WITH JEROME CREEK, [3] FEET ABOVE CONFLUENCE WITH SALEM BRANCH BRIGHTON CREEK, *DATA NOT AVAILABLE

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

KENOSHA COUNTY, WI
AND INCORPORATED AREAS

FLOODWAY DATA

UNNAMED TRIBUTARY 2 TO DES PLAINES RIVER - UNNAMED TRIBUTARY NO. 2 TO JEROME CREEK - UNNAMED TRIBUTARY NO. 2 TO SALEM BRANCH BRIGHTON CREEK

FLOODING SOURCE		FLOODWAY				1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD 88)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	WIDTH REDUCED FROM PRIOR STUDY (FEET)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
UNNAMED TRIBUTARY NO. 3 TO JEROME CREEK									
A	1,950[1]	5	11	2.3	0	680.5	680.5	680.5	0.0
B	2,200[1]	40	98	0.3	0	680.5	680.5	680.5	0.0
C	2,395[1]	4	12	2.1	0	680.5	680.5	680.5	0.0
D	2,515[1]	4	17	1.4	0	680.5	680.5	680.5	0.0
E	2,556[1]	4	15	1.6	0	588.9	680.6	680.6	0.0
F	2,946[1]	20	40	0.8	0	680.7	680.7	680.7	0.0
G	4,429[1]	3	9	4.8	0	681.0	681.0	681.0	0.0
H	4,504[1]	3	10	4.3	0	681.9	681.9	681.9	0.0
I	4,984[1]	472	302	0.2	0	682.3	682.3	682.3	0.0
J	6,879[1]	37	33	1.7	0	683.4	683.4	683.4	0.0
K	7,059[1]	122	38	1.8	0	684.0	684.0	684.0	0.0
L	7,185[1]	130	56	1.0	0	684.3	684.3	684.3	0.0
M	7,755[1]	8	19	2.2	0	687.7	687.7	687.7	0.0
UNNAMED TRIBUTARY NO. 3 TO SALEM BRANCH BRIGHTON CREEK									
A	201[2]	*	*	*	*	756.8	*	*	*
B	623[2]	*	*	*	*	762.8	*	*	*
C	898[2]	*	*	*	*	769.2	*	*	*
D	1,119[2]	*	*	*	*	771.0	*	*	*
E	1,463[2]	*	*	*	*	775.4	*	*	*
F	2,656[2]	*	*	*	*	789.9	*	*	*

[1]FEET ABOVE CONFLUENCE WITH JEROME CREEK, [2]FEET ABOVE CONFLUENCE WITH SALEM BRANCH BRIGHTON CREEK, *DATA NOT AVAILABLE

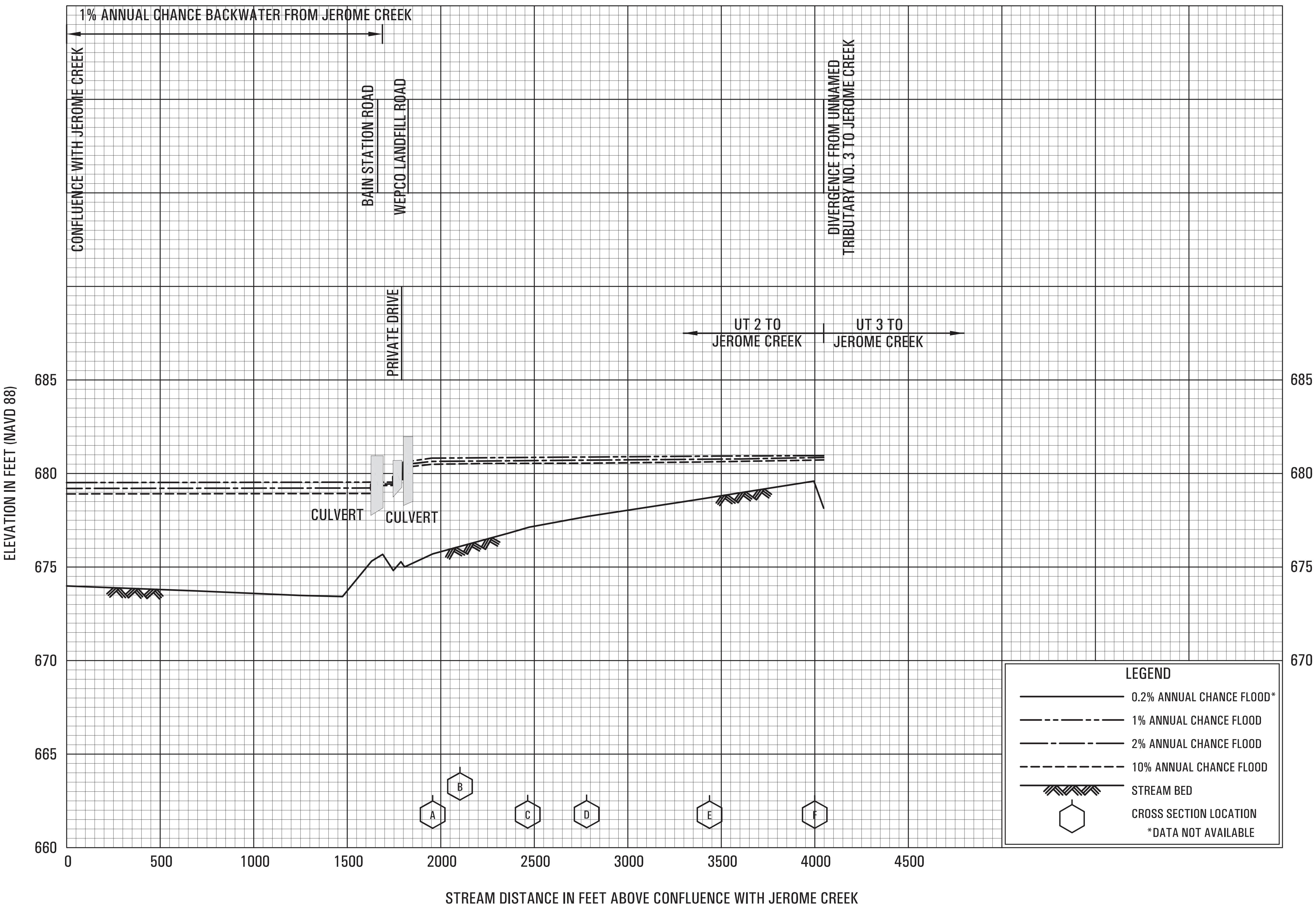
TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

KENOSHA COUNTY, WI
AND INCORPORATED AREAS

FLOODWAY DATA

UNNAMED TRIBUTARY NO. 3 TO JEROME CREEK - UNNAMED TRIBUTARY NO. 3 TO SALEM BRANCH BRIGHTON CREEK

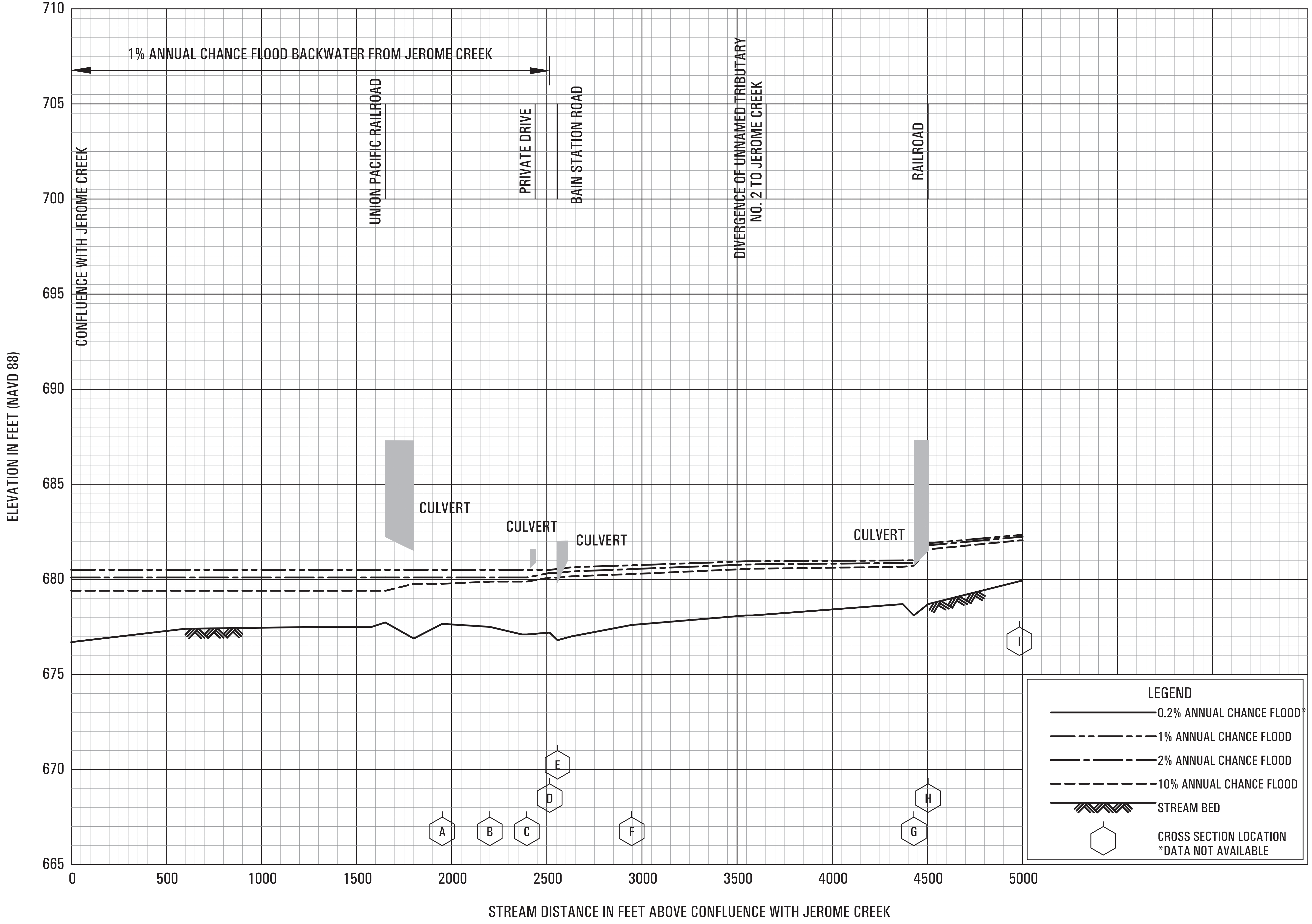


FLOOD PROFILES

UNNAMED TRIBUTARY NO. 2 TO JEROME CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

KENOSHA COUNTY, WI
AND INCORPORATED AREAS



FLOOD PROFILES

UNNAMED TRIBUTARY NO. 3 TO JEROME CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY
KENOSHA COUNTY, WI
AND INCORPORATED AREAS

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) Report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS Report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study Report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study Report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study Report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 16N. The **horizontal datum** was NAD 83, GRS 1980 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713- 3242**, or visit its website at http://www.ngs.noaa.gov.

Base map information shown on this FIRM was derived from the National Agriculture Imagery Program's (NAIP) digital orthoimagery produced by the USDA, Farm Service Agency. The orthophoto was collected in the summer of 2005 and produced at a resolution of 1 meter.

The **profile baselines** depicted on this map represent the hydraulic modeling baselines that match the flood profiles in the FIS report. As a result of improved topographic data, the **profile baseline**, in some cases, may deviate significantly from the channel centerline or appear outside the SFHA.

Based on updated topographic information, this map reflects more detailed and up-to-date **stream channel configurations and floodplain delineations** than those shown on the previous FIRM for this jurisdiction. As a result, the Flood Profiles and Floodway Data tables for multiple streams in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on the map. Also, the road to floodplain relationships for unrevised streams may differ from what is shown on previous maps.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

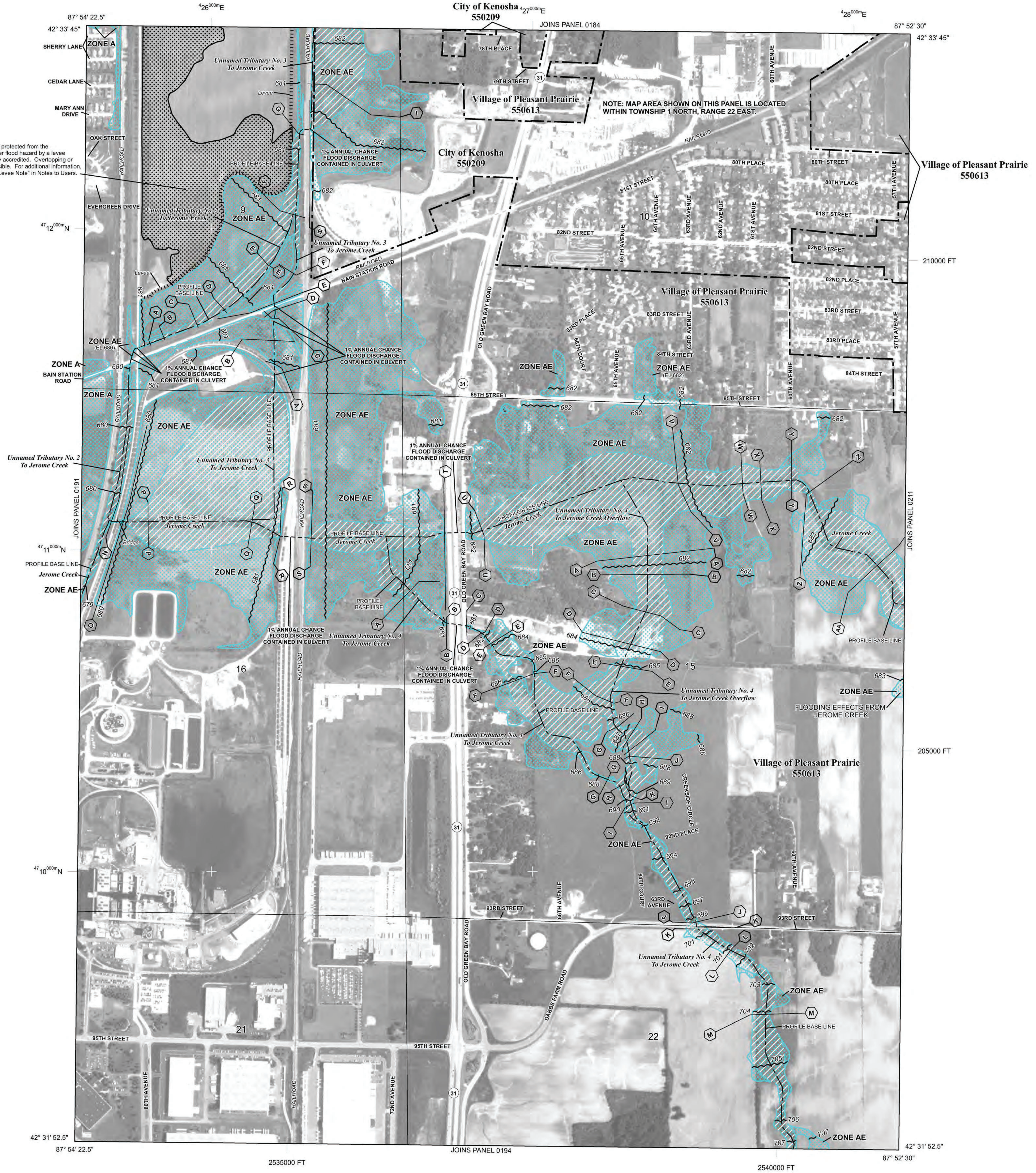
Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

For information on available products associated with this FIRM visit the **Map Service Center** (MSC) website at http://msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the MSC website.

If you have **questions about this map**, how to order products or the National Flood Insurance Program in general, please call the FEMA Map Information eXchange (FMIX) at **1 -877-FEMA-MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip.

Provisionally Accredited Levee Notes to Users: Check with your local community to obtain more information, such as the estimated level of protection provided (which may exceed the 1-percent-annual-chance level) and Emergency Action Plan, on the levee system shown as providing protection for areas on this panel. To maintain accreditation, the levee owner or community is required to submit the data and documentation necessary to comply with Section 65.10 of the NFIP regulations by August 11, 2012. If the community or owner does not provide the necessary data and documentation or if the data and documentation provided indicate the levee system does not comply with Section 65.10 requirements, FEMA will revise the flood hazard and risk information for this area to reflect de-accreditation of the levee system. To mitigate flood risk in residual risk areas, property owners and residents are encouraged to consider flood insurance and floodproofing or other protective measures. For more information on flood insurance, interested parties should visit the FEMA website at ww.fema.gov/business/nfip/index.shtm.

Note: This area is shown as being protected from the 1-percent-annual-chance or greater flood hazard by a levee system that has been provisionally accredited. Overtopping or failure of any levee system is possible. For additional information, see the "Provisionally Accredited Levee Note" in Notes to Users.



LEGEND

▨ SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Areas formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

▨ FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

▨ OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

☐ OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

▨ COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

▨ OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

───	1% Annual Chance Floodplain Boundary
───	0.2% Annual Chance Floodplain Boundary
— —	Floodway boundary
— — —	Zone D boundary
• • • • • • • • • • • • •	CBRS and OPA boundary
▨ ←	Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths, or flood velocities.
~~ 513 ~~~	Base Flood Elevation line and value; elevation in feet*
(EL 987)	Base Flood Elevation value where uniform within zone; elevation in feet*

*Referenced to the North American Vertical Datum of 1988

(A)———(A)	Cross section line
(23) - - - - - (23)	Transect line
- - - - - - -	Culvert
	Bridge
45° 02' 08", 93° 02' 12"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83) Western Hemisphere
3100000 FT	5000-foot ticks: Wisconsin State Plane South Zone (FIPS Zone 4803), Lambert Conformal Conic projection
4989000m N	1000-meter Universal Transverse Mercator grid values, zone 16N
DX5510 ×	Bench mark (see explanation in Notes to Users section of this FIRM panel)
• FT1,000	River Station

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
June 19, 2012

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

N

MAP SCALE 1" = 500'

250 0 500 1000 FEET
150 0 150 300 METERS

NFIP
NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0192D

FIRM
FLOOD INSURANCE RATE MAP
KENOSHA COUNTY, WISCONSIN
AND INCORPORATED AREAS

PANEL 192 OF 331
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
KENOSHA, CITY OF	550209	0192	D
PLEASANT PRAIRIE, VILLAGE OF	550613	0192	D

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
55059C0192D

EFFECTIVE DATE
JUNE 19, 2012

Federal Emergency Management Agency

Tab 8

44 CFR 65.10(b)(4); Embankment and Foundation Stability

Tab 8

44 CFR 65.10 (b) (4) Tab

(4) *Embankment and foundation stability.*
Engineering analyses that evaluate levee embankment stability must be submitted. The analyses provided shall evaluate expected seepage during loading conditions associated with the base flood and shall demonstrate that seepage into or through the levee foundation and embankment will not jeopardize embankment or foundation stability. An alternative analysis demonstrating that the levee is designed and constructed for stability against loading conditions for Case IV as defined in the U.S. Army Corps of Engineers (COE) manual, ''Design and Construction of Levees'' (EM 1110–2–1913, Chapter 6, Section II), may be used. The factors that shall be addressed in the analyses include: Depth of flooding, duration of flooding, embankment geometry and length of seepage path at critical locations, embankment and foundation materials, embankment compaction, penetrations, other design factors affecting seepage (such as drainage layers), and other design factors affecting embankment and foundation stability (such as berms).

P.E. Signature: ______________________

Non Applicable: ______________________

P.E. Name: John M. Trast, P.E.

P.E. License Number and State: 31792-6, WI

CALCULATION SHEET

			Page 1	**Of** 9		
			Project No.	60218395		
Client	We Energies	**Subject** Seepage and	**Prepared By**	CEF	**Date**	05/13
Project	Pleasant Prairie Ash	Global Stability Analysis	**Reviewed By**	JXT	**Date**	05/13
Landfill Floodplain Levee Cert		44 CFR 65.10 (b) (4)	**Approved By**	JXT	**Date**	06/13

SEEPAGE AND GLOBAL STABILITY ANALYSIS

Objective

Verify that the Pleasant Prairie Ash Landfill Floodplain Levee meets the requirements of 44 CFR 65.10(b)(4): Embankment and Foundation Stability.

Engineering analyses that evaluate levee embankment stability must be submitted. The analyses provided shall evaluate expected seepage during loading conditions associated with the base flood and shall demonstrate that seepage into or through the levee foundation and embankment will not jeopardize embankment or foundation stability. An alternative analysis demonstrating that the levee is designed and constructed for stability against loading conditions for Case IV as defined in the U.S. Army Corps of Engineers Manual, *Design and Construction of Levees* (EM 1110–2–1913, Chapter 6, Section II), may be used. The factors that shall be addressed in the analyses include: Depth of flooding, duration of flooding, embankment geometry and length of seepage path at critical locations, embankment and foundation materials, embankment compaction, penetrations, other design factors affecting seepage (such as drainage layers), and other design factors affecting embankment and foundation stability (such as berms).

A seepage evaluation of the Pleasant Prairie Ash Landfill Floodplain Levee was conducted to predict the pore water pressure conditions within the levee during flood conditions. The stability of the levee during flood conditions was then evaluated using the pore water pressure conditions predicted from the seepage evaluation. The stability of the levee was evaluated for normal, flood (steady state seepage from full flood stage), and rapid drawdown conditions. The seepage and stability models were developed in accordance with United States Army Corps of Engineers, Engineering Manual 1110-2-1902 *Slope Stability*, as recommended by 1110-2-1913 *Design and Construction of Levees*. The following subsections outline the methods used to develop the seepage and stability models and present the results of the evaluation.

Subsurface Profile and Levee Geometry

Soil borings were not completed as part of the levee certification process. However, soils borings from the site were completed as part of the landfill permitting process. This information was used to estimate the subsurface profile and material parameters. The subsurface profile and material parameters were estimated from the following resources:

- Previous project experience near the Pleasant Prairie Ash Landfill Floodplain Levee.
- Published soil maps obtained from United States Department of Agriculture (USDA) National Resource Conservation online Web Soil Survey (WSS) for Kenosha County.
- Published engineering correlations with material types.

Based on previous project experience and a review of the WSS for Kenosha County, the subsurface profile beneath the Pleasant Prairie Ash Landfill Floodplain Levee consists of native silty clay soil to depths greater than 50 feet below the ground surface. The static groundwater table is anticipated to be approximately 10 feet below the ground surface.

The levee was constructed with on-site low-plasticity silty clay soil similar in composition to the native site soils. The cross-section geometry of the levee was based on the results of AECOM topographic surveys completed in November and December 2011. Based on the results of the survey, the cross-sectional geometry of the levee is relatively consistent across its entire length.

CALCULATION SHEET

Page 2 **Of** 9
Project No. 60218395

Client	We Energies	**Subject**	Seepage and	**Prepared By**	CEF	**Date**	05/13
Project	Pleasant Prairie Ash	Global Stability Analysis		**Reviewed By**	JXT	**Date**	05/13
Landfill Floodplain Levee Cert		44 CFR 65.10 (b) (4)		**Approved By**	JXT	**Date**	06/13

Model Development

The computer program SEEP/W (Geo-Slope International, Ltd., GeoStudio 2007, Version 7.13) was used for seepage evaluation of the floodplain levee. The program was used to model the flow of groundwater and estimate the position of the phreatic surface within the levee during normal, flood, and rapid drawdown conditions. The SEEP/W program uses a finite-element approach as applied to fluid flow to simulate the flow of groundwater through porous media.

The computer program SLOPE/W (Geo-Slope International, Ltd., GeoStudio 2007, Version 7.13) was used to evaluate the stability of the levee under normal, flood, and rapid drawdown conditions. The SLOPE/W program uses a limit equilibrium approach as applied to the method of slices to determine slope stability. Factors of Safety (FS) were computed using the Morgenstern-Price method which satisfies both force and moment equilibrium. The pore water pressure conditions predicted by the SEEP/W program for flood conditions were directly imported into SLOPE/W for determining the global factor of safety.

Seepage Evaluation Boundary Conditions

For flood conditions, groundwater seepage through the levee was evaluated using a steady state analysis. In a steady state analysis, the boundary conditions are held constant with time. Therefore, a steady state analysis does not predict the timing at which steady state seepage conditions will occur, but rather the long term groundwater conditions (i.e., long term embankment phreatic surface) that will result from a given set of boundary conditions. Due to the relatively impermeable nature of the silty clay used to construct the levee, the use of a steady-state analysis is considered conservative because the flood pool will likely recede before steady-state embankment seepage conditions occur.

The phreatic surface is the position of the water table within the water retaining earth embankment. Pore water pressure is positive below the phreatic surface (saturated conditions) and negative above the phreatic surface (unsaturated conditions). In SEEP/W, the position of the phreatic surface within an earth embankment is estimated by evaluating a finite-element model based on boundary conditions and material hydraulic conductivities input by the user. The methods used to select the appropriate boundary conditions and material hydraulic conductivities for the Pleasant Prairie Ash Landfill Floodplain Levee are summarized below:

Flood Pool Condition

Water Side Reservoir (Headwater Boundary Condition) is elevation 683 feet. Estimated flood pool elevation data was not available at the time of this report; therefore, we have conservatively estimated the maximum flood pool elevation is 3 feet below the crest elevation of the levee at elevation 686 feet.

The point where the phreatic surface intersects the land side of an earth embankment is typically referred to as a “seepage face”. The position of the seepage face along the land side of an earth embankment is influenced by several factors including embankment geometry, subsurface profile, etc. In order to predict the position of the steady-state seepage face, the land side toe and slope face of the Pleasant Prairie Ash Landfill Floodplain Levee were defined as “potential seepage faces” in SEEP/W. A seepage face represents an area where water reaches the ground surface and exits the embankment, but cannot pond (pore water pressure equals 0 but constant head is not maintained) because of the typically sloped nature of the face. Seepage faces along the toe and land side slope face of embankments can be detrimental to slope stability.

Stability Evaluation Phreatic Surface

The steady state phreatic surface and seepage pressure conditions predicted from the SEEP/W seepage evaluation for the flood pool conditions were directly imported into the SLOPE/W model to determine the global stability of the levee.

For normal conditions, the embankment phreatic surface was assumed to equal the elevation of the estimated static groundwater table (670 feet).

For rapid drawdown conditions, groundwater seepage through an embankment is typically evaluated using a transient seepage analysis. In a transient analysis, the boundary conditions are varied with time. Thus, a transient analysis can predict the magnitude and timing of changes in the embankment phreatic surface under a time-dependent set of boundary conditions.

A transient seepage analysis for the existing levee geometry under rapid drawdown conditions was not conducted because insufficient data was available to develop the boundary conditions required for a transient model. Thus, the position of the phreatic surface within the levee was conservatively assumed to be equivalent to the steady-state phreatic surface estimated for the flood pool condition (maximum surcharge), with the exception that the water side reservoir (headwater) elevation was reduced to the bottom of reservoir elevation (680 feet) which is equivalent to a 100% drawdown. This condition assumes that the phreatic surface will remain elevated within the levee long after the flood pool has been drawn down, which represents a worst-case scenario.

Critical Failure Surface Definition

Slope failures in embankments with seepage are typically characterized as ‘rotational’, i.e. the failure mass appears to have rotated around an imaginary axis point. Thus, a circular failure, defined by user specified ‘entry’, ‘exit’, and radius ranges, was used to estimate potential failure surfaces and corresponding factors of safety in the SLOPE/W model. The entry and exit ranges were each defined by 20 possible entry/exit increments over the range. Additionally, the radius range was defined by 20 possible radius increments over the entry and exit ranges. This means that each SLOPE/W model was evaluated for roughly 9000 possible failure surfaces.

For both the normal pool and flood pool conditions, it was assumed that the entry point of the failure surface range would be located on the land side and that the failure mass would move left to right (water side to land side). For the rapid drawdown condition, it was assumed that the entry point of the failure surface range would be located on the water side and that the failure mass would move from right to left (land side to water side).

The critical failure surface and corresponding factor of safety was selected using engineering judgment based on the following criteria:

- The critical failure surface must extend a minimum of 5 feet below the ground surface at its deepest point (to eliminate the inclusion of shallow erosion type failures that are considered overly conservative and/or controllable with adequate slope vegetation), or
- The critical failure surface must intersect the phreatic surface within the levee (which could lead to progressive failures at an exposed seepage face), or
- The critical failure surface must result in a loss of freeboard at the levee crest.

Material Properties

The material hydraulic conductivities used in the seepage evaluation were estimated based on accepted engineering correlations with grain size and material type. The material hydraulic conductivities utilized in the seepage analysis are summarized in Table 1 below.

For the stability analysis, the soil profile was modeled using the Mohr-Coulomb failure criterion under drained conditions (i.e., effective stress analysis (ESA)) where excess pore water pressure has fully dissipated. Material unit weight and drained strength data was unavailable for the levee and native soils were unavailable; therefore, the unit weight and drained strength properties used in the stability analysis were estimated based on published engineering correlations with material type. The material properties used in the stability analysis are summarized in Table 1 below.

Table 1
SLOPE/W Material Properties

Material	Unit Weight (pcf)	Hydraulic Conductivity (ft/sect)	Drained Strength Parameters (ESA)		Ref.
			Cohesion (psf)	Friction Angle (deg)	
Embankment Fill (CL)	120	3.28E-9	0	30	(a)(b)(c)
Native Brown Silty Clay (CL)	125	3.28E-9	0	30	(a)(b)(c))
Native Gray Silty Clay (CL)	130	3.28E-9	0	30	(a)(b)(c)

References:
(a) Holtz and Kovacs, 1981. Figure 7.6, Page 210.
(b) Effective cohesion conservatively assumed to equal 0 psf.
(c) NAVFAC DM 7.01, Table 6.

Conclusions

The individual seepage and stability outputs for the Pleasant Prairie Ash Landfill Floodplain Levee are presented on Pages 6 through 9. The stability analysis results for the levee are summarized in Table 2. According to Table 6.1b Minimum Factors of Safety – Levee Slope Stability of the United States Army Corps of Engineers, Engineering Manual 1110-2-1913 *Design and Construction of Levees*, the following factors of safety are required:

Table 2 - Stability Analysis Results Summary

Reservoir Condition	Factor of Safety	Minimum Required Factor of Safety
Existing Normal Pool Condition	2.60	---
Steady State Seepage Condition	1.64	1.4
Sudden Drawdown Condition	1.38	1.0 to 1.2

Based on these requirements, the Pleasant Prairie Ash Landfill Floodplain Levee is considered stable under existing normal pool conditions, steady state seepage conditions, and sudden drawdown conditions.

CALCULATION SHEET

Page 5 **Of** 9
Project No. 60218395

Client	We Energies	**Subject**	Seepage and	**Prepared By**	CEF	**Date**	05/13
Project	Pleasant Prairie Ash		Global Stability Analysis	**Reviewed By**	JXT	**Date**	05/13
Landfill Floodplain Levee Cert			44 CFR 65.10 (b) (4)	**Approved By**	JXT	**Date**	06/13

References

Holtz, Robert D. and Kovacs, William D. An Introduction to Geotechnical Engineering. Prentice-Hall Inc., Englewood Cliffs, New Jersey. 1981.

Naval Facilities Engineering Command, Soil Mechanics Design Manual 7.01, NAVFAC, September, 1986.

United States Army Corps of Engineers, Engineering Manual 1110-2-1902 *Slope Stability*, October 31, 2003.

United States Army Corps of Engineers, Engineering Manual 1110-2-1913 *Design and Construction of Levees*, April 30, 2000

List of Seepage Stability Outputs

Page 6 – SEEP/W Seepage Analysis, Flood Pool (Steady State Seepage) Condition
Page 7 – SLOPE/W Stability Analysis, Flood Pool (Steady State Seepage) Condition
Page 8 – SLOPE/W Stability Analysis, Empty Reservoir (Existing Normal Pool) Condition
Page 9 – SLOPE/W Stability Analysis, Sudden Drawdown Condition

FIGURES

PROJECT: P4 Flood Plain Levee
PROJECT NO.: 60223980
SUBJECT: Groundwater Seepage Analysis
PAGE NO.: 6 of 9

CROSS SECTION: D-D'
ANALYSIS TYPE: Steady-State
RESERVOIR CONDITION: Flood Pool
HEADWATER ELEVATION: 683 Feet

ORIGINATED BY: JDW
DATE: 01/17/2012
CHECKED BY: DLH
DATE: 01/27/2012

Material Properties:

Name: Native Brown Silty Clay (CL)
Model: Saturated Only
K-Sat: 3.28e-009 ft/sec
K-Ratio: 1

Name: Native Gray Silty Clay (CL)
Model: Saturated Only
K-Sat: 3.28e-009 ft/sec
K-Ratio: 1

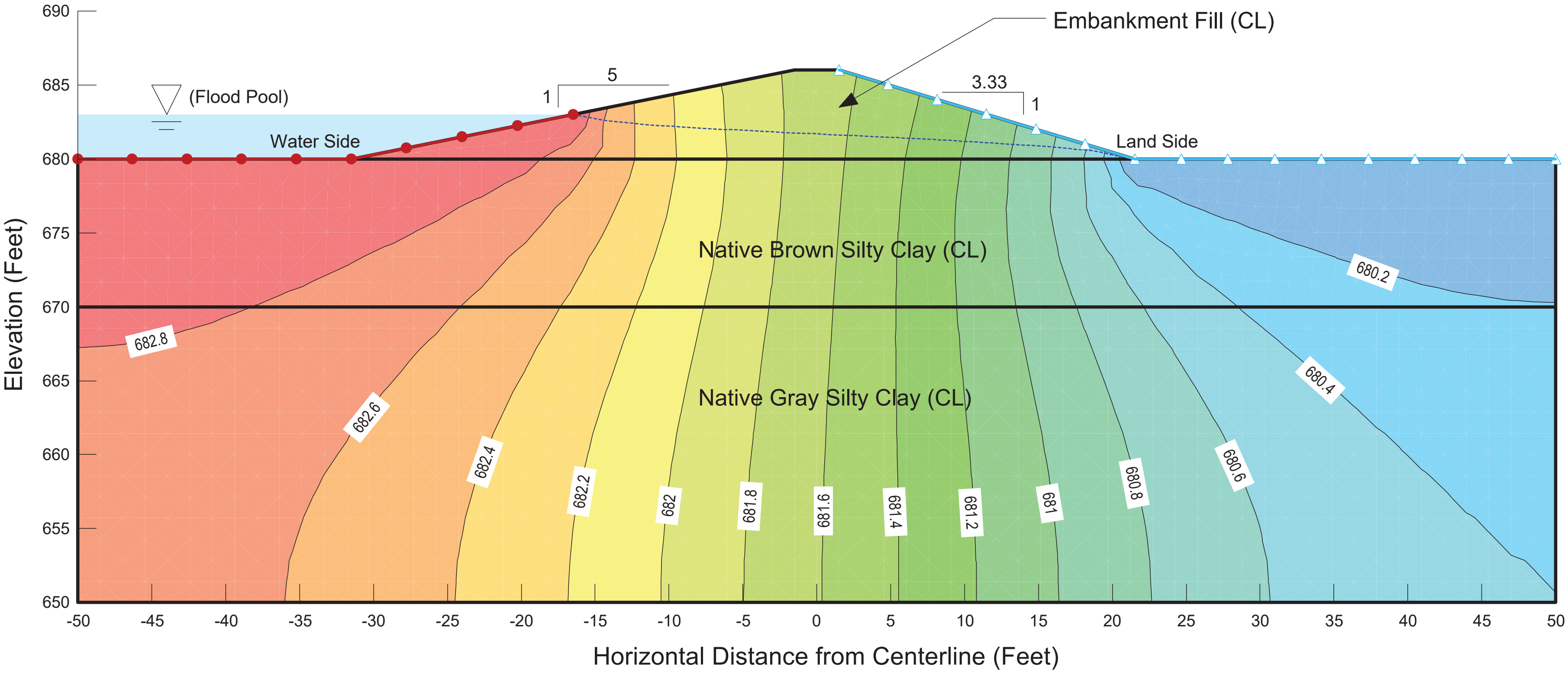
Name: Embankment Fill (CL)
Model: Saturated Only
K-Sat: 3.28e-009 ft/sec
K-Ratio: 1

Assumptions:

1) Steady-state conditions exist (likely conservative given that flood pool will likely not be in place long enough for steady-state conditions to occur)
2) Minimum 3 feet of freeboard is maintained between the flood pool elevation and the crest of the embankment

Notes:

1) Contour Type: Total Head
2) Contour Interval: 0.2 Feet



PROJECT: P4 Flood Plain Levee
PROJECT NO.: 60223980
SUBJECT: Global Stability Analysis
PAGE NO.: 7 of 9

CROSS SECTION: D-D'
ANALYSIS TYPE: Morgenstern-Price
RESERVOIR CONDITION: Flood Pool
HEADWATER ELEVATION: 683 Feet

ORIGINATED BY: JDW
DATE: 01/18/2012
CHECKED BY: DLH
DATE: 01/27/2012

Material Properties:

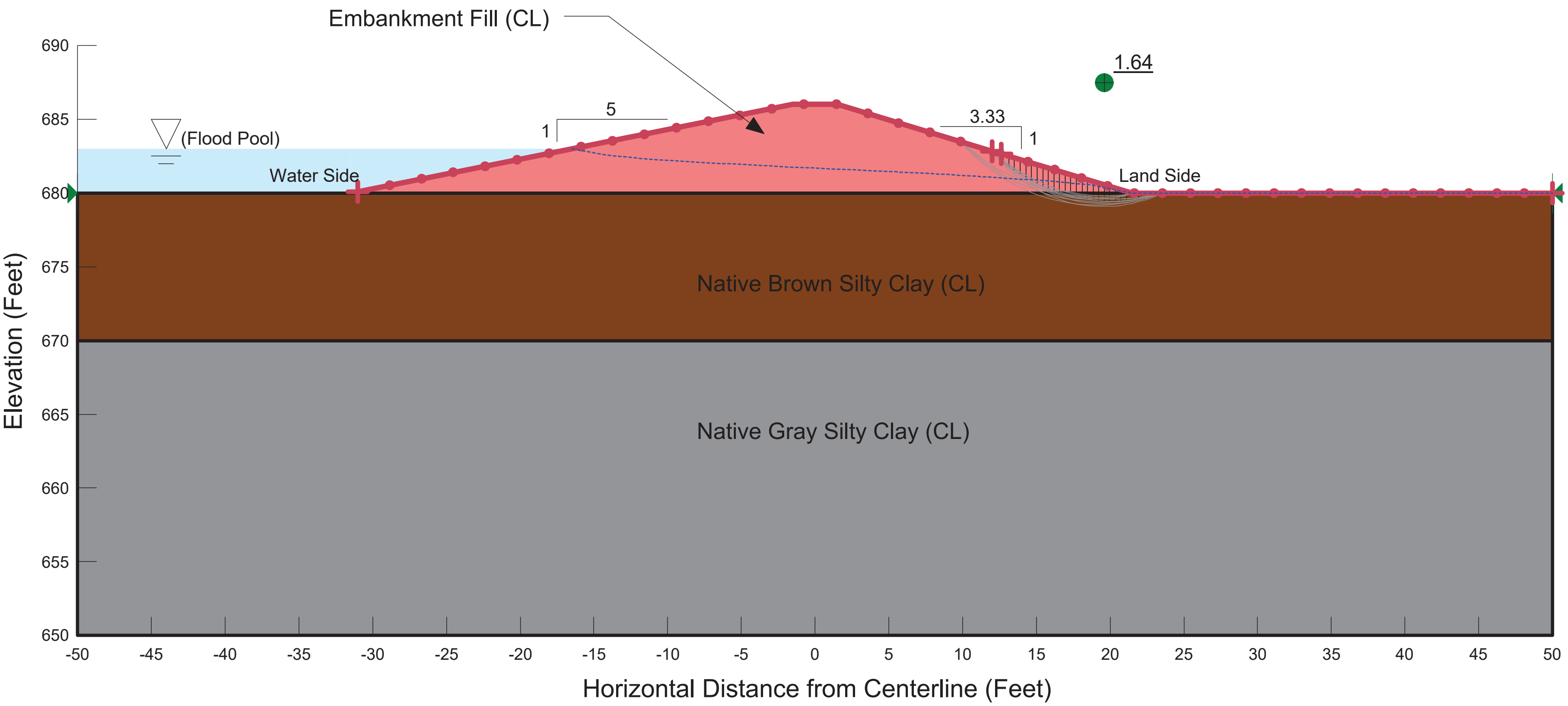
Name: Native Brown Silty Clay (CL)	Name: Native Gray Silty Clay (CL)	Name: Embankment Fill (CL)
Model: Mohr-Coulomb	Model: Mohr-Coulomb	Model: Mohr-Coulomb
Unit Weight: 125 pcf	Unit Weight: 130 pcf	Unit Weight: 120 pcf
Cohesion: 0 psf	Cohesion: 0 psf	Cohesion: 0 psf
Phi: 30 °	Phi: 30 °	Phi: 30 °

Assumptions:

1) Analysis performed using long-term (drained) material properties assuming embankment has been in place long enough such that excess pore water pressure has dissipated
2) Effection cohesion = 0 psf under drained conditions (likely conservative for cohesive soils)

Notes:

1) Critical Factor of Safety: 1.64 (10 most critical surfaces shown, FOS Range is 1.64 to 1.67)
2) Minimum Failure Depth: 5 feet, unless failure intercepts phreatic surface or results in a loss of freeboard
3) Failure Surface Type: Entry and Exit
4) Failure Surface Movement: Left to Right



PROJECT: P4 Flood Plain Levee
PROJECT NO.: 60223980
SUBJECT: Global Stability Analysis
PAGE NO.: 8 of 9

CROSS SECTION: D-D'
ANALYSIS TYPE: Morgenstern-Price
RESERVOIR CONDITION: Empty Pool (Normal)
STATIC WATER TABLE ELEVATION: 670 Feet

ORIGINATED BY: JDW
DATE: 01/18/2012
CHECKED BY: DLH
DATE: 01/27/2012

Material Properties:

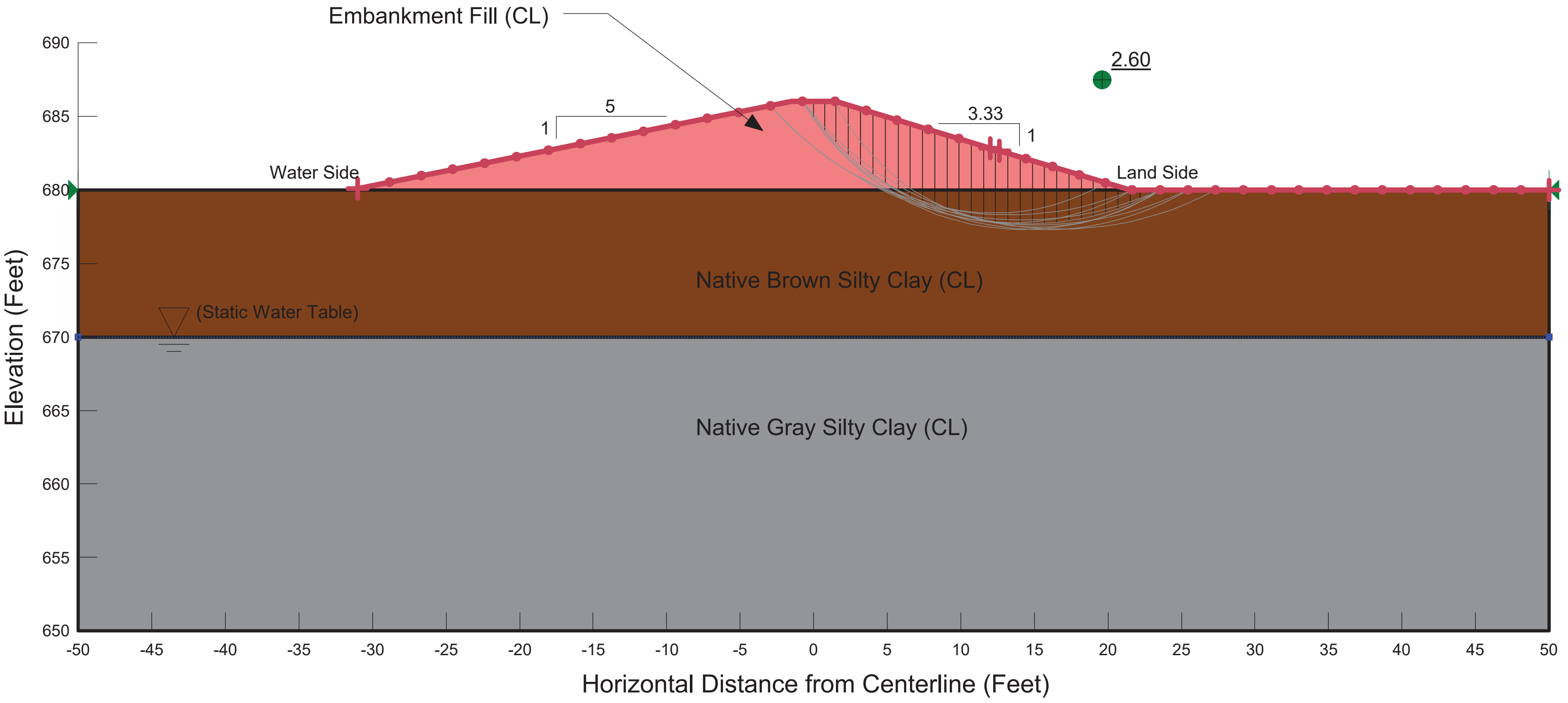
Name: Native Brown Silty Clay (CL)	Name: Native Gray Silty Clay (CL)	Name: Embankment Fill (CL)
Model: Mohr-Coulomb	Model: Mohr-Coulomb	Model: Mohr-Coulomb
Unit Weight: 125 pcf	Unit Weight: 130 pcf	Unit Weight: 120 pcf
Cohesion: 0 psf	Cohesion: 0 psf	Cohesion: 0 psf
Phi: 30 °	Phi: 30 °	Phi: 30 °

Assumptions:

1) Analysis performed using long-term (drained) material properties assuming embankment has been in place long enough such that excess pore water pressure has dissipated
2) Effection cohesion = 0 psf under drained conditions (likely conservative for cohesive soils)

Notes:

1) Critical Factor of Safety: 2.60 (10 most critical surfaces shown, FOS Range is 2.60 to 2.71)
2) Minimum Failure Depth: 5 feet, unless failure intercepts phreatic surface or results in a loss of freeboard
3) Failure Surface Type: Entry and Exit
4) Failure Surface Movement: Left to Right



PROJECT: P4 Flood Plain Levee
PROJECT NO.: 60223980
SUBJECT: Global Stability Analysis
PAGE NO.: 9 of 9

CROSS SECTION: D-D'
ANALYSIS TYPE: Morgenstern-Price
RESERVOIR CONDITION: Rapid Drawdown
HEADWATER ELEVATION: 680 Feet

ORIGINATED BY: JDW
DATE: 01/18/2012
CHECKED BY: DLH
DATE: 01/27/2012

Material Properties:

Name: Native Brown Silty Clay (CL)
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion: 0 psf
Phi: 30 °

Name: Native Gray Silty Clay (CL)
Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion: 0 psf
Phi: 30 °

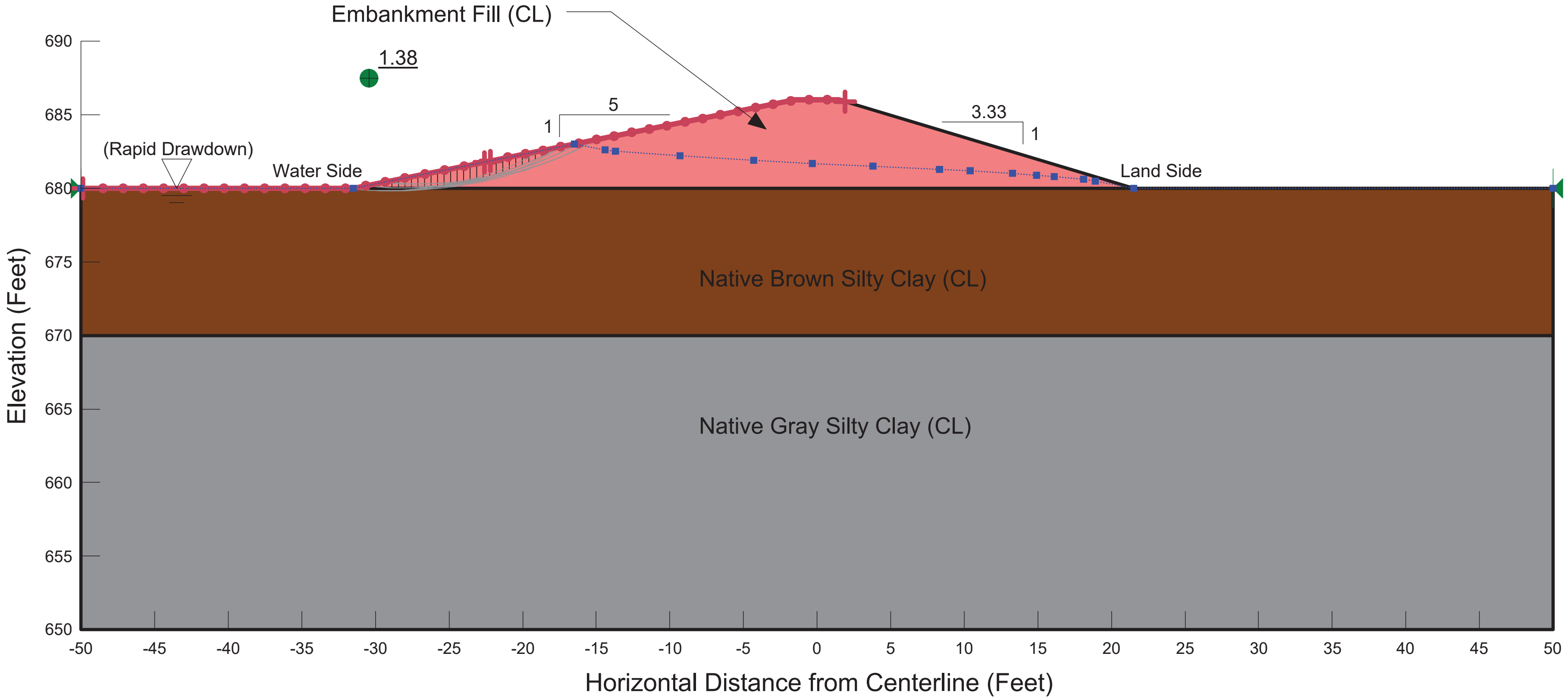
Name: Embankment Fill (CL)
Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion: 0 psf
Phi: 30 °

Assumptions:

1) Analysis performed using long-term (drained) material properties assuming embankment has been in place long enough such that excess pore water pressure has dissipated
2) Effection cohesion = 0 psf under drained conditions (likely conservative for cohesive soils)

Notes:

1) Critical Factor of Safety: 1.38 (10 most critical surfaces shown, FOS Range is 1.38 to 1.42)
2) Minimum Failure Depth: 5 feet, unless failure intercepts phreatic surface or results in a loss of freeboard
3) Failure Surface Type: Entry and Exit
4) Failure Surface Movement: Right to Left



Tab 9

44 CFR 65.10(b)(5); Settlement

44 CFR 65.10 (b) (5) Tab

(5) *Settlement.* Engineering analyses must be submitted that assess the potential and magnitude of future losses of freeboard as a result of levee settlement and demonstrate that freeboard will be maintained within the minimum standards set forth in paragraph (b)(1) of this section. This analysis must address embankment loads, compressibility of embankment soils, compressibility of foundation soils, age of the levee system, and construction compaction methods. In addition, detailed settlement analysis using procedures such as those described in the COE manual, ''Soil Mechanics Design— Settlement Analysis'' (EM 1100–2–1904) must be submitted.

P.E. Signature: ____________________

Non Applicable: ____________________

P.E. Name: John M. Trast, P.E.

P.E. License Number and State: 31792-6, WI

AECOM

CALCULATION SHEET

Page 1 Of 5
Project No. 60223980
Client We Energies
Subject Settlement
Prepared By JDW **Date** 01/2012
Project Pleasant Prairie Ash Landfill Floodplain Levee Cert
44 CFR 65.10 (b) (5)
Reviewed By DLH **Date** 01/2012
Approved By JXT **Date** 05/2012

SETTLEMENT ANALYSIS

Objective

Verify that the Pleasant Prairie Ash Landfill Floodplain Levee meets the requirements of 44 CFR 65.10(b) (5): Settlement.

Engineering analyses must be submitted that assess the potential and magnitude of future losses of freeboard as a result of levee settlement and demonstrate that freeboard will be maintained within the minimum standards set forth in paragraph (b)(1) of this section. This analysis must address embankment loads, compressibility of embankment soils, compressibility of foundation soils, age of the levee system, and construction compaction methods. In addition, detailed settlement analysis using procedures such as those described in the COE manual, "Soil Mechanics Design—Settlement Analysis" (EM 1100–2–1904) must be submitted.

Estimate the amount of primary consolidation settlement that has occurred in the native soils as a result of the Pleasant Prairie Ash Landfill Floodplain Levee. Estimate the time required for the majority of primary consolidation settlement to be completed. This analysis also assesses the magnitude of possible freeboard loss as a result of levee settlement.

Design Criteria and Assumptions

1. Soil borings were not completed as part of the levee certification process. However, soils borings from the site were completed as part of the landfill permitting process. This information was used to estimate the subsurface profile and material parameters. The subsurface profile and material parameters were estimated from the following resources:
    - Previous project experience near the Pleasant Prairie Ash Landfill Floodplain Levee.
    - Published soil maps obtained from United States Department of Agriculture (USDA) National Resource Conservation online Web Soil Survey (WSS) for Kenosha County.
    - Published engineering correlations with material types.
2. Based on previous project experience and a review of the WSS for Kenosha County, it is anticipated that the subsurface profile beneath Pleasant Prairie Ash Landfill Floodplain Levee likely consists of native silty clay to depths greater than 50 feet below the ground surface. The static groundwater table is anticipated to approximately 10 feet below the ground surface. Typically, the glacial-lacustrine clay soils in southeastern Wisconsin are over-consolidated with time due to desiccation. Conversely, the clayey soils below the water table are more normally consolidated. The material parameters used in the calculation are summarized in Table 1 on Page 4.
3. The levee is assumed to have been constructed with silty clay similar in composition to the native soils of the Kenosha area.
4. Cohesive soils above the water table are assumed to be unsaturated, whereas cohesive soils below the water table are assumed to be saturated
5. The specific gravity of cohesive soils is assumed to be approximately 2.67
6. The cross-section geometry of the levee is based on the results of an AECOM survey

completed in August 2011. The levee was originally constructed in 2000. Based on the results of the survey, the cross-sectional geometry of the levee is relatively consistent across its entire length. The levee geometry is summarized in Table 2 on Page 4.

7. Settlement was calculated beneath the center of the levee, which is conservative as settlement will generally be less towards the toe of the levee.

Conclusions

The results of the settlement analysis are included in Tables 4 and 5 on Page 5. Based on the results of the settlement analysis, it is estimated that approximately 1.5 to 2 inches of primary consolidation settlement has occurred beneath the center of the levee since the original construction in 2000. The estimated time required to complete 90% of primary consolidation in the silty clay soils is approximately 15 to 20 months; therefore, it is anticipated that primary consolidation is mostly complete as of the November 2011 survey. Additionally, the magnitude of levee settlement is generally expected to be less towards the toe. A minimum freeboard requirement of 3 feet is required for certification. Based on the results of this analysis, it is our opinion that settlements on the order of 2 inches or less do not have a major impact on the overall crest elevation or freeboard height of the levee.

References

Das, Braja M. Principles of Geotechnical Engineering. 5th edition. Brooks-Cole, Pacific Grove, California. 2002.

Holtz, Robert D. and Kovacs, William D. An Introduction to Geotechnical Engineering. Prentice-Hall Inc., Englewood Cliffs, New Jersey. 1981.

PROJECT: P4 Flood Plain Levee
PROJECT NO.: 60223980
SUBJECT: Settlement Analysis
PAGE NO.: 3 of 5

CROSS SECTION: Typical
ANALYSIS TYPE: Primary Consolidation
RESERVOIR CONDITION: Empty Pool (Normal)
STATIC WATER TABLE ELEVATION: 670 Feet

ORIGINATED BY: JDW
DATE: 01/17/2012
CHECKED BY: DLH
DATE: 01/27/2012

Material Properties:

Name: Native Brown Silty Clay (CL)
Unit Weight: 125 pcf
Moisture Content: 10%
Coefficient of Compression: 0.06
Coefficient of Recompression: 0.012
Initial Void Ratio: 0.47

Name: Native Gray Silty Clay (CL)
Unit Weight: 130 pcf
Moisture Content: 20%
Coefficient of Compression: 0.08
Coefficient of Recompression: 0.016
Initial Void Ratio: 0.53

Name: Embankment Fill (CL)
Unit Weight: 120 pcf

Assumptions:

1) Cohesive soils above the water table are unsaturated (S < 100%)
2) Cohesive soils below the water table are saturated (S = 100%)
3) Cohesive soils above the water table are overconsolidated due to dessication
4) Cohesive soils below the water table are assumed to be normally consolidated
5) Specific gravity of cohesive soils is approximately 2.67

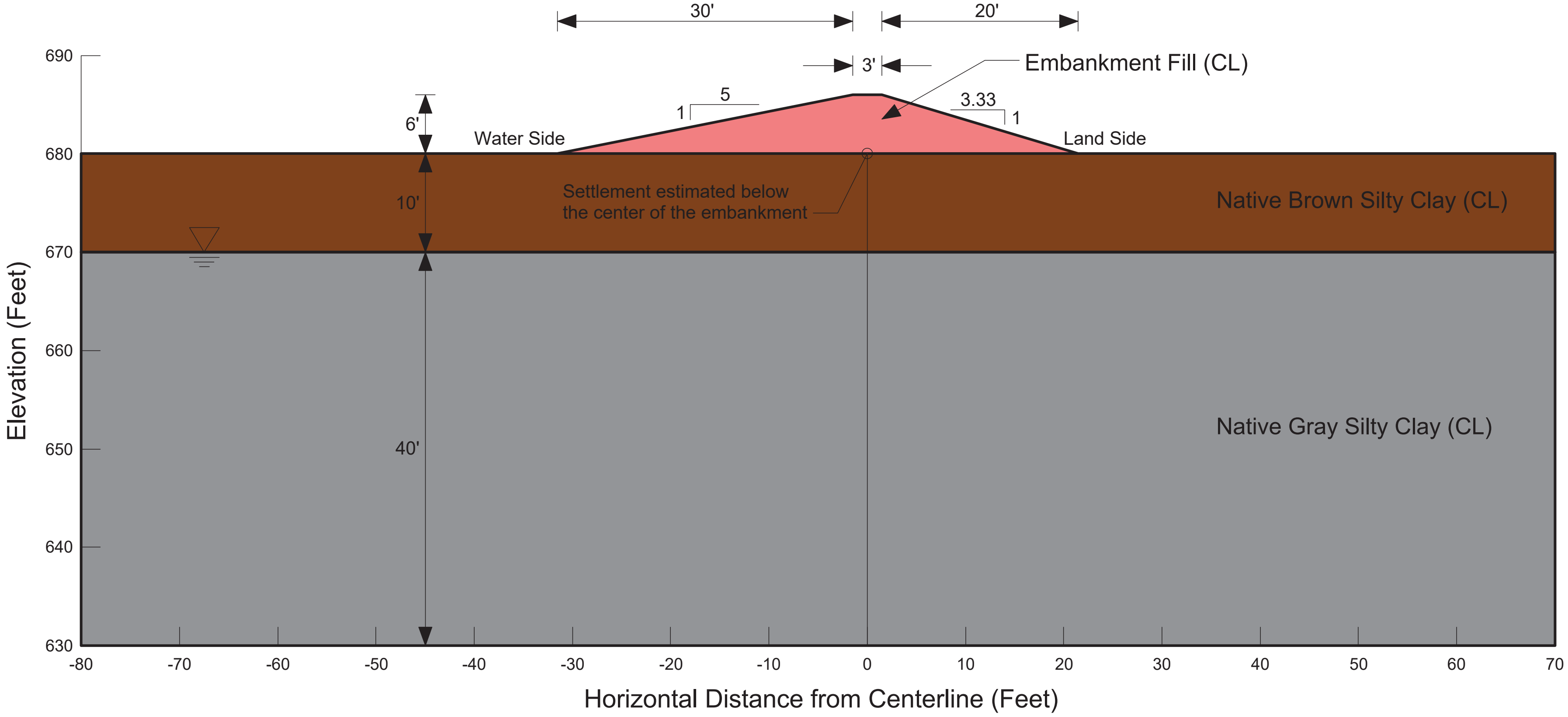


Table 1
Pleasant Prairie Power Plant Floodplain Levee Material Properties

Layer No.	Soil Type	Cohesive (c) or Granular (g)?	Unit Weight, γ (pcf)	Cohesive Settlement Properties				References
				Natural Moisture Content, w (%)	Coefficient of Compression, C_c	Coefficient of Recompression, C_{cr}	Initial Void Ratio, e	
1	Native Brown Silty Clay (above water table)	c	125	10	0.06	0.012	0.47	[1][2]
2	Native Gray Silty Clay (below water table)	c	130	20	0.08	0.016	0.53	[1][2]

Table 2
Levee Geometry and Material Parameters

U/S Embankment Side Slope, s (deg)	11.31
U/S Side Slope Width, B2 (feet)	30
U/S Embankment Crest Width, B1 (feet)	1.5
D/S Embankment Side Slope, s (deg)	16.70
D/S Side Slope Width, B2 (feet)	20
D/S Embankment Crest Width, B1 (feet)	1.5
New Fill Thickness, t (feet)	6
New Fill Unit Weight, γ_f (pcf)	120
New Fill Surcharge, q_f (psf)	720

Table 3
Groundwater Parameters

Depth to Groundwater, d (feet)	10
Unit Weight of Water, γ_w (pcf)	62.4

REFERENCES:

[1] Das (2002), *Principles of Geotechnical Engineering* . 5th ed., Table 3.2, Page 53
[2] Holtz and Kovacs (1981), *An Introduction to Geotechnical Engineering.* Table 8-2, Page 341

ASSUMPTIONS:

1) Cohesive soils above the water table are unsaturated (S < 100%)
2) Cohesive soils below the water table are saturated (S = 100%)
3) Cohesive soils above the water table are overconsolidated due to dessication
4) Cohesive soils below the water table are normally consolidated
5) Specific gravity of cohesive soils is approximately 2.67

FORMULAS

$$\boxed{e = \frac{(1+w)G_s * \gamma_w}{\gamma} - 1}$$
…for unsaturated soils, from Das (2002), Equation 3.15, Page 49

$$\boxed{e = w * Gs}$$
…for saturated soils, from Das (2002), Equation 3.20, Page 49

$$\boxed{C_c = 0.30(e_o - 0.27)}$$
…from Holtz and Kovacs (1981), Table 8-2, Page 341

$$\boxed{C_{cr} = \frac{1}{5} C_c}$$
…from Das (2002), Equation 10.31, Page 282

$$\boxed{q_f = \gamma_f * t}$$

$$\boxed{\gamma_e = \gamma - \gamma_w}$$

$$\boxed{\sigma' = \sum \gamma_e * H}$$

$$\boxed{\alpha 1 = \tan^{-1}(\frac{B1 + B2}{z}) - \tan^{-1}(\frac{B1}{z})}$$
…from Das (2002), Equation 9.20, Page 238

$$\boxed{\alpha 2 = \tan^{-1}(\frac{B1}{z})}$$
…from Das (2002), Equation 9.21, Page 238

$$\boxed{I = \frac{\left(\frac{B1 + B2}{B1}\right)(\alpha 1 + \alpha 2) - \frac{B1}{B2}(\alpha 2)}{\pi}}$$
…from Das (2002), Equation 9.19, Page 238

$$\boxed{\Delta\sigma = q_f * I}$$
…from Das (2002), Equation 9.22, Page 239

$$\boxed{S(cohesive) = \frac{C_c}{1 + e_o} * \log(\frac{\sigma' + \Delta\sigma}{\sigma'})}$$
…for normally consolidated soils, from Das (2002), Equation 10.24, Page 281

$$\boxed{S(cohesive) = \frac{C_{cr}}{1 + e_o} * \log(\frac{\sigma' + \Delta\sigma}{\sigma'})}$$
…for overconsolidated soils, from Das (2002), Equation 10.26, Page 281

Table 4
Primary Consolidation Settlement Calculation

Depth, z (ft)		Midpoint Depth (ft)	Midpoint Elevation (ft)	Layer Height, H (ft)	Layer No.	Unit Weight, γ (pcf)	Effective Unit Weight, γ_e (pcf)	Overburden Pressure at Layer Midpoint, σ' (psf)	Upstream Side			Downstream Side			Surcharge, $\Delta\sigma_z$ (psf)	Primary Settlement, S (in.)	Total Settlement Per Layer (in.)
From:	To:								$\alpha1$ (radians)	$\alpha2$ (radians)	Influence Factor, I	$\alpha1$ (radians)	$\alpha2$ (radians)	Influence Factor, I			
0	1	0.5	685.5	1	1	125	125	200.0	0.31	1.2	0.4998	0.30	1.2	0.4997	719.7	0.064	0.358
1	2	1.5	684.5	1		125	125	200.0	0.74	0.8	0.4966	0.72	0.8	0.4949	713.9	0.064	
2	3	2.5	683.5	1		125	125	312.5	0.95	0.5	0.4899	0.91	0.5	0.4850	701.9	0.049	
3	4	3.5	682.5	1		125	125	437.5	1.06	0.4	0.4816	1.00	0.4	0.4726	687.0	0.039	
4	5	4.5	681.5	1		125	125	562.5	1.11	0.3	0.4725	1.04	0.3	0.4592	670.8	0.033	
5	6	5.5	680.5	1		125	125	687.5	1.13	0.3	0.4630	1.05	0.3	0.4454	654.1	0.028	
6	7	6.5	679.5	1		125	125	812.5	1.14	0.2	0.4534	1.05	0.2	0.4316	637.2	0.024	
7	8	7.5	678.5	1		125	125	937.5	1.14	0.2	0.4437	1.04	0.2	0.4179	620.4	0.021	
8	9	8.5	677.5	1		125	125	1062.5	1.13	0.2	0.4341	1.02	0.2	0.4045	603.8	0.019	
9	10	9.5	676.5	1		125	125	1187.5	1.12	0.2	0.4246	1.00	0.2	0.3914	587.5	0.017	
10	11	10.5	675.5	1	2	130	67.6	1283.8	1.11	0.1	0.4152	0.97	0.1	0.3787	571.6	0.099	1.651
11	12	11.5	674.5	1		130	67.6	1351.4	1.09	0.1	0.4059	0.95	0.1	0.3663	556.0	0.093	
12	13	12.5	673.5	1		130	67.6	1419.0	1.07	0.1	0.3968	0.92	0.1	0.3544	540.9	0.087	
13	14	13.5	672.5	1		130	67.6	1486.6	1.06	0.1	0.3879	0.90	0.1	0.3430	526.3	0.082	
14	15	14.5	671.5	1		130	67.6	1554.2	1.04	0.1	0.3792	0.87	0.1	0.3320	512.0	0.077	
15	16	15.5	670.5	1		130	67.6	1621.8	1.02	0.1	0.3706	0.85	0.1	0.3215	498.3	0.072	
16	17	16.5	669.5	1		130	67.6	1689.4	1.00	0.1	0.3623	0.83	0.1	0.3114	485.0	0.068	
17	18	17.5	668.5	1		130	67.6	1757.0	0.98	0.1	0.3542	0.80	0.1	0.3017	472.2	0.064	
18	19	18.5	667.5	1		130	67.6	1824.6	0.96	0.1	0.3462	0.78	0.1	0.2924	459.8	0.060	
19	20	19.5	666.5	1		130	67.6	1892.2	0.94	0.1	0.3385	0.76	0.1	0.2836	447.9	0.057	
20	21	20.5	665.5	1		130	67.6	1959.8	0.92	0.1	0.3310	0.74	0.1	0.2752	436.4	0.054	
21	22	21.5	664.5	1		130	67.6	2027.4	0.90	0.1	0.3237	0.72	0.1	0.2671	425.4	0.051	
22	23	22.5	663.5	1		130	67.6	2095.0	0.88	0.1	0.3166	0.70	0.1	0.2594	414.7	0.049	
23	24	23.5	662.5	1		130	67.6	2162.6	0.87	0.1	0.3098	0.68	0.1	0.2520	404.5	0.046	
24	25	24.5	661.5	1		130	67.6	2230.2	0.85	0.1	0.3031	0.66	0.1	0.2450	394.6	0.044	
25	26	25.5	660.5	1		130	67.6	2297.8	0.83	0.1	0.2966	0.64	0.1	0.2383	385.1	0.042	
26	27	26.5	659.5	1		130	67.6	2365.4	0.81	0.1	0.2903	0.63	0.1	0.2319	376.0	0.040	
27	28	27.5	658.5	1		130	67.6	2433.0	0.80	0.1	0.2843	0.61	0.1	0.2258	367.2	0.038	
28	29	28.5	657.5	1		130	67.6	2500.6	0.78	0.1	0.2784	0.59	0.1	0.2199	358.7	0.036	
29	30	29.5	656.5	1		130	67.6	2568.2	0.77	0.1	0.2726	0.58	0.1	0.2143	350.6	0.034	
30	31	30.5	655.5	1		130	67.6	2635.8	0.75	0.0	0.2671	0.56	0.0	0.2089	342.8	0.033	
31	32	31.5	654.5	1		130	67.6	2703.4	0.74	0.0	0.2617	0.55	0.0	0.2038	335.2	0.031	
32	33	32.5	653.5	1		130	67.6	2771.0	0.72	0.0	0.2565	0.54	0.0	0.1989	327.9	0.030	
33	34	33.5	652.5	1		130	67.6	2838.6	0.71	0.0	0.2515	0.53	0.0	0.1942	320.9	0.029	
34	35	34.5	651.5	1		130	67.6	2906.2	0.70	0.0	0.2466	0.51	0.0	0.1897	314.1	0.028	
35	36	35.5	650.5	1		130	67.6	2973.8	0.68	0.0	0.2419	0.50	0.0	0.1853	307.6	0.026	
36	37	36.5	649.5	1		130	67.6	3041.4	0.67	0.0	0.2373	0.49	0.0	0.1812	301.3	0.025	
37	38	37.5	648.5	1		130	67.6	3109.0	0.66	0.0	0.2329	0.48	0.0	0.1772	295.2	0.024	
38	39	38.5	647.5	1		130	67.6	3176.6	0.65	0.0	0.2286	0.47	0.0	0.1733	289.4	0.023	
39	40	39.5	646.5	1		130	67.6	3244.2	0.64	0.0	0.2244	0.46	0.0	0.1697	283.7	0.023	
40	41	40.5	645.5	1		130	67.6	3311.8	0.62	0.0	0.2203	0.45	0.0	0.1661	278.3	0.022	
41	42	41.5	644.5	1		130	67.6	3379.4	0.61	0.0	0.2164	0.44	0.0	0.1627	273.0	0.021	
42	43	42.5	643.5	1		130	67.6	3447.0	0.60	0.0	0.2126	0.43	0.0	0.1594	267.9	0.020	
43	44	43.5	642.5	1		130	67.6	3514.6	0.59	0.0	0.2089	0.42	0.0	0.1563	262.9	0.019	
44	45	44.5	641.5	1		130	67.6	3582.2	0.58	0.0	0.2053	0.42	0.0	0.1532	258.2	0.019	
45	46	45.5	640.5	1		130	67.6	3649.8	0.57	0.0	0.2019	0.41	0.0	0.1503	253.5	0.018	
46	47	46.5	639.5	1		130	67.6	3717.4	0.56	0.0	0.1985	0.40	0.0	0.1474	249.1	0.017	
47	48	47.5	638.5	1		130	67.6	3785.0	0.55	0.0	0.1952	0.39	0.0	0.1447	244.7	0.017	
48	49	48.5	637.5	1		130	67.6	3852.6	0.55	0.0	0.1920	0.39	0.0	0.1420	240.5	0.016	
49	50	49.5	636.5	1		130	67.6	3920.2	0.54	0.0	0.1889	0.38	0.0	0.1395	236.5	0.016	
															TOTAL SETTLEMENT		**2.0**

Table 5
Time Rate of Consolidation

Coefficient of Consolidation, cv (in^2/sec)	4.40E-05	…from Das (2002), Table 10.6, Page 297
Time Factor for 90% Consolidation, Tu	0.848	…from Das (2002), Table 10.5, Page 293
Drainage Distance, Hdr (feet)	50	…assumed soil profile is singly drained
Time required for 90% Consolidation, t90 (days)	558	

$$\boxed{t90 = \frac{Tu * Hdr^2}{cv}}$$

…from Das (2002), Equation 10.55, Page 295

SUMMARY:

Primary Consolidation Settlement (Cohesive Soil) = 2.0 inches
Approximately 558 days will be required to achieve 90 percent consolidation once embankment load is applied

Tab 10

44 CFR 65.10(b)(6); Interior Drainage

Tab 10

44 CFR 65.10 (b) (6) Tab

(6) *Interior drainage.* An analysis must be submitted that identifies the source(s) of such flooding, the extent of the flooded area, and, if the average depth is greater than one foot, the water-surface elevation(s) of the base flood. This analysis must be based on the joint probability of interior and exterior flooding and the capacity of facilities (such as drainage lines and pumps) for evacuating interior floodwaters.

P.E. Signature: ______________________

Non Applicable: ______________________

P.E. Name: John M. Trast, P.E.

P.E. License Number and State: 31792-6 WI

CALCULATION SHEET

Page 1 **Of** 3
Project No. 1325060

Client	We Energies	**Subject**	Interior Drainage	**Prepared By**	CEF	**Date**	05/2013
Project	Pleasant Prairie Ash		44 CFR 65.10 (b) (6)	**Reviewed By**	JXT	**Date**	05/2013
Landfill Floodplain Levee Cert				**Approved By**	JXT	**Date**	06/2013

INTERIOR DRAINAGE ANALYSIS

Objective

Verify that the Pleasant Prairie Ash Landfill Floodplain Levee meets the requirements of 44 CFR 65.10(b)(6) Interior Drainage, which states:

An analysis must be submitted that identifies the source(s) of such flooding, the extent of the flooded area, and, if the average depth is greater than one foot, the water-surface elevation(s) of the base flood. This analysis must be based on the joint probability of interior and exterior flooding and the capacity of facilities (such as drainage lines and pumps) for evacuating interior floodwaters.

Assumptions

1. The worst-case combined flooding event is assumed to be a 1% annual chance flood in the channel and a 1% annual chance local rainfall.
2. The worst-case 1% annual chance local rainfall is based on the SCS 24-hour storm.
3. The area behind the Pleasant Prairie Ash Landfill Floodplain Levee acts as a level-pool reservoir during flood events.

Calculations

Watershed Area

The watershed area behind the Pleasant Prairie Ash Landfill Floodplain Levee was determined from existing topography prepared by AECOM based on 2011 surveys and is shown on Figure 01. The watershed area behind the Pleasant Prairie Ash Landfill Floodplain Levee was calculated in AutoCAD to be 100.1 acres.

Time of Concentration

Time of concentration for the Pleasant Prairie Ash Landfill Floodplain Levee watershed was calculated using TR-55 methodology (NRCS, 1986). Time of concentration (T_c) is the time it takes for runoff to travel from the most hydraulically remote portion of the watershed to a point of interest within the watershed. The time of concentration is determined by adding all of the travel times for consecutive components of the drainage conveyance system. The longest flow path lengths for each TR-55 flow type are shown on Figure 01. The longest flow path to the point of interest for the levee watershed consists of 100 feet of sheet flow, 1,230 feet of shallow concentrated flow, and 3,175 feet of channel flow for a total length of 4,505 feet. Input parameters were obtain from the AECOM survey and selected using TR-55 methodologies. Time of concentration calculations are included in Appendix B.

Runoff Curve Number

The soils in the Pleasant Prairie Ash Landfill Floodplain Levee watershed consist of Martinton Silt Loam and Montgomery Silty Clay (NRCS, 2012). A map of the soil for this area is included in Appendix A. These soils are consistent with SCS hydrologic soil group "C" which applies for "soils with a subsurface layer that impedes downward movement of water, or soils with moderately fine to fine texture" (Mays, 2001). Using TR-55, the P4 Levee watershed was estimated to consist of "Open Space" in "Fair Condition" which corresponds to a curve number of 79 for soil group C.

Rainfall

An SCS Type II 100-year 24-hour rainfall event was used to determine flooding in the Pleasant Prairie Ash Landfill Floodplain Levee watershed. Additionally, the SCS Type II 2-year 24-hour rainfall event was needed to calculate sheet flow time. These rainfall depths were obtained from NRCS data available from the WinTR-55 computer program and equal 5.7 inches and 2.8 inches, respectively.

Flood Storage and Reservoir Routing Methodology

The U.S Army Corps of Engineers (USACE) Hydrologic Engineering Center – hydrologic Modeling System (HEC-HMS) version 3.5 (2010) computer model was used to analyze the area behind the Pleasant Prairie Ash Landfill Floodplain Levee. The HEC-HMS computer model simulates watershed response to precipitation by representing the drainage basin as a system of interconnected hydrologic and hydraulic components. Typical input parameters to the program include basin area, overland flow travel time, soil permeability, soil infiltration relationships, land use characteristics, precipitation depths and distribution, and base flow.

HEC-HMS was used to estimate flow rates, runoff volumes, and to generate hydrographs to describe the magnitude, timing of runoff, and identify areas of interior flooding with areas of ponding and BFEs. Three 12-inch outlet pipes and a 36-inch pipe equipped with backflow preventers were set as the outlet to the reservoir based on the AECOM survey. A stage-storage table was input into HEC-HMS based on AECOM survey data (Appendix B). The HEC-HMS model was run with three tailwater scenarios:

1. Free-Discharge – This condition will not occur during a combined event but represents the best case flooding scenario
2. Tailwater at Elevation 681.0 – This condition represents the 1% Annual Chance flood elevation for the main channel presented in the 2012 flood insurance study (FEMA, 2012).
3. Tailwater at Elevation 690.0 – This condition is also not likely to occur but represents a worst case flooding scenario where the watershed is essentially unable to discharge to the main channel.

The peak elevation for the P4 Levee reservoir for the above scenarios is 681.1, 681.2, and 681.4 respectively. These results are provided in the attached HEC-HMS output files (Appendix B) and the flooding extents for scenario 2 are shown on Figure 02.

Conclusions

These calculations have provided the 1% annual chance flood elevations for the interior watershed of the Pleasant Prairie Ash Landfill Floodplain Levee based on standard hydrologic techniques. The results indicate that the elevation of interior flooding is relatively insensitive to tailwater condition with a minimum water surface of 681.1 for a free discharge condition and a water surface of 681.4 for a zero discharge condition. The expected elevation of interior flooding for a combined 1% annual chance flood occurring both within the Pleasant Prairie Ash Landfill Floodplain Levee watershed and in the adjacent channel is 681.2 and the extents of this flooding are provided as Figure 02.

References

Federal Emergency Management Agency. (2012). *Flood Insurance Study – Kenosha County, Wisconsin and Incorporated Areas, Effective June 2012*. Federal Emergency Management Agency. Retrieved January 19, 2012 from ftp://ftp.wi.gov/DNR/shared/floodplain/Temporary/To_Kenosha/FIS

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CALCULATION SHEET

Page 3 **Of** 3
Project No. 1325060
Client We Energies **Subject** Interior Drainage **Prepared By** CEF **Date** 05/2013
Project Pleasant Prairie Ash 44 CFR 65.10 (b) (6) **Reviewed By** JXT **Date** 05/2013
Landfill Floodplain Levee Cert **Approved By** JXT **Date** 06/2013

Natural Resource Conservation Service, (2013) *WinTR-55, version 1.00.10* (February 7, 2013), United Stated Department of Agriculture.

Hydrologic Engineering Center, (2010), *HEC-HMS, version 3.5*, (August 2010) US Army Corp of Engineers, Washington DC.

FIGURES

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Pleasant Prairie Power Plant
Landfill Flood Plain Levee Certification
We Energies, Pleasant Prairie, WI
Project No.: 60218395 2012-04

Watershed Boundary and Longest Flow Path

AECOM

FIGURE 01

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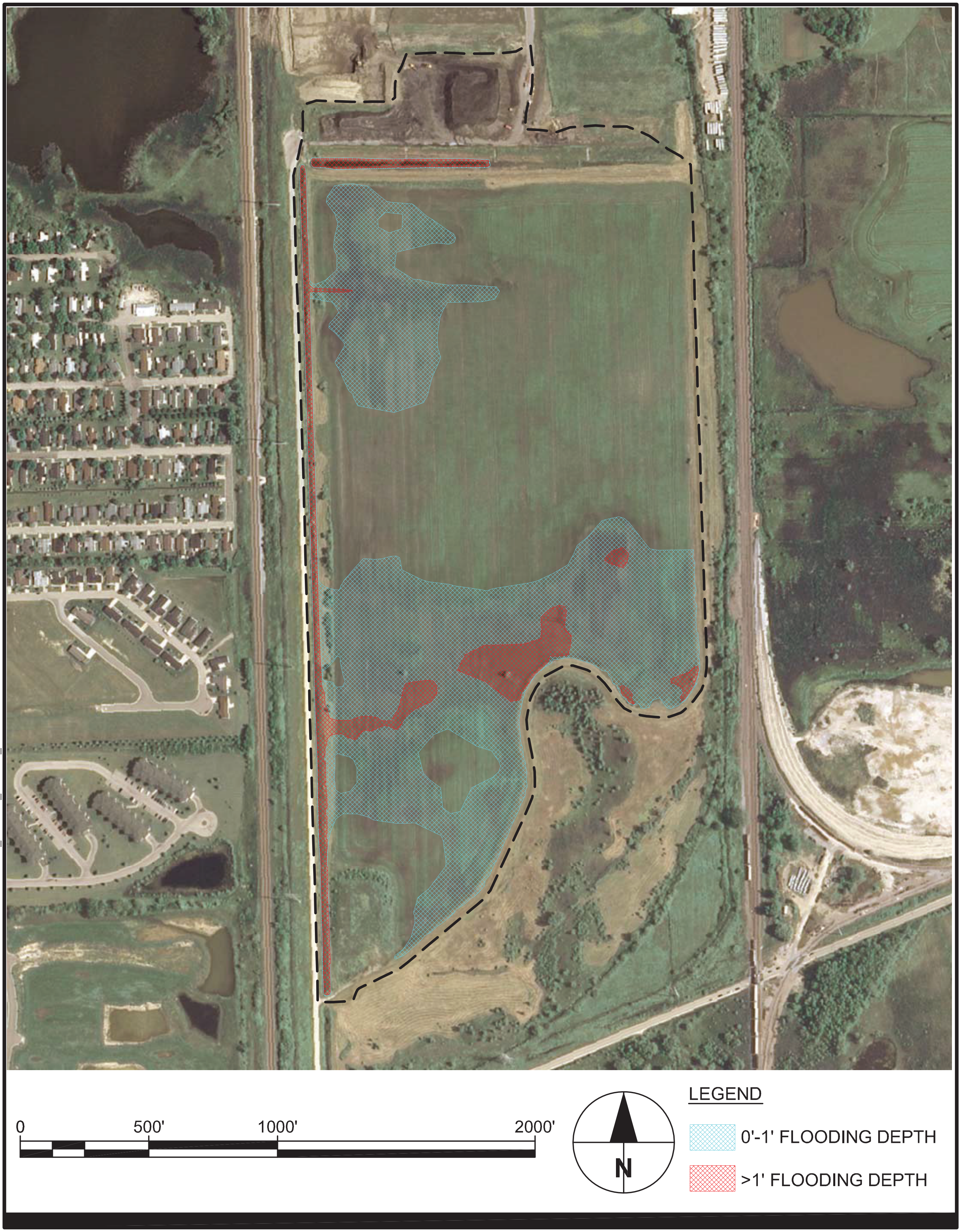


Pleasant Prairie Power Plant
Landfill Flood Plain Levee Certification
We Energies, Pleasant Prairie, WI
Project No.: 60218395 2012-04

Flooding Depth Plan

AECOM

FIGURE 02

APPENDIX A

KENOSHA COUNTY SOIL MAP

Soil Map—Kenosha and Racine Counties, Wisconsin

Map Scale: 1:11,500 if printed on A size (8.5" x 11") sheet.

MAP LEGEND

Area of Interest (AOI)
- ▭ Area of Interest (AOI)

Soils
- ▭ Soil Map Units

Special Point Features
- ◡ Blowout
- ☒ Borrow Pit
- ✳ Clay Spot
- ◆ Closed Depression
- ✕ Gravel Pit
- ∴ Gravelly Spot
- Ⓐ Landfill
- Λ Lava Flow
- ⩛ Marsh or swamp
- ⚒ Mine or Quarry
- ◎ Miscellaneous Water
- ◉ Perennial Water
- ∨ Rock Outcrop
- + Saline Spot
- ⁘ Sandy Spot
- ≡ Severely Eroded Spot
- ◇ Sinkhole
- ⟫ Slide or Slip
- ø Sodic Spot
- ≣ Spoil Area
- ◊ Stony Spot
- ꝏ Very Stony Spot
- ψ Wet Spot
- ▲ Other

Special Line Features
- ∿ Gully
- ⋯ Short Steep Slope
- ⌒ Other

Political Features
- ● Cities

Water Features
- ∼ Streams and Canals

Transportation
- ┼┼┼ Rails
- 〰 Interstate Highways
- ∼ US Routes
- ≈ Major Roads
- ∿ Local Roads

MAP INFORMATION

Map Scale: 1:11,500 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:15,840.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 16N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Kenosha and Racine Counties, Wisconsin
Survey Area Data: Version 7, Aug 14, 2010

Date(s) aerial images were photographed: 6/8/2005

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

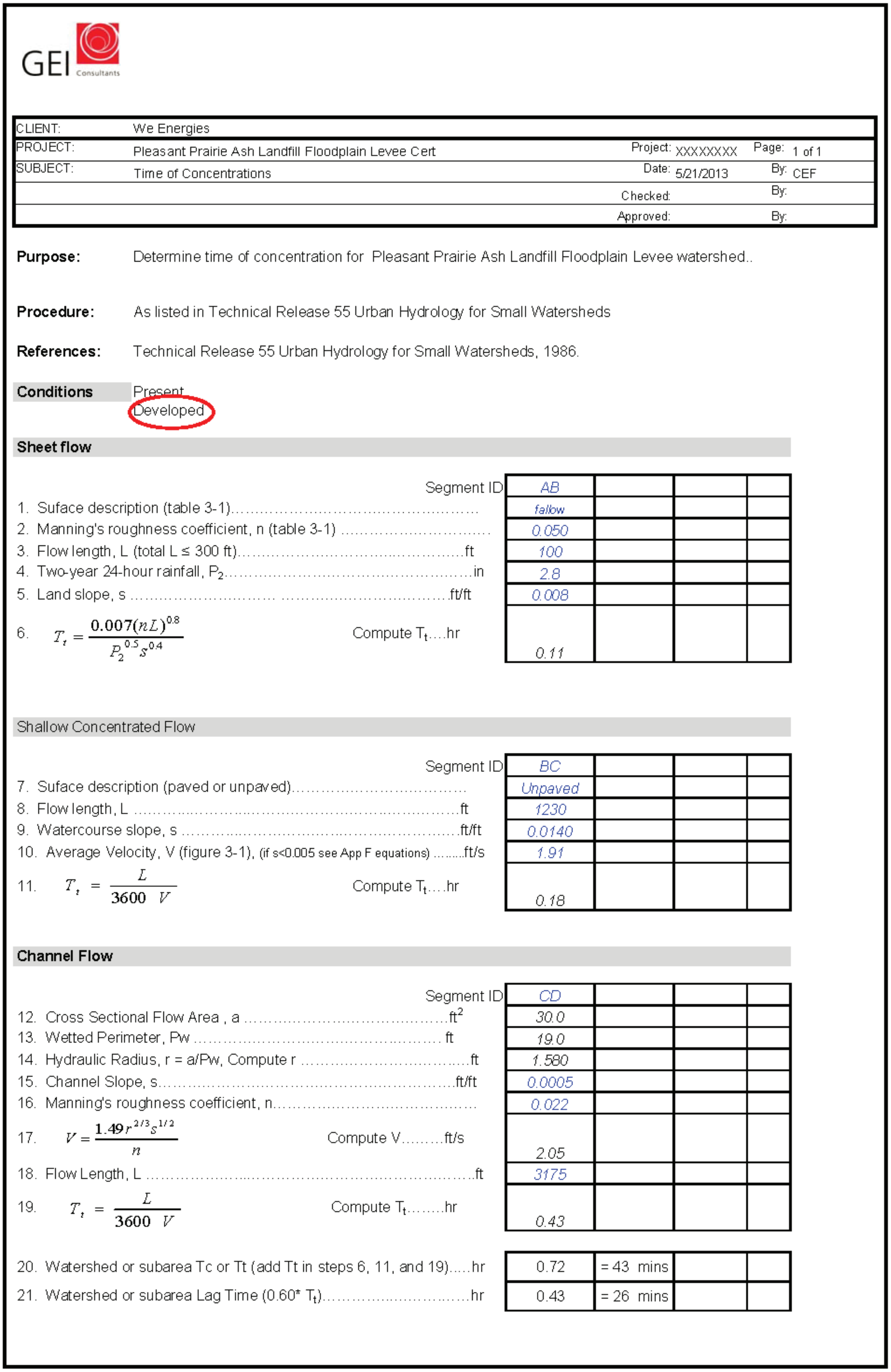
Map Unit Legend

Kenosha and Racine Counties, Wisconsin (WI601)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
AtA	Ashkum silty clay loam, 0 to 3 percent slopes	53.8	7.7%
AzB	Aztalan loam, 2 to 6 percent slopes	4.2	0.6%
BcA	Beecher silt loam, 1 to 3 percent slopes	7.0	1.0%
EtB	Elliott silty clay loam, 2 to 6 percent slopes	26.1	3.7%
HeB2	Hebron loam, 2 to 6 percent slopes, eroded	6.0	0.9%
Ht	Houghton muck	2.3	0.3%
KhA	Kane silt loam, clayey substratum, 1 to 3 percent slopes	3.4	0.5%
MeB	Markham silt loam, 2 to 6 percent slopes	95.5	13.6%
MeB2	Markham silt loam, 2 to 6 percent slopes, eroded	6.3	0.9%
Mf	Marsh	1.8	0.3%
MgA	Martinton silt loam, 1 to 3 percent slopes	66.3	9.5%
Mzc	Montgomery silty clay	316.3	45.2%
MzdB	Morley silt loam, 2 to 6 percent slopes	9.1	1.3%
MzdB2	Morley silt loam, 2 to 6 percent slopes, eroded	11.4	1.6%
MzdD2	Morley silt loam, 12 to 20 percent slopes, eroded	1.0	0.1%
Oc	Ogden muck	40.0	5.7%
Sm	Sebewa silt loam	6.3	0.9%
VaB	Varna silt loam, 2 to 6 percent slopes	9.0	1.3%
W	Water	21.1	3.0%
WeB	Warsaw loam, 2 to 6 percent slopes	13.7	2.0%
Totals for Area of Interest		**700.6**	**100.0%**

Appendix B

HEC-HMS Input and Output

Time of Concentration Determination:



GEI Consultants

CLIENT:	We Energies				
PROJECT:	Pleasant Prairie Ash Landfill Floodplain Levee Cert	Project:	XXXXXXXX	Page:	1 of 1
SUBJECT:	Time of Concentrations	Date:	5/21/2013	By:	CEF
		Checked:		By:	
		Approved:		By:	

Purpose: Determine time of concentration for Pleasant Prairie Ash Landfill Floodplain Levee watershed..

Procedure: As listed in Technical Release 55 Urban Hydrology for Small Watersheds

References: Technical Release 55 Urban Hydrology for Small Watersheds, 1986.

Conditions Present [✓ Developed]

Sheet flow

Segment ID	AB			
1. Suface description (table 3-1)……………………………………………	fallow			
2. Manning's roughness coefficient, n (table 3-1) …………………………..	0.050			
3. Flow length, L (total L ≤ 300 ft)……………………………………….ft	100			
4. Two-year 24-hour rainfall, P_2…………………………………………in	2.8			
5. Land slope, s ……………………… ……………………………ft/ft	0.008			
6. $T_t = \frac{0.007(nL)^{0.8}}{P_2^{0.5} s^{0.4}}$ Compute T_t….hr	0.11			

Shallow Concentrated Flow

Segment ID	BC			
7. Suface description (paved or unpaved)………………………………	Unpaved			
8. Flow length, L ………………………………………………………ft	1230			
9. Watercourse slope, s ………………………………………………ft/ft	0.0140			
10. Average Velocity, V (figure 3-1), (if s<0.005 see App F equations) ……..ft/s	1.91			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t….hr	0.18			

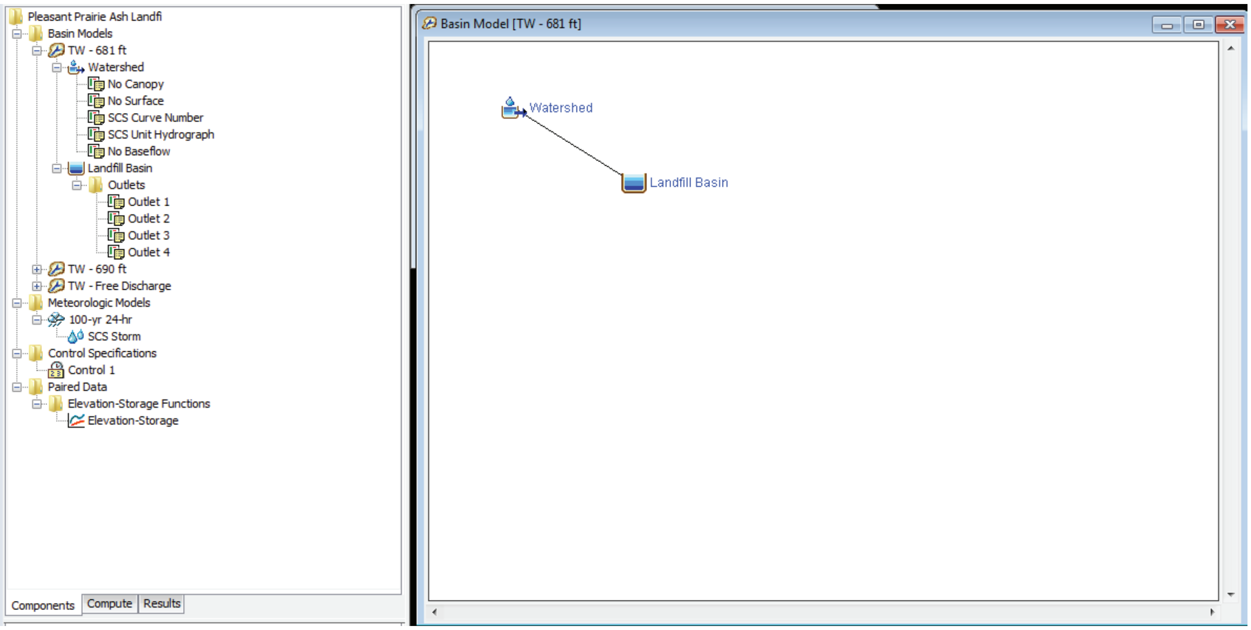
Channel Flow

Segment ID	CD			
12. Cross Sectional Flow Area , a …………………………………….ft^2	30.0			
13. Wetted Perimeter, Pw ………………………………………… ft	19.0			
14. Hydraulic Radius, r = a/Pw, Compute r ………………………………ft	1.580			
15. Channel Slope, s…………………………………………………….ft/ft	0.0005			
16. Manning's roughness coefficient, n……………………………………	0.022			
17. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V………ft/s	2.05			
18. Flow Length, L ……………………………………………………..ft	3175			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t……..hr	0.43			

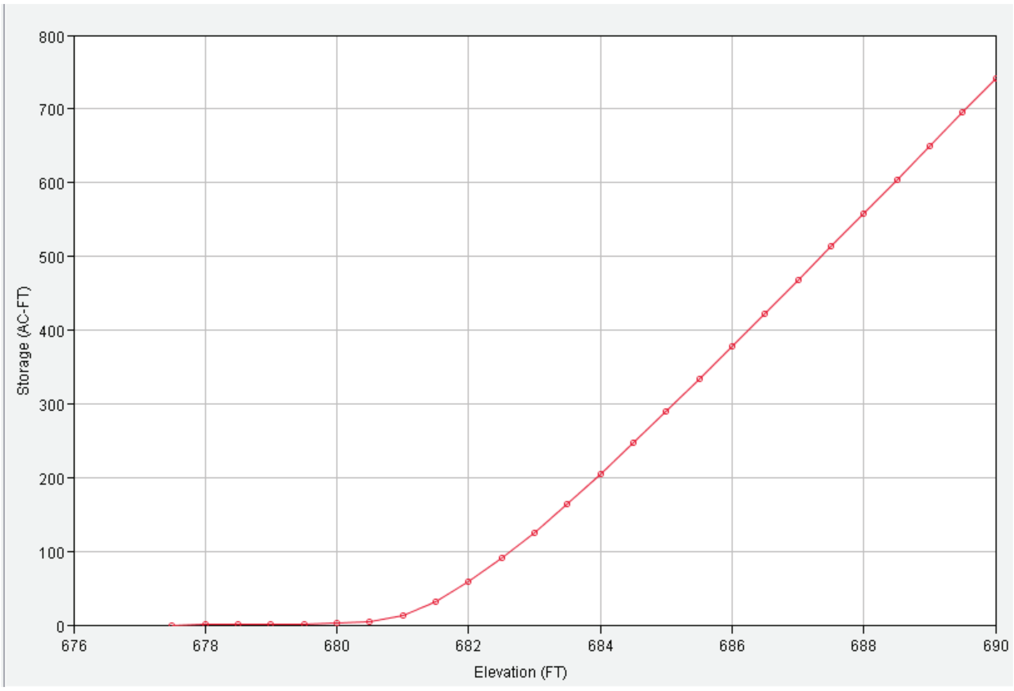
20. Watershed or subarea Tc or Tt (add Tt in steps 6, 11, and 19)…..hr	0.72	= 43 mins		
21. Watershed or subarea Lag Time (0.60* T_t)…………………………hr	0.43	= 26 mins		

Model Setup:

HEC-HMS Basin Model Setup

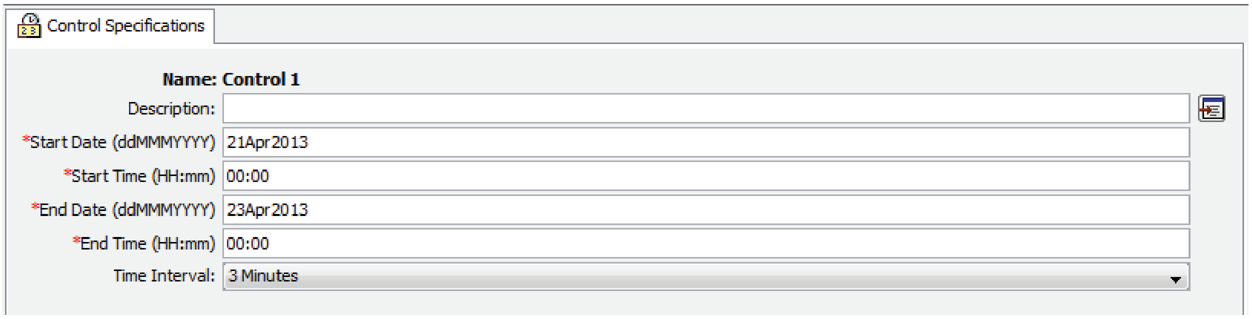


Paired Data – (Elevation – Storage Function):



Elevation (ft)	Storage (ac-ft)
677.5	0.00
678.0	0.04
678.5	0.18
679.0	0.50
679.5	1.05
680.0	1.89
680.5	4.75
681.0	13.55
681.5	32.10
682.0	58.60
682.5	90.25
683.0	125.64
683.5	164.32
684.0	204.80
684.5	246.66
685.0	289.68
685.5	333.47
686.0	377.90
686.5	422.76
687.0	467.91
687.5	513.20
688.0	558.61
688.5	604.13
689.0	649.77
689.5	695.52
690.0	741.38

Control Specifications: (Used for all three scenarios)



Name: Control 1

Description:

*Start Date (ddMMMYYYY) 21Apr2013

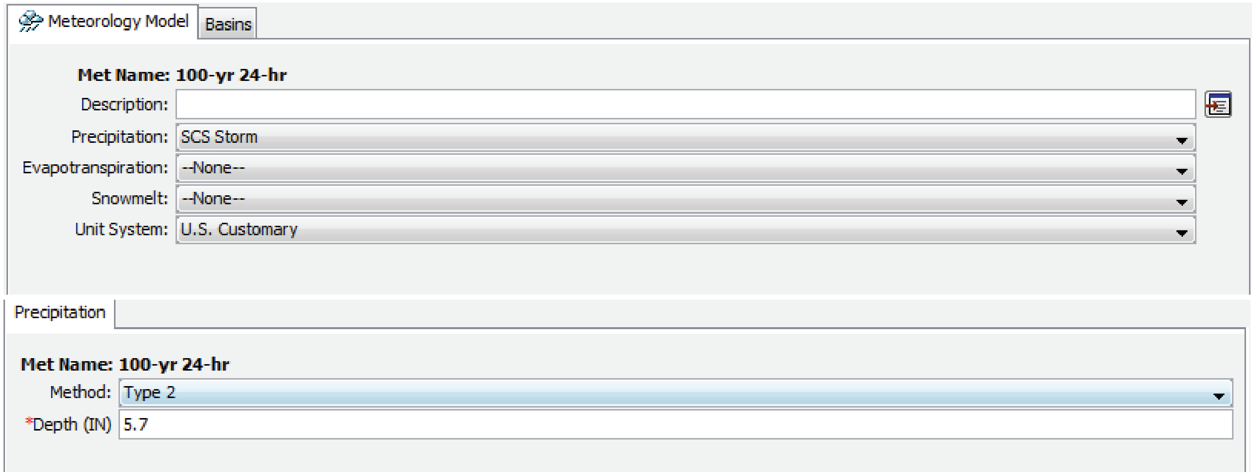
*Start Time (HH:mm) 00:00

*End Date (ddMMMYYYY) 23Apr2013

*End Time (HH:mm) 00:00

Time Interval: 3 Minutes

Meterologic Model: (Used for all three scenarios)



Met Name: 100-yr 24-hr

Description:

Precipitation: SCS Storm

Evapotranspiration: --None--

Snowmelt: --None--

Unit System: U.S. Customary

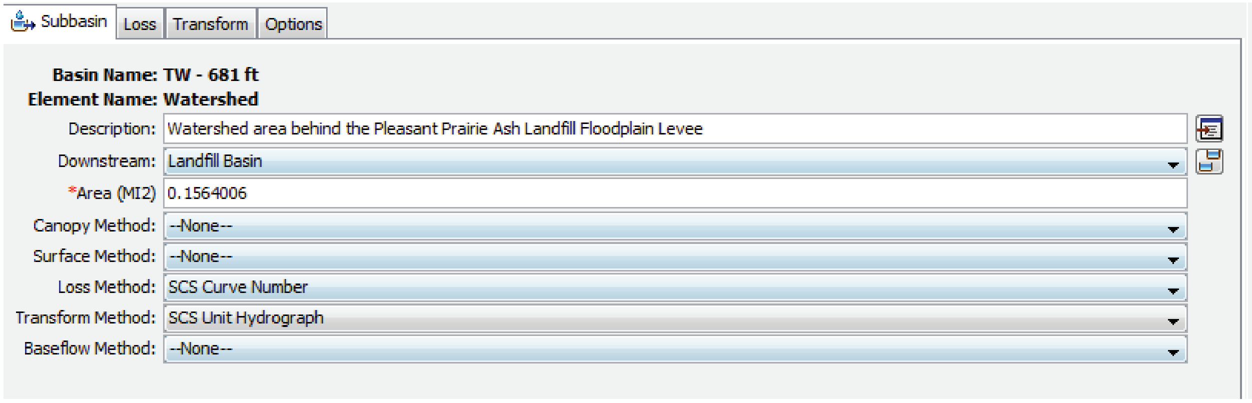
Met Name: 100-yr 24-hr

Method: Type 2

*Depth (IN) 5.7

Basin Model: (Used for all three scenarios)

Subbasin – Watershed

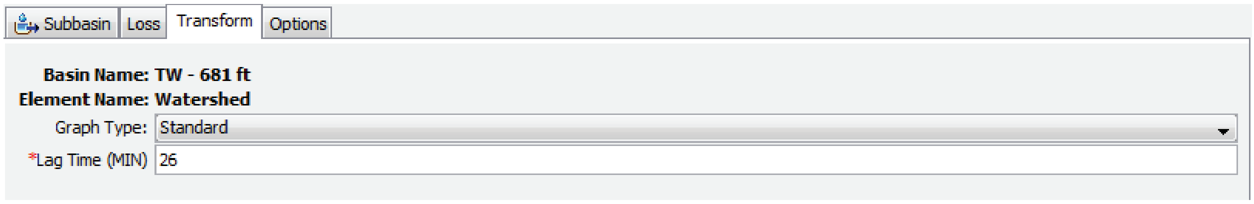


Basin Name: TW - 681 ft
Element Name: Watershed

Description: Watershed area behind the Pleasant Prairie Ash Landfill Floodplain Levee
Downstream: Landfill Basin
*Area (MI2) 0.1564006
Canopy Method: --None--
Surface Method: --None--
Loss Method: SCS Curve Number
Transform Method: SCS Unit Hydrograph
Baseflow Method: --None--

Basin Name: TW - 681 ft
Element Name: Watershed

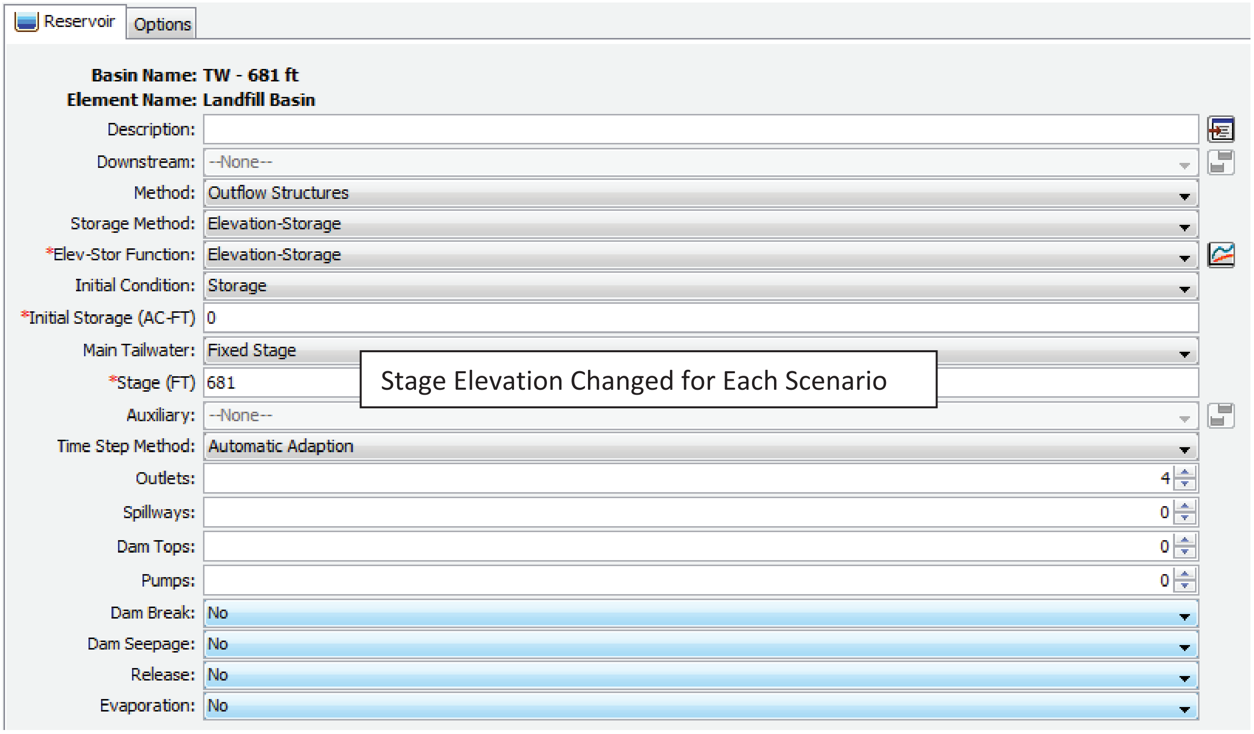
Initial Abstraction (IN) 0.532
*Curve Number: 79
*Impervious (%) 0.0



Basin Name: TW - 681 ft
Element Name: Watershed

Graph Type: Standard
*Lag Time (MIN) 26

Reservoir – Landfill Basin

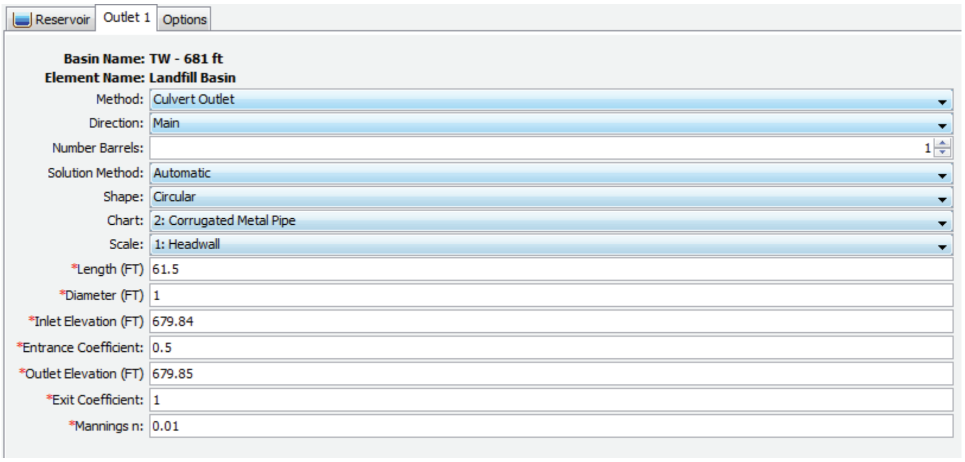


Basin Name: TW - 681 ft
Element Name: Landfill Basin

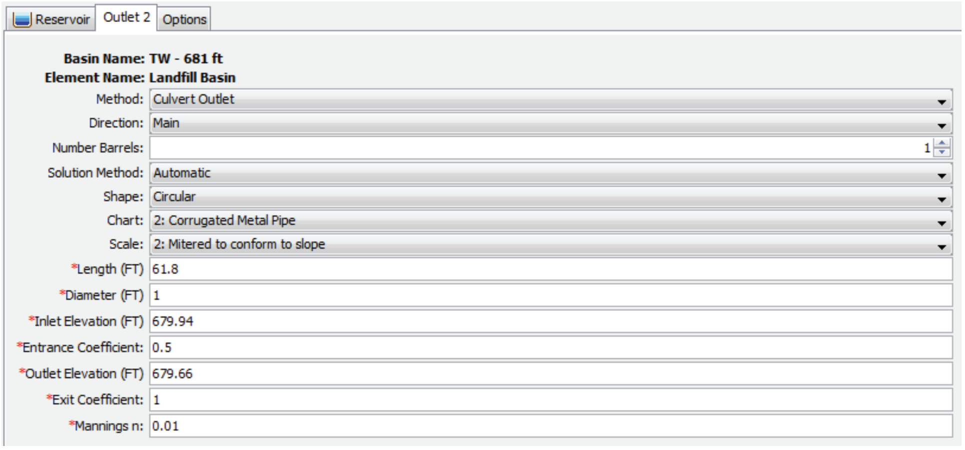
Description:
Downstream: --None--
Method: Outflow Structures
Storage Method: Elevation-Storage
*Elev-Stor Function: Elevation-Storage
Initial Condition: Storage
*Initial Storage (AC-FT) 0
Main Tailwater: Fixed Stage
*Stage (FT) 681
Auxiliary: --None--
Time Step Method: Automatic Adaption
Outlets: 4
Spillways: 0
Dam Tops: 0
Pumps: 0
Dam Break: No
Dam Seepage: No
Release: No
Evaporation: No

Stage Elevation Changed for Each Scenario

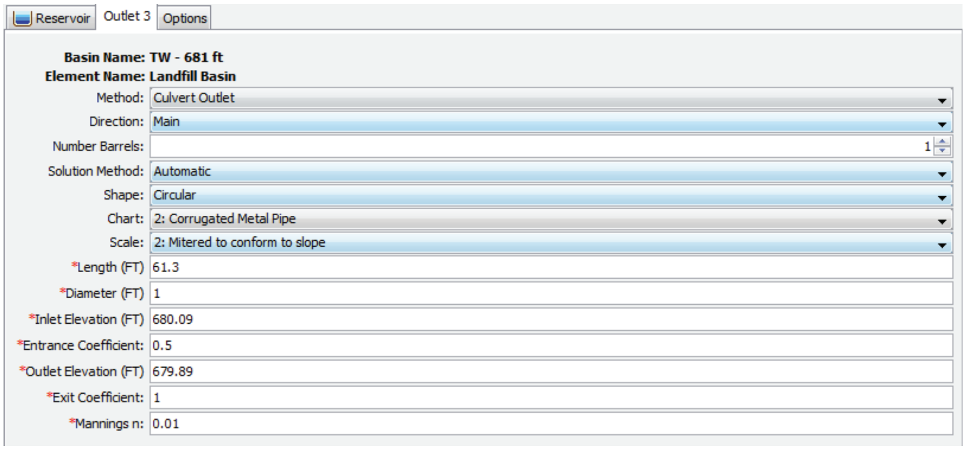
Outlets:



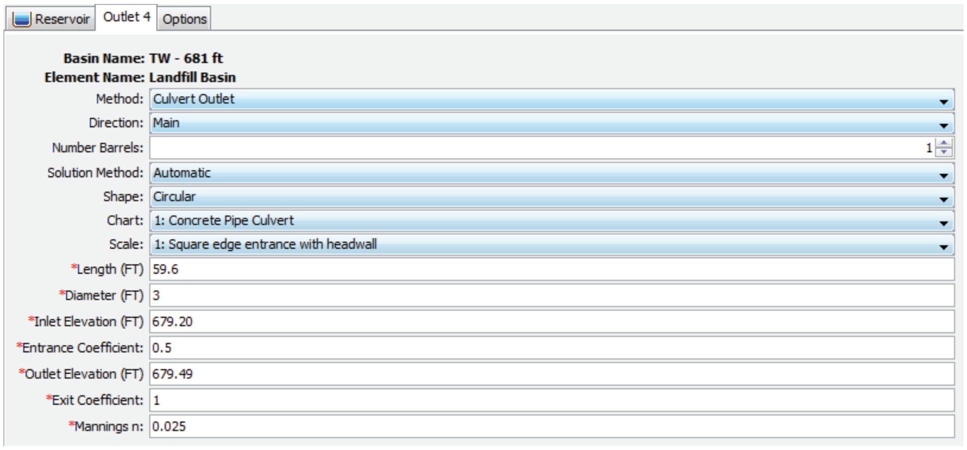
Basin Name: TW - 681 ft
Element Name: Landfill Basin
Method: Culvert Outlet
Direction: Main
Number Barrels: 1
Solution Method: Automatic
Shape: Circular
Chart: 2: Corrugated Metal Pipe
Scale: 1: Headwall
*Length (FT) 61.5
*Diameter (FT) 1
*Inlet Elevation (FT) 679.84
*Entrance Coefficient: 0.5
*Outlet Elevation (FT) 679.85
*Exit Coefficient: 1
*Mannings n: 0.01



Basin Name: TW - 681 ft
Element Name: Landfill Basin
Method: Culvert Outlet
Direction: Main
Number Barrels: 1
Solution Method: Automatic
Shape: Circular
Chart: 2: Corrugated Metal Pipe
Scale: 2: Mitered to conform to slope
*Length (FT) 61.8
*Diameter (FT) 1
*Inlet Elevation (FT) 679.94
*Entrance Coefficient: 0.5
*Outlet Elevation (FT) 679.66
*Exit Coefficient: 1
*Mannings n: 0.01



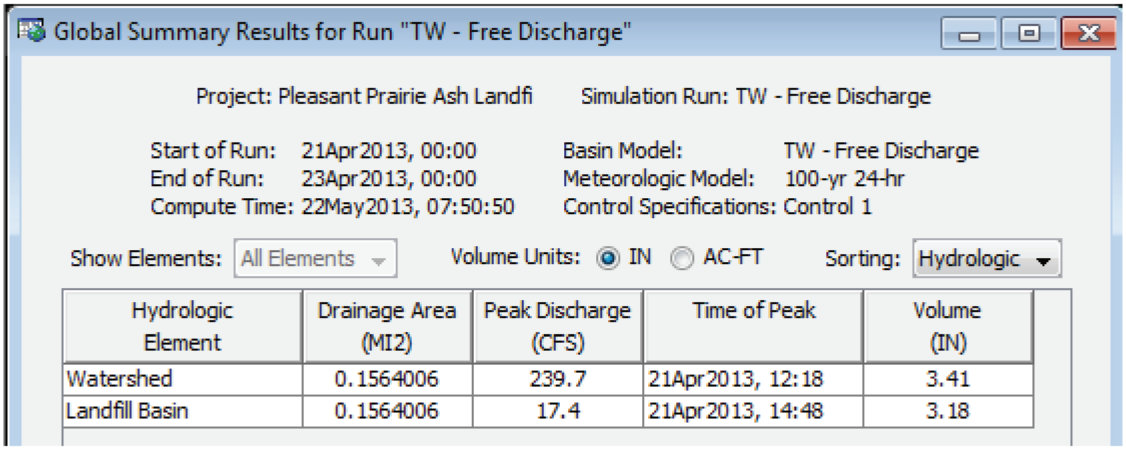
Basin Name: TW - 681 ft
Element Name: Landfill Basin
Method: Culvert Outlet
Direction: Main
Number Barrels: 1
Solution Method: Automatic
Shape: Circular
Chart: 2: Corrugated Metal Pipe
Scale: 2: Mitered to conform to slope
*Length (FT) 61.3
*Diameter (FT) 1
*Inlet Elevation (FT) 680.09
*Entrance Coefficient: 0.5
*Outlet Elevation (FT) 679.89
*Exit Coefficient: 1
*Mannings n: 0.01



Basin Name: TW - 681 ft
Element Name: Landfill Basin
Method: Culvert Outlet
Direction: Main
Number Barrels: 1
Solution Method: Automatic
Shape: Circular
Chart: 1: Concrete Pipe Culvert
Scale: 1: Square edge entrance with headwall
*Length (FT) 59.6
*Diameter (FT) 3
*Inlet Elevation (FT) 679.20
*Entrance Coefficient: 0.5
*Outlet Elevation (FT) 679.49
*Exit Coefficient: 1
*Mannings n: 0.025

RESULTS:

TW – Free-Discharge



Global Summary Results for Run "TW - Free Discharge"

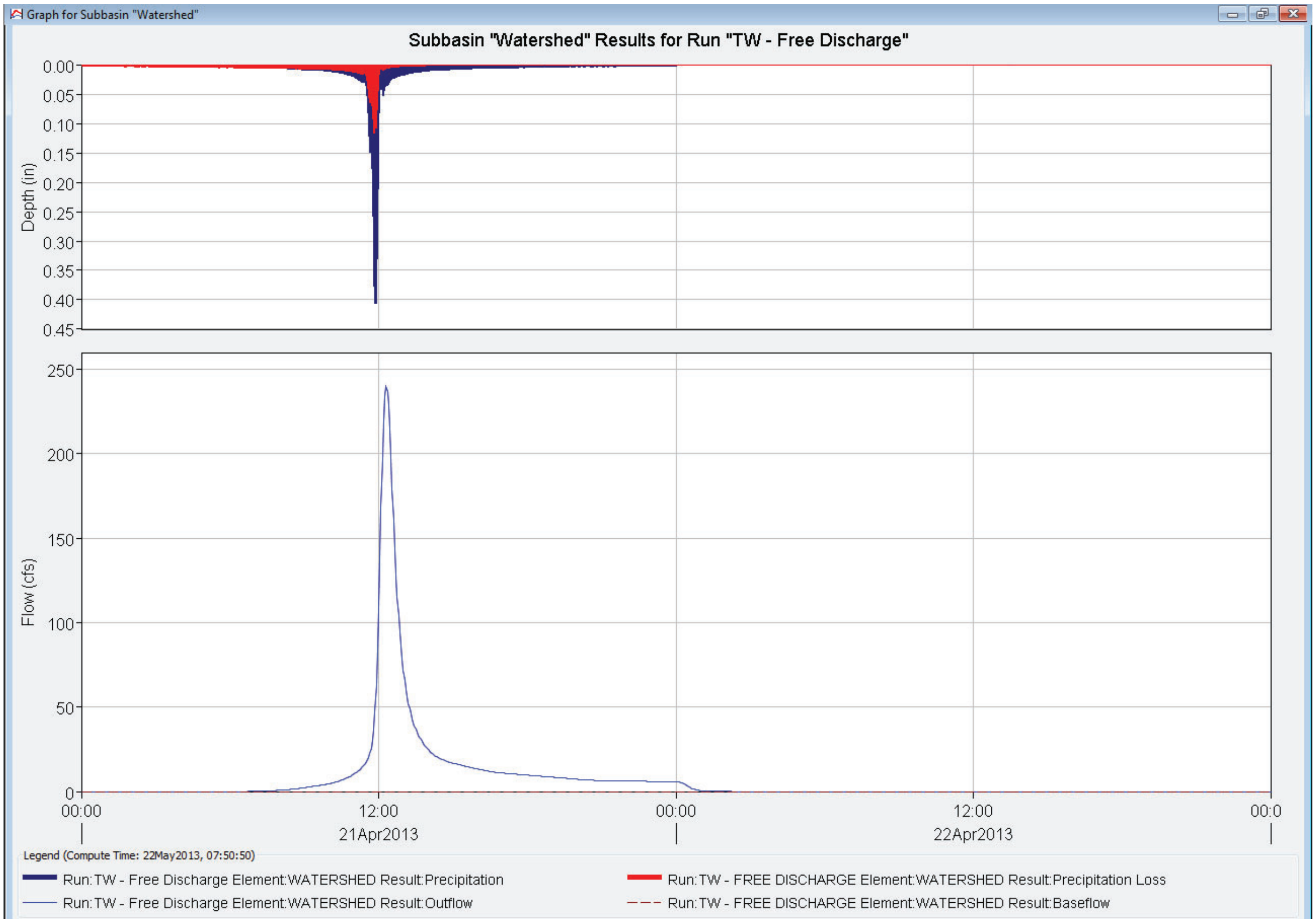
Project: Pleasant Prairie Ash Landfi   Simulation Run: TW - Free Discharge

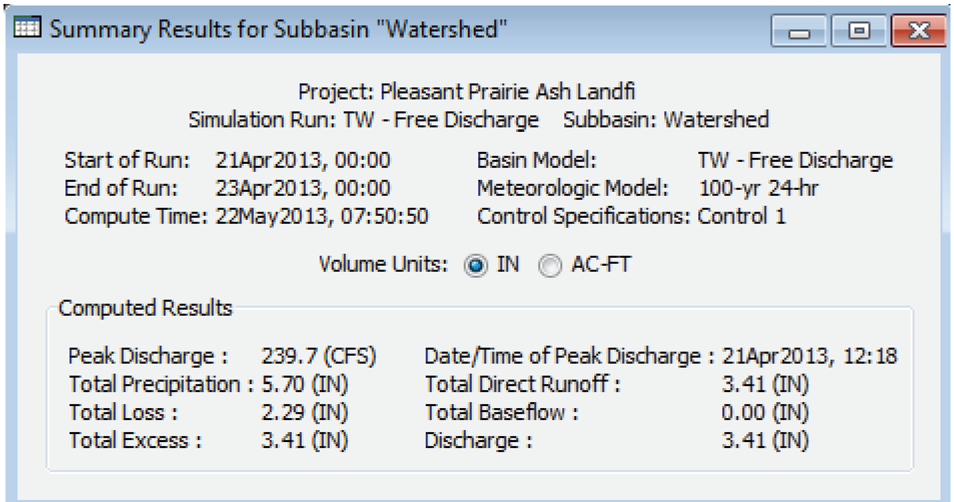
Start of Run: 21Apr2013, 00:00
End of Run: 23Apr2013, 00:00
Compute Time: 22May2013, 07:50:50

Basin Model: TW - Free Discharge
Meteorologic Model: 100-yr 24-hr
Control Specifications: Control 1

Show Elements: All Elements   Volume Units: ● IN ○ AC-FT   Sorting: Hydrologic

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Watershed	0.1564006	239.7	21Apr2013, 12:18	3.41
Landfill Basin	0.1564006	17.4	21Apr2013, 14:48	3.18




Summary Results for Subbasin "Watershed"

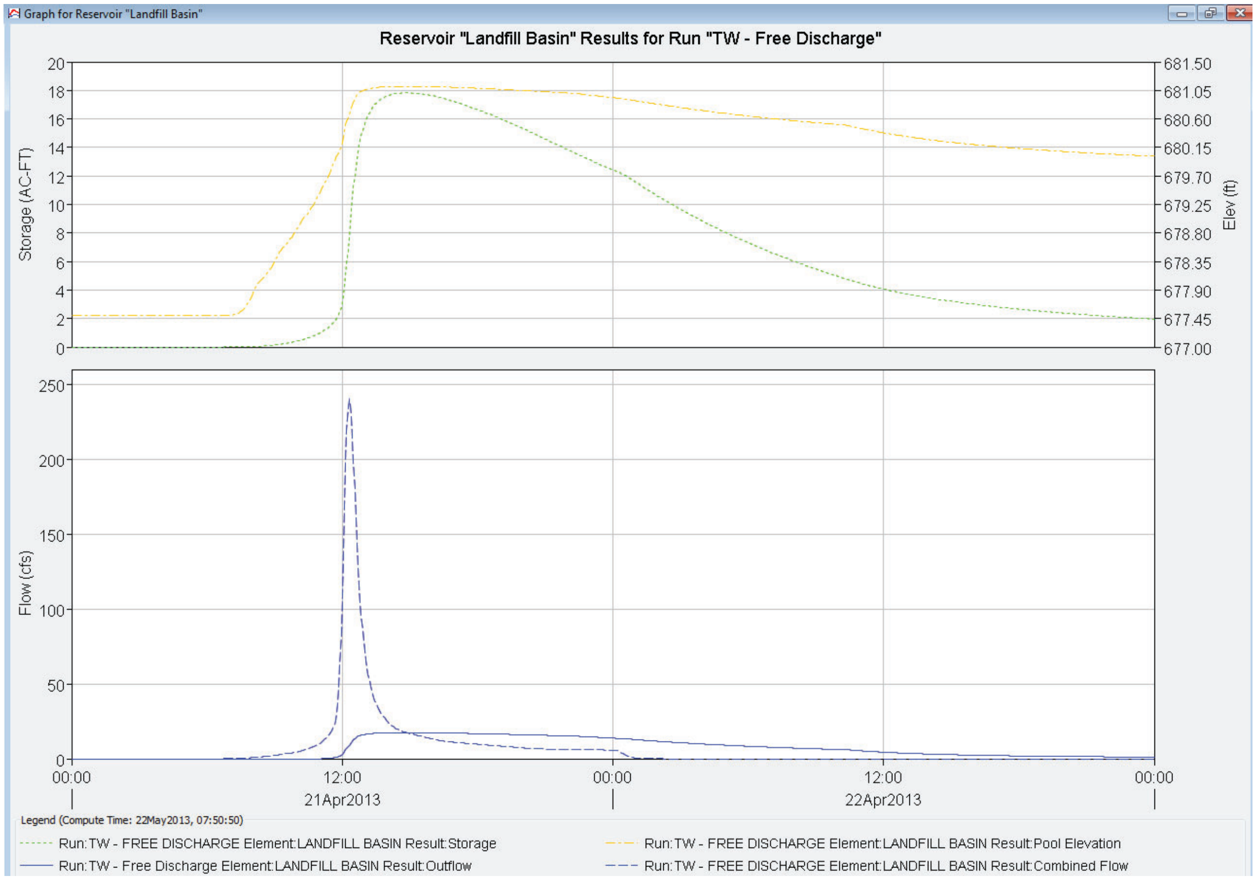
Project: Pleasant Prairie Ash Landfi
Simulation Run: TW - Free Discharge   Subbasin: Watershed

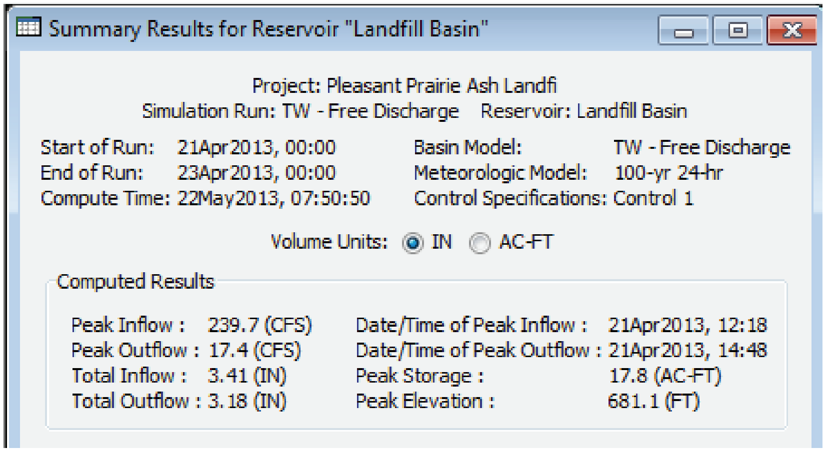
Start of Run:	21Apr2013, 00:00	Basin Model:	TW - Free Discharge
End of Run:	23Apr2013, 00:00	Meteorologic Model:	100-yr 24-hr
Compute Time:	22May2013, 07:50:50	Control Specifications:	Control 1

Volume Units: ● IN ○ AC-FT

Computed Results

Peak Discharge :	239.7 (CFS)	Date/Time of Peak Discharge :	21Apr2013, 12:18
Total Precipitation :	5.70 (IN)	Total Direct Runoff :	3.41 (IN)
Total Loss :	2.29 (IN)	Total Baseflow :	0.00 (IN)
Total Excess :	3.41 (IN)	Discharge :	3.41 (IN)




Summary Results for Reservoir "Landfill Basin"

Project: Pleasant Prairie Ash Landfi
Simulation Run: TW - Free Discharge   Reservoir: Landfill Basin

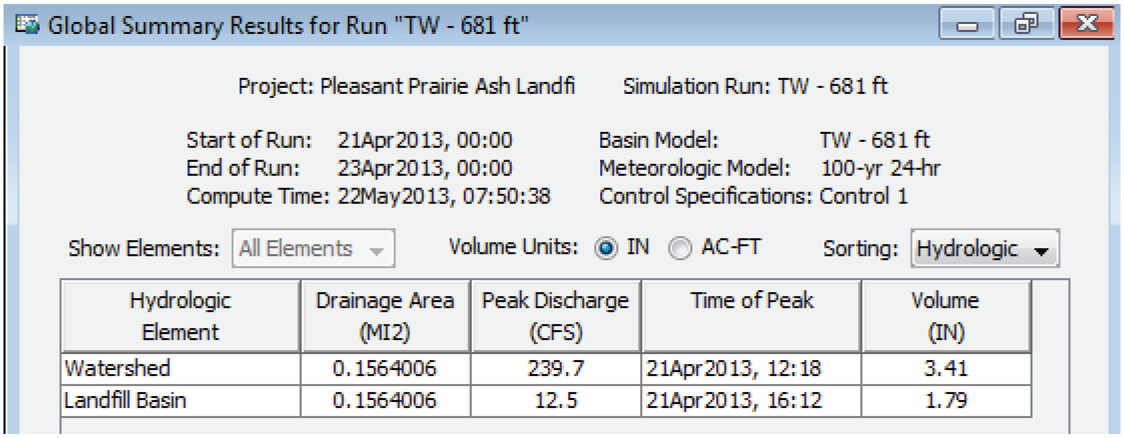
Start of Run:	21Apr2013, 00:00	Basin Model:	TW - Free Discharge
End of Run:	23Apr2013, 00:00	Meteorologic Model:	100-yr 24-hr
Compute Time:	22May2013, 07:50:50	Control Specifications:	Control 1

Volume Units: ● IN ○ AC-FT

Computed Results

Peak Inflow :	239.7 (CFS)	Date/Time of Peak Inflow :	21Apr2013, 12:18
Peak Outflow :	17.4 (CFS)	Date/Time of Peak Outflow :	21Apr2013, 14:48
Total Inflow :	3.41 (IN)	Peak Storage :	17.8 (AC-FT)
Total Outflow :	3.18 (IN)	Peak Elevation :	681.1 (FT)

TW – 681 ft



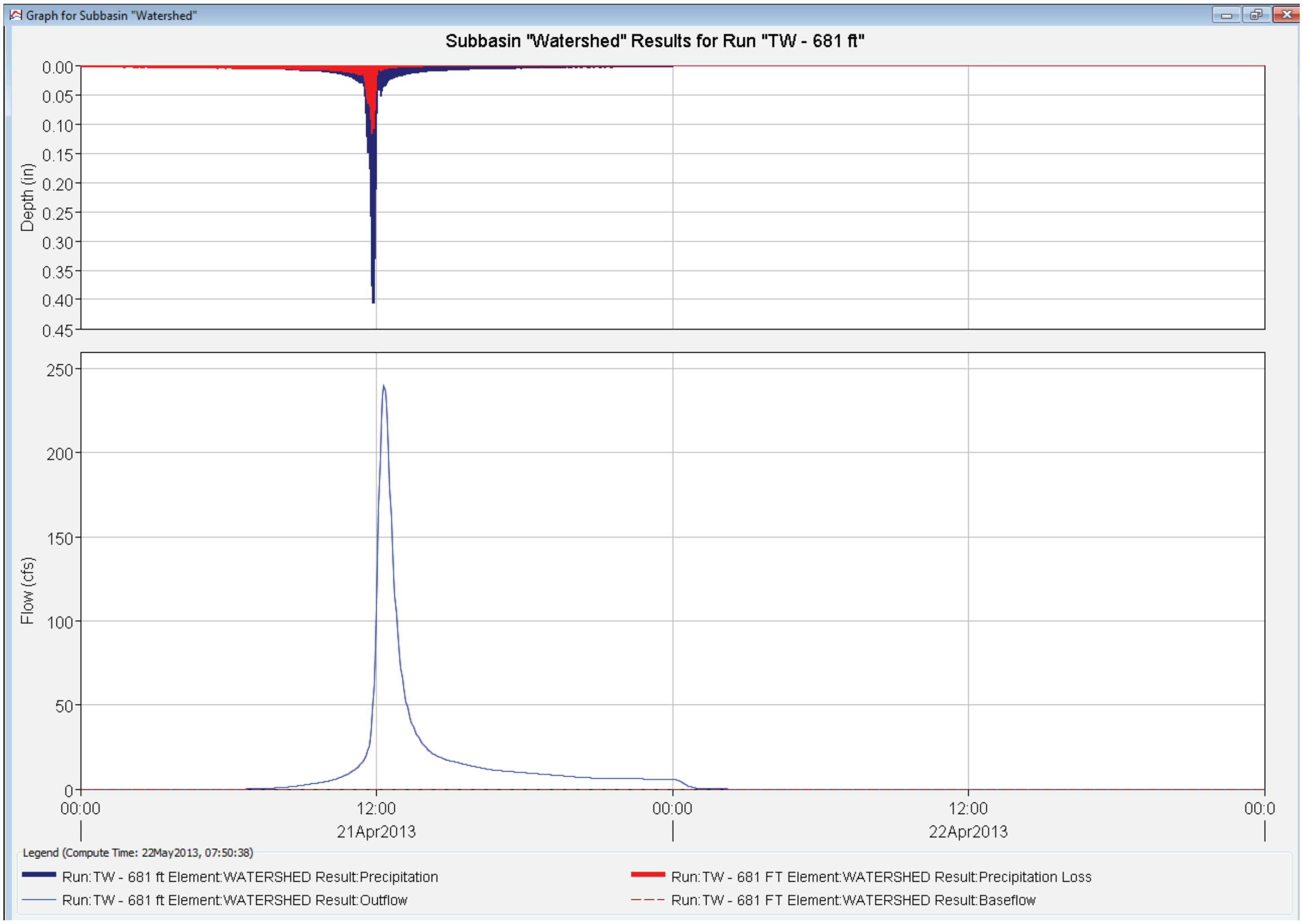
Global Summary Results for Run "TW - 681 ft"

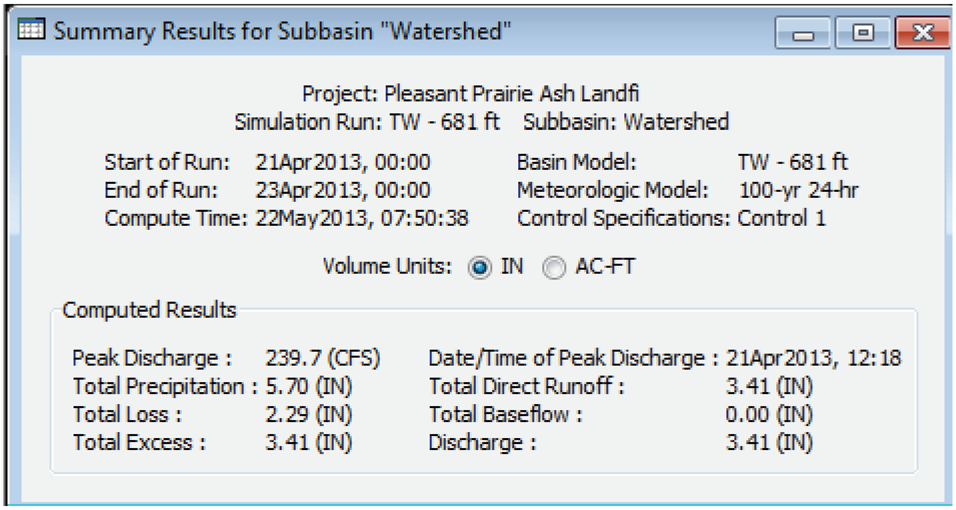
Project: Pleasant Prairie Ash Landfi   Simulation Run: TW - 681 ft

Start of Run: 21Apr2013, 00:00   Basin Model: TW - 681 ft
End of Run: 23Apr2013, 00:00   Meteorologic Model: 100-yr 24-hr
Compute Time: 22May2013, 07:50:38   Control Specifications: Control 1

Show Elements: All Elements   Volume Units: ● IN ○ AC-FT   Sorting: Hydrologic

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Watershed	0.1564006	239.7	21Apr2013, 12:18	3.41
Landfill Basin	0.1564006	12.5	21Apr2013, 16:12	1.79





Summary Results for Subbasin "Watershed"

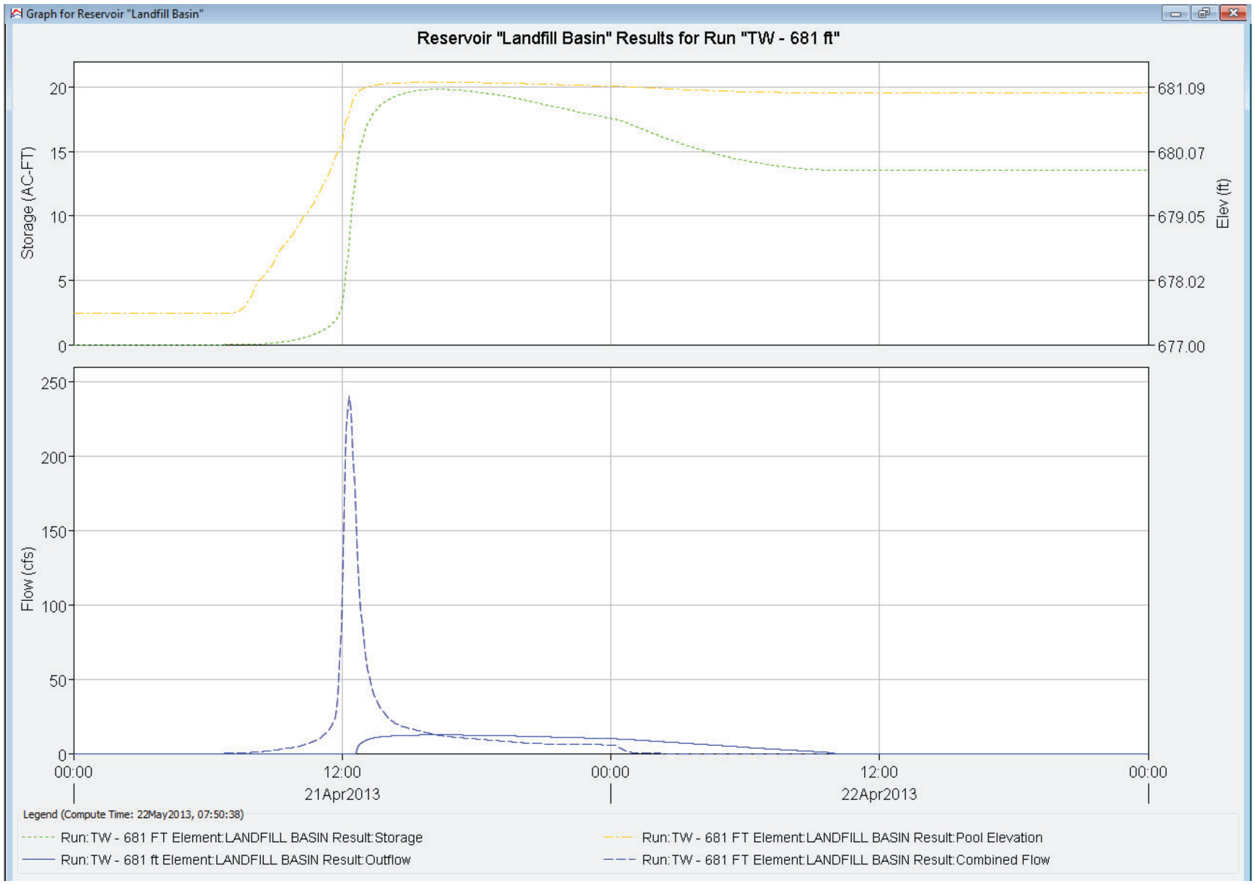
Project: Pleasant Prairie Ash Landfi
Simulation Run: TW - 681 ft   Subbasin: Watershed

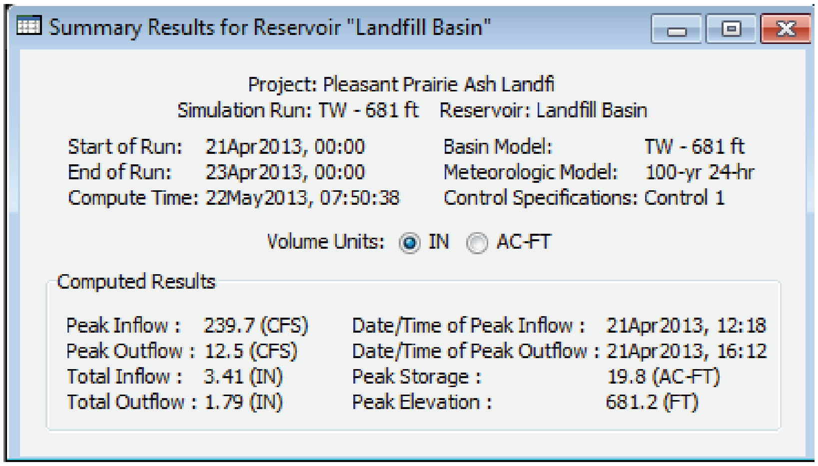
Start of Run:	21Apr2013, 00:00	Basin Model:	TW - 681 ft
End of Run:	23Apr2013, 00:00	Meteorologic Model:	100-yr 24-hr
Compute Time:	22May2013, 07:50:38	Control Specifications:	Control 1

Volume Units: ● IN ○ AC-FT

Computed Results

Peak Discharge :	239.7 (CFS)	Date/Time of Peak Discharge :	21Apr2013, 12:18
Total Precipitation :	5.70 (IN)	Total Direct Runoff :	3.41 (IN)
Total Loss :	2.29 (IN)	Total Baseflow :	0.00 (IN)
Total Excess :	3.41 (IN)	Discharge :	3.41 (IN)





Summary Results for Reservoir "Landfill Basin"

Project: Pleasant Prairie Ash Landfi
Simulation Run: TW - 681 ft   Reservoir: Landfill Basin

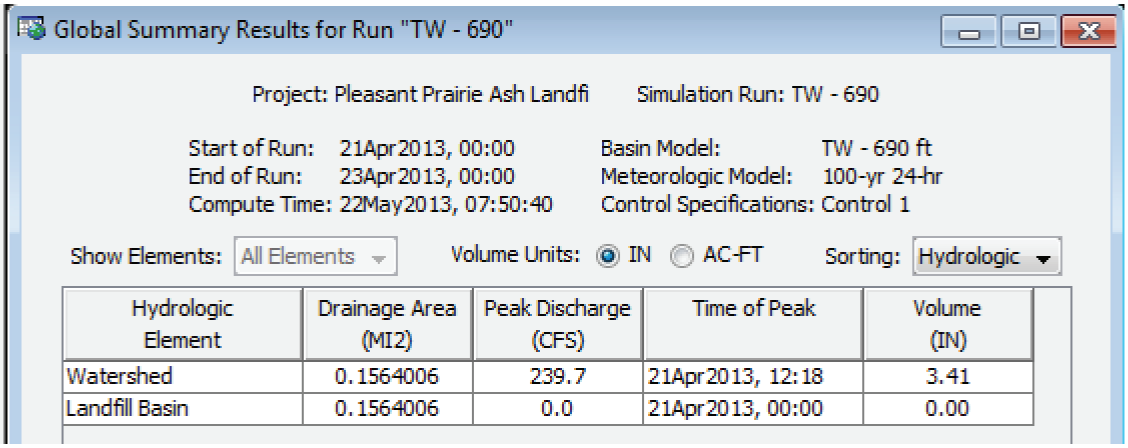
Start of Run:	21Apr2013, 00:00	Basin Model:	TW - 681 ft
End of Run:	23Apr2013, 00:00	Meteorologic Model:	100-yr 24-hr
Compute Time:	22May2013, 07:50:38	Control Specifications:	Control 1

Volume Units: ● IN ○ AC-FT

Computed Results

Peak Inflow :	239.7 (CFS)	Date/Time of Peak Inflow :	21Apr2013, 12:18
Peak Outflow :	12.5 (CFS)	Date/Time of Peak Outflow :	21Apr2013, 16:12
Total Inflow :	3.41 (IN)	Peak Storage :	19.8 (AC-FT)
Total Outflow :	1.79 (IN)	Peak Elevation :	681.2 (FT)

TW – 690 ft



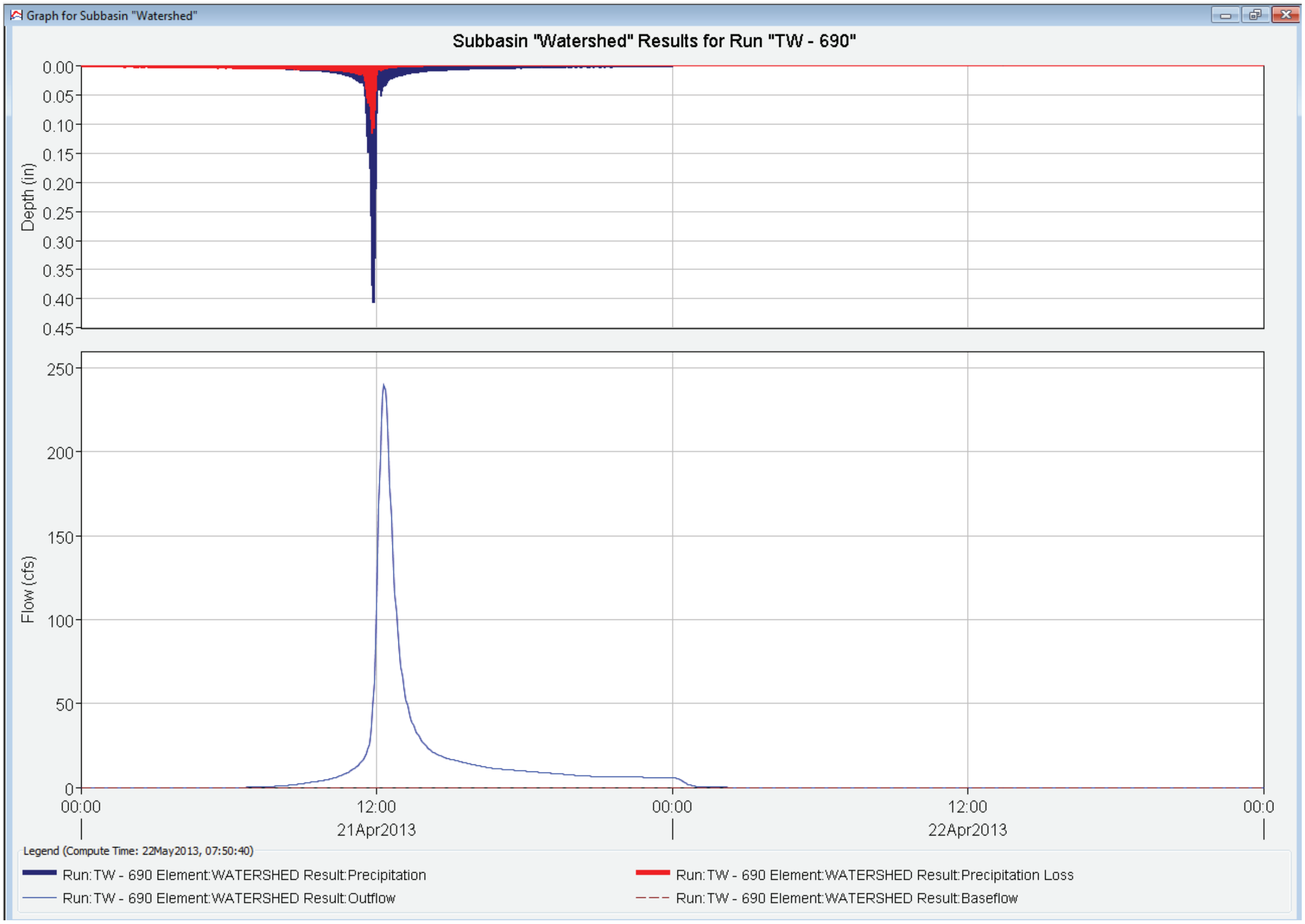
Global Summary Results for Run "TW - 690"

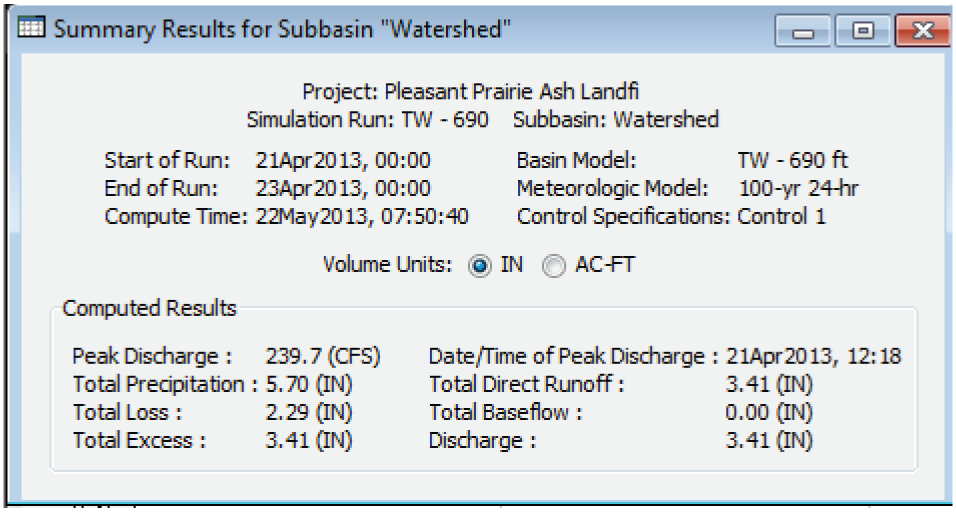
Project: Pleasant Prairie Ash Landfi   Simulation Run: TW - 690

Start of Run: 21Apr2013, 00:00   Basin Model: TW - 690 ft
End of Run: 23Apr2013, 00:00   Meteorologic Model: 100-yr 24-hr
Compute Time: 22May2013, 07:50:40   Control Specifications: Control 1

Show Elements: All Elements   Volume Units: ● IN ○ AC-FT   Sorting: Hydrologic

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
Watershed	0.1564006	239.7	21Apr2013, 12:18	3.41
Landfill Basin	0.1564006	0.0	21Apr2013, 00:00	0.00




Summary Results for Subbasin "Watershed"

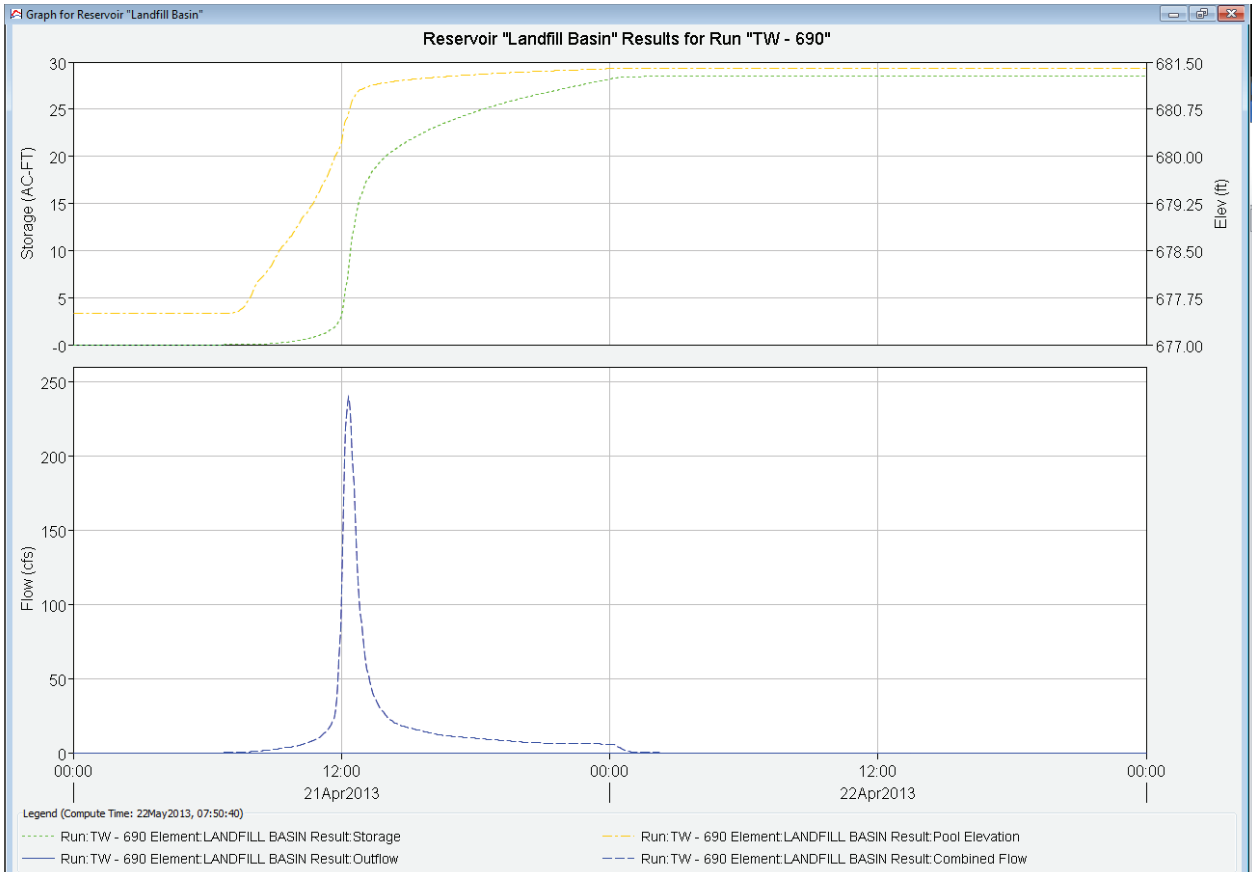
Project: Pleasant Prairie Ash Landfi
Simulation Run: TW - 690   Subbasin: Watershed

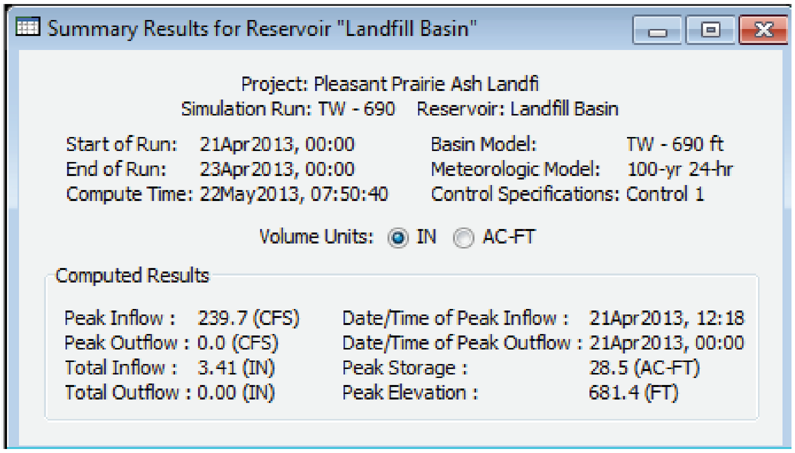
Start of Run: 21Apr2013, 00:00   Basin Model: TW - 690 ft
End of Run: 23Apr2013, 00:00   Meteorologic Model: 100-yr 24-hr
Compute Time: 22May2013, 07:50:40   Control Specifications: Control 1

Volume Units: ● IN ○ AC-FT

Computed Results

Peak Discharge : 239.7 (CFS)   Date/Time of Peak Discharge : 21Apr2013, 12:18
Total Precipitation : 5.70 (IN)   Total Direct Runoff : 3.41 (IN)
Total Loss : 2.29 (IN)   Total Baseflow : 0.00 (IN)
Total Excess : 3.41 (IN)   Discharge : 3.41 (IN)




Summary Results for Reservoir "Landfill Basin"

Project: Pleasant Prairie Ash Landfi
Simulation Run: TW - 690   Reservoir: Landfill Basin

Start of Run: 21Apr2013, 00:00   Basin Model: TW - 690 ft
End of Run: 23Apr2013, 00:00   Meteorologic Model: 100-yr 24-hr
Compute Time: 22May2013, 07:50:40   Control Specifications: Control 1

Volume Units: ● IN ○ AC-FT

Computed Results

Peak Inflow : 239.7 (CFS)   Date/Time of Peak Inflow : 21Apr2013, 12:18
Peak Outflow : 0.0 (CFS)   Date/Time of Peak Outflow : 21Apr2013, 00:00
Total Inflow : 3.41 (IN)   Peak Storage : 28.5 (AC-FT)
Total Outflow : 0.00 (IN)   Peak Elevation : 681.4 (FT)

Appendix C

Excerpts from Kenosha County FIS

FLOOD INSURANCE STUDY

VOLUME 1 OF 2

KENOSHA COUNTY, WISCONSIN,
AND INCORPORATED AREAS

Community Name	Community Number
Bristol, Village of	550595
*Genoa City, Village of	550465
Kenosha, City of	550209
Kenosha County, Unincorporated Areas	550523
Paddock Lake, Village of	550073
Pleasant Prairie, Village of	550613
Silver Lake, Village of	550210
Twin Lakes, Village of	550211

*No Special Flood Hazard Areas Identified

EFFECTIVE:
June 19, 2012

U.S. DEPARTMENT OF HOMELAND SECURITY

Federal Emergency Management Agency
FLOOD INSURANCE STUDY NUMBER
55059CV001A

TABLE 6 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-PERCENT ANNUAL CHANCE	2-PERCENT ANNUAL CHANCE	1-PERCENT ANNUAL CHANCE	0.2-PERCENT ANNUAL CHANCE
UNNAMED TRIBUTARY NO. 2 TO DES PLAINES RIVER					
At Confluence with Des Plaines River	0.6	149	229	268	*
UNNAMED TRIBUTARY NO. 2 TO JEROME CREEK					
At Confluence with Jerome Creek	0.3	36	41	43	*
UNNAMED TRIBUTARY NO. 2 TO SALEM BRANCH BRIGHTON CREEK					
At Confluence with Salem Branch Brighton Creek	0.8	69	97	110	*
UNNAMED TRIBUTARY NO. 3 TO DUTCH GAP CANAL					
At Confluence with Dutch Gap Canal	3.5	63	106	129	*
UNNAMED TRIBUTARY NO. 3 TO JEROME CREEK					
At Confluence with Jerome Creek	0.7	19	23	25	*
Just upstream of divergence with Unnamed Tributary No. 2 to Jerome Creek	*	35	39	41	*
UNNAMED TRIBUTARY NO. 3 TO SALEM BRANCH BRIGHTON CREEK					
At Confluence with Salem Branch Brighton Creek	0.7	34	48	55	*
UNNAMED TRIBUTARY TO NO. 4 TO DUTCH GAP CANAL					
At Confluence with Dutch Gap Canal	1.6	35	62	77	*

FLOODING SOURCE		FLOODWAY				1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD 88)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	WIDTH REDUCED FROM PRIOR STUDY (FEET)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
UNNAMED TRIBUTARY NO. 2 TO DES PLAINES RIVER (CONTINUED)									
K	8,380[1]	31	53	1.8	0	704.1	704.1	704.1	0.0
UNNAMED TRIBUTARY NO. 2 TO JEROME CREEK						588.9			
A	1,961[2]	33	107	0.4	0	680.8	680.8	680.8	0.0
B	2,109[2]	29	92	0.6	0	680.8	680.8	680.8	0.0
C	2,468[2]	93	260	0.3	0	680.9	680.9	680.9	0.0
D	2,780[2]	162	262	0.3	0	680.9	680.9	680.9	0.0
E	3,440[2]	172	217	0.3	0	680.9	680.9	680.9	0.0
F	4,000[2]	142	178	0.2	0	681.0	681.0	681.0	0.0
UNNAMED TRIBUTARY NO. 2 TO SALEM BRANCH BRIGHTON CREEK									
A	100[3]	*	*	*	*	752.1	*	*	*
B	950[3]	*	*	*	*	763.1	*	*	*
C	1,352[3]	*	*	*	*	768.3	*	*	*
D	1,621[3]	*	*	*	*	768.6	*	*	*
E	1,874[3]	*	*	*	*	772.7	*	*	*
F	2,767[3]	*	*	*	*	780.6	*	*	*
G	3,216[3]	*	*	*	*	789.1	*	*	*

[1]FEET ABOVE CONFLUENCE WITH UNNAMED TRIBUTARY NO. 1E TO DES PLAINES RIVER, [2]FEET ABOVE CONFLUENCE WITH JEROME CREEK, [3]FEET ABOVE CONFLUENCE WITH SALEM BRANCH BRIGHTON CREEK, *DATA NOT AVAILABLE

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

KENOSHA COUNTY, WI

AND INCORPORATED AREAS

FLOODWAY DATA

UNNAMED TRIBUTARY 2 TO DES PLAINES RIVER - UNNAMED TRIBUTARY NO. 2 TO JEROME CREEK - UNNAMED TRIBUTARY NO. 2 TO SALEM BRANCH BRIGHTON CREEK

FLOODING SOURCE		FLOODWAY				1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION (FEET NAVD 88)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	WIDTH REDUCED FROM PRIOR STUDY (FEET)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
UNNAMED TRIBUTARY NO. 3 TO JEROME CREEK									
A	1,950[1]	5	11	2.3	0	680.5	680.5	680.5	0.0
B	2,200[1]	40	98	0.3	0	680.5	680.5	680.5	0.0
C	2,395[1]	4	12	2.1	0	680.5	680.5	680.5	0.0
D	2,515[1]	4	17	1.4	0	680.5	680.5	680.5	0.0
E	2,556[1]	4	15	1.6	0	588.9	680.6	680.6	0.0
F	2,946[1]	20	40	0.8	0	680.7	680.7	680.7	0.0
G	4,429[1]	3	9	4.8	0	681.0	681.0	681.0	0.0
H	4,504[1]	3	10	4.3	0	681.9	681.9	681.9	0.0
I	4,984[1]	472	302	0.2	0	682.3	682.3	682.3	0.0
J	6,879[1]	37	33	1.7	0	683.4	683.4	683.4	0.0
K	7,059[1]	122	38	1.8	0	684.0	684.0	684.0	0.0
L	7,185[1]	130	56	1.0	0	684.3	684.3	684.3	0.0
M	7,755[1]	8	19	2.2	0	687.7	687.7	687.7	0.0
UNNAMED TRIBUTARY NO. 3 TO SALEM BRANCH BRIGHTON CREEK									
A	201[2]	*	*	*	*	756.8	*	*	*
B	623[2]	*	*	*	*	762.8	*	*	*
C	898[2]	*	*	*	*	769.2	*	*	*
D	1,119[2]	*	*	*	*	771.0	*	*	*
E	1,463[2]	*	*	*	*	775.4	*	*	*
F	2,656[2]	*	*	*	*	789.9	*	*	*

[1] FEET ABOVE CONFLUENCE WITH JEROME CREEK, [2] FEET ABOVE CONFLUENCE WITH SALEM BRANCH BRIGHTON CREEK, *DATA NOT AVAILABLE

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

KENOSHA COUNTY, WI

AND INCORPORATED AREAS

FLOODWAY DATA

UNNAMED TRIBUTARY NO. 3 TO JEROME CREEK - UNNAMED TRIBUTARY NO. 3 TO SALEM BRANCH BRIGHTON CREEK