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**US Army Corps  
of Engineers®**

Buffalo District

Wellsville, New York  
Genesee River  
Right Bank Levee and Dyke Creek  
Flood Damage Reduction Project  
Levee Periodic Inspection 2010  
System 12 of 13  
Contract No. W912QR-10-D-0003  
Task Order No. DN01

**Stantec Consulting Services Inc.  
One Team. Infinite Solutions**

801 Jones Franklin Road, Suite 3  
Raleigh, NC 27606-2012  
Tel: (919) 851-6866 • Fax: (919) 851-7024  
[www.stantec.com](http://www.stantec.com)

Prepared for:  
**USACE Buffalo District  
Buffalo, New York**

February 16, 2011

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Stantec Consulting Services Inc.  
801 Jones Franklin Road, Suite 3  
Raleigh, NC 27606-2012  
Tel: (919) 851-6866  
Fax: (919) 851-7024

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February 16, 2011

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David J. Mitchell, P.G., P.E.  
USACE Buffalo District  
1776 Niagara Street  
Buffalo, New York 14207

Re: Wellsville, New York  
Genesee River  
Right Bank Levee and Dyke Creek  
Flood Damage Reduction Project  
Levee Periodic Inspection 2010  
System 12 of 13  
Contract No. W912QR-10-D-0003  
Task Order No. DN01

Dear Mr. Mitchell:

Stantec Consulting Services Inc. (Stantec) is pleased to submit our 2010 Periodic Inspection Report for the Wellsville, New York Flood Damage Reduction Project for the USACE Buffalo District Levee Periodic Inspection Program. This Periodic Inspection Report consists of the findings from the inspection.

This satisfies the Final PI Deliverable for Task 10 of the Wellsville, New York Right Bank Levee and Dyke Creek Flood Damage Reduction Project. Stantec looks forward to continuing work with the Buffalo District on this project. Please contact Don Gibbs at (919) 865-7559 with any questions.

Sincerely,

STANTEC CONSULTING SERVICES INC.

Donald Gibbs, P.E.  
Task Manager

Enclosures: 1

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Wellsville, New York

Genesee River

Right Bank Levee and Dyke Creek

Flood Damage Reduction Project

Levee Periodic Inspection 2010

System 12 of 13

Contract No. W912QR-10-D-0003

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**Wellsville, New York**  
**Genesee River**  
**Right Bank Levee and Dyke Creek**  
**Flood Damage Reduction Project**  
**Levee Periodic Inspection 2010**  
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## **Preface**

The purpose of this levee system periodic inspection is to identify deficiencies that pose hazards to human life or property. This assessment of the general condition of the levee system is based on available data and visual inspections. Detailed investigation and analyses involving hydrologic design, topographic mapping, subsurface investigations, testing and detailed computational evaluations are beyond the scope of this levee system inspection. The inspection is intended to identify the issues to facilitate such future studies and associated repairs as appropriate.

This levee system inspection is based on observations of field conditions and available data at the time of the inspection. The condition of any levee system depends on numerous and constantly changing internal and external conditions and is evolutionary in nature. It is incorrect to assume the present condition of the levee system will continue to represent the levee system condition in the future. Only through continued inspection, maintenance, repair and rehabilitation can there be a reasonable chance that unsafe conditions can be avoided.



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## Executive Summary

The Wellsville Flood Damage Reduction Project (FDRP) is a federally authorized and non-federally operated and maintained, urban FDRP. The FDRP is located on the east (right) bank of the Genesee River within the Village of Wellsville, New York. The Wellsville FDRP was authorized by congress by the Flood Control Act on 17 May, 1950 (Public law 516, 81<sup>st</sup> Congress 2<sup>nd</sup> Session). Original construction was completed on 1958 and rectification was completed in two phases. The first phase was authorized in November 1966 and the second phase in June 1975. Rectification work was required to improve the original project. Emergency rehabilitation work was completed in 1996-1997.

The New York State Department of Environmental Conservation (NYSDEC), Region 9 is responsible for operating and maintaining the FDRP.

The levee and Dyke Creek was inspected on July 23, 2010. The local sponsors show an active response to operation and maintenance of the project; however, some deficiencies were noted and remedial actions are required. The overall system rating will be determined by USACE.

Segment Name(s): Wellsville, New York Right Bank Levee and Dyke Creek

Community	Wellsville, New York
County	Allegany County
State	New York
Stream	Genesee River

**Inspection Date:** July 23, 2010

**Inspection Team:** David P. Belaskas, P.E. (Stantec - Team Lead), Joe Bergquist, P.E. (Stantec), Donald Gibbs, P.E. (Stantec – Task Order Manager), Brian Lambert (Stantec – LIS Operator), David Mitchell, P.G.,P.E. (USACE - Escort), Jon Kolber, P.E. (USACE - Escort), Robert W. Remmers, P.E. (USACE - Escort), Joseph Kasperski (USACE - Escort), Theodore Myers P.E. (NYSDEC - Sponsor)

### Summary of Findings:

#### Design Criteria Review:

- Calculations that demonstrate satisfaction of current design criteria for stability were not provided.
- Based on limited design documentation provided, the following could not be verified:

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## Executive Summary Flood Damage Reduction Project Periodic Inspection

- Levee stability
- Seepage control
- Settlement
- Slope protection
- Level of protection
- Levee underseepage design documentation is unavailable.
- The design flood protection requirements based on current criteria are risk based in nature and are unknown. Thus, flood protection review is inconclusive.

### Inspection Results:

- **Earthen levees** were observed to be functional, however, moderate amounts of excessive vegetation, encroachments and animal burrows were observed.
- **Channel** was observed to be functional and generally in good condition; however, heavy shoaling was observed in the channel. Moderate amounts of vegetation and displaced riprap were observed along the banks of the channel.
- **Interior Drainage Systems** was observed to be functional, however, vegetative encroachments, missing riprap and concrete damage at flap gates were observed.

### Recommendations:

#### Documentation:

- Update O&M Manual.
- Maintain records of all inspection, maintenance and repair activities.
- Maintain records of flood response activities.
- Update as-built construction records with actual conditions.

#### Levee Embankments:

- Maintain right of way and remove unwanted vegetation and encroachments and restore rutting/erosion. An animal control program should be developed.

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## **Executive Summary Flood Damage Reduction Project Periodic Inspection**

### Interior Drainage System:

- Maintain the right of way and remove unwanted vegetation.
- Repair/seal areas of concrete cracking to prevent additional damage during periods of thawing and freezing.
- Remove obstructions, address minor corrosion with maintenance and periodically exercise and lubricate flap gates.
- Inspect and video all the culverts, flap gates and piping as well as locate all the outfalls and inlets. Evaluate the need for positive closure on the flap gates.

### Flood Damage Reduction Channel:

- Maintain the right of way and remove unwanted vegetation and encroachments.
- Heavy shoaling needs to be removed to bring channel back to its original dimensions.
- Monitor the areas of bank rutting/erosion. Develop and implement a plan to address these areas.
- Repair/seal areas of concrete cracking to prevent additional damage during periods of thawing and freezing.
- Evaluate the need for riprap in the channel and replace as needed.

### Design Criteria Review:

- Conduct analysis of current level of protection.
- Update system elevations to NAVD88.

### Levee Safety Recommendations:

- Develop site-specific Emergency Action Plan.
- USACE should complete its review of the sponsor provided EAP and provide comments or approval.

The next periodic inspection is scheduled for FY 2015.

Stantec is not responsible for providing the overall rating of the system. This will be provided by the USACE Buffalo District. A description of the identified deficiencies for each feature

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### **Executive Summary Flood Damage Reduction Project Periodic Inspection**

and item and recommendations for the Local Sponsor to consider on how to repair, mitigate, or improve these deficiencies are discussed in the appropriate report section.

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## Wellsville, New York

### Genesee River Right Bank Levee and Dyke Creek Flood Damage Reduction Project Levee Periodic Inspection 2010 System 12 of 13 Contract No. W912QR-10-D-0003 Task Order No. DN01

#### 1. Inspection Team and Dates of Inspection

##### 1.1. Inspection Team and Escorts

The following were members of the inspection team including Team Lead, Sponsors, and Escorts.

**Table 1. Inspection Team and Escorts**

<b>Name</b>	<b>Title</b>	<b>Organization</b>
David P. Belaskas, PE (NY #073048-1)	Team Lead/Geotechnical Engineer	Stantec
Joe Bergquist, PE (AZ #22638)	Senior Structural Engineer	Stantec
Donald Gibbs, PE (NC #29814)	Task Order Manager	Stantec
Brian Lambert	LIS Operator	Stantec
Theodore Myers, PE	Sponsor	NYSDEC Region 9
David Mitchell, PG,PE	Project Manager	USACE, Buffalo (Escort)
Jon Kolber, PE	Geotechnical Engineer	USACE, Buffalo (Escort)
Robert W. Remmers, PE, PMP, LSPM	Chief, Operations and Technical Support Section, Levee Safety Program Manager	USACE, Buffalo (Escort)
Joseph Kasperski	Civil Engineer	USACE, Buffalo (Escort)

##### 1.2. Dates of Inspection

The inspection on July 23, 2010 began with a pre-inspection meeting held at the northern end of the levee to review the inspection process with the inspection team, local sponsor and USACE representatives.

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## 1.3. Weather During Inspection

The weather during the inspection ranged from the low 60's °F to the mid 80's °F with intermittent rain.

## 1.4. River Stage During the Inspection

Daily gage heights for the period of record for the National Weather Service (NWS) gage on the Genesee River at Wellsville, New York, operated in cooperation with NWS, NYSDEC, USACE Buffalo District and the United States Geological Survey (Station-USGS 04221000) referenced to NGVD29 have been referenced for this report and are presented in Table 2 below. The river stages for this gauge are reported as provisional data.

**Table 2. River Stages During Inspection**

Date	River Stage (feet)	Elevation (feet, NAVD88)	Elevation (feet, NGVD29)	Discharge ft <sup>3</sup> /s (mean)
July 22	4.42	1,473.24	1,474.42	44
July 23	4.5	1,473.32	1,474.50	130

NGVD29 Datum of gage is 1,470

## 2. System Background Information

### 2.1. Project Type and Identification

This is a Federally authorized and non-federally operated and maintained, urban flood protection project. The Wellsville FDRP is located on the Genesee River within the Town of Wellsville, Allegany County, New York. The project extends on the Genesee River 1.6 miles downstream from the mouth of Dyke Creek and upstream from this point 1.0 mile to the south limit of the Village, and on Dyke Creek from its mouth 0.75 miles upstream.

### 2.2. Project Authority

Construction of improvements for flood control on the Genesee River at Wellsville, New York, Was authorized by the Flood Control Act of 1950 (Public Law 516, 81st Congress, Second Session) substantially in accordance with the recommendations of the Chief of Engineers in House Document No. 232, 81st Congress, First Session. Rectification of deficiencies to the original project was authorized in two phases. The first phase was authorized in November 1966 and the second phase in June 1975. USACE accepted transfer of the project to the NYSDEC for operation and maintenance in May 1967. The project cooperation agreement is provided in the Operations and Maintenance Manual (USACE, 2000).

#### 2.2.1. Estimated Original Cost of Project

Based on assembled documentation, construction specifications and planning estimates dated August 1955, the estimated original project cost was:

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Federal Cost:	\$1,102,000
Non Federal Cost:	<u>\$194,300</u>
Total:	\$1,296,300

### **2.2.2. Construction Completion Date of Original Project**

The construction completion date of the original Wellsville FDRP was February 1958.

### **2.2.3. Public Sponsor and Point of Contact**

The local sponsor for the Wellsville FDRP is the New York State Department of Environmental Conservation, Region 9. The current point of contact is Theodore A. Myers, P.E. Environmental Engineer II. Mr. Myers can be contacted by telephone at (716) 851-7070.

### **2.2.4. Location**

The Wellsville FDRP is located on the Genesee River in the Village and Town of Wellsville, Allegany County, New York. Site location maps are included in Appendix A of this report. The project is located on the right descending bank of the Genesee River and the lower 0.75 mile section of Dyke Creek.

### **2.2.5. Potential Consequences**

The Wellsville Flood Damage Reduction Project was authorized by Congress on 17 May 1950 (Public Law 516, 81<sup>st</sup> Congress), to prevent an estimated annual cost of \$430,000 dollars in damages due to flood waters (USACE 1966). The system protects two overwhelmingly commercial and residential reaches within the Town of Wellsville. It protects 405 acres subject to flooding. The population at risk is unknown.

The FDRP serves as a flood reduction measure to urban populations, as well as residential, commercial and industrial developments. The potential consequences resulting from various modes of potential failure and pertaining to populations at risk and the estimated value of the property in the protected areas of the Wellsville FDRP are to be obtained from the National Levee Database (NLD), which had not been populated at the time this report was prepared.

### **2.2.6. Investigations Prior to Construction**

Prior to the inspection of the Wellsville FDRP, the Inspection Team received copies of any available documentation pertaining to the FDRP from the USACE Buffalo District office. During the data collection process "Work As Constructed" commonly referred to as "As Built Drawings" were reviewed. Within the "As Built Drawings", limited geotechnical subsurface information was provided. The Drawings contained graphical boring logs and test pit logs which only contained soil horizons. The following is a list of collected "As Built Drawings":

- Local Flood Protection Project, at Wellsville, New York. February 1956
- Local Flood Protection Project, at Wellsville, New York. April 1973

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- Local Flood Protection Project, at Wellsville, New York. April 1976
- Flood Control Project Emergency Rehabilitation Dyke Creek and Genesee River, Wellsville, New York. September 1996

### **2.2.7. History of Remedial Measures and Major Modifications**

Based on documentation provided by the Buffalo District USACE, the following paragraphs provide a brief summary of changes and events pertaining to the Wellsville FDRP.

Construction was initiated by contract in July 1956 and was completed in February 1958. This original construction improved the channel from a point 2,700 feet north of Bolivar Road to a point 1,815 feet upstream of the former Wellsville, Addison, and Galetton (W.A. & G.) Railroad Bridge. Additional bank protection was placed under contract modifications in June-July 1958 and September 1959. The latter resulted from the January 1959 flood which damaged and eroded the rip rap slopes near the upstream limit on Dyke Creek and upstream of the railroad bridge on the Genesee River. The prime contractor was Gasparini Excavating Company of Peckville, PA. The project was given its final inspection before acceptance by local interests on 15 August 1958. (USACE, O&M Manual, 2000)

Tropical storm "Agnes" caused extensive damage to the original flood control project at Wellsville. Emergency restoration work was accomplished by plant rental and supply contract, under Public Law 99, 84th Congress, to restore the Genesee River and Dyke Creek channels to their pre-"Agnes" condition. This work involved almost the entire length of the improved river and creek channels. The work accomplished was shoal removal, replacement of compacted embankments and levees and restoration of bank stone protection where required. This work was initiated in June 1972 and was completed in November 1972.

Rectification work was required to improve the original project. Construction was initiated in July 1973 and completed in July 1974 by Hull-Hazzard Inc., Syracuse, NY under Contract No. DACW49-73-C-0158. The work under this contract involved channel widening and levee construction in the area between West Genesee Street and the downstream concrete drop structure. Also, in the reach of the Genesee River between State Street bridge and extending approximately 5,050 feet upstream, work involved channel widening, levee construction, placement of additional riprap, and the extension and lowering of a steel sheet pile weir. Dyke Creek work involved channel widening, levee construction and placement of additional stone protection all upstream of Miller Street.

Additional rectification work was further required and construction was started in June 1976 and completed in November 1976 by Frank DiMino Inc. of Rochester, NY under Contract No. DACW49-76-C-0059. This work involved the extension of the upstream project limits including the construction of a steel sheet pile weir, levee construction, and channel realignment and widening, and the placement of additional stone protection. Dyke Creek work involved channel excavation and placement of additional stone protection between Broad Street and Miller Street. This work was indicated in the superseded April 1977 Operation and Maintenance Manual.

The NYSDOT completed two construction contracts, in conjunction with the realignment of Routes 17 (re-designated 417) and 19, along the Genesee River and Dyke Creek. The first phase was completed in 1974 and involved the relocation of approximately 1,900 feet of the



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river, downstream from State Street, toward the left bank to provide room for the new highway, and the construction of a new bridge over the river connecting West Madison and Stevens Streets. The second contract, completed in 1977, involved highway construction along the river and some channel work between Bolivar Road and the confluence with Dyke Creek. Work along Dyke Creek involved channel relocation and placement of bank protection, with the construction of a new bridge over the creek near Hanover Creek. This work had been reviewed by the Buffalo District, Corps of Engineers; it did not have a detrimental effect on the existing project.

Emergency rehabilitation work under Public Law 99, 84th Congress, was required to repair extensive damage to the project from the January 17-20, 1996 Thaw flood event. Material from eroded banks of the project, as well as farther upstream, was deposited as shoals in the channel, reducing its capacity. Initial emergency repair work (January 24-26) involved placement of rip rap in two areas on 700 feet of eroded banks - left bank of Dyke Creek upstream of Miller Street (450 feet) and left bank of Genesee River near Seneca Street (250 feet). The rehabilitation work was started in November 1996 and completed in May 1997 by Haseley Consultants/Construction Inc. of Niagara Falls, NY under Contract No. DACW49-97-C-0003. (USACE, O&M Manual, 2000)

### **3. Pre-Inspection Information**

The Pre-Inspection package prepared prior to the performance of the levee inspection is included as Appendix F of this report.

### **4. Inspection Findings and Evaluations**

Based on visual observations, our review and consideration of the data provided for this system and this segment, and the individual rated items discussed below, the overall system does not appear to be in accordance with current USACE guidelines. Specific deficiencies are discussed individually in the sections that follow.

Photographs are shown in Appendix B. The completed Periodic Inspection Report using the Levee Inspection System is provided in Appendix B. Individual inspection notes and trip reports are in Appendix C. Individually rated items from Appendix B are discussed in the following paragraphs.

#### **4.1. Results of Inspection**

##### **4.1.1. Levees, Channel, and Interior Drainage System**

The earthen levee (right bank), channel, and interior drainage system were inspected to determine their general condition and acceptability. The overall condition of the earthen levee, interior drainage system, and channel was mainly determined by visual methods only. Hammers, measuring tapes, levels, probe rods and other nondestructive devices were utilized to assist in the inspection of the system.

A four person team (Stantec) inspected the earthen levees, channel and interior drainage system of the Wellsville Right Bank FDRP. An escort from the USACE was also present during the inspection.

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During the inspection, items associated with levee embankments were reviewed based on rating guidelines outlined by the USACE to determine their acceptability and included the following:

1. unwanted vegetation growth,
2. sod cover,
3. encroachments,
4. closure structures,
5. slope stability,
6. erosion/bank caving,
7. settlement,
8. depressions/rutting,
9. cracking,
10. animal control,
11. culverts/discharge pipes (This item includes both concrete and corrugated metal pipe),
12. riprap revetments & bank protection,
13. revetments other than Riprap,
14. under seepage Relief Wells/Toe Drainage Systems, and
15. seepage.

The items associated with the interior drainage system included the following:

1. vegetation and obstructions,
2. encroachments,
3. ponding areas,
4. fencing and gates,
5. concrete surfaces (such as gate wells, outfalls, intakes, or culverts),
6. tilting, sliding or settlement of concrete and sheet pile structures (such as gate wells, outfalls, intakes or culverts)
7. foundation of concrete structures (such as culverts, inlet and discharge structures, or gate wells.)
8. monolith joints
9. culverts/discharge pipes
10. sluice/slide gates
11. flap gates/flap valves/pinch valves
12. trash racks (non-mechanical)
13. other metallic items
14. riprap revetments of inlet/discharge areas
15. revetments other than riprap

The items associated with the channel included the following:

1. vegetation and obstructions,
2. shoaling,
3. encroachments,
4. erosion,
5. concrete surfaces,
6. tilting, sliding or settlement of concrete structures,
7. foundation of concrete structures,
8. slab and monolith joints,
9. flap gates/flap valves/pinch valves,
10. riprap revetments & banks, and

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11. revetments other than riprap.

Upon completion of inspecting the earthen levees, interior drainage system, and channel the Inspection Team determined the condition and assigned a rating for each item.

The following items are included within the attached Appendices.

Appendix A includes the project vicinity map and location sheets.

Appendix B includes the LIS generated Periodic Inspections Checklist with photographs.

Appendix C includes the updated design criteria review checklist following the inspection.

Appendix D Crack Survey is not applicable to this levee inspection.

Appendix E References.

Appendix F the Pre-inspection packet for the levee inspection.

Appendix G The Independent Technical Review comments and certifications.

Appendix H includes the outline meeting minutes.

### **4.2. Results of Examination for Each Feature**

Upon completion of the periodic inspection and data processing using the Levee Inspection System (LIS) Unit, detailed results pertaining to specific levee features were generated. Results of the visual inspection of the features and components of the Wellsville FDRP are discussed below. Selected photographs have been referenced in the following sections to illustrate the current condition of all representative features. Photographic documentation is included in Appendix B. All Items are discussed in general below, and detailed comments and recommendations can be found in Section 5 of this report as well as in the Periodic Inspection Checklist provided in Appendix B. Specific inspection point identification numbers associated with deficiencies are listed within the Periodic Inspection Checklist and are denoted with USACE notation (i.e. USACE\_CELRB\_N21R\_2010\_a\_0000\_1) and presented on inspection location sheets within Appendix A.

#### **4.2.1. General Items for all Flood Damage Reduction Systems**

##### **4.2.1.1. Operations and Maintenance Manuals**

Operation and Maintenance Manuals were present and utilized, however, the manuals are out of date and should be revised to show existing FDRP conditions. Overall the Operation and Maintenance Manuals for the entire system are considered Minimally Acceptable.

##### **4.2.1.2. Emergency Supplies and Equipment**

The sponsor should maintain a stockpile of sandbags, shovels and other flood fight supplies which will adequately supply all needs for the initial days of a flood fight. The sponsor should evaluate the required quantity of supplies after consulting with the USACE inspector. Overall emergency supplies and equipment observed are Minimally Acceptable.

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### 4.2.1.3. Flood Preparedness and Training

During the field inspection the sponsor demonstrated a working knowledge of the system but did not have a formal emergency action plan (EAP) in place. Documentation of system specific emergency procedures and emergency contact personnel is insufficient and out of date. Overall flood preparedness and training observed are Minimally Acceptable.

### 4.2.2. Levee Embankments

Based on visual observations, our review and consideration of the data provided for this system and this segment, and the individual rated items discussed below, this feature does not appear to be in accordance with current USACE guidelines. Specific deficiencies are discussed individually in the sections that follow.

Levees have been constructed along numerous reaches of the Genesee River and Dyke Creek, consisting of a 10 foot crest width and 1 foot vertical on 2-1/2 foot horizontal side slopes, unless otherwise stated. A levee is located on the right bank of the Genesee River starting at the concrete drop structure and extending upstream approximately 1,350 feet to about West Genesee Street. The levee is generally six feet in height, constructed to prevent high stream flows from bypassing the drop structure. A small levee, generally two feet or less in height, was constructed along the right bank of the river immediately upstream of the former W.A. & G. Bridge, extending 620 feet upstream to prevent flooding of a low area in Island Park. A barrier levee was constructed on the right bank, approximately perpendicular to the channel and parallel to the steel sheet pile weir located approximately 1,300 feet upstream of the former W.A. & G. Bridge. The levee extends approximately 670 feet to existing ground, constructed to prevent flood flows from bypassing the weir drop structure. See figure 1 for a typical section of levee at Wellsville FDRP. (USACE, O&M Manual, 2000)

On Dyke Creek, a levee was constructed on the left bank, upstream of the Miller Street drop structure, for approximately 530 feet upstream, where it curves away from the channel to become perpendicular to the channel line and forms a barrier levee which is an additional 310 feet long.

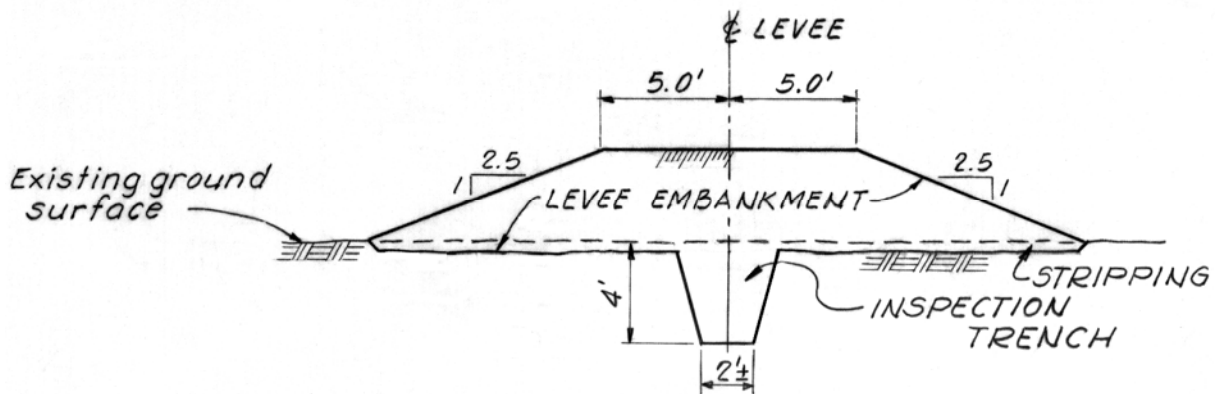


Figure 1. Typical Section of Right Bank Levee

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A 4 foot deep inspection trench, with a 2 foot bottom width, was excavated before construction of each levee. The inspection trenches were backfilled with levee material and compacted in a manner similar to the levees.

### **4.2.2.1. Unwanted Vegetation Growth**

In accordance with USACE guidelines ETL 1110-2-571 (USACE, 2009), no unwanted vegetation should be located within a minimum length of 15 feet from the toe of the earthen embankment of levees. Numerous areas of unwanted vegetation growth were documented along the limits of the levee embankment. Unwanted vegetation included brushy vegetation, large diameter trees located on properties within the vegetation free zone and overhanging tree limbs. Overall the unwanted vegetation growth observed is Unacceptable due to the large diameter trees within the vegetation free zone. See photo USACE\_CELRB\_N21R\_2010\_a\_0088\_1 for an example of unwanted vegetation growth.

### **4.2.2.2. Sod Cover**

The overall condition of sod cover along the levee embankment was Acceptable as there were no visible signs of sod deterioration noted during the Wellsville FDRP inspection.

### **4.2.2.3. Encroachments**

In accordance with USACE guidelines ETL 1110-2-571 (USACE, 2009), structures should be located at a minimum length of 15 feet from the toe of the earthen embankment of levees or "the single exception to the 15-foot minimum requirement arises in the case where the width of existing real estate interest for the project is less than 15 feet."

Numerous encroachments were documented along the limits of the levee embankment. Encroachments documented during the inspection included fencing, roadways, utility lines, utility poles, buildings, residential storage sheds, guardrails, traffic signs, and general debris from residential, commercial and industrial areas. Overall encroachments observed are Unacceptable and will inhibit operations and maintenance. See photographs USACE\_CELRB\_N21R\_2010\_a\_0006\_1 and USACE\_CELRB\_N21R\_2010\_a\_0010\_1 for an example of a fence encroachment and a building respectively.

### **4.2.2.4. Closure Structures**

The Wellsville FDRP contains no closure structures. The overall rating for closure structures was Not Applicable.

### **4.2.2.5. Slope Stability**

No slides, sloughs, tension cracks or slope depressions identified in the inspection. The overall rating for slope stability was Acceptable at the time of this inspection.

### **4.2.2.6. Erosion/Bank Caving**

There are areas where minor erosion or bank caving is observed. Based on this assessment, it was determined that the conditions were Minimally Acceptable at the time of this inspection. An example of erosion is shown in photo USACE\_CELRB\_N21R\_2010\_a\_0033\_1.

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### **4.2.2.7. Settlement**

During the Wellsville FDRP inspection no observed depressions in crown were identified. While there are no points identified, the overall rating for settlement was Unacceptable do to the lack of updated records or no available survey data on the elevation of the levee.

### **4.2.2.8. Depressions/Rutting**

There were areas of depressions and rutting documented during the field inspection found on both the land and river side of the levee. It appears that the majority of observed rutting was due to water ponding in low areas along with mowing activities along the levee. Based on this assessment, it was determined that the conditions were Minimally Acceptable at the time of this inspection. An example of rutting is shown in photo USACE\_CELRB\_N21R\_2010\_a\_0021\_1.

### **4.2.2.9. Cracking**

During the Wellsville FDRP inspection, cracking was not noted within the earthen levee embankments. The overall rating for cracking was Acceptable.

### **4.2.2.10. Animal Control**

During the Wellsville FDRP inspection, several areas of animal burrows ranging from 2 to 12 inches in diameter were noted within the earthen levee embankments. An animal control program is nonexistent. The overall rating for animal control was Unacceptable because no animal control program is in place.

### **4.2.2.11. Culvert/Discharge Pipes**

The overall rating for Culvert/Discharge pipes is Not Applicable. The Culverts/Discharge pipes are discussed in section 4.2.3.9.

### **4.2.2.12. Riprap Revetments and Bank Protection**

Riprap revetments and bank protection were not noted within the earthen levee embankment. The overall rating for riprap revetments and bank protection was Not Applicable.

### **4.2.2.13. Revetments Other Than Riprap**

During the Wellsville FDRP inspection other revetment besides riprap were not noted within the earthen levee embankments. The overall rating for revetments other than riprap was Not Applicable.

### **4.2.2.14. Underseepage/Toe Drains**

There is no evidence of relief wells/toe drainage systems along this component of the Wellsville FDRP and no relief wells or toe drains were indicated on the as-builts. The overall rating was Not Applicable.

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## 4.2.2.15. Seepage

During the Wellsville Right Bank and Dyke Creek FDRP inspection, seepage was not noted within the earthen levee embankments. The overall rating was Acceptable.

## 4.2.3. Interior Drainage System

Based on visual observations, our review and consideration of the data provided for this system and this segment, and the individual rated items discussed below, this feature does not appear to be in accordance with current USACE guidelines. Specific deficiencies are discussed individually in the sections that follow.

### Drainage Structures

Where active storm drains entered the old stream channel outside the limits of the levees, ditches were excavated to connect the ends of the pipes to the new channel or existing pipes were shortened, if they extended into the new channel, to correspond to the new channel alignment. Many pipes, no longer in use, were removed within the limits of the work area. The left bank levee in the reach from the concrete drop structure to State Street required the improvement of two drainage lines and the removal of all others within the limits of this levee. Drainage routes were revised to use the two remaining lines. Each of these was re-laid within the levee limits with new pipe and seepage rings added. A concrete manhole was built at the riverward side of the levee crest and a concrete outlet, including head and wing walls and an apron, was built at the riverward end of the line. An area surrounding the outlet and extending into the channel bottom was paved with grouted riprap. An automatic (gravity-operated) flap gate was placed at the riverward end of each pipe and a manually-operated sluice gate was placed on each pipe at the downstream side of the manhole. One drainage line through the levee is an extension of a 24-inch storm drain in Brooklyn Avenue, and is laid with concrete culvert pipe. The other drains a ponding area, to which all other local drainage behind the levee was led, and is laid with two parallel, 36-inch, corrugated metal pipes. The gates used for the above drainage structures are Armco-Pekrul sluice gates and Armco flap gates. The left bank levee constructed from State Street and extending upstream 2,350 feet required some alterations in the drainage system between State Street and the former W.A.&G. bridge. Existing 36-inch and 48-inch corrugated metal pipe drainage lines were re-laid through the levee with new pipe, along with the addition of seepage rings. The 48-inch drain pipe required headwalls and aprons at three locations, one each at the landward and riverward side of the levee and one where the pipe emerges from under the former W.A.&G. railroad embankment. The 36-inch drain pipe required the construction of one concrete outlet with headwalls and apron at the riverward side of the levee. The 48-inch drain pipe was provided with two automatic (gravity-operated) flap gates, one at the pipe's exit from the railroad embankment and one at the riverward side of the levee. The 36-inch pipe was also fitted with a flap gate at the riverward concrete outlet. These three gates are Armco flap gates. The northeast end of the right bank barrier levee, located about 1,300 feet upstream of the former W.A.&G. bridge, is provided with a 24-inch corrugated metal pipe to allow the drainage of runoff from an existing ditch to flow through the levee. The new pipe was installed with seepage diaphragms and prefabricated end sections. The left bank levee, located near the upstream project limit, was provided with a 12-inch corrugated metal pipe to allow drainage of the area south of the levee into the auxiliary channel adjacent to the river. The pipe was fitted with prefabricated end sections. (USACE, O&M Manual, 2000)

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### **4.2.3.1. Vegetation and Obstructions**

Obstructions including, vegetation, debris and sediment have impaired the channel flow capacity and have blocked more than 10% of a culvert opening at several locations. Sediment and vegetation removal are required to reestablish flow capacity. Overall the vegetation and obstructions observed are Unacceptable due to the blockages. See photo USACE\_CELRB\_N21R\_2010\_a\_0099\_1 for an example of vegetation and obstructions.

### **4.2.3.2. Encroachments**

Unauthorized encroachments within the interior drainage were not noted. Overall observed encroachments are Acceptable at the time of inspection.

### **4.2.3.3. Ponding Areas**

There are no ponding areas associated with the interior drainage system of the Genesee River Right Bank and Dyke Creek FDRP. This item is Not Applicable.

### **4.2.3.4. Fencing and Gates**

There are no features noted that require safety fencing. This item is Not Applicable.

### **4.2.3.5. Concrete Surfaces**

Negligible concrete spalling, scaling or cracking was evident. The overall condition of the concrete surfaces was considered Acceptable.

### **4.2.3.6. Tilting, Sliding or Settlement of Concrete Structures (Such as gate wells, outfalls, intakes or culverts)**

There are no significant areas of tilting, sliding, or settlement of concrete structures. The overall rating for this item is Acceptable.

### **4.2.3.7. Foundation of Concrete Structures (Such as Culverts, inlet and discharge structures and gate wells)**

There were no areas of erosion or bank caving conditions identified during the inspection and the overall condition of the concrete foundations was considered Acceptable.

### **4.2.3.8. Monolith Joints**

The joint material is in good condition in the interior drainage system and was rated Acceptable.

### **4.2.3.9. Culverts/Discharge Pipes**

In the interior drainage system the culvert pipes have been covered by soil and debris and the condition of the pipes could not be determined. An Unacceptable rating has been assigned as the condition of the pipes has not been verified using television camera videotaping and visual inspection methods within the past five years and reports for all pipes



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are not available for review by the inspector. See photo USACE\_CELRB\_N21R\_2010\_a\_0099\_1 for example.

### **4.2.3.10.Sluice/Slide Gates**

There is one sluice/slide gate at Sta. 8+00 along Dyke Creek. The overall rating of this item was Acceptable.

### **4.2.3.11.Flap Gates**

Gravity discharge pipes must have provisions for emergency closure in the event of inoperable flap valves on the creek side. Existing flap gates are damaged and need to be repaired. See example photo USACE\_CELRB\_N21R\_2010\_a\_0044\_1. The overall rating is Minimally Acceptable.

### **4.2.3.12.Trash Racks (Non-Mechanical)**

There are no trash racks with this levee segment. The overall rating is Not Applicable.

### **4.2.3.13.Other Metallic Items**

There are no other metallic items. The rating for other metallic items is Not Applicable.

### **4.2.3.14.Riprap Revetments of Inlet/Discharge Areas**

The rating for riprap revetments of inlet/discharge areas is Not Applicable.

### **4.2.3.15.Revetments other than Riprap**

There are no such revetments protecting this feature of the segment/system. The overall rating is Not Applicable.

### **4.2.4. Flood Damage Reduction Channel**

Based on visual observations, our review and consideration of the data provided for this system and this segment, and the individual rated items discussed below, this feature does not appear to be in accordance with current USACE guidelines. Specific deficiencies are discussed individually in the sections that follow.

The channel of Dyke Creek was improved from the mouth of the creek upstream for approximately 4,000 feet. The stream was realigned near its mouth to eliminate a sharp curve and to provide a better entrance of flows into the Genesee River. The channel bottom widths in the reach downstream of the Miller Street drop structure, a distance of about 3,300 feet, vary from 40 to 50 feet. Upstream of the structure, the bottom width is 70 feet. The channel bottom grade varies from 0.026 to 0.516 percent. Side slopes vary between 1 foot vertical on 2 foot horizontal and 1 foot vertical on 3 foot horizontal. Banks were protected with riprap in the vicinity of the drop structure and where slopes are steeper than 1 foot vertical on 2-1/2 foot horizontal. The NYSDOT has constructed a new highway realignment from the mouth of Dyke Creek to about 1,100 feet upstream, which involves the realignment of the mouth, widening of the channel, and the placement of additional bank protection. The

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Buffalo District reviewed the plans for this improvement and insured that the highway construction did not compromise the channel capacity. (USACE, O&M Manual, 2000)

### **4.2.4.1. Vegetation and Obstructions**

The condition of the channel during the inspection was considered to be Unacceptable due to the amounts of vegetation lining the channel. An example is shown in photo USACE\_CELRB\_N21R\_2010\_a\_0077\_1. Vegetation and Obstructions is rated as Unacceptable due to obstructions impairing the channel.

### **4.2.4.2. Shoaling**

Shoaling is well established. Shoals are diverting flow to channels walls in some locations along the channel. Channel flow capacity is reduced and maintenance is required. An example of the shoaling observed in the channel is shown on the following photo USACE\_CELRB\_N21R\_2010\_a\_0046\_1. The overall rating for shoaling is Unacceptable.

### **4.2.4.3. Encroachments**

During the inspection, multiple encroachments along the Dyke Creek FDRP flood damage reduction channel was noted including a railroad bridge. An example of an encroachment is shown on photo USACE\_CELRB\_N21R\_2010\_a\_0063\_1. The overall rating of encroachments was Unacceptable.

### **4.2.4.4. Erosion**

The condition of the channel during the inspection was considered to be Minimally Acceptable due to the erosion observed along the channel banks. The erosion along the channel banks is shown in photo USACE\_CELRB\_N21R\_2010\_a\_0050\_1.

### **4.2.4.5. Concrete Surfaces**

There are no concrete items in the channel. The rating for this category is Not Applicable.

### **4.2.4.6. Titling, Sliding or Settlement of Concrete Surfaces and Sheet Pile**

There is one sheet pile weir and one concrete drop structure associated with the interior drainage system. There are no significant areas of tilting, sliding or settlement (either active or inactive) of sheet pile and concrete features that threaten the concrete structures integrity and performance. There is no tilting or sliding of the weir. The overall condition was Acceptable.

### **4.2.4.7. Foundation of Concrete Structures**

No active erosion, scouring, or caving was identified at the concrete drop structure. The rating for this category is Acceptable.

### **4.2.4.8. Slab and Monolith Joints**

The joint material is in good condition at the concrete drop structure. The rating for this category is Acceptable.

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### **4.2.4.9. Flap Gates/Flap Valves/ Pinch Valves**

The flap gates are addressed under 4.2.3.11. The rating for this category is Not Applicable.

### **4.2.4.10. Riprap Revetments and Banks**

The riprap is generally present but covered with vegetation. Some displacement of riprap has occurred since the completion of the channel. An example of vegetated riprap and lack of riprap is shown in photos USACE\_CELRB\_N21R\_2010\_a\_0068\_1 and 0067\_1, respectively. The riprap displacement could pose a threat to the integrity of the channel bank. Riprap displacement and vegetation within the riprap results in an Unacceptable rating.

### **4.2.4.11. Revetments other than Riprap**

There are concrete revetments associated with the Dyke creek Channel. The concrete revetments were observed to have unwanted vegetation and cracking. The rating for this category is considered Minimally Acceptable due to the cracking in concrete observed during the inspection. An example of cracking in concrete is shown in photo USACE\_CELRB\_N21R\_2010\_a\_0043\_1.

### **4.2.5. Emergency Action Plan**

The local sponsor does have a regional emergency action plan but does not have a complete site specific emergency action plan in writing. This plan is Minimally Acceptable with no documentation of system specific emergency procedures in place. This document should be developed by the local sponsor with assistance from USACE as needed.

### **4.2.6. Compliance with Project Agreement**

The local sponsor is committed to seeing that operations and maintenance of the System are maintained to the best of their ability. The sponsor has indicated that funding and the lack of resources limit the ability to fully perform all duties required by the Operation and Maintenance Manual. The sponsor was unable to provide any documentation showing the correction of the deficiencies previously identified in the 2006 and 2007 inspections, as described in the Pre-Inspection Report in Appendix F. These deficiencies were identified during the current inspection, and are included in the report in Appendix C.

## **4.3. Design Criteria Review**

Detailed design criteria review was conducted and reported during the pre-inspection phase of the Inspection Team's scope of services. The pre-inspection packet and submittal is included in Appendix F of this report. The following sections highlight important aspects of this review and additional findings during the course of field inspection.

### **4.3.1. General Criteria and Survey Datum**

No evidence was provided that the project datum has ever been reassessed by the sponsor. The project elevations are not referenced to NAVD88. No evidence or information on benchmarks was provided.

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### 4.3.2. Instrumentation

No records of any instrumentation data for monitoring the levee embankment, seepage or flow rate have been provided for review.

### 4.3.3. Hydraulics

According to the 1955 Design Memorandum,

- a. General: The design criteria used in developing the project plan are presented in the following paragraphs.
- b. Design discharges: The design discharges adopted for the Wellsville project are based on the estimated discharges from the maximum floods of record on the Genesee River and on Dyke Creek at Wellsville.
- c. Channel cross section: The improved channel is trapezoidal in shape, with varying bottom widths.
- d. Velocity: Stream bed and bank materials through Wellsville are erosion resistant and can withstand fairly high velocities. The improved channels have been designed to carry the design discharges with a mean velocity of 7 feet per second with steady uniform flow. Thus, occurrence of 7-foot per second velocity will be very infrequent and no bank protection is considered necessary except at curves, bridges and places where steep side slopes occur.
- e. Channel roughness coefficients: A roughness coefficient (Manning's "n") of 0.030 was adopted for use in design of the improved channels.
- f. Bottom grades: The depths and slopes of the improved channels have been governed by topography and other design criteria listed above.
- g. Side slopes: Channel side slopes have been covered by stability of bank material and maintenance requirements. The adopted side slopes are 1 on 2½ except at places where channel banks were made steeper to avoid alteration of existing structures and at places where riprap is required.
- h. Riprap: Riprap will be provided wherever channel velocities exceed 7 feet per second, channel curvature exceeds 6 degrees, and where protection of bridge abutments is required due to lowering of the existing grade. Riprap will also be placed at the confluence of the Genesee River and Dyke Creek to prevent any possibility of scour.

Deficiencies in design of existing project:

The existing project was designed for the following flood flows:

	<u>Design Flood</u>
Genesee River, below Dyke Creek	12,300 cfs
Genesee River, above Dyke Creek	9,900 cfs
Dyke Creek	5,350 cfs

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Based on the records available prior to 1956 when preconstruction planning was completed, the design discharges on Genesee River were estimated to have about 1 percent chance of occurrence; the design discharge on Dyke Creek to have about 2 percent chance of occurrence. However, since completion of project planning, they have been nearly equaled or exceeded every year, and the estimated frequencies thereof have increased.

**Table 3. Designed Flood Flows for the Wellsville FDRP**

	<b>1955 Design Flood</b>	<b>1966 Design Flood</b>
Genesee River, below Dyke Creek	12,300 cfs	21,500 cfs
Genesee River, above Dyke Creek	9,900 cfs	17,300 cfs

Based on the records available prior to 1956 when preconstruction planning was completed, the design discharges on Genesee River were estimated to have about 1 percent chance of occurrence. However, since completion of project planning, they have been nearly equaled or exceeded every year, and the estimated frequencies thereof have increased.

Since completion of the project only very minor flood damages have been incurred, even though flood flows exceeding the design discharges have been experienced. This is because the actual flood profiles have been less than were anticipated for the related discharges. The largest discharges experienced, though considerably in excess of design discharges, have resulted in flood profiles approximately equal to design profiles. Thus, the completed channel improvements have proven to be more efficient than anticipated from the original design computations, that is, they pass a given discharge through the project area more rapidly (at higher velocities) than predicted.

Despite the fact that flood discharges have so far been contained by the project, it is nonetheless true that the project does not afford the degree of protection intended, and a potential exists for serious flooding. Further, the high velocities which have accompanied these discharges have had a detrimental effect on the project itself.

The project was designed to carry the design discharges with a mean velocity of 7 feet per second with steady uniform flow. Thus, occurrence of 7-foot-per-second velocities was expected to be very infrequent, and bank protection was provided only at curves, bridges and on steep side slopes. However, since construction, the design discharges have been approached or exceeded frequently and the accompanying velocities, due to the unexpected efficiency of the project channels, have been higher than was anticipated. Greater lengths of channel banks have therefore been exposed to high velocities, accounting for the erosion that has taken place in some unprotected sections. Further, on protected sections, although the riprap itself is adequate to withstand the higher velocities, deterioration of the adjacent unprotected sections has exposed the ends of the riprap to progressive unraveling. (USACE, Design Memorandum, 1966).

Based on the USACE provided Wellsville O&M Manual, the Genesee River channel was designed for a flow of 21,500 cfs. below the mouth of Dyke Creek and 17,300 cfs. above the creek. The project was originally designed to protect the Village of Wellsville against damage from floods equal to a two-percent chance exceedence flood in the Genesee River and Dyke Creek and to reduce damages in the event a larger flood should occur on either.

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The improvement was extended downstream into the town of Wellsville far enough to accomplish the desired lowering of stages in the village. Latest frequency curves indicate full protection against a 2.5-percent flood. The two percent flood has one chance in 50 years of being exceeded in any given year, while the 2.5-percent flood has one chance in 40 years of being exceeded. Peak flows on the two streams do not occur simultaneously. The modifications undertaken by the New York State Department of Transportation (NYSDOT) on the river and creek are capable of passing the design flows stated above. (USACE, Design Memorandum, 1966)

EM 1110-2-1913 (USACE, 2000) references current level of protection design criteria for levees. Section 6-1, Paragraph B states that “the term and concept of freeboard to account for these (hydraulic) uncertainties was no longer used in the design of levee projects” and “risk-based analysis directly accounts for hydraulic uncertainties and establishes nominal top of protection.” It is our understanding that a risk-based analysis has not been completed for the Wellsville FDRP; therefore, for the purposes of this design criteria review, current Federal Emergency Management Agency (FEMA) guidelines used to meet the requirements of Code of Federal Regulations (CFR) 65.10 of the National Flood Insurance Program (NFIP) are referenced. FEMA specifies that all levees must have a minimum of 3 feet of freeboard above the 100-year flood elevation level (FEMA, 2008). It is acknowledged that this is a general guideline established by FEMA and not a design criteria, but is referenced for general review purposes only.

Due to the lack of FEMA criteria analysis and adequate documentation regarding past performance of the levee during flood events (it appears that there have been occasions where the floodwaters have made it to the levee), definitive conclusions regarding adequacy of the system’s level of protection from a hydrology and hydraulics standpoint could not be assessed at the time of this report.

#### **4.3.4. Structural**

Structures include the pipe and headwalls for interior drainage through the levee. There are no floodwalls or closure structures on this project.

No structural analysis calculations, results or summary was provided in the design report and therefore could not be reviewed. Technical review of the design memoranda indicated that concrete pipe was to comply with D-Load requirements and should have pressure type gasketed joints. No requirements for D-Load or for pressure pipe are shown on the plans so the adequacy of the reinforced concrete pipes could not be evaluated.

There is no record of observed structural failures in the previous inspection report. However, without a structural analysis, no conclusion can be made regarding the adequacy of the structures to meet the required structural design criteria.

Based on a review of the Wall Foundation Stability Analysis presented in Appendix D of the Design Memorandum on Local Flood Protection, it appears the structural elements met design criteria at the time of construction. Given the evolution of design criteria over the years, the design calculations do not allow a conclusion to be made regarding adequacy of the design to meet current design criteria guidelines without performing additional stability analysis. (USACE, Design Memorandum, 1966)

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Based on historic reliability issues corrugated metal pipe (CMP) should not be used for gravity drains. The USACE has since changed the minimum standard to reinforced concrete pipe for new construction of gravity drains. It is noted in the O&M manual that CMP and other types of pipe are used in the levee system. This does not meet current design criteria.

### 4.3.5. Geotechnical

Based on the typical “as built” levee sections illustrated in as-built drawings, the levee geometry appears to be in compliance with current design criteria, with the exception of the horizontal drainage layer which is not present. A minimum of 1.5 feet thick horizontal drainage layer is required in the current design criteria. Seepage/under seepage controls are not in place according to “as built” drawings, specific seepage design calculations were not available. Without complete design calculations, a conclusion cannot be made regarding adequacy of the earthen levee design to meet current design criteria guidelines as shown in Table 4. Given the evolution of design criteria over the years, stability analyses would be necessary to confirm that the earthen levee meets current design criteria. These analyses are beyond the scope of this report. Therefore, definitive conclusions with regard to the adequacy of the seepage controls for the levee cannot be made and comparison to current design criteria cannot be made.

**Table 4. Design Criteria for Slope Stability**

<b>Levee Slope Stability</b>	<b>Required Factor of Safety</b>
End of Construction	1.3
Long Term (Steady Seepage)	1.4
Rapid Drawdown	1.0 – 1.2
Earthquake	See ER 1110-2-1806

During the inspection, no significant areas pertaining to slope stability issues/concerns were observed. Since the 1996 – 1997 rehabilitation of the levee, seepage control and stability of existing levee systems is unknown with respect to maximum flood protection levels.

No evidence was provided that the project datum has ever been reassessed by sponsor. The project elevations should be updated to NAV88. No evidence or information on benchmarks were provided.

### 4.3.6. Slope Stability

No slope stability analysis was provided. A factor of safety was not provided.

### 4.3.7. Seepage Control

No through or under seepage analysis was found for the existing levee design.

### 4.3.8. Settlement

No settlement design was found for the existing levee design.

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### 4.3.9. Seismic

No seismic analysis was found for the existing levee design.

### 4.3.10. Interior Drainage

Stantec did not locate historic interior drainage design criteria in the Contract Plans (USACE, 1966), Operation and Maintenance Manual (USACE, 2000), or Design Memorandum (USACE, 1966).

For the purposes of this design criteria review, current FEMA guidelines used to meet the requirements of Code of Federal Regulations (CFR) 65.10 of the National Flood Insurance Program (NFIP) are referenced. In general, the base flood is referenced as a planning guideline to follow which is generally the 100-year storm event.

Due to a lack of documentation of historic interior drainage design criteria, and deviations to EM1110-2-1410 with the original design, Stantec cannot verify that the interior drainage system complies with current design standards. Based on the evolution of design criteria over the past years and changes to the interior, Stantec has assumed that the interior drainage system of the Wellsville FDRP does not meet present-day design criteria until further analyses demonstrate otherwise. These analyses are beyond the scope of this task order.

USACE design criteria indicates that all pipes that cross over or through the levee should be in known good condition, be able to withstand levee loading, and have adequate cover for frost. Pipelines crossing over the levee are encouraged to be within the freeboard zone.

It is indicated that the interior drainage pipes contain flap gates and no slide gates. All pipes should have devices that assure positive closure. Gravity lines should be provided with flap-type or slide-type service gates on the riverside of the levee. Automatic flap-type gates are usually used where the water is likely to rise to the "Gate Closing Stage" rather suddenly and where the water stage is likely to fluctuate within a few feet above and below the "Gate Closing Stage" for prolonged periods of time during flood season. Automatic gates are also required on slower rising streams or bodies of water where frequent visit from operating personnel are not practical.

Based on historic reliability issues with corrugated metal pipe (CMP) for gravity drains, USACE has changed the minimum standard to reinforced concrete pipe for new construction of gravity drains. It is noted that CMP's are used throughout the Wellsville FDRP.

The minimum standard for gravity drain pipelines is reinforced concrete pipe (RCP) or ductile iron pipe. The use of RCP or CMP for gravity drains was observed in most cases during the inspection. The existing CMP drainage pipelines identified do not satisfy current design criteria.

Manholes and catch basins were observed to be concrete structures with cast iron grating, covers, and rims. All of these structures were observed to satisfy the current design criteria.



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## **4.4. Documentation**

The Operation and Maintenance Manual for the levee system appears to have been last revised in January 2000 and needs to be updated and maintained to promote effective usage in the future. A database that is accessible to the local sponsor and USACE needs to be created to house digitized documentation of “as built drawings”, investigations performed, and modifications made to the system since the completion of construction. At the time of this report, a current survey of existing levee conditions does not exist. In an effort to monitor alignment, crest elevation and record any modifications made to the Wellsville FDRP, a topographic survey of site conditions should be performed.

No records of any instruments or instrumentation data for monitoring the levee embankment, seepage or flow rates have been provided for review. As-built plans do not include any reference to instruments being installed on the levee. No documentation was available from the sponsor during the inspection.

## **4.5. Levee Safety Issues**

The Wellsville FDRP does not have a written site specific Emergency Action Plan (EAP). An overall regional EAP was provided for review. An EAP that defines responsibilities, contacts and procedures for actions to be taken in the event of an actual or potential emergency condition should be created and distributed to agencies responsible for emergency response. For entities other than the levee sponsor that are responsible for operation and maintenance, a written agreement should be available stating the responsibility of said party. The location and contact information for sand, sand bags and storage of these supplies needs to be identified in the Emergency Action Plan. The local sponsor and USACE should be aware of this information.

## **5. Conclusions and Recommendations**

### **5.1. General**

Throughout the Wellsville FDRP, items rated Unacceptable and Minimally Acceptable will require repairs within an acceptable time period determined by the USACE. Of the items observed, there are several routine maintenance issues that are within the capability of the local levee sponsor to address, however, there are also several Unacceptable issues that may be beyond the means of the local sponsor that require the levee sponsor to work with other entities such as local or state governments or the USACE to resolve.

### **5.2. General Items for Damage Reduction Systems**

#### **5.2.1. Operation and Maintenance Manuals**

Operation and Maintenance Manuals were present and utilized; however the manuals are out of date and should be revised to show existing FDRP conditions.

#### **5.2.2. Emergency Supplies and Equipment**

The sponsor has limited sandbag supplies available for flood fighting. The sponsor should inventory and test necessary supplies to ensure adequate flood fighting supplies and equipment.

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### **5.2.3. Flood Preparedness and Training**

The sponsor demonstrated a working knowledge of the system but there was no site specific emergency action plan present at the time of the inspection. A site specific Emergency Action Plan should be developed for the Wellsville FDRP and be made readily available to flood fighting personnel.

### **5.3. Levee Embankments**

#### **5.3.1. Unwanted Vegetation Growth**

All unwanted vegetation located within 15 feet of toes of earthen embankments should be removed.

This is a developed commercial/residential area. The local sponsor with guidance from the USACE needs to determine levee right-of-way, permanently mark right-of-way and remove the unwanted vegetation growth to a minimum of 15 feet from the levee toe as necessary.

#### **5.3.2. Encroachments**

The Wellsville FDRP is in a developed industrial/commercial/residential area. There are many locations throughout the FDRP where encroachments are within 15 feet of the levee toe. These encroachments could inhibit or possibly prevent access to the levee toe area for routine, emergency operations and inspections. The local sponsor with guidance from the USACE needs to determine levee right-of-way, permanently mark the right-of-way and remove the unwanted vegetation growth and encroachments to a minimum of 15 feet from the levee toe as necessary.

#### **5.3.3. Erosion/Bank Caving**

Backfill eroded areas with engineered fill and re-establish appropriate sod cover.

#### **5.3.4. Settlement**

Determine if settlement of the levee has occurred by topographic survey to confirm design elevation is met.

#### **5.3.5. Depression/Rutting**

Surface depressions along the crown or toe of the levee should be repaired by removing vegetation within its limits, backfilling the depression with clay type material free of trash, debris, rock greater than 3 inches in diameter and organic matter, compacting backfill, placing seed and straw, and monitoring the area to confirm a vegetative ground cover is established.

#### **5.3.6. Animal Control**

Animal control program is nonexistent and needs to be implemented. The local sponsor should monitor the earthen levee segments for burrowing animals on a regular basis. Any existing rodent holes should be backfilled with lean concrete or other approved engineered

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fill to prevent water seepage into the levee. Establish and implement an effective animal control program.

### **5.4. Interior Drainage System**

#### **5.4.1. Vegetation and Obstructions**

Obstructions including, vegetation, debris and sediment have impaired the channel flow capacity and have blocked more than 10% of a culvert opening. Sediment and vegetation needs to be removed to reestablish flow capacity.

#### **5.4.2. Culverts/Discharge Pipes**

Remove the soil and debris from over the ends of the culverts in the interior drainage system. Television camera videotaping and visual inspection and reporting for all pipes.

#### **5.4.3. Flap Gates**

Gravity discharge pipes must have provisions for emergency closure in the event of inoperable flap valves on the creek side. Repair the existing flap gates which are detached or damaged.

### **5.5. Flood Damage Reduction Channel**

The Wellsville channel has over time experienced vegetation growth, shoaling, erosion, and degradation of the riprap cover.

#### **5.5.1. Vegetation and Obstructions**

Obstructions, vegetation, debris or sediment have impaired the channel flow capacity. Sediment, vegetation and debris removal is required to re-establish flow capacity.

#### **5.5.2. Shoaling**

Shoaling is well established and shoals are diverting channel flow to the channel banks/walls. Channel flow capacity is reduced and maintenance is required. The volume of shoaling should be determined and a plan for removal should be developed and executed.

#### **5.5.3. Encroachments**

Encroachments should be documented in accordance with USACE guidance and removed if determined necessary.

#### **5.5.4. Erosion**

Eroded areas should be backfilled with engineered fill and appropriate sod cover should be re-established.

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### **5.5.5. Riprap Revetments & Banks**

Unwanted vegetation within the riprap should be cleared or sprayed with an appropriate herbicide. Areas of displaced riprap should be surveyed and monitored to ensure additional displacement does not occur. Repair and or replace significant riprap displacement, exposed bedding and stone degradation, scour activity undercut banks and eroded embankment areas.

### **5.5.6. Revetments other than riprap**

Repair/seal concrete slab spalling to prevent additional damage.

### **5.6. Emergency Action Plan**

The local sponsor was not able to demonstrate that a site specific emergency action plan exists pertaining to priorities and river stages operations and does not have a complete EAP in writing. Although the current levee staff can verbally present their plan for actions during a flood emergency, a formal written document that can be passed on to new personnel or emergency responders does not exist. This document should be developed by the local sponsor with assistance from the USACE as needed.

### **5.7. Compliance with Project Agreement**

The local sponsor for the Wellsville FDRP has attempted to maintain the flood protection system over the years to include correcting inspection findings, permitting, and maintaining the flood protection system based upon available funding, however there remains a number of deficiencies that have gone uncorrected over the years and this inspection has identified other deficiencies that should be addressed. See Appendix F paragraph 10.8 regarding noted deficiencies in 2006 that had not been corrected in 2007 or at the time of this inspection.

### **5.8. System Conclusions**

Stantec is not responsible for providing the overall rating of the system. This will be provided by the USACE Buffalo District. A description of the identified deficiencies for each feature and item and recommendations for the Local Sponsor to consider on how to repair, mitigate, or improve these deficiencies are discussed in the appropriate report section.

The periodic inspection noted various deficiencies, some of which are considered Unacceptable and Minimally Acceptable. Repairs should be made to Minimally Acceptable and Unacceptable items and investigations completed as recommended in this report within an appropriate time frame to be determined by the USACE. The Wellsville FDRP may be eligible for aid through the state or federal government and this aid should be considered to repair items beyond means of the local sponsor. The overall system rating will be provided by the USACE Levee Safety Officer (LSO) following the out brief as a supplemental / addendum to this the Wellsville FDRP PI report.

There has been development and changes to the watershed since the construction of the project. We recommend that a new hydrologic/hydraulic study be completed in accordance with current USACE guidelines.

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There were several items identified in the design criteria review that did not have design information available. Therefore, it was not possible to determine whether the original design would meet current standards. It is recommended that an analysis of these items be performed to confirm if these aspects of the system meet current standards.

### **5.9. Certification**

The Wellsville FDRP had not been previously certified nor will it be certified as a part of this report.

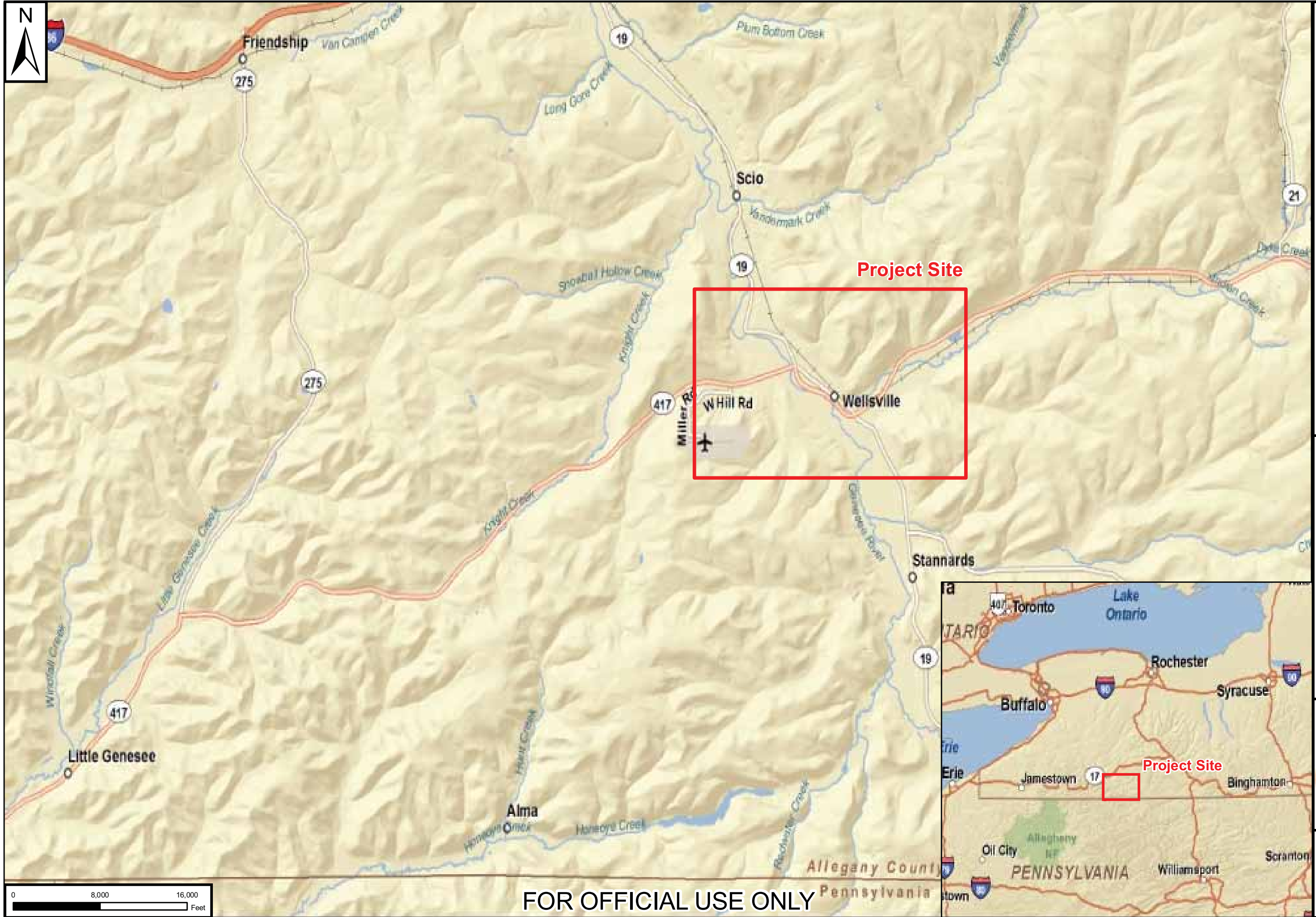
### **5.10. Next Periodic Inspection**

The next periodic inspection is scheduled for fiscal year (FY) 2015.

## Appendix A

### Maps

V:\1996\business\_development\Proposals\Active 2010\Environmental Management\Buffalo\levees\ACE Provided Info\_4.2.10\Genesee River, Wellsville, NY\GIS Data\Figure 1 - Genesee River - Wellsville.mxd



Wellsville FDRP Righ Bank and Dyke Creek

United States Army Corps of Engineers (USACE)

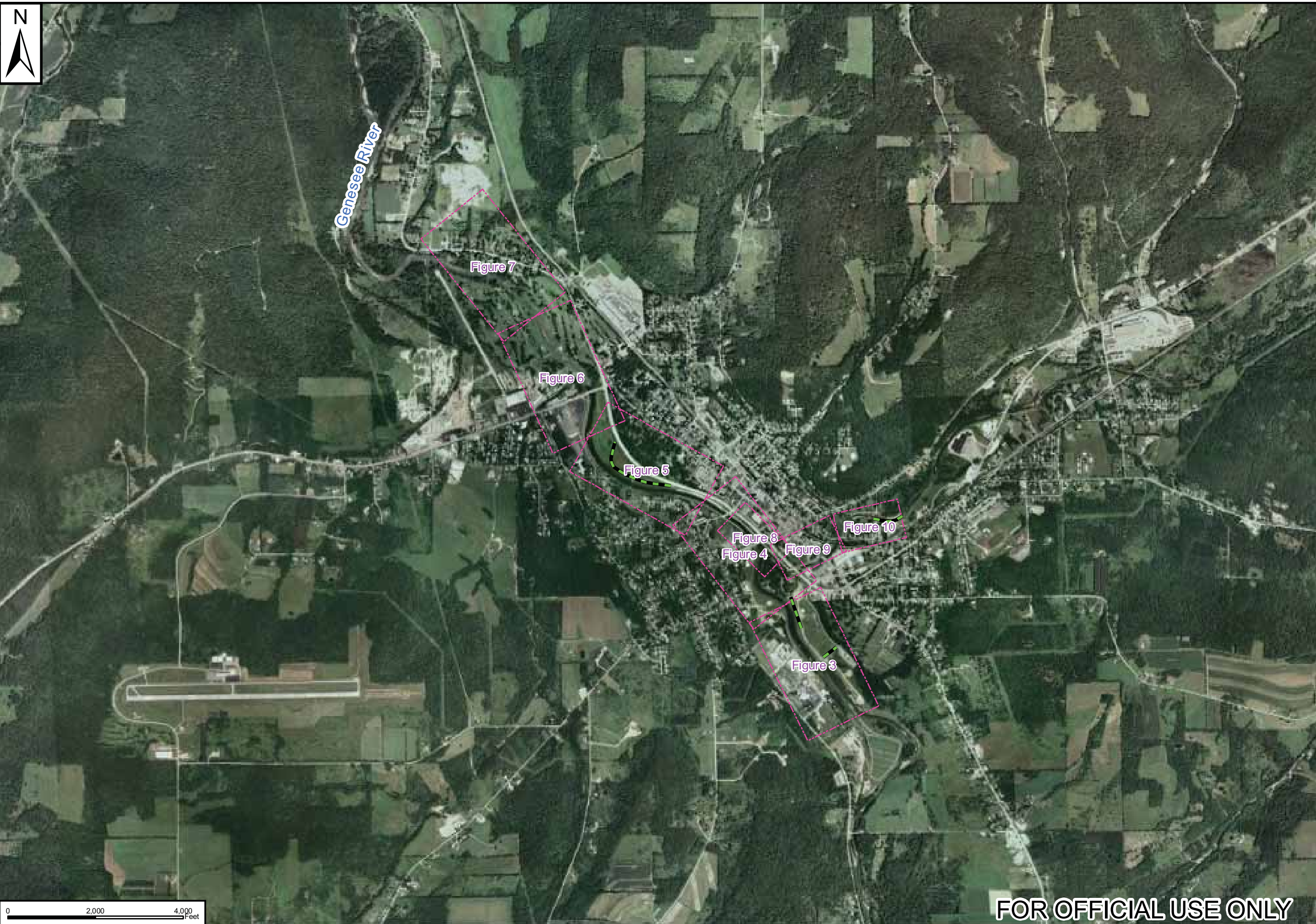
Buffalo District  
Levee Periodic Inspection  
Wellsville, Allegany County, New York



Project  
Vicinity  
Map  
Figure 1



V:\1996\business\_development\Proposal\Active 2010\Environmental Management\buffalo\levees\ACE Provided Info\_4.2.10\Genesee River, Wellsville, NY\GIS Data\Figure 2- Genesee River - Wellsville.mxd





 <p>Map Panel</p> <p>Earthen Levee</p>	Wellsville FDRP - Right Bank and Dyke Creek
	United States Army Corps of Engineers (USACE) Buffalo District Levee Periodic Inspection Wellsville, Allegany County, New York
	Location Sheet Figure 2



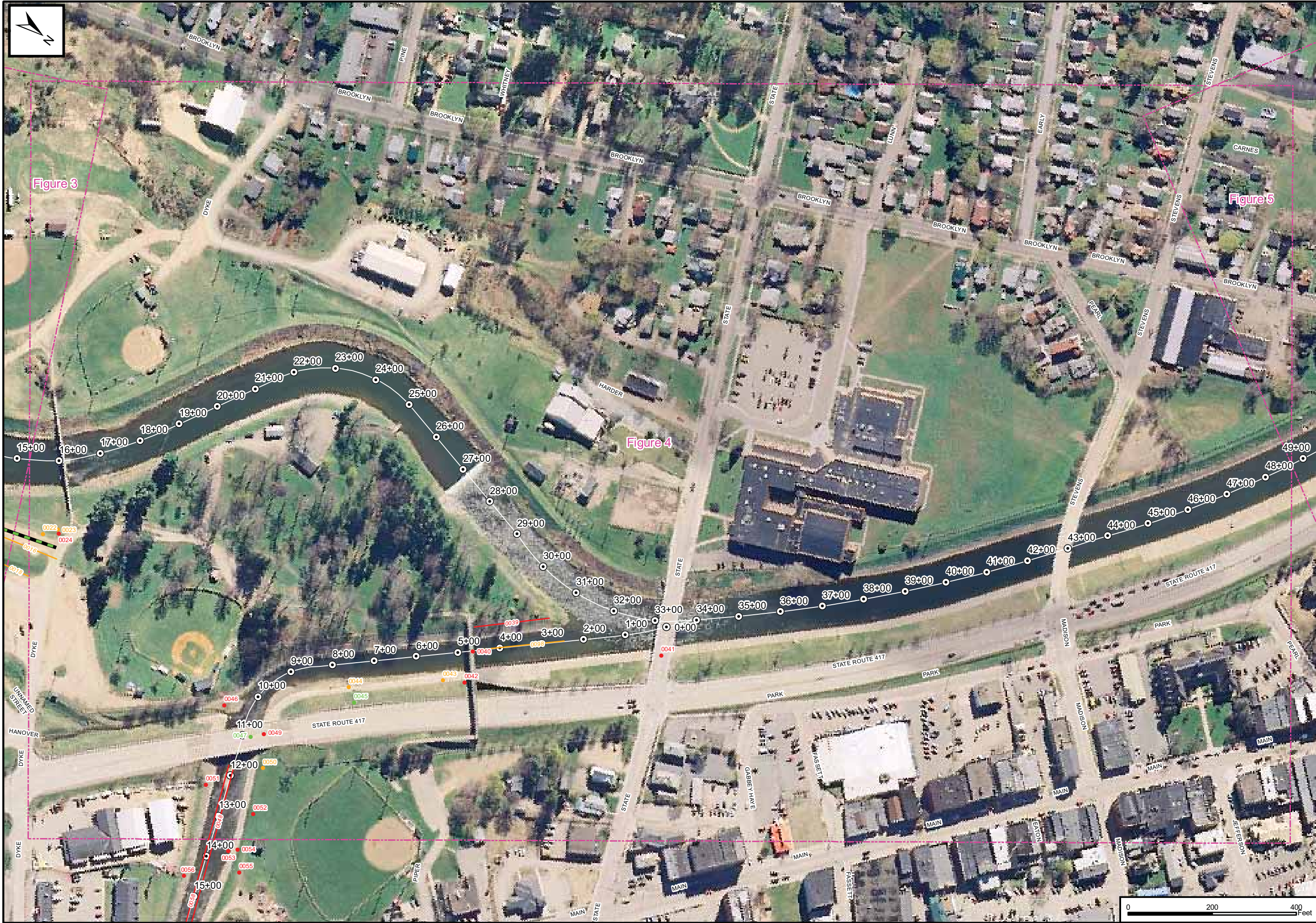


Figure 3

Figure 4

<p>Wellsville FDRP - Right Bank and Dyke Creek United States Army Corps of Engineers (USACE) Buffalo District Levee Periodic Inspection Wellsville, Allegany County, New York</p>	<p>Levee Station Earthen Levee</p>	<p>Acceptable Observation Minimally Acceptable Observation Unacceptable Observation</p>
	<p>Map Panel</p>	
<p>Location Sheet Figure 3</p>		





<p>Wellsville FDRP - Right Bank and Dyke Creek</p> <p>United States Army Corps of Engineers (USACE)</p> <p>Buffalo District</p> <p>Levee Periodic Inspection</p> <p>Wellsville, Allegany County, New York</p>	<p>Levee Station</p> <p>Earthen Levee</p> <p>Map Panel</p>	<p>Acceptable Observation</p> <p>Minimally Acceptable Observation</p> <p>Unacceptable Observation</p>
<p>Location Sheet</p> <p>Figure 4</p>		





<p>Acceptable Observation</p> <p>Minimally Acceptable Observation</p> <p>Unacceptable Observation</p>	<p>Levee Station</p> <p>Earthen Levee</p> <p>Map Panel</p>	<p>Wellsville FDRP - Right Bank and Dyke Creek</p> <p>United States Army Corps of Engineers (USACE)</p> <p>Buffalo District</p> <p>Levee Periodic Inspection</p> <p>Wellsville, Allegany County, New York</p>	





Acceptable Observation Minimally Acceptable Observation Unacceptable Observation	Levee Station Earthen Levee Map Panel
	Wellsville FDRP - Right Bank and Dyke Creek United States Army Corps of Engineers (USACE) Buffalo District Levee Periodic Inspection Wellsville, Allegany County, New York

Location Sheet  
Figure 6





<p>Wellsville FDRP - Right Bank and Dyke Creek</p> <p>United States Army Corps of Engineers (USACE)</p> <p>Buffalo District</p> <p>Levee Periodic Inspection</p> <p>Wellsville, Allegany County, New York</p>	<p>Levee Station</p> <p>●</p>	<p>Acceptable Observation</p> <p>●</p>
	<p>Levee Type</p> <p>— Earthen Levee</p>	<p>Minimally Acceptable Observation</p> <p>●</p>
<p>Map Panel</p> <p>□</p>		<p>Unacceptable Observation</p> <p>●</p>

Location Sheet

Figure 7





<p>Wellsville FDRP Right Bank and Dyke Creek United States Army Corps of Engineers (USACE) Buffalo District Levee Periodic Inspection Wellsville, Allegany County, New York</p>		<p>Levee Station</p> <p>Map Panel</p>	<p>Acceptable Observation</p> <p>Minimally Acceptable Observation</p> <p>Unacceptable Observation</p>
<p>Location Sheet Figure 8</p>			





<p>Levee Station</p> <p>Map Panel</p>	<p>Acceptable Observation</p> <p>Minimally Acceptable Observation</p> <p>Unacceptable Observation</p>
<p>Wellsville FDRP Right Bank and Dyke Creek</p> <p>United States Army Corps of Engineers (USACE)</p> <p>Buffalo District</p> <p>Levee Periodic Inspection</p> <p>Wellsville, Allegany County, New York</p>	<p>Stantec</p>
<p>Location Sheet</p> <p>Figure 9</p>	





Wellsville FDRP Right Bank and Dyke Creek  
United States Army Corps of Engineers (USACE)  
Buffalo District  
Levee Periodic Inspection  
Wellsville, Allegany County, New York



Location Sheet  
Figure 10



## Appendix B

### Periodic Inspection Checklist with Photographs

- Levee Embankments
- Interior Drainage  
Systems
- Flood Damage  
Reduction Channels



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## Flood Damage Reduction Segment / System Inspection Report

Name of Segment / System: Wellsville, Genesee River, Right Bank Levee and Dyke Creek

Public Sponsor(s): NYSDEC

Public Sponsor Representative: Theodore A. Myers, P.E.

Sponsor Phone: (716) 851-7070

Sponsor Email: tamyers@gw.dec.state.ny.us

Corps of Engineers Inspector: Robert W. Remmers, P.E.

Date of Inspection: 9/1/2010

Inspection Report Prepared By: Donald E. Gibbs, P.E.

Date Report Prepared: 8/27/2010

Internal Technical Review (for Periodic Inspections) By: Don Basham

Date of ITR: 9/9/2010

Final Approved By: \_\_\_\_\_

Date Approved: \_\_\_\_\_

Type of Inspection:

- ☐ Initial Eligibility Inspection  
☐ Continuing Eligibility Inspection (Routine)  
☒ Continuing Eligibility Inspection (Periodic)

Overall Segment / System Rating:

- ☐ Acceptable  
☐ Minimally Acceptable  
☒ Unacceptable

Contents of Report:

- ☒ Instructions  
☐ Initial Eligibility Inspection  
☒ General Items for All Flood Control Works  
☒ Levee Embankment  
☐ Concrete Floodwalls  
☐ Sheet Pile and Concrete I-walls  
☒ Interior Drainage System  
☐ Pump Stations  
☒ FDR System Channels

Note: In addition to the report contents indicated here, a plan view drawing of the system, with stationing, should be included with this report to reference locations of items rated less than acceptable. Photos of general system condition and any noted deficiencies should also be attached.

Note: This inspection rating represents the Corps evaluation of operations and maintenance of the flood damage reduction system and may be used in conjunction with other information for a levee certification determination for National Flood Insurance Program (NFIP) purposes if applicable. An Acceptable Corps inspection rating, alone, does not equate to a certifiable levee for the NFIP. It is recommended for levee systems currently accredited by the Federal Emergency Management Agency (FEMA) for NFIP purposes receiving a Corps Minimally Acceptable or Unacceptable rating be evaluated by the levee owner to determine the potential impacts to the certification for FEMA.



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# **Flood Damage Reduction Segment / System Public Sponsor Pre-Inspection Form**

The following information is to be provided by the levee district sponsor prior to an inspection. This information will be used to help evaluate the organizational capability of the levee district to manage the levee segment / system maintenance program.

<b>1. Levee segment / system and district: (name of the segment / system and levee district)</b> Wellsville Genesee River Right Bank Levee and Dyke Creek
<b>2. Reporting period: (month/day/year to month/day/year)</b> 7/22/2010 to 7/23/2010
<b>3. Summary of maintenance required by last inspection report:</b> See last inspection report
<b>4. Summary of maintenance performed this reporting period:</b> See last inspection report
<b>5. Summary of maintenance planned next reporting period:</b> See last inspection report
<b>6. Summary of changes to segment / system since last inspection:</b> No changes to system were reported
<b>7. Problems/ issues requiring the assistance of the US Army Corps of Engineers:</b> See items 10.6 found within Pre-Inspection Report



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**Flood Damage Reduction Segment / System  
Inspection Report**

**Pre-Inspection Form  
Page 1 of 2**

# Public Sponsor Pre-Inspection Report

The following information is to be provided by the levee district sponsor prior to an inspection

8. Levee district organization: (elected or appointed levee district officials and key employees)

Name	Position	Mailing Address	Phone Number	Email Address
Theodore A. Myers	Environmental Engineer II	270 Michigan Avenue Buffalo, NY 14203	(716) 851-7070	tamyers@gw.dec.state.ny.us

# General Instructions for the Inspection of Flood Damage Reduction Segments / Systems

## A. Purpose of USACE Inspections:

The primary purpose of these inspections is to prevent loss of life and catastrophic damages; preserve the value of Federal investments, and to encourage non-Federal sponsors to bear responsibility for their own protection. Inspections should assure that Flood Damage Reduction structures and facilities are continually maintained and operated as necessary to obtain the maximum benefits. Inspections are also conducted to determine eligibility for Rehabilitation Assistance under authority of PL 84-99 for Federal and non-Federal systems. (ER 1130-2-530, ER 500-1-1)

## B. Types of Inspections:

The Corps conducts several types of inspections of Flood Damage Reduction systems, as outlined below:

Initial Eligibility Inspections	Continuing Eligibility Inspections	
	Routine Inspections	Periodic Inspections
IEIs are conducted to determine whether a non-Federally constructed Flood Damage Reduction system meets the minimum criteria and standards set forth by the Corps for initial inclusion into the Rehabilitation and Inspection Program.	RIs are intended to verify proper maintenance, owner preparedness, and component operation.	PIs are intended to verify proper maintenance and component operation and to evaluate operational adequacy, structural stability, and safety of the system. Periodic Inspections evaluate the system's original design criteria vs. current design criteria to determine potential performance impacts, evaluate the current conditions, and compare the design loads and design analysis used against current design standards. This is to be done to identify components and features for the sponsor that need to be monitored more closely over time or corrected as needed. (Periodic Inspections are used as the basis of risk assessments.)

## C. Inspection Boundaries:

Inspections should be conducted so as to rate each Flood Damage Reduction "Segment" of the system. The overall system rating will be the lowest segment rating in the system.

Project	System	Segment
A flood damage reduction project is made up of one or more flood damage reduction systems which were under the same authorization.	A flood damage reduction system is made up of one or more flood damage reduction segments which collectively provide flood damage reduction to a defined area. Failure of one segment within a system constitutes failure of the entire system. Failure of one system does not affect another system.	A flood damage reduction segment is defined as a discrete portion of a flood damage reduction system that is operated and maintained by a single entity. A flood damage reduction segment can be made up of one or more features (levee, floodwall, pump stations, etc).

## D. Land Use Definitions:

The following three definitions are intended for use in determining minimum required inspection intervals and initial requirements for inclusion into the Rehabilitation and Inspection Program. Inspections should be considered for all systems that would result in significant environmental or economic impact upon failure regardless of specific land use.

Agricultural	Rural	Urban
Protected population in the range of zero to 5 households per square mile protected.	Protected population in the range of 6 to 20 households per square mile protected.	Greater than 20 households per square mile; major industrial areas with significant infrastructure investment. Some protected urban areas have no permanent population but may be industrial areas with high value infrastructure with no overnight population.



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## Flood Damage Reduction Segment / System Inspection Report

General Instructions  
Page 1 of 3

**E. Use of the Inspection Report Template:**

The report template is intended for use in all Army Corps of Engineers inspections of levee and floodwall systems and flood damage reduction channels. The section of the template labeled "Initial Eligibility" only needs to be completed during Initial Eligibility Inspections of Non-Federally constructed Flood Damage Reduction Systems. The section labeled "General Items" needs to be completed with every inspection, along with all other sections that correspond to features in the system. The section labeled "Public Sponsor Pre-Inspection Report" is intended for completion before the inspection, if possible.

**F. Individual Item / Component Ratings:**

Assessment of individual components rated during the inspection should be based on the criteria provided in the inspection report template, though inspectors may incorporate additional items into the report based on the characteristics of the system. The assessment of individual components should be based on the following definitions.

Acceptable Item	Minimally Acceptable Item	Unacceptable Item
The inspected item is in satisfactory condition, with no deficiencies, and will function as intended during the next flood event.	The inspected item has one or more minor deficiencies that need to be corrected. The minor deficiency or deficiencies will not seriously impair the functioning of the item as intended during the next flood event.	The inspected item has one or more serious deficiencies that need to be corrected. The serious deficiency or deficiencies will seriously impair the functioning of the item as intended during the next flood event.

**G. Overall Segment / System Ratings:**

Determination of the overall system rating is based on the definitions below. Note that an Unacceptable System Rating may be either based on an engineering determination that concluded that noted deficiencies would prevent the system from functioning as intended during the next flood event, or based on the sponsor's demonstrated lack of commitment or inability to correct serious deficiencies in a timely manner.

Acceptable System	Minimally Acceptable System	Unacceptable System
All items or components are rated as Acceptable.	One or more items are rated as Minimally Acceptable or one or more items are rated as Unacceptable and an engineering determination concludes that the Unacceptable items would not prevent the segment / system from performing as intended during the next flood event.	One or more items are rated as Unacceptable and would prevent the segment / system from performing as intended, or a serious deficiency noted in past inspections (which had previously resulted in a minimally acceptable system rating) has not been corrected within the established timeframe, not to exceed two years.

**H. Eligibility for PL84-99 Rehabilitation Assistance:**

Inspected systems that are not operated and maintained by the Federal government may be Active in the Corps' Rehabilitation and Inspection Program (RIP) and eligible for rehabilitation assistance from the Corps as defined below:

If the Overall System Rating is Acceptable	If the Overall System Rating is Minimally Acceptable	If the Overall System Rating is Unacceptable
The system is active in the RIP and eligible for PL84-99 rehabilitation assistance.	The system is Active in the RIP during the time that it takes to make needed corrections. Active systems are eligible for rehabilitation assistance. However, if the sponsor does not present USACE with proof that serious deficiencies (which had previously resulted in a minimally acceptable system rating) were corrected within the established timeframe, then the system will become Inactive in the RIP.	The system is Inactive in the RIP, and the status will remain Inactive until the sponsor presents USACE with proof that all items rated Unacceptable have been corrected. Inactive systems are ineligible for rehabilitation assistance.



**I. Reporting:**

After the inspection, the Corps is responsible for assembling an inspection report (or a summary report if it was a Periodic Inspection) including the following information:

- a. All sections of the report template used during the inspection, including the cover and pre-inspection materials. (Supplemental data collected, and any sections of the template that weren't used during the inspection do not need to be included with the report.)
- b. Photos of the general system condition and noted deficiencies.
- c. A plan view drawing of the system, with stationing, to reference locations of items rated less than acceptable.
- d. The relative importance of the identified maintenance issues should be specified in the transmittal letter.
- e. If the Overall System Rating is Minimally Acceptable, the report needs to establish a timeframe for correction of serious deficiencies noted (not to exceed two years) and indicate that if these items are not corrected within the required timeframe, the system will be rated as Unacceptable and made Inactive in the Rehabilitation Inspection Program.

**J. Notification:**

Reports are to be disseminated as follows within 30 days of the inspection date.

<b>If the Overall System Rating is Acceptable</b>	<b>If the Overall System Rating is Minimally Acceptable</b>	<b>If the Overall System Rating is Unacceptable</b>
Reports need to be provided to the local sponsor and the county emergency management agency.	Reports need to be provided to the local sponsor, state emergency management agency, county emergency management agency, and to the FEMA region.	Reports need to be provided to the local sponsor, state emergency management agency, county emergency management agency, FEMA region, and to the Congressional delegation within 30 days of the inspection.

## General Items for All Flood Damage Reduction Segments / Systems

For use during all inspections of all Flood Damage Reduction Segments / Systems

Rated Item	Rating	Rating Guidelines		Location/Remarks/Recommendations
1. Operations and Maintenance Manuals	<b>M</b>	<b>A</b>	Levee Owner's Manual, O&M Manuals, and/or manufacturer's operating instructions are present.	Manuals are out of date and should be revised to show existing FDRP conditions
		<b>M</b>	Sponsor manuals are lost or missing or out of date; however, sponsor will obtain manuals prior to next scheduled inspection.	
		<b>U</b>	Sponsor has not obtained lost or missing manuals identified during previous inspection.	
2. Emergency Supplies and Equipment (A or M only)	<b>M</b>	<b>A</b>	The sponsor maintains a stockpile of sandbags, shovels, and other flood fight supplies which will adequately supply all needs for the initial days of a flood fight. Sponsor determines required quantity of supplies after consulting with inspector.	Sponsor does not maintain an adequate supply of flood fighting materials.
		<b>M</b>	The sponsor does not maintain an adequate supply of flood fighting materials as part of their preparedness activities.	
3. Flood Preparedness and Training (A or M only)	<b>M</b>	<b>A</b>	Sponsor has a written system-specific flood response plan and a solid understanding of how to operate, maintain, and staff the FDR system during a flood. Sponsor maintains a list of emergency contact information for appropriate personnel and other emergency response agencies.	System specific emergency procedures is insufficient and out of date
		<b>M</b>	The sponsor maintains a good working knowledge of flood response activities, but documentation of system-specific emergency procedures and emergency contact personnel is insufficient or out of date.	

Key: A = Acceptable. M = Minimally Acceptable; Maintenance is required. U = Unacceptable. N/A = Not Applicable. FDR = Flood Damage Reduction



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**Flood Damage Reduction Segment / System  
Inspection Report**

General Items for All Flood Damage Reduction  
Segments / Systems  
**Page 1 of 1**



# Levee Embankments

For use during Initial and Continuing Eligibility Inspections of levee segments / systems

Rated Item	Rating	Rating Guidelines		Location/Remarks/Recommendations
1. Unwanted Vegetation Growth <sup>1</sup>	<b>U</b>	<b>A</b>	The levee has little or no unwanted vegetation (trees, bush, or undesirable weeds), except for vegetation that is properly contained and/or situated on overbuilt sections, such that the mandatory 3-foot root-free zone is preserved around the levee profile. The levee has been recently mowed. The vegetation-free zone extends 15 feet from both the landside and riverside toes of the levee to the centerline of the tree. If the levee access easement doesn't extend to the described limits, then the vegetation-free zone must be maintained to the easement limits. Reference EM 1110-2-301 or Corps policy for regional vegetation variance.	N21R_2010_a_0007: Vegetation on bank: Remove all excess vegetation on levee within 15 ft. of toe (U) N21R_2010_a_0011: Trees: Remove all excess vegetation on levee within 15 ft. of toe (U) N21R_2010_a_0088: Trees along bank: Remove all excess vegetation on levee within 15 ft. of toe (U)
		<b>M</b>	Minimal vegetation growth (brush, weeds, or trees 2 inches in diameter or smaller) is present within the zones described above. This vegetation must be removed but does not currently threaten the operation or integrity of the levee.	
		<b>U</b>	Significant vegetation growth (brush, weeds, or any trees greater than 2 inches in diameter) is present within the zones described above and must be removed to reestablish or ascertain levee integrity.	
2. Sod Cover	<b>A</b>	<b>A</b>	There is good coverage of sod over the levee.	
		<b>M</b>	Approximately 25% of the sod cover is missing or damaged over a significant portion or over significant portions of the levee embankment. This may be the result of over-grazing or feeding on the levee, unauthorized vehicular traffic, chemical or insect problems, or burning during inappropriate seasons.	
		<b>U</b>	Over 50% of the sod cover is missing or damaged over a significant portion or portions of the levee embankment.	
		<b>N/A</b>	Surface protection is provided by other means.	
3. Encroachments	<b>U</b>	<b>A</b>	No trash, debris, unauthorized farming activity, structures, excavations, or other obstructions present within the easement area. Encroachments have been previously reviewed by the Corps, and it was determined that they do not diminish proper functioning of the levee.	N21R_2010_a_0001: Survey marker: Document encroachments in accordance with USACE guidance (U) N21R_2010_a_0003: Guy wire: Document encroachments in accordance with USACE guidance (U) N21R_2010_a_0005: Guy wire: Document encroachments in accordance with USACE guidance (U) N21R_2010_a_0006: Fence: Document encroachments in accordance with USACE guidance (U) N21R_2010_a_0008: Water line: Document encroachments in accordance with USACE guidance (U) N21R_2010_a_0010: Building: Document encroachments in accordance with USACE guidance (U) N21R_2010_a_0012: Fence: Document encroachments in accordance with USACE guidance (U) N21R_2010_a_0014: Fence on crown: Document encroachments in accordance with USACE guidance (U) N21R_2010_a_0015: Railroad ties used for parking: Document encroachments in accordance with USACE
		<b>M</b>	Trash, debris, unauthorized farming activity, structures, excavations, or other obstructions present, or inappropriate activities noted that should be corrected but will not inhibit operations and maintenance or emergency operations. Encroachments have not been reviewed by the Corps.	
		<b>U</b>	Unauthorized encroachments or inappropriate activities noted are likely to inhibit operations and maintenance, emergency operations, or negatively impact the integrity of the levee.	

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				<p>guidance (U)</p> <p>N21R_2010_a_0017: Fence from baseball field: Document encroachments in accordance with USACE guidance (U)</p> <p>N21R_2010_a_0019: Lighting Manhole: Document encroachments in accordance with USACE guidance (U)</p> <p>N21R_2010_a_0020: Lighting Manhole: Document encroachments in accordance with USACE guidance (U)</p> <p>N21R_2010_a_0023: Railroad ties along edge of drive: Document encroachments in accordance with USACE guidance (M)</p> <p>N21R_2010_a_0024: Sinclair Refinery project sign: Document encroachments in accordance with USACE guidance (U)</p> <p>N21R_2010_a_0028: Fence, vegetation: Document encroachments in accordance with USACE guidance (U)</p> <p>N21R_2010_a_0029: Pond, water against levee bank: Document encroachments in accordance with USACE guidance (U)</p> <p>N21R_2010_a_0030: Access ramp: Document encroachments in accordance with USACE guidance (U)</p> <p>N21R_2010_a_0035: Concrete monument: Document encroachments in accordance with USACE guidance (U)</p> <p>N21R_2010_a_0037: Access ramp, fence: Document encroachments in accordance with USACE guidance (U)</p> <p>N21R_2010_a_0087: Miscellaneous encroachments: Document encroachments in accordance with USACE guidance (U)</p> <p>N21R_2010_a_0089: Log in channel: Remove debris from channel (U)</p>
4. Closure Structures (Stop Log, Earthen Closures, Gates, or Sandbag Closures) (A or U only)	NA	A	Closure structure in good repair. Placing equipment, stoplogs, and other materials are readily available at all times. Components are clearly marked and installation instructions/ procedures readily available. Trial erections have been accomplished in accordance with the O&M Manual.	
		U	Any of the following issues is cause for this rating: Closure structure in poor condition. Parts missing or corroded. Placing equipment may not be available within the anticipated warning time. The storage vaults cannot be opened during the time of inspection. Components of closure are not clearly marked and installation instructions/ procedures are not readily available. Trial erections have not been accomplished in accordance with the O&M Manual.	
		N/A	There are no closure structures along this component of the FDR segment / system.	
5. Slope Stability	A	A	No slides, sloughs, tension cracking, slope depressions, or bulges are present.	

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Rated Item	Rating	Rating Guidelines		Location/Remarks/Recommendations
6. Erosion/ Bank Caving	<b>M</b>	<b>M</b>	Minor slope stability problems that do not pose an immediate threat to the levee embankment.	N21R_2010_a_0002: Lack of vegetation: Backfill erosion with engineered fill, re-establish appropriate sod cover (M) N21R_2010_a_0016: Gravel drive on crown: Backfill erosion with engineered fill, re-establish appropriate sod cover (M) N21R_2010_a_0018: Lack of vegetation: Backfill erosion with engineered fill, re-establish appropriate sod cover (M) N21R_2010_a_0033: 20' x 8' erosion: Backfill erosion with engineered fill, re-establish appropriate sod cover (M)
		<b>U</b>	Major slope stability problems (ex. deep seated sliding) identified that must be repaired to reestablish the integrity of the levee embankment.	
		<b>A</b>	No erosion or bank caving is observed on the landward or riverward sides of the levee that might endanger its stability.	
7. Settlement <sup>2</sup>	<b>U</b>	<b>M</b>	There are areas where minor erosion is occurring or has occurred on or near the levee embankment, but levee integrity is not threatened.	Note: No records exist that no design elevation is comprised.
		<b>U</b>	Erosion or caving is occurring or has occurred that threatens the stability and integrity of the levee. The erosion or caving has progressed into the levee section or into the extended footprint of the levee foundation and has compromised the levee foundation stability.	
		<b>A</b>	No observed depressions in crown. Records exist and indicate no unexplained historical changes.	
8. Depressions/ Rutting	<b>M</b>	<b>M</b>	Minor irregularities that do not threaten integrity of levee. Records are incomplete or inclusive.	N21R_2010_a_0004: 6' x 4' depression: Backfill rutting with engineered fill, re-establish appropriate sod cover (M) N21R_2010_a_0009: 15' x 3' depression, ponding: Backfill rutting with engineered fill, re-establish appropriate sod cover (M) N21R_2010_a_0013: Ponding: Backfill rutting with engineered fill, re-establish appropriate sod cover (M) N21R_2010_a_0021: 30' x 6' depression, ponding: Backfill rutting with engineered fill, re-establish appropriate sod cover (M) N21R_2010_a_0022: 30' x 3' depression: Backfill rutting with engineered fill, re-establish appropriate sod cover (M) N21R_2010_a_0032: 30' x 6" rutting by mower: Backfill rutting with engineered fill, re-establish appropriate sod cover (M)
		<b>U</b>	Obvious variations in elevation over significant reaches. No records exist or records indicate that design elevation is compromised.	
		<b>A</b>	There are scattered, shallow ruts, pot holes, or other depressions on the levee that are unrelated to levee settlement. The levee crown, embankments, and access road crowns are well established and drain properly without any ponded water.	
9. Cracking	<b>A</b>	<b>M</b>	There are some infrequent minor depressions less than 6 inches deep in the levee crown, embankment, or access roads that will pond water.	
		<b>U</b>	There are depressions greater than 6 inches deep that will pond water.	
		<b>A</b>	Minor longitudinal, transverse, or desiccation cracks with no vertical movement along the crack. No cracks extend continuously through the levee crest.	
		<b>M</b>	Longitudinal and/or transverse cracks up to 6 inches in depth with no vertical movement along the crack. No cracks extend continuously through the levee crest. Longitudinal cracks are no longer than the height of the levee.	
		<b>U</b>	Cracks exceed 6 inches in depth. Longitudinal cracks are longer than the height of the levee	

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			and/or exhibit vertical movement along the crack. Transverse cracks extend through the entire levee width.	
10. Animal Control	<b>U</b>	<b>A</b>	Continuous animal burrow control program in place that includes the elimination of active burrowing and the filling in of existing burrows.	N21R_2010_a_0027: Burrow hole: Establish animal control program (U)
		<b>M</b>	The existing animal burrow control program needs to be improved. Several burrows are present which may lead to seepage or slope stability problems, and they require immediate attention.	N21R_2010_a_0031: Burrow hole: Establish animal control program (U) N21R_2010_a_0034: Burrow hole: Establish animal control program (U)
		<b>U</b>	Animal burrow control program is not effective or is nonexistent. Significant maintenance is required to fill existing burrows, and the levee will not provide reliable flood protection until this maintenance is complete.	N21R_2010_a_0036: Burrow hole: Establish animal control program (U)
11. Culverts/ Discharge Pipes <sup>3</sup> (This item includes both concrete and corrugated metal pipes.)	<b>NA</b>	<b>A</b>	There are no breaks, holes, cracks in the discharge pipes/ culverts that would result in significant water leakage. The pipe shape is still essentially circular. All joints appear to be closed and the soil tight. Corrugated metal pipes, if present, are in good condition with 100% of the original coating still in place (either asphalt or galvanizing) or have been relined with appropriate material, which is still in good condition. Condition of pipes has been verified using television camera video taping or visual inspection methods within the past five years, and the report for every pipe is available for review by the inspector.	
		<b>M</b>	There are a small number of corrosion pinholes or cracks that could leak water and need to be repaired, but the entire length of pipe is still structurally sound and is not in danger of collapsing. Pipe shape may be ovalized in some locations but does not appear to be approaching a curvature reversal. A limited number of joints may have opened and soil loss may be beginning. Any open joints should be repaired prior to the next inspection. Corrugated metal pipes, if present, may be showing corrosion and pinholes but there are no areas with total section loss. Condition of pipes has been verified using television camera video taping or visual inspection methods within the past five years, and the report for every pipe is available for review by the inspector.	
		<b>U</b>	Culvert has deterioration and/or has significant leakage; it is in danger of collapsing or as already begun to collapse. Corrugated metal pipes have suffered 100% section loss in the invert. HOWEVER: Even if pipes appear to be in good condition, as judged by an external visual inspection, an Unacceptable Rating will be assigned if the condition of pipes has not been verified using television camera video taping or visual inspection methods within the past five years, and reports for all pipes are not available for review by the inspector.	
		<b>N/A</b>	There are no discharge pipes/ culverts.	
12. Riprap Revetments & Bank Protection	<b>NA</b>	<b>A</b>	No riprap displacement or stone degradation that could pose an immediate threat to the integrity of channel bank. Riprap intact with no woody vegetation present.	
		<b>M</b>	Minor riprap displacement or stone degradation that could pose an immediate threat to the integrity of the channel bank. Unwanted vegetation must be cleared or sprayed with an appropriate herbicide.	

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		<b>U</b>	Significant riprap displacement, exposure of bedding, or stone degradation observed. Scour activity is undercutting banks, eroding embankments, or impairing channel flows by causing turbulence or shoaling. Rock protection is hidden by dense brush, trees, or grasses.	
		<b>N/A</b>	There is no riprap protecting this feature of the segment / system, or riprap is discussed in another section.	
13. Revetments other than Riprap	<b>NA</b>	<b>A</b>	Existing revetment protection is properly maintained, undamaged, and clearly visible.	
		<b>M</b>	Minor revetment displacement or deterioration that does not pose an immediate threat to the integrity of the levee. Unwanted vegetation must be cleared or sprayed with an appropriate herbicide.	
		<b>U</b>	Significant revetment displacement, deterioration, or exposure of bedding observed. Scour activity is undercutting banks, eroding embankments, or impairing channel flows by causing turbulence or shoaling. Revetment protection is hidden by dense brush and trees.	
		<b>N/A</b>	There are no such revetments protecting this feature of the segment / system.	
14. Underseepage Relief Wells/ Toe Drainage Systems	<b>NA</b>	<b>A</b>	Toe drainage systems and pressure relief wells necessary for maintaining FDR segment / system stability during high water functioned properly during the last flood event and no sediment is observed in horizontal system (if applicable). Nothing is observed which would indicate that the drainage systems won't function properly during the next flood, and maintenance records indicate regular cleaning. Wells have been pumped tested within the past 5 years and documentation is provided.	
		<b>M</b>	Toe drainage systems or pressure relief wells are damaged and may become clogged if they are not repaired. Maintenance records are incomplete or indicate irregular cleaning and pump testing.	
		<b>U</b>	Toe drainage systems or pressure relief wells necessary for maintaining FDR segment / system stability during flood events have fallen into disrepair or have become clogged. No maintenance records. No documentation of the required pump testing.	
		<b>N/A</b>	There are no relief wells/ toe drainage systems along this component of the FDR segment / system.	
15. Seepage	<b>A</b>	<b>A</b>	No evidence or history of unrepaired seepage, saturated areas, or boils.	
		<b>M</b>	Evidence or history of minor unrepaired seepage or small saturated areas at or beyond the landside toe but not on the landward slope of levee. No evidence of soil transport.	
		<b>U</b>	Evidence or history of active seepage, extensive saturated areas, or boils.	

<sup>1</sup> If there is significant growth on the levee that inhibits the inspection of animal burrows or other items, the inspection should be ended until this item is corrected.

<sup>2</sup> Detailed survey elevations are normally required during Periodic Inspections, and whenever there are obvious visual settlements.

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<sup>3</sup> The decision on whether or not USACE inspectors should enter a pipe to perform a detailed inspection must be made at the USACE District level. This decision should be made in conjunction with the District Safety Office, as pipes may be considered confined spaces. This decision should consider the age of the pipe, the diameter of the pipe, the apparent condition of the pipe, and the length of the pipe. If a pipe is entered for the purposes of inspection, the inspector should record observations with a video camera in order that the condition of the entire pipe, including all joints, can later be assessed. Additionally, the video record provides a baseline to which future inspections can be compared.

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	<p><b>Inspect ID:</b> N21R_2010_a_0001 <b>Title:</b> USACE_CELRB_N21R_2010_a_0001_1.jpg <b>Caption:</b> Survey marker Levee Crown Only</p>
	<p><b>Inspect ID:</b> N21R_2010_a_0002 <b>Title:</b> USACE_CELRB_N21R_2010_a_0002_1.jpg <b>Caption:</b> Lack of vegetation L/S</p>



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	<p><b>Inspect ID:</b> N21R_2010_a_0003 <b>Title:</b> USACE_CELRB_N21R_2010_a_0003_1.jpg <b>Caption:</b> Guy wire L/S</p>
	<p><b>Inspect ID:</b> N21R_2010_a_0004 <b>Title:</b> USACE_CELRB_N21R_2010_a_0004_1.jpg <b>Caption:</b> 6' x 4' depression</p>





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	<p><b>Inspect ID:</b> N21R_2010_a_0005 <b>Title:</b> USACE_CELRB_N21R_2010_a_0005_1.jpg <b>Caption:</b> Guy wire L/S</p>
	<p><b>Inspect ID:</b> N21R_2010_a_0006 <b>Title:</b> USACE_CELRB_N21R_2010_a_0006_1.jpg <b>Caption:</b> Fence along toe of levee L/S</p>



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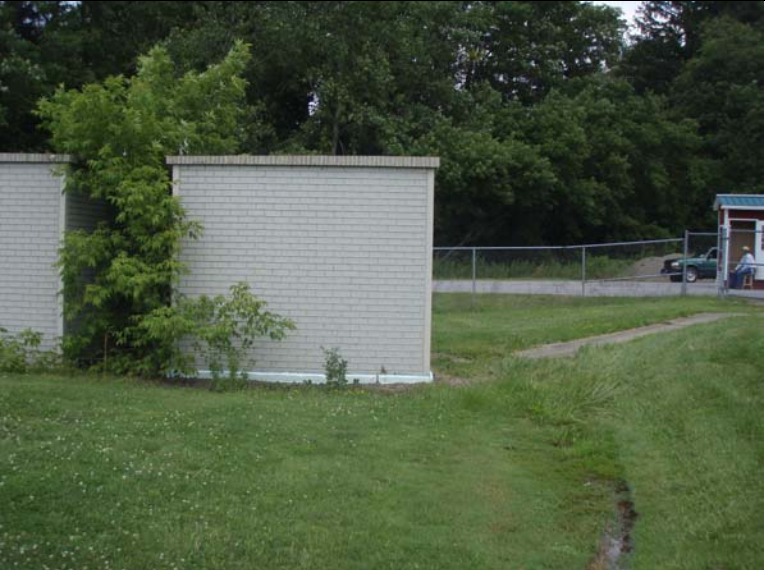
	<p><b>Inspect ID:</b> N21R_2010_a_0007 <b>Title:</b> USACE_CELRB_N21R_2010_a_0007_1.jpg <b>Caption:</b> Vegetation along levee L/S</p>
	<p><b>Inspect ID:</b> N21R_2010_a_0008 <b>Title:</b> USACE_CELRB_N21R_2010_a_0008_1.jpg <b>Caption:</b> Water line at fence L/S</p>





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	<p><b>Inspect ID:</b> N21R_2010_a_0009 <b>Title:</b> USACE_CELRB_N21R_2010_a_0009_1.jpg <b>Caption:</b> 15' x 3' depression, ponding L/S</p>
	<p><b>Inspect ID:</b> N21R_2010_a_0010 <b>Title:</b> USACE_CELRB_N21R_2010_a_0010_1.jpg <b>Caption:</b> Building along levee L/S</p>



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	<p><b>Inspect ID:</b> N21R_2010_a_0011 <b>Title:</b> USACE_CELRB_N21R_2010_a_0011_1.jpg <b>Caption:</b> Trees along levee L/S</p>
	<p><b>Inspect ID:</b> N21R_2010_a_0012 <b>Title:</b> USACE_CELRB_N21R_2010_a_0012_1.jpg <b>Caption:</b> Fence along levee L/S</p>





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	<p><b>Inspect ID:</b> N21R_2010_a_0013 <b>Title:</b> USACE_CELRB_N21R_2010_a_0013_1.jpg <b>Caption:</b> Ponding L/S</p>
	<p><b>Inspect ID:</b> N21R_2010_a_0014 <b>Title:</b> USACE_CELRB_N21R_2010_a_0014_1.jpg <b>Caption:</b> Fence</p>



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	<p><b>Inspect ID:</b> N21R_2010_a_0015   <b>Title:</b> USACE_CELRB_N21R_2010_a_0015_1.jpg <b>Caption:</b> Railroad ties</p>
	<p><b>Inspect ID:</b> N21R_2010_a_0016   <b>Title:</b> USACE_CELRB_N21R_2010_a_0016_1.jpg <b>Caption:</b> Gravel drive</p>



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	<p><b>Inspect ID:</b> N21R_2010_a_0017 <b>Title:</b> USACE_CELRB_N21R_2010_a_0017_1.jpg <b>Caption:</b> Fence from baseball field L/S</p>
	<p><b>Inspect ID:</b> N21R_2010_a_0018 <b>Title:</b> USACE_CELRB_N21R_2010_a_0018_1.jpg <b>Caption:</b> Lack of vegetation L/S</p>





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	<p><b>Inspect ID:</b> N21R_2010_a_0019 <b>Title:</b> USACE_CELRB_N21R_2010_a_0019_1.jpg <b>Caption:</b> Lighting manhole L/S</p>
	<p><b>Inspect ID:</b> N21R_2010_a_0020 <b>Title:</b> USACE_CELRB_N21R_2010_a_0020_1.jpg <b>Caption:</b> Lighting Manhole L/S</p>





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	<p><b>Inspect ID:</b> N21R_2010_a_0021 <b>Title:</b> USACE_CELRB_N21R_2010_a_0021_1.jpg <b>Caption:</b> 30' x 6' depression, ponding Levee Crown Only</p>
	<p><b>Inspect ID:</b> N21R_2010_a_0022 <b>Title:</b> USACE_CELRB_N21R_2010_a_0022_1.jpg <b>Caption:</b> 30' x 3' depression Levee Crown Only</p>



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**Inspect ID:** N21R\_2010\_a\_0023 **Title:** USACE\_CELRB\_N21R\_2010\_a\_0023\_1.jpg  
**Caption:** Railroad ties along edge of drive Levee Crown Only



**Inspect ID:** N21R\_2010\_a\_0024 **Title:** USACE\_CELRB\_N21R\_2010\_a\_0024\_1.jpg  
**Caption:** Sinclair Refinery project sign Levee Crown Only



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	<p><b>Inspect ID:</b> N21R_2010_a_0027 <b>Title:</b> USACE_CELRB_N21R_2010_a_0027_1.jpg <b>Caption:</b> Burrow hole Levee Crown Only</p>
	<p><b>Inspect ID:</b> N21R_2010_a_0028 <b>Title:</b> USACE_CELRB_N21R_2010_a_0028_1.jpg <b>Caption:</b> Fence, vegetation Levee Slope and Crown</p>





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 A photograph showing a grassy levee bank on the right side, with water ponded up against it. In the background, there are trees and a small building under a cloudy sky.	<p><b>Inspect ID:</b> N21R_2010_a_0029 <b>Title:</b> USACE_CELRB_N21R_2010_a_0029_1.jpg <b>Caption:</b> Ponding water against levee bank L/S</p>
 A photograph showing a grassy area with many yellow wildflowers in the foreground. In the background, there is a body of water, trees, and a small building. A person wearing a yellow safety vest is partially visible on the right edge.	<p><b>Inspect ID:</b> N21R_2010_a_0030 <b>Title:</b> USACE_CELRB_N21R_2010_a_0030_1.jpg <b>Caption:</b> Access ramp R/S</p>



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	<p><b>Inspect ID:</b> N21R_2010_a_0031 <b>Title:</b> USACE_CELRB_N21R_2010_a_0031_1.jpg <b>Caption:</b> Burrow hole L/S</p>
	<p><b>Inspect ID:</b> N21R_2010_a_0032 <b>Title:</b> USACE_CELRB_N21R_2010_a_0032_1.jpg <b>Caption:</b> 30' x 6' rutting by mower L/S</p>





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	<p><b>Inspect ID:</b> N21R_2010_a_0033 <b>Title:</b> USACE_CELRB_N21R_2010_a_0033_1.jpg <b>Caption:</b> 20' x 8' erosion L/S</p>
	<p><b>Inspect ID:</b> N21R_2010_a_0034 <b>Title:</b> USACE_CELRB_N21R_2010_a_0034_1.jpg <b>Caption:</b> Burrow hole L/S</p>



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		<p><b>Inspect ID:</b> N21R_2010_a_0035 <b>Title:</b> USACE_CELRB_N21R_2010_a_0035_1.jpg <b>Caption:</b> Concrete monument L/S</p>
		<p><b>Inspect ID:</b> N21R_2010_a_0036 <b>Title:</b> USACE_CELRB_N21R_2010_a_0036_1.jpg <b>Caption:</b> Burrow hole L/S</p>





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	<p><b>Inspect ID:</b> N21R_2010_a_0037 <b>Title:</b> USACE_CELRB_N21R_2010_a_0037_1.jpg <b>Caption:</b> Fence R/S</p>
	<p><b>Inspect ID:</b> N21R_2010_a_0087 <b>Title:</b> USACE_CELRB_N21R_2010_a_0087_1.jpg <b>Caption:</b> Miscellaneous encroachments</p>





## Levee Embankments

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	<p><b>Inspect ID:</b> N21R_2010_a_0088 <b>Title:</b> USACE_CELRB_N21R_2010_a_0088_1.jpg <b>Caption:</b> Trees along bank</p>
	<p><b>Inspect ID:</b> N21R_2010_a_0089 <b>Title:</b> USACE_CELRB_N21R_2010_a_0089_1.jpg <b>Caption:</b> Log in channel</p>



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# Interior Drainage System

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Rated Item	Rating	Rating Guidelines		Location/Remarks/Recommendations
1. Vegetation and Obstructions	<b>U</b>	<b>A</b>	No obstructions, vegetation, debris, or sediment accumulation noted within interior drainage channels or blocking the culverts, inlets, or discharge areas. Concrete joints and weep holes are free of grass and weeds.	N21R_2010_a_0099: Vegetation around CMP drainage pipe: Remove all excess vegetation (U)
		<b>M</b>	Obstructions, vegetation, debris, or sediment are minor and have not impaired channel flow capacity or blocked more than 10% of any culvert openings, but should be removed. A limited volume of grass and weeds may be present in concrete channel joints and weep holes.	
		<b>U</b>	Obstructions, vegetation, debris, or sediment have impaired the channel flow capacity or blocked more than 10% of a culvert opening. Sediment and debris removal required to re-establish flow capacity.	
2. Encroachments	<b>A</b>	<b>A</b>	No trash, debris, unauthorized structures, excavations, or other obstructions present within the easement area. Encroachments have been previously reviewed by the Corps, and it was determined that they do not diminish proper functioning of the interior drainage system.	
		<b>M</b>	Trash, debris, unauthorized structures, excavations, or other obstructions present, or inappropriate activities noted that should be corrected but will not inhibit operations and maintenance or emergency operations. Encroachments have not been reviewed by the Corps.	
		<b>U</b>	Unauthorized encroachments or inappropriate activities noted are likely to inhibit operations and maintenance, emergency operations, or negatively impact the integrity of this component of the interior drainage system.	
3. Ponding Areas	<b>NA</b>	<b>A</b>	No trash, debris, structures, or other obstructions present within the ponding areas. Sediment deposits do not exceed 10% of capacity.	
		<b>M</b>	Trash, debris, excavations, structures, or other obstructions present, or inappropriate activities that will not inhibit operations and maintenance. Sediment deposits do not exceed 30% of capacity.	
		<b>U</b>	Trash, debris, excavations, structures, or other obstructions, or other encroachments or activities noted that will inhibit operations, maintenance, or emergency work. Sediment deposits exceeds 30% of capacity.	
		<b>N/A</b>	There are no ponding areas associated with the interior drainage system.	
4. Fencing and Gates <sup>1</sup>	<b>NA</b>	<b>A</b>	Fencing is in good condition and provides protection against falling or unauthorized access. Gates open and close freely, locks are in place, and there is little corrosion on metal parts.	
		<b>M</b>	Fencing or gates are damaged or corroded but appear to be maintainable. Locks may be missing or damaged.	
		<b>U</b>	Fencing and gates are damaged or corroded to the point that replacement is required, or potentially dangerous features are not secured.	
		<b>N/A</b>	There are no features noted that require safety fencing.	
5. Concrete Surfaces (Such as gate)	<b>A</b>	<b>A</b>	Negligible spalling, scaling or cracking. If the concrete surface is weathered or holds moisture, it is still satisfactory but should be seal coated to prevent freeze/ thaw damage.	

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Rated Item	Rating	Rating Guidelines		Location/Remarks/Recommendations
wells, outfalls, intakes, or culverts)		<b>M</b>	Spalling, scaling, and open cracking present, but the immediate integrity or performance of the structure is not threatened. Reinforcing steel may be exposed. Repairs/ sealing is necessary to prevent additional damage during periods of thawing and freezing.	
		<b>U</b>	Surface deterioration or deep cracks present that may result in an unreliable structure. Any surface deterioration that exposes the sheet piling or lies adjacent to monolith joints may indicate underlying reinforcement corrosion and is unacceptable.	
		<b>N/A</b>	There are no concrete items in the interior drainage system.	
6. Tilting, Sliding or Settlement of Concrete and Sheet Pile Structures <sup>2</sup> (Such as gate wells, outfalls, intakes, or culverts)	<b>A</b>	<b>A</b>	There are no significant areas of tilting, sliding, or settlement that would endanger the integrity of the structure.	
		<b>M</b>	There are areas of tilting, sliding, or settlement (either active or inactive) that need to be repaired. The maximum offset, either laterally or vertically, does not exceed 2 inches unless the movement can be shown to be no longer actively occurring. The integrity of the structure is not in danger.	
		<b>U</b>	There are areas of tilting, sliding, or settlement (either active or inactive) that threaten the structure's integrity and performance. Any movement that has resulted in failure of the waterstop (possibly identified by daylight visible through the joint) is unacceptable. Differential movement of greater than 2 inches between any two adjacent monoliths, either laterally or vertically, is unacceptable unless it can be shown that the movement is no longer active. Also, if the floodwall is of I-wall construction, then any visible or measurable tilting of the wall toward the protected side that has created an open horizontal crack on the riverside base of a monolith is unacceptable.	
		<b>N/A</b>	There are no concrete items in the interior drainage system.	
7. Foundation of Concrete Structures <sup>3</sup> (Such as culverts, inlet and discharge structures, or gatewells.)	<b>A</b>	<b>A</b>	No active erosion, scouring, or bank caving that might endanger the structure's stability.	
		<b>M</b>	There are areas where the ground is eroding towards the base of the structure. Efforts need to be taken to slow and repair this erosion, but it is not judged to be close enough to the structure or to be progressing rapidly enough to affect structural stability before the next inspection. The rate of erosion is such that the structure is expected to remain stable until the next inspection.	
		<b>U</b>	Erosion or bank caving observed that may lead to structural instabilities before the next inspection.	
		<b>N/A</b>	There are no concrete items in the interior drainage system.	
8. Monolith Joints	<b>A</b>	<b>A</b>	The joint material is in good condition. The exterior joint sealant is intact and cracking/ desiccation is minimal. Joint filler material and/or waterstop is not visible at any point.	
		<b>M</b>	The joint material has appreciable deterioration to the point where joint filler material and/or waterstop is visible in some locations. This needs to be repaired or replaced to prevent spalling and cracking during freeze/ thaw cycles, and to ensure water tightness of the joint.	

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		<b>U</b>	The joint material is severely deteriorated or the concrete adjacent to the monolith joints has spalled and cracked, damaging the waterstop; in either case damage has occurred to the point where it is apparent that the joint is no longer watertight and will not provide the intended level of protection during a flood.	
		<b>N/A</b>	There are no monolith joints in the interior drainage system.	
9. Culverts/ Discharge Pipes <sup>4</sup>	<b>U</b>	<b>A</b>	There are no breaks, holes, cracks in the discharge pipes/ culverts that would result in significant water leakage. The pipe shape is still essentially circular. All joints appear to be closed and the soil tight. Corrugated metal pipes, if present, are in good condition with 100% of the original coating still in place (either asphalt or galvanizing) or have been relined with appropriate material, which is still in good condition. Condition of pipes has been verified using television camera video taping or visual inspection methods within the past five years, and the report for every pipe is available for review by the inspector.	N21R_2010_a_0099: 24" CMP drainage pipe: Clean gravity drains to ensure adequate flow. Remove all excess vegetation from drainage structure (U) Pipes have not been verified using television camera video or visual inspection methods within the last five years.
		<b>M</b>	There are a small number of corrosion pinholes or cracks that could leak water and need to be repaired, but the entire length of pipe is still structurally sound and is not in danger of collapsing. Pipe shape may be ovalized in some locations but does not appear to be approaching a curvature reversal. A limited number of joints may have opened and soil loss may be beginning. Any open joints should be repaired prior to the next inspection. Corrugated metal pipes, if present, may be showing corrosion and pinholes but there are no areas with total section loss. Condition of pipes has been verified using television camera video taping or visual inspection methods within the past five years, and the report for every pipe is available for review by the inspector.	
		<b>U</b>	Culvert has deterioration and/or has significant leakage; it is in danger of collapsing or as already begun to collapse. Corrugated metal pipes have suffered 100% section loss in the invert. HOWEVER: Even if pipes appear to be in good condition, as judged by an external visual inspection, an Unacceptable Rating will be assigned if the condition of pipes has not been verified using television camera video taping or visual inspection methods within the past five years, and reports for all pipes are not available for review by the inspector.	
		<b>N/A</b>	There are no discharge pipes/ culverts.	
10. Sluice / Slide Gates <sup>5</sup>	<b>A</b>	<b>A</b>	Gates open and close freely to a tight seal or minor leakage. Gate operators are in good working condition and are properly maintained. Sill is free of sediment and other obstructions. Gates and lifters have been maintained and are free of corrosion. Documentation provided during the inspection.	N21R_2010_a_0045: Slide gate above flap gate, exterior good condition: Maintain, exercise, lubricate as required (A)
		<b>M</b>	Gates and/or operators have been damaged or have minor corrosion, and open and close with resistance or binding. Leakage quantity is controllable, but maintenance is required. Sill is free of sediment and other obstructions.	
		<b>U</b>	Gates do not open or close and/or operators do not function. Gate, stem, lifter and/or guides may be damaged or have major corrosion.	
		<b>N/A</b>	There are no sluice/ slide gates.	

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Rated Item	Rating	Rating Guidelines		Location/Remarks/Recommendations
11. Flap Gates/ Flap Valves/ Pinch Valves <sup>1</sup>	<b>M</b>	<b>A</b>	Gates/ valves open and close easily with minimal leakage, have no corrosion damage, and have been exercised and lubricated as required.	N21R_2010_a_0044: 18" CMP flap gate & pipe separated: Remove any obstructions, address minor corrosion with maintenance and periodically exercise and lubricate. Evaluate if gate valve has positive closure. (M) N21R_2010_a_0066: 24" CMP flap gate, damaged: Remove any obstructions, address minor corrosion with maintenance and periodically exercise and lubricate. Evaluate if gate valve has positive closure. (M)
		<b>M</b>	Gates/ valves will not fully open or close because of obstructions that can be easily removed, or have minor corrosion damage that requires maintenance.	
		<b>U</b>	Gates/ valves are missing, have been damaged, or have deteriorated to the point that they need to be replaced.	
		<b>N/A</b>	There are no flap gates.	
12. Trash Racks (non-mechanical)	<b>NA</b>	<b>A</b>	Trash racks are fastened in place and properly maintained.	
		<b>M</b>	Trash racks are in place but are unfastened or have bent bars that allow debris to enter into the pipe or pump station, bars are corroded to the point that up to 10% of the sectional area may be lost. Repair or replacement is required.	
		<b>U</b>	Trash racks are missing or damaged to the extent that they are no longer functional and must be replaced. (For example, more than 10% of the sectional area may be lost.)	
		<b>N/A</b>	There are no trash racks, or they are covered in the pump stations section of the report.	
13. Other Metallic Items	<b>NA</b>	<b>A</b>	All metal parts are protected from corrosion damage and show no rust, damage, or deterioration that would cause a safety concern.	
		<b>M</b>	Corrosion seen on metallic parts appears to be maintainable.	
		<b>U</b>	Metallic parts are severely corroded and require replacement to prevent failure, equipment damage, or safety issues.	
		<b>N/A</b>	There are no other significant metallic items.	
14. Riprap Revetments of Inlet/ Discharge Areas	<b>NA</b>	<b>A</b>	No riprap displacement or stone degradation that could pose an immediate threat to the integrity of channel bank. Riprap intact with no woody vegetation present.	
		<b>M</b>	Minor riprap displacement or stone degradation that could pose an immediate threat to the integrity of the channel bank. Unwanted vegetation must be cleared or sprayed with an appropriate herbicide.	
		<b>U</b>	Significant riprap displacement, exposure of bedding, or stone degradation observed. Scour activity is undercutting banks, eroding embankments, or impairing channel flows by causing turbulence or shoaling. Rock protection is hidden by dense brush, trees, or grasses.	
		<b>N/A</b>	There is no riprap protecting this feature of the segment / system, or riprap is discussed in another section.	
15. Revetments other than Riprap	<b>NA</b>	<b>A</b>	No riprap displacement or stone degradation that could pose an immediate threat to the integrity of channel bank. Riprap intact with no woody vegetation present.	

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		<b>M</b>	Minor riprap displacement or stone degradation that could pose an immediate threat to the integrity of the channel bank. Unwanted vegetation must be cleared or sprayed with an appropriate herbicide.	
		<b>U</b>	Significant riprap displacement, exposure of bedding, or stone degradation observed. Scour activity is undercutting banks, eroding embankments, or impairing channel flows by causing turbulence or shoaling. Rock protection is hidden by dense brush, trees, or grasses.	
		<b>N/A</b>	There are no such revetments protecting this feature of the segment / system.	

<sup>1</sup> Proper operation of this item must be demonstrated during the inspection.

<sup>2</sup> The sponsor should be monitoring any observed movement to verify whether the movement is active or inactive.

<sup>3</sup> Inspectors must have as-built drawings available during the inspection so that the lateral distance to the heel and toe of the floodwalls can be determined in the field.

<sup>4</sup> The decision on whether or not USACE inspectors should enter a pipe to perform a detailed inspection must be made at the USACE District level. This decision should be made in conjunction with the District Safety Office, as pipes may be considered confined spaces. This decision should consider the age of the pipe, the diameter of the pipe, the apparent condition of the pipe, and the length of the pipe. If a pipe is entered for the purposes of inspection, the inspector should record observations with a video camera in order that the condition of the entire pipe, including all joints, can later be assessed. Additionally, the video record provides a baseline to which future inspections can be compared.

<sup>5</sup> Proper operation of the gates (full open and closed) must be demonstrated during the inspection if no documentation is available. Be aware of both manual and electrical operators.

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**Inspect ID:** N21R\_2010\_a\_0044 **Title:** USACE\_CELRB\_N21R\_2010\_a\_0044\_1.jpg  
**Caption:** 18" CMP flap gate & pipe separated



**Inspect ID:** N21R\_2010\_a\_0045 **Title:** USACE\_CELRB\_N21R\_2010\_a\_0045\_1.jpg  
**Caption:** Slide gate above flap gate, exterior good condition



## Interior Drainage System

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	<p><b>Inspect ID:</b> N21R_2010_a_0066 <b>Title:</b> USACE_CELRB_N21R_2010_a_0066_1.jpg <b>Caption:</b> 24" CMP flap gate, damaged</p>
	<p><b>Inspect ID:</b> N21R_2010_a_0099 <b>Title:</b> USACE_CELRB_N21R_2010_a_0099_1.jpg <b>Caption:</b> Vegetation around CMP drainage pipe</p>





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	<p><b>Inspect ID:</b> N21R_2010_a_0100 <b>Title:</b> USACE_CELRB_N21R_2010_a_0100_1.jpg <b>Caption:</b> 24" CMP with flap gate</p>



# Flood Damage Reduction Channels

For use during Initial and Continuing Eligibility Inspections of flood damage reduction channels

Rated Item	Rating	Rating Guidelines		Location/Remarks/Recommendations
1. Vegetation and Obstructions	<b>U</b>	<b>A</b>	No obstructions, vegetation, debris, or sediment accumulation within the channel. Concrete channel joints and weep holes are free of grass and weeds.	N21R_2010_a_0039: Multiple trees, fence, vegetation: Remove all excess vegetation on channel slopes (U)
		<b>M</b>	Obstructions (including log jams), vegetation, debris, or sediment are minor and have not impaired channel flow capacity, but should be removed. Sediment shoals have not developed to the extent that they can support vegetation other than non-aquatic grasses. A limited volume of grass and weeds may be present in concrete channel joints and weep holes.	N21R_2010_a_0042: Tree at bridge support: Remove debris from channel and on channel slopes (U) N21R_2010_a_0051: Drainage channel to Dyke creek, vegetation: Remove all excess vegetation on channel slopes (U)
		<b>U</b>	Obstructions (including log jams), vegetation, debris or sediment have impaired the channel flow capacity. Sediment shoals are well established and support woody and/or brushy vegetation. Sediment and debris removal required to re-establish flow capacity.	N21R_2010_a_0062: Heavy vegetation both banks: Remove all excess vegetation on channel slopes (U) N21R_2010_a_0065: Outfall covered with vegetation: Remove all excess vegetation from drainage structure (U) N21R_2010_a_0069: Manhole and drainage inlet: Remove all excess vegetation from drainage structure (U) N21R_2010_a_0071: Vegetation on both banks: Remove all excess vegetation on channel slopes (U) N21R_2010_a_0072: Vegetation on bank: Remove all excess vegetation on channel slopes (U) N21R_2010_a_0074: Outfall covered with vegetation: Remove all excess vegetation from drainage structure (U) N21R_2010_a_0077: Vegetation on bank: Remove all excess vegetation on channel slopes (U) N21R_2010_a_0083: Vegetation, trees on levee bank: Remove all excess vegetation on channel slopes (U) N21R_2010_a_0084: 24" x 24" drainage inlet: Remove all excess vegetation from drainage structure (U) N21R_2010_a_0090: Log on bank: Remove debris from channel and on channel slopes (U)
2. Shoaling <sup>1</sup> (sediment deposition)	<b>U</b>	<b>A</b>	No shoaling or minor, non-vegetated shoaling is present.	N21R_2010_a_0046: Shoaling in drainage channel to Dyke creek: Sediment and debris removal recommended (U)
		<b>M</b>	More widespread vegetated and non-vegetated shoaling is present. Non-aquatic grasses are present on shoal. No trees or brush is present on shoal, and channel flow is not significantly reduced. Sediment and debris removal recommended.	N21R_2010_a_0048: Shoaling in channel: Sediment and debris removal recommended (U)
		<b>U</b>	Shoaling is well established, stabilized by saplings, brush, or other vegetation. Shoals are diverting flow to channel walls. Channel flow capacity is reduced and maintenance is required.	N21R_2010_a_0073: Shoaling in channel: Sediment and debris removal recommended (U) N21R_2010_a_0076: Shoaling on bank side: Sediment and debris removal recommended (U) N21R_2010_a_0085: Shoaling bank side: Sediment and debris removal recommended (U) N21R_2010_a_0096: Shoaling along bank: Sediment and debris removal recommended (U) N21R_2010_a_0091: Shoaling in channel: Sediment and debris removal recommended (U) N21R_2010_a_0094: Shoaling in channel: Sediment and

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Rated Item	Rating	Rating Guidelines		Location/Remarks/Recommendations
				debris removal recommended (U) N21R_2010_a_0098: Shoaling at both sides of channel: Sediment and debris removal recommended (M)
3. Encroachments	U	A	No trash, debris, unauthorized structures, excavations, or other obstructions present within the easement area. Encroachments have been previously reviewed by the Corps, and it was determined that they do not diminish proper functioning of the channel.	N21R_2010_a_0040: Pedestrian bridge: Document encroachments in accordance with USACE guidance (U) N21R_2010_a_0041: Two 12" CMP, one is corroded: Document encroachments in accordance with USACE guidance (U)
		M	Trash, debris, unauthorized structures, excavations, or other obstructions present, or inappropriate activities noted that should be corrected but will not inhibit operations and maintenance or emergency operations. Encroachments have not been reviewed by the Corps.	N21R_2010_a_0047: Bridge over channel: Document encroachments in accordance with USACE guidance (A) N21R_2010_a_0049: Two 6" CMP drainage pipes: Document encroachments in accordance with USACE guidance (U)
		U	Unauthorized encroachments or inappropriate activities noted are likely to inhibit operations and maintenance, emergency operations, or negatively impact the integrity of the channel.	N21R_2010_a_0052: Burrow hole on top of bank: Establish animal control program (U) N21R_2010_a_0053: 12" CMP drainage pipe: Document encroachments in accordance with USACE guidance (U) N21R_2010_a_0054: Burrow hole: Establish animal control program (U) N21R_2010_a_0055: Two Burrow holes: Establish animal control program (U) N21R_2010_a_0056: Fence on bank: Document encroachments in accordance with USACE guidance (U) N21R_2010_a_0059: Utility pole, guy wire, generator, builders: Document encroachments in accordance with USACE guidance (U) N21R_2010_a_0060: Bridge over channel: Document encroachments in accordance with USACE guidance (U) N21R_2010_a_0061: 12" CMP both sides of channel: Remove all excess vegetation from drainage structure (U) N21R_2010_a_0063: Railroad bridge over channel: Document encroachments in accordance with USACE guidance (U) N21R_2010_a_0064: Bridge over channel: Document encroachments in accordance with USACE guidance (U) N21R_2010_a_0070: USACE manhole: Document encroachments in accordance with USACE guidance (U) N21R_2010_a_0078: Manhole: Document encroachments in accordance with USACE guidance (U) N21R_2010_a_0079: Weir: Document encroachments in accordance with USACE guidance (U) N21R_2010_a_0081: 24" CMP drainage pipe: Document

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Rated Item	Rating	Rating Guidelines		Location/Remarks/Recommendations
				encroachments in accordance with USACE guidance (U) N21R_2010_a_0082: Concrete barriers, utility pole, sign: Document encroachments in accordance with USACE guidance (U)
4. Erosion	<b>M</b>	<b>A</b>	No head cutting or horizontal deviation observed.	N21R_2010_a_0050: 15' x 2' erosion: Backfill erosion with engineered fill, re-establish appropriate sod cover (M) N21R_2010_a_0093: Erosion: Backfill erosion with engineered fill, re-establish appropriate sod cover (M)
		<b>M</b>	Head cutting and horizontal deviation evident, but is less than 1 foot from the designed grade or cross section.	
		<b>U</b>	Head cutting and horizontal deviation of more than 1 foot from the designed grade or cross section. Corrective actions required to stop or slow erosion.	
5. Concrete Surfaces	<b>NA</b>	<b>A</b>	Negligible spalling, scaling or cracking. If the concrete surface is weathered or holds moisture, it is still satisfactory but should be seal coated to prevent freeze/ thaw damage.	
		<b>M</b>	Spalling, scaling, and open cracking present, but the immediate integrity or performance of the structure is not threatened. Reinforcing steel may be exposed. Repairs/ sealing is necessary to prevent additional damage during periods of thawing and freezing.	
		<b>U</b>	Surface deterioration or deep cracks present that may result in an unreliable structure. Any surface deterioration that exposes the sheet piling or lies adjacent to monolith joints may indicate underlying reinforcement corrosion and is unacceptable.	
		<b>N/A</b>	There are no concrete items in the channel.	
6. Tilting, Sliding or Settlement of Concrete Structures <sup>2</sup>	<b>A</b>	<b>A</b>	There are no significant areas of tilting, sliding, or settlement that would endanger the integrity of the structure.	
		<b>M</b>	There are areas of tilting, sliding, or settlement (either active or inactive) that need to be repaired. The maximum offset, either laterally or vertically, does not exceed 2 inches unless the movement can be shown to be no longer actively occurring. The integrity of the structure is not in danger.	
		<b>U</b>	There are areas of tilting, sliding, or settlement (either active or inactive) that threaten the structure's integrity and performance. Any movement that has resulted in failure of the waterstop (possibly identified by daylight visible through the joint) is unacceptable. Differential movement of greater than 2 inches between any two adjacent monoliths, either laterally or vertically, is unacceptable unless it can be shown that the movement is no longer active. Also, if the floodwall is of I-wall construction, then any visible or measurable tilting of the wall toward the protected side that has created an open horizontal crack on the riverside base of a monolith is unacceptable.	
		<b>N/A</b>	There are no concrete items in the channel.	
7. Foundation of	<b>A</b>	<b>A</b>	No active erosion, scouring, or bank caving that might endanger the structure's stability.	

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Rated Item	Rating	Rating Guidelines		Location/Remarks/Recommendations
Concrete Structures <sup>3</sup>		<b>M</b>	There are areas where the ground is eroding towards the base of the structure. Efforts need to be taken to slow and repair this erosion, but it is not judged to be close enough to the structure or to be progressing rapidly enough to affect structural stability before the next inspection. For the purposes of inspection, the erosion or scour is not closer to the riverside face of the wall than twice the floodwall's underground base width if the wall is of L-wall or T-wall construction; or if the wall is of sheetpile or I-wall construction, the erosion is not closer than twice the wall's visible height. Additionally, rate of erosion is such that the wall is expected to remain stable until the next inspection.	
		<b>U</b>	Erosion or bank caving observed that is closer to the wall than the limits described above, or is outside these limits but may lead to structural instabilities before the next inspection. Additionally, if the floodwall is of I-wall or sheetpile construction, the foundation is unacceptable if any turf, soil or pavement material got washed away from the landside of the I-wall as the result of a previous overtopping event.	
		<b>N/A</b>	There are no concrete items in the channel.	
8. Slab and Monolith Joints	<b>A</b>	<b>A</b>	The joint material is in good condition. The exterior joint sealant is intact and cracking/desiccation is minimal. Joint filler material and/or waterstop is not visible at any point.	
		<b>M</b>	The joint material has appreciable deterioration to the point where joint filler material and/or waterstop is visible in some locations. This needs to be repaired or replaced to prevent spalling and cracking during freeze/ thaw cycles, and to ensure water tightness of the joint.	
		<b>U</b>	The joint material is severely deteriorated or the concrete adjacent to the monolith joints has spalled and cracked, damaging the waterstop; in either case damage has occurred to the point where it is apparent that the joint is no longer watertight and will not provide the intended level of protection during a flood.	
		<b>N/A</b>	There are no concrete items in the channel.	
9. Flap Gates/ Flap Valves/ Pinch Valves <sup>4</sup>	<b>NA</b>	<b>A</b>	Gates/ valves open and close easily with minimal leakage, have no corrosion damage, and have been exercised and lubricated as required.	
		<b>M</b>	Gates/ valves will not fully open or close because of obstructions that can be easily removed, or have minor corrosion damage that requires maintenance.	
		<b>U</b>	Gates/ valves are missing, have been damaged, or have deteriorated to the point that they need to be replaced.	
		<b>N/A</b>	There are no flap gates.	
10. Riprap Revetments & Banks	<b>U</b>	<b>A</b>	No riprap displacement or stone degradation that could pose an immediate threat to the integrity of channel bank. Riprap intact with no woody vegetation present.	N21R_2010_a_0057: Vegetation in riprap: Remove all excess vegetation on channel slopes (U)
		<b>M</b>	Minor riprap displacement or stone degradation that could pose an immediate threat to the integrity of the channel bank. Unwanted vegetation must be cleared or sprayed with an appropriate herbicide.	N21R_2010_a_0058: Vegetation along channel: Unwanted vegetation must be cleared or sprayed with an appropriate herbicide (U)

Key: A = Acceptable. M = Minimally Acceptable; Maintenance is required. U = Unacceptable. N/A = Not Applicable. FDR = Flood Damage Reduction



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# Flood Damage Reduction Channels

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Rated Item	Rating	Rating Guidelines		Location/Remarks/Recommendations
		<b>U</b>	Significant riprap displacement, exposure of bedding, or stone degradation observed. Scour activity is undercutting banks, eroding embankments, or impairing channel flows by causing turbulence or shoaling. Rock protection is hidden by dense brush, trees, or grasses.	N21R_2010_a_0067: Lack of riprap: Unwanted vegetation must be cleared or sprayed with an appropriate herbicide and riprap replaced as applicable (U)
		<b>N/A</b>	There is no riprap protecting this feature of the segment / system, or riprap is discussed in another section.	N21R_2010_a_0068: Vegetation in riprap: Unwanted vegetation must be cleared or sprayed with an appropriate herbicide and riprap replaced as applicable (U) N21R_2010_a_0080: Vegetation in riprap: Remove all excess vegetation on channel slopes (U) N21R_2010_a_0095: Vegetation in riprap: Remove all excess vegetation on channel slopes (U) N21R_2010_a_0097: Vegetation in riprap: Remove all excess vegetation on channel slopes (U)
11. Revetments other than Riprap	<b>M</b>	<b>A</b>	Existing revetment protection is properly maintained, undamaged, and clearly visible.	N21R_2010_a_0043: Concrete cracking, vegetation, both banks: Unwanted vegetation must be cleared or sprayed with an appropriate herbicide (M)
		<b>M</b>	Minor revetment displacement or deterioration that does not pose an immediate threat to the integrity of the levee. Unwanted vegetation must be cleared or sprayed with an appropriate herbicide.	
		<b>U</b>	Significant revetment displacement, deterioration, or exposure of bedding observed. Scour activity is undercutting banks, eroding embankments, or impairing channel flows by causing turbulence or shoaling. Revetment protection is hidden by dense brush and trees.	
		<b>N/A</b>	There are no such revetments protecting this feature of the segment / system.	

<sup>1</sup> If weather and flow conditions allow, inspectors should walk in the channel and probe shoal areas in order to estimate extent of blockage of the cross-sectional area where shoaling is present.

<sup>2</sup> The sponsor should be monitoring any observed movement to verify whether the movement is active or inactive.

<sup>3</sup> Inspectors must have as-built drawings available during the inspection so that the lateral distance to the heel and toe of the floodwalls can be determined in the field.

<sup>4</sup> Proper operation of this item must be demonstrated during the inspection.

Key: A = Acceptable. M = Minimally Acceptable; Maintenance is required. U = Unacceptable. N/A = Not Applicable. FDR = Flood Damage Reduction



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	<p><b>Inspect ID:</b> N21R_2010_a_0039 <b>Title:</b> USACE_CELRB_N21R_2010_a_0039_1.jpg <b>Caption:</b> Multiple trees, fence, vegetation</p>
	<p><b>Inspect ID:</b> N21R_2010_a_0039 <b>Title:</b> USACE_CELRB_N21R_2010_a_0039_2.jpg <b>Caption:</b> Multiple trees, fence, vegetation</p>



# Flood Damage Reduction Channels

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**Inspect ID:** N21R\_2010\_a\_0040 **Title:** USACE\_CELRB\_N21R\_2010\_a\_0040\_1.jpg  
**Caption:** Pedestrian bridge



**Inspect ID:** N21R\_2010\_a\_0040 **Title:** USACE\_CELRB\_N21R\_2010\_a\_0040\_2.jpg  
**Caption:** Pedestrian bridge



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**Inspect ID:** N21R\_2010\_a\_0040 **Title:** USACE\_CELRB\_N21R\_2010\_a\_0040\_3.jpg  
**Caption:** Pedestrian bridge



**Inspect ID:** N21R\_2010\_a\_0041 **Title:** USACE\_CELRB\_N21R\_2010\_a\_0041\_1.jpg  
**Caption:** Two 12" CMP, one is corroded



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**Inspect ID:** N21R\_2010\_a\_0042 **Title:** USACE\_CELRB\_N21R\_2010\_a\_0042\_1.jpg  
**Caption:** Tree at bridge support



**Inspect ID:** N21R\_2010\_a\_0043 **Title:** USACE\_CELRB\_N21R\_2010\_a\_0043\_1.jpg  
**Caption:** Concrete cracking, vegetation, both banks



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**Inspect ID:** N21R\_2010\_a\_0046 **Title:** USACE\_CELRB\_N21R\_2010\_a\_0046\_1.jpg  
**Caption:** Shoaling in drainage channel to Dyke creek



**Inspect ID:** N21R\_2010\_a\_0047 **Title:** USACE\_CELRB\_N21R\_2010\_a\_0047\_1.jpg  
**Caption:** Bridge over channel



## Flood Damage Reduction Channels

For use during Initial and Continuing Eligibility Inspections of flood damage reduction channels



**Inspect ID:** N21R\_2010\_a\_0047 **Title:** USACE\_CELRB\_N21R\_2010\_a\_0047\_2.jpg  
**Caption:** Bridge over channel



**Inspect ID:** N21R\_2010\_a\_0047 **Title:** USACE\_CELRB\_N21R\_2010\_a\_0047\_3.jpg  
**Caption:** Bridge over channel



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## Flood Damage Reduction Channels

For use during Initial and Continuing Eligibility Inspections of flood damage reduction channels



**Inspect ID:** N21R\_2010\_a\_0048 **Title:** USACE\_CELRB\_N21R\_2010\_a\_0048\_1.jpg  
**Caption:** Shoaling in channel



**Inspect ID:** N21R\_2010\_a\_0049 **Title:** USACE\_CELRB\_N21R\_2010\_a\_0049\_1.jpg  
**Caption:** Two 6" CMP drainage pipes





## Flood Damage Reduction Channels


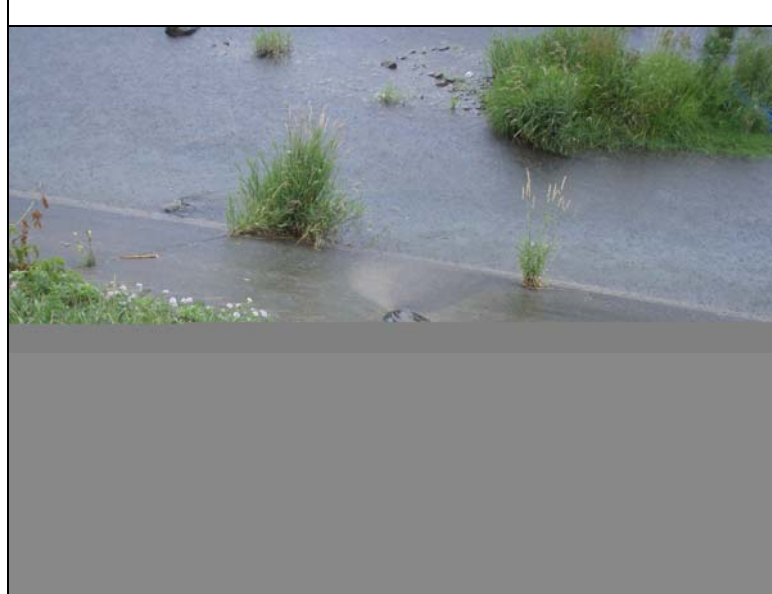
For use during Initial and Continuing Eligibility Inspections of flood damage reduction channels

	<p><b>Inspect ID:</b> N21R_2010_a_0050 <b>Title:</b> USACE_CELRB_N21R_2010_a_0050_1.jpg <b>Caption:</b> 15' x 2' erosion</p>
	<p><b>Inspect ID:</b> N21R_2010_a_0051 <b>Title:</b> USACE_CELRB_N21R_2010_a_0051_1.jpg <b>Caption:</b> Drainage channel to Dyke creek, vegetation</p>



## Flood Damage Reduction Channels

For use during Initial and Continuing Eligibility Inspections of flood damage reduction channels

	<p><b>Inspect ID:</b> N21R_2010_a_0052 <b>Title:</b> USACE_CELRB_N21R_2010_a_0052_1.jpg <b>Caption:</b> Burrow hole on top of bank</p>
	<p><b>Inspect ID:</b> N21R_2010_a_0053 <b>Title:</b> USACE_CELRB_N21R_2010_a_0053_1.jpg <b>Caption:</b> 12" CMP drainage pipe</p>





## Flood Damage Reduction Channels

For use during Initial and Continuing Eligibility Inspections of flood damage reduction channels

	<p><b>Inspect ID:</b> N21R_2010_a_0054 <b>Title:</b> USACE_CELRB_N21R_2010_a_0054_1.jpg <b>Caption:</b> Burrow hole</p>
	<p><b>Inspect ID:</b> N21R_2010_a_0055 <b>Title:</b> USACE_CELRB_N21R_2010_a_0055_1.jpg <b>Caption:</b> Two Burrow holes</p>



## Flood Damage Reduction Channels

For use during Initial and Continuing Eligibility Inspections of flood damage reduction channels



**Inspect ID:** N21R\_2010\_a\_0056 **Title:** USACE\_CELRB\_N21R\_2010\_a\_0056\_1.jpg  
**Caption:** Fence on bank



**Inspect ID:** N21R\_2010\_a\_0057 **Title:** USACE\_CELRB\_N21R\_2010\_a\_0057\_1.jpg  
**Caption:** Vegetation in riprap



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**Inspect ID:** N21R\_2010\_a\_0058 **Title:** USACE\_CELRB\_N21R\_2010\_a\_0058\_1.jpg  
**Caption:** Vegetation along channel



**Inspect ID:** N21R\_2010\_a\_0059 **Title:** USACE\_CELRB\_N21R\_2010\_a\_0059\_1.jpg  
**Caption:** Utility pole, guy wire, generator, buildings



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**Inspect ID:** N21R\_2010\_a\_0060 **Title:** USACE\_CELRB\_N21R\_2010\_a\_0060\_1.jpg  
**Caption:** Bridge over channel



**Inspect ID:** N21R\_2010\_a\_0061 **Title:** USACE\_CELRB\_N21R\_2010\_a\_0061\_1.jpg  
**Caption:** Heavy vegetation both banks



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**Inspect ID:** N21R\_2010\_a\_0062 **Title:** USACE\_CELRB\_N21R\_2010\_a\_0062\_1.jpg  
**Caption:** Heavy vegetation both banks



**Inspect ID:** N21R\_2010\_a\_0063 **Title:** USACE\_CELRB\_N21R\_2010\_a\_0063\_1.jpg  
**Caption:** Railroad bridge over channel



## Flood Damage Reduction Channels

For use during Initial and Continuing Eligibility Inspections of flood damage reduction channels



**Inspect ID:** N21R\_2010\_a\_0064 **Title:** USACE\_CELRB\_N21R\_2010\_a\_0064\_1.jpg  
**Caption:** Bridge over channel



**Inspect ID:** N21R\_2010\_a\_0065 **Title:** USACE\_CELRB\_N21R\_2010\_a\_0065\_1.jpg  
**Caption:** Outfall covered with vegetation



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## Flood Damage Reduction Channels

For use during Initial and Continuing Eligibility Inspections of flood damage reduction channels

	<p><b>Inspect ID:</b> N21R_2010_a_0067 <b>Title:</b> USACE_CELRB_N21R_2010_a_0067_1.jpg <b>Caption:</b> Lack of riprap</p>
	<p><b>Inspect ID:</b> N21R_2010_a_0068 <b>Title:</b> USACE_CELRB_N21R_2010_a_0068_1.jpg <b>Caption:</b> Lack of rip rap</p>



## Flood Damage Reduction Channels

For use during Initial and Continuing Eligibility Inspections of flood damage reduction channels



	<p><b>Inspect ID:</b> N21R_2010_a_0069 <b>Title:</b> USACE_CELRB_N21R_2010_a_0069_1.jpg <b>Caption:</b> Manhole and drainage inlet</p>
	<p><b>Inspect ID:</b> N21R_2010_a_0070 <b>Title:</b> USACE_CELRB_N21R_2010_a_0070_1.jpg <b>Caption:</b> Corps manhole</p>





## Flood Damage Reduction Channels

For use during Initial and Continuing Eligibility Inspections of flood damage reduction channels

	<p><b>Inspect ID:</b> N21R_2010_a_0071 <b>Title:</b> USACE_CELRB_N21R_2010_a_0071_1.jpg <b>Caption:</b> Vegetation on both banks</p>
	<p><b>Inspect ID:</b> N21R_2010_a_0072 <b>Title:</b> USACE_CELRB_N21R_2010_a_0072_1.jpg <b>Caption:</b> Vegetation on bank</p>



## Flood Damage Reduction Channels

For use during Initial and Continuing Eligibility Inspections of flood damage reduction channels



**Inspect ID:** N21R\_2010\_a\_0073 **Title:** USACE\_CELRB\_N21R\_2010\_a\_0073\_1.jpg  
**Caption:** Shoaling in channel



**Inspect ID:** N21R\_2010\_a\_0074 **Title:** USACE\_CELRB\_N21R\_2010\_a\_0074\_1.jpg  
**Caption:** Outfall covered with vegetation



# Flood Damage Reduction Channels

For use during Initial and Continuing Eligibility Inspections of flood damage reduction channels



**Inspect ID:** N21R\_2010\_a\_0076 **Title:** USACE\_CELRB\_N21R\_2010\_a\_0076\_1.jpg  
**Caption:** Shoaling on bank side





**Inspect ID:** N21R\_2010\_a\_0077 **Title:** USACE\_CELRB\_N21R\_2010\_a\_0077\_1.jpg  
**Caption:** Vegetation on bank





## Flood Damage Reduction Channels

For use during Initial and Continuing Eligibility Inspections of flood damage reduction channels

	<p><b>Inspect ID:</b> N21R_2010_a_0077 <b>Title:</b> USACE_CELRB_N21R_2010_a_0077_2.jpg <b>Caption:</b> Vegetation on bank</p>
	<p><b>Inspect ID:</b> N21R_2010_a_0078 <b>Title:</b> USACE_CELRB_N21R_2010_a_0078_1.jpg <b>Caption:</b> Manhole</p>



## Flood Damage Reduction Channels

For use during Initial and Continuing Eligibility Inspections of flood damage reduction channels



**Inspect ID:** N21R\_2010\_a\_0079 **Title:** USACE\_CELRB\_N21R\_2010\_a\_0079\_1.jpg  
**Caption:** Weir



**Inspect ID:** N21R\_2010\_a\_0080 **Title:** USACE\_CELRB\_N21R\_2010\_a\_0080\_1.jpg  
**Caption:** Vegetation in riprap





## Flood Damage Reduction Channels

For use during Initial and Continuing Eligibility Inspections of flood damage reduction channels



**Inspect ID:** N21R\_2010\_a\_0081 **Title:** USACE\_CELRB\_N21R\_2010\_a\_0081\_1.jpg  
**Caption:** 24" CMP drainage pipe



**Inspect ID:** N21R\_2010\_a\_0082 **Title:** USACE\_CELRB\_N21R\_2010\_a\_0082\_1.jpg  
**Caption:** Concrete barriers, utility pole, sign



## Flood Damage Reduction Channels

For use during Initial and Continuing Eligibility Inspections of flood damage reduction channels



**Inspect ID:** N21R\_2010\_a\_0083 **Title:** USACE\_CELRB\_N21R\_2010\_a\_0083\_1.jpg  
**Caption:** Vegetation, trees on levee bank



**Inspect ID:** N21R\_2010\_a\_0084 **Title:** USACE\_CELRB\_N21R\_2010\_a\_0084\_1.jpg  
**Caption:** 24" x 24" drainage inlet



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## Flood Damage Reduction Channels

For use during Initial and Continuing Eligibility Inspections of flood damage reduction channels



**Inspect ID:** N21R\_2010\_a\_0085 **Title:** USACE\_CELRB\_N21R\_2010\_a\_0085\_1.jpg  
**Caption:** Shoaling bank side





**Inspect ID:** N21R\_2010\_a\_0090 **Title:** USACE\_CELRB\_N21R\_2010\_a\_0090\_1.jpg  
**Caption:** Log on bank



## Flood Damage Reduction Channels

For use during Initial and Continuing Eligibility Inspections of flood damage reduction channels

	<p><b>Inspect ID:</b> N21R_2010_a_0091 <b>Title:</b> USACE_CELRB_N21R_2010_a_0091_1.jpg <b>Caption:</b> Shoaling in channel</p>
	<p><b>Inspect ID:</b> N21R_2010_a_0092 <b>Title:</b> USACE_CELRB_N21R_2010_a_0092_1.jpg <b>Caption:</b> Vegetation in riprap</p>





## Flood Damage Reduction Channels

For use during Initial and Continuing Eligibility Inspections of flood damage reduction channels



**Inspect ID:** N21R\_2010\_a\_0093 **Title:** USACE\_CELRB\_N21R\_2010\_a\_0093\_1.jpg  
**Caption:** Erosion



**Inspect ID:** N21R\_2010\_a\_0094 **Title:** USACE\_CELRB\_N21R\_2010\_a\_0094\_1.jpg  
**Caption:** Shoaling in channel



## Flood Damage Reduction Channels

For use during Initial and Continuing Eligibility Inspections of flood damage reduction channels

	<p><b>Inspect ID:</b> N21R_2010_a_0095 <b>Title:</b> USACE_CELRB_N21R_2010_a_0095_1.jpg <b>Caption:</b> Vegetation in riprap</p>
	<p><b>Inspect ID:</b> N21R_2010_a_0096 <b>Title:</b> USACE_CELRB_N21R_2010_a_0096_1.jpg <b>Caption:</b> Shoaling along bank</p>



## Flood Damage Reduction Channels

For use during Initial and Continuing Eligibility Inspections of flood damage reduction channels



**Inspect ID:** N21R\_2010\_a\_0097 **Title:** USACE\_CELRB\_N21R\_2010\_a\_0097\_1.jpg  
**Caption:** Vegetation in riprap to the right of fence



**Inspect ID:** N21R\_2010\_a\_0098 **Title:** USACE\_CELRB\_N21R\_2010\_a\_0098\_1.jpg  
**Caption:** Shoaling at both sides of channel



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## Appendix C

### Inspection Notes / Design Criteria Checklist



### Table 1. Drainage Structure Field Observations Right Bank

[illegible]

## USACE Levee Periodic Inspections

### DESIGN CRITERIA REVIEW CHECKLIST

Wellsville, New York FDRP

Project Number 178440003

### Levee Segment: Right Bank Levee and Dyke Creek – Post Inspection Comments

### Task Order A

## CONTENTS

- I. General Criteria and Survey Datum
- II. Hydraulics
- III. Structural
- IV. Geotechnical
- V. Pump Stations:
  - Electrical
  - Mechanical

## Reviewed by

Don Gibbs, P.E.

Don Gibbs, P.E.

Tommy Dudeck, P.E.

Don Gibbs, P.E.

---

N/A

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N/A

N/A

## Date

7.2.2010/8.20.2010

7.2.2010/8.20.2010

7.2.2010/8.20.2010

7.2.2010/8.20.2010

## Quality Control Review by

David Belaskus, P.E.

7.3.2010/8.20.2010

APPENDICES (I. thru V.)

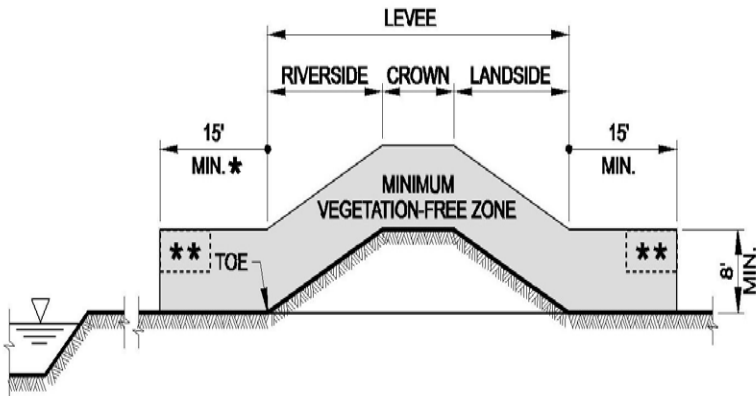
	Reference	Page	Meets Criteria: Yes/No/Unknown	Reviewer's Comment
<b>I. General Criteria and Survey Datum</b>				
<b>A. General Criteria</b>				
1. Are the levees, of adequate height, capacity, storage, or level of protection? In the absence of a valid risk based analysis, the following FEMA criteria can be used; (Guidelines & Specifications for Flood Hazard Mapping Partners, Appendix H: Guidance for Mapping of Areas Protected by Levee Systems, pg H-5). Riverine levees must provide a minimum freeboard of 3 feet above the 1-percent-annual-chance flood elevation. An additional 0.5 foot above that minimum is required along the length of the upstream tieback levee and at the upstream end of the main levee. An additional 1 foot of freeboard above the 3-foot minimum is required within 100 feet of either side of structures within the levee.	EM 1110-2-1416	C-4	No	According to the O&M Manual, the project is designed to protect the Village and Town of Wellsville against damage from floods equal to a 2.5 percent chance exceedance flood in the Genesee River and Dyke Creek. The Design Memorandum document of October 1964, Indicates that the freeboard ranges from 1 foot to 5 feet throughout the system.
2. Is the plan conceptually correct? Will it function in an appropriate manner? Are conclusions supported by a logical sequence of data analyses and deductions?	EM 1110-2-1416	C-4	Unknown	According to the O&M Manual, the project is capable of passing the design flows from a 2.5 percent chance exceedance flood. No engineering analysis was provided.
3. Are the project description, local cooperation, and operation and maintenance requirements appropriate?	EM 1110-2-1416	C-4	Yes	
4. Does the engineering analysis appear appropriate for supporting formulation and design objectives?	EM 1110-2-1416	C-4	Unknown	No engineering analysis was provided.
5. Are operational requirements, personnel and equipment, and any constraints (such as warning time) under the plan satisfied?	EM 1110-2-1416	C-4	Unknown	
<b>B. Survey Datum</b>				
1. It is the policy of the USACE that the designed, constructed, and maintained elevation grades of projects shall be reliably and accurately referenced to a consistent nationwide framework, or vertical datum—i.e., the National Spatial Reference System (NSRS) or the National Water Level Observation Network (NWLON) maintained by the U.S. Department of Commerce, National Oceanic and Atmospheric Administration (NOAA). The current orthometric vertical reference datum within the NSRS in CONUS is the North American Vertical Datum of 1988 (NAVD88).	ER 1110-2-8160	1	No	Project map states elevations are indicated in feet and tenths above mean sea level and based upon USCGS Datum.
2. Frequency of required periodic assessments of project datums is project site dependent ranging from 5 years in high subsidence areas to 20 years in stable, non-tidal project locations. NSRS/NWLON reference datum updates and readjustments must also be continuously monitored and included as assessment items in periodic inspections of completed works (ICW).	EC 1110-2-8160	2	No	No evidence that project datum has ever been reassessed.
3. All existing projects shall be evaluated to verify that designed and constructed grades are adequately connected and referenced to the NSRS and/or NWLON networks.	ER 1110-2-8160	2	No	No evidence that project datum has ever been reassessed.

4. The relationship between local (legacy) orthometric or hydraulic reference datums and the current nationwide frameworks maintained by the U.S. Department of Commerce must be documented in O&M manuals, and be kept current; especially in high subsidence areas.	ER 1110-2-8160	2	No	No information is in O&M Manual.
5. Project datums and controlling protective elevations in high subsidence areas require special consideration and must be periodically reevaluated and updated after construction. This also applies to areas subject to crustal uplift of earthquakes.	ER 1110-2-8160	3	Unknown	It is Unknown if project is located in a high subsidence or coastal uplift area.
6. Project elevations that are referenced to tidal datums will have to be periodically coordinated with and/or reviewed by NOAA to ensure the latest tidal hydraulic effects are incorporated and that the project is reliably connected with the NSRS. In all cases, a complete reevaluation of the vertical datum should be conducted at each scheduled periodic inspection—e.g., NTE 5 years.	EC 1110-2-6065	13	No	No evidence that project datum has ever been reassessed.
7. Verify that the original and/or periodic maintenance design documents indicate that constructed project grades are based on direct hydraulic or tidal observations, and that the relationship between the hydraulic/tidal datum and the geodetic datum used for construction (e.g., NGVD 29 or NAVD 88) was firmly established.	EC 1110-2-6065	8	No	No information is in O&M Manual.
8. Verify that, at minimum, one benchmark at each flood control structure site is geodetically connected to the NAVD88 orthometric datum on the NSRS network maintained by the National Geodetic Survey (NGS), and that this benchmark(s) is published in the NSRS. In areas where subsidence or crustal uplift is known to exist, this connection must have been made periodically in order to monitor potential loss of flood protection. This may require establishment of vertical time-dependent networks—see IPET 2006.	EC 1110-2-6065	9	No	No information on benchmarks was provided.
9. Verify that current project documents (or equivalent CADD databases) used in design or construction plans accurately describe the source and datum of any elevations or depths.	EC 1110-2-6065	9	No	No information referenced to elevations source datum.
10. Verify all USACE operated and maintained projects have, at minimum, three up-to-date vertical control benchmarks identified in the most recent contract plans and specifications from which to stake out construction. Confirm these controlling benchmarks have dual elevations on the latest adjustments and/or epochs: (1) hydraulic/tidal and (2) NAVD88 (NSRS).	EC 1110-2-6065	9	Unknown	No information on benchmarks was provided.
11. Verify permanent benchmarks shown on the most recent contract plans and specifications contain complete metadata descriptions—date, adjustment, epoch, monument description, etc.	EC 1110-2-6065	10	Unknown	No information on benchmarks was provided.
12. The main issues to be evaluated for each flood control project include:	EC 1110-2-6065	B-21		
a. The protection grade elevations are referenced to NAVD88 based on primary project control benchmarks published in the NSRS.			No	The project elevations are not referenced to NAVD88. No information on benchmarks was provided.
b. Project drawings, CADD files, and related documents, contain full and complete metadata on primary project control benchmarks.				



	Reference	Page	Applicable to this Levee Segment: Yes/No	Meets Criteria Yes/No/Unknown	Reviewer's Comment
<b>II. Hydraulics</b>					
A. Level of Protection					
1. FEMA specifies that all levees must have a minimum of 3 foot of freeboard against 100-year flooding to be considered a safe flood protection structure. A minimum of 4 feet of freeboard is required within 100 feet of structures. (See Section I.A.1)			Yes	No	According to the O&M Manual, the project is designed to protect the Village and Town of Wellsville against damage from floods equal to a 2.5 percent chance exceedance flood in the Genesee River and Dyke Creek. The Design Memorandum document of October 1964, Indicates that the freeboard ranges from 1 foot to 5 feet throughout the system.
2. A 3-ft freeboard allowance for earth levees is generally considered to be satisfactory.	EM 1110-2-1601	2-14	Yes	No	
3. A default freeboard value of 3 feet on urban flood walls is generally accepted.	EM 1110-2-2502	7-2	No	No	No flood walls associated with this system.
B. Embankment Protection					
1. If flood water is not expected to act for a long period of time on the levee, grass cover is adequate	EM 1110-2-1913	7-6	Yes	Yes	
2. High-class slope protection such as riprap, articulated mat, or paving should be provided on riverside slopes at the following locations: (a) Beneath bridges, since adequate turf cannot be generally established because of inadequate sunlight. (b) Adjacent to structures passing through levee embankments.	EM 1110-2-1913	7-7	Yes	Unknown	More extensive slope protection may be required due to the higher design flows.
3. When the full height of a levee is to be protected, the revetment will cover the freeboard, i.e., extend to the top of the levee. A horizontal collar, at the top of bank, is provided to protect against escaping and returning flows as necessary.	EM 1110-2-1601	3-9	Yes	Unknown	It is unknown if a horizontal collar is provided.
4. The upstream and downstream ends of riprap revetment should be protected against erosion by increasing the revetment thickness or extending the revetment to areas of non-eroding velocities and relatively stable banks.	EM 1110-2-1601	3-9	Yes	Unknown	It is unknown if riprap on this system was designed as described.
5. For braided channels, bank-full discharges may not be the most severe condition. At lesser flows, flow is often divided into multiple channels. Flow in these channels often impinges abruptly on banks or levees at sharp angles. This may also occur with meandering streams. Bank protection is needed in those situations.	EM 1110-2-1601	3-5 and 3-7	No	N/A	Channel is not braided.
C. Riprap Design Criteria					

	Reference	Page	Applicable to this Levee Segment: Yes/No	Meets Criteria Yes/No/Unknown	Reviewer's Comment
1. Stone shall be predominantly angular in shape	EM 1110-2-1601	3-1	Yes	Unknown	Design specifications for riprap did not indicate the shape required for riprap.
2. Stone should be reasonably well graded throughout the in-place layer thickness.	EM 1110-2-1601	3-2	Yes	Yes	Design specifications for riprap indicate riprap stone shall be well graded.
3. Riprap layer thickness should not be less than the spherical diameter of the upper limit W100 stone or less than 1.5 times the spherical diameter of the upper limit W50 stone, whichever results in the greater thickness.	EM 1110-2-1601	3-4	Yes	Unknown	Riprap thickness related to spherical diameter not provided in design analysis.
4. Bedding where slopes are composed of erodible granular soils or fine-grained soils of low plasticity, a bedding layer of sand and gravel or spoils, or geotechnical filter should be provided beneath the riprap.			Yes	Yes	Filter fabric was utilized per design specification.
D. Vegetation Free Zone					
1. The vegetation-free zone is a three-dimensional corridor surrounding all levees, floodwalls and critical appurtenant structures in all flood damage reduction systems. The vegetation-free zone applies to all vegetation except grass.	ETL 1110-2-571	2-1	Yes	No	Vegetation was found during inspection
2. The only acceptable vegetative ground cover in the vegetation free zone is perennial grasses.	ETL 1110-2-571	4-3	Yes	No	Areas with minimal vegetation growth that needs to be cleared.
3. The vegetation-free zone must be wide enough, and tall enough, to accommodate all likely access requirements. The minimum height of the corridor shall be 8 feet, measured vertically from any point on the ground. No vegetation, other than approved grasses, may penetrate the vegetation-free zone, with two exceptions. a. Mature Trees and Shrubs: tree limbs and crown may be above, but not in, the zone. b. Newly Planted Trees and Shrubs: These limbs and crown are acceptable as temporary intrusions into the zone.	ETL 1110-2-571  ETL 1110-2-571	2-1  6-2	Yes	No	Areas with minimal vegetation growth that needs to be cleared.
4. Along with the above criteria there are two additional concerns with flood walls a. Large trees can be a threat to project reliability through overturning. b. Large trees have large roots which can damage concrete structures by jacking them causing potential seepage paths.	ETL 1110-2-571 ETL 1110-2-571	3-2 3-3	Yes	No	Areas with minimal vegetation growth that needs to be cleared.

	Reference	Page	Applicable to this Levee Segment: Yes/No	Meets Criteria Yes/No/Unknown	Reviewer's Comment
5. Vegetation Free Zone Illustrations	ETL 1110-2-571				
a. Basic Condition	 <p>           * 15' OR DISTANCE TO EDGE OF NORMAL WATER SURFACE, IF LESS            ** IN THIS 4' X 7' TRANSITION ZONE, TEMPORARY OBSTRUCTION BY LIMBS AND CROWN IS ALLOWED DURING DEVELOPMENT OF NEW PLANTINGS, FOR UP TO 10 YEARS            ▽ NORMAL WATER SURFACE         </p>		Yes	No	Areas need to be cleared per 2010 FY Inspection.
b. See Appendix II for more illustrations of vegetation free zones					

	Reference	Page	Applicable to this Levee Segment: Yes/No	Meets Criteria Yes/No/Unknown	Reviewer's Comment
6. Regional Variances on Vegetation Standards Federal and Non-Federal Levees. The public sponsor of an Active flood control levee may seek a variance from Corps policy (i.e., Appendix A of EP 500-1-1, and ER 1130-2-530) so as to allow additional vegetation to grow on levees, when allowing such vegetation would preserve, protect, and/or enhance natural resources, and/or protect the rights of Native Americans.	EP 500-1-1 and ER-1130-2-530	5-27	Yes	Unknown	It is unknown if the sponsor has sought any variances.



	Reference	Page	Applicable to this Levee Segment: Yes/No	Meets Criteria Yes/No/Unknown	Reviewer's Comment
<b>III. Structural</b>					
<b>A. Flood Walls</b>					
1. Horizontal Movement	EM 1110-2-2502	7-24	No	N/A	No floodwalls exist.
a. Areas in which movement of a straight section of monoliths or differential movement between any two monoliths is greater than expected is considered critical.					
b. Check for unequal settlements adjacent to structures such as pump house and gate wells					
2. Earthen levee connection with concrete drainage structure			No	N/A	No floodwalls exist.
a. If levee ties in to drainage control structure by abutting directly against the structure, the abutting end walls of the concrete structure should be battered at 10V to 1H.					
3. Factor of Safety -- See Appendix III for factors of safety and stability	EM 1110-2-2100 EM 1110-2-2502	3-4 to 3-6 4-5 to 4-7	No	N/A	No floodwalls exist.
4. Load conditions -- See Appendix III for load conditions	EM 1110-2-2100	B-5 to B-21	No	N/A	No floodwalls exist.
5. I Walls and Inverted T Walls			No	N/A	No floodwalls exist.
a. For stability reasons, I flood walls should rarely exceed 7 ft above the ground surface.	EM 1110-2-1913	8-13b			
b. The inverted T flood wall is used to make flood wall levee enlargements when walls higher than 7 ft are required.	EM 1110-2-1913	8-13c			
6. Minimum Thickness of Walls			No	N/A	No floodwalls exist.
a. Walls with height greater than 10 feet shall be a minimum of 12 inches thick and shall contain reinforcement in both faces.	EM 1110-2-2104	3-7			
7. Surface Drainage at Retaining Walls			No	N/A	No floodwalls exist.
a. All retaining walls must have adequate surface drainage to dispose of surface water. A layer of impervious soil should be placed on top of the soil backfill to reduce surface infiltration of rainfall.	EM 1110-2-2502	6-4			
8. Weepholes			No	N/A	No floodwalls exist.
a. Weepholes should consist of a pipe, at least 3 inches in diameter, extending through the stem of the wall. The weepholes are commonly spaced not more than 10 feet apart vertically and horizontally.	EM 1110-2-2502	6-5			
9. Flood Wall Scour Protection			No	N/A	No floodwalls exist.

	Reference	Page	Applicable to this Levee Segment: Yes/No	Meets Criteria Yes/No/Unknown	Reviewer's Comment
a. A flood wall maybe exposed to scouring because of the direction, curvature, and velocity of current or waves, characteristics of the soil, topography, etc. Scouring at the wall footing should be considered, and where anticipated, protected with riprap or other erosion protection methods such as gabions.	EM 1110-2-2502	7-13			
10. Structures Adjacent to Flood Walls			No	N/A	No floodwalls exist.
a. Flood walls are usually built because only a narrow right-of-way is available. The presence of existing buildings or other structures is usually the reason for a narrow right-of-way. Sewer pipes with open joints, structures with basements, and excavations close to the wall may create a hazard to the safety of a flood wall and so noted on the inspection form.	EM 1110-2-2502	7-21			
11. Inspection Criteria for Flood Walls	EM 1110-2-2502	7-24, 25	No	N/A	No floodwalls exist.
a. Flood walls should be examined during scheduled periodic inspections, after major periods of high water, and when special events warrant an inspection. A determination of areas which may be weak or critical from the standpoint of leakage and stability should be made.					
b. Horizontal Movement. Areas in which movement of a straight section of monoliths or differential movement between any two monoliths is greater than expected is considered critical.					
c. Joint Opening or Spreading. Joints referred to in this paragraph are those having a water stop embedded in the interior of the section. Not only may joints at corner monoliths become critical upon application of load, but open joints below ground should be considered critical. Any joint can become open through loss of joint filler or through unequal settlement between adjacent monoliths or structures such as levees, pump houses, gate wells, and gate abutments. If the expected joint opening is greater than the allowable, the area is considered critical.					
d. Foreign Material in Joints. The presence of inflexible foreign material, such as grout and pieces of aggregate, in expansion joints is dangerous. Grout and pieces of aggregate anywhere in the joint prevent the joint from fulfilling its expansion function.					

	Reference	Page	Applicable to this Levee Segment: Yes/No	Meets Criteria Yes/No/Unknown	Reviewer's Comment
e. Water Stops. Joints with torn or parted water stops are considered critical. Torn water stops may not be noticed during an inspection, particularly if the joint has not spread open. If sufficient differential movement has occurred, it should be assumed that the water stop is torn. If a total differential movement (transverse and longitudinal combined) of 1/2 inch or more has occurred, the water stop should be considered torn unless shown otherwise.					
f. Foundation Voids. All unequal settlements should be viewed with suspicion. In particular, unequal settlements adjacent to structures such as pump houses and gate wells should be the subject of examination.					
g. Stability Analyses. Original seepage assumptions or patterns should be reviewed for realistic representation of actual foundation conditions. Particular attention should be paid to foundations having pervious strata which connect directly with the river.					
h. Basements and Other Excavations. The seepage aspects and the foundation stability of walls which have had basements excavated on either side of and adjacent to the wall since the original design and construction were completed should be investigated.					
i. Seepage Conditions Landside of Flood Walls. These areas should be investigated thoroughly and seepage control of pressure relief provided, if needed.					
B. Closure Structures			No	N/A	No closure structures exist.
1. Security	EM 1110-2-2502	4-4			
a. Closure structures must include security provisions which prevent vandalism and the impairment of operating capability. Locked storage facilities which are inaccessible to the public should be provided for the storage of stoplogs, removable posts, and other unsecured parts of closure structures. In areas subject to vandalism, masonry buildings should be used. Latching devices which hold gates in the stored position should be provided with adequate locks.	EM 1110-2-2705	2-2			
2. Seal Assemblies	EM 1110-2-2705	5-2	No	N/A	No closure structures exist.
a. Rubber seals should be of the type suitable for the particular application.					
b. Seal assemblies should be designed to fit the configuration of the gate and the gate sills.					
3. Embedded Metals	EM 1110-2-2705	5-3	No	N/A	No closure structures exist.

	Reference	Page	Applicable to this Levee Segment: Yes/No	Meets Criteria Yes/No/Unknown	Reviewer's Comment
a. Embedded structural steel bearing plates and anchorages must be provided as required for the installation of gates and appurtenances.					
b. Embedded seal plates shall be galvanized steel, stainless clad steel, or solid stainless steel for prevention of corrosion.					
c. The edges of embedded steel plates should extend approximately 2 in. beyond the sealing surface.					
4. Corrosion Control	EM 1110-2-2703	7-1	No	N/A	No closure structures exist.
a. Corrosion causes different degrees of structural and metallic deterioration of the gates. This affects operation and repair of the gates.					
b. Adequate coating (painting) and cathodic protection is desired.					
C. Gate Wells			Yes	Unknown	
1. Gate wells should be cast-in-place concrete for major levees. Precast concrete gate wells may be used for less critical levees if applicable.	EM 1110-2-2902	3-5			
D. Pipelines					
1. General					
a. Existing Pipelines in Levees	EM 1110-2-1913	8-2			
1) Must be known to be in good condition 2) Must have adequate strength to withstand levee loading 3) Must have sufficient flexibility in joints to adjust under expected settlement and stretching of pipe 4) Pressure lines must have provisions for rapid closure in event of leakage or rupture 5) Gravity discharge pipes must have provisions for emergency closure in event of inoperable flap valves on riverside end 6) Must have pervious backfill under landside third of levee where foundation materials are susceptible to piping			Yes	Unknown	The loading design and condition of existing pipelines are unknown.
b. Pipelines Crossing Over Levee			No	N/A	No pipelines crossing over levee.
1) These pipes must be properly designed and constructed to prevent (a) flotation if submerged, (b) scouring or erosion of the embankment slopes from leakage or currents, and (c) damage from debris carried by currents, etc. All pipes on the riverside of the levee should have a minimum of 1 ft of soil cover for protection from debris during high water.	EM 1110-2-1913	8-2			
c. Seepage rings or collars should not be provided for the purpose of increasing seepage resistance	EM 1110-2-1913	8-4	Yes	Unknown	No information available to confirm.

	Reference	Page	Applicable to this Levee Segment: Yes/No	Meets Criteria Yes/No/Unknown	Reviewer's Comment
d. All pipes: 18 inch annular thickness of drainage fill should be provided around the landside third of the pipe where landside levee zoning does not provide for such drainage fill	EM 1110-2-1913	8-5	Yes	Unknown	The quality of the backfill is unknown.
e. Pipes within Foundation: Landside outlet through a blind drain to ground surface at the levee toe, connection with pervious under seepage features, or through an annular drainage fill outlet to ground surface around a manhole structure must be included.			Yes	Unknown	These details are not shown on plans.
2. Reinforced Concrete Pipe (RCP)					
a. General	EM 1110-2-2902	3-1 thru 3-6			
1) Used for urban levees, and other levees where loss of life or substantial property damage could occur. Must have sufficient flexibility in joints to adjust under expected settlement and stretching of pipe. 2) Ancillary structures such as inlet structures, gate wells, and outlet structures should be constructed with cast-in-place reinforced concrete. 3) Inlet structures should be cast-in-place on major levees, but may be precast as appropriate. 4) Inlet structures, gate wells, and outlet structures should be concrete unless agricultural (rural).			Yes	Unknown	The levee pipe details are unknown per 1955 Design Memorandum.
b. Joints	EM 1110-2-2902	3-9			
1) Joints for precast concrete pipe must resist infiltration/exfiltration leakage, accommodate lateral and longitudinal movements, and provide hydraulic continuity. 2) At the structure integral O-ring gaskets and steel end rings are required at gate wells and gated outlets.			Yes	Unknown	The levee pipe details are unknown.
c. Shape					
Conduit shapes are determined by hydraulic design and installation, the circular shapes are the most common. The arch and rectangular (box-shaped) conduits are generally used for large conduits through levees and for culverts carrying waterways. Horizontal elliptical are used under roads or railways.			Yes	Unknown	The levee pipe details are unknown.
d. Length	EM 1110-2-2902	3-4			



	Reference	Page	Applicable to this Levee Segment: Yes/No	Meets Criteria Yes/No/Unknown	Reviewer's Comment
1) Lengths of pipe used should not exceed 16 ft for conduits when minimal foundation settlements are expected, and pipe lengths of 8 to 12 ft should be used when nominal settlements are expected. Inlet structures should be cast-in-place on major levees, but may be precast as appropriate. 2) Two half lengths of pipe should be used immediately downstream of the intake structure, at the end of the concrete cradle, immediately upstream of the stilling basin, and when there is a change in the foundation stiffness.			Yes	Unknown	The levee pipe details are unknown.
3. Corrugated Metal Pipe (CMP)	EM 1110-2-2902	4-1			
a. Corrugated metal pipe may be used in rural levee systems when risk of substantial property damage and loss of life is low.			Yes	Unknown	The CMP levee pipe details are unknown.
b. Corrugated metal pipes are acceptable through agricultural levees where conduits are 36-in diameter and where levee embankments are not higher than 12 ft above the conduit invert.			Yes	Unknown	The levee pipe details are unknown.
c. Life cycle cost studies are required where corrugated metal pipes are used.			Yes	Unknown	The levee pipe details are unknown.
4. Ductile Iron Pipe (DIP) and Steel Pipe	EM 1110-2-2902				
a. Ductile iron pipe has replaced cast iron pipe in use and application.			Yes	Unknown	The levee pipe details are unknown.
b. DIP is used under levees and for water mains and other installations where fluids are carried under pressure.			Yes	Unknown	The levee pipe details are unknown.
c. Steel pipes should be used for discharge lines from pumping stations for flood protection work.			Yes	Unknown	The levee pipe details are unknown.
d. In general, these pipes should be carried over rather than through the levee.			Yes	No	Force main runs through levee.
e. Steel pipes should be designed in accordance with American Water Works Association (AWWA) M11 (AWWA 1985).			Yes	Unknown	The levee pipe details are unknown.
5. Plastic Pipe	EM 1110-2-2902				
a. Plastic pipes are available in both solid wall and profile wall thermoplastic acrylonitrile-butadiene-styrene (ABS), high-density polyethylene (HDPE), and polyvinyl chloride (PVC) pipes, as well as thermoset reinforced plastic motor (RPM) pipes.			Yes	Unknown	The levee pipe details are unknown.

	Reference	Page	Applicable to this Levee Segment: Yes/No	Meets Criteria Yes/No/Unknown	Reviewer's Comment
b. Plastic pipes vary significantly in strength, stiffness, and performance. Differences depend more on their design and intended use than on the specific pipe wall material. A thorough evaluation of the intended use and detailed material, jointing, and backfill specifications is necessary to ensure performance. Use of plastic pipes in drainage and sub drainage applications is increasing. However, their use in low cover with heavy wheel loads or high cover applications is limited. Plastic pipe will not be used through embankments of dams and levees without approval from HQUSACE. Plastic pipes will typically be used for drainage piping behind structures.			Yes	Unknown	These details are not shown on plans
E. Culverts	EM 1110-2-2902				
1. For culvert applications, the exposed ends of some types of plastic pipes need protection from exposure to ultraviolet, thermal cycling, etc.			Yes	Yes	These details are not shown on plans.
2. Concrete or metal end sections, headwalls, or other end protection is recommended.			Yes	Yes	Riprap is identified as in place.
F. Safety					
1. Ladders should be provided on the sides of rectangular channel walls and steps provided on the sloped paving of trapezoidal channels to provide safe access for operations personnel.	EM 1110-2-2007	1-2	No		
G. Structural Inspections.					
1. Concrete -- (See Appendix III)	EM 1110-2-2002		Yes	Unknown	Existing condition of concrete structure is unknown.

	Reference	Page	Applicable to this Levee Segment: Yes/No	Meets Criteria Yes/No/Unknown	Reviewer's Comment
<b>IV. Geotechnical</b>					
A. Embankment					
1. Embankment Geometry	EM 1110-2-1913	6-1 and 6-2			
a. Minimum crown width of 10 ft			Yes	Yes	10 feet width provided per as-builts.
b. Slopes flatter than 1V:2H			Yes	Yes	1V:2.5H per as-built plans provided.
c. Slope no greater than 1V:3H is required for conventional mowing equipment			Yes	No	Based upon review of as-builts 1V:2.5H does not meet 1V:3H criteria.
d. For sand levees, a 1V:5H landside slope is adequate to prevent damage from seepage exiting that slope.			No		
e. Riverside slopes flatter than those required for stability may have to be provided to protect against wave action.			Yes	Unknown	No information available to confirm.
B. Slope Stability			Yes	Unknown	No calculations were available for review.
1. General					
a. Design of levees is governed by EM 1110-2-1913. Stability analyses of levees and their foundations should be performed following the principles set forth in that manual. The factors of safety listed in Table 6-1b (See Appendix IV) provide guidance for levee slope stability, but the values listed are not required.	EM 1110-2-1913	6-5			
2. Factor of safety guidance			Yes	Unknown	A factor of safety was not provided.
a. Factors of safety should be selected consistent with the uncertainty involved in the parameters such as shear strength and pore water pressures that affect the calculated value of factor of safety and the consequences of failure. When the uncertainty and the consequences of failure are both small, it is acceptable to use small factors of safety, on the order of 1.3 or even smaller in some circumstances. When the uncertainties or the consequences of failure increase, larger factors of safety are necessary. Large uncertainties coupled with large consequences of failure represent an unacceptable condition, no matter what the calculated value of the factor of safety. The values of factor of safety listed in Table 6-1b (See Appendix IV) provide guidance but are not prescribed for slopes other than the slopes of new embankment dams.	EM 1110-2-1902	3-2			

	Reference	Page	Applicable to this Levee Segment: Yes/No	Meets Criteria Yes/No/Unknown	Reviewer's Comment
b. What is considered an acceptable factor of safety should reflect the differences between new slopes, where stability must be forecast, and existing slopes, where information regarding past slope performance is available. A history free of signs of slope movements provides firm evidence that a slope has been stable under the conditions it has experienced. Conversely, signs of significant movement indicate marginally stable or unstable conditions. Values of factors of safety that are lower than those required for new slopes can often be justified for existing slopes.	EM 1110-2-1902	3-2			
c. Factors of Safety					
1) For new earth and rock-fill dams see Appendix IV, Table 3-1.	EM 1110-2-1902	3-2			
2) For Levees see Appendix IV, Table 6-1b.	EM 1110-2-1913	6-5	Yes	Unknown	
3) Earthquake (See ER 1110-2-1806).	ER 1110-2-1806				
C. Seepage Control			Yes	Unknown	No information was available for review.
1. Seepage control in earth foundations is necessary to prevent excessive uplift pressures and piping through the foundation.	EM 1110-2-1901	9-1			
2. The use of some underseepage control methods such as relief wells and toe drains may increase the quantity of underseepage.	EM 1110-2-1901	9-1			
3. Horizontal Drainage Layer	EM 1110-2-1914	5-10			
a. Minimum of 1.5 feet thickness.					
4. Landside Seepage Berms	EM 1110-2-1913	C-5			
a. Situations requiring a landside seepage berm;	EM 1110-2-1913	C-4			
1) When the upward gradient at the landside toe of the levee is between 0.5 and 0.8 without a berm.					
2) When the computed gradient is less than 0.5, but either severe seepage has been observed or seepage is expected to become severe and soften the landside portion of the levee.					
3) Where a levee overlies a top stratum creating a landside blanket and the upward gradient through the blanket at the landside toe of the levee is greater than 0.8, a seepage berm should be designed with an allowable upward gradient of 0.3 through the blanket and berm at the landside toe of the levee.					
b. Minimum thickness of 5 feet at levee toe.	EM 1110-2-1913	C-5			
c. Minimum thickness of 2 feet at berm crown.	EM 1110-2-1913	C-5			
d. Design thickness of the berm should be increased by 25% to allow for shrinkage, foundation settlements, and variations in design factors.	EM 1110-2-1913	C-5			
e. Minimum width of 150 feet.	EM 1110-2-1913	C-5			
f. Maximum berm width to be 300 to 400 feet.	ETL 1110-2-569	8			

	Reference	Page	Applicable to this Levee Segment: Yes/No	Meets Criteria Yes/No/Unknown	Reviewer's Comment
g. Slope should be 1V:50H or steeper for drainage. If foundation is fully consolidated, then 1V:75H is allowed.	EM 1110-2-1913	C-6			
h. Berms to be constructed as "semi pervious" must be constructed with silty sands or fine sands.	ETL 1110-2-569	7			
i. Material used in a sand berm should be as pervious as possible, with a minimum permeability of $100 \times 10^{-4}$ cm per second. Sand berms require less material and occupy less space than impervious or semi-pervious berms providing the same degree of protection.	EM 1110-2-1913	5-3			
5. Pervious Toe Trench	EM 1110-2-1913	5-4	No		
a. Generally located at the levee toe, but are sometimes constructed beneath the downstream levee slope.					
b. Typically 2 feet to 6 feet wide.					
c. Sand is used as backfill material using filter criteria (See Appendix IV).					
d. Collector pipes should be surrounded by 1 foot of gravel.					
6. Pressure Relief Wells			No		No pressure relief wells associated with this system.
a. Maximum gradient midway between wells or landward from well line should not exceed 0.5.	EM 1110-2-1913	3-6			
b. Relief wells should always be located where they are accessible by a drill rig for pump testing and cleaning and provided with outlets for this purpose. The outlets should be designed to minimize maintenance and to provide protection against contamination from back-flooding, damage from floating debris, and vandalism.	EM 1110-2-1914	9-1			
c. Periodic inspections of relief wells should be carried out as described in ER 1110-2-100.	EM 1110-2-1914	10-2			
d. All wells should be pump tested every five years.	EM 1110-2-1914	10-3			
e. Riser Pipe and Screen					
1) Screen opening size should be equal to or less than 50% size of the finest gradation of filter.	EM 1110-2-1913 and	5-7			
2) Well screen extends from just below the top of the previous section to bottom of well.	EM 1110-2-1914	6-2			
3) Solid riser pipe to be present from top of pervious strata to the surface.					
4) Well screen - open area should maintain an entrance velocity of less than 0.1 fps at design flow.					
f. Filter	EM 110-2-1914	6-5			



	Reference	Page	Applicable to this Levee Segment: Yes/No	Meets Criteria Yes/No/Unknown	Reviewer's Comment
1) Minimum of 6 inches filter material surrounding screen. 2) Extends at least 2 feet above top of well screen. 3) Extends at least 4 feet below the bottom of well screen . 4) In order to prevent infiltration of foundation sands into the filter, the filter gradation must meet the requirement that the 15 percent size of the filter should be not greater than five times the 85 percent size of the foundation materials.					
g. Well Appurtenances (Recommendations, but not required)					
1) Aluminum check valve 2) Rubber gasket 3) Plastic standpipe 4) Metal screen or flap type gate on top of well	EM 1110-2-1913 and EM 1110-2-1914	5-7 9-3			
7. Design of Seepage control	EM 1100-2-569	6-7	Yes	Unknown	No information provided in 1955 Design Memorandum
a. The allowable factor of safety for use in evaluations and/or design of seepage control measures should correspond to an exit gradient at the toe of the levee of $i = 0.5$ . In general, this would provide a factor of safety of about 1.6. This change will standardize all levee seepage requirements to one exit gradient of 0.5.					
b. Landside drainage ditches (along the toe of the levee), seepage berms, and relief wells should all be designed to the same exit gradient of 0.5.					
8. Levee Landside Ditches	EM 1110-2-1913	8-16	No		
a. Drainage ditches should be located such that the exit gradient in the bottom of the ditch does not exceed 0.5 at the landside levee toe and does not exceed 0.8 at a distance 150 ft landward of the landside levee toe and beyond.					
b. Between the landside levee toe and 150 ft landward of the landside levee toe, the maximum allowable exit gradient in the bottom of the ditch should increase linearly from 0.5 to 0.8.					
c. The exit gradient should be computed assuming the water level in the ditch is at the bottom of the ditch.					
D. Settlement			Yes	Unknown	No calculation was available to review.
1. Total settlement should not exceed 2 inches for most facilities.	EM 1110-1-1904	2-1			
2. Differential settlement should not usually exceed 0.5 inch in buildings, otherwise cracking and structural damage may occur.	EM 1110-1-1904	2-2			
E. Collapsible Soils			Yes	Unknown	No analysis of collapsible soils was provided.

	Reference	Page	Applicable to this Levee Segment: Yes/No	Meets Criteria Yes/No/Unknown	Reviewer's Comment
1. A collapsible soil at natural water content may support a given foundation load with negligible settlement, but when water is added to this soil the volume can decrease significantly and cause substantial settlement of the foundation, even at relatively low applied stress or at the overburden pressure. Collapsible soils exposed to perimeter watering of vegetation around structures or leaking utility lines are most likely to settle. Collapse may be initiated beneath the ground surface and propagate toward the surface leading to sudden and nonuniform settlement of overlying facilities.	EM 1110-1-1904	5-12			
F. Conduit Penetrations of Levees			Yes	Unknown	No information is available to review.
1. When the foundation consists of compressible soils, the conduit should be founded upon or in stronger soils or rock. When conduits are laid in excavated trenches in soil foundations, concrete seepage cutoff collars shall not be provided solely for the purpose of increasing seepage resistance since their presence often results in poorly compacted backfill around the conduit. Collars, with a minimum projection from the conduit surface, will be used over conduit joints to protect against joint displacements resulting from differential movement on yielding foundations.	EM 1110-2-1901	10-1			
G. Design Criteria for Filter Materials (See Appendix IV)	EM 1110-2-1901	Appendix D	Yes	Unknown	No filter data was available for review.
H. Slope Protection	EM 1110-1-1913	7-7	Yes	Unknown	No detail was available for review.
1. High-class slope protection, such as riprap, articulated material or paving should be provided on riverside slopes beneath bridges, since adequate turf cannot be generally established because of inadequate sunlight, and adjacent to structures passing through levee embankments.					
2. Guidance on the design of riprap revetment to protect slopes against currents is presented in EM 1110-2-1601. Where slopes are composed of erodible granular soils or fine-grained soils of low plasticity, a bedding layer of sand and gravel or spalls, or plastic filter cloth should be provided beneath the riprap.					

## Appendix D

### Summary of Crack Surveys

*Note: A Crack Survey was  
not completed as part of  
this inspection.*

Appendix E

References

## References

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United States Army Corps of Engineers (USACE). 1966. Design Memorandum for Rectification of Deficiencies in Completed Local Flood Protection Project. Wellsville, New York.

## Appendix F

### Pre-Inspection Packet

*Note: Please refer to DVD  
for full appendices*



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of Engineers®**

Buffalo District

Wellsville, New York

Genesee River

Right Bank Levee and Dyke Creek

Flood Damage Reduction Project

Pre-Inspection Package

Levee Periodic Inspection 2010

System 12 of 13

Contract No. W912QR-10-D-0003

Task Order No. DN01

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**Stantec Consulting Services Inc.**

**One Team. Infinite Solutions**

801 Jones Franklin Road, Suite 3

Raleigh, NC 27606-2012

Tel: (919) 851-6866 • Fax: (919) 851-7024

[www.stantec.com](http://www.stantec.com)

Prepared for:

USACE Buffalo District

Buffalo, New York

July 8, 2010

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Stantec Consulting Services Inc.  
801 Jones Franklin Road, Suite 3  
Raleigh, NC 27606-2012  
Tel: (919) 851-6866  
Fax: (919) 851-7024

---

July 8, 2010

rpt\_pre\_inspect\_001\_178440003

David J. Mitchell, P.G., P.E.  
USACE Buffalo District  
1776 Niagara Street

Re: Wellsville, New York  
Genesee River  
Right Bank Levee and Dyke Creek  
Flood Damage Reduction Project  
Pre-Inspection Package  
Levee Periodic Inspection 2010  
System 12 of 13  
Contract No. W912QR-10-D-0003  
Task Order No. DN01

Dear Mr. Mitchell:

Stantec Consulting Services Inc. is pleased to submit our Pre-Inspection Packet for Wellsville, New York for the United States Army Corps of Engineers Buffalo District Levee Periodic Inspection project referenced above. This Pre-Inspection Packet consists of a review of documentation of the history and performance of the levee as well as a working Design Criteria Checklist provided as an Appendix.

This satisfies the deliverable for Task 4 and 5 of the USACE Buffalo District Levee Periodic Inspection Project referenced above. Stantec looks forward to working with the USACE on the rest of this project. We anticipate completing the field inspection during the week of July 20, 2010. Please contact us at (919) 851-6866 with any questions.

Sincerely,

STANTEC CONSULTING SERVICES INC.

Donald Gibbs, PE  
Task Manager

Enclosures: 1

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Genesee River

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Wellsville, New York  
Genesee River  
Right Bank Levee and Dyke Creek  
Flood Damage Reduction Project  
Pre-Inspection Package  
Levee Periodic Inspection 2010  
System 12 of 13  
Contract No. W912QR-10-D-0003  
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(Figures and drawings are attached in CD)

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**Wellsville, New York  
Genesee River  
Right Bank Levee and Dyke Creek  
Flood Damage Reduction Project  
Pre-Inspection Package  
Levee Periodic Inspection 2010  
System 12 of 13  
Contract No. W912QR-10-D-0003  
Task Order No. DN01**

## **1. Introduction**

The purpose of this document is to summarize the information provided for the Wellsville, New York Flood Damage Reduction Project (FDRP). This document will be used by the Buffalo District United States Army Corps of Engineers (USACE) and the Levee Inspection Teams to aid in the field inspection of the FDRP in accordance with the project's Statement of Work (SOW).

It is Stantec's understanding that all available and applicable documentation has been provided by the USACE to assist in the preparation of this pre-inspection packet. In addition to the information provided by the USACE. It is our understanding, USACE provided a written request to the sponsor in order to obtain additional information relevant to the upcoming periodic inspection. The following is a list of items that have been supplied by the USACE Buffalo District to date:

- Previous inspection reports (annual operation and maintenance, and periodic)
- Base maps
- Operation and Maintenance Manuals
- Engineering and design documentation (design manuals)
- Emergency Action Plan
- As-built drawings
- Flood Insurance map and information
- Construction specs
- Project Cooperation Agreement (PCA)
- Flood Insurance certification documents

The following is a list of items not available for review to date:

- Flood event reports
- Boring Logs
- Survey Data
- Instrumentation Data/ Report (reports of levee system performance during previous flood events)
- Maintenance/repair/modification/rehabilitation records
- Hydraulics and Hydrology
- Evaluation reports



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- Easements, Utility crossings, Encroachments, Variances, etc.
- Real Estate
- Flood warning system
- Design calculations

Any of the above missing information obtained during the inspection will be reported in the Draft Periodic Inspection (PI) Report. Information not available will be noted as such in the Draft PI Report.

## **2. Project Description**

### **2.1. Authorization**

Construction of improvements for flood control on the Genesee River at Wellsville, New York, Was authorized by the Flood Control Act of 1950 (Public Law 516, 81st Congress, Second Session) substantially in accordance with the recommendations of the Chief of Engineers in House Document No. 232, 81st Congress, First Session. Rectification of deficiencies to the original project was authorized in two phases. The first phase was authorized in November 1966 and the second phase in June 1975. (USACE, O&M Manual, 2000)

### **2.2. Location**

The project is located on Genesee River and Dyke Creek in the village and town of Wellsville, Allegany County, NY. The village is located 136 river miles upstream from the mouth of the Genesee River and 70 miles southeast of Buffalo. The town of Wellsville surrounds the village. The Genesee River rises in Potter County, PA, and flows in a northerly direction to enter Lake Ontario at Rochester, NY. It drains 216 square miles above Dyke Creek in the village of Wellsville. Dyke Creek rises in Steuben County, NY, and flows westward to enter the Genesee River at Wellsville, draining 72 square miles. The project extends on the Genesee River 1.6 miles downstream from the mouth of Dyke Creek, upstream 1.0 miles to the south limit of the village, and on Dyke Creek from its mouth 0.75 miles upstream.

### **2.3. Description**

The project from the original construction to the 1996-97 rehabilitation is summarized on the project map in Appendix A. The project works consist of channel improvements, with control and drainage structures. The channel of the Genesee River was deepened where necessary to provide uniform bottom grades with bottom widths of 100-135 feet from a point 2,700 feet downstream from the Bolivar Road Bridge to the confluence with Dyke Creek, and from there with bottom widths of 100-300 feet to about 5,400 feet upstream of Dyke Creek. There was a major realignment upstream from Bolivar Road to eliminate two sharp curves with other realignments to ease curves. A concrete drop structure was constructed between Bolivar Road and Pearl Street, and steel sheet pile weirs were constructed near the village line and near the upper limit of the project. These structures are intended to reduce high velocities, and consequent erosion. Bank protection was provided in the vicinities of these structures and at other points where scouring could be expected. Low levees were constructed in the vicinities of Pearl and State Street, between State Street to upstream of West Dyke Street, and upstream of the upstream sheet pile weir. Existing drainage facilities were altered to

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provide better entrances into the improved channel and to prevent backflow at high river stages.

The channel in Dyke Creek was also deepened to uniform bottom grades and widths of 50 to 70 feet, with a drop structure at Miller Street. As in the Genesee River, bank protection was provided and drainage structures were altered. A levee was constructed upstream of Miller Street. (USACE, O&M Manual, 2000)

## **2.4. Vertical Datum Adjustment**

The elevations in the design plans, Operations and Maintenance (O&M) manual and the As-built drawings for the Wellsville, Flood Damage Reduction Project (FDRP) are referenced to the United States Coast and Geodetic Survey Datum (USC&GS). Unless otherwise noted, the elevations in this document will be referenced to this datum (USC&GS). According to EC 1110-2-6065 (USACE, 2007), the current standard for vertical datum is the North American Vertical Datum of 1988 (NAVD 88).

## **3. Maps and Drawings**

Project maps for the Wellsville FDRP are provided in Appendix A. As-built drawings are provided in Appendix B.

## **4. Instrumentation Data**

No records of any instruments or instrumentation data for monitoring the levee embankment, seepage or flow rates have been provided for review. As-built plans do not include any reference to instruments being installed on the levee. An attempt to collect this information from the sponsor will be made during the field inspections; however, if no documentation is available it will be noted as such in the Draft PI Report.

## **5. Technical Summary of Foundation Conditions**

The Design memorandum on Wellsville, New York (USACE, 1955), local Flood Protection was reviewed for information regarding the foundation conditions and analysis that was performed in designing the levee and walls. That information is summarized below and in Section 13.1.1.

### **5.1. Geological**

The rock features of the Genesee Valley were formed in the Silurian and Devonian periods of the Paleozoic era. The rock strata in this area were originally parallel layers of mineral matter spread over the floor of epicontinental seas. At the close of the Devonian period, western New York was subjected to epeirogenic movements which ended marine submergence and the formation of sedimentary rocks. The vertical land movements were slow; consequently, the rock strata were not severely fractured or faulted, nor thrown much out of their horizontal position. There is, however, a slight southerly inclination averaging 40 feet per mile, due partly to the original slope of the sediments and partly to the net effect of the continental movements. In the Pleistocene period, western New York was covered by an ice sheet several hundred feet thick. Glacial erosion, transportation, and deposition modified the surface but did not change the gross features of the topography. The most effective

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work of the glacier was depositional, and the true terminal moraine of the ice shoots lies at the headwaters of the Genesee River in Pennsylvania. After the last recession of the ice shoot, the land relieved of its weight, rose slowly, producing a dome-shaped uplift. At Rochester, the uplift has been determined to be about 250 feet, from which it decreases to the south. (USACE, Design Memorandum, 1955)

### **5.2. Soils**

The soils of the upper Genesee River basin are largely of glacial origin as the retreating ice sheet left a thin mantle of glacial till. The weathering of this till has resulted in soils of light color, known as the Volusia series. These vary in texture from a heavy silt Loam to comparatively light gravelly Loam, the former of which predominates. Drainage is deficient because the impervious subsoil at shallow depths prevents seepage. The Genesee series of soils in the valley bottoms is highly productive when it is not subject to overflow, but after a flood, two to three years may be required to work in the silt deposits and restore productivity. (USACE, Design Memorandum, 1955)

### **5.3. Foundation Exploration**

Subsurface conditions were explored by numerous auger holes, core holes and test pits. Investigations were confined to the construction area. (USACE, Design Memorandum, 1955)

### **5.4. Materials encountered**

Throughout the project, the materials encountered were brown silty sand and gravel with firm gray silt at lower levels. Rock does not exist close to the surface. (USACE, Design Memorandum, 1955)

### **5.5. Testing**

Soils were tested by the North Central Division Laboratory at Chicago. Mechanical analyses, direct shear and Proctor tests were run on the various samples for determining probable changes in volume between excavation and embankment. Results of tests, on typical materials, obtained from test pits are shown below in Table 1. (USACE, Design Memorandum, 1955)

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**Table 1. Characteristics of Typical Soils**

Description	TP-3	TP-4
Classifications	Sandy clay	Sandy clay
Direct shear undisturbed Ø C, tons/sq. ft.	31° 0	29° 0.06
Direct shear remolded Ø C, tons/sq. ft.	30° 0.06	30° 0.25
Unit weight, undisturbed Dry, lbs. /cu. ft. Wet, lbs. /cu. ft.	78 99	75 98
At optimum compaction Dry weight, lbs. /cu. ft. Wet weight, lbs. /cu. ft.	107 127	106 125
Specific gravity	2.70	2.68
Liquid limit	36	43
Plastic limit	22	26

## 6. System Features

Significant features of the Wellsville FDRP include Levees, Channels and Drop Structures. Table 2 presents a general overview of the features of the Wellsville FDRP Right Bank & Dyke Creek operated and maintained by the State of New York.

**Table 2. Features of the Wellsville Right Bank and Dyke Creek FDRP**

Total Length (Miles)	Flood Wall (Miles)	Earthen Levee (Miles)	Pump Stations (Each)	Traffic and Pedestrian Closures (Each)	Channel (Miles)	Drop Structure/Weirs (Feet)
2.3	0	1.5	0	0	0.8	1

### 6.1. Channels

#### 6.1.1. Dyke Creek Channel

The channel of Dyke Creek was improved from the mouth of the creek upstream for approximately 4,000 feet. The stream was realigned near its mouth to eliminate a sharp curve and to provide a better entrance of flows into the Genesee River. The channel bottom widths in the reach downstream of the Miller Street drop structure, a distance of about 3,300 feet, vary from 40 to 50 feet. Upstream of the structure, the bottom width is 70 feet. The channel bottom grade varies from 0.026 to 0.516 percent. Side slopes vary between 1 foot vertical on 2 foot horizontal and 1 foot vertical on 3 foot horizontal. Banks were protected

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with riprap in the vicinity of the drop structure and where slopes are steeper than 1 foot vertical on 2-1/2 foot horizontal. The NYSDOT has constructed a new highway realignment from the mouth of Dyke Creek to about 1,100 feet upstream, which involves the realignment of the mouth, widening of the channel, and the placement of additional bank protection. The Buffalo District reviewed the plans for this improvement and insured that the highway construction did not compromise the channel capacity. (USACE, O&M Manual, 2000)

### **6.2. Levees**

#### **6.2.1. Genesee River**

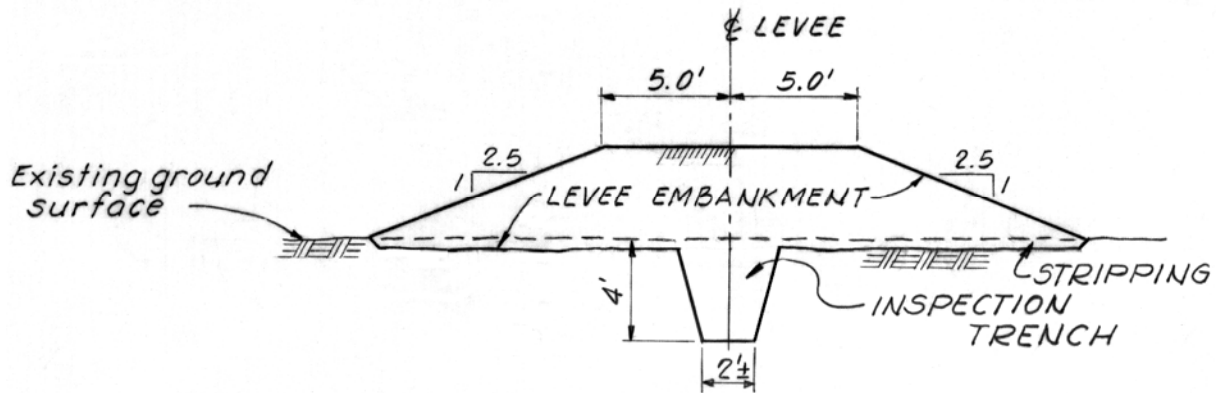
Levees have been constructed along numerous reaches of the Genesee River and Dyke Creek, consisting of a 10 foot crest width and 1 foot vertical on 2-1/2 foot horizontal side slopes, unless otherwise stated. A levee was constructed along the left bank of the Genesee River upstream for 2,850 feet from the concrete drop structure to State Street. Along the upstream 1,150 feet of the levee, there were only small areas on the land side of the levee which were lower than the top of the levee; these were filled to that elevation so that drainage facilities would not be needed. A short levee was constructed south of State Street to prevent overflow through an abandoned mill race west of the former W.A. & G. Railroad. This levee has a crest width of 50 feet and side slopes of 1 foot vertical on 3 foot horizontal. Another levee is located on the right bank of the Genesee River starting at the concrete drop structure and extending upstream approximately 1,350 feet to about West Genesee Street. The levee is generally six feet in height, constructed to prevent high stream flows from bypassing the drop structure. A levee was constructed along the left river bank, starting immediately upstream of the State Street Bridge, and progressing about 1,680 feet upstream to the former W.A. & G. bridge and then an additional 680 feet to existing ground. A small levee, generally two feet or less in height, was constructed along the right bank of the river immediately upstream of the former W.A. & G. Bridge, extending 620 feet upstream to prevent flooding of a low area in Island Park. A barrier levee was constructed on the right bank, approximately perpendicular to the channel and parallel to the steel sheet pile weir located approximately 1,300 feet upstream of the former W.A. & G. Bridge. The levee extends approximately 670 feet to existing ground, constructed to prevent flood flows from bypassing the weir drop structure. Along the left bank, starting 290 feet downstream of the sheet pile weir located approximately 3,000 feet upstream of the former W.A. & G. Bridge and extending upstream from the weir for approximately 1,170 feet and tying into the former W.A. & G. Railroad bed, is a levee protecting the upstream flank of the project. See figure 1 for Typical section of levee. (USACE, O&M Manual, 2000)

#### **6.2.2. Dyke Creek**

On Dyke Creek, a levee was constructed on the left bank, upstream of the Miller Street drop structure, for approximately 530 feet upstream, where it curves away from the channel to become perpendicular to the channel line and forms a barrier levee which is an additional 310 feet long. (USACE, O&M Manual, 2000)



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**Figure 1. Typical Section of Levee**

### 6.3. Drainage Structures

The documentation provided indicates that 1 drainage structure is included in the Dyke Creek Wellsville FDRP. See table 3 below for details.

#### 6.3.1. Dyke Creek

On Dyke Creek, the left bank levee between Miller Street and the upstream project limit caused the alteration of the drainage pattern behind the levee. In order to handle this runoff, a ditch was excavated nearly parallel to the levee; the ditch flows are carried under Miller Street and exit through the side slope downstream of the drop structure from a 24-inch corrugated metal pipe. A metal end section was provided at the upstream end of the pipe. See Table 3 for details. (USACE, O&M Manual, 2000)

**Table 3. Interior Drainage Structure Information Dyke Creek**

32+89 LB	24" CMP

CMP=Corrugated Metal Pipe

### 6.4. Miscellaneous Facilities

A tabulation of miscellaneous facilities identified on the plans within the project is presented in Table 4.

**Table 4. Miscellaneous Facilities Information Dyke Creek**

22+25	Center line Broad Street Bridge
30+75	2-8" Vitrified tile pipe inverted siphon
34+25	10" Water Main

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## 6.5. Bridges

The bridges at Bolivar Road and State Street were not changed structurally. The Pearl Street Bridge was removed and was relocated farther upstream, and a new bridge was constructed over Dyke Creek near Hanover Creek in connection with the highway realignment undertaken by the NYSDOT. The right bank slopes at Bolivar Road were protected with riprap. At the State Street Bridge, the right bank and the upstream left bank approach were protected with riprap. A ring of PSA-23 steel sheet piles was placed around the center pier of the South Main Street bridge and the area between piles and pier was filled with concrete to protect against undermining after the channel was deepened. Both banks were protected with riprap through this bridge. A row of PZ-27 steel sheet piles was placed in front of the left abutment of the Erie Railroad bridge, and both banks there were protected with riprap. The four pile bents of the former W.A. & G. Bridge within the channel limits were ringed by PMA-22 steel sheet piles, 15 feet long, extending 10.5 feet below the channel bottom. The area inside each ring was backfilled and capped with 10 inches of concrete. All cross bracing was replaced and some sheathing was added. The sheathed part of the three larger bents was filled with rock. Five, 25-foot wood piles were arranged in a triangle on the upstream side of each of these piers and sheathed with timber to form ice fenders, which were filled with rock. The remainder of the channel cross section through this bridge has riprap. (USACE, O&M Manual, 2000)

## 6.6. Drop Structures

### 6.6.1. Dyke Creek

This structure at Sta. 35+00 consists of a section of concrete-paved channel with Derrick stone and riprap protection upstream and downstream. The concrete paving covers the channel bottom and the side slopes to a height of 10.18 feet above the bottom, on a slope of 1 foot vertical on 2 foot horizontal, for a length of 49.26 feet. There is a fall of 8.52 feet in the upstream 19.26 feet, beyond which the bottom is level except for a sill at the downstream end 18 inches wide and one foot higher than the level area. Three lines of PZ-27 steel sheet piles extend the entire width of the concrete, one at each end and one at the break in the slope. Piles in each line are 10 feet long in the center of the channel and decrease at the edges in two steps to six feet, except at the right end of the upper line where the outer five piles were extended seven feet each by welding an additional length. The concrete paving has a minimum thickness of 18 inches across the channel bottom with thicker sections at the edges and at the break in grade. Paving on the side slopes decreases in thickness uniformly from 16 inches at the bottom to nine inches at the top. All the concrete paving is underlain by 12 inches of gravel. A strip 10 feet wide, extending across the channel above the concrete, and a similar strip 15 feet wide downstream are protected with two-foot thick Derrick stone underlain by 15 inches of gravel. A strip 32 feet wide across the bottom and side slopes at the upstream end of the structure is protected with 15 inches of riprap over six inches of gravel. There is a riprap toe at the downstream end. In the reaches paved with concrete or Derrick stone, there is a strip six feet wide on each bank, at levels higher than those thus paved, which is protected with 12 inches of riprap. Upstream from the structure, a 40-foot length of the right bank and, to the upstream limit of work, 653 feet on the left bank is protected with 12 inches of riprap. There is a riprap toe at the foot of each slope. Banks downstream of the drop structure are also rip rapped. The left bank has 30 inches of riprap overlying 15 inches of bedding, extending from downstream of the drop structure approximately 124 feet; 12 inches of riprap over six inches of bedding continues for an

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additional 174 feet. The right bank is rip rapped with 12 inches of stone for approximately 1,470 feet downstream. From the upstream end of the structure to the downstream end of the concrete paving, the channel bottom is 70 feet wide. It narrows to 50 feet between the downstream end of the concrete and the downstream end of the structure. (USACE, O&M Manual, 2000)

### **6.7. Sheet Pile Weirs**

Two steel sheet pile weirs are located on the river approximately 1,600 feet and 3,000 feet upstream of the former W.A. & G. Bridge. The weir located 1,600 feet upstream of the former W.A. & G. Bridge was originally constructed during the 1956 contract and was modified in the 1974 contract. This structure consists of a line of PZ-32 steel sheet piles, 36 feet long, extending across the river between the tops of both banks. Wherever it was necessary in the vicinity of this structure, compacted embankment was placed on the banks to bring the surface of the protected bank to the prescribed grade, but no fill was placed on the existing channel bottom. The right bank, upstream from the piles for a distance of about 487 feet, is protected with 12 inches of riprap with a riprap toe in the channel bottom. The left bank, upstream from the piles, is also protected with 12 inches of riprap extending for about 78 feet to an existing concrete intake structure. There is a riprap toe along the bottom and upstream side of the left bank protection. The channel bottom above the piles is not riprapped except for the rock toes on each bank. Immediately below the weir, the bottom width is 130 feet. The bottom is protected with three foot thick Derrick stone from the left bank toe extending across the channel bottom 93 feet, and the remaining 37 feet of channel bottom is protected with two-foot thick Derrick stone. The surface of the Derrick stone is four feet below the top of the weir. For a distance of 24 feet downstream of the weir, the three-foot thick Derrick stone gradually narrows to cover 74 feet of the channel bottom, and the remaining 56 feet is protected with two-foot thick derrick stone to a distance of 49 feet downstream of the weir. The 74-foot width of three-foot thick Derrick stone extends an additional six feet downstream; the two-foot thick derrick stone extends to a line 49 feet downstream of the weir, across the entire channel bottom, with a five-foot wide riprap toe at the lower end. The left bank side slope is protected with three-foot thick Derrick stone for a distance of 24 feet downstream of the weir, and for an additional 25 feet with two-foot thick Derrick stone; the slope is protected with 12 inches of riprap to a point 350 feet from the weir. The right bank side slope is protected with 18 inches of riprap for 55 feet downstream of the weir and with 12 inches of riprap for an additional 290 feet.

The sheet pile weir located about 3,000 feet upstream of the former W.A&G. Bridge consists of a line of PZ-27 steel sheet piles, 25 feet long, extending across the river between the tops of both banks. Wherever it was necessary in the vicinity of the structure, compacted fill was placed on the banks to bring the surface of the protected bank to the prescribed grade, but no fill was placed on the channel bottom. The right bank, upstream of the weir for a distance of 150 feet, is protected with 18 inches of riprap. The left bank, upstream from the weir, is also protected with 18 inches of riprap for a distance of 680 feet. This bank has a 10-foot wide rip rap toe at the top of bank for a distance of about 330 feet upstream starting at a point approximately 350 feet upstream of the weir. The channel bottom is riprapped with 18 inches of stone for a distance of 50 feet upstream of the piles. Both banks have the riprap protection toed into the channel bottom. Immediately below the weir is the stilling basin, 150 feet wide and 115 feet long. The bottom and side slopes are paved with two-foot thick concrete blocks with plan dimensions not less than 5.5 feet nor greater than 6.5 feet. The surface of the concrete blocks in the stilling basin is 8 feet below the top of weir. At the

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downstream end of the stilling basin is a steel sheet pile toe wall consisting of PZ-27 sheet piles, 14 feet long, extending 171 feet across the channel bottom. The top of the toe wall is two feet higher than the bottom of the stilling basin. For a distance of 25 feet downstream of the toe wall, the bottom and side slopes are paved with 2-foot thick concrete blocks with plan dimensions not less than 5.5 feet nor greater than 6.5 feet. The channel bottom downstream of the toe wall is two feet higher than the stilling basin bottom. The channel bottom for a distance of 100 feet downstream from the end of the concrete blocks is protected with 24 inches of riprap. The side slopes are protected with 30 inches of riprap for 50 feet downstream of the weir and for an additional 100 feet with 18 inches of riprap. Also on the left bank, the downstream nose of the earth levee is riprapped with 18 inches of stone. The bottom grade is 0.3 percent across the upper riprap, level across the stilling basin, and 0.065 percent downstream of the toe wall. See Table 5 below for details. (USACE, O&M Manual, 2000)

**Table 5. Dyke Creek Wellsville Sheet Pile Weir**

Description	Station	Top of Weir Elevation
Steel Sheet Pile Weir	33+47	1490.84

### **6.8. Spoil Areas**

Spoiled material was placed on both banks of the river near the downstream end of the project and upstream from Bolivar Road, on the right bank between the concrete drop structure and Pearl Street, on the right bank upstream of West Dyke Street to the barrier levee, from this barrier levee upstream to near the project limit, and on the right bank of Dyke Creek above State Street. (USACE, O&M Manual, 2000)

## **7. Culvert Inspections**

Culverts have been visually inspected during the past annual inspections. However, no video inspection records have been provided for review. No records of inspections for the miscellaneous culverts have been provided for review. According to the Buffalo USACE District, video or other methods to inspect the pipes are the responsibility of the sponsor. An attempt to collect this information from the sponsor will be made during the field inspections; however, if no documentation is available it will be noted as such in the Draft PI Report.

## **8. Hydrology and Hydraulics**

### **8.1. General**

The Genesee River has its source in Potter County, Pa., rising at an elevation of 2,200 feet in the Allegheny Mountains of northern Pennsylvania and flows northward to Lake Ontario at Rochester, N.Y. The watershed contains 2,476 square miles, 288.2 square miles of which are above Wellsville, N.Y. The southern part of the basin is rough with ridges having summits 2,000 to 2,500 feet above sea level separated by valleys whose floor elevations vary from 1,000 to 1,700 feet. The branches of the river in the headwater regions flow in deep narrow valleys and have average slopes of about 70 feet per mile. Dyke Creek drains a fan shaped area of about 72 square miles. The creek rises in Steuben County, N.Y., at an elevation of about 2,280 feet and flows westward to enter the Genesee River at an elevation

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of about 1,480 feet. The creek has an average slope of 95 feet per mile for 7.5 miles from its source and an average slope of 17 feet per mile for the lower 5 miles. The lower valley has an average width of about one-half mile and the steep hills flanking it contain many small, flashy tributaries. The channel capacities of the Genesee River and of Dyke Creek at Wellsville are estimated at 4,000 and 2,000 cubic feet per second, respectively. (USACE, Design Memorandum, 1955)

### 8.2. Climate

The climate of the Genesee River basin south of Wellsville is temperate. The prevailing wind is from the west. The average annual temperature of the watershed is about 45.4 degrees Fahrenheit and the average annual precipitation, including snow cover, is 36.2 inches.

Record gage heights for the Dyke Creek are included in Table 6. This information was obtained from the U.S. Geological Survey (USGS) National Water Information System website (<http://nwis.waterdata.usgs.gov/nwis>) for the Dyke Creek (USGS Site no. 04220500 Dyke Creek at Wellsville, NY.).

**Table 6. Ten Highest Recorded Peak Stream Flows for Dyke Creek at Wellsville**

Date	Stream Flow	Gage Height	Flood Elevation
Mar. 08, 1956	5,110	11.06	1503.24
Apr. 06, 1958	2,080	13.98 <sup>3</sup>	
Jan. 22, 1959	3,930	15.48 <sup>3</sup>	
Jun. 15, 1960	5,230	16.10 <sup>3</sup>	
Mar. 05, 1964	2,650	14.12 <sup>3</sup>	
Feb. 13, 1966	1,940 <sup>2</sup>		
Sep. 28, 1967	1,990	13.51 <sup>3</sup>	
Oct. 19, 1967	1,990 <sup>2</sup>		
Apr. 05, 1969	1,900	13.44 <sup>3</sup>	
Jun. 23, 1972	1,200 <sup>7,9</sup>		

Gage Datum 1492.18 feet above sea level (NGVD29)

Peak Gage Height Qualification codes:

- 3 – Gage height at different site and (or) datum

Peak Stream flow qualification codes:

- 2 – Discharge is an Estimate
- 7 – Discharge is an Historic Peak
- 9 – Discharge due to Snowmelt, Hurricane, Ice Jam or debris dam breakup

## 9. History of the System

Based on documentation provided by the Buffalo District USACE, the following paragraphs provide a brief summary of changes and events pertaining to the Wellsville FDRP. Portions of the Wellsville FDRP have been modified since the original construction. These modifications are summarized below and are taken from the O&M Manual.



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## 9.1. Construction History

Construction was initiated by contract in July 1956 and was completed in February 1958. This original construction improved the channel from a point 2,700 feet north of Bolivar Road to a point 1,815 feet upstream of the former Wellsville, Addison, and Galetton (W.A. & G.) Railroad Bridge. Additional bank protection was placed under contract modifications in June-July 1958 and September 1959. The latter resulted from the January 1959 flood which damaged and eroded the rip rap slopes near the upstream limit on Dyke Creek and upstream of the railroad bridge on the Genesee River. The prime contractor was Gasparini Excavating Company of Peckville, PA. The project was given its final inspection before acceptance by local interests on 15 August 1958.

Tropical storm "Agnes" caused extensive damage to the original flood control project at Wellsville. Emergency restoration work was accomplished by plant rental and supply contract, under Public Law 99, 84th Congress, to restore the Genesee River and Dyke Creek channels to their pre-"Agnes" condition. This work involved almost the entire length of the improved river and creek channels. The work accomplished was shoal removal, replacement of compacted embankments and levees and restoration of bank stone protection where required. This work was initiated in June 1972 and was completed in November 1972.

Rectification work was required to improve the original project. Construction was initiated in July 1973 and completed in July 1974 by Hull-Hazzard Inc., Syracuse, NY under Contract No. DACW49-73-C-0158. The work under this contract involved channel widening and levee construction in the area between West Genesee Street and the downstream concrete drop structure. Also, in the reach of the Genesee River between State Street bridge and extending approximately 5,050 feet upstream, work involved channel widening, levee construction, placement of additional riprap, and the extension and lowering of a steel sheet pile weir. Dyke Creek work involved channel widening, levee construction and placement of additional stone protection all upstream of Miller Street.

Additional rectification work was further required and construction was started in June 1976 and completed in November 1976 by Frank DiMino Inc. of Rochester, NY under Contract No. DACW49-76-C-0059. This work involved the extension of the upstream project limits including the construction of a steel sheet pile weir, levee construction, and channel realignment and widening, and the placement of additional stone protection. Dyke Creek work involved channel excavation and placement of additional stone protection between Broad Street and Miller Street. This work was indicated in the superseded April 1977 Operation and Maintenance Manual.

The NYSDOT completed two construction contracts, in conjunction with the realignment of Routes 17 (re-designated 417) and 19, along the Genesee River and Dyke Creek. The first phase was completed in 1974 and involved the relocation of approximately 1,900 feet of the river, downstream from State Street, toward the left bank to provide room for the new highway, and the construction of a new bridge over the river connecting West Madison and Stevens Streets. The second contract, completed in 1977, involved highway construction along the river and some channel work between Bolivar Road and the confluence with Dyke Creek. Work along Dyke Creek involved channel relocation and placement of bank protection, with the construction of a new bridge over the creek near Hanover Creek. This

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work had been reviewed by the Buffalo District, Corps of Engineers; it did not have a detrimental effect on the existing project.

Emergency rehabilitation work under Public Law 99, 84th Congress, was required to repair extensive damage to the project from the January 17-20, 1996 Thaw flood event. Material from eroded banks of the project, as well as farther upstream, was deposited as shoals in the channel, reducing its capacity. Initial emergency repair work (January 24-26) involved placement of rip rap in two areas on 700 feet of eroded banks - left bank of Dyke Creek upstream of Miller Street (450 feet) and left bank of Genesee River near Seneca Street (250 feet). The rehabilitation work was started in November 1996 and completed in May 1997 by Haseley Consultants/Construction Inc. of Niagara Falls, NY under Contract No. DACW49-97-C-0003. See table 7 below for contractor information. (USACE, O&M Manual, 2000)

Several local projects, which occurred in the vicinity of the flood control project since the April 1977 edition of the manual, include:

- A. Route 417 (Bolivar Road) bridge replacement over the Genesee River in 1987
- B. Levee construction with riprap protection on Dyke Creek beyond the upstream limit of the project by U.S. Soil Conservation Service in 1992
- C. South Main Street bridge replacement over Dyke Creek in 1992, and
- D. "Riverwalk" shopping center construction at the southwestern corner of the intersection of Genesee River and Route 417 (Bolivar Road) by L.c. Whitford Co., Inc. in 1994.

**Table 7. Contract information**

Contract#	Contractor	Construction Period	
		Start	Complete
DACW49-73-C-0158	Hull-Hazzard Inc., Syracuse, NY	July-1973	July-1974
DACW49-76-C-0059	Frank DiMino Inc., Rochester, NY	June-1976	Nov.-1976
DACW49-97-C-0003	Haseley Consultants/Construction Inc., Niagara Falls, NY	Nov.-1996	May-1997

## 10. Most Current Periodic Inspections

The local Flood Protection 2007 Inspection Report for Flood Control Works produced by the USACE Buffalo District rated the Wellsville, New York, Flood Damage Reduction Project "MINIMALLY ACCEPTABLE" (M). Reportable deficiencies were identified during the inspection. A list of minor deficiencies is listed under section 7 b. of the Inspection Report.

A copy of the local Flood Protection 2007 Inspection Report for Flood Control Works produced by the USCE Buffalo District is attached in Appendix C. Prior to the FY2007 Inspection, the project was last inspected on September 21, 2006. The condition of the

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project at the time of that inspection was rated as "Excellent" (C-1), which roughly compares to the "Acceptable" (A) rating under the current rating system.

### **10.1. Potential Deficiencies**

No potential deficiencies were reported

### **10.2. Minor Deficiencies**

1. A gravel pile is located on the left bank of the Genesee River at the confluence of Crowner Brook. This deficiency was also noted in the FY 2006 inspection. This deficiency must be corrected by 12/31/08.
2. Heavy vegetation exists along the side slopes of the Genesee River channel in various locations. Significant areas include between the Route 17 Bridge and the Chamberlain Street levee, in the vicinity of Island Park, and near the two upstream weirs. There may be other areas which require vegetation removal. This deficiency must be corrected by 12/31/08.
3. There are a number of trees growing in the Chamberlain Street levee, as well as within 15 feet of the landward toe. This deficiency must be corrected by 06/30/09.
4. There is a garden located on the landward side slope of the Chamberlain Street levee, upstream of the drop structure. This deficiency must be corrected by 12/31/08.
5. There is a tree stand (wooden children's playground) located on the Chamberlain Street levee. This deficiency must be corrected by 12/31/08.
6. Low height soft vegetation is growing in the concrete lining along the Dyke Creek channel near Island Park. This deficiency must be corrected by 12/31/08.
7. Heavy vegetation exists along the side slopes of the Dyke Creek channel, particularly upstream of the Broad Street Bridge to the Dyke Creek drop structure. This deficiency must be corrected by 12/31/08.

### **10.3. Serious Deficiencies**

No Serious deficiencies were reported

### **10.4. Summary of Maintenance Required by Last Inspection Report**

1. Vegetation exists along the channel side slopes and within rip rapped areas. Woody growth is also growing along Dyke Creek.
2. A gravel pile on the left bank of the Genesee River, at the confluence of Crowner Brook, should be removed.
3. Shoaling is starting to re-form at the upstream project limits on both the Genesee River and Dyke Creek.
4. Encroachments exist along the landward side of the Chamberlain Street levee.

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### **10.5. Summary of Maintenance Performed since last Inspection**

1. Shoals at upstream project limits on the Genesee River were removed.
2. The other maintenance reported by the 2006 inspection report appears to not have been done.

### **10.6. Problems / Issues Requiring Assistance of USACE**

The Corps needs to review existing encroachments as described in Section 10.7. below and issue after the fact project modifications to allow them, if appropriate. If not appropriate, encroachments will have to be removed or rectified.

### **10.7. Additional Observations**

1. With the exception of vegetation control, the project is generally in good condition and is being adequately maintained by the local sponsor.
2. There are a number of encroachments within the project limits as follows:
  - a. A gravel pile exists on the left bank of the Genesee River downstream of the Route 417 Bridge, near the confluence of Crowner Brook (pile was reported in the 2006 inspection report).
  - b. There are trees in the landward side slope of the Chamberlain Street levee, upstream of the drop structure. Trees also exist within 15 feet of the landward toe of the levee.
  - c. There is a garden located on the landward side slope of the Chamberlain Street levee, upstream of the drop structure. A pond is located within 15 feet of the landward toe of the levee.
  - d. Several structures are located within 15 feet of the landward toe of the Chamberlain Street levee, including sheds and garages.
  - e. There is a tree stand (wooden children's playground) located on the Chamberlain Street levee.

### **10.8. Recommendations and Maintenance Required as a Result of the FY 2007 Inspection**

1. The project sponsor needs to have a written system-specific Flood Emergency Response Plan to document that they have a solid understanding of how to operate, maintain and staff the Flood Damage Reduction project during a flood. The project sponsor must physically produce a copy of the project Operations and Maintenance manual and the written Emergency Response Plan for Corps review during all future project inspections beginning in 2008. Failure to provide these required documents will result in a "Minimally Acceptable" (M) rating for these specific items and an overall project rating that will also be no better than "Minimally Acceptable" (M).

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2. For all future project inspections beginning in 2008, the condition of all culverts or discharge pipes must be verified by a qualified professional by using video camera or visual inspection methods at a frequency of not less than five years. Inspection reports for all pipes must be available for review during inspection. Failure to produce these required documents during an inspection will result in a "Minimally Acceptable" (M) rating for these specific items and an overall project rating that will also be no better than "Minimally Acceptable" (M).
3. The internal drainage facilities for this project need to be more thoroughly inspected for the next joint routine inspection (currently scheduled for summer 2008). Gate wells will need to be physically operated during the inspection to demonstrate they are operating properly. Flap gates will also be inspected.
4. The gravel pile located on the left bank of the Genesee River at the confluence of Crowner Brook needs to be removed.
5. Heavy vegetation along the side slopes of the Genesee River channel in various locations needs to be removed. Significant areas include between the Route 17 Bridge and the Chamberlain Street levee, in the vicinity of Island Park, and near the two upstream weirs. There may be other areas which require vegetation removal.
6. All trees growing in the Chamberlain Street levee must be removed and the levee properly repaired after removal. Trees within 15 feet of the landward and water ward toes of all project levees must also be removed, provided that they are within the current project easements.
7. The garden located on the landward side slope of the Chamberlain Street levee, upstream of the drop structure, must be removed and the levee restored to proper condition.
8. The tree stand (wooden children's playground) located on the Chamberlain Street levee.
9. The low height soft vegetation is growing in the concrete lining along the Dyke Creek channel near Island Park needs to be removed.
10. The heavy vegetation which exists along the side slopes of the Dyke Creek channel, particularly upstream of the Broad Street Bridge to the Dyke Creek drop structure, needs to be removed.
11. USACE and NYSDEC review and approval are required before any encroachment can be constructed or allowed. Encroachments will be examined more thoroughly during the next joint routine inspection. Encroachments not approved will need to be removed or rectified. Encroachments that can be approved will require a project modification to be signed by the Corps and NYSDEC after a thorough review. Encroachments which must be reviewed further to determine whether or not Corps approval can be granted include buildings located within 15 feet of the landward toe of the Chamberlain Street levee and the pond.



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### **10.9. Continuing Eligibility Inspection (Routine) Report (USACE, 2007)**

The 2007 inspection report uses a format that allows the user to rate individual components of the levee system based on criteria provided in the inspection report template. The ratings for each item can be "Acceptable", "Minimally Acceptable", or "Unacceptable" and the inspection report template provides definitions for each rating. The user also assigns an overall segment/system rating of "Acceptable", "Minimally Acceptable", or "Unacceptable" to the levee system. A rating of "Unacceptable" may be based on engineering judgment that deficiencies noted during the inspection would prevent the system from functioning as intended during the next flood event or "the sponsor's demonstrated lack of commitment or inability to correct serious deficiencies in a timely manner". The 2007 report reports an overall segment/system rating of "Minimally Acceptable". No items received "Unacceptable" ratings during the 2007 inspection. Remarks and recommendations for each of the ratings may be found in the 2007 inspection report provided in Appendix D.

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**Table 8. Wellsville FDRP 2007 Continuing Eligibility Inspection Report  
Summary of Results**

Category	Item	Rating
Overall Segment/System Rating		Minimally Acceptable
General Items	Operations and Maintenance Manuals	Acceptable
	Emergency Supplies and Equipment	Acceptable
	Flood Preparedness and training	*
Levee Embankments	Unwanted Vegetation Growth	Minimally Acceptable
	Sod Cover	Acceptable
	Encroachments	Minimally Acceptable
	Closure Structures	N/A
	Slope Stability	Acceptable
	Erosion / Bank Caving	Acceptable
	Settlement	Acceptable
	Depressions / Rutting	Acceptable
	Cracking	Acceptable
	Animal Control	Acceptable
	Culverts/Discharge Pipes	*
	Riprap Revetments and bank Protection	Acceptable
	Revetments other than Riprap	Acceptable
	Under seepage Relief Wells/ Toe Drainage Systems	N/A
	Seepage	Acceptable
Interior Drainage System	Vegetation and Obstructions	Acceptable
	Encroachments	Acceptable
	Ponding Areas	Acceptable
	Fencing and Gates	Acceptable
	Concrete Surfaces	Acceptable
	Tilting, Sliding or Settlement of Concrete and Sheet Pile Structures	Acceptable
	Foundation of Concrete Structures	Acceptable
	Monolith Joints	N/A
	Culverts/Discharge Pipes	Acceptable
	Sluice/Slide Gates	Acceptable
	Flap Gates/Flap Valves/Pinch Valves	Acceptable

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**Table 8. Wellsville FDRP 2007 Continuing Eligibility Inspection Report  
Summary of Results**

Category	Item	Rating
	Trash Racks	N/A
	Other Metallic Items	Acceptable
	Riprap Revetments of Inlet/Discharge Areas	Acceptable
	Revetments other than Riprap	N/A
Channels	Vegetation and Obstructions	Minimally Acceptable
	Shoaling (sediment deposition)	Acceptable
	Encroachments	Acceptable
	Erosion	Acceptable
	Concrete Surfaces	Acceptable
	Tilting, Sliding or Settlement of concrete Structures	Acceptable
	Foundation of Concrete Structures	Acceptable
	Slab and Monolith Joints	Acceptable
	Flap Gates/Flap Valves/Pinch Valves	Acceptable
	Riprap Revetments & Banks	Minimally Acceptable
	Revetments other than Riprap	Minimally Acceptable

## 11. Identification of Fracture Critical Members

No information related to identification of fracture critical structural elements in this levee was provided to Stantec for review.

## 12. Levee Performance During Major Flood Events

Information regarding past performance during major flood events of the FDRP was not available by the USACE Buffalo District. Past historical flood data is provided in Table 6. The limited information provided in the Design Memorandum (USACE, 1966) is included in the paragraphs below. However, with regard to past performance of the levee during flood events, definitive conclusions cannot be made without additional documentation.

During the field inspection, Stantec will attempt to obtain records (if available) that the sponsor may have regarding past flood levels for the area.

### 12.1. Deficiencies in Design of Existing project

The existing project was designed for the following flood flows, see Table 9 below

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**Table 9. Designed Flood Flows for the Wellsville FDRP**

	<b>1955 Design Flood</b>	<b>1966 Design Flood</b>
Dyke Creek	5,350 cfs	7,300 cfs

Based on the records available prior to 1956 when preconstruction planning was completed, the design discharge on Dyke Creek to have about 2 percent chance of occurrence. However, since completion of project planning, they have been nearly equaled or exceeded every year, and the estimated frequencies thereof have increased.

Since completion of the project only very minor flood damages have been incurred, even though flood flows exceeding the design discharges have been experienced. This is because the actual flood profiles have been less than were anticipated for the related discharges. The largest discharges experienced, though considerably in excess of design discharges, have resulted in flood profiles approximately equal to design profiles. Thus, the completed channel improvements have proven to be more efficient than anticipated from the original design computations, that is, they pass a given discharge through the project area more rapidly (at higher velocities) than predicted.

Despite the fact that flood discharges have so far been contained by the project, it is nonetheless true that the project does not afford the degree of protection intended, and a potential exists for serious flooding. Further, the high velocities which have accompanied these discharges have had a detrimental effect on the project itself.

The project was designed to carry the design discharges with a mean velocity of 7 feet per second with steady uniform flow. Thus, occurrence of 7-foot-per-second velocities was expected to be very infrequent, and bank protection was provided only at curves, bridges and on steep side slopes. However, since construction, the design discharges have been approached or exceeded frequently and the accompanying velocities, due to the unexpected efficiency of the project channels, have been higher than was anticipated. Greater lengths of channel banks have therefore been exposed to high velocities, accounting for the erosion that has taken place in some unprotected sections. Further, on protected sections, although the riprap itself is adequate to withstand the higher velocities, deterioration of the adjacent unprotected sections has exposed the ends of the riprap to progressive unraveling.

### **12.2. Other Deficiencies**

The area on the right bank of Genesee River between the lower drop structure and Bolivar Road is a low undeveloped area, formerly subject to frequent flooding. The project was expected to provide sufficient protection to this area as to permit its development for residential use. Local interests (the Village of Wellsville) contributed \$50,000 toward Federal project costs in return for this expected enhancement. The project has considerably reduced flooding at this location but, since the potential for serious flooding obviously still exists, no development has taken place.

### **12.3. 1966 Additional Improvements to Levee**

Where channel improvements were contemplated, the channel bottom was excavated to specified depths and bottom widths, and the banks cut on a slope of 1V:2.5H. The new

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barrier levees would be constructed of compacted embankment; levee side slopes would be 1V:2.5H; an inspection trench would be excavated along the center line of the levee; crest widths would be 10 feet; and crests would be at least one foot above the hydraulic energy level of the design discharge. Heights of the sections of barrier levee would range from two to eight feet, including freeboard, with the average about four feet. The existing channel banks would be raised in several locations with compacted embankment; the embankment side slope would be 1V:2H; crest widths would be 10 feet and crests would be one foot above the design water surface. The one exception to this is the embankment on the right bank, where the crest would beat design water surface profile. Heights of the various sections of compacted embankment would range from two to six feet including freeboard, with the average about four feet. Bank and bottom protection would be a 12 inch layer of dumped riprap on a 6 inch bedding layer. Where protection was required on a levee slope, it would extend to the top of the levee. The vicinity of the Wellsville, Addison and Galetton Railroad Bridge is the only location where bottom protection would be provided. At locations where only slope protection is contemplated (no paving on channel bottom) the total 18 inch thickness of riprap will terminate in a 3 foot toe at the edge of the channel.

### **12.4. Modification of Existing Drop Structure**

The weir crest of the drop structure below Pearl Street would be lowered four feet, from elevation 1478.11 to 1474.11. The weir is reinforced concrete, five feet high and two feet thick.

### **12.5. Modification of Existing Steel Sheet Pile Weir**

The existing steel sheet pile weir is a single line of Z-32 sheet piling located at station 103+00. The crest of the weir would be lowered three feet, from elevation 1488.00 to elevation 1485.00 and the crest would be lengthened from 114 feet to 150 feet. The channel bottom upstream of the weir would be at elevation 1482 thus creating a pool three feet deep. The village would draw its water supply from this pool. To prevent erosion of the channel, derrick stone would be placed from the weir to station 103+54. New Z-32 steel sheet piling would be used for making the modification to the weir.

## **13. Design Criteria Review**

This section provides details on specific design criteria for the Wellsville FDRP. This section was developed from a review of available documentation from the USACE Buffalo District and USACE design criteria guidance and policies. A draft design criteria check list developed by Stantec for the review of this levee system is included in Appendix D.

### **13.1. Geotechnical**

#### **13.1.1. Slope and Foundation Stability**

According to the 1955 Design Memorandum,

- a. General: The design criteria used in developing the project plan are presented in the following paragraphs.

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- b. Design discharges: The design discharges adopted for the Wellsville project are based on the estimated discharges from the maximum floods of record on the Genesee River and on Dyke Creek at Wellsville.
- c. Channel cross section: The improved channel is trapezoidal in shape, with varying bottom widths.
- d. Velocity: Stream bed and bank materials through Wellsville are erosion resistant and can withstand fairly high velocities. The improved channels have been designed to carry the design discharges with a mean velocity of 7 feet per second with steady uniform flow. Thus, occurrence of 7-foot per second velocity will be very infrequent and no bank protection is considered necessary except at curves, bridges and places where steep side slopes occur.
- e. Channel roughness coefficients: A roughness coefficient (Manning's "n") of 0.030 was adopted for use in design of the improved channels.
- f. Bottom grades: The depths and slopes of the improved channels have been governed by topography and other design criteria listed above.
- g. Side slopes: Channel side slopes have been covered by stability of bank material and maintenance requirements. The adopted side slopes are 1 on 2½ except at places where channel banks were made steeper to avoid alteration of existing structures and at places where riprap is required.
- h. Riprap: Riprap will be provided wherever channel velocities exceed 7 feet per second, channel curvature exceeds 6 degrees, and where protection of bridge abutments is required due to lowering of the existing grade. Riprap will also be placed at the confluence of the Genesee River and Dyke Creek to prevent any possibility of scour.

A factor of safety was not provided.

The current design criteria for new levees are summarized in Table 10.

**Table 10. Design Criteria for Slope Stability**

Levee Slope Stability	Required Factor of Safety
End of Construction	1.3
Long Term (Steady Seepage)	1.4
Rapid Drawdown	1.0 – 1.2
Earthquake	See ER 1110-2-1806

A slope stability analysis was not available for review. There is no record in the design memorandum of an earthquake analysis being performed for the levee.

There is no record of observed embankment or foundation failures in the previous inspection report and no other data was provided for review. An attempt to collect this information from



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the sponsor will be made during the field inspections; however, if no documentation is available it will be noted as such in the Draft PI Report.

### 13.1.2. Settlement

No engineering analysis of settlement is provided in the design report. No documentation was available to. There is also no record of settlement related issues in the previous inspection report. An attempt to collect this information from the sponsor will be made during the field inspections; however, if no documentation is available it will be noted as such in the Draft PI Report.

### 13.1.3. Levee Embankment and Seepage Control

The design criteria and as-built conditions for the levee embankment and seepage control are provided in Table 11. The embankment meets the minimum required dimensions and slopes.

**Table 11. Design Criteria for Levee Embankment and Seepage Control**

Parameter	Current Design Criteria	As-Built Condition
Crown Width	10-12 feet	10 feet minimum
River Side Slopes	1(V):2(H)	1 (V):2.5(H)
Land Side Slopes	1(V):2(H)	1 (V):2.5(H)
Horizontal Drainage Layer	Minimum of 1.5 feet thickness	Not Present
Landside Seepage Berms	Not Present	Not Present
Upward Gradient at the toe side of the levee	Between 0.5 and 0.8 with a berm Gradient less than 0.5	No seepage data or analysis provided for as-built embankment section
Pervious Toe Trench	2-6 feet	Not present
Filter Criteria	See Appendix D	No filter material used
Pressure Relief Wells	See Appendix D	Not Present
Seepage Conditions vs. Gradients	See Appendix D	No seepage data or analysis provided for as-built embankment section
Levee Landside Ditches	See Appendix D	Not Present

The original design did not identify the need for pressure relief wells to address seepage. The levee system was generally constructed in accordance with the design criteria that existed at the time of the construction. The available data does not allow the levee design to be compared to current design criteria and given the evolution of design criteria over the years, further analyses would be required in order to demonstrate otherwise. This analysis is beyond the scope of this task order.

### 13.1.4. Structural

Structures include the pipe and headwalls for interior drainage through the levee. There are no floodwalls or closure structures on this project.

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No structural analysis calculations, results or summary was provided in the design report and therefore could not be reviewed. Technical review of the design memoranda indicated that concrete pipe was to comply with D-Load requirements and should have pressure type gasketed joints. No requirements for D-Load or for pressure pipe are shown on the plans so the adequacy of the reinforced concrete pipes could not be evaluated.

There is no record of observed structures failures in the previous inspection report. Without a structural analysis, no conclusion can be made regarding the adequacy of the structures to meet the required structural design criteria.

Based on a review of the Wall Foundation Stability Analysis presented in Appendix D of the Design Memorandum on Local Flood Protection (USACE, 1955), it appears the structural elements met design criteria at the time of construction. Given the evolution of design criteria over the years, the design calculations do not allow a conclusion to be made regarding adequacy of the design to meet current design criteria guidelines without performing additional stability analysis.

### **13.2. Hydrology and Hydraulics**

#### **13.2.1. Level of protection**

Based on the USACE provided Wellsville O&M Manual, The Genesee River channel was designed for a flow of 21,500 cfs. below the mouth of Dyke Creek and 17,300 cfs. Above the creek. The Dyke Creek channel was designed for a flow of 7,300 cfs. The project was originally designed to protect the Village of Wellsville against damage from floods equal to a two-percent chance exceedence flood in the Genesee River and Dyke Creek and to reduce damages in the event a larger flood should occur on either. The improvement was extended downstream into the town of Wellsville far enough to accomplish the desired lowering of stages in the village. Latest frequency curves indicate full protection against a 2.5-percent flood. The two percent flood has one chance in 50 years of being exceeded in any given year, while the 2.5-percent flood has one chance in 40 years of being exceeded. Peak flows on the two streams do not occur simultaneously. The modifications undertaken by the New York State Department of Transportation (NYSDOT) on the river and creek are capable of passing the design flows stated above.

EM 1110-2-1913 (USACE, 2000) references current level of protection design criteria for levees. Section 6-1, Paragraph b states that “the term and concept of freeboard to account for these (hydraulic) uncertainties is no longer used in the design of levee projects” and “risk-based analysis directly accounts for hydraulic uncertainties and establishes nominal top of protection”. A risk-based analysis was not available for the Wellsville FDRP; therefore, current Federal Emergency Management Agency (FEMA) design criteria used to meet the requirements of Code of Federal Regulations (CFR) 65.10 of the National Flood Insurance Program (NFIP) have been referenced for the design criteria review with respect to hydrology and hydraulics.

FEMA specifies that all levees must have a minimum of 3 feet of freeboard against the 100-year flood (FEMA, 2008).

Definitive conclusions regarding adequacy of the systems level of protection from hydrology and hydraulics standpoint cannot be made due to lack of a current risk-based analysis and

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complete documentation with regards to past performance of the levee during flood events more severe than the FEMA 100 year event.

### **13.2.2. Interior Drainage**

Stantec did not locate historic interior drainage design criteria in the Contract Plans (USACE, 1966), Operation and Maintenance Manual (USACE, 2000), or Design Memorandums (USACE, 1955,1964,1966).

For the purposes of this design criteria review, current FEMA guidelines used to meet the requirements of Code of Federal Regulations (CFR) 65.10 of the National Flood Insurance Program (NFIP) are referenced. In general, the base flood is referenced as a planning guideline to follow which is generally the 100-year storm event.

Due to a lack of documentation of historic interior drainage design criteria, Stantec cannot verify that the interior drainage system complies with current design standards. Based on the evolution of design criteria over the last 44 years, Stantec assumes that the interior drainage system of the Wellsville FDRP does not meet present-day design criteria until further analyses demonstrate otherwise. These analyses are beyond the scope of this task order.

### **13.2.3. Water Works (Pipe Penetrations, Crossings, Manholes, and Catch Basins)**

The pipes that will be evaluated in the field include pipes that penetrate or cross levees or structural elements. The levees and structural elements were constructed over existing storm and sewer pipes. These pipes will not be evaluated during the field inspection unless they are determined to directly impact the Wellsville FDRP.

### **13.2.4. Pipe Materials**

Based on historic reliability issues with corrugated metal pipe (CMP) for gravity drains, the minimum standard for these pipelines is reinforced concrete pipe (RCP). As-built drawings (USACE, 1973) for the Wellsville FDRP indicate that pipe lines associated with the FDRP are constructed of corrugated metal pipe (CMP) or cast iron pipe (CIP). Pipe materials will be verified during the field inspection.

### **13.2.5. Pipe Penetrations and Crossings**

USACE design criteria indicates that all pipes that cross over or through the levee should be in known good condition, be able to withstand levee loading, and have adequate cover for frost. Pipelines crossing over the levee are encouraged to be within the freeboard zone. Pipes observed in the field will be noted and reviewed using these criteria.

It is indicated that the interior drainage pipes contain flap gates and no slide gates. The gates will be noted and reviewed with the following criteria. All pipes should have devices that assure positive closure. Gravity lines should be provided with flap-type or slide-type service gates on the riverside of the levee. Automatic flap-type gates are usually used where the water is likely to rise to the "Gate Closing Stage" rather suddenly and where the water stage is likely to fluctuate within a few feet above and below the "Gate Closing Stage" for prolonged periods of time during flood season. Automatic gates are also required on slower rising streams or bodies of water where frequent visit from operating personnel are not practical.

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### **14. Responsibilities of Operation and Maintenance of Flood Protection Works**

In accordance with the assurances of local cooperation and letter from the Department of the Army to the State of New York dated October 7<sup>th</sup>, 1955, attached in Appendix E, the Government transferred all operation and maintenance functions to the State of New York. As of May 1967, the state's responsibilities shifted from the Public Works to the Conservation Department, which later became the Department of Environmental Conservation (NYSDEC). Operation and Maintenance is to be in accordance with the provisions in the O&M Manual.

As indicated in the O&M manual, the Superintendent has a general responsibility for maintaining and operating the structures and facilities, particularly in flood periods. The name and address, and telephone number of the superintendent shall be furnished to the District Commander; USACE Buffalo District.

### **15. Emergency Action Plan**

A flood Emergency Plan was provided for review. The Response Plan indicates the following flood preparedness for the NYSDEC Region 9 projects.

1. High Water Stage Response
2. Planning contact and emergency numbers
3. Project features and County map
4. Flood plan response
5. Evacuation plan

### **16. Developments Since Last Periodic Inspection**

No information has been provided for review of developments for the levee since the last annual inspection. Inspections from 2007 have been reviewed for this levee. Any new information will be collected during the field inspections. If no new documentation is available it will be noted as such in the Draft PI Report.

### **17. Inspection Checklists**

A USACE Inspection Checklist will be used for the upcoming field inspection. The actual Inspection Checklist will be automatically generated as a part of the final report process using the Levee Inspection System (LIS) software.

### **18. References**

National Geodetic Survey (NGS), 2009. Vertcon: North American Vertical Datum Conversion. 13 October, 2009

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- United States Army Corps of Engineers (USACE). 1987. EM 1110-2-1413: Hydrologic Analysis of Interior Areas.
- United States Army Corps of Engineers (USACE). 1989. EM 1110-2-2502: Retaining and Flood Walls.
- United States Army Corps of Engineers (USACE). 1994. EM 1110-2-2705: Engineering and Design - Structural Design of Closure Structures for Local Flood Protection Projects.
- United States Army Corps of Engineers (USACE). 2000. EM 1110-2-1913: Design and Construction of Levees.
- United States Army Corps of Engineers (USACE). 2003. EM 1110-2-2104: Strength Design for Reinforced Concrete Hydraulic Structures.
- United States Army Corps of Engineers (USACE). 2005. EM 1110-2-2100: Stability Analysis of Concrete Structures.
- United States Army Corps of Engineers (USACE). 1998. EM 1110-2-2902: Engineering and Design Conduits, Culverts and pipes.
- United States Army Corps of Engineers (USACE). 2007. EC 1110-2-6065: Engineering and Design Comprehensive Evaluation of Project Datum.
- United States Army Corps of Engineers (USACE). Local Flood Protection, Wellsville, New York, 1956 Drawings 1 through 19, 1973 Drawings 1 through 13, 1976 Drawings 1 through 5.
- United States Army Corps of Engineers (USACE). 1955. Genesee River and Dyke Creek Wellsville, New York. Design Memorandum on Local Flood Protection.
- United States Army Corps of Engineers (USACE). 1964. Design Memorandum for Rectification of Deficiencies in Completed Local Flood Protection Project. Wellsville, New York.
- United States Army Corps of Engineers (USACE). 1966. Design Memorandum for Rectification of Deficiencies in Completed Local Flood Protection Project. Wellsville, New York.

## Appendix G

### Independent Technical Review




## INDEPENDENT TECHNICAL REVIEW (ITR) Team Certification and Memorandum

Project: Periodic Levee Inspection, U.S. Army Corps of Engineers Buffalo District

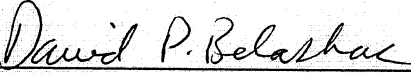
Segment Name: Wellsville Right Bank Levee, NY

Review Date: 9 September, 2010

The Stantec Consulting Services, Inc has completed the Periodic Inspection for the above referenced levee system and has developed the report included herein. Notice is hereby given that an Independent Technical Review, that is appropriate to the level of risk and complexity inherent in the project, has been conducted as defined in the Project Quality Plan. During the independent technical review, compliance with established policy, principles, and procedures, utilizing justified and valid assumptions, was verified. This included review of: assumptions; methods, procedures, and material used; the appropriateness of data used and level obtained; and reasonableness of the result, including whether the product meets the customer's needs, and existing Corps policy. The independent technical review was accomplished by a team separate from the project delivery team. All comments resulting from ITR have been resolved.

  
\_\_\_\_\_  
Donald L. Bashan, PE (KY # 8938)  
ITR Team Leader

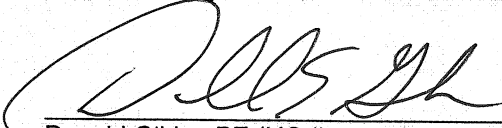
09/14/2010  
Date

  
\_\_\_\_\_  
David P. Belaskas, PE (NY # 073048-1)  
Inspection Team Leader

9/15/2010  
Date

### CERTIFICATION OF INDEPENDENT TECHNICAL REVIEW AND QUALITY ASSURANCE REVIEW

Significant concerns and the explanations of the resolution are included in the ITR Review Comment Form that follows. As noted above, all concerns resulting from the independent technical review of the project deliverables have been fully resolved and the Periodic Inspection Report revised accordingly.

  
\_\_\_\_\_  
Donald Gibbs, PE (NC # 29814)  
Task Order Manager

9/15/10  
Date

## ITR Review Comments

Project: Periodic Levee Inspection, U.S. Army Corps of Engineers Buffalo District

System Name: Wellsville Right Bank Levee and Dyke Creek, NY

Review: This document includes all comments and responses resulting from the Independent Technical Review (ITR). All comments were discussed between the review team and the report team and were resolved prior to submittal.

Reviewer/Discipline:

Donald Basham, PE (KY # 8938), Civil

Date: 9 September 2010

Responses: Donald Gibbs, PE (NC # 29814), Civil

Date: 9 September 2010

No.	Page, Para. #	Reviewer Comment	Preparer Response	Concur (Y –N)	Reviewer Acceptance Y = Accepted N = Not Accepted
Review Comments by Donald L. Basham, Civil, 9/9/2010					
1	Exec. Summary	Inspection Results only cover the Levee feature where as under Recommendations Interior Drainage and FDR Channel is addressed. Should include Inspection Results that are consistent with the recommendations proposed.	Revised and included results consistent with the recommendations proposed on page E-2.	Y	Y
2	Exec Summary	The headings O&M, General, and Safety Recommendations and corresponding recommendations are not consistent with the body of the report write-up in par. 5. While just a summary they should align with the report format.	Revised report summary and align to report format.	Y	Y

## ITR Review Comments

Project: Periodic Levee Inspection, U.S. Army Corps of Engineers Buffalo District

System Name: Wellsville Right Bank Levee and Dyke Creek, NY

Review: This document includes all comments and responses resulting from the Independent Technical Review (ITR). All comments were discussed between the review team and the report team and were resolved prior to submittal.

Reviewer/Discipline:

Donald Basham, PE (KY # 8938), Civil

Date: 9 September 2010

Responses: Donald Gibbs, PE (NC # 29814), Civil

Date: 9 September 2010

3	2/2.2 & 3/2.2.2	Construction completion dates in these two par. do not appear consistent. Par. 2.2 has completion in 1966 where Par. 2.2.2 has 1958 which would appear to be built under the original 1950 Act. If there is a difference in the dates associated with the term "original" in par. 2.2.2 suggest explaining. Would also note that construction was completed the same year as authorized which is not typical. The 1966 date is not mentioned any where in par. 2.2.7.	Construction completion date in 1958 was the original phase. There is no difference in dates. Report updated to clarify date.	Y	Y
4	8/4.2.3	The levee described on the Left descending bank is not part of this report. For clarity consider deleting the description of the Left descending levee since it is not part of this segment or report.	Paragraph clarification made and revised.	Y	Y
5	9/4.2.3.4	Need to confirm if the encroachments are likely to inhibit operations and maintenance, emergency operations, or negatively impact the integrity of the levee.	Confirmed yes it will inhibit operations and revised to update section.	Y	Y
6	10/4.2.3. 8	This is the same identical number and location of depressions as described for the Left Bank Levee. Verify this is correct and not mistakenly copied from one another.	Comment revised to right bank only.	Y	Y

## ITR Review Comments

Project: Periodic Levee Inspection, U.S. Army Corps of Engineers Buffalo District

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Reviewer/Discipline:

Donald Basham, PE (KY # 8938), Civil

Date: 9 September 2010

Responses: Donald Gibbs, PE (NC # 29814), Civil

Date: 9 September 2010

7	11/4.2.3. 12	Since this references the IDS and this appears to be the same write-up as in par. 4.2.4.9 should this be N/A and say covered in IDS.	Still should give Unacceptable rating due to this segment. Rate still unacceptable recommended.	N	Y
8	11/4.2.3. 15	Confirm if the as-built dwgs. indicate any underseepage relief wells or toe drain systems proposed.	No relief wells or toe drain systems proposed.	Y	Y
9	15/4.2.7	If "The sponsor has shown a reasonable effort to maintain the Wellsville FDRP and continues to serve their duties within the means available." Then how does one explain all the deficiencies in past reports mentioned in the Pre- Inspection Report and those identified in this report that in many cases are the same as mentioned in the past and based on this statement why would the sponsor be expected to make any of the suggested recommendation? Might want to consider the unintended consequences of such a statement.	Comment deleted and revised for no unintended consequences.	Y	Y

## ITR Review Comments

Project: Periodic Levee Inspection, U.S. Army Corps of Engineers Buffalo District

System Name: Wellsville Right Bank Levee and Dyke Creek, NY

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Reviewer/Discipline:

Donald Basham, PE (KY # 8938), Civil

Date: 9 September 2010

Responses: Donald Gibbs, PE (NC # 29814), Civil

Date: 9 September 2010

10	15/4.2.6	Delete this par. since EAP is covered in par. 4.5 in much great detail.	Concur. Paragraph deleted	Y	Y
11	15/4.3.1	There are 12 sub items listed under Survey Datum in the Design Criteria Checklist that do not meet design criteria but only two are referred too here, Expand to address the others at least in general terms.	Concur. Expanded to address items in this section.	Y	
12	20/5.3.5	This refers to ruts 6" in depth. If these do exist then the rating should be "U" and not "M". Verify and if appropriate should mention these in par. 4.2.3.8.	Reviewed and "M" rating is appropriate. Removed reference of ruts 6" in depth.	Y	Y
13	21/5.3.8	Par. 4.2.3.13 mentions unwanted vegetation that should be addressed here.	Concur. Note added to item.	Y	Y
14	21/5.4.2	The 1 <sup>st</sup> sentence is the same as in par. 4.2.4.9. Rewrite in the form of a recommendation i.e.: Remove the soil and debris from over the ends of the culverts in the interior drainage system.	Concur. Note revised as requested.	Y	Y

## ITR Review Comments

Project: Periodic Levee Inspection, U.S. Army Corps of Engineers Buffalo District

System Name: Wellsville Right Bank Levee and Dyke Creek, NY

Review: This document includes all comments and responses resulting from the Independent Technical Review (ITR). All comments were discussed between the review team and the report team and were resolved prior to submittal.

Reviewer/Discipline:

Donald Basham, PE (KY # 8938), Civil

Date: 9 September 2010

Responses: Donald Gibbs, PE (NC # 29814), Civil

Date: 9 September 2010

15	22/5.7	This is a very general statement. The criteria for compliance should not be based on to the "best of their ability" but based on Project Cooperation Agreement, O&M manuals, etc. in taking over the project. Address how the sponsor has maintained the project over the years to include performing O&M, correcting deficiencies, permitting, assessment of the features in this report. Also refer to Par. 10 of the Pre-Inspection Report where it is noted that deficiencies noted in 2006 had not been corrected in 2007 and it would appear some of the deficiencies identified in this report are the same as identified in 2006 and 2007. Also refer to par. 10.8 and App. E.	Concur. Revise statement to reference performing O&M correcting deficiencies, assessment of the features and referencing paragraph 10.8 of the Pre-inspection package in Appendix E.	Y	Y
16	23/5.9	Par 1 of the Pre-Inspection Report refers to "Flood Insurance certification documents" that were provided by the Corps suggesting the project had been previously certified or considered. Clarify	Confirmed. The project was not previously certified.	Y	Y



## ITR Review Comments

Project: Periodic Levee Inspection, U.S. Army Corps of Engineers Buffalo District

System Name: Wellsville Right Bank Levee and Dyke Creek, NY

Review: This document includes all comments and responses resulting from the Independent Technical Review (ITR). All comments were discussed between the review team and the report team and were resolved prior to submittal.

Reviewer/Discipline:

Donald Basham, PE (KY # 8938), Civil

Date: 9 September 2010

Responses: Donald Gibbs, PE (NC # 29814), Civil

Date: 9 September 2010

17	Par. 5	Include pars. addressing recommendations on Design Criteria Review & Levee Safety Issue findings covered in par. 4.3 & 4.5 respectively.	Concur. Paragraph revised to include information in paragraph 5.8.	Y	Y
18		Under the SOW Task 6, item 17 there is mention of identification of any changes in the system's floodplain since construction that may impact the system's discharge capacity. Did not find this addressed. Look at top of page 14 of the Pre- Inspection Report for some possible changes to consider.	This item has been addressed in Section 5.10 (System Conclusions) with the following paragraph:  There has been development and changes to the watershed since the construction of the project. We recommend that a new hydrologic/hydraulic study be completed in accordance with current USACE guidelines.	Y	Y
19		Under SOW Task 6, Item 20 – were there any “features and/or alterations that are not shown in the pre-inspection packet but are verified during the inspection”.	Confirmed: None identified	Y	Y

## ITR Review Comments

Project: Periodic Levee Inspection, U.S. Army Corps of Engineers Buffalo District

System Name: Wellsville Right Bank Levee and Dyke Creek, NY

Review: This document includes all comments and responses resulting from the Independent Technical Review (ITR). All comments were discussed between the review team and the report team and were resolved prior to submittal.

Reviewer/Discipline:

Donald Basham, PE (KY # 8938), Civil

Date: 9 September 2010

Responses: Donald Gibbs, PE (NC # 29814), Civil

Date: 9 September 2010

20	Pre- Inspectio n Report	Page 12, par 1 has the following statement, "Any of the above missing information obtained during the inspection will be reported in the Draft Periodic Inspection (PI) Report. Information not available will be noted as such in the Draft PI Report." Did not find the following items mentioned: 1) PCA, 2) flood event reports, 3) evaluation reports, 4) Real Estate, 5) Flood Warning system.	Concur. Revised and noted in section 2.2 and 5.10	Y	Y
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## Appendix H

### Out Brief Meeting Minutes

## **Meeting Notes**



**Stantec**

### **Wellsville Right Bank and Dyke Creek Channel, New York FDRP Periodic Inspection Out-Brief**

Buffalo District Periodic Inspection / FILE 178440003

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Date/Time: November 30, (3:00 p.m. to 4:00 p.m.), 2010

Place: 1776 Niagara Street, Buffalo, New York

Next Meeting: No meeting scheduled

Attendees: Tom Switala, PE (CELRB-TD), Bob Remmers, PE (Buffalo District-Operations), Josh Feldmann, PE (CELRB-TD-O), Dave Mitchell, PE (CELRB-TD-OT), Joseph Kasperski (USACE), David Belaskas, PE (Stantec-Team Lead), Don Gibbs, PE (Stantec)

Distribution: USACE, Stantec

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#### Introduction – Review of scope of work and project plan

Bob Remmers introduced all of the inspection team members present and copies of the presentation were distributed to USACE attendees by Stantec. The presentation included an overview of the periodic inspection scope, discussion of key unacceptable and minimally acceptable rated features, and suggested overall rating recommendations by Stantec.

Don Gibbs, with Stantec, reviewed the scope of work and purpose for the Levee Periodic Inspection as well as an overview of tasks performed by Stantec: Project Plan, Standardization Workshop, System Documentation Collection, Design Criteria Review, Pre-Inspection Packet, Field Inspection, Draft PI Report, Independent Technical Review, PI Outbrief for USACE Levee Safety Officer.

#### Discussion

11/30 – Right Bank and Dyke Creek Channel:

1. Sponsor Manuals have been updated through 1996. Sponsor manuals should be updated periodically to stay current.
2. Stantec Recommendation for Right Bank and Dyke Creek Channel: Unacceptable. District agrees.

The meetings adjourned at approximately 3:00 PM on November 30<sup>th</sup>.

One Team. Infinite Solutions.

**Stantec**

November 30, 2010

Wellsville Right Bank and Dyke Creek Channel, New York FDRP

Periodic Inspection Out-Brief

Page 2 of 3

The foregoing is considered to be a true and accurate record of all items discussed. If any discrepancies or inconsistencies are noted, please contact the writer immediately.

**STANTEC CONSULTING SERVICES INC.**

David P. Belaskas, P.E.  
Team Lead

Donald E. Gibbs, P.E.  
Project Manager

November 30, 2010

Wellsville Right Bank and Dyke Creek Channel, New York FDRP

Periodic Inspection Out-Brief

Page 3 of 3

# USACE - Periodic Inspections Out Brief Meeting (11/30/10)

## Sign In Sheet

David Mitchell	USACE LRB
Tom Swartz	USACE LRB
Bob Remmers	USACE LRB
Joseph Kasperski	USACE LRB
David Belaskas	Stantec
Josh Forman	USACE LRB
Don Gibbs	Stantec





# Levee Periodic Inspections for the US Army Corps of Engineers (USACE)

Document Title: **Wellsville New York Right Bank and Dyke Creek FDRP**

Prepared by: Donald Gibbs, PE  
 Revision No.: 01  
 Date: Feb, 2011  
 Page No.: 1

Rating Component	Rated Item	Rating	Notes
<b>General Items for all Flood Damage Reduction Systems</b>			
	Operations and Maintenance Manuals	M	
	Emergency Supplies and Equipment	M	
	Flood Preparedness and Training	M	
<b>Levee Embankments</b>			
	Unwanted Vegetation Growth	U	ETL 1110-2-571
	Sod Cover	A	
	Encroachments	U	ETL 1110-2-571
	Closure Structures	N/A	
	Slope Stability	A	
	Erosion/Bank Caving	M	
	Settlement	U	EM 1110-1-1904
	Depressions/Rutting	M	
	Cracking	A	
	Animal Control	U	ETL 1110-2-571, 5-2
	Culverts/Discharge Pipes	N/A	
	Riprap Revetments/Bank Protection	N/A	
	Revetments other than Riprap	N/A	
	Underseepage Relief Wells	N/A	
	Seepage	A	
<b>Interior Drainage</b>			
	Vegetation and Obstructions	U	
	Encroachments	A	
	Ponding Areas	N/A	
	Fencing and Gates	N/A	
	Concrete Surfaces	A	
	Tilting, Sliding or Settlement	A	
	Foundation of Concrete Structures	A	
	Monolith Joints	A	
	Culverts/Discharge Pipes	U	
	Sluice/Slide Gates	A	
	Flap Gates	M	
	Trash Racks (non-mechanical)	N/A	
	Other Metallic Items	N/A	
	Riprap Revetments of Inlet/Discharge Areas	N/A	



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	Revetments other than Riprap	N/A	
<b>Flood Damage Reduction Channel</b>			
	Vegetation and Obstructions	U	ETL 1110-2-571
	Shoaling	U	EM 1110-2-1601
	Encroachments	U	
	Erosion	M	
	Concrete Surfaces	N/A	
	Tilting, Sliding or Settlement	A	
	Foundation of Concrete Structures	A	
	Slab and Monolith Joints	A	
	Flap Gates	N/A	
	Riprap Revetments and Banks	U	
	Revetments other than Riprap	M	

	A = Acceptable
	M = Minimally Acceptable
	U = Unacceptable
	N/A = Not Applicable



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# Wellsville, NY Right Bank and Dyke Creek Channel Flood Damage Reduction Project Periodic Inspection Out-Brief

Levee Periodic Inspection 2010  
USACE Buffalo District  
Contract No. W912QR-10-D-0003  
Task Order: DNO1

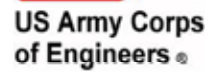
Date Presented: 30 November – 1 December 2010



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# Location Map





# Aerial Map





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# Objectives

- Provide an overview of Periodic Inspections
- Summarize critical findings
- Present inspection observations and evaluations for Minimally Acceptable and Unacceptable rated items





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## Project Type

- Wellsville, New York FDRP
  - Federally Authorized
  - Operated and Maintained by the State of New York NYSDEC
  - Flood Damage Reduction Project
- Location
  - Town of Wellsville, Allegany County, New York on the right descending bank and channel of Dyke Creek



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# Project Overview

- **Authority**
  - Flood Control Act of 1950, Public Law 516-81
- **Construction**
  - Began July 1956
  - Completed February, 1958
  - Total Cost: \$ 1,296,300 (Total Federal Cost \$ 1,102,000)
- **Public Sponsor**
  - NYSDEC
- **Protection**
  - Property Protected Cost \$ 1,000,000 (1956 Estimate)
  - 405 Acres
- **Restoration Work**
  - 1972 Emergency Restoration work – Tropical Storm Agnes
  - 1996 Emergency Rehabilitation work – Thaw Flood Event



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# System Details

- Levee System
  - 2.3 Miles – Total Length
  - 0.8 Miles – Channel (Dyke Creek)
  - 1.5 Miles – Earthen Levee
- Associated Drop Structures, and Drainage Features



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## Protection Provided

- The Wellsville FDRP was designed to protect against a flood with a recurrence interval of 50 years with no freeboard.
- Recent high water-surface elevation recorded September 15, 2007 with Elevation 1481.64 ft.
- Flood protection ranges from elevation 1494 to 1503.



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# Previous Inspection

- 2009 Annual Inspection deficiencies
  - General items/Levees/Channel
    - Riprap revetment had heavy vegetation noted
    - Shoaling along the channel should be removed
    - Encroachments exist along right bank and Dyke Creek channel.
    - Vegetation and debris was noted along some interior drainage structures to be removed



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## Previous Inspection (cont.)

- 2009 Annual Inspection deficiencies (cont.)
  - General items/Levees/Channel
    - Videotape inspections of gravity pipes has not been completed
    - Riprap missing at outfall near Island Park pedestrian bridge
    - Multiple encroachments identified throughout the project





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# Current Inspection

- Fieldwork Conducted
  - 22-23 July 2010
- Teams
  - Linear Inspection Team
- Observations
  - 93 Observations Recorded



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# Inspection Team

- Linear Team
  - Dave Belaskas, PE, Team Lead (Geotechnical)
  - Don Gibbs, PE, (Civil)
  - Joe Bergquist, PE (Structural)
  - Brian Lambert (LIS Operator)



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# Inspected Items

- General Items For All Flood Control Works
- Levee Embankments
- Interior Drainage System
- Flood Damage Reduction System Channels



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# Inspection Results



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# General Items For Flood Control

- Operations and Maintenance Manuals – M
  - Sponsors manuals are out of date.
- Emergency Supplies and Equipment – M
  - Need to maintain flood fighting supplies.
- Flood Preparedness and Training – M
  - No system specific emergency action procedures or flood response plan in place



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# Levee Embankments



# Levee Embankments

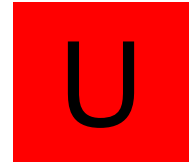
## 1. Unwanted Vegetation Growth

- 0089: Dense vegetation noted within 15 feet of Landside toe: remove vegetation (U)
- Near Sta. 35+00





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# Levee Embankments

## 3. Encroachments

- 0006: encroachments : fence, maintenance building (U)
- Near Sta. 0+00





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# Levee Embankments

M

- **6 Erosion/Bank Caving**

- Minor erosion observed

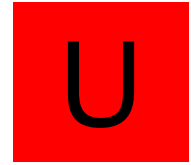


- 0033: Erosion noted (M)
- Near Sta. 70+00



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# Levee Embankments



- **7. Settlement**

- No available survey data or records to confirm

# Levee Embankments

## 8. Depressions/Rutting

M

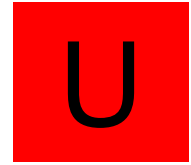
- 0021: Depression/Ponding area noted (M)
- Near Sta. 14+00





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# Levee Embankments

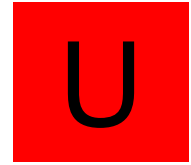


- **10. Animal Control**
  - Sponsor does not currently have an Animal Control Program in place





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# Levee Embankments

- **11. Culverts/ Discharge Pipes**
  - Condition of the pipes has not been verified using televising camera within the past 5 years



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# Interior Drainage System



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# Interior Drainage System

U

- **1. Vegetation and Obstructions**

- Areas of sediment, debris and vegetation lining channel

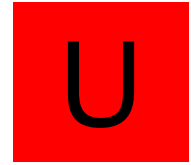


- 0066: Unwanted vegetation: remove vegetation (U)
- Near Sta. 22+00



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# Interior Drainage System



- **9. Culverts/Discharge Pipes**
  - Condition of pipes have not been verified



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# Interior Drainage System

M

- **11. Flap Gates**



- 0044: Flap gate hinge loose from 18 inch CMP through the levee (M)
- Near Sta. 8+00



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# Flood Damage Reduction System Channels





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# Channels

U

- **1. Vegetation and Obstructions**

- Areas of sediment, debris and vegetation lining channel



- 0077: Unwanted vegetation along Dyke Creek channel : remove vegetation (U)
- Near Sta. 31+00



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# Channels

U

- **2. Shoaling**

- Channel flow capacity is reduced



- 0046: Shoaling is well established (U)
- Near Sta. 10+00



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# Channels

U

- **3. Encroachments**

- Multiple encroachments along channel



- 0059: Multiple encroachments (U)
- Near Sta. 18+00

- **4. Erosion**

- Erosion observed along channel banks



- 0050: Erosion noted: (M)
- Near Sta. 12+00



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# Channels

U

- **10. Riprap Revetments and Banks**

- Vegetation in riprap has occurred



- 0068: Vegetation in riprap noted: (U)
- Near Sta. 22+00

- **11. Revetments other than riprap**
  - Cracking noted in concrete along channel banks



- 0043: Cracking in concrete noted: (M)
- Near Sta. 5+00



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# Questions?