FLOOD INSURANCE STUDY

SANDUSKY COUNTY, OHIO
AND INCORPORATED AREAS

COMMUNITY NAME	COMMUNITY NUMBER
BURGOON, VILLAGE OF	390448
CLYDE, CITY OF	390489
FREMONT, CITY OF	390490
GIBSONBURG, VILLAGE OF	390491
GREEN SPRINGS, VILLAGE OF	390492
[1]HELENA, VILLAGE OF	390493
LINDSEY, VILLAGE OF	390494
SANDUSKY COUNTY (UNINCORPORATED AREAS)	390486
WOODVILLE, VILLAGE OF	390495

[1] NO SPECIAL FLOOD HAZARD AREAS IDENTIFIED

Sandusky County

Revised Preliminary

December 9, 2015

Revised: TBD

Federal Emergency Management Agency

FLOOD INSURANCE STUDY NUMBER

39143CV000B

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study (FIS) report may not contain all data available within the Community Map Repository. Please contact the Community Map Repository for any additional data.

The Federal Emergency Management Agency (FEMA) may revise and republish part or all of this FIS report at any time. In addition, FEMA may revise part of this FIS report by the Letter of Map Revision process, which does not involve republication or redistribution of the FIS report. Therefore, users should consult with community officials and check the Community Map Repository to obtain the most current FIS report components.

Selected Flood Insurance Rate Map (FIRM) panels for this community contain information that was previously shown separately on the corresponding Flood Boundary and Floodway Map (FBFM) panels (e.g., floodways, cross sections). In addition, former flood hazard zone designations have been changed as follows:

Old Zone(s)	New Zone
Al through A30	AE
V1 through V30	VE
B	X (shaded)
C	X

Initial Countywide FIS Effective Date: April 18, 2011
Revised Countywide FIS Date: To Be Determined

TABLE OF CONTENTS

1.0 INTRODUCTION 1

1.1 Purpose of Study 1

1.2 Authority and Acknowledgments 1

1.3 Coordination 3

2.0 AREA STUDIED 4

2.1 Scope of Study 4

2.2 Community Description 5

2.3 Principal Flood Problems 8

2.4 Flood Protection Measures 10

3.0 ENGINEERING METHODS 10

3.1 Hydrologic Analyses 10

3.2 Hydraulic Analyses 13

3.3 Vertical Datum 16

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS 18

4.1 Floodplain Boundaries 18

4.2 Floodways 19

5.0 INSURANCE APPLICATIONS 29

6.0 FLOOD INSURANCE RATE MAP 30

7.0 OTHER STUDIES 32

8.0 LOCATION OF DATA 32

9.0 BIBLIOGRAPHY AND REFERENCES 32

TABLE OF CONTENTS

FIGURES

Figure 1 – Vertical Datum Conversion 16
Figure 2 – Floodway Schematic 20

TABLES

Table 1 – Initial and Final CCO Meetings 3
Table 2 – Areas Studied by Detailed Methods 4
Table 3 – Major Storms in Boothbay Harbor 8
Table 4 – Summary of Discharges ..... **Error! Bookmark not defined.**
Table 5 – Summary of Stillwater Elevations 13
Table 6 – Manning's "n" Values 15
Table 7 – Vertical Datum Conversion Values 17
Table 8 – Floodway Data 21
Table 9 – Community Map History 31

EXHIBITS

Exhibit 1 – Flood Profiles

Buck Creek	Panels 01P – 02P
Flag Run	Panels 03P – 04P
Flag Run Tributary	Panel 05P
Portage River	Panels 06P – 09P
Raccoon Creek	Panels 10P – 12P
Sandusky River	Panels 13P – 15P
Victoria Creek	Panels 16P – 17P

Exhibit 2 – Flood Insurance Rate Map Index
Flood Insurance Rate Map

FLOOD INSURANCE STUDY
SANDUSKY COUNTY, OHIO AND INCORPORATED AREAS

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study (FIS) revises and supersedes the FIS reports, Flood Insurance Rate Maps (FIRMs), Flood Boundary and Floodway Maps in the geographic area of Sandusky County, Ohio, including: the Village of Burgoon, the City of Clyde, the City of Fremont, the Village of Gibsonburg, the Village of Green Springs, the Village of Helena, the Village of Lindsey, the Village of Woodville and Sandusky County Unincorporated Areas, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood risk data for various areas of the community that will be used to establish actuarial flood insurance rates. This information will also be used by Sandusky County to update existing floodplain regulations as part of the Regular Phase of the National Flood Insurance Program (NFIP), and by local and regional planners to further promote sound land use and floodplain development. Minimum floodplain management requirements for participation in the NFIP are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

The Village of Helena is a community with no special flood hazards identified.

The City of Bellevue and the Village of Green Springs are dual-county communities located in Huron and Sandusky Counties, and Seneca and Sandusky Counties, respectively. Information for the City of Bellevue is included in the Huron County FIS. Information for the Village of Green Springs is included in this FIS.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the State (or other jurisdictional agency) will be able to explain them.

The Digital Flood Insurance Rate Maps (DFIRMs) and FIS Report for this countywide study have been produced in digital format. Flood hazard information was converted to meet the Federal Emergency Management Agency (FEMA) DFIRM database specifications and Geographic Information System (GIS) format requirements. The flood hazard information was created and is provided in a digital format so that it can be incorporated into a local GIS and be accessed more easily by the community.

1.2 Authority and Acknowledgments

The sources of authority for this FIS are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

This FIS was prepared to include the incorporated communities within Sandusky County in a countywide format. Information on the authority and acknowledgements for each jurisdiction included in this countywide FIS, as compiled from their previously printed FIS reports is shown below.

Information pertaining to the authority and acknowledgements for each of the previously effective FIS reports and new floodplain studies for communities within Sandusky County was compiled for this FIS report and is shown below.

Clyde, City of	The previously effective FIS for the City of Clyde is dated October, 1978. The hydrologic and hydraulic analyses for this study were performed by Howard Needles, Tammen and Bergendoff for the Federal Insurance Administration (FIA), under Contract No. H-3980. This work, which was completed in April 1977, covered all significant flooding sources affecting the City of Clyde (Reference 1).
Green Springs, Village of	The previously effective FIS for the Village of Green Springs is dated February, 1980. The hydrologic and hydraulic analyses for this study were performed by Finkbeiner, Pettis & Strout, Limited for the FIA, under Contract No. H-4529. This study was completed in February 1979 (Reference 2).
Sandusky County (Unincorporated Areas)	The previously effective FIS for Sandusky County Unincorporated Areas is dated July 1978. The hydrologic and hydraulic analyses for this study were performed by Howard, Needles, Tammen, and Bergendoff for the FIA, under Contract No. H-3980. The work, which was completed in May 1977, covered all significant flooding sources in the unincorporated areas of Sandusky County (Reference 3).
Woodville, Village of	The previously effective FIS for the Village of Woodville is dated December, 1979. The hydrologic and hydraulic analyses for this study were performed by Finkbeiner, Pettis & Strout, Limited for the FIA, under Contract No. H-4529. This work, which was completed in May 1978, covered all significant flooding sources affecting the Village of Woodville (Reference 4).

FIS reports were not published for the City of Fremont and for the Villages of Burgoon, Gibsonburg, Helena, and Lindsey; therefore, the authorities and acknowledgements for these communities are not included in this FIS and may not appear in the Community Map History Table (Section 6.0).

Redelineation of previously effective flood hazard information for this FIS report and accompanying FIRMs, correction to the North American Vertical Datum of 1988 (NAVD88), as well as conversion of the incorporated areas of Sandusky County into Countywide Format was prepared for FEMA by STARR, (a joint venture between Atkins Global, Stantec Inc., and Camp, Dresser, and McKee (CDM), under Joint Venture Contract No. HSFE05-05-D- 0026, Task Order No. 37. This work was completed in September, 2009.

New approximate hydrologic and hydraulic analyses for 120 stream reaches in Sandusky County were performed by Stantec for FEMA under Contract No. HSFE05-05-D-0026, Task Order No. 37. This study was completed in April 2009 using the methodology reported in "Hydrologic Report: Countywide DFIRM for Sandusky County" by Stantec dated February 20, 2009 (Reference 5) and in "Hydraulic Report: Countywide DFIRM Production and Development for Sandusky County" by Stantec dated April 3, 2009 (Reference 6). Study reaches included reaches with existing effective approximate flood hazards and additional reaches identified during the scoping meeting for the project.

For this Physical Map Revision (PMR), the Sandusky River accredited levee will now be shown on the effective FIRM as providing protection from the 1-percent-annual-chance flood. The City of Fremont submitted the levee accreditation package to FEMA which was approved on January 7th, 2013. The end result of this accreditation package is an updated DFIRM panel (319143C0280D) reflecting the Sandusky River Levee protecting against the 1-percent annual chance flood hazard and the associated interior drainage areas.

The digital topographic data was provided by Ohio Statewide Imagery Program (OSIP) with a 2-foot contour interval for Sandusky County (Reference 7). The coordinate system used for the production of this DFIRM is State Plane Ohio North 3402 Feet, North American Datum 1983, Lambert Conformal Conic Projection. Differences in the datum and projection system used in the production of DFIRMs for adjacent counties may result in slight positional differences in map features at the county boundaries. These differences do not affect the accuracy of information shown on this DFIRM.

1.3 Coordination

The purpose of an initial Consultation Coordination Officer's (CCO's) meeting is to discuss the scope of the FIS. A final CCO meeting is held to review the results of the study. The dates of the initial and final CCO meetings held for the previous FIS reports covering the geographic area of Sandusky County, Ohio are shown in Table 1. The initial and final CCO meetings were attended by representatives of FEMA or the FIA, Ohio Department of Natural Resources (ODNR), the study contractor, and the community.

Table 1 – Initial and Final CCO Meetings

COMMUNITY NAME	INITIAL MEETING	FINAL MEETING
Clyde, City of	March 19, 1976	October 24, 1977
Green Springs, Village of	June 9, 1977	July 10, 1979
Sandusky County (Unincorporated Areas)	March 20, 1976	October 25, 1977
Woodville, Village of	June 9, 1977	June 4, 1979
Freemont, City of	*	September 21, 2015

* Data not available

The initial CCO meeting for this countywide FIS was held on May 14, 2007 and was attended by representatives of FEMA, Sandusky County, ODNR and the study contractor. The results of the study were reviewed at the final CCO meeting held on November 19, 2009 and attended by representatives of FEMA, Sandusky County, ODNR and the study contractor. All problems raised at that meeting have been addressed. The CCO meeting for the PMR was held on September 21, 2015 and was attended by representatives of FEMA, Sandusky County, the City of Freemont, the study's contractor STARR, and the Ohio State NFIP Coordinator.

2.0 AREA STUDIED

2.1 Scope of Study

This FIS covers the geographic area of Sandusky County, Ohio, including all communities listed in Section 1.1.

The following streams listed in Table 2, "Areas Studied by Detailed Methods," were studied by detailed methods in the pre-countywide flood insurance studies. Limits of Detailed Study are indicated on the Flood Profiles (Exhibit 1) and on the FIRM (Exhibit 2).

Table 2 – Areas Studied by Detailed Methods

Stream Reach	Study Length (Miles)	Limit of Detailed Study
Buck Creek	0.9	Approximately 1.3 miles above mouth to 0.36 miles upstream of Conrail
Flag Run	0.9	From 1,880 feet downstream of Broadway Street to Adams Street
Flag Run Tributary	0.1	From confluence with Flag Run to a point 790 feet upstream
Portage River	1.0	From 3,735 feet downstream of Contrail to 2,820 feet upstream of Cherry Street
Raccoon Creek	2.6	From 9.9 miles above mouth to Limerick Road
Sandusky River	13.8	Approximately 3.0 miles above mouth to approximately 260 feet upstream of Tiffin Road
Victoria Creek	0.6	From confluence with Portage River to 1,680 feet upstream of Lueke Avenue

The areas studied by detailed methods were selected as a priority that was given to known flood hazard areas, areas of projected development and proposed construction. Flooding sources studied by detailed methods include: Buck Creek, Flag Run, Flag Run Tributary, Portage River, Raccoon Creek, Sandusky River, and Victoria Creek.

For this PMR, the Sandusky River accredited levee will now be shown on the effective FIRM as providing protection from the 1-percent-annual-chance flood.

Approximate methods of analysis were used to study those areas having low development potential and/or minimal flood hazards as identified at the initial CCO meetings detailed in Table 1. The scope and methods of approximate study were agreed upon by FEMA and Sandusky County, and consequently, 326 miles of stream reaches were studied by approximate methods.

No Letters of Map Revision (LOMRs) were incorporated as part of this study.

2.2 Community Description

Sandusky County is located in north-central Ohio. It is bordered on the north by Sandusky Bay, off Lake Erie, and Ottowa County; to the east by Erie County, to the south by Seneca County, and to the west by Wood County (Reference 3).

During the War of 1812, Fort Stephenson, now the City of Fremont, was successfully defended against the British and Indians, and in 1820 Sandusky (meaning "cold water") County was established (Reference 8). It has remained primarily agricultural, as its soil is fertile and easily cultivated. At the time of the previously effective FIS, only 8.7 percent of the 266,240 acres in the county had been developed (Reference 9). Some of the undeveloped area is wooded or wetland, the wooded areas being primarily ash swamp forest (Reference 10).

The 2010 population of Sandusky County was 60,944 (Reference 11).

The climate of Sandusky County is classified as continental. Such a climate is marked by sizable annual and diurnal ranges in temperature. At the time of the previously effective FIS, the average monthly temperature at Fremont ranged from a high of 73.7°F in July to a low of 26.0°F in January. The average annual precipitation at the City of Fremont was 34.28 inches, ranging from an average monthly high of 4.10 inches in June to a low of 1.99 inches in February (Reference 12).

The Sandusky County area receives an average annual rainfall of approximately 34.67 inches and an average annual snowfall of approximately 32.8 inches (Reference 12).

The soils of Sandusky County were developed from glacial till and glacial lake deposits (Reference 13). The basic topography of the area ranges from flat or depressed areas, to gently sloping, and the soils are primarily poorly drained (Reference 14).

The Sandusky River flows northerly to Sandusky Bay through the central portion of Sandusky County Unincorporated Areas. Upstream of the City of Fremont, the river is for the most part confined to a narrow, high-banked gorge. North of the City of Fremont the bluffs along the river descend and finally form a wide, flat, marshy flood plain (Reference 3).

Like the Sandusky River, streams in the central and eastern part of Sandusky County flow into Sandusky Bay. Streams in the west continue north, outside the county, and flow directly into Lake Erie, northwest of Sandusky Bay. Most of the streams, especially in the western section of the county, are extremely flat- sloped. Many of these also have channel sections that appear to have been uniformly excavated to provide improved drainage for the agricultural areas. Owing to the flatness of the area, roadside ditches in

agricultural areas are noticeably deep, whereas closer to Sandusky Bay, roadside ditches and streams more closely resemble small, full canals (Reference 3).

At the time of the previously effective FIS, along the Sandusky River from the mouth to just north of Wightman's Grove in Sandusky County, most of the land within the flood plain was owned or leased by hunting clubs and was also farmed (Reference 15). The area is very marshy, in some cases below the level of Lake Erie, and is criss-crossed by earthen dikes. Many summer cottages were built during the 1920s and 1930s along the river in areas like Wightman's Grove, Shannon, Schlegel's Grove, and Muncie Hollow. By 1961 half of these cottages were being used for year-round residences (Reference 15). By 1978, residential development had occurred in the vicinity of the Ohio Turnpike at Logsdon and Shorewood. At the same time, south of Fremont, residential development was occurring in the Ballville area, while the west flood plain of the Sandusky River was a golf course (Reference 3).

Industrial development in the county was expected to expand near the City of Fremont, City of Clyde, and City of Bellevue along the major highways U.S. Route 20 and State Route 53. Residential expansion was expected to take place south of Clyde and south of Gibsonburg and in all directions around Fremont except the northeast and southwest areas which are in the Sandusky River flood plain. Little additional residential development was expected to take place in the communities along Sandusky Bay (Reference 3).

The City of Clyde is largely a residential community with an agricultural base for its economy (Reference 16). Development began in 1852 when a railroad junction brought prosperity to a small trading center. By 1902, Main Street was lined with hotels, lunchrooms, and stores. Many homes also surrounded it. With the decline of the railroad, the City of Clyde's prosperity also declined. However, the construction of U.S. Highway 20, connecting major industrial centers, brought a rebirth of prosperity (Reference 17). Industry and commercial establishments were built along the highway while residential expansion occurred primarily south of the railroad lines that intersect in the City of Clyde (Reference 1).

Though most of the City of Clyde is developed or agricultural, there is a wooded area along Raccoon Creek at the southern corporate limits, which may be classified as Ash Swamp Forest. This area is dominated by ash and maple trees (Reference 10).

Raccoon Creek runs northward through the western part of the City of Clyde. In addition to the Whirlpool Corporation Plant, a few residential buildings were located in the Raccoon Creek flood plain. These residences are situated where local streets cross the creek, primarily at Vine and Mulberry Streets. Sucker Run flows into Raccoon Creek from the east, with mostly residential buildings in its flood plain. Exceptions are the City Administration Building and the water treatment plant. Buck Creek runs through the northeast corner of the City of Clyde and eventually flows into Raccoon Creek north of the city. At the time of the previously effective FIS, a few residential buildings were located in its flood plain along State Route 101 but most of the flood plain is field, orchard or cemetery. These three creeks carry the stormwater runoff collected by Clyde's expanding sewer system (Reference 1).

Much of the area around the City of Clyde is part of Ohio's till plain. Since the area was glaciated, the existing soils were formed in high lime content glacial lake sediments. The

soils in this area are of the Hoytville-Napanee Association, which are typically flat expanses of soil formed in the lime-clay glacial till, or of the Granby-Ottokee-Tedrow Association, which are characterized by nearly level to slightly sloping soils formed by glacial lakes and wind-deposited sand (Reference 12). With the exception of the hollow formed by Raccoon Creek, most of the City of Clyde's topography typifies this association since it slopes gently from a southern elevation of approximately 710 feet to a northern elevation of approximately 650 feet (Reference 1).

The Village of Green Springs lies on the glaciated, moderately smooth lake plain, about 1.0 mile southeast of the beach ridges of old Lake Warren, and 1.5 miles northwest of the beach ridges of old Lake Whittlesey, at an elevation of approximately 700 feet. The area was glaciated by both the Illinoian and Wisconsin ice sheets. Locally, drift is from 40 to 70 feet in thickness (Reference 18). The topography surrounding Green Springs ranges from flat to rolling. The streams traversing Green Springs have become well entrenched as the channels approach Green Creek, a significantly larger tributary that drains to Sandusky Bay. The stream gradients of Flag Run and its tributaries are significantly steeper through Green Springs than on other reaches upstream. The soils of the flat plains that surround Green Springs, Ohio, are characterized by extensive areas of poorly drained land between old beach ridges. Some of these soils are smooth-surfaced deposits composed predominately of clays that have been turned into highly undulating slightly acidic sandy soils (Reference 19). The difference in characteristics among the soils cause variations in the effect rainfall has on them. These characteristics range from drouthiness to very wet, from practically no surface runoff to high runoff. At the time of the previously effective FIS for the watersheds included in this study, much of the area was currently used for agriculture; the associated vegetation included wheat, corn, soy beans, tomatoes, pickles, sugar beets, cabbage, and fruits (Reference 20).

The major use of land within the Village of Green Springs is for residential purposes. Commercial development appears to be concentrated along State Route 19 in the central part of the community, and some industry is found in the south-central part of the community. Institutional land use is located in the northwest corner of the village, with a natural gas conversion plant located west of Green Springs. Some development has taken place along Flag Run which isthe major drainage outlet for the community. However, as development pressure increases, the flood plain will be subject to increasing demands for development (Reference 2).

The topography of the Portage River in the Village of Woodville is generally very flat except for those areas immediately adjacent to streams. The average gradient from head to mouth is 3.3 feet per mile. The surface is, in general, a broad plateau with the lake plain along the north edge being the dominant feature. Many of the originally swampy areas have been drained by ditching. The bedrock in the area consists of consolidated rocks of sedimentary origin, including limestone, dolomite, shale, and sandstone. Overlying the bedrock are unconsolidated deposits of glacial origin which include clay, silt, sand, and gravel. During the final retreat of glacial ice in this area, meltwater from the ice front was ponded between the ice front and the glacial materials previously deposited. The lake crested in this way remained for sufficient time to allow deposition of fine materials, chiefly clay and fine sand. Near the downstream reaches of the Portage River, the lake plain is characterized by areas of poorly-drained land between old beach ridges. The till plains, which extend to the south, are generally smooth surfaced deposits composed predominantly of clay. At the time of the previously effective FIS, approximately 90 percent of the basin was in farms and non-farm forest and woods. The

majority of this land was cropland with some minor pasture usage. The crops typically raised include corn, wheat, oats, soy beans, alfalfa, and truck crops, such as tomatoes and sugar beets (Reference 4).

Several bridges affect the stream hydraulics of both the Portage River and Victoria Creek in the Village of Woodville. Both streams have gentle average stream gradients. Although ditch drainage projects have been completed throughout the basin to augment agricultural production, little has been done to modify the streams in the study area. The bridges included in this study cause localized increases in flood stage as shown on the attached stream profiles. Woodville includes only a small percentage of commercial development, which is generally located very near the center of the community along U.S. Highway 20. Some commercial development in Woodville is primarily in the western half of the community. The northwest quadrant is the primary area although strip residential development has taken place in other areas (Reference 4).

2.3 Principal Flood Problems

Flag Run and the Flag Run Tributary are reasonably well entrenched so that flood damages are limited. Development pressure, however, has created a need for detailed information in the flood plains of these streams. There are some scattered residential buildings that are subject to inundation (Reference 2).

The majority of the Village of Woodville lies outside the 1-percent-annual-chance flood plain of the Portage River. However, some development has occurred that is subject to periodic inundation. These areas are generally in the fringe areas of the flood plain and do not interfere with conveyance of floodwaters (Reference 4).

Flooding occurs on an annual basis in the flood plain immediately adjacent to the Portage River. Ice jams also affect high water elevations. Table 3 summarizes data taken at the Village of Woodville gage (U.S. Geological Survey (USGS) Gage No. 04195500) (Reference 4).

Table 3 – Major Storms in Boothbay Harbor

Date	Elevation (NAVD88)	Discharge (cfs)[1]	Frequency (years)[3]
March, 1913[2]	630.99	17,000	*
February 15, 1950	628.50	11,500	30
March 23, 1948	627.97	10,600	*
March 12, 1952	627.23	9,490	10
April 12, 1944	627.07	9,300	*
January 15, 1930	626.95	9,150	*
May 13, 1956	626.71	8,740	*
March 15, 1933	626.51	8,220	*
April 16, 1957	626.29	8,180	*

Table 4 – Major Storms in Boothbay Harbor (Continued)

Date	Elevation (NAVD88)	Discharge (cfs)[1]	Frequency (years)[3]
May 19, 1943	626.29	8,180	*

* Data not available

[1] cubic feet per second

[2] Discharge data for the March 1913 flood in the Village of Woodville are Estimates

[3] The frequencies were estimated from the Ohio Department of Natural Resources Bulletin No. 45 (Reference 25)

Some of the major floods on Raccoon Creek and Sucker Run occurred in 1913, 1937, January and February 1959, and 1963 (Reference 1).

During the February 1913 flood, portions of Main Street and West Buckeye Street were under water. In some areas the water was so deep that emergency transportation had to be provided by boat. In the flood of 1937, the floodwaters covered the intersection of Main and Arch Streets. The 1937 and 1959 floods have an estimated recurrence interval in the range of 15 to 20 years and the 1963 flood, approximately 7 years (Reference 1).
Areas in Sandusky County along Sandusky Bay are generally low lying and exceptionally vulnerable to flooding. Flooding along the shoreline is mainly the result of strong easterly or northeasterly winds, creating an increase in water level at the western end of Lake Erie. Flooding along the entire shoreline from Sandusky to Toledo occurred on November 17, 1972 and April 9, 1973 (Reference 21).

Major floods on the Sandusky River occurred in January 1847; February 1883; January, February, and March 1904, March 1913; June 1937; January and February 1959; and March 1963 (Reference 3). The greatest flood on record with an estimated recurrence interval of 1,000 years occurred in March 1913 and is regarded as the historical maximum. Although the flood occurred in March, it was the result of high discharges only and was not caused by ice jams. During this flood a majority of the bridges along the Sandusky River were destroyed (Reference 15).

Another major flood occurred in January 1959. Storms resulting from conditions similar to the one which produced this flood are not uncommon. The storm of January 19-22, which was in itself of flood-producing proportions, was preceded by the storm of January 14-17. The precipitation from this storm fell as rain and snow, and remained as either snow or frozen soil moisture which, when melted, added to the surface runoff during the following storm (Reference 12). This flood, with an estimated recurrence interval of 20 years, caused an estimated $87,000 based on March 1963 price levels (Reference 15).

Flooding of Victoria Creek is primarily a result of backwater on the Portage River. Thus, high water events would correspond to those on the Portage River, as indicated in the above table. Ice jams can significantly affect high water elevations and may increase elevations by several feet (Reference 4).

2.4 Flood Protection Measures

As a result of repetitive, damaging floods, in 1972 the U.S. Army Corps of Engineers (USACE) (formerly the Corps of Engineers, COE) built floodwalls and levees along the Sandusky River. Realignment of the river channel and dredging at the river bottom were also part of the flood control project (Reference 12). There were no other stream improvements or flood protection measures planned through 1979 (Reference 3).

Storm drainage projects along Sucker Run had been recently completed, and their effects were considered in the preparation of the study.

On January 7, 2013, the City of Fremont received notification of levee accreditation for the levee for Sandusky River, which states that the levee complies within the minimum requirements outlined in Title 44 of the Code of Federal Regulations, Section 65.10 (44 CFR 65.10). The accredited levee is shown on the effective FIRM as providing protection from the 1-percent-annual-chance flood.

There are no structural flood protection measures, such as earth or concrete dams in the Village of Green Springs. At the time of the previously effective FIS, there were no projects under construction or being considered. The natural entrenchment of the stream has provided the main deterrent to development in the flood plain (Reference 2).

There are no structural protection measures, such as earth or concrete dams, that are effective in providing flood protection for the Village of Woodville (Reference 4).

3.0 ENGINEERING METHODS

For the flooding sources studied by detailed methods in Sandusky County, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for these studies. Flood events of a magnitude that are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10-, 2-, 1-, and 0.2-percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long-term, average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood that equals or exceeds the 1-percent-annual-chance flood in any 50-year period is approximately 40 percent (4 in 10); for any 90 year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of the original study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish peak discharge-frequency relationships for each flooding source studied by detailed methods affecting the community.

Hydrologic analyses were carried out to establish peak discharge-frequency relationships for each flooding source studied by detailed methods affecting the

community.

Data from USGS Gage Number 04198000 was analyzed to determine the discharge-frequency relationships for the portion of the Sandusky River studied in detail. The gage is located upstream of Fremont at Rice Road Bridge. It has been in continuous operation since 1924 with the exception of the years 1936 through 1938. Historical data, to supplement the gage data, was obtained from a USACE Flood Plain Information Report (Reference 10). The historical information was later updated by USCACE correspondence. A log-Pearson Type III analysis was then performed on the gage and historical data, using the computer program "FREQFLO" endorsed by the U.S. Water Resources Council (Reference 22). A regional skew coefficient was used in accordance with USACE policy. The 0.2-percent-annual-chance flood discharge was estimated using a log-normal statistical distribution based on the 10-, 2-, and 1-percent-annual-chance flood discharges (Reference 3).

There are no stream gages on Raccoon or Buck Creeks that would allow a statistical analysis of flood recurrence intervals. Therefore, a regional study, Floods in Ohio – Magnitude and Frequency was used to determine peak discharges for the 10-, 2-, and 1-percent-annual-chance floods (Reference 23). This study provides regression equations developed from a regression analysis of gage data in the area and variables that describe the hydrologic characteristics of the drainage area for those gages. The 0.2-percent-annual-chance flood was extrapolated using a log-normal distribution based on the 10-, 2-, and 1-percent-annual-chance flood discharges (Reference 1).

No stream gaging data was available for Flag Run or Flag Run Tributary. However, USGS, in cooperation with the ODNR, has prepared a statewide regional frequency analysis for estimating flood flows on ungaged watersheds (Reference 24). This procedure considers drainage area, basin slope, soils, and the basin location to generate flow quantities. The 0.2-percent-annual-chance discharges were obtained by straight-line extrapolation from the 0.2- and 1-percent-annual-chance storms (Reference 2).

At the time the Portage River was studied, the USGS maintained a stream gaging station on the Portage River, at the U.S. Highway 20 bridge. The USGS, in the ODNR, Bulletin No. 45 (Reference 25), computed flood frequencies at gaging stations using the U.S. Water Resources Council Bulletin No. 17 procedure (Reference 22). These results were used for the Portage River (Reference 4).

For Victoria Creek, which is not gaged, the regional frequency analysis as presented in Bulletin No. 45 was used (Reference 25). In this procedure, mathematical equations that relate peak discharges to basin parameters are developed through multiple regression analysis of data for many gaging stations within a defined geographic area. Basin parameters for any ungaged site within the area may then be used in the developed regional equations to compute peak discharges of selected recurrence intervals for the site (Reference 25). Basin parameters include slope, soil, vegetation, and drainage (Reference 4).

Peak discharges for the 10-, 2-, 1-, and 0.2-percent-annual-chance floods of each flooding source studied in detail in the community are shown in Table 4.

Table 4 – Summary of Discharges

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQ. MILES)	PEAK DISCHARGES (cfs) 10%-ANNUAL-CHANCE	2%-ANNUAL-CHANCE	1%-ANNUAL-CHANCE	0.2%-ANNUAL-CHANCE
BEAR CREEK					
Northern Corporate Limits of City of Clyde	3.0	260	380	440	570
Shaw Road (County Road 181)	4.4	725	1,056	1,200	1,600
Broadway Street	3.9	650	940	1,060	1,300
Conrail	3.2	550	797	900	1,180
FLAG RUN TRIBUTARY					
At Mouth	0.5	165	239	275	350
PORTAGE RIVER					
USGS Gaging Station	428.0	9,920	12,700	13,700	15,600
RACCOON CREEK					
Northern Corporate Limits	13.3	800	1,170	1,300	1,620
Whirlpool Corporation Building	12.9	770	1,100	1,250	1,590
Mulberry Street Bridge	12.6	720	1,030	1,170	1,470
South Street Bridge	10.6	620	870	970	1,220
SANDUSKY RIVER					
Cross Section A	1,339.0	24,400	32,300	35,500	45,000
VICTORIA CREEK					
Confluence with Portage River	3.0	157	238	271	330

The USACE provided Lake Erie flood stage-frequency relationships for Marblehead Point, Ohio, near the entrance to Sandusky Bay, based on their analysis of gage data obtained at that location (Reference 30). These flood levels are the result of wind setup on Lake Erie. Due to the extremely narrow entrance to Sandusky Bay, the figures are a conservative estimate of the flood levels in the bay. Wind setup is the tilting of the bay's water-surface toward the leeward shore under the action of the wind. This current of

surface water is a result of tangential stresses between the wind and the water and of differences in atmospheric pressure. The latter, however, is typically a smaller effect. By methods outlined in the Shore Protection Manual (Reference 27), the maximum wave height that could develop in this relatively small, shallow bay was determined for a water depth using the mean of the highest average monthly water levels (Reference 28) as the stillwater elevation. The resultant wave and associated runup superimposed on the stillwater level have a lower flood potential than the flood levels due to wind setup. Thus, the Lake Erie flood levels provided by the USACE, which are based on wind setup effects at the entrance to Sandusky Bay, were adopted. These flood stage-frequency relationships for Sandusky Bay in Sandusky County, Ohio, are presented in Table 5.

Table 5 – Summary of Stillwater Elevations

	ELEVATION (feet NAVD88)			
FLOODING SOURCE AND LOCATION	**10%-ANNUAL-CHANCE**	**2%-ANNUAL-CHANCE**	**1%-ANNUAL-CHANCE**	**0.2%-ANNUAL-CHANCE**
Sandusky Bay	575.3	576.2	576.5	577.1

For the approximate study of flooding sources in Sandusky County, hydrologic calculations were performed using regression equations presented in A Streamflow Statistics (StreamStats) Web Application for Ohio by Koltun, G.F., Kula, S.P. and Puskas, B.M., 2006, USGS, Scientific Investigations Report (SIR) 2006-5312 (Reference 29). The regression equations use drainage area, slope of the main channel, percentage of basin classified as wetlands and water, along with regional regression constants (Reference 34).

Additionally, several closed basin systems (depressions with floodplains mapped on the effective maps) were analyzed in Sandusky County as part of the approximate study of flooding sources. For these areas SCS TR-55 methodology was used to determine the volume of runoff for each sink. A stage versus storage curve was developed assuming no outflow (Reference 34).

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals. Users should be aware that flood elevations shown on the FIRM represent rounded whole-foot elevations and may not exactly reflect the elevations shown on the Flood Profiles or in the Floodway Data tables in the FIS report. Flood elevations shown on the FIRM are primarily intended for flood insurance rating purposes. For construction and/or floodplain management purposes, users are cautioned to use the flood elevation data presented in this FIS report in conjunction with the data shown on the FIRM.

Flood profiles were prepared for all streams studied by detailed methods and show computed water-surface elevations to an accuracy of 0.5 foot for floods of selected recurrence intervals. In cases where the 1-percent-annual-chance and 0.2-percent-annual-

chance flood elevations are close together, only the 1- percent-annual-chance profile has been shown due to limitations of the map scale.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway was computed (Section 4.2), selected cross section locations are also shown on the DFIRM (Exhibit 2).

All structures and cross sections were field surveyed for Flag Run and Flag Run. No detailed topographic mapping was available (Reference 2). The roughness factors were determined by a field reconnaissance and documented with photographs at selected points (Reference 2).

All structures and cross sections for the Portage River and Victoria Creek were field surveyed. Portions of the overbanks on certain sections were taken from USGS quadrangle sheets (Reference 30). Also, all available construction plans for the bridges were obtained. All obstructions to flow and cross sections were surveyed. In certain instances, cross section data were supplemented with data from USGS quadrangle sheets (Reference 30). All below-water sections were surveyed (Reference 4).

Elevations at the gaging station in the City of Woodville were used to calibrate the roughness factors in the backwater analysis on the Portage River. Roughness factors for both the Portage River and Victoria Creek were established by field observation. The values on the Portage River were modified slightly to correlate with high water elevations available at the gaging station. Note that local deviations in roughness vary considerably and the specified values are considered to be representative (Reference 4).

Cross-section data for the Sandusky River and shore profiles for Sandusky Bay in Sandusky County and Raccoon and Buck were obtained by field survey. Cross section data was also obtained from the USACE. Bridges were surveyed to obtain elevation data and structural geometry or to supplement bridge construction plans provided by the Ohio Department of Transportation, Conrail, the Sandusky County Engineer, and the Ohio Turnpike Commission (Reference 1 and 3).

Starting elevations for Flag Run were established using normal depth elevations downstream and generating backwater to the downstream study limit. Starting elevations on the Flag Run Tributary were established using normal depth techniques also. However, the backwater profiles on the tributary reflect the effects of flood elevations of Flag Run. For both streams studied in detail, backwater profiles were generated using the HEC-2 backwater program (Reference 31). All obstructions to flow and cross sections were field surveyed for entry in the backwater program (Reference 2).

For the Portage River in the City of Woodville, starting elevations were established using normal depth computations downstream of the study reach and conducting backwater computations up to the study reach. These profiles were compared to elevations at the stream gaging station for known flows. The overall character of the hydraulic backwater profile relative to the streambed was also reviewed. Hydraulic computations for Victoria Creek in the City of Woodville were started at normal depth. Backwater from the Portage River appears on the Victoria Creek profiles, significantly raising the flood elevations. For both the Portage River and Victoria Creek, backwater profiles were drawn using the HEC- 2 backwater program (Reference 32).

Water-surface profiles for the Buck Creek and Raccoon River and Sandusky Rivers were developed through the use of USACE HEC-2 step-backwater computer program (Reference 33).

Starting elevations for the water-surface profiles for the Sandusky River were obtained by interpolating between the elevations of the water-surface profiles for historic floods at the starting section (Reference 15).

Starting elevations for the water-surface profiles for Raccoon and Buck Creeks were calculated using Manning's equation, the continuity equation and an approximation of the downstream cross section and were adjusted based on the results of the first output of the HEC-2 computer program (Reference 1).

Roughness coefficients (Manning's "n") for the Sandusky River in Sandusky County and Raccoon and Buck Creeks in the City of Clyde were estimated by field inspection (Reference 1 and 3).

Table 6 shows the ranges of Manning's "n" for streams studied by detailed methods.

Table 6 – Manning's "n" Values

STREAM	CHANNEL	OVERBANK
Buck Creek	0.012 – 0.045	0.035 – 0.100
Flag Run	0.025 – 0.040	0.043 – 0.120
Flag Run Tributary	0.070	0.120
Portage Run	0.030	0.045 – 0.050
Raccoon Creek	0.017 – 0.050	0.016 – 0.100
Sandusky River	0.035 – 0.050	0.035 – 0.088
Victoria Creek	0.035	0.050

For the approximate study of flooding sources in Sandusky County, the hydraulic analyses were performed using USACE HEC-RAS (version 4.0) models (Reference 34). Structural measurements and field survey were not performed. No structures were modeled in the new approximate study. Cross section geometry was derived from topographic maps with a 2-ft contour interval provided by Ohio Statewide Imagery Program (OSIP) with an average spacing of approximately 2,000 feet. Average roughness factors (Manning's n) were estimated based on aerial mapping. Starting water surface elevation was specified as a known water surface if a downstream water surface elevation could be determined from an effective detailed study or a discharge-elevation curve. If a downstream water surface elevation was not available, the starting water surface elevation was assumed to be normal depth (Reference 6). When the coincident peak criteria were met (i.e. the drainage areas of the streams at a confluence were between the ratio of 0.6 and 1.4), a junction was created in the HEC-RAS model at the confluence of the streams in question. The model then uses the calculated water surface elevation from the receiving stream as the boundary condition for the contributing stream(s).

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the Flood Profiles (Exhibit 1) are thus considered valid only if

hydraulic structures remain unobstructed, operate properly, and do not fail and if the channel and overbank conditions remain essentially the same as ascertained.

3.3 Vertical Datum

All FIS reports and FIRMs are referenced to a specific vertical datum. The vertical datum provides a starting point against which flood, ground, and structure elevations can be referenced and compared. Until recently, the standard vertical datum used for newly created or revised FIS reports and FIRMs was the National Geodetic Vertical Datum of 1929 (NGVD29). With the completion of the NAVD88, many FIS reports and FIRMs are now prepared using NAVD88 as the referenced vertical datum.

For this countywide FIS, all flood elevations shown in the FIS report and on the FIRM are referenced to NAVD88. Structure and ground elevations in the community must, therefore, be referenced to NAVD88. It is important to note that adjacent communities may be referenced to NGVD29. This may result in differences in BFEs across corporate limits between the communities.

Flood elevations shown in this FIS report and on the FIRM are referenced to the NAVD88. These flood elevations must be compared to structure and ground elevations referenced to the same vertical datum. Some of the data used in this study were taken from the prior effective FIS reports and FIRMs and adjusted to NAVD88. The datum conversion factor from NGVD29 to NAVD88 in Sandusky County is **-0.654 feet**. The locations used to establish the conversion factor were USGS 7.5-minute topographic quadrangle corners that fell within the County, as well as those that were within 2.5 miles outside the County. The benchmarks are referenced to NAVD88.

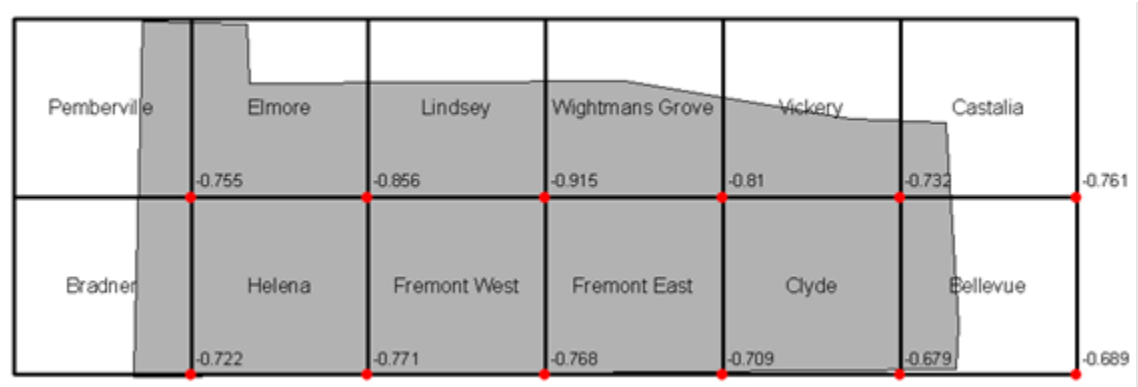

Figure 1 – Vertical Datum Conversion

The data points used to determine the conversion are listed in Table 7, "Vertical Datum Conversion Values."

Table 7 – Vertical Datum Conversion Values

USGS 7.5-minute Quadrangle Name	Corner	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)	Conversion from NGVD29 to NAVD88 (feet)
Pemberville	SE	41.375	-83.375	-0.755
Elmore	SE	41.375	-83.250	-0.856
Lindsey	SE	41.375	-83.125	-0.915
Wightmans Grove	SE	41.375	-83.000	-0.810
Vickery	SE	41.375	-82.875	-0.732
Castalia	SE	41.375	-82.750	-0.761
Bradner	SE	41.250	-83.375	-0.722
Helena	SE	41.250	-83.250	-0.771
Fremont West	SE	41.250	-83.125	-0.768
Fremont East	SE	41.250	-83.000	-0.709
Clyde	SE	41.250	-82.875	-0.679
Bellevue	SE	41.250	-82.750	-0.689
			AVERAGE	**-0.654 feet**

The BFEs are shown on the FIRM represent whole-foot rounded values. For example, a BFE of 102.4 will appear as 102 on the FIRM and 102.6 will appear as 103. Therefore, users that wish to convert the elevations in this FIS to NGVD29 should apply the conversion factor to elevations shown on the Flood Profiles and supporting data tables in this FIS report, which are shown at a minimum to the nearest 0.1 foot.

NAVD88 = NGVD29 – 0.654

For additional information regarding conversion between the NGVD29 and NAVD88, visit the National Geodetic Survey website at http://www.ngs.noaa.gov, or contact the National Geodetic Survey at the following address:

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

Temporary vertical monuments are often established during the preparation of a flood hazard analysis for the purpose of establishing local vertical control. Although these monuments are not shown on the FIRM, they may be found in the Technical Support Data Notebook associated with the FIS report and FIRM for this community. Interested individuals may contact FEMA to access these data.

All qualifying benchmarks within a given jurisdiction that are catalogued by the NGS and entered into the National Spatial Reference System (NSRS) as First or Second Order Vertical and have a vertical stability classification of A, B or C are shown and labeled on the FIRM with their 6-character NSRS Permanent Identifier.

Benchmarks catalogued by the NGS and entered into the NSRS vary widely in vertical stability classification. NSRS vertical stability classifications are as follows:

- Stability A: Monuments of the most reliable nature, expected to hold position/elevation (e.g. mounted in bedrock)
- Stability B: Monuments which generally hold their position/elevation (e.g. concrete bridge abutment)
- Stability C: Monuments which may be affected by surface ground movements (e.g. concrete monument below frost line)
- Stability D: Mark of questionable or unknown vertical stability (e.g. concrete monument above frost line, or steel witness post)

In addition to NSRS benchmarks, the FIRM may also show vertical control monuments established by a local jurisdiction; these monuments will be shown on the FIRM with the appropriate designations. Local monuments will only be placed on the FIRM if the community has requested that they be included, and if the monuments meet the aforementioned NSRS inclusion criteria.

To obtain current elevation, description, and/or location information for benchmarks shown on the FIRM for this jurisdiction, please contact the Information Services Branch of the NGS at (301) 713-3242, or visit their Web site at www.ngs.noaa.gov.

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The NFIP encourages State and local governments to adopt sound floodplain management programs. Therefore, each FIS provides 1-percent-annual-chance (100-year) flood elevations and delineations of the 1- and 0.2-percent-annual-chance (500-year) floodplain boundaries and 1-percent-annual-chance floodway to assist communities in developing floodplain management measures. This information is presented on the FIRM and in many components of the FIS report, including Flood Profiles and Floodway Data Table. Users should reference the data presented in the FIS report as well as additional information that may be available at the local map repository before making flood elevation and/or floodplain boundary determinations.

4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1-percent-annual-chance flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2-percent-annual-chance flood is employed to indicate additional areas of flood risk in the community. For the streams studied in detail, the 1- and 0.2-percent-annual-chance floodplain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps. Topographic mapping used for floodplain delineation was provided by OSIP and has a 2-foot contour interval for the entire county.

The 1- and 0.2-percent-annual-chance floodplain boundaries are shown on the FIRM (Exhibit 2). On this map, the 1-percent-annual-chance floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones A and AE), and the 0.2-percent-annual-chance floodplain boundary corresponds to the boundary of areas of moderate flood hazards. In cases where the 1- and 0.2-percent-annual-chance floodplain boundaries are close together, only the 1-percent-annual-chance floodplain boundary has been shown. Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

For the streams studied by approximate methods, only the 1-percent-annual-chance floodplain boundaries are shown on the FIRM (Exhibit 2).

4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces flood carrying capacity, increases flood heights, and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the NFIP, a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 1-percent-annual-chance floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the 1-percent-annual-chance flood can be carried without substantial increases in flood heights. Minimum federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this study are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway studies.

The floodways presented in this FIS report and on the FIRM was computed for certain stream segments on the basis of equal conveyance reduction from each side of the floodplain. Floodway widths were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. The results of the floodway computations have been tabulated for selected cross sections (Table 8). In cases where the floodway and 1-percent-annual-chance floodplain boundaries are either close together or collinear, only the floodway boundary has been shown.

The area between the floodway and the 1-percent-annual-chance floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the water surface elevation of the 1-percent-annual-chance flood by more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 2.

In the redelineation efforts, the floodway was not recalculated. As a result, there were areas where the previous floodway did not fit within the boundaries of the 1-perecent-annual-chance floodplain. In areas where this occurred, the floodway was reduced. Table 9, Floodway Data table lists the water surface elevations, with and without a floodway, the mean velocity in the floodway, and the locations and areas at each surveyed cross section as determined by hydraulic methods. The width of the floodway depicted by the

FIRM panels and the amount of reduction to fit the floodway inside the 1-perent-annual-chance floodplain, if also listed.

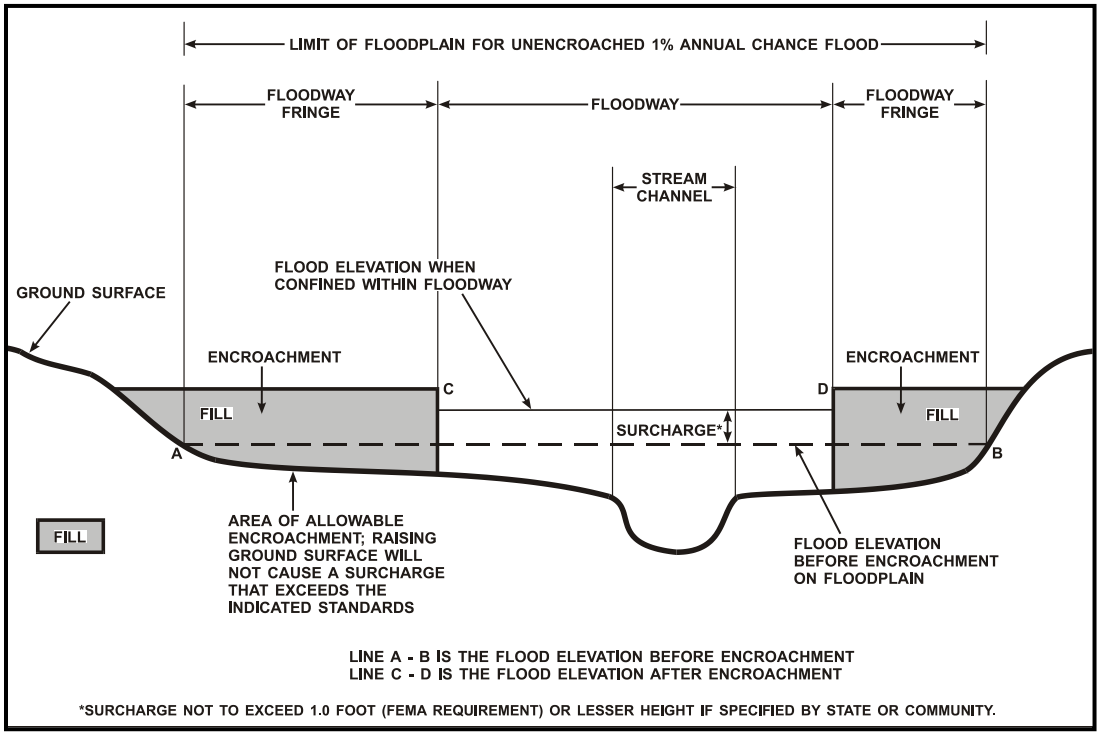

Figure 2 – Floodway Schematic

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD88)	WITHOUT FLOODWAY (FEET NAVD88)	WITH FLOODWAY (FEET NAVD88)	INCREASE (FEET)
BUCK CREEK								
A	7,286	30	86	5.1	656.8	656.8	657.1	0.3
B	8,131	26	70	6.3	663.0	663.0	663.0	0.0
C	9,293	24	73	6.0	669.2	669.2	669.3	0.1
D	9,715	18	68	6.4	673.4	673.4	673.5	0.1
E	9,926	28	280	1.6	680.8	680.8	680.8	0.0
F	10,613	20	136	3.2	680.8	680.8	680.8	0.0
G	11,722	24	203	1.7	689.2	689.2	689.3	0.1

[1] FEET ABOVE MOUTH

TABLE 8

FEDERAL EMERGENCY MANAGEMENT AGENCY

SANDUSKY COUNTY, OH

AND INCORPORATED AREAS

FLOODWAY DATA

BUCK CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD88)	WITHOUT FLOODWAY (FEET NAVD88)	WITH FLOODWAY (FEET NAVD88)	INCREASE (FEET)
FLAG RUN								
A	3,770	69	268	4.5	671.5	671.5	671.7	0.2
B	5,118	80	594	1.8	683.1	683.1	683.1	0.0
C	5,847	93	477	2.2	683.4	683.4	683.6	0.2
D	6,518	83	369	2.9	685.5	685.5	658.6	0.1
E	7,084	52	364	2.5	690.4	690.4	690.9	0.5

[1] FEET ABOVE COUNTY HIGHWAY 181

TABLE 8

FEDERAL EMERGENCY MANAGEMENT AGENCY

SANDUSKY COUNTY, OH

AND INCORPORATED AREAS

FLOODWAY DATA

FLAG RUN

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD88)	WITHOUT FLOODWAY (FEET NAVD88)	WITH FLOODWAY (FEET NAVD88)	INCREASE (FEET)
FLAG RUN TRIBUTARY								
A	620	21	86	3.2	690.2	685.8[2]	686.4	0.6

[1] FEET ABOVE CONFLUENCE WITH FLAG RUN
[2] ELEVATIONS WITHOUT CONSIDERING BACKWATER EFFECT FROM FLAG RUN

TABLE 8

FEDERAL EMERGENCY MANAGEMENT AGENCY

SANDUSKY COUNTY, OH

AND INCORPORATED AREAS

FLOODWAY DATA

FLAG RUN TRIBUTARY

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD88)	WITHOUT FLOODWAY (FEET NAVD88)	WITH FLOODWAY (FEET NAVD88)	INCREASE (FEET)
PORTAGE RIVER								
A	2,400	286	2,972	4.6	624.6	624.6	625.5	0.9
B	4,050	260	1,849	7.4	625.4	625.4	626.4	1.0
C	5,700	201	2,018	6.8	628.2	628.2	628.8	0.6
D	8,014	161	2,217	6.2	629.7	629.7	630.6	0.9
E	10,047	278	3,323	4.1	631.1	631.1	632.1	1.0
F	11,547	171	2,630	5.2	631.6	631.6	632.6	1.0

[1] FEET ABOVE SHAW ROAD

TABLE 8

FEDERAL EMERGENCY MANAGEMENT AGENCY

SANDUSKY COUNTY, OH

AND INCORPORATED AREAS

FLOODWAY DATA

PORTAGE RIVER

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD88)	WITHOUT FLOODWAY (FEET NAVD88)	WITH FLOODWAY (FEET NAVD88)	INCREASE (FEET)
RACCOON CREEK								
A	52,430	39	233	5.6	646.3	643.3	646.8	0.5
B	55,018	20	157	8.3	655.3	655.3	655.3	0.0
C	55,229	63	184	6.8	656.6	655.6	656.6	0.0
D	55,757	37	246	5.1	659.3	659.3	659.3	0.0
E	56,174	43	264	4.7	660.3	660.3	660.4	0.1
F	56,633	54	276	4.5	662.9	662.9	663.1	0.2
G	56,813	41	345	3.4	665.1	665.1	665.1	0.0
H	57,922	20	141	8.3	666.5	666.5	666.9	0.4
I	58,080	91	330	3.6	668.0	668.0	668.3	0.3
J	58,766	28	184	6.4	669.4	669.4	669.6	0.2
K	59,453	20	105	11.2	671.1	671.1	671.4	0.3
L	59,770	120	516	2.3	674.0	674.0	674.4	0.4
M	60,245	61	250	4.7	674.4	674.4	674.9	0.5
N	60,826	58	185	5.3	675.7	675.7	676.2	0.5
O	60,878	50	112	8.6	679.2	679.9	679.9	0.0
P	62,885	170	442	2.2	682.2	682.2	682.7	0.5
Q	64,363	160	317	3.1	687.6	687.6	688.1	0.5
R	65,842	27	148	6.6	692.4	692.4	692.7	0.3

[1] FEET ABOVE MOUTH

TABLE 8

FEDERAL EMERGENCY MANAGEMENT AGENCY

SANDUSKY COUNTY, OH

AND INCORPORATED AREAS

FLOODWAY DATA

RACCOON CREEK

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD88)	WITHOUT FLOODWAY (FEET NAVD88)	WITH FLOODWAY (FEET NAVD88)	INCREASE (FEET)
SANDUSKY RIVER								
A	16,157	4,834	18,596	1.9	578.1	578.1	578.1	0.0
B	25,925	2,379	25,297	1.4	579.3	579.3	579.5	0.2
C	31,152	1,939	18,615	1.9	579.8	579.8	580.0	0.2
D	36,590	1,127	12,437	2.9	580.4	580.4	580.8	0.4
E	39,494	700	10,755	3.3	580.8	580.8	581.3	0.5
F	41,606	1,002	10,409	3.4	581.2	581.2	581.6	0.4
G	43,296	913	8,547	4.2	581.7	581.7	582.1	0.4
H	44,246	665	9,005	3.9	582.2	582.2	582.5	0.3
I	46,042	1,520	16,087	2.2	582.6	582.6	583.0	0.4
J	51,480	1,447	13,429	2.6	583.3	583.3	583.7	0.4
K	59,136	1,375	14,516	2.5	584.4	584.4	584.9	0.5
L	63,571	1,004	13,696	2.6	585.0	585.0	585.4	0.4
M	65,314	900	12,618	2.8	585.3	585.3	585.7	0.4
N	67,056	593	8,981	4.0	585.6	585.6	586.0	0.4
O	67,637	783	10,880	3.3	585.8	585.8	586.2	0.4
P	69,010	715	11,149	3.2	586.1	586.1	586.5	0.4
Q	72,600	864	*	*	586.7	586.7	587.0	0.3
R	76,190	557	*	*	586.9	586.9	587.3	0.4
S	76,930	379	*	*	587.0	587.0	587.3	0.3

[1] FEET ABOVE MOUTH
* DATA NOT AVAILABLE

TABLE 8

FEDERAL EMERGENCY MANAGEMENT AGENCY

SANDUSKY COUNTY, OH
AND INCORPORATED AREAS

FLOODWAY DATA

SANDUSKY RIVER

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD88)	WITHOUT FLOODWAY (FEET NAVD88)	WITH FLOODWAY (FEET NAVD88)	INCREASE (FEET)
SANDUSKY RIVER (CONTINUED)								
T	77,774	405	*	*	587.5	587.5	587.8	0.3
U	79,728	471	*	*	588.5	588.5	588.8	0.3
V	80,309	302	*	*	588.8	588.8	589.0	0.2
W	81,576	230	*	*	589.8	589.8	590.0	0.2
X	82,157	411	*	*	592.8	592.8	592.9	0.1
Y	82,896	423	*	*	593.0	593.0	593.1	0.1
Z	85,800	770	6,452	5.5	594.8	594.8	594.9	0.1
AA	88,070	269	2,640	13.5	600.1	600.1	600.2	0.1
AB	88,598	274	3,006	11.8	603.8	603.8	603.8	0.0

[1] FEET ABOVE MOUTH

* DATA NOT AVAILABLE

TABLE 8

FEDERAL EMERGENCY MANAGEMENT AGENCY

SANDUSKY COUNTY, OH

AND INCORPORATED AREAS

FLOODWAY DATA

SANDUSKY RIVER

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NAVD88)	WITHOUT FLOODWAY (FEET NAVD88)	WITH FLOODWAY (FEET NAVD88)	INCREASE (FEET)
VICTORIA CREEK								
A	825	25	38	7.1	629.4	628.0[3]	628.0	0.0
B	1,004	28	110	2.5	629.7	629.7	630.5	0.8
C	1,944	24	84	3.2	630.9	630.9	631.6	0.7
D	2,594	29	122	2.2	631.6	631.6	632.2	0.6
E	3,194	25	66	4.1	631.9	631.9	632.7	0.8

[1] FEET ABOVE CONFLUENCE WITH PORTAGE RIVER

TABLE 8

FEDERAL EMERGENCY MANAGEMENT AGENCY

SANDUSKY COUNTY, OH

AND INCORPORATED AREAS

FLOODWAY DATA

VICTORIA CREEK

5.0 INSURANCE APPLICATIONS

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. These zones are as follows:

Zone A

Zone A is the flood insurance risk zone that corresponds to the 1-percent-annual-chance floodplains that are determined in the FIS by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no BFE or base flood depths are shown within this zone.

Zone AE

Zone AE is the flood insurance risk zone that corresponds to the 1-percent-annual-chance floodplains that are determined in the FIS by detailed methods. In most instances, whole-foot BFEs derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AH

Zone AH is the flood insurance risk zone that corresponds to the areas of 1-percent-annual-chance shallow flooding (usually areas of ponding) where average depths are between 1 and 3 feet. Whole-foot BFEs derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AO

Zone AO is the flood insurance risk zone that corresponds to the areas of 1-percent-annual-chance shallow flooding (usually sheet flow on sloping terrain) where average depths are between 1 and 3 feet. Average whole-foot base flood depths derived from the detailed hydraulic analyses are shown within this zone.

Zone AR

Zone AR is the flood insurance risk zone that corresponds to an area of special flood hazard formerly protected from the 1-percent-annual-chance flood event by a flood-control system that was subsequently decertified. Zone AR indicates that the former flood-control system is being restored to provide protection from the 1-percent-annual-chance or greater flood event.

Zone A99

Zone A99 is the flood insurance risk zone that corresponds to areas of the 1-percent-annual-chance floodplain that will be protected by a Federal flood protection system where construction has reached specified statutory milestones. No BFEs or depths are shown within this zone.

Zone V

Zone V is the flood insurance risk zone that corresponds to the 1-percent-annual-chance coastal floodplains that have additional hazards associated with storm waves. Because approximate hydraulic analyses are performed for such areas, no BFEs are shown within this zone.

Zone VE

Zone VE is the flood insurance risk zone that corresponds to the 1-percent-annual-chance coastal floodplains that have additional hazards associated with storm waves. Whole-foot BFEs derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone X

Zone X is the flood insurance risk zone that corresponds to areas outside the 0.2-percent-annual-chance floodplain, areas within the 0.2-percent-annual-chance floodplain, areas of 1-percent-annual-chance flooding where average depths are less than 1 foot, areas of 1-percent-annual-chance flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 1-percent-annual-chance flood by levees. No BFEs or base flood depths are shown within this zone.

Zone X (Future Base Flood)

Zone X (Future Base Flood) is the flood insurance risk zone that corresponds to the 1-percent-annual-chance floodplains that are determined based on future-conditions hydrology. No BFEs or base flood depths are shown within this zone.

Zone D

Zone D is the flood insurance risk zone that corresponds to unstudied areas where flood hazards are undetermined, but possible.

6.0 FLOOD INSURANCE RATE MAP

The FIRM is designed for flood insurance and floodplain management applications.

For flood insurance applications, the map designates flood insurance risk zones as described in Section 5.0 and, in the 1-percent-annual-chance floodplains that were studied by detailed methods, shows selected whole-foot BFEs or average depths. Insurance agents use the zones and BFEs in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For floodplain management applications, the map shows by tints, screens, and symbols, the 1- and 0.2-percent-annual-chance floodplains, floodways, and the locations of selected cross sections used in the hydraulic analyses and floodway computations.

The current FIRM presents flooding information for the entire geographic area of Sandusky County. Previously, FIRMs were prepared for each identified flood prone incorporated community and for the unincorporated area of the county. Historical data relating to the maps prepared for each community are presented in Table 9.

COMMUNITY NAME	INITIAL NFIP MAP DATE	FLOOD HAZARD BOUNDARY MAP REVISIONS DATE	INITIAL FIRM DATE	FIRM REVISIONS DATE
BURGOON, VILLAGE OF	August 2, 1974	July 16, 1976	April 18, 2011	NONE
CLYDE, CITY OF	February 15, 1974	September 12, 1975	April 2, 1979	NONE
FREMONT, CITY OF	March 15, 1974	April 17, 1984	April 18, 2011	NONE
GIBSONBURG, VILLAGE OF	April 18, 2011	NONE	April 18, 2011	NONE
[1] GREEN SPRINGS, VILLAGE OF	March 1, 1974	June 11, 1976	August 15, 1980	NONE
[2] HELENA, VILLAGE OF	N/A	NONE	N/A	NONE
LINDSEY, VILLAGE OF	March 15, 1974	May 21, 1976	September 1, 1978	September 1, 1978
SANDUSKY COUNTY (UNINCORPORATED AREAS)	January 13, 1978	NONE	January 17, 1979	NONE
WOODVILLE, VILLAGE OF	March 15, 1974	November 21, 1975	June 18, 1980	November 21, 1975

[1] The Village of Green Springs is a dual county community located in Seneca and Sandusky Counties. The entire Village of Green Springs will be mapped in Sandusky County.

[2] No special flood hazard area identified

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

SANDUSKY COUNTY, OH
AND INCORPORATED AREAS

COMMUNITY MAP HISTORY

7.0 OTHER STUDIES

This FIS report either supersedes or is compatible with all previous studies on streams studied in this report and should be considered authoritative for purposes of the NFIP.

8.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting the Flood Insurance and Mitigation Division, Federal Emergency Management Agency Region V, 536 South Clark Street, 6th Floor, Chicago, IL 60605- 1509.

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