FHWA-ID-EIS-12-01-F

Floodplain Technical Report

Final Environmental Impact Statement

US-95 Thorncreek Road to Moscow

Project No. DHP-NH-4110(156);Key No 09294

US-95 THORNCREEK ROAD TO MOSCOW
HYDRAULIC STUDY FOR AFFECTED FLOODPLAINS
ON ALTERNATIVES CARRIED FORWARD

DHP-NH-4110 (156)
KEY # 09294

PREPARED BY
DISTRICT 2 PROJECT DEVELOPMENT ENGINEER

Curtis J. Arnzen

Curtis J. Arnzen, P.E.

03/27/15

Date

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Hydraulic Study For EIS

DHP-NH-4110 (156); Key No. 9294; Thorncreek to Moscow

December 29, 2014

Preface

This report supersedes the Hydraulic Study For EIS dated April 12, 2012. The purpose of this report is to document the floodway and floodplain impacts of Alternative Modified W4 as well as the impacts of Alternatives C3 and E2. The previous report included impacts for Alternative W4 instead of Alternative Modified W4.

Introduction

This report is the Hydraulic Study for the Environmental Impact Statement for Thorncreek to Moscow. 23 CFR 650, Subpart A requires a discussion of the following items related to floodplain development:

a. The flooding risks;
b. The impacts on natural and beneficial floodplain values;
c. The support of probable incompatible floodplain development;
d. The measures to minimize floodplain impacts; and
e. The measures to restore and preserve the natural and beneficial values.

The detail in the discussion of the items must be commensurate with the level of risk or environmental impact for the encroachment on each floodplain area. The level of detail in this Hydraulics Study is not sufficient to apply for a no rise certificate.

The Environmental Impact Statement for Thorncreek to Moscow has three action alternatives, Alternatives E2, C3, and Modified W4 and a No Action Alternative. The floodplain and floodway impacts of the alternatives are described in Table 1 shown below. The acreages have been calculated based on the most recent Flood Insurance Rate Maps (FIRM) dated August 15, 1980.

Table 1: Floodway and Floodplain Impacts

Alternative	Floodway Impacts (acre)	Floodplain Impacts (acre)
No Action	0.0	0.0
E2	0.0	0.0
C3	0.0	1.8
Modified W4	0.0	1.6

Affected Floodplains and Floodways

No floodway impacts are anticipated in any of the action alternatives or the No Action Alternative. No floodplain impacts are anticipated on Alternative E2. Alternative Modified W4 affects 1.6 acres of total floodplain in one location labeled Site B within this report. Alternative C3 affects 1.8 acres of floodplain in 1 location labeled Site C within this report. The locations of Sites B and C are shown in Appendix A on the Floodplain Encroachment Map. District 2 personnel had two separate meetings with the Michelle Fusion, the Director of Latah County Planning and Zoning and Bill Belknap, the Community Development Director of the City of Moscow to discuss impacts to each site.

Alternative Modified W4 Site B Floodplain Impact

The 1.6 acre floodplain impact at Site B of Alternative Modified W4 is a crossing of a Zone A floodplain finger of the South Fork of the Palouse River. Zone Designation A within the FIRM is an area within a 100-year flood where base flood elevations and flood hazard factors have not been determined. The floodplain is located on farmland within the encroachment area. Michelle Fusion, the Latah County Community Development Director, indicated that Zone A floodplains generally have a low risk associated with them and that structures are usually not in close proximity to the floodplains. She said that there is "low" risk associated with this floodplain because of the low cost of property and because only a few buildings are in the vicinity of the floodplain. The buildings are all associated with Primeland Cooperatives, an agricultural cooperative.

There are no effects to natural and beneficial floodplain values since the land use is currently used as farmland. Development in this area is not anticipated at this time and the development would not be to enhance the floodplain. Steepening slopes or building retaining structures may be considered to lessen floodplain impacts if Alternative Modified W4 is selected. An oversized pipe, or pipes, would be designed to accommodate flood backwater in this location.

Since US-95 is a critical facility the proposed elevation of US-95 should be 3 feet taller than the 100 year flood elevation and a maximum of a 1 foot rise to the 100-year floodplain would be allowed.

Floodplain impacts associated with Site B are recorded in Appendix B which includes a Location Hydraulic Survey Form used by CalTrans to satisfy 23 CFR 650 for floodplain impacts on projects

requiring Environmental Impact Statements. Appendix B also shows USGS Streamstats Data, FIRM Map copies, and photographs of Site B.

Alternative C3 Site C Floodplain Impact

The 1.8 acre floodplain impact at Site C of Alternative C3 is longitudinal Zone A floodplain encroachment of the South Fork of the Palouse River. Zone Designation A within the FIRM is an area within a 100-year flood where base flood elevations and flood hazard factors have not been determined. The floodplain encroachment is on farmland. Michelle Fusion, the Latah County Community Development Director, indicated that Zone A floodplains generally have a low risk associated with them and that structures are usually not in close proximity to the floodplains. She said that there is "low" risk associated with this floodplain because of the low cost of property and because only a few buildings are in the vicinity of the floodplain. The buildings are associated with Primeland Cooperatives, an agricultural cooperative.

There are no effects to natural and beneficial floodplain values since the land use is currently used as farmland. Development in this area is not anticipated at this time and the possible future development at this site would not enhance the floodplain. Steepening slopes or building retaining structures may be considered to lessen floodplain impacts if Alternative C3 is selected.

Since US-95 is a critical facility the proposed elevation of US-95 should be 3 feet taller than the 100 year flood elevation and a maximum of a 1 foot rise to the 100-year floodplain would be allowed.

Floodplain impacts associated with Site C are recorded in Appendix C which includes a Location Hydraulic Survey Form used by CalTrans to satisfy 23 CFR 650 for floodplain impacts on projects requiring Environmental Impact Statements. Appendix D also shows USGS Streamstats Data, FIRM Map copies, and photographs of Site C.

Recent Floodplain Investigation of South Fork of Palouse River

ITD D2 Personnel had a meeting with Bill Belknap, the Community Development Director of Moscow. He indicated that a local civil engineering firm named Terra Graphics completed an extensive floodplain and floodway investigation near Sites B and C for a proposed industrial park in Southeast Moscow that may affect the floodplain and floodway areas at Sites B and C if

the analysis is approved by FEMA. Terra Graphics indicated in Memorandum #4 – Southeast Moscow Industrial Park Existing Condition Hydraulic Model, dated February 22, 2010, that they updated the HEC-2 hydraulic model used to create the August 15, 1980 FIRM Maps in order to define a new 100-year flood elevation with more accurate survey data and the preferred HEC-RAS hydraulic model. The results of this model are that the 100 year flood elevation decreases and that Sites B and C impacts would no longer be in a 100-year floodplain. If Terra Graphics's calculations used to create Memorandum #4, shown in Appendix E, are correct and approved by FEMA, Sites B and C will not be a floodplain impact on Alternatives C3 and Modified W4.

Conclusion

Floodplain and floodway impacts are shown in Table 2 below:

Table 2: Floodway and Floodplain Impacts		
Alternative	Floodway Impacts (acre)	Floodplain Impacts (acre)
No Action	0.0	0.0
E2	0.0	0.0
C3	0.0	1.8
Modified W4	0.0	1.6

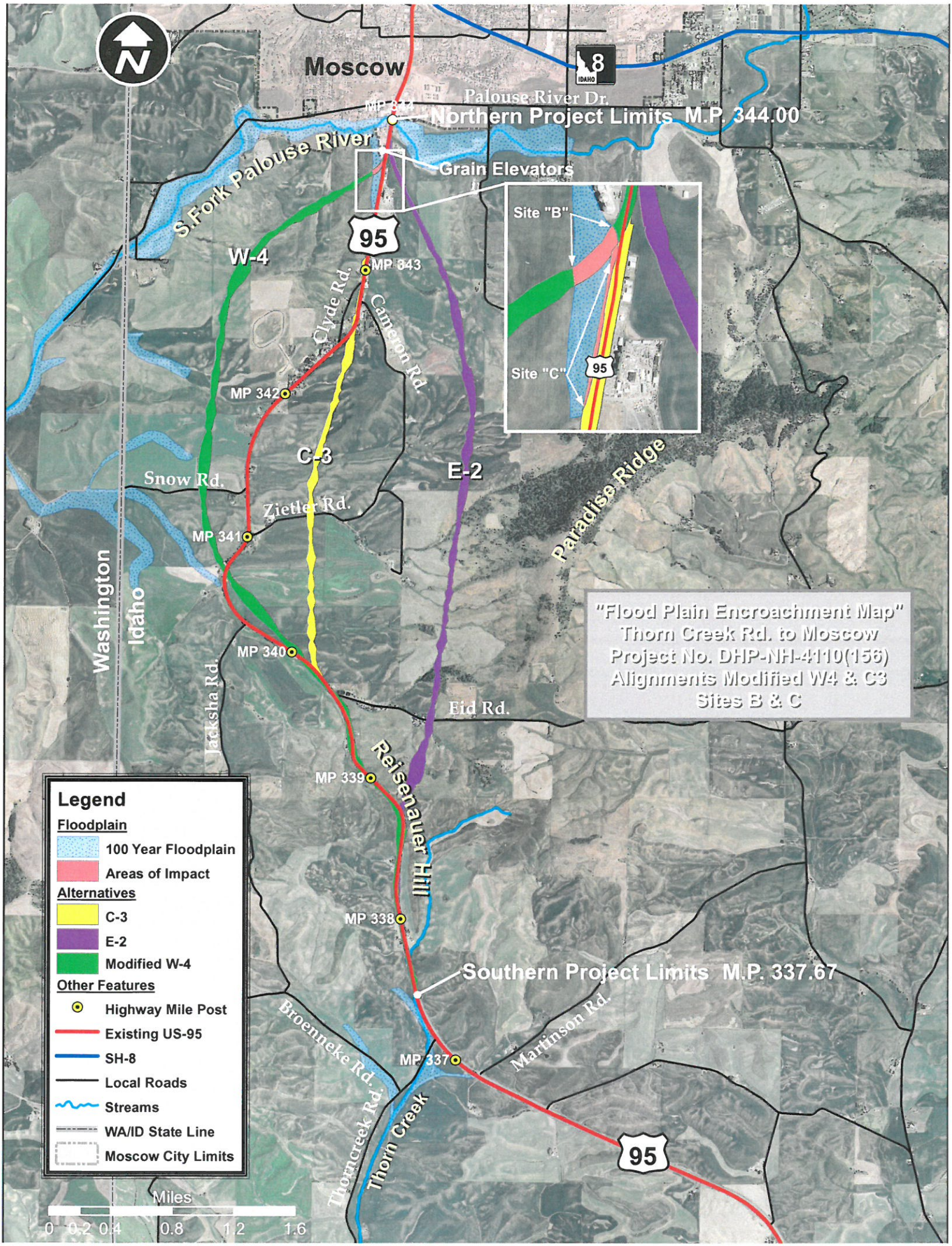
There are no floodway impacts for Alternatives E2, C3, and Modified W4 and for the No Action Alternative and there are no floodplain impacts for the No Action Alternative and Alternative E2.

Alternative Modified W4 has 1.6 total acres of floodplain impacts in one location at Site B which is a crossing of a finger of floodplain used for the South Fork of the Palouse River that is currently used as farm field at the north end of the project. The floodplain is in Zone A of the FIRM maps and has no natural or beneficial floodplain value. Filling into the floodplains at Site B on Alternative Modified W4 has a low associated risk for future flooding potential.

C3 has 1.8 total acres of floodplain impacts in one location (Site C). The floodplain impact area is a longitudinal encroachment of a finger of floodplain of the South Fork of the Palouse River that is currently used as farm field at the north end of the project. The floodplains are in Zone A of the FIRM maps and have no natural or beneficial floodplain value. Filling into the floodplain at Site C on Alternative C3 has a low associated risk for future flooding potential.

Appendix A

Floodplain Encroachment Map


Moscow
8
IDAHO
Palouse River Dr.
Northern Project Limits M.P. 344.00
MP 344
S.Fork Palouse River
Grain Elevators
Site "B"
Site "C"
95
W-4
MP 343
Clyde Rd.
Cameron Rd.
MP 342
C-3
E-2
Snow Rd.
Zietler Rd.
Paradise Ridge
MP 341
Washington
Idaho
MP 340
Jacksha Rd.
Eid Rd.
Reisenauer Hill
MP 339
MP 338
Southern Project Limits M.P. 337.67
Broenneke Rd.
Martinson Rd.
MP 337
Thorncreek Rd.
Thorn Creek
"Flood Plain Encroachment Map"
Thorn Creek Rd. to Moscow
Project No. DHP-NH-4110(156)
Alignments Modified W4 & C3
Sites B & C
Legend
Floodplain
100 Year Floodplain
Areas of Impact
Alternatives
C-3
E-2
Modified W-4
Other Features
Highway Mile Post
Existing US-95
SH-8
Local Roads
Streams
WA/ID State Line
Moscow City Limits
Miles
0 0.2 0.4 0.8 1.2 1.6

Appendix B

Site B Information

EIS Hydraulics Study Form for Site B

USGS Stream Stats Data for Site B

Federal Insurance Rate Map for Site B

Photos of Site B

LOCATION HYDRAULIC STUDY FORM
THORN CREEK ROAD TO MOSCOW
PROJECT NO. DHP-NH-4110(156)
ALIGNMENT- MODIFIED W4
SITE B

District 02 County Latah Route US-95 Mile Post 343.475

Floodplain Description:

This floodplain is a finger of the Southfork of the Palouse River outside the southern City Limits of Moscow. The FIRM panels show that it is classified as a Zone A floodplain with no 100-year flood elevation being determined by FEMA. The floodplain is currently used as an agricultural field and no buildings are within the floodplain, but buildings associated with Primeland Cooperatives are in close proximity. The proposed location crossing the floodplain is approximately at Latitude 46.710160°, Longitude -117.0050003° just South of Moscow, Idaho.

See the Latah County, Idaho Flood Insurance Rate Map, Panel 160086 0330D, Section 19, Township 39 North, Range 5 West, Boise Meridian.

1. Description of Proposal

A proposed 4 lane roadway with a divided median would cross the floodplain finger and divide it impacting about 1.6 total acres. The impact could be minimized by slope adjustment or retaining walls. Drainage culverts sized to accommodate backwater of a 100 year flood event the South Fork of the Palouse River would be added through the highway embankment. If this alignment was chosen we would fill out a Floodplain Development Application for Latah County Planning and Zoning to meet their requirements. The floodplain could not rise more than 1 foot and the elevation of the roadway would need to be 3 feet taller than the 100 year flood elevation. Latah County Planning and Zoning indicated that this encroachment was minimal and that there is low associated risk with filling in this floodplain.

2. ADT: Current 6400 Projected 10221

3. Hydraulic Data: Base Flood Q_{100}= *1440 ft^3 / s WSE$_{100}$= **
The flood of record, if greater than Q_{100}: **NA** Q= **NA** ft^3 / s WSE= **NA**
Overtopping flood Q=**NA** ft^3 / s WSE= **NA**

* *Q_{100} is based on calculations from the Stream Stats Program at the location shown on the South Fork Palouse River which is attached.*

** *No water surface elevation was determined on the FIRM panels because this is located in a Zone A Floodplain.*

Are NFIP maps and studies available? YES XX NO_____

4. Is the highway location alternative within a regulatory floodway ?
YES_____ NO XX

5. Attach map with flood limits outlined showing all buildings or other improvements within the base floodplain.

No buildings are within the floodplain, but buildings associated with Primland Cooperatives are close to the floodplain.

Potential Q_{100} backwater damages:

A.	Residences?	NO XX	YES
B.	Other Bldgs?	NO XX	YES
C.	Crops?	NO	YES XX
D.	Natural and beneficial Floodplain values?	NO XX	YES

6. Type of Traffic:

A. Emergency supply or evacuation route?	NO	YES XX
B. Emergency vehicle access?	NO	YES XX
C. Practicable detour available?	NO	YES XX
D. School bus or mail route?	NO	YES XX

7. Estimated duration of traffic interruption for 100-year event hours: No Interruption

8. Estimated value of Q_{100} flood damages (if any) – moderate risk level.

A.	Roadway	$ N/A
B	Property	$ N/A
	Total	$ N/A

9. Assessment of Level of Risk Low XX
Moderate
High

For High Risk projects, during design phase, additional Design Study Risk Analysis May be necessary to determine design alternative.

Is there any longitudinal encroachment, significant encroachment, or any support of incompatible Floodplain development? NO XX YES

If yes, provide evaluation and discussion of practicability of alternatives in accordance with 23 CFR 650.113

Information developed to comply with the Federal requirement for the Location Hydraulic Study shall be retained in the project files.

Signature – D2PDE Curtis J Lunsford Date 3/27/15

USGS
Idaho StreamStats

Basin Characteristics Report

Date: Thu Mar 29 2012 08:41:58 Mountain Daylight Time
NAD27 Latitude: 46.7134 (46 42 48)
NAD27 Longitude: -117.0064 (-117 00 23)
NAD83 Latitude: 46.7132 (46 42 48)
NAD83 Longitude: -117.0074 (-117 00 27)

Parameter	Value
Area that drains to a point on a stream, in square miles	28.05
Mean annual precipitation, in inches	24.4
Minimum Basin Elevation in feet	2540
Maximum Basin Elevation in feet	4990
Mean Basin Elevation in feet	2970
Maximum - minimum elevation, in feet	2450
Mean basin slope computed from 10 m DEM, in percent	18
Mean basin slope. Computed from 10 m DEM and adjusted to approximate earlier values computed from 30 m DEM.	16.4
Percent of area having slope greater than or equal to 30 percent, computed from 10-m DEM	16
Percent of area with slopes greater than 30 percent. Computed from 10 m DEM and adjusted to approximate earlier values based on 30-m DEMs	12.3
Percentage of area having slopes greater than 50 percent, computed from 30-meter DEMs	0.68
Percent of area having North-facing slopes greater than or equal to 30 percent, computed from 10-m DEM	4
Percent of area having North-facing slopes greater than or equal to 30 percent. Computed from 10 m DEM and adjusted to approximate values computed from 30 m DEM.	3
10-85 slope based on longest flow path computed using 10-m DEMs, in feet per mile	75.2
10-85 slope, in feet per mile. Computed based on longest flow path using 10-m DEMs and adjusted to approximate earlier measurements done using BASINSOFT.	75.9
Percent of drainage area as surficial volcanic rocks as defined in SIR 2006-5035	66.7
Percent of area covered by forest	23
Agricultural Land in Percentage of Drainage Area	65.4
Developed Land in Percentage of Drainage Area from 1992 NLCD data	2.76
Percentage of area covered by water or perennial ice or snow from NLCD1992	0.12
Percentage of impervious area determined from NLCD 2001 impervious dataset	0.99
Percentage of urban land cover determined from NLCD 2001 land cover dataset	5.37

USGS
Idaho StreamStats

Streamstats Ungaged Site Report

Date: Thu Mar 29 2012 08:47:26 Mountain Daylight Time
Site Location: Idaho
NAD27 Latitude: 46.7134 (46 42 48)
NAD27 Longitude: -117.0064 (-117 00 23)
NAD83 Latitude: 46.7132 (46 42 48)
NAD83 Longitude: -117.0074 (-117 00 27)
Drainage Area: 28.05 mi2
Percent Urban: 5.38 %
Percent Impervious: 0.99 %

Peak-Flow Basin Characteristics

100% Peak Flow Region 3 (28.1 mi2)

Parameter	Value	Regression Equation Valid Range	
		Min	Max
Drainage Area (square miles)	28.1	2	788.7
Mean Basin Elevation (feet)	2970	1458.4	4040.1

Low-Flow Basin Characteristics

100% Low Flow Region 3 (28.1 mi2)

Parameter	Value	Regression Equation Valid Range	
		Min	Max
Drainage Area (square miles)	28.1	17.6	674.9
Mean Basin Elevation (feet)	2970	2647.1	3752.2
Mean Annual Precipitation (inches)	24.4	19.3	30.1
Relief (feet)	2450	1442.8	5098.9

Zero-Flow Probability Basin Characteristics

100% Undefined Region (28.05 mi2)

The selected watershed is entirely in an area for which flow equations were not defined.

Monthly and Annual Basin Characteristics

100% Low Flow Region 3 (28.1 mi2)

Parameter	Value	Regression Equation Valid Range	
		Min	Max
Drainage Area (square miles)	28.1	17.6	674.9
Mean Basin Elevation (feet)	2970	2647.1	3752.2
Mean Annual Precipitation (inches)	24.4	19.3	30.1
Relief (feet)	2450	1442.8	5098.9

Peak-Flow Streamflow Statistics

Statistic	Flow (ft^3/s)	Prediction Error (percent)	Equivalent years of record	90-Percent Prediction Interval	
				Minimum	Maximum
PK1_5	198	84		57.2	686
PK2	271	69		94.2	782
PK2_33	310	63		116	826
PK5	505	49		229	1120
PK10	693	44		336	1430
PK25	970	43		476	1980
PK50	1200	44		575	2490
PK100	1440	46		665	3100
PK200	1690	49		746	3840
PK500	2060	54		845	5020

Low-Flow Streamflow Statistics

Statistic	Flow (ft^3/s)	Estimation Error (percent)	Equivalent years of record	90-Percent Prediction Interval	
				Minimum	Maximum
M1D10Y	0.36	130			
M7D10Y	0.5	130			

M7D2Y	0.71	75			
M30D5Y	0.84	83			

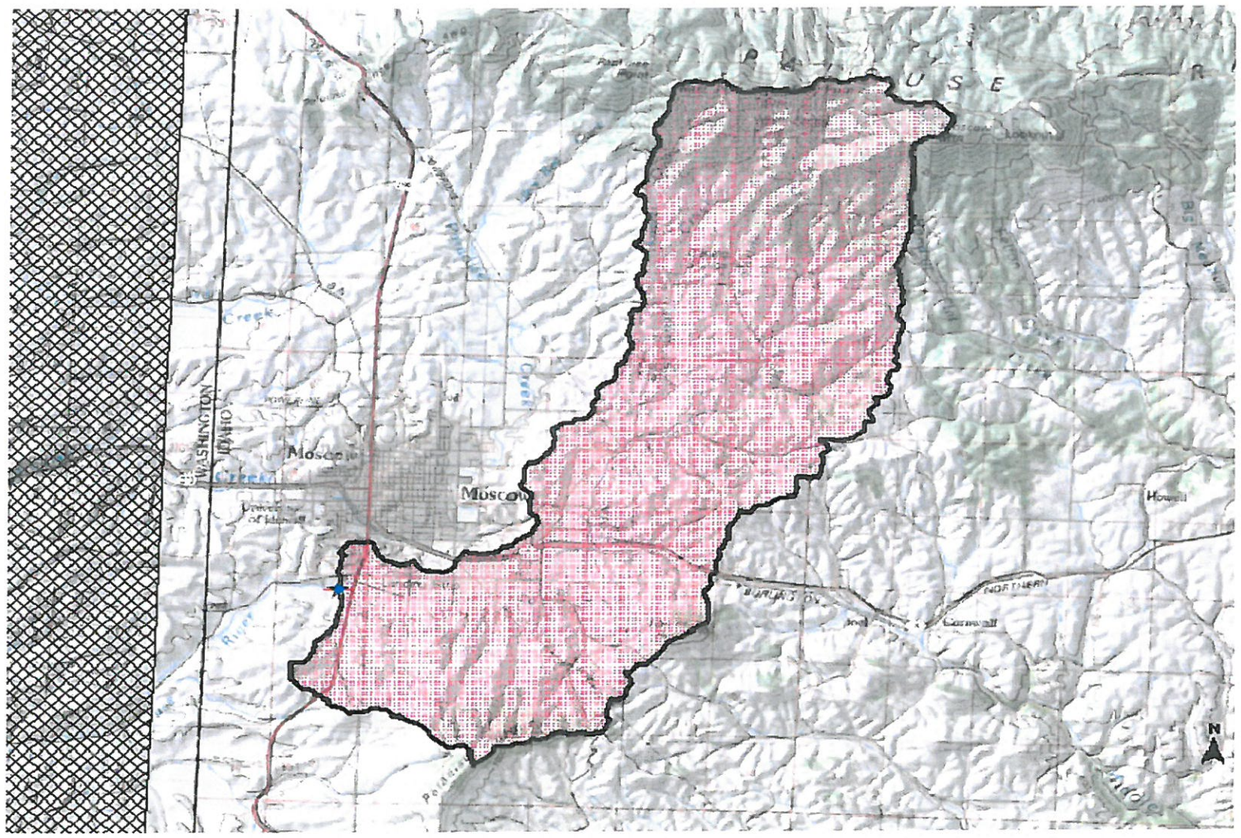
Monthly and Annual Streamflow Statistics

Statistic	Flow (ft^3/s)	Estimation Error (percent)	Equivalent years of record	90-Percent Prediction Interval	
				Minimum	Maximum
QA	10.8	17			
JAND20	21.3	46			
JAND50	6.65	43			
JAND80	2.05	21			
FEBD20	39.5	39			
FEBD50	14.5	19			
FEBD80	5.02	27			
MARD20	40.5	41			
MARD50	19.3	26			
MARD80	6.9	26			
APRD20	19.2	44			
APRD50	8.74	46			
APRD80	4.18	62			
MAYD20	8.3	61			
MAYD50	3.85	51			
MAYD80	2.37	44			
JUND20	4.01	43			
JUND50	2.55	30			
JUND80	1.89	36			
JULD20	2.06	21			
JULD50	1.83	30			
JULD80	1.73	50			
AUGD20	1.84	28			
AUGD50	1.78	44			
AUGD80	1.73	96			
SEPD20	1.88	22			
SEPD50	1.78	33			
SEPD80	1.72	63			
OCTD20	1.94	26			
OCTD50	1.83	25			
OCTD80	1.73	37			
NOVD20	3.21	67			
NOVD50	1.8	29			
NOVD80	1.77	28			
DECD20	7.26	49			
DECD50	1.85	42			
DECD80	1.81	22			

USGS
Idaho StreamStats

StreamStats Print Page

SO. FORK PALOUSE RV.



25 1.25 0 25 Miles

Explanation

- GlobalWatershedPoint
- Slp1085Point
- LongestFlowPath3D
- GlobalWatershed
- HUCLongestFlowPath
- Gaging Station, Continuous Record
- Low Flow, Partial Record
- Peak Flow, Partial Record
- Peak and Low Flow, Partial Record
- Stage Only
- Low Flow, Partial Record, Stage
- Miscellaneous Record
- Unknown
- hucpoly
- NHDPlusFlowline
- NHDPlusGages

3/29/2012 8:26:34 AM

FIRM
FLOOD INSURANCE RATE MAP

LATAH COUNTY, IDAHO
(UNINCORPORATED AREAS)

PANEL 330 OF 475
(SEE MAP INDEX FOR PANELS NOT PRINTED)

COMMUNITY-PANEL NUMBER
1600860330 D

MAP REVISED:
APRIL 15, 2002

Federal Emergency Management Agency

JOINS PANEL 0240

APPROXIMATE SCALE IN FEET
1000 0

City of Moscow
AREA NOT INCLUDED

WASHINGTON
IDAHO

13
24
19

ZONE C
ZONE B
ZONE A4
ZONE A2
ZONE A
ZONE C

Farm Road Bridge

2531 2532 2532 2534 2530 2529 2525 2525 2535 2536 2537 2538 2539 2540 2541 2542 2542 2543 2544 2549 2548 2550 2555 2524 2523 2522 2521 2520 2519 2518 2517 2516 2516

South Fork Palouse River

LIMIT OF DETAILED STUDY

Site B

Approximate Modified W4 Align.

ELEVATION REFERENCE MARKS

REFERENCE MARK	ELEVATION (FT. NGVD)	DESCRIPTION OF LOCATION
RM11	2592.5	Bronze disk stamped NO 5 DPW located approximately 0.4 mile south along Washington Street from the post office at Moscow, thence 2.6 miles east along State Highway 8, at the southwest corner of the Elks Golf Course, 241 feet west of the northwest corner of a concrete bridge, set in the top of a concrete post. Established by County Department of Power and Water.

KEY TO MAP

- 500-Year Flood Boundary
- 100-Year Flood Boundary
- Zone Designations*
- 100-Year Flood Boundary
- 500-Year Flood Boundary
- Base Flood Elevation Line With Elevation in Feet** — 513
- Base Flood Elevation in Feet Where Uniform Within Zone** — (EL 987)
- Elevation Reference Mark — RM7×
- Zone D Boundary
- River Mile — •M1.5
- Approximate 100- Year Flood Boundary

ZONE B
ZONE A1
ZONE A5
ZONE B
ZONE A

**Reference to the National Geodetic Vertical Datum of 1929

UNDEVELOPED COASTAL BARRIERS†

Identified 1983 | Identified 1990 | Otherwise Protected Areas

†Coastal barrier areas are normally located within or adjacent to special flood hazard areas.

*EXPLANATION OF ZONE DESIGNATIONS

ZONE	EXPLANATION
A	Areas of 100-year flood; base flood elevations and flood hazard factors not determined.
AO	Areas of 100-year shallow flooding where depths are between one (1) and three (3) feet; average depths of inundation are shown, but no flood hazard factors are determined.
AH	Areas of 100-year shallow flooding where depths are between one (1) and three (3) feet; base flood elevations are shown, but no flood hazard factors are determined.
A1-A30	Areas of 100-year flood; base flood elevations and flood hazard factors determined.
A99	Areas of 100-year flood to be protected by flood protection system under construction; base flood elevations and flood hazard factors not determined.
B	Areas between limits of the 100-year flood and 500-year flood; or certain areas subject to 100-year flooding with average depths less than one (1) foot or where the contributing drainage area is less than one square mile; or areas protected by levees from the base flood. (Medium shading)
C	Areas of minimal flooding. (No shading)
D	Areas of undetermined, but possible, flood hazards.
V	Areas of 100-year coastal flood with velocity (wave action); base flood elevations and flood hazard factors not determined.
V1-V30	Areas of 100-year coastal flood with velocity (wave action); base flood elevations and flood hazard factors determined.

NOTES TO USER

This map is for use in administering the National Flood Insurance Program; it does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size, or all planimetric features outside Special Flood Hazard Areas. The community map repository should be

PROJECT NO. DHP-NH-4110(156)

FLOOD PLAIN PHOTOS

ALIGNMENT MODIFIED W-4

SITE B

Approximate Beginning of Crossing of

Flood Plain Encroachment at Site B

Looking North

Approximate End of Crossing of

Flood Plain Encroachment at Site B

Looking North

Appendix C

Site C Information

EIS Hydraulics Study Form for Site C

USGS Stream Stats Data for Site C

Federal Insurance Rate Map for Site C

Photos of Site C

LOCATION HYDRAULIC STUDY FORM
THORN CREEK ROAD TO MOSCOW
PROJECT NO. DHP-NH-4110(156)
ALIGNMENT- C-3
SITE C

District 02 County Latah Route US-95 Mile Post 343.457 to Mile Post 343.651

Floodplain Description:

This floodplain is a finger of the Southfork of the Palouse River outside the southern City Limits of Moscow. The FIRM panels show that it is classified as a Zone A floodplain with no 100-year flood elevation being determined by FEMA. The floodplain is currently used as an agricultural field and no buildings are within the floodplain, but buildings associated with Primeland Cooperatives are in close proximity. The proposed encroachment location is approximately starting at Latitude 46.705919°, Longitude -117.005757° to Latitude 46.7089546°, Longitude -117.0050693° just South of Moscow, Idaho. See the Latah County, Idaho Flood Insurance Rate Map, Panel 160086 0330D, Section 19, Township 39 North, Range 5 West, Boise Meridian.

1. Description of Proposal

A proposed 4 lane roadway with a divided median would create a longitudinal encroachment on the floodplain finger that is about 2.0 acres in size. Effects to the floodplain could be minimized by slope adjustment or retaining walls. If this alignment was chosen, a Floodplain Development Application for Latah County Planning and Zoning to meet their requirements would be completed. The floodplain could not rise more than 1 foot and the elevation of the roadway would need to be 3 feet taller than the 100 year flood elevation. Latah County Planning and Zoning indicated that this encroachment was minimal and that there is low associated risk with filling in this floodplain.

2. ADT: Current 6400 Projected 10221

3. Hydraulic Data: Base Flood Q_{100}= *1440 ft^3 / s WSE_{100}= **
The flood of record, if greater than Q_{100}: **NA** Q= **NA** ft^3 / s WSE= **NA**
Overtopping flood Q= **NA** ft^3 / s WSE= **NA**

* *Q_{100} is based on calculations from the Stream Stats Program at the location shown on the South Fork Palouse River which is attached.*

** *No water surface elevation was determined on the FIRM panels because this is located in a Zone A Floodplain.*

Are NFIP maps and studies available? YES XX NO

4. Is the highway location alternative within a regulatory floodway ?
YES NO XX

5. Attach map with flood limits outlined showing all buildings or other improvements within the base floodplain.

No buildings are within the floodplain, but buildings associated with Primland Cooperatives are close to the floodplain.

Potential Q_{100} backwater damages:

A.	Residences?	NO XX	YES
B.	Other Bldgs?	NO XX	YES
C.	Crops?	NO	YES XX
D.	Natural and beneficial Floodplain values?	NO XX	YES

6. Type of Traffic:

A. Emergency supply or evacuation route?	NO	YES XX
B. Emergency vehicle access?	NO	YES XX
C. Practicable detour available?	NO	YES XX
D. School bus or mail route?	NO	YES XX

7. Estimated duration of traffic interruption for 100-year event hours: No Interruption

8. Estimated value of Q_{100} flood damages (if any) – moderate risk level.

A.	Roadway	$ N/A
B	Property	$ N/A
	Total	$ N/A

9. Assessment of Level of Risk Low XX
Moderate
High

For High Risk projects, during design phase, additional Design Study Risk Analysis May be necessary to determine design alternative.

Is there any longitudinal encroachment, significant encroachment, or any support of incompatible Floodplain development? NO XX YES

If yes, provide evaluation and discussion of practicability of alternatives in accordance with 23 CFR 650.113

Information developed to comply with the Federal requirement for the Location Hydraulic Study shall be retained in the project files.

Signature – D2PDE Curtis J. Amyx Date 4/12/12

USGS
Idaho StreamStats

Basin Characteristics Report

Date: Thu Mar 29 2012 08:41:58 Mountain Daylight Time
NAD27 Latitude: 46.7134 (46 42 48)
NAD27 Longitude: -117.0064 (-117 00 23)
NAD83 Latitude: 46.7132 (46 42 48)
NAD83 Longitude: -117.0074 (-117 00 27)

Parameter	Value
Area that drains to a point on a stream, in square miles	28.05
Mean annual precipitation, in inches	24.4
Minimum Basin Elevation in feet	2540
Maximum Basin Elevation in feet	4990
Mean Basin Elevation in feet	2970
Maximum - minimum elevation, in feet	2450
Mean basin slope computed from 10 m DEM, in percent	18
Mean basin slope. Computed from 10 m DEM and adjusted to approximate earlier values computed from 30 m DEM.	16.4
Percent of area having slope greater than or equal to 30 percent, computed from 10-m DEM	16
Percent of area with slopes greater than 30 percent. Computed from 10 m DEM and adjusted to approximate earlier values based on 30-m DEMs	12.3
Percentage of area having slopes greater than 50 percent, computed from 30-meter DEMs	0.68
Percent of area having North-facing slopes greater than or equal to 30 percent, computed from 10-m DEM	4
Percent of area having North-facing slopes greater than or equal to 30 percent. Computed from 10 m DEM and adjusted to approximate values computed from 30 m DEM.	3
10-85 slope based on longest flow path computed using 10-m DEMs, in feet per mile	75.2
10-85 slope, in feet per mile. Computed based on longest flow path using 10-m DEMs and adjusted to approximate earlier measurements done using BASINSOFT.	75.9
Percent of drainage area as surficial volcanic rocks as defined in SIR 2006-5035	66.7
Percent of area covered by forest	23
Agricultural Land in Percentage of Drainage Area	65.4
Developed Land in Percentage of Drainage Area from 1992 NLCD data	2.76
Percentage of area covered by water or perennial ice or snow from NLCD1992	0.12
Percentage of impervious area determined from NLCD 2001 impervious dataset	0.99
Percentage of urban land cover determined from NLCD 2001 land cover dataset	5.37

USGS
Idaho StreamStats

Streamstats Ungaged Site Report

Date: Thu Mar 29 2012 08:47:26 Mountain Daylight Time
Site Location: Idaho
NAD27 Latitude: 46.7134 (46 42 48)
NAD27 Longitude: -117.0064 (-117 00 23)
NAD83 Latitude: 46.7132 (46 42 48)
NAD83 Longitude: -117.0074 (-117 00 27)
Drainage Area: 28.05 mi2
Percent Urban: 5.38 %
Percent Impervious: 0.99 %

Peak-Flow Basin Characteristics

100% Peak Flow Region 3 (28.1 mi2)

Parameter	Value	Regression Equation Valid Range	
		Min	Max
Drainage Area (square miles)	28.1	2	788.7
Mean Basin Elevation (feet)	2970	1458.4	4040.1

Low-Flow Basin Characteristics

100% Low Flow Region 3 (28.1 mi2)

Parameter	Value	Regression Equation Valid Range	
		Min	Max
Drainage Area (square miles)	28.1	17.6	674.9
Mean Basin Elevation (feet)	2970	2647.1	3752.2
Mean Annual Precipitation (inches)	24.4	19.3	30.1
Relief (feet)	2450	1442.8	5098.9

Zero-Flow Probability Basin Characteristics

100% Undefined Region (28.05 mi2)

The selected watershed is entirely in an area for which flow equations were not defined.

Monthly and Annual Basin Characteristics

100% Low Flow Region 3 (28.1 mi2)

Parameter	Value	Regression Equation Valid Range	
		Min	Max
Drainage Area (square miles)	28.1	17.6	674.9
Mean Basin Elevation (feet)	2970	2647.1	3752.2
Mean Annual Precipitation (inches)	24.4	19.3	30.1
Relief (feet)	2450	1442.8	5098.9

Peak-Flow Streamflow Statistics

Statistic	Flow (ft^3/s)	Prediction Error (percent)	Equivalent years of record	90-Percent Prediction Interval	
				Minimum	Maximum
PK1_5	198	84		57.2	686
PK2	271	69		94.2	782
PK2_33	310	63		116	826
PK5	505	49		229	1120
PK10	693	44		336	1430
PK25	970	43		476	1980
PK50	1200	44		575	2490
PK100	1440	46		665	3100
PK200	1690	49		746	3840
PK500	2060	54		845	5020

Low-Flow Streamflow Statistics

Statistic	Flow (ft^3/s)	Estimation Error (percent)	Equivalent years of record	90-Percent Prediction Interval	
				Minimum	Maximum
M1D10Y	0.36	130			
M7D10Y	0.5	130			

M7D2Y	0.71	75			
M30D5Y	0.84	83			

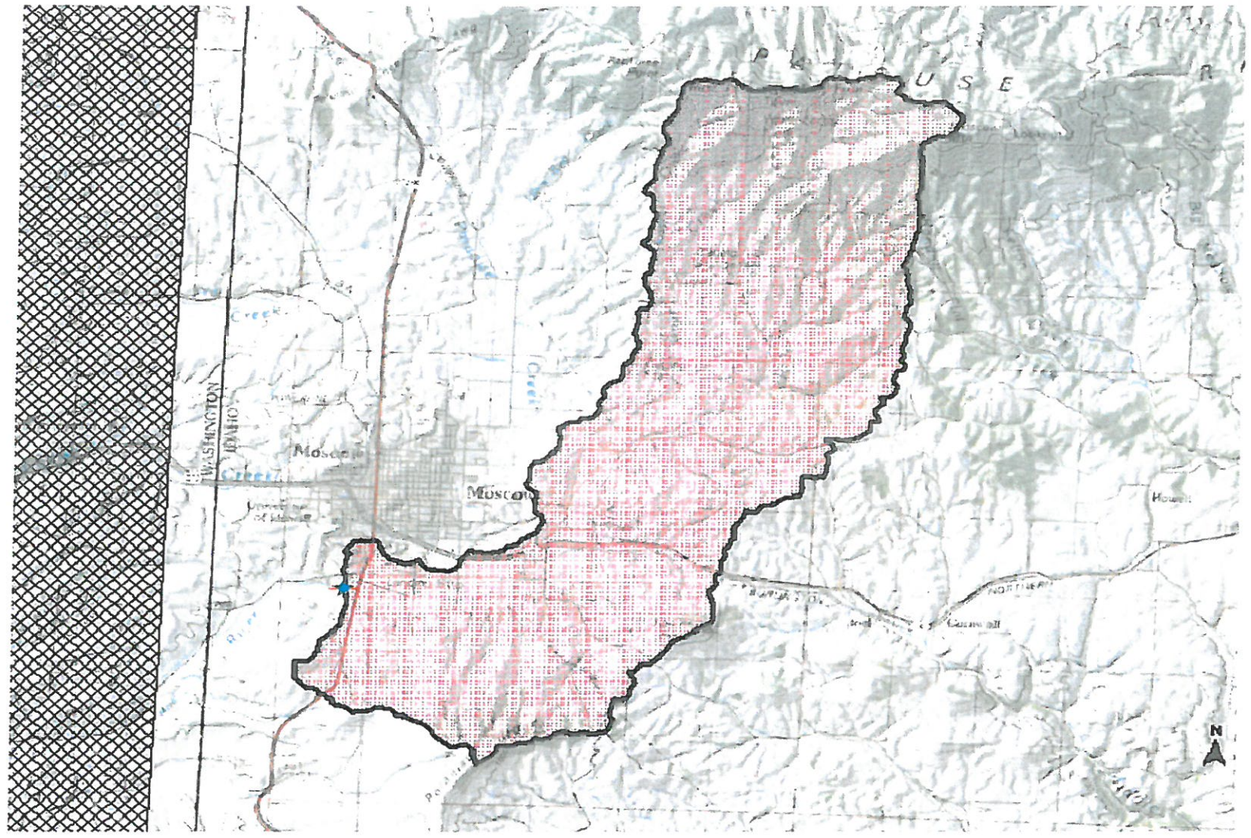
Monthly and Annual Streamflow Statistics

Statistic	Flow (ft^3/s)	Estimation Error (percent)	Equivalent years of record	90-Percent Prediction Interval	
				Minimum	Maximum
QA	10.8	17			
JAND20	21.3	46			
JAND50	6.65	43			
JAND80	2.05	21			
FEBD20	39.5	39			
FEBD50	14.5	19			
FEBD80	5.02	27			
MARD20	40.5	41			
MARD50	19.3	26			
MARD80	6.9	26			
APRD20	19.2	44			
APRD50	8.74	46			
APRD80	4.18	62			
MAYD20	8.3	61			
MAYD50	3.85	51			
MAYD80	2.37	44			
JUND20	4.01	43			
JUND50	2.55	30			
JUND80	1.89	36			
JULD20	2.06	21			
JULD50	1.83	30			
JULD80	1.73	50			
AUGD20	1.84	28			
AUGD50	1.78	44			
AUGD80	1.73	96			
SEPD20	1.88	22			
SEPD50	1.78	33			
SEPD80	1.72	63			
OCTD20	1.94	26			
OCTD50	1.83	25			
OCTD80	1.73	37			
NOVD20	3.21	67			
NOVD50	1.8	29			
NOVD80	1.77	28			
DECD20	7.26	49			
DECD50	1.85	42			
DECD80	1.81	22			

USGS
Idaho StreamStats

StreamStats Print Page

SO. FORK PALOUSE RV.



Explanation

- GlobalWatershedPoint
- Slp1085Point
- LongestFlowPath3D
- GlobalWatershed
- HUCLongestFlowPath
- Gaging Station, Continuous Record
- Low Flow, Partial Record
- Peak Flow, Partial Record
- Peak and Low Flow, Partial Record
- Stage Only
- Low Flow, Partial Record, Stage
- Miscellaneous Record
- Unknown
- hucpoly
- NHDPlusFlowline
- NHDPlusGages

25 1.25 0 25 Miles

3/29/2012 8:26:34 AM

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

LATAH COUNTY, IDAHO
(UNINCORPORATED AREAS)

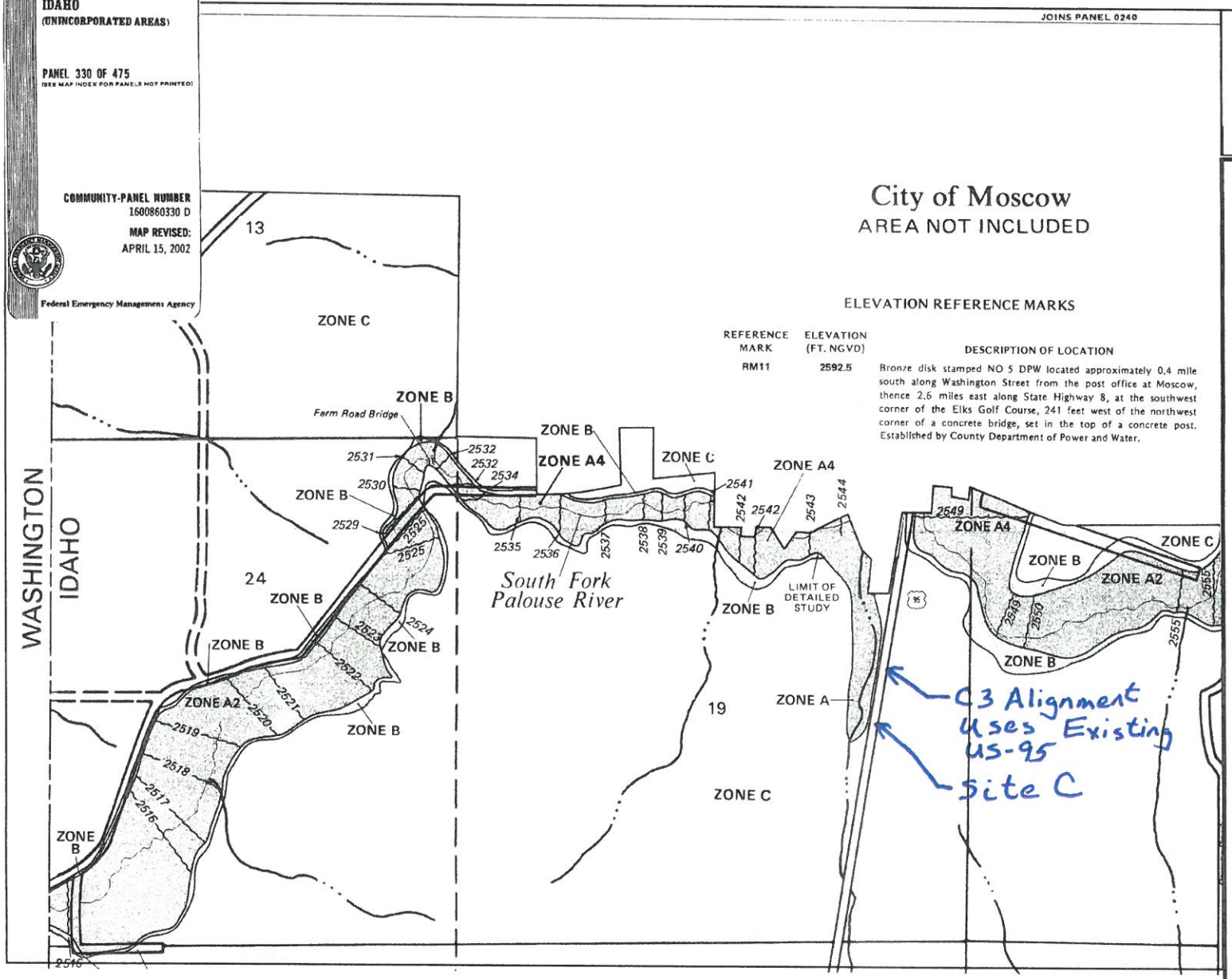
PANEL 330 OF 475
(SEE MAP INDEX FOR PANELS NOT PRINTED)

COMMUNITY-PANEL NUMBER
1600860330 D

MAP REVISED:
APRIL 15, 2002

Federal Emergency Management Agency

JOINS PANEL 0240



ELEVATION REFERENCE MARKS

REFERENCE MARK	ELEVATION (FT. NGVD)	DESCRIPTION OF LOCATION
RM11	2592.5	Bronze disk stamped NO 5 DPW located approximately 0.4 mile south along Washington Street from the post office at Moscow, thence 2.6 miles east along State Highway 8, at the southwest corner of the Elks Golf Course, 241 feet west of the northwest corner of a concrete bridge, set in the top of a concrete post. Established by County Department of Power and Water.

APPROXIMATE SCALE IN FEET
1000 0

KEY TO MAP

500-Year Flood Boundary	ZONE B
100-Year Flood Boundary	ZONE A1
Zone Designations*	ZONE A5
100-Year Flood Boundary	ZONE B
500-Year Flood Boundary	ZONE B
Base Flood Elevation Line With Elevation in Feet**	513
Base Flood Elevation in Feet Where Uniform Within Zone**	(EL 987)
Elevation Reference Mark	RM7x
Zone D Boundary	
River Mile	•M1.5
Approximate 100- Year Flood Boundary	ZONE A

**Reference to the National Geodetic Vertical Datum of 1929

UNDEVELOPED COASTAL BARRIERS†

Identified 1983 | Identified 1990 | Otherwise Protected Areas

† Coastal barrier areas are normally located within or adjacent to special flood hazard areas.

*EXPLANATION OF ZONE DESIGNATIONS

ZONE	EXPLANATION
A	Areas of 100-year flood; base flood elevations and flood hazard factors not determined.
AO	Areas of 100-year shallow flooding where depths are between one (1) and three (3) feet; average depths of inundation are shown, but no flood hazard factors are determined.
AH	Areas of 100-year shallow flooding where depths are between one (1) and three (3) feet; base flood elevations are shown, but no flood hazard factors are determined.
A1-A30	Areas of 100-year flood; base flood elevations and flood hazard factors determined.
A99	Areas of 100-year flood to be protected by flood protection system under construction; base flood elevations and flood hazard factors not determined.
B	Areas between limits of the 100-year flood and 500-year flood; or certain areas subject to 100-year flooding with average depths less than one (1) foot or where the contributing drainage area is less than one square mile; or areas protected by levees from the base flood. (Medium shading)
C	Areas of minimal flooding. (No shading)
D	Areas of undetermined, but possible, flood hazards.
V	Areas of 100-year coastal flood with velocity (wave action); base flood elevations and flood hazard factors not determined.
V1-V30	Areas of 100-year coastal flood with velocity (wave action); base flood elevations and flood hazard factors determined.

NOTES TO USER

This map is for use in administering the National Flood Insurance Program; it does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size, or all planimetric features outside Special Flood Hazard Areas. The community map repository should be

PROJECT NO. DHP-NH-4110(156)

FLOOD PLAIN PHOTOS

ALIGNMENT C-3

SITE C

Approximate Beginning of Longitudinal

Flood Plain Encroachment of Site C

Looking South

Approximate Ending of Longitudinal

Flood Plain Encroachment of Site C

Looking North

Appendix D

SOUTHEAST MOSCOW INDUSTRIAL PARK EXISTING CONDITION HYDRAULIC MODEL

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7000 Smoke Ranch Rd. Las Vegas, NV 89128
Phone: (702) 685-2229; Fax: (702) 685-2223

www.terragraphics.com

MEMORANDUM #4

To: Bill Belknap, City of Moscow

From: Andy Heitmann, TerraGraphics, Moscow
Susan Firor, TerraGraphics, Moscow

Date: February 22, 2010

Project Code: 09216

Subject: Southeast Moscow Industrial Park Existing Condition Hydraulic Model

Introduction

The purpose of this memorandum is to summarize the development of an existing condition hydraulic model on the South Fork Palouse River (South Fork) near Moscow, Idaho. Specifically, the memorandum will discuss the hydrologic analysis, updated model geometric data, and model results. The purpose of this investigation was to determine the accuracy of the Federal Emergency Management Agency (FEMA) Effective Flood Insurance Study (FIS) and Flood Insurance Rate Map (FIRM) by using recent topographic survey data to update FEMA's hydraulic model. The Effective FIS, FIRM, and hydraulic model have an original effective date of August 15, 1980. TerraGraphics converted the Effective model to the now-preferred modeling platform, HEC-RAS, as described in Memorandum #3, Southeast Moscow Industrial Park HEC-2 Duplicate Model. In this exercise, the converted model was updated to reflect current geometric and hydrologic data.

Updated Geometry Data

The most significant change in the geometry data was the replacement of all the previous model cross-sections with survey data collected by TerraGraphics in 2010, as described in Memorandum #2, Southeast Moscow Industrial Park Field Survey Summary. Since the Effective hydraulic model was developed for the South Fork in 1980 the stream crossings at Highway 95 and Paradise Ridge Road have been replaced or modified. Therefore, all associated bridge data were updated in the model to reflect the current conditions. Blocked areas (obstructions) were added where cross-sections intersect buildings. During survey and while comparing cross-section data between the Effective model and the current survey, several dikes where fill material has been placed within the floodplain were noted within the project reach. Since these dikes are not certified or accredited by FEMA for flood control, they were removed from the cross-section data for the majority of modeling scenarios in accordance with FEMA guidance (FEMA, 2003). Manning's n values were changed to 0.030 (cultivated field) in areas that are currently being farmed in order to accurately represent the current farming practices. The vertical datum used in this study is NAVD88 and the horizontal datum is Idaho State Plane, Zone West, NAD 83, US survey foot.

Hydrologic Analysis

In addition to the geometry changes made in the updated model, the peak flow rates used for the 100-year return interval flood were updated. The hydrology for the Effective FEMA model, like the geometry, was developed about 30 years ago. Since that time, the United States Geological Survey (USGS) has gathered additional data for the streams in this region, and new regional regression equations were developed in 2002 (Berenbrock, 2002). Comparable regional regression analyses were completed based on the flow change locations in the effective FEMA HEC-2 model. Table 1 shows the 100-year peak flow rates for both the effective FIS model and the updated regional regression analysis.

Table 1. 100-year Peak Flow Rates for Effective and Updated Hydraulic Model.

FIS Designation	River Station	100-year Peak Flow Rates (cfs)	
		Effective FIS	Regional Regression
BB	10334	1800	1280
AV	7150	1890	1310
AP	3746	2870	1370

100-year peak flow estimates at the upstream end of the US 95 Highway bridge were also acquired from the Idaho Transportation Department (ITD). Although ITD's estimate of 1080 cubic feet per second (cfs) was less than the regional regression analysis, the hydrologic analysis did not extend beyond the immediate vicinity of the bridge and, thus, was not suitable for use in this analysis.

Hydraulic Modeling Scenarios

As part of the modeling process, several different combinations of geometry and flow data were compiled into model scenarios in order to gather further insight into the current conditions and possible changes due to FEMA regulations, and to perform sensitivity analyses. Table 2 outlines the different geometry files developed with their corresponding descriptions. Table 3 summarizes the different steady flow files used in this study. Table 4 depicts the resulting model scenarios used for the existing condition modeling effort. Each model scenario uses a combination of a geometry file and a flow data file. More in-depth explanations of each scenario are presented below.

Table 2. Geometry Files Developed for Existing Hydraulic Model

Name (short)	HEC-RAS File Name	Description
Existing	Existing	Compiled using TerraGraphics survey completed in 2010
FEMA	Existing_FEMA	Same as Existing with dikes and fill removed from floodplain

Table 3. Steady Flow Data Files Developed for Existing Hydraulic Model

Name (short)	HEC-RAS File Name	Description
FIS	FEMA HEC2 Dup	Flow data used based on effective FIS for Latah County
RR	Existing_Regional Regression	Flow data based on regional regression analysis published by USGS in 2002 (Berenbrock, 2002)

Table 4. Scenarios Compiled for Existing Hydraulic Model

Scenario Name	Geometry Data	Flow Data	Analysis
Existing	Existing	FIS, RR	Actual flooding potential based on existing topography
FEMA	Existing_FEMA	FIS	Compare FIS floodplain with existing conditions using old hydrology
FEMA - with Ineff	FEMA - with Ineff	FIS	Check for impacts of ineffective flow areas
Regional Regression	Existing_FEMA	RR	Compare FIS floodplain with existing conditions using updated hydrology
FEMA - Floodway	Existing_FEMA	FIS	Determine Floodway extents using old hydrology
RR - Floodway	Existing_FEMA	RR	Determine Floodway extents using updated hydrology

The Existing scenario uses the survey data collected by TerraGraphics in 2010 and represents the actual conditions currently seen along the study reach of the South Fork. The results of this scenario, although generally reflective of reality, are not applicable to this analysis because FEMA will not recognize the dikes along the South Fork unless considerable effort is made to certify them for flood control. The effort required for certification will include extensive engineering analysis, reconstruction to meet levee standards, incorporation of closure devices, and development and implementation of operations and maintenance plans (FEMA, 2008). These steps may be considered in future analyses.

The FEMA scenario is the same as the existing condition with uncertified dikes and filled areas removed. This scenario was created in order to produce a modeling condition that would be in accordance with FEMA modeling guidance and regulations. The 100-year return interval floodplain extent from this scenario is compared to the effective FEMA floodplain in Figure 1. The remaining modeling scenarios all use the FEMA geometry data.

As part of a sensitivity analysis, the next modeling scenario (FEMA – with Ineff) incorporated ineffective flow areas into the cross-sections as appropriate. This allowed for low-lying areas away from the channel to be modeled as contributing no effective flow conveyances until a specified water surface elevation (WSE) has been reached. The results showed this had little effect on the overall extents of the floodplain, so it was not used in further analyses.

The Regional Regression scenario was developed to show results based on the most current data available for both geometry and flow rates. This plan depicts what is believed to be the most accurate and acceptable approach for developing an updated model for FEMA. The floodplain extent from this scenario is compared to the effective FEMA floodplain in Figure 1.

The final two scenarios were created in order to perform encroachment analyses for the updated information using both the FIS and regional regression hydrology. Encroachment analysis is used to determine and map floodway extents along the study reach. Figures 2 and 3 show the results for the FIS and regional regression hydrology, respectively. These analyses were based on a maximum base flood elevation (BFE) rise of one foot at any given cross-section as outlined by FEMA regulations.

Existing Condition Model Results

Upon completion of all the modeling scenarios, output results were compared to published FIS values for Latah County. Table 5 compares the BFE for the Effective FIS, FEMA, and Regional Regression modeling scenarios. All elevations have been converted to NAVD88 using the NGS published conversion of 3.6 feet for this area. Table 6 shows a comparison of floodway widths from the Effective FIS and those resulting from encroachment analyses on FEMA, and Regional Regression modeling scenarios.

Table 5. Floodway WSE for Effective FIS and Modeling Scenarios

Cross-Section			Base Flood Elevation (ft)		
FIS Designation	Number	River Station	Effective FIS [1]	FEMA [2]	Regional Regression [3]
BB	63	10334	2563.1	2562.9	2562.4
BA	62	9614	2561.9	2561.8	2561.4
AZ	61	9038	2561.2	2561.0	2560.3
AY	60	8306	2559.8	2560.8	2559.9
AX	59	7890	2559.5	2560.8	2558.1
AW	58	7808	2559	2558.6	2557.9
AV	56	7150	2558.2	2557.3	2556.9
AU	55	6649	2556.5	2556.5	2556.1
AT	54	6040	2555.1	2554.4	2554.4
AS	53	5202	2552.8	2554.3	2552.7
AR	52	4530	2552.7	2554.2	2552.5
AQ	51	4200	2552.6	2554.2	2552.3
AP	50	3746	2552.6	2554.1	2551.7
AO	48	3506	2552.2	2554.0	2551.2
AN	47	3360	2550.6	2552.2	2550.7
AM	46	3014	2549.4	2551.6	2550.2
AL	45	2717	2548.6	2550.5	2548.7
AK	44	2614	2548.4	2548.9	2548.2
AJ	43	2411	2548.1	2548.5	2547.7
AI	42	2287	2547.2	2548.0	2547.3
AH	41	2137	2547	2547.6	2546.7
AG	40	2045	2546.7	2547.5	2546.5
AF	39	1390	2544.7	2546.9	2545.6
AE	38	1274	2545.5	2546.8	2545.5
AD	37	1084	2544.9	2546.6	2544.6
AC	36	1010	2544.9	2545.6	2543.9
AB	35	619	2543.6	2544.0	2542.4
AA	34	107	2541.4	2543.3	2541.8

[1] Elevation converted to NAVD88 using a 3.6' conversion factor

[2] Existing-FEMA geometry file and FIS hydrology

[3] Existing-FEMA geometry file and RR hydrology

Table 6. Floodway Widths for Effective FIS and Existing Condition Model Scenarios

Cross-Section			Floodway Width (ft)		
FIS Designation	Number	River Station	Effective FIS	FEMA	Regional Regression
BB	63	10334	77	95	38
BA	62	9614	130	130	75
AZ	61	9038	197	162	70
AY	60	8306	203	231	140
AX	59	7890	326	141	160
AW	58	7808	254	141	141
AV	56	7150	136	125	120
AU	55	6649	111	120	100
AT	54	6040	258	200	70
AS	53	5202	75	470	161
AR	52	4530	574	300	235
AQ	51	4200	831	529	296
AP	50	3746	743	386	321
AO	48	3506	100	275	77
AN	47	3360	121	250	71
AM	46	3014	47	140	50
AL	45	2717	102	76	52
AK	44	2614	77	100	73
AJ	43	2411	110	125	55
AI	42	2287	53	150	75
AH	41	2137	68	180	80
AG	40	2045	79	199	107
AF	39	1390	142	205	102
AE	38	1274	140	218	110
AD	37	1084	91	232	38
AC	36	1010	70	95	60
AB	35	619	95	59	48
AA	34	107	61	115	75

The modeling scenarios in HEC-RAS are based on surveyed cross-sections, so model results are given at points that fall along the cross-section lines. To display floodplain and floodway boundaries that follow the existing ground, a digital elevation model (DEM) provided by the City of Moscow was used to interpolate along the contour lines between cross-sections. Using this method allows for a more representative shape of the floodplain, but some uncertainty is introduced because the accuracy of the DEM is less than that of the survey data. Elevations of survey points along the cross-sections were compared with corresponding DEM elevations, and it was noted that the DEM was lower than the surveyed points by an average of 0.5 feet on the north side of the South Fork. To estimate the impact of this uncertainty on the floodplain extents, the DEM was raised by 0.5 feet and the floodplain extent was re-analyzed. As predicted, the floodplain extent was shifted towards the river channel slightly on the north side as compared to the previous scenario. This comparison is shown in Figure 4.

Conclusion

Significant changes to the floodplain and floodway boundaries have been modeled using updated topographic and hydrologic information. Most significantly, the width of the floodway is much smaller in much of the proposed Industrial Park area using the most recent data, although some existing buildings are still inside the floodway. In addition, although differences are noted between survey data and the DEM, resurvey of the area is not recommended, as the expected resulting decrease in flood width is not significant. Subsequent steps in this process will be discussed with City personnel at upcoming meetings.

References

Berenbrock, Charles, 2002. *Estimating the Magnitude of Peak Flows at Selected Recurrence Intervals for Streams in Idaho*, USGS Water-Resources Investigations Report 02–4170.

Federal Emergency Management Agency (FEMA), 2003. *Guidelines and Specifications for Flood Hazard Mapping Partners, Appendix H: Guidance for Mapping Areas Protected by Levee Systems,* Federal Emergency Management Agency, April 2003.

FEMA, 2008. *Meeting the Criteria for Accrediting Levee Systems on NFIP Flood Maps,* Federal Emergency Management Agency, July 2008.

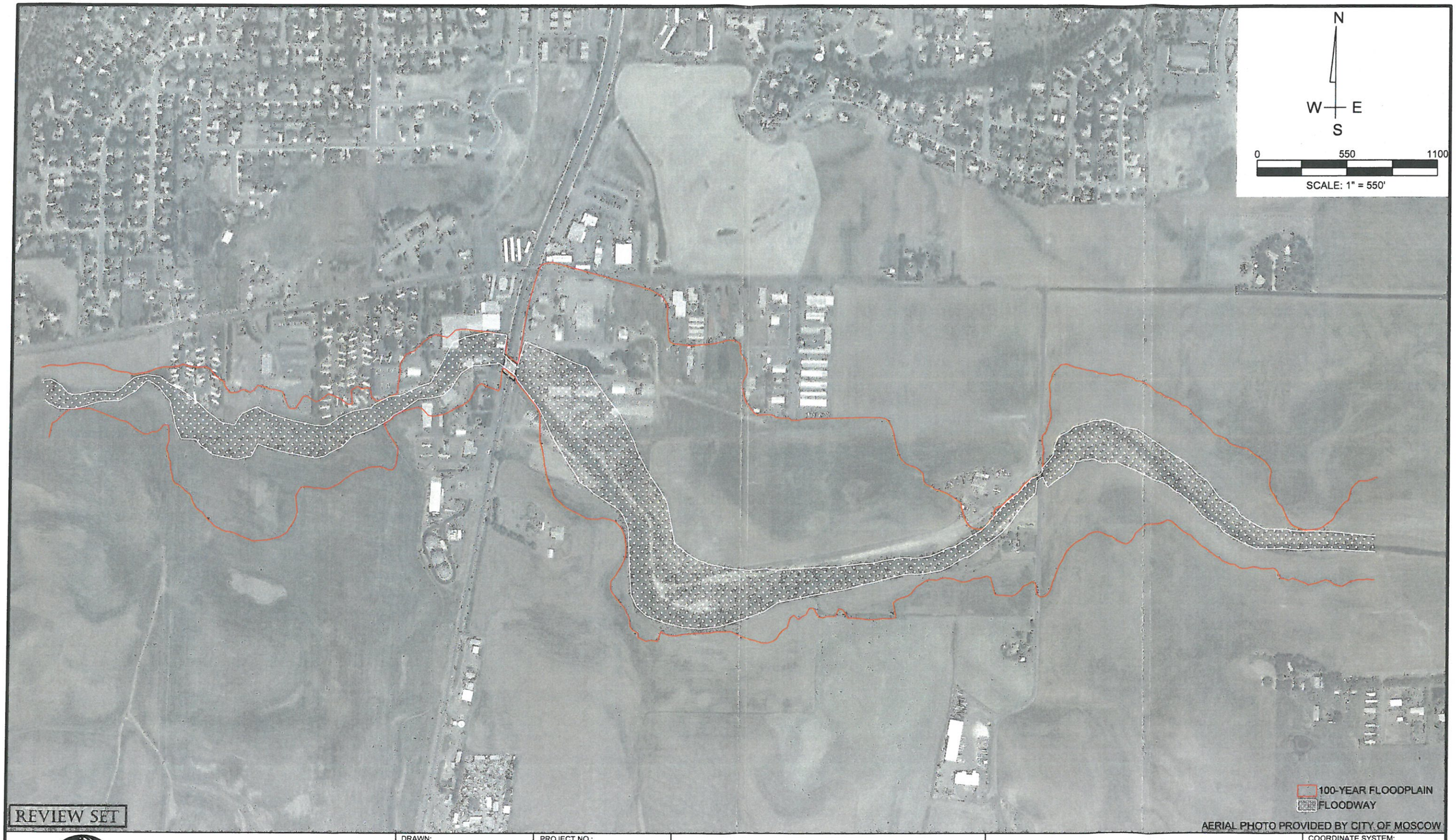
cc: Tom Jones, WHPacific
Laila Maqbool, WHPacific

REVIEW SET

TerraGraphics
Environmental Engineering, Inc.

DRAWN: A. HEITMANN	PROJECT NO.: 09216	MOSCOW INDUSTRIAL PARK	COORDINATE SYSTEM: ISP, NAD 83, WEST, FT, NAVD88
ENGINEER: S. FIROR	SCALE: 1" = 550'		
CHECKED: S. FIROR	APPROVED:	SOUTH FORK PALOUSE RIVER	DATE: 2/23/2010
	DATE:		

FIGURE 1 -
100-YEAR FLOODPLAIN EXTENT



REVIEW SET

TerraGraphics
Environmental Engineering, Inc.

DRAWN: A. HEITMANN	PROJECT NO.: 09216	MOSCOW INDUSTRIAL PARK	COORDINATE SYSTEM: ISP, NAD 83, WEST, FT, NAVD88
ENGINEER: S. FIROR	SCALE: 1" = 550'	SOUTH FORK PALOUSE RIVER	DATE: 2/22/2010
CHECKED: S. FIROR	APPROVED:		
	DATE:		

FIGURE 2 - 100-YEAR FLOODPLAIN AND FLOODWAY EXTENTS USING 2010 SURVEY AND FIS HYDROLOGY

REVIEW SET

TerraGraphics
Environmental Engineering, Inc.

DRAWN: A. HEITMANN	PROJECT NO.: 09216	MOSCOW INDUSTRIAL PARK	FIGURE 3 - 100-YEAR FLOODPLAIN AND FLOODWAY EXTENTS USING 2010 SURVEY AND UPDATED HYDROLOGY	COORDINATE SYSTEM: ISP, NAD 83, WEST, FT, NAVD88
ENGINEER: S. FIROR	SCALE: 1" = 550'			DATE: 2/22/2010
CHECKED: S. FIROR	APPROVED:	SOUTH FORK PALOUSE RIVER		
	DATE:			

REVIEW SET

AERIAL PHOTO PROVIDED BY CITY OF MOSCOW

TerraGraphics
Environmental Engineering, Inc.

DRAWN: A. HEITMANN	PROJECT NO.: 09216	MOSCOW INDUSTRIAL PARK	COORDINATE SYSTEM: ISP, NAD 83, WEST, FT, NAVD88
ENGINEER: S. FIROR	SCALE: 1" = 550'		
CHECKED: S. FIROR	APPROVED:	SOUTH FORK PALOUSE RIVER	DATE: 2/22/2010
	DATE:		

FIGURE 4 - 100-YEAR FLOODPLAIN EXTENTS WITH ALTERED DEM AND REGIONAL REGRESSION

P:\Engineering\Moscow Industrial Park\Drawings\Moscow Industrial Park_Existing Condition Model Results3.dwg