UPDATED 19 September 2013
Great Lakes and Ohio River Division
Louisville District

CONTINUING AUTHORITIES PROJECT FACT SHEET

1. **Project:** Haw Creek, Columbus, Indiana, Section 205 Flood Damage Reduction Project
   P2#: 335069

2. **Congressional Delegation/ Location of Project:** The City of Columbus is located in the 6th Congressional District of the State of Indiana.

   - Rep. Luke Messer R-6-IN
   - Sen. Daniel Coats
   - Sen. Joe Donnelly

Location: The portion of Haw Creek being considered in this study is located in the vicinity of Columbus, Indiana in Bartholomew County. The county covers 409 square miles of relatively flat terrain surrounding the East Fork White River in the southeastern part of Indiana. It is bounded on the northwest by Johnson County, northeast by Shelby County, east by Decatur County, southeast by Jennings County, southwest by Jackson County, and west by Brown County. Haw Creek is a tributary to the East Fork White River and has a drainage area of 57.1 square miles with a discharge of 4650 cfs for the 10% chance (10-year) flood event. It flows directly through the City Columbus to its confluence with the East Fork White River just to the southwest of the city. The county seat of Bartholomew County is Columbus (see Section 14), located near the center of the county.

3. Study Authority: This study was authorized under the general authority provided in Section 205 of the 1948 Flood Control Act, as amended, which states:

> The Secretary of the Army is hereby authorized to allot from any appropriations hereto or hereafter made for flood control, not to exceed $55,000,000 for any one fiscal year, for the construction of small projects for flood control and related purposes not specifically authorized by Congress, which come within the provisions of Section 1 of the Flood Control Act of June 22, 1936, when, in the opinion of the Chief of Engineers such work is advisable. The amount allotted for a project shall be sufficient to complete Federal participation in the project. Not more than $7,000,000 shall be allotted under this section for a project at any single locality. The provisions of local cooperation specified in Section 3 of the Flood Control Act of June 22, 1936, as amended, shall apply. The work shall be complete in itself and not commit the United States to any additional improvement to insure its successful operation, except as may result from the normal procedure applying to projects authorized after submission of preliminary examination and survey reports.

4. Study Purpose: The purpose of this study is to investigate the feasibility of structural and nonstructural measures for flood risk management of Haw Creek in the vicinity of Columbus, Indiana and to determine whether there is a federal interest in further studying improvements that would offer a reduction in flooding. The flood of record in the area occurred in June of 2008. This flooding exceeded the 0.2% annual chance (500-year) flood. Plans considered in this study focused on eight frequency floods ranging from the 99% annual chance (1-year) flood to the 0.2% annual chance (500-year) flood. Federal interest requires that: a flood risk management project is economically feasible, environmentally acceptable and in compliance with current regulations and policies; and that a willing and financially capable local entity be identified to act as the local sponsor for the project and to provide the required non-Federal cost sharing. It is also the purpose of this study to determine whether the planning process should continue into more detailed feasibility studies, based on a preliminary appraisal of potential costs, potential benefits, and possible environmental impacts of alternatives considered in this preliminary analysis. A proposed plan must follow policy guidelines set forth for the Section 205 program and be technically sound, providing a significant level of flood reduction. In accordance with Environmental Operating Principles, the objectives of this study are to achieve a design level of flood risk management with beneficial environmental impacts. Additionally, the derived benefits of the proposed plan must be greater than (or equal to) the costs of the proposed plan.

The level of effort given in this analysis and results in this study should preclude findings as considered final or detailed in nature. This level of study only allows for a cursory evaluation of existing conditions and proposed modifications.

5. Discussion of Prior Studies Reports and Existing Water Projects

Federal Emergency Management Agency

The most recent Flood Insurance Study for the City of Columbus, Indiana, Bartholomew County is dated January 5, 1996. This study for Community Number 180007 included a detailed analysis of Haw Creek and the East Fork White River among others.

United States Geological Survey

The U.S. Geological Survey (USGS) in cooperation with the Federal Emergency Management Agency and the Indiana Department of Natural Resources, Division of Water, documented the meteorological and hydrological conditions associated with the June 2008 flood in the Columbus, Indiana vicinity. The study includes peak gage heights, streamflows, and recurrence intervals at USGS streamgages and estimate streamflows and recurrence intervals at selected ungaged locations; construct flood profiles and peak-stage inundation maps; and summarize flood damages and impacts.

Christopher B. Burke Engineering:

Christopher B. Burke Engineering completed studies of the June 7, 2008 flood along Haw Creek for both Columbus Regional Hospital and Cummins. Those studies resulted in flood models being created for Haw Creek.

Columbus, Indiana/ Christopher B. Burke Engineering:
Columbus Flood Management Plan: The City of Columbus is in the process of developing a Comprehensive Flood Management Plan for the City. This plan will include the three key elements of (1) recommending coordinated regulations for new development, (2) identifying flood mitigation projects, and (3) creating a flood emergency management plan.

6. Plan Formulation

A. Identified Problems:

Existing Conditions: The City of Columbus is located at the confluence for several regionally significant streams and smaller tributaries and periodically experiences flooding. The most significant local flood event occurred on June 7, 2008 (Figures 3 and 4) when flood waters from Haw Creek, Clifty Creek, Driftwood River, Flatrock River, and East Fork of the White River inundated significant portions of the City. This flooding resulted in 3 fatalities locally, damage to an estimated 3,000 homes, damage to significant local employers, and the closure of Columbus Regional Hospital for over 6 months. In general,

Figure 1: June 2008 Flooding in Columbus, IN

Figure 2: June 2008 Flooding in Columbus, IN

significant flooding in the Haw Creek area appears to begin around the 4% chance (25-year) event with local businesses and residences being affected. Potential flood damages for the study area associated with the 10% (10-year), 1% (100-year), and 0.2% chance (500-year) flood events are estimated at $1,772,350; $19,976,091; and $45,996,890 respectively. Expected annual flood damages for existing conditions are estimated to total $5,319,560. This figure does not include damages to automobiles, emergency costs or traffic diversion.

Since the 2008 event, Columbus Regional Hospital completed a flood wall to protect their campus and Cummins Inc. is completing a flood wall to provide protection for their technical center and engine plant. Still, numerous residential and commercial properties in Columbus remain exposed to flooding from Haw Creek. This Section 205 study seeks to identify an alternative to provide comprehensive flood damage reduction for the broader community.

Expected Future Without Project Conditions: The flow rates and stages for future storms may increase from current (existing) conditions as a result of increased development upstream of Columbus. However, the City of Columbus has placed restrictions on development, construction and earth moving activities that occur within the 0.2% chance flood flow conveyance path of Haw Creek. This limit to development in the floodplain may be sufficient to prevent an increase in flow rates and stages.

B. Planning Constraints & Planning Objectives:

Constraints:

- Supplemental Haw Creek Floodplain Regulations – Adopted by the City Council (10.4.11): No development, construction, earth moving, or other similar activities shall result in any obstruction or loss of capacity in any 0.2% chance flood flow conveyance path (as identified by the base model) unless the required modeling shows that the proposed project along with any proposed compensatory measure, acting alone or in combination with existing development will not increase the modeled 0.2% chance flood elevations more than 0.1 foot.

- Compliance with Applicable Executive Orders, Statutes and Regulations including but not limited to:
    - Executive Order 11988 – Floodplain Management
    - Executive Order 11990 – Protection of Wetlands
    - Archeological and Historic Preservation Act
    - Archeological Resources Protection Act
    - Clean Air Act, Clean Water Act
    - Endangered Species Act
    - National Environmental Policy Act

- The project must be economically justified with expected benefits over the 50-year project life.

- A high level of coordination between the local sponsor and the Corps is necessary to align with the Columbus Flood Management Plan.

- Any plan recommended for construction by this report is subject to possible schedule constraints due to nationwide funding constraints inherent in the Section 205 program.

Objective:

- Reduce residential and commercial flood damages associated with overbank flooding from Haw Creek in the City of Columbus by the year 2015.

Problems:

- Property owners along Haw Creek in the City of Columbus, suffer frequent property damages due to recurrent flooding.

- The floodway has become more and more constrained due to development adjacent to Haw Creek.

- General growth in the area, both residual and commercial, has increased impervious surfaces and consequently runoff into the creek. Accordingly, rainfall events which may have caused only moderate creek rises in the past, now contribute to habitual flooding.

Opportunities:

- Land is undeveloped upstream of the City of Columbus where detention or retention basins could be constructed to reduce the effects of storm events further downstream.

- The City of Columbus is actively removing properties from the floodplain through various FEMA acquisition programs. There is the opportunity to augment this effort with non-structural measures which protect individual structures, enterprises, and/or groups of structures, without significantly changing the flood's water level itself.

- Any recommended plan will be designed in such a way to minimize negative impacts, and to utilize good environmental design and aesthetic treatments.

- There may be limited opportunities to enhance environmental habitats, water quality, and / or recreation in conjunction with a particular flood-damage reduction measure.

C. Alternative Plans Considered: The following Alternatives were considered in this initial evaluation.

- Without Project Plan – The "No Action Plan" would allow events to continue in the same manner with flooding from Haw Creek. This plan assumes that the City of Columbus, Bartholomew County, Indiana will continue any current maintenance of Haw Creek. No Federal action would be taken at this time. Flow rates and stages for future storms may increase from current (existing) conditions due to further development upstream of Columbus. However, the City of Columbus has placed restrictions on development, construction, earth moving activities that occur within the 0.2% chance flood flow conveyance path of Haw Creek. This limit to development in the floodplain may be sufficient to prevent an increase in flow rates and stages.

- Plan 1 – Includes one off-channel detention basin downstream of the confluence of Tough Creek with Haw Creek. The modeled location of this detention basin is between Cross Sections 8.8 and 8.54. With a footprint of approximately 85 acres, this detention basin would add approximately 1,350 acre-feet of storage to the floodplain.

- Plan 2 – This alternative is situated in approximately the same location as Plan 1. However, basin size was reduced to 28 acres and the spillway elevation was raised to optimize reductions of the 5-year flood.

- Plan 3 – At the request of the local sponsor, a debris blockage scenario was investigated. To simulate debris blockage in the channel, the Manning's roughness coefficients for the channel were increased by 0.02. Blockages were also simulated at bridges using the floating pier debris option in HEC-RAS to block bridge openings by 20%. These changes resulted in significantly increased water surface elevations for all eight frequency floods.

- Plan 4 – Channel modification scenario modeled for the golf course area resulted in significant reductions in flood elevations for the area of the modification and immediately upstream in the vicinity of the Hospital. The first channel modification scenario in the agricultural area yielded noticeable flood elevation reductions mainly in the modification area.

- Plan 5 – Channel modification in the agricultural area between 32nd Street and Rocky Ford Road. The first channel modification scenario in the agricultural area yielded noticeable flood elevation reductions mainly in the modification area.

- Plan 6 – The third channel modification scenario was an extension of the second area in both the upstream and downstream directions, from just north of National Road, to south of Marr Road. The channel modification scenario modeled for the extended agricultural area yielded significant flood elevation reductions over a wider range of cross sections than the original agricultural area scenario.

The reach of Haw Creek in the vicinity of the Cummins facilities was considered for a channel modification. However, preliminary runs of that scenario did not yield noticeable reductions in flood elevations so the effort was not continued. Scenarios for extending the agricultural area in only one direction, upstream or downstream, were also considered. Those scenarios are not included, as the extension of the area in both directions yielded the best results.

Additionally, levees were considered as a potential alternative for select areas on Haw Creek. However, based on inundation mapping created using HEC Geo-RAS, existing conditions model results, and the 2011 DEM adjusted to NGVD, damages do not appear to occur in the Candlelight and Northbrook neighborhoods at a frequency that would suggest levees in those areas would be feasible from a federal standpoint. While a small number of structures appear to be flooded between the 4% and 2% chance events, the majority of damages appear to be associated with the 1% and 0.2% chance floods. For levees to be considered a feasible alternative for a federal interest in these areas, damages would need to be prevalent at more frequent events.

The same is true of the Everoad Park and Windsor Place/Hillcrest areas. Damages are not widespread during more frequent events. With most of the damages occurring at the 1% and 0.2% chance events, investigation of levees in these areas would not be recommended to determine federal participation in implementation.

The area between State Street and high ground in the golf course north of 10th Street exhibited damages at frequencies that would have justified the investigation of levees in the area. However, a rough unsteady flow model of the area with levees in place revealed that the loss of floodplain storage would raise flood elevations for the 1% chance flood by more than a foot and the 0.2% chance flood by more than 3 feet through the area of interest and directly upstream. Thus, levees in this area do not appear to be a feasible alternative.

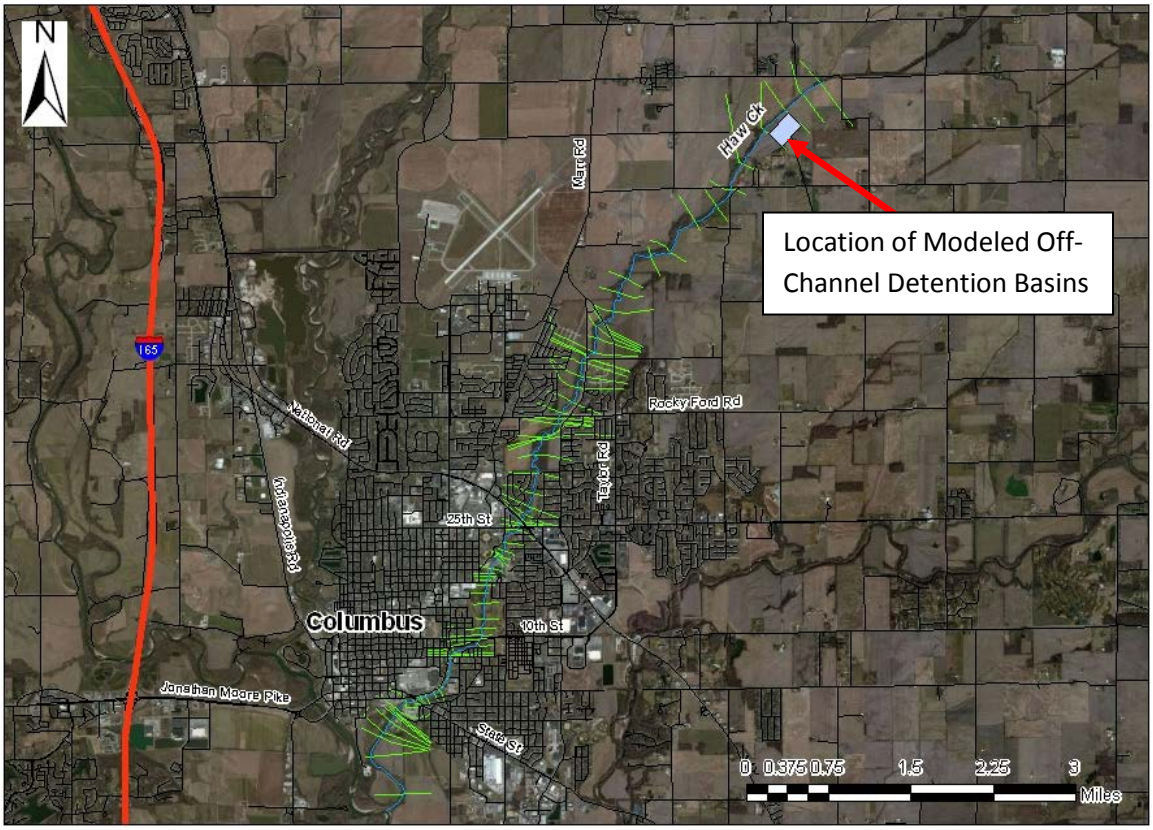
D. Preliminary Evaluation of Alternatives: For this preliminary evaluation, annual benefits of the studied alternatives were assessed as reductions in expected annual damages. These reductions in expected annual damages are expressed as the difference between estimated without-project condition damages and residual damages estimated in the with-project condition. Damages in both the with-project and without-project conditions were estimated for structures and their contents in the study area.

It is important to note that the geospatial locations of the parcel footprints were utilized for the assignment of ground elevations to each structure. The application of ground elevations based upon geospatial parcel locations in lieu of specific structure locations introduces a considerable amount of uncertainty associated with the input variables and, consequently, into the economic analysis of the study area.

Initially, an 85-acre detention basin was investigated to accommodate the approximately 1,350 acre-feet of storage necessary to reduce flows from the 4% chance flood to the desired level. The reductions from this plan were considerable. However, the large amount of excavation required to build a detention basin of this size resulted in a total preliminary cost estimate of approximately $28 million.

A smaller basin was also modeled to determine if flows still could be reduced with less excavation. Consequently, the basin size was reduced to 28 acres (Figure 4), the spillway elevation was raised to optimize reductions of the 20% chance (5-year flood), and the simulation was run again, resulting in modest reductions.

Figure 3: Location of Off-Channel Basin



Following the formulation of the two detention basins, it was requested by the local sponsor that debris blockage in the channel and at bridges be considered in this study. As debris was not noted in the channel or at bridge openings during site visits, it did not appear to be an issue at this time. However, this scenario was modeled, but a BCR was not developed for this plan as it was not considered a feasible alternative. Further discussion of this scenario and the results of the analysis are located in Appendix A.

Finally, three channel modification scenarios were also considered as part of this preliminary analysis. The first location considered for channel modifications was the reach of Haw Creek in the golf course area; the second location was the agricultural area between 32nd Street and Rocky Ford Road; and the third scenario was an extension of the second area in both the upstream and downstream directions, from just north of National Road, to south of Marr Road. Neither bridge geometry nor internal bridge cross sections were altered as part of these analyses.

Four of the five proposed structural alternatives were found to produce a benefit-cost ratio above unity and generate positive net benefits (Table 1). Therefore, only one alternative (Channel Modification – golf course), is not considered to be economically feasible. Among the four economically feasible alternatives, the extended agricultural area channel modification produces a 6.93 BCR and is the plan which has been estimated to generate the most net benefits ($1,987,000) for Haw Creek in Columbus, IN.

Table 1

Haw Creek, Columbus, IN
Section 205
Summary of Annual Benefits and Costs
FY 2013 Price Levels (x $1,000)
3.75% Interest Rate

Investment Cost	**28 acre-foot Detention Basin**	**85 acre-foot Detention Basin**	**Agricultural Area Channel Modification**	**Agricultural Area Extended Channel Modification**	**Golf Course Channel Modification**
Construction First Cost	$7,733	$26,441	$3,477	$6,832	$4,449
Interest During Construction	$144	$998	$65	$127	$83
Total Investment Cost	$7,877	$27,439	$3,542	$6,959	$4,532
Annual Charges					
Interest & Amortization	$351	$1,223	$158	$310	$202
Operation & Maintenance	$5	$10	$25	$25	$25
Total Annual Charges	$356	$1,233	$183	$335	$227
Annual Benefits					
Flood Risk Management	$401	$1,463	$688	$2,322	$106
Total Annual Benefits	$401	$1,463	$688	$2,322	$106
Benefit vs. Cost Ratio	1.13	1.19	3.76	6.93	0.47
Net Benefits	$45	$230	$505	$1,987	-$121

Further analysis of an in-line detention basin upstream of the study reach, near the town of Hope, Indiana may be warranted in future study efforts. Investigation is also warranted to determine if other locations or configurations of off-channel detention basins would offer similar reductions at a more feasible cost. Further study should also consider if non-structural measures, such as relocations and buyouts, could supplement any selected structural measure.

Future evaluation and comparison of these alternatives will require a detailed evaluation of environmental effects associated with their implementation. Mitigation and any necessary monitoring and adaptive management plans will be determined in greater detail later in the study process if a recommended alternative is developed. There is the potential that these alternatives may require mitigation for impacts to wetlands and wildlife habitat. Additionally, impacts to cultural resources are unknown at this time and if a preferred alternative is selected, a cultural resources investigation would be implemented.

7. Federal Interest: Based on the initial data collected during this review, a potential alternative exists that results in $1,987,000 in net benefits and a BCR of 6.93.

8. Project Schedule: Based on current funding constraints a detailed schedule was not developed. Upon receipt of funds, plan formulation will be completed within 6 months and Feasibility will be complete in 12 months.

9. Feasibility Phase Cost Estimate: The estimated cost to complete the Feasibility Phase is $400,000.

10. Recommendation: Based on the analysis presented in this report, the four identified alternatives found to be economically feasible support preliminary federal interest and warrant further inspection and consideration. It should be noted that future study efforts producing additional and more detailed analysis could demonstrate that the flood risk management alternatives considered to date are more or less efficient (or feasible) than reported in this study. Additionally, plan optimization associated with future study efforts may yield additional alternatives and/or measures previously not considered for this study.

Moreover, full consideration should be given to The Columbus Comprehensive Flood Risk Management Plan to determine if further investigation of an alternative described in this report coincides with the Columbus plan recommendations that were developed with broad community input. The results of this fact sheet contain sufficient justification for continued federal participation to identify a viable alternative with a Federal Interest. However, if the City of Columbus determines that the most appropriate course of action to manage their flood risk along Haw Creek is best served by actions outside of the Corps of Engineers, then this Section 205 study should be terminated.

11. Views of the Sponsor: The City of Columbus submitted a Letter of Intent on April 19, 2012, which indicated their understanding of all project requirements and willingness to act as the non-Federal Sponsor for this project (Appendix D). The City of Columbus continues to indicate their support for further investigation of options for limiting exposure to future flood hazards and mitigating flood risk for existing neighborhoods and business areas.

12. Views of Federal, State, and Regional Agencies: No formal or informal coordination has been conducted with other resource agencies. At this time, there is no known resource agency or organized opposition to the proposed project. Further coordination with all appropriate resource agencies will occur if the Feasibility Study progresses.

13. Supplemental Information: If a project was proposed it will be reviewed for compliance with the National Environmental Policy Act of 1969 (NEPA), Clean Water Act, Fish and Wildlife Coordination Act, Endangered Species Act, National Historic Preservation Act, etc. Potential project impacts will be evaluated and documented pursuant to NEPA, which will include a Section 404(b) (1) evaluation and Public Notice pursuant to the Clean Water Act. National Environmental Policy Act documentation will be made available to agencies and public for review and comment. At this preliminary stage, costs associated with these cultural and environmental reviews have not been fully explored. However, it is anticipated that alternatives presented in this fact sheet that require extensive modifications to existing streams or previously undisturbed sites could potentially require extensive mitigation or may prove unacceptable to state and federal regulatory agencies.

14. Project Area Maps: Also See Figure 4

Columbus, Indiana

Haw Creek

Section 205 Study

Flood Risk Management

Appendix A - Engineering Division

Hydrologic and Hydraulic Analysis

U.S. Army Corps of Engineers

Louisville District

July 2013

Haw Creek
Columbus, Indiana

H&H Appendix

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Haw Creek
Columbus, Indiana

H&H Appendix

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1. Introduction

The primary purpose of this study was to assess possible flood risk management alternatives along Haw Creek near Columbus, Indiana. Several configurations of off-channel detention basins were studied as options to lower flood levels. A debris blockage scenario was examined and channel modifications were also studied. Attachment 1 shows the overall study area.

Both hydrologic and hydraulic analyses were required for this study. Christopher Burke Engineering Ltd. provided USACE with hydrologic and hydraulic models of Haw Creek. Their hydrologic model was used to develop frequency discharge hydrographs for use in the hydraulic model. Given these results, existing conditions and proposed flood risk management options were simulated by using the supplied unsteady flow HEC-RAS model.

The level of effort given in this analysis and results in this study should preclude findings as considered final or detailed in nature. This level of study only allows for a cursory evaluation of existing conditions and proposed modifications. Additionally, more detailed efforts in hydrologic analysis and hydraulic model development could show that the flood damage reduction alternatives considered to date are more or less efficient (or feasible) than reported. Additional analysis could also promote other flood damage reduction alternatives not yet considered.

2. Hydrologic Analysis

Hydrologic analysis efforts for this study began with determination of 24-hour duration frequency rainfall depths from NOAA Atlas 14 for the Columbus, Indiana area.

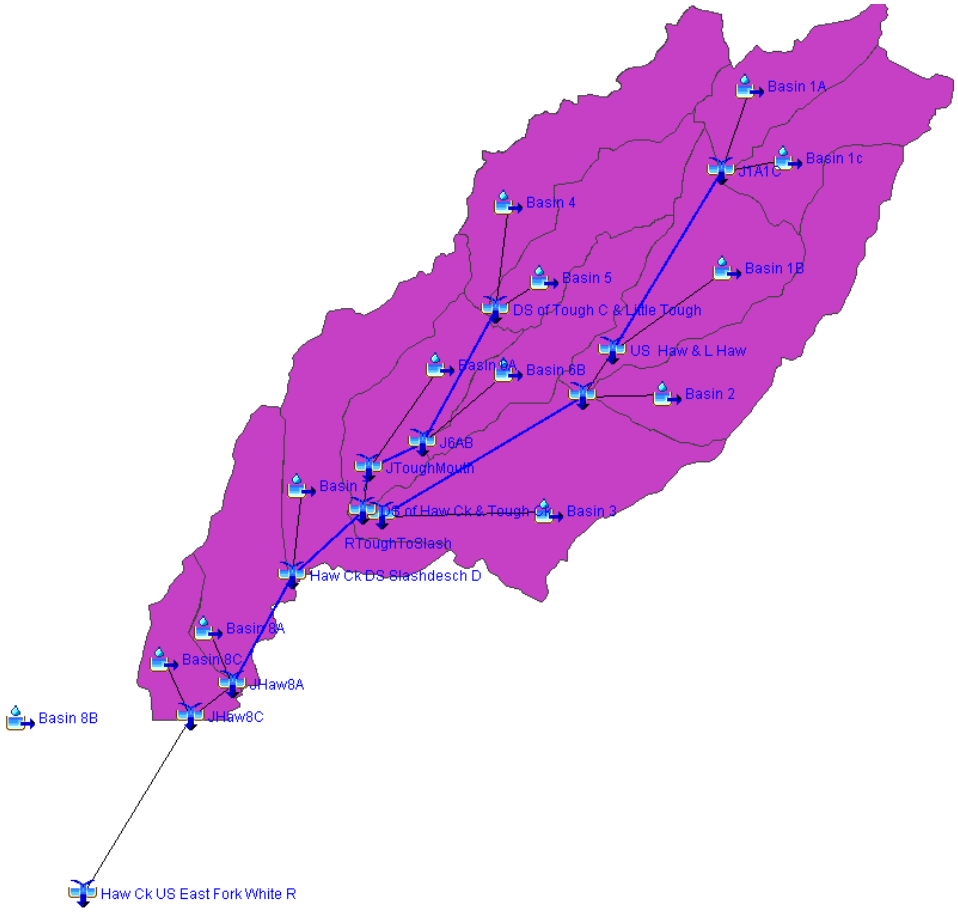
Table 1
Atlas 14 Frequency Rainfall
Columbus, Indiana

Frequency	24-Hour Rainfall Depth (in)
1-year	2.43
2-year	2.91
5-year	3.62
10-year	4.18
25-year	4.98
50-year	5.64
100-year	6.34
500-year	8.11

A report provided by Christopher Burke Engineering Ltd. supplied insight into the development of their HEC-HMS model. The Haw Creek watershed and its subbasins were delineated with the use of USGS 10-foot contour mapping and aerial photography. Curve numbers were based on land use and soil data

obtained from the USGS National Land Cover Dataset (NLCD) 2001 and Natural Resource Conservation Service (NRCS) Soil Survey Geographic database (SSURGO), respectively. NRCS TR-55 methodology was used to make Time of Concentration (TC) calculations for each subbasin. The default value for initial abstraction was used in the model. Muskingum-Cunge methodology was used for channel routing and the storage coefficient (R) for each subbasin was computed from the calculated TC value and an R/(TC+R) ratio of 0.60. Layout of the Haw Creek watershed in HEC-HMS is shown in Figure 1.

Figure 1
HEC-HMS Model Layout for the Haw Creek Watershed



Once meteorological data for the eight frequency storm events were entered into the model, simulation runs could be set up for each event using the existing conditions basin model. The model was simulated to calculate frequency discharge hydrographs for the 99%, 50% 20%, 10%, 4%, 2%, 1%, and 0.02%(1-, 2-, 5-, 10-, 25-, 50-, 100-, and 500-year) annual chance flood events. Resulting peak discharges are presented at several locations along Haw Creek in Table 2.

Table 2
Peak Discharges for Key Hydrologic Elements

Location	Peak Discharge* (cfs)							
HMS Hydrologic Element	**1-year**	**2-year**	**5-year**	**10-year**	**25-year**	**50-year**	**100-year**	**500-year**
U/S Haw & L Haw	490	720	1110	1450	1880	2260	2680	3890
D/S of Haw Ck & Little Haw Ck	730	1080	1660	2160	2800	3360	3980	5740
Haw U/S Tough Ck	1010	1500	1970	2630	3630	4440	5290	7570
D/S of Haw Ck & Tough Ck	1470	2110	2930	4000	5500	6720	8030	11510
Haw Ck U/S East Fork White R	1760	2530	3510	4650	6480	7960	9560	13760

*Discharges Rounded to nearest 10 cfs.

3. Hydraulic Analysis

Once the hydrologic analysis was complete and the frequency flood hydrographs had been computed, work began on the unsteady flow hydraulic model. According to the Burke Engineering report, cross section data was acquired from a variety of sources including survey data, 2' topographic mapping, and a Digital Elevation Model (DEM). Cross section locations are shown in Attachment 1.

Manning's roughness coefficients were determined for the original Burke model from an existing USGS hydraulic model at USGS surveyed cross sections and from field observations and aerial mapping at all other locations. Bridge data was taken from IDNR survey data and adjusted to NGVD 1929.

A number of areas along the studied reach were modeled as storage areas. Some areas of high ground along the reach were modeled as lateral weirs to connect the stream to these storage areas. Connections were modeled between some of the storage areas as well.

The flow hydrograph from the HMS hydraulic element "D/S of Haw Ck & Tough Ck" was used as the upstream boundary condition. "Basin 7", "Basin8A", and "Basin 8C" hydrographs were entered into the model as lateral inflow hydrographs. These boundary conditions remained the same from the original model to the model developed for this study. However, the downstream boundary condition used in the original model had to be changed for this study. The original model used the June 7, 2008 water surface elevation on the East Fork White River at Haw Creek, which was slightly lower than the 10-year water surface elevation. For the purpose of this study, the downstream boundary condition was taken as the water surface elevation on the East Fork White River at Haw Creek corresponding to the frequency flood

being modeled. For example, when modeling the 100-year event on Haw Creek, the downstream boundary condition was taken as the 100-year water surface elevation of the East Fork White River at Haw Creek. Frequency flood elevations for the East Fork White River were obtained from the stage frequency curve for the East Fork White River at the Columbus gage. Then, using Flood Insurance Study Water Surface Profiles, these elevations were parallel profiled along the East Fork White River to the point impacting Haw Creek.

High water marks for the June 2008 flood event were collected by both the USGS and Bartholomew County. The original hydraulic model was calibrated to the 2008 event using these marks.

Existing conditions along the study reach of Haw Creek were modeled first. Eight separate plans and unsteady flow files were developed in the HEC-RAS model corresponding to the eight frequency flood events to be modeled and the simulations were run. Frequency profiles derived from existing conditions modeling are shown on Attachment 2 and are comparable to the frequency flood results from Burke Engineering.

After existing condition calculations were completed, flood risk management alternatives were developed and incorporated into the model. Initially, an off-channel detention basin was the main focus of this effort. At the request of the local sponsor, a debris blockage scenario and channel modifications were also studied.

The existing conditions HEC-RAS model geometry was modified to represent each option. A 40-acre off-channel detention basin was considered first. It was assumed that the basin would be modeled so that its bottom elevation was equal to the channel bottom elevation and its rim elevation was equal to the existing conditions 100-year flood elevation at that location. Since the HEC-RAS model being used for this study is an unsteady flow model, storage is accounted for and the detention basin could be directly incorporated into the model geometry. A possible location for this basin was determined to be downstream of the confluence of Tough Creek with Haw Creek, between Cross Sections 8.8 and 8.54. Two new cross sections were added (8.55 and 8.79) and a lateral structure was modeled between them. A storage area with the discussed dimensions was also added and connected to the lateral structure. This option produced only modest reductions in flood elevations.

Significant flooding from Haw Creek in the Columbus area appears to begin around the 25-year flood. According to the report by Burke Engineering, flows over 3000 cfs through the hydraulic element “D/S of Haw Ck and Tough Ck” resulted in flooding. By running their detention basin scenario in the provided HEC-HMS model, it was determined that approximately 1350 acre-feet of storage was necessary to reduce flows from the 25-year flood to the desired level. Keeping the same bottom and rim elevations, this resulted in a required area of approximately 85 acres, slightly more than double the initial area considered. Running the simulation with a basin of these dimensions resulted in significant water surface elevation reductions. Reductions for several points along Haw Creek are summarized in Table 3. Frequency profiles for this option are presented on Attachment 4.

Table 3
Summary of Water Surface Elevation Reductions for Plan 1: 85 Acre Detention Basin

Location		Flood Elevation Reductions* (ft)							
Cross Section	**Description**	**1-year**	**2-year**	**5-year**	**10-year**	**25-year**	**50-year**	**100-year**	**500-year**
8.8	Just U/S of modeled detention basin	0.8	1.1	1.7	2.0	1.7	1.4	1.1	0.4
7.93	U/S of County Road 450 N	0.7	0.9	1.1	0.8	0.6	0.3	0.2	0.2
4.85	U/S of Rocky Ford Road	0.5	0.6	0.6	0.7	0.6	0.7	0.6	0.5
3.494	U/S of 25th Street	0.6	1.0	1.2	1.5	1.2	0.9	0.8	0.8
2.38	U/S of 10th Street	0.5	0.8	1.2	1.6	1.2	1.0	0.6	0.4
1.981	U/S of 7th Street	0.5	0.7	1.0	1.3	1.0	0.9	0.6	0.5
1.46	U/S of State Street	0.5	0.6	0.8	1.0	0.7	0.5	0.6	0.3
1.2	U/S of Railroad Bridge	0.4	0.5	0.6	0.7	0.4	0.3	0.4	0.2

*Reductions in flood elevations are rounded to the nearest tenth of a foot.

While the reductions from this plan were considerable, the large amount of excavation required to build a detention basin of this size resulted in a total preliminary cost estimate of nearly $28 million, which is outside the realm of a Section 205 study. It was determined that in order for the project to qualify for Section 205, the basin would need to be reduced in size by approximately two thirds. To satisfy this requirement, the basin size was reduced to 28 acres, the spillway elevation was raised to optimize reductions of the 5-year flood, and the simulation was run again, resulting in modest reductions. The modeled location for this basin is shown in Attachment 3. Reductions for several points along Haw Creek are summarized in Table 4. Frequency profiles for this option are presented on Attachment 5.

Table 4

Summary of Water Surface Elevation Reductions for Plan 2: Reduced 28 Acre Detention Basin

Location		Flood Elevation Reductions* (ft)							
Cross Section	Description	1-year	2-year	5-year	10-year	25-year	50-year	100-year	500-year
8.8	Just U/S of modeled detention basin	0.2	0.6	1.0	1.2	1.1	0.9	0.8	+ 0.1
7.93	U/S of County Road 450 N	0.2	0.4	0.4	0.1	0.1	0.0	0.0	0.0
4.85	U/S of Rocky Ford Road	0.1	0.2	0.2	0.1	0.1	0.1	0.1	0.1
3.494	U/S of 25th Street	0.1	0.4	0.5	0.2	0.2	0.1	0.1	0.1
2.38	U/S of 10th Street	0.1	0.3	0.5	0.2	0.1	0.1	0.1	0.1
1.981	U/S of 7th Street	0.1	0.3	0.4	0.2	0.1	0.2	0.1	0.1
1.46	U/S of State Street	0.1	0.3	0.4	0.2	0.1	0.0	0.1	0.0
1.2	U/S of Railroad Bridge	0.1	0.2	0.3	0.1	0.1	0.0	0.1	0.0

*Reductions in flood elevations are rounded to the nearest tenth of a foot.

It was requested by the local sponsor that debris blockage in the channel and at bridges be considered in this study. As debris was not noted in the channel or at bridge openings during site visits, it did not appear to be an issue at this time. To examine the effects that debris blockage could possibly have on flood elevations, changes were made to the existing conditions geometry. The roughness coefficients in the channel were increased by 0.02 and the bridge openings were blocked by 20% using the floating pier debris option. These changes resulted in significantly increased water surface elevations for all eight frequency floods. Increases in flood elevations at several points along Haw Creek are summarized in Table 5. Frequency profiles for this scenario are shown on Attachment 6.

Table 5
Summary of Increases in Water Surface Elevations for Plan 3: Debris Blockage Scenario

Location		Increase in Flood Elevation* (ft)							
Cross Section	**Description**	**1-year**	**2-year**	**5-year**	**10-year**	**25-year**	**50-year**	**100-year**	**500-year**
9.21	U/S Boundary of Model	1.6	1.4	0.9	0.6	0.5	0.4	0.3	0.3
7.93	U/S of County Road 450 N	1.0	1.0	0.6	0.6	0.3	0.1	0.2	0.1
4.85	U/S of Rocky Ford Road	0.8	0.6	0.6	0.7	1.0	1.0	1.1	1.4
3.494	U/S of 25th Street	0.9	0.9	1.2	1.3	1.2	1.2	1.0	1.2
2.38	U/S of 10th Street	1.0	1.1	1.5	1.6	1.1	0.9	0.7	0.5
1.981	U/S of 7th Street	1.0	1.0	1.4	1.6	1.4	1.5	1.3	0.9
1.46	U/S of State Street	0.8	0.7	1.0	1.1	0.7	0.9	0.6	0.1
1.2	U/S of Railroad Bridge	0.6	0.5	0.7	0.8	0.5	0.6	0.4	0.1

*Increases in flood elevations are rounded to the nearest tenth of a foot.

Three channel modification scenarios were also considered in this study at the request of the local sponsor. The first location considered for channel modifications was the reach of Haw Creek in the golf course area, between cross sections 2.38 and 2.85. The second location was the agricultural area between 32nd Street and Rocky Ford Road, cross sections 4.06 to 4.79. The third scenario was an extension of the second area in both the upstream and downstream directions, from cross section 3.63, just north of National Road, to cross section 5.85, south of Marr Road.

To determine the bottom width of the modified channel, the average bottom width of the existing channel in each modification area was increased by a factor of 1.5. For the golf course area, this resulted in a modified channel bottom width of 65 feet. The modified channel bottom width used for both scenarios in the agricultural area was 70 feet. Modified channel side slopes of 1.0 foot vertical to 3.0 feet horizontal were used for all scenarios. A Manning's n value of 0.04 was adopted for the modified portions of the channel and the modified channel was placed 1.0 foot above the existing channel bottom, to maintain a natural channel. Figures 2 and 3 depict typical cross sections for the golf course and agricultural area modifications, respectively. Neither bridge geometry nor internal bridge cross sections were altered as part of these analyses.

Figure 2
Typical Channel Modification Cross Section: Golf Course Area

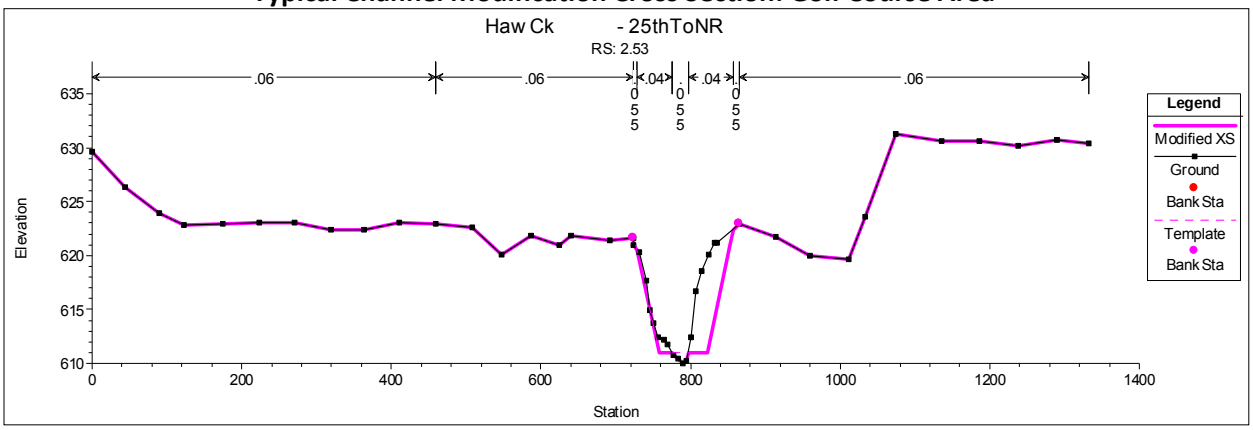
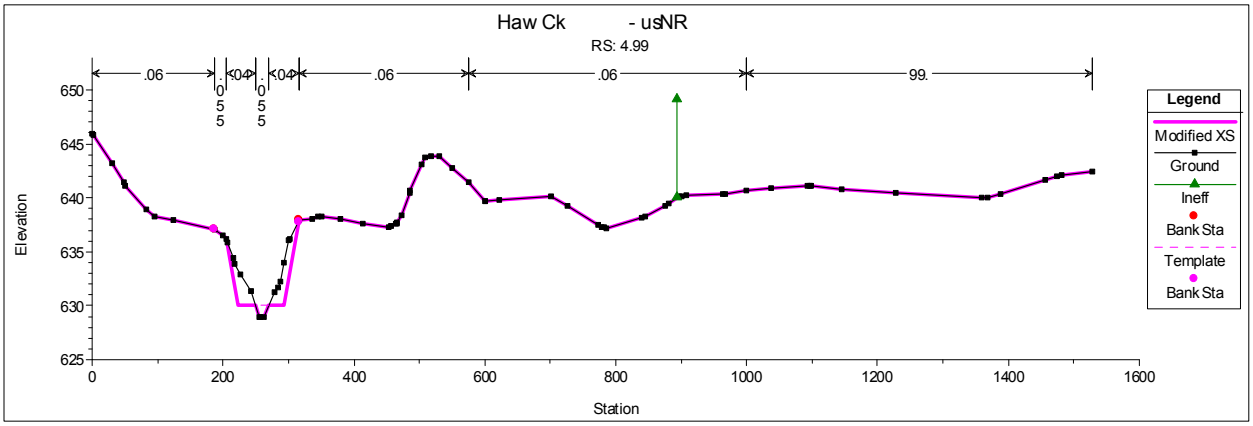


Figure 3
Typical Channel Modification Cross Section: Agricultural Area



The channel modification scenario modeled for the golf course area resulted in significant reductions in flood elevations for the area of the modification and immediately upstream in the vicinity of the Hospital. Reductions for several cross sections are summarized in Table 6. Frequency profiles for this scenario are included in Attachment 7.

Table 6
Summary of Water Surface Elevation Reductions for Plan 4: Channel Modification of Golf Course Area

Location	Flood Elevation Reductions* (ft)							
Cross Section	1-year	2-year	5-year	10-year	25-year	50-year	100-year	500-year
3.46	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.1
3.21	1.1	1.2	1.2	0.9	0.7	0.6	0.5	0.7
3.15	1.4	1.4	1.4	1.1	0.8	0.8	0.7	0.9
3.01	2.0	2.0	1.8	1.5	1.1	1.0	0.9	1.1
2.94	2.1	2.1	2.0	1.6	1.2	1.0	1.0	1.1
2.89	2.2	2.3	2.1	1.7	1.2	1.1	1.1	1.2
2.85	1.9	2.0	1.8	1.4	0.9	0.7	0.6	0.5
2.45	0.5	0.3	0.2	0.1	0.0	0.1	0.0	0.0

*Reductions in flood elevations are rounded to the nearest tenth of a foot.

The first channel modification scenario in the agricultural area yielded noticeable flood elevation reductions mainly in the modification area. These reductions are summarized for a number of cross sections in Table 7. Flood frequency profiles are included for this scenario in Attachment 8.

Table 7
Summary of Water Surface Elevation Reductions for Plan 5: Channel Modification of Agricultural Area

Location	Flood Elevation Reductions* (ft)							
Cross Section	1-year	2-year	5-year	10-year	25-year	50-year	100-year	500-year
5.14	0.1	0.0	+0.1	0.0	0.0	0.0	0.1	0.2
4.99	0.7	0.6	0.5	0.4	0.3	0.2	0.2	0.4
4.79	1.3	1.5	1.4	1.0	0.9	0.9	0.9	0.8
4.74	1.2	1.4	1.4	1.1	1.0	1.0	0.9	0.8
4.5	0.0	0.0	0.1	0.3	0.4	0.5	0.5	0.4
4.48	1.5	1.6	1.5	1.3	0.8	0.6	0.6	0.4
4.33	1.5	1.6	1.5	1.4	1.0	0.8	0.7	0.5
4.06	0.5	0.5	0.5	0.5	0.4	0.3	0.3	0.2

*Reductions in flood elevations are rounded to the nearest tenth of a foot.

The channel modification scenario modeled for the extended agricultural area yielded significant flood elevation reductions over a wider range of cross sections than the original agricultural area scenario. Reductions for this scenario are tabulated for several cross sections in Table 8. Flood frequency profiles for this scenario are presented in Attachment 9.

Table 8
Summary of Water Surface Elevation Reductions for Plan 6: Channel Modification of Extended Agricultural Area

Location	Flood Elevation Reductions* (ft)							
Cross Section	1-year	2-year	5-year	10-year	25-year	50-year	100-year	500-year
6.09	1.1	0.8	0.8	0.7	0.7	0.5	0.4	0.4
5.72	1.8	1.7	1.2	0.9	0.6	0.6	0.6	0.6
5.49	0.6	0.9	1.0	0.9	0.8	0.7	0.7	0.7
5.14	2.3	2.2	1.8	1.5	1.2	1.1	1.0	0.9
4.79	1.3	1.5	1.4	1.2	1.0	1.0	1.0	1.0
4.5	0.0	0.0	0.1	0.3	0.4	0.6	0.7	0.7
4.06	2.4	2.0	1.6	1.3	1.0	1.0	0.9	0.8
3.74	0.4	0.3	0.2	0.2	0.1	0.1	0.1	0.0

*Reductions in flood elevations are rounded to the nearest tenth of a foot.

Additionally, the reach of Haw Creek in the vicinity of the Cummins facilities, from cross section 1.47 to 1.93, was considered for a channel modification. However, preliminary runs of that scenario did not yield noticeable reductions in flood elevations so the effort was not continued. Scenarios for extending the agricultural area in only one direction, upstream or downstream, were also considered. Those scenarios are not included, as the extension of the area in both directions yielded the best results.

Once all model simulations were performed, results were provided to the study team economist for preliminary determination of whether given alternatives are economically feasible.

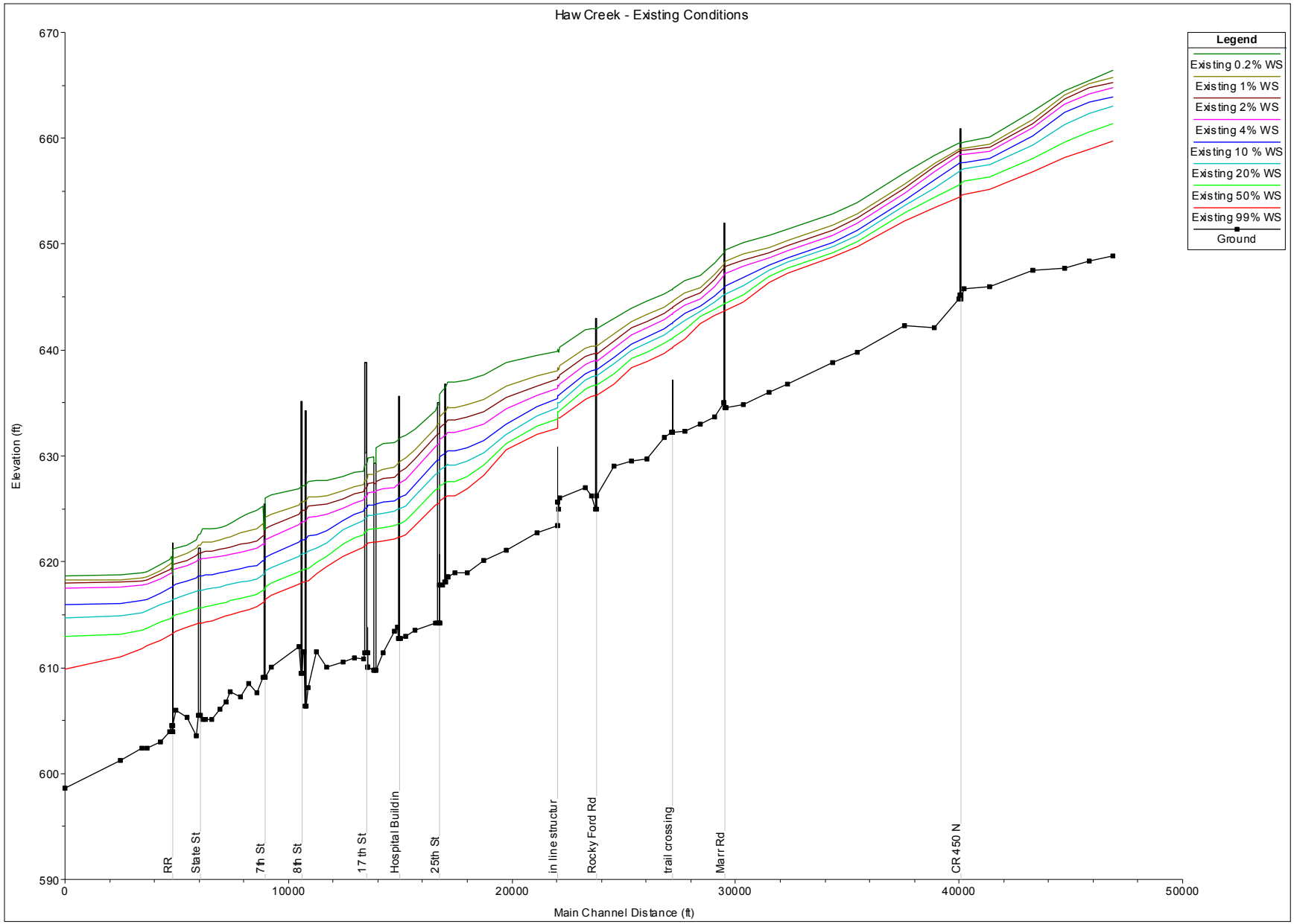
4. Future Modeling Efforts

This section of the appendix is intended to provide guidance for future detailed modeling efforts associated with this study.

Analysis of an in-line detention basin upstream of the study reach, near the town of Hope, Indiana may be warranted in future study efforts. Further analysis might also determine that other locations or configurations of off-channel detention basins would offer similar reductions at a more feasible cost.

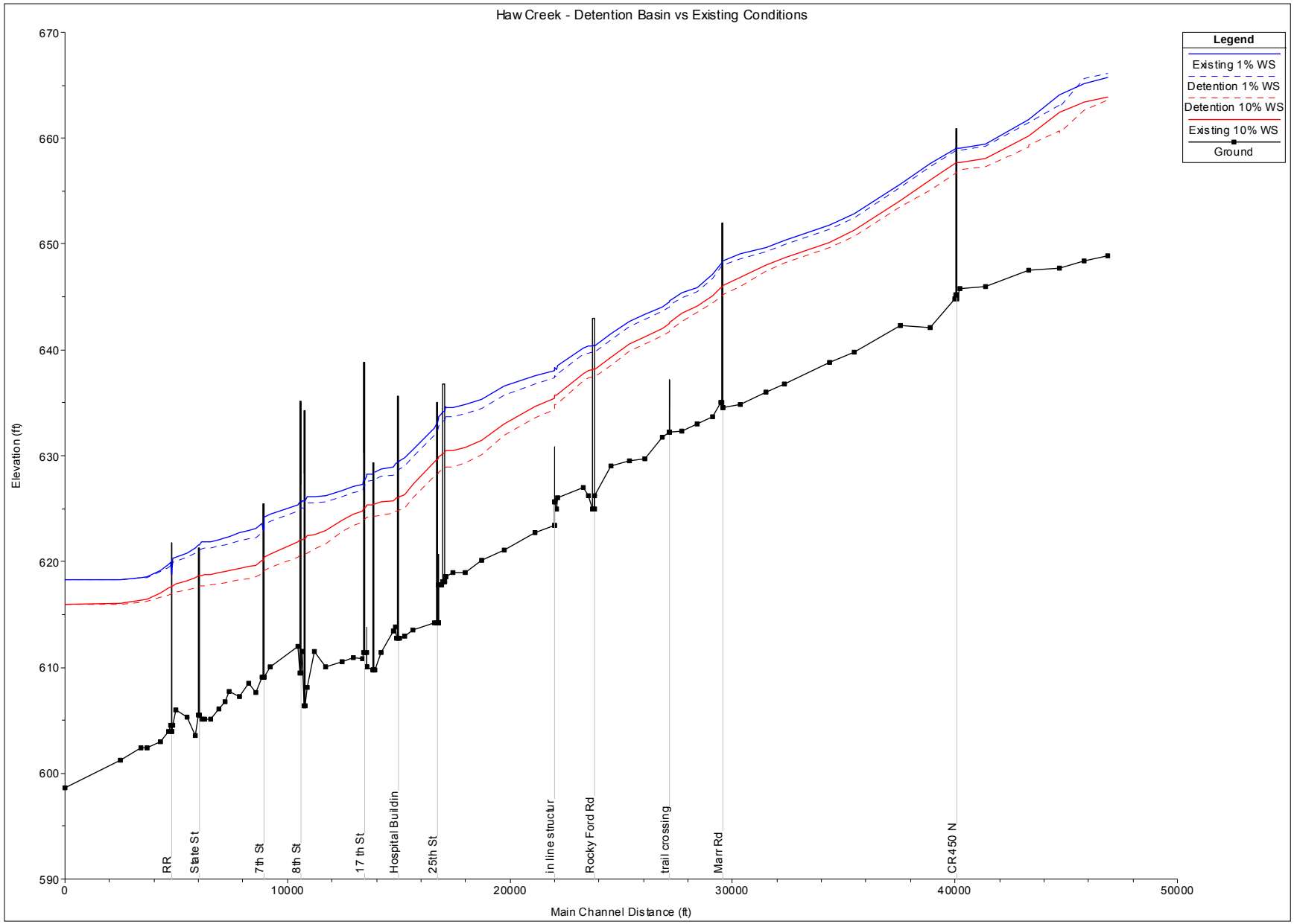
It was noted that several cross sections in the original HEC-RAS model were not of sufficient length to span the floodplain for all eight frequency events. Due to the limited resources available at this stage of study, this issue was not addressed. Any future analysis should include extension of all cross sections of insufficient length and recalibration of the model.

Attachment 1: Haw Creek Study Area

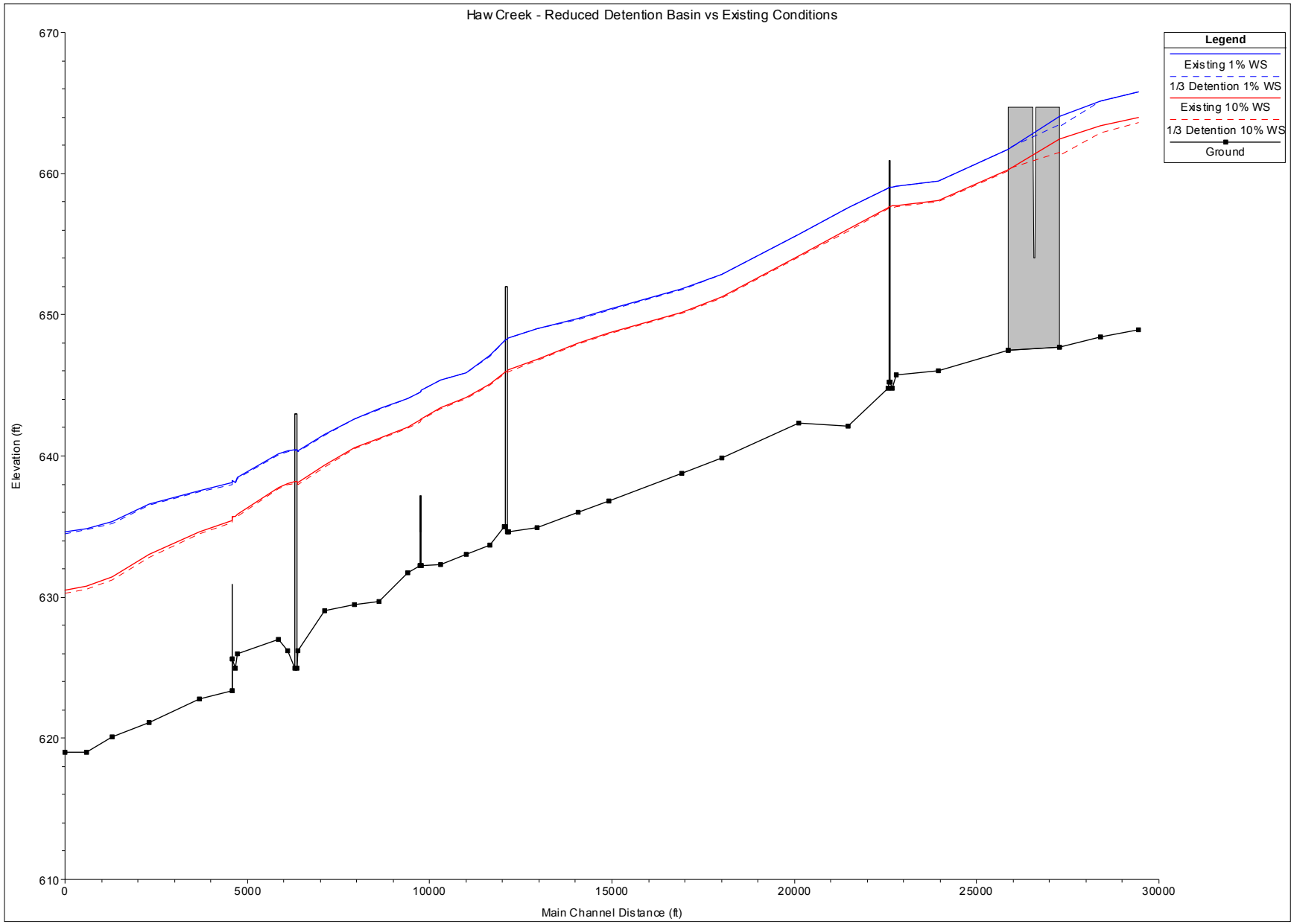


Attachment 2: Existing Conditions Frequency Profiles

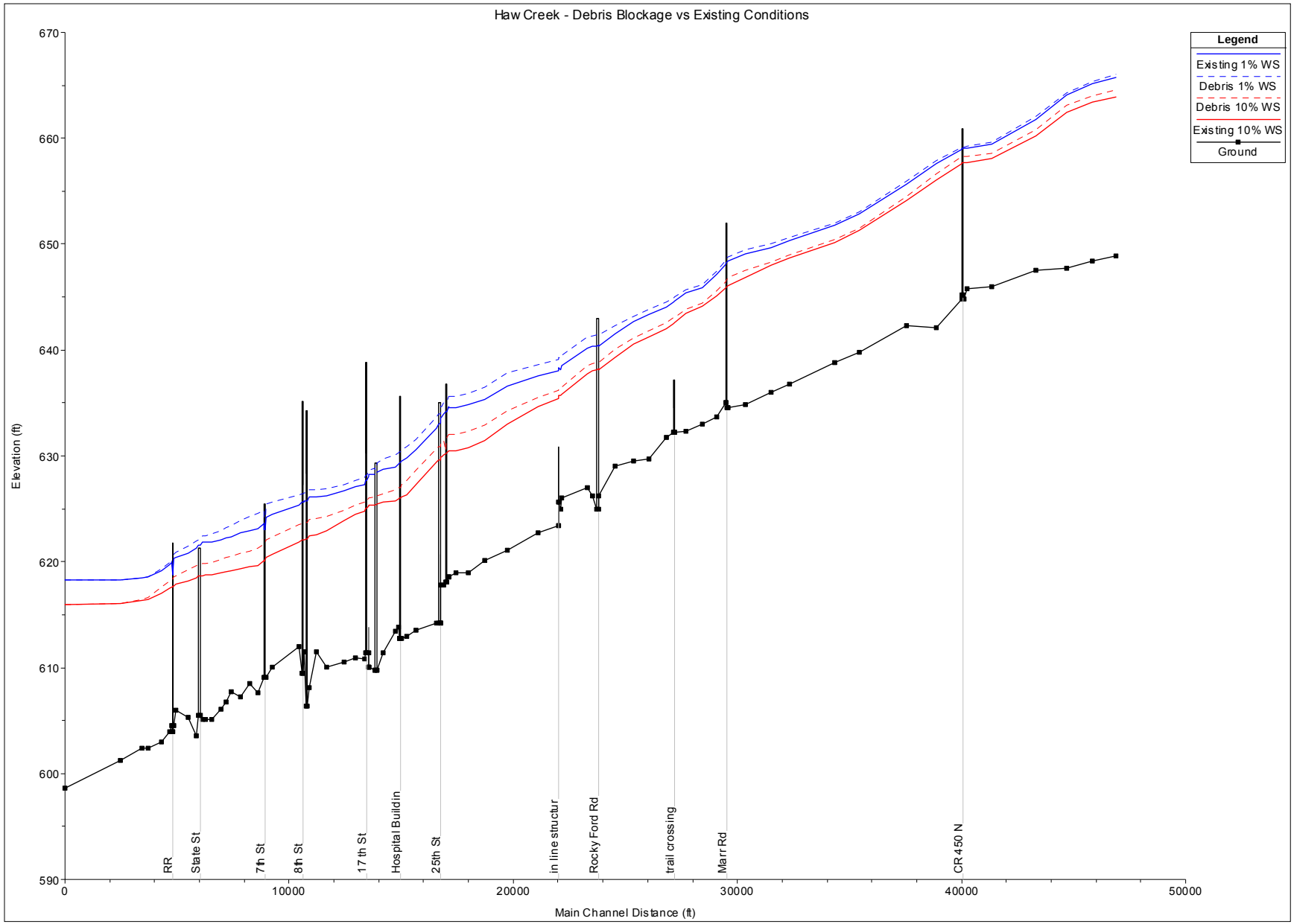
Attachment 3: Modeled Location of Off-Channel Detention Basin



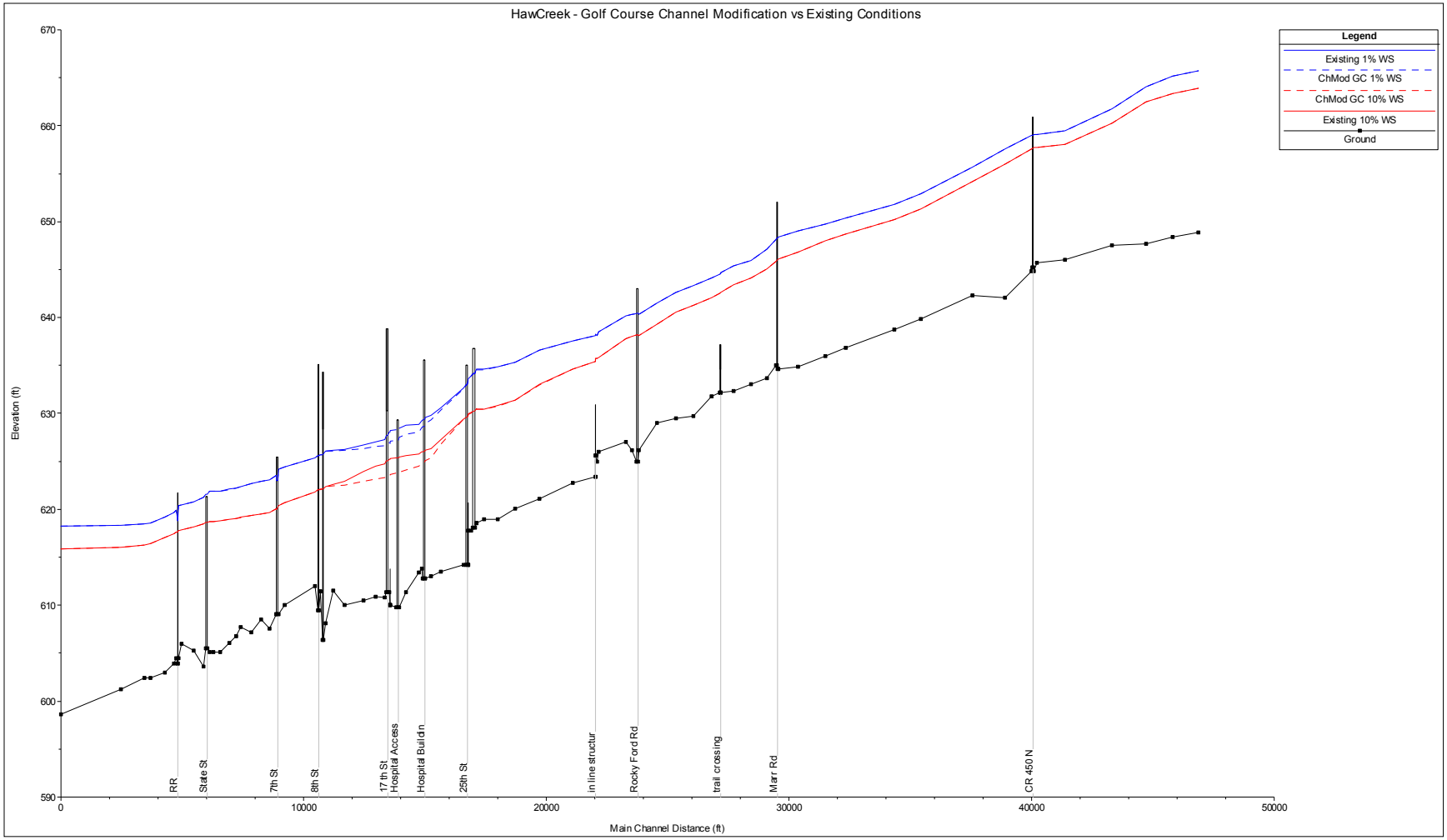
Attachment 4: 85 Acre Detention Basin Profiles vs. Existing Conditions



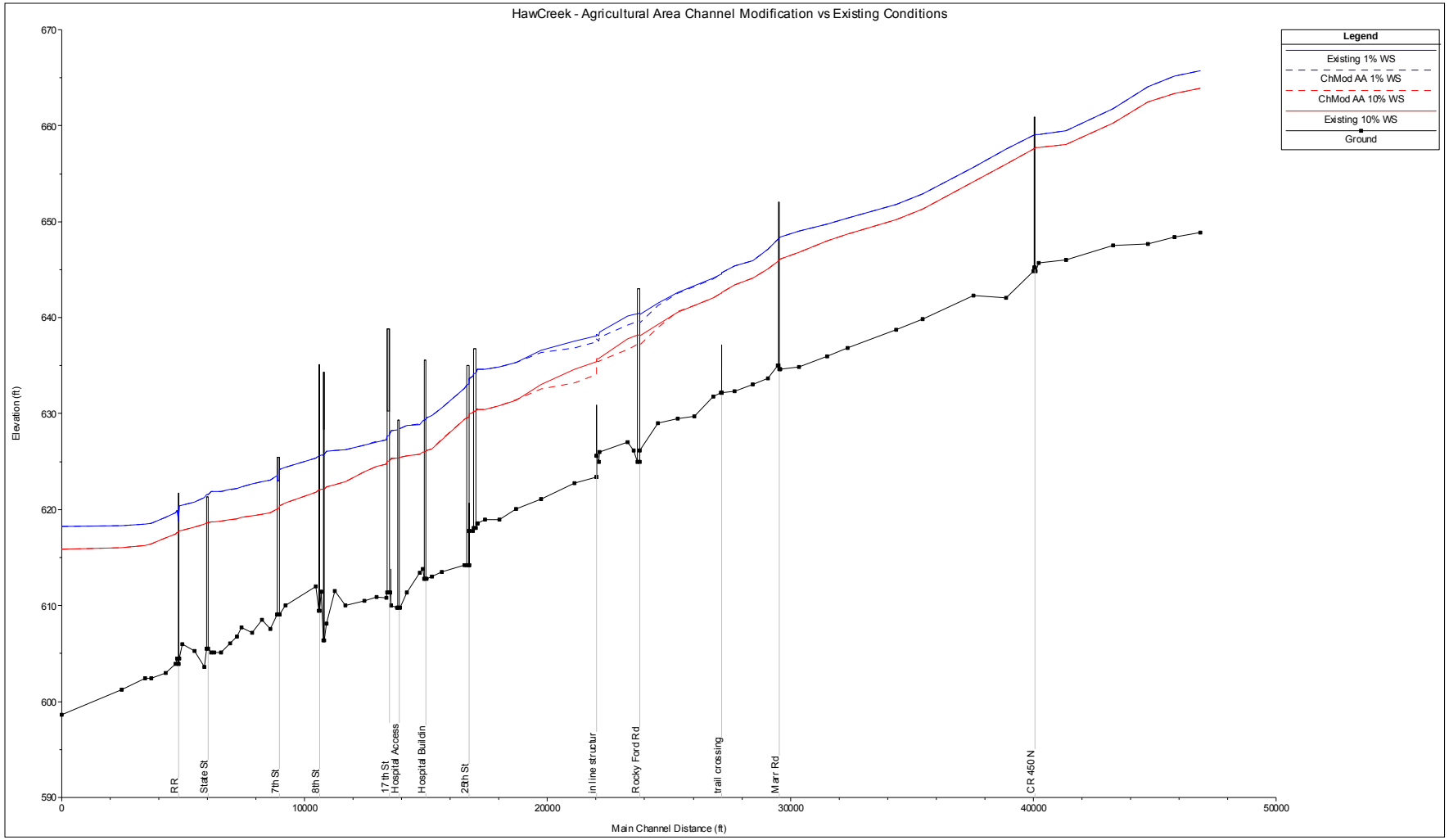
Attachment 5: 28 Acre Detention Basin Profiles vs. Existing Conditions



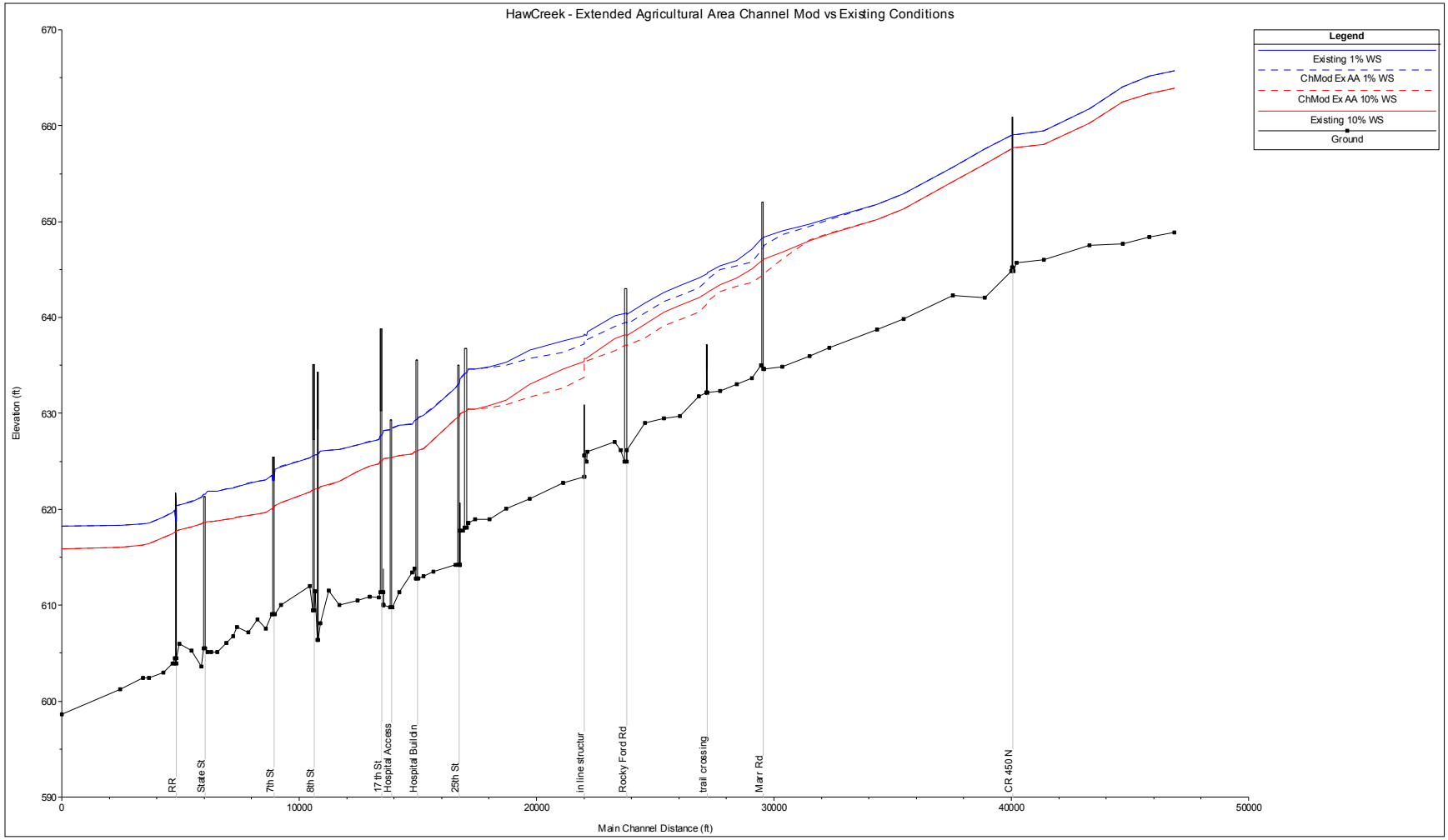
Attachment 6: Debris Blockage Scenario Profiles vs. Existing Conditions



Attachment 7: Golf Course Channel Modification Scenario Profiles vs. Existing Conditions



Attachment 8: Agricultural Area Channel Modification Scenario Profiles vs. Existing Conditions



Attachment 9: Extended Agricultural Area Channel Modification Scenario Profiles vs. Existing Conditions

Columbus, Indiana

Haw Creek

Section 205 Study

Flood Risk Management

Appendix B - Economics

U.S. Army Corps of Engineers

Louisville District

July 2013

1 - Introduction

The purpose of this Continuing Authorities Program – Section 205 study was to investigate the economic feasibility of structural and/or nonstructural measures for the purposes of flood risk management of Haw Creek in the vicinity of Columbus, Indiana. Specifically, analysis results are to be utilized to determine whether a federal interest exists to further study flood risk management improvements in a feasibility-level analysis. From an economics perspective, federal interest is obtained by the presentation of a benefit-cost ratio (BCR) greater than unity (1.0). This document presents both the methodology and the associated results of a preliminary-level economic analysis of the Haw Creek study area. The level of effort given in this analysis and results in this study should preclude findings as considered final or detailed in nature. This level of study only allows for a cursory evaluation of existing conditions and proposed modifications.

For this analysis, annual benefits of the studied alternative were assessed as reductions in expected annual damages. These reductions in expected annual damages are expressed as the difference between estimated without-project condition damages and residual damages estimated in the with-project condition. Damages in both the with-project and without-project conditions were estimated for structures and their contents in the study area. The study area was delineated by hydraulic and hydrologic engineers to reflect the 0.2%-chance floodplain. The Hydrologic Engineering Center's Flood Damage Analysis (HEC-FDA ver. 1.2.4) model was used to perform a risk-based analysis of damages for both conditions. The HEC-FDA program was utilized to integrate the collected economic data with hydrologic and hydraulic (H&H) data in a risk-based framework. For this analysis, all dollar values shown are in a 2013 price level and the FY13 federal discount rate of 3.75% was utilized for discounting and amortization.

2 - Study Area

The portion of Haw Creek being considered in this study is located in the vicinity of Columbus, Indiana in Bartholomew County. Founded in 1821, Bartholomew County covers 409 square miles of relatively flat terrain surrounding the East Fork White River in the southeastern part of Indiana. It is bounded on the northwest by Johnson County, northeast by Shelby County, east by Decatur County, southeast by Jennings County, southwest by Jackson County, and west by Brown County. Haw Creek is a tributary to the East Fork White River. It flows directly through the city of Columbus to its confluence with the East Fork White River just to the southwest of the city. The county seat of Bartholomew County is Columbus, located near the center of the county. Columbus is also the largest community in the county and the 20th largest city in the state.

3 - Structure Inventory

The study area was delineated by H&H engineers as the area of the city of Columbus, IN estimated to be impacted by a 0.2%-chance flood event. The structure inventory is a dataset of properties within the study area, including all relevant data employed as input parameters for the HEC-FDA analysis. Structure data required for HEC-FDA analysis can be subdivided into four primary components: structure counts and locations within the floodplain (stream name and stationing corresponding to that used in the H&H model), structure values and other characteristics, structure elevations, and susceptibility to flooding damages and the magnitude of those damages as represented by a depth-damage curve. The processes and acknowledged assumptions used to develop these components are detailed below.

3.1 Structure Locations and Values

Detailed parcel data, in the form of ArcGIS shapefiles, were obtained for the structures in the Haw Creek study area from the Bartholomew County GIS Mapping Division. The acquired parcel data provided a very broad geospatial location of individual structures and also contained a significant amount of additional data on these structures, including improvement values. These assessed improvement values were utilized as the structure value for each individual structure in the study area, in lieu of depreciated structure replacement values required in feasibility level analysis.

The structure inventory associated with the Haw Creek study area consists of three structure classes: residential, commercial, and public structures. Table 1 presents the number of structures inventoried in the Haw Creek 0.2%-chance floodplain by damage category.

Table 1

Haw Creek - Columbus, IN
Number of Structures Inventoried
0.2%-chance Floodplain
By Damage Category

Residential	1,006
PUBLIC	59
Commercial	73
TOTAL	**1,138**

3.2 Structure Elevations

The geospatial locations of the parcel footprints were utilized for the assignment of ground elevations to each structure. Ground elevations were assigned by overlaying these footprints over a digital elevation model (DEM) with five-foot contour lines. It should be noted that application of ground elevations based upon geospatial parcel locations in lieu of specific structure locations introduces a considerable amount of uncertainty associated with the input variables and, consequently, into the economic analysis of the study area.

3.3 Structure Characteristics

In addition to structure values and elevations, a number of other structure characteristics are critical for accurate estimation of flood damages. These include foundation heights (relative elevation of the structure's first floor above the ground elevation described above), structure class (damage category), number of stories, effective age, and presence of a basement. Structure class information was available from the parcel data. However, in the absence of a detailed site survey, the remainder of this data was approximated. Foundation height (difference between ground elevation and first floor elevation) associated with each structure were generically applied per structure class. All residential structures were assumed to have a foundation height of 2.5 feet while all commercial and public structures were assumed to have a foundation height of 0 feet. All structures were assumed to be one story with no finished basement.

3.4 Depth-Damage Relationships

The structure class, presence of a basement, and number of stories estimated above are used to assign each structure a depth-damage relationship, or curve. Depth-damage curves essentially relate a flood depth, relative to the first floor elevation of a given structure, to a damage or economic loss represented as a percentage of that structure's value. Two such curves exist for each structure. One curve describes the relationship between depth and structure damage and the other curve describes depth and content damage. Both depth-damage curves are represented as a percentage of structure value. Standardized generic depth-damage curves developed by the USACE Institute for Water Resources' (IWR) Flood Damage Data Collection Program were used in this analysis. Flood damage data was collected under this program from nationwide flooding events during the period of 1996 through 2001, and these curves and their associated standard deviations of error were developed by IWR via regression analyses on the data collected.

4 - Hydraulic and Hydrologic Data

Hydraulic and Hydrologic (H&H) data is used to estimate flood stages at structures for the eight analyzed probabilistically-weighted flood scenarios. H&H data was provided in the form of water surface profiles for numerous cross-sections along Haw Creek (river stations 9.21 to 0.2). These water surface profiles relate stage and discharge to each stream station for a range of eight possible flood events, ranging from a 99.9%-chance event to those with 0.2%-chance event. Uncertainty around discharge exceedance probability (the chance in a given year of river flow exceeding a set amount, or "discharge") and stage discharge relationships (expected river stages associated with a given discharge) for each cross section are additionally incorporated into the HEC-FDA model. During HEC-FDA model runs, these input parameters are sampled from within the defined uncertainty ranges for each Monte Carlo iteration. As HEC-FDA dynamically interpolates water surface profile data between input stream stations, structures can be assigned to these interpolated stream stations to more accurately represent flood stages at their locations.

5 - HEC-FDA Analysis

The US Army Corps of Engineers requires the use of risk-based analysis for evaluating flood damages and flood damage reduction measures, as described in ER 1105-2-101, Risk Analysis for Flood Damage Reduction Studies. A risk-based analysis accounts for uncertainty in the stage-flow relationships, discharge -exceedance probability relationships, stage-damage relationships, structure characteristics, and other categories for which uncertainty exists. This procedure further integrates these categories into an economic analysis for without-project (existing) and with- project (modified) conditions and a performance analysis for flood risk management measures. These computations were performed for this analysis using the HEC-FDA software package, version 1.2.4.

All of the data previously described are integrated within the HEC-FDA program, along with associated uncertainty distributions. FDA performs a Monte Carlo analysis using these distributions to model uncertainty in model inputs. This Monte Carlo analysis will be explained below.

5.1 Model Overview

The HEC-FDA program can be described as a 2-dimensional model as geospatial structure location is unknown. Rather, the model recognizes only the set of water surface profile data to which each structure is assigned (as well as elevation and other characteristics). For each river station, a series of river stages are associated with a range of flood events ranging in exceedance probability from 99.9% (1 year flood) to 0.2% (500 year flood). Structures are individually associated with these stations based on their geographic location with respect to the geospatially delineated river stations identified by H&H. Each structure will have a stage-damage curve associated with it, assigning a percentage loss of the structure and contents based on the depth of flooding at that structure. Each curve has an uncertainty distribution associated with it to account for unknown variance in flood depths and related damage.

Two reaches were identified for this study effort and applied to the HEC-FDA model. Reach 1 (usNR) is identified as river station 9.21 to 3.63. Reach 2 (25thToNR) is identified as river station 3.571 to 0.2. An index location (typically near the reach's midpoint) is identified within each reach. Within this framework, FDA essentially aggregates and analyzes a series of probabilistic curves defining relationships between flood stage and frequency of occurrence as well as flood stage and damages. These are used ultimately to generate a curve relating probability of occurrence and total damages (called a damage frequency curve), the integration of which provides expected annual damages (EAD). Stage-exceedance probability functions for each reach are used to generate a range of stages and probabilities at each index location that are used in the creation of an aggregated stage damage function for that reach. This aggregated stage damage function represents the total stage-damage relationship of that reach, including damages to all structures and contents within it, for a series of probability ordinates.

The HEC-FDA software essentially generates a reach-wide depth-damage function (including uncertainty) similar to those input for each structure as described above. To generate these aggregated damages, total damages must be estimated for all structures and contents within that reach for a given

stage at the index location. Accounting for the variation in stage throughout the reach, the water surface profiles are used to translate the index stage to the corresponding stage at the stream station of each structure. These stages are then compared to that structure's ground elevation plus foundation height, the difference applied to the structure's individual depth-damage functions (content and structure), and percent damages computed using these functions. Dollar damages are computed by simply multiplying the percent damage by the total structure value.

5.2 Monte Carlo Analysis

HEC-FDA uses Monte Carlo simulation to account for uncertainty. This process produces estimates that do not reflect the single most likely outcome (i.e. flood damages of a certain dollar value), but rather the *average* of all possible outcomes. This average is known as an expected value. This approach is also useful in that it provides a distribution of results, translating uncertainties around input parameters into an uncertainty distribution around model outputs. This Monte Carlo analysis is a random sampling approach in which uncertain input parameters are randomly sampled from associated uncertainty distributions. This process is continued and repeated for thousands of iterations until results converge on an expected value.

6 - Analysis Results

HEC-FDA model results are presented as expected annual damages (EAD). EAD do not represent the damages expected to occur in a given year, but rather the probability weighted damages of the range of analyzed flood events. The previous discussions of FDA methodology described the process of creating an aggregated damage-frequency curve, a curve which relates property damages in the area with probabilities of occurrence. Expected annual damages result from the integration of this curve performed by Monte Carlo simulation in risk-based analysis.

6.1 Without-Project Condition

Without-project condition EAD represents the annualized value of the range of potential flood damages, assuming the existing condition in the study area remains unchanged. Without-project conditions are illustrated in the following tables. Table 2 on the following page displays the number of structures estimated to be flooded in the existing condition. The figures are displayed by damage category and flood event.

Table 2

Haw Creek - Columbus, IN
Estimated Number of Structures Flooded
Without Project - Existing Condition
By Category and Flood Event (Based on Zero Damage Elevations)

	Flood Events by Chance of Occurrence							
Damage Category	99.9%	50%	20%	10%	4%	2%	1%	0.2%
Residential	0	0	1	113	214	265	449	905
PUBLIC	0	0	0	2	2	5	8	58
Commercial	0	0	2	22	24	30	41	65
TOTAL	**0**	**0**	**3**	**137**	**240**	**300**	**498**	**1,028**

Table 3, below, presents the estimated damages associated with the existing condition. The estimates are displayed by damage category and flood event.

Table 3

Haw Creek - Columbus, IN
Estimated Damages ($1,000's)
Without Project - Existing Condition
By Category and Flood Event (Based on Zero Damage Elevations)
FY 13 Price Levels

	Flood Events by Chance of Occurrence							
Damage Category	99.9%	50%	20%	10%	4%	2%	1%	0.2%
Residential	$0.00	$0.00	$5.46	$123.50	$1,137.31	$2,937.07	$6,352.75	$20,112.47
PUBLIC	$0.00	$0.00	$0.00	$322.47	$609.01	$980.72	$1,635.91	$3,107.62
Commercial	$0.00	$0.00	$85.24	$2,277.89	$7,067.53	$9,697.31	$12,614.06	$25,065.14
TOTAL	**$0.00**	**$0.00**	**$90.70**	**$2,723.85**	**$8,813.85**	**$13,615.10**	**$20,602.72**	**$48,285.23**

6.2 With-Project Condition

With-project condition EAD represents annualized flood damages to structures provided that an alternative is applied to the study area. For this effort, a collection of 5 different alternatives were analyzed. These five different alternatives consisted of a 28 acre-foot detention basin, 85 acre-foot detention basin, channel modification – agricultural area, channel modification – extended agricultural area, and channel modification – golf course area. Please refer to the H&H appendix for a further description of each alternative. Each alternative was individually input into the HEC-FDA model previously constructed for the without project condition and analyzed in the same manner as outlined above. Upon completion of each model run, a with-project condition EAD is calculated. The array of

with-project condition EADs are individually compared to the without-project condition EAD. Reductions in EAD are calculated to determine project benefits for each alternative. Table 4, below, displays the number of structures estimated to be flooded in for each alternative. The figures are displayed by damage category and flood event.

Table 4

Haw Creek - Columbus, IN
Estimated Number of Structures Flooded
With Project - Modified Condition
By Category and Flood Event (Based on Zero Damage Elevations)

		Flood Events							
Plan	**Damage Category**	99.9%	50%	20%	10%	4%	2%	1%	0.2%
28 ac-ft	Residential	0	0	1	17	214	259	418	870
Detention Basin	Public	0	0	0	2	2	3	8	58
	Commercial	0	0	0	22	24	28	41	65
	Total	**0**	**0**	**1**	**41**	**240**	**290**	**467**	**993**
85 ac-ft	Residential	0	0	0	1	131	217	336	736
Detention Basin	Public	0	0	0	0	2	2	5	42
	Commercial	0	0	0	6	22	24	30	54
	Total	**0**	**0**	**0**	**7**	**155**	**243**	**371**	**832**
Channel Modification	Residential	0	0	1	112	207	265	420	889
Agricultural Area	Public	0	0	0	0	2	5	8	58
	Commercial	0	0	0	18	24	30	41	65
	Total	**0**	**0**	**1**	**130**	**233**	**300**	**469**	**1012**
Channel Modification	Residential	0	0	1	16	127	187	261	703
Extended	Public	0	0	0	0	2	3	6	58
Agricultural Area	Commercial	0	0	0	18	22	28	39	65
	Total	**0**	**0**	**1**	**34**	**151**	**218**	**306**	**826**
Channel Modification	Residential	0	0	1	113	214	265	449	870
Golf Course Area	Public	0	0	0	2	2	4	8	58
	Commercial	0	0	2	22	24	29	41	65
	Total	**0**	**0**	**3**	**137**	**240**	**298**	**498**	**993**

6.3 Expected Annual Damages

The HEC-FDA model results (expected annual damages in the without-project and with-project conditions) are displayed in Table 6, on the following page. Project benefits, the difference in without and with-project conditions, are also displayed in this table as EAD Reduction. Given the level of uncertainty associated with the input parameters as noted in this appendix, these benefit estimates are likewise uncertain. However, the level of effort applied to this analysis is appropriate for determination of potential federal interest.

Table 5

Haw Creek, Columbus, IN
Estimated Expected Annual Damages ($1,000's)
By Project Condition and Damage Category
FY13 Price Levels

	Damage Category			Estimated	EAD
Project Condition	**Residential**	**Commercial**	**Public**	**Annual Damages**	**Reduction**
Existing Condition	$3,479.22	$1,554.43	$285.91	$5,319.56	----
28 ac ft Detention Basin	$3,241.57	$1,416.48	$260.11	$4,918.16	$401.40
85 ac ft Detention Basin	$2,609.60	$1,054.67	$191.88	$3,856.15	$1,463.41
Channel Modification AA	$3,162.87	$1,255.79	$213.16	$4,631.82	$687.74
Channel Modification AA_DSUS	$1,647.85	$1,234.13	$115.65	$2,997.63	$2,321.93
Channel Modification GC	$3,479.00	$1,452.34	$282.29	$5,213.63	$105.93

6.4 Annualized Implementation Costs

The construction first cost associated with each alternative was developed by cost engineering in MCASES format. A twenty-four month period of construction was assumed for the 85 acre-foot detention basin while the remaining four alternatives were analyzed based on a twelve month period of construction. Interest during construction (IDC) was calculated for each alternative based on the plan's estimated period of construction. Addition of each alternative's first cost and IDC yielded a total investment cost for each plan. This total investment cost was annualized over a 50 year analysis period at the federal discount rate of 3.75% to generate annual interest and amortization costs for each alternative studied. Annual operation and maintenance costs (O&M) were generated for each plan based on input from H&H and cost engineering. Addition of interest and amortization costs to annual O&M costs produce the total annual costs for each alternative. The total annual costs are utilized for comparison to expected total annual benefits to produce a benefit-cost ratio for the proposed project. All costs can be found in Table 7.

7 - Summary

7.1 Benefit-Cost Ratio Purpose

The results of a benefit-cost analysis can be displayed as a single net benefits number (benefits minus costs) and as a benefit-cost ratio (BCR). Net benefits are typically used to select and scale a recommended course of action from an array of alternatives within the context of a single study or analysis. Benefit-cost ratios are used as a metric to test the viability of a proposed course of action. A benefit-cost ratio above unity (greater than one) indicates that every dollar invested will yield in excess of one dollar of benefit to the nation, whereas a benefit-cost ratio less than one indicates that every dollar invested will yield less than one dollar in benefit. A BCR above unity is typically required to identify federal interest in any proposed project.

7.2 Haw Creek Benefit-Cost Calculation

Benefit-cost ratios are computed by dividing annual benefits (annualized damage reductions) by annual costs associated with the alternative or plan analyzed. The summary of annual benefits and costs and related benefit-cost ratio for the alternative considered for Haw Creek in Columbus, IN is presented in Table 7 below.

Table 6

Haw Creek, Columbus, IN
Section 205
Summary of Annual Benefits and Costs
FY 2013 Price Levels (x $1,000)
3.75% Interest Rate

	28 acre-foot Detention Basin	85 acre-foot Detention Basin	Agricultural Area Channel Modification	Agricultural Area Extended Channel Modification	Golf Course Channel Modification
Investment Cost					
Construction First Cost	$7,733	$26,441	$3,477	$6,832	$4,449
Interest During Construction	$144	$998	$65	$127	$83
Total Investment Cost	$7,877	$27,439	$3,542	$6,959	$4,532
Annual Charges					
Interest & Amortization	$351	$1,223	$158	$310	$202
Operation & Maintenance	$5	$10	$25	$25	$25
Total Annual Charges	$356	$1,233	$183	$335	$227
Annual Benefits					
Flood Risk Management	$401	$1,463	$688	$2,322	$106
Total Annual Benefits	$401	$1,463	$688	$2,322	$106
Benefit vs. Cost Ratio	1.13	1.19	3.76	6.93	0.47
Net Benefits	$45	$230	$505	$1,987	-$121

8 - Recommendation

Four of the five proposed structural alternatives were found to produce a benefit-cost ratio above unity and generate positive net benefits. Therefore, only one alternative (Channel Modification – golf course), is not considered to be economically feasible. Among the four economically feasible alternatives, the Extended agricultural area channel modification produces a 6.93 BCR and is the plan which has been estimated to generate the most net benefits ($1,987,000) for Haw Creek in Columbus, IN. Based on the analysis presented in this appendix, the four identified alternatives found to be economically feasible support preliminary federal interest and warrant further inspection and consideration. It should be noted that future study efforts producing additional and more detailed analysis could demonstrate that the flood risk management alternatives considered to date are more or less efficient (or feasible) than reported in this appendix. Additionally, plan optimization associated with future study efforts may yield additional alternatives and/or measures previously not considered for this study.

Columbus, Indiana

Haw Creek

Section 205 Study

Flood Risk Management

Appendix C - Cost Estimate

U.S. Army Corps of Engineers

Louisville District

July 2013

Haw Creek Detention Basin

Columbus, IN

P2 353575

Estimated by	U.S. Army Corps of Engineers; CELRL-ED-M-C
Designed by	CELRL-ED-T-H
Prepared by	Justin Tabor
Preparation Date	12/21/2012
Effective Date of Pricing	12/21/2012
Estimated Construction Time	365 Days

Checked By: James Vermillion/Taylor Canfield

File Path: \\lrl-fs01lou\org\ED\Public\MCACES\ED-M-C\Civil\FY13\353575- Haw Creek Columbus, IN\Estimate

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Designed by
CELRL-ED-T-H

Estimated by
U.S. Army Corps of Engineers; CELRL-ED-M-C

Prepared by
Justin Tabor

Design Document	Section 205 Fact Sheet
Document Date	12/21/2012
District	Louisville District
Contact	Justin Tabor
Budget Year	2012
UOM System	Original

Direct Costs
LaborCost
EQCost
MatlCost
SubBidCost

Timeline/Currency

Preparation Date	12/21/2012
Escalation Date	12/21/2012
Eff. Pricing Date	12/21/2012
Estimated Duration	365 Day(s)
Currency	US dollars
Exchange Rate	1.000000

Costbook CB10EB: MII English Cost Book 2010

Labor Bartholome: General Decision Number: IN120006 12/07/2012 IN6
Note: State: Indiana Construction Types: Heavy and Highway

Labor Rates
LaborCost1
LaborCost2
LaborCost3
LaborCost4

Equipment EP11R02: MII Equipment 2011 Region 02
Note: Fuel prices updated 12 DEC 2012 for Columbus, IN via gasbuddy.com

02 MIDEAST

Sales Tax	5.90
Working Hours per Year	1,450
Labor Adjustment Factor	1.01
Cost of Money	2.50
Cost of Money Discount	25.00
Tire Recap Cost Factor	1.50
Tire Recap Wear Factor	1.80
Tire Repair Factor	0.15
Equipment Cost Factor	1.00
Standby Depreciation Factor	0.50

Fuel

Electricity	0.096
Gas	3.200
Diesel Off-Road	3.360
Diesel On-Road	3.990

Shipping Rates

Over 0 CWT	9.67
Over 240 CWT	8.90
Over 300 CWT	8.01
Over 400 CWT	7.19
Over 500 CWT	4.67
Over 700 CWT	4.67
Over 800 CWT	7.09

Date	Author	Note
12/7/2012	Tabor	**Estimator's Notes**

Key Assumptions:

Estimate is based on the 28 AC detension basin.

Means and Methods:

- Clearing and Grubbing - Minimal effort will be required as area is mostly agriculture land.

- Topsoil Stripping- Assume 6" of organics will be stripped from the project area. (2) D8 or equivalent dozers are estimated to be used.

- Detention Basin Mass Excavation- Assume 1 excavator will work one 8 hour shift 5 days a week to complete the project within a reasonable time frame. Crew is comprised of (1) CAT 365C or equivalent hydraulic excavators, (15) 17 YD over-the-road dump trucks, (1) D-8LGP or equivalent dozer placing the wasted material and a compactor.

- Basin will be fed from the channel via a spillway. Estimator assumes this will be a concrete spillway. Dimensions provided by the PDT are 30ft wide with a bottom elevation of 556' with a 3 horizontal to 1 vertical bank.

- Water will have to be removed by some method for water below the spillway elevation of 556' and down to the bottom elevation of the basin which is 447.7'. The estimator assumes this will be accomplished by some type of drop structure, however, no information was provided. Estimator included 3 EA concrete box structures with grated inlet and 36" outlet pipes.

- Estimator assumes a security fence will be placed around the basin as it will be a public safety nuisance.

Contractor Hierarchy:

- Estimator assumes that due to volume of material and costs that this will be an unrestricted procurement that heavy civil contractor will be interested in bidding. Estimator assumes that Prime will self-perform excavation items and subcontract other items including concrete, fencing, and seeding.

Project Information:

- No spoil site(s) have been identified by PDT or local sponsor

- No confirmation that rock is no present onsite to elevation 647.7' but it is assumed that it will not be an issue

Schedule:

- Estimator has included no overtime and estimate is based on a 5/8s schedule. With weather days, the project should be able to be completed in 12 months on this

Date	Author	Note
		schedule. Contingency: - Captured in the TPCS. Estimator has applied a 25% contingency to the estimate given the lack of design information at this point. This is considered reasonable for a reconnaissance level estimate. Escalation: - Captured in the TPCS. Design is assumed to PED will start in FY15 and will be one year in duration. Construction would be scheduled for FY16 and completed in latter FY17.

Direct Cost Markups	**Category**	**Method**
Productivity	Productivity	Productivity
Overtime	Overtime	Overtime

	Days/Week	*Hours/Shift*	*Shifts/Day*	*1st Shift*	*2nd Shift*	*3rd Shift*
Standard	*5.00*	*8.00*	*1.00*	*8.00*	*0.00*	*0.00*
Actual	*5.00*	*8.00*	*1.00*	*10.00*	*0.00*	*0.00*

Day	*OT Factor*	*Working*	*OT Percent*	*FCCM Percent*
Monday	*1.50*	*Yes*	*10.00*	*(20.00)*
Tuesday	*1.50*	*Yes*		
Wednesday	*1.50*	*Yes*		
Thursday	*1.50*	*Yes*		
Friday	*1.50*	*Yes*		
Saturday	*1.50*	*No*		
Sunday	*2.00*	*No*		

Sales Tax	TaxAdj	Running % on Selected Costs
MatlCost		

Contractor Markups	**Category**	**Method**
JOOH (Small Tools)	Allowance	% of Labor
JOOH	JOOH	JOOH (Calculated)
SUBJOOH	Allowance	Running %
HOOH	HOOH	Running %
Profit	Profit	Running %
Bond	Bond	Bond Table
Class B, Tiered, 24 months, 1.00% Surcharge		

Contract Price	*Bond Rate*
500,000	*15.84*
2,000,000	*9.57*
2,500,000	*7.59*
2,500,000	*6.93*
7,500,000	*6.34*

Excise Tax	Excise	Running %

Owner Markups	**Category**	**Method**
Escalation	Escalation	Escalation

StartDate	*StartIndex*	*EndDate*	*EndIndex*	*Escalation*

Contingency	Contingency	Running %
SIOH	SIOH	Running %

Description	Quantity	UOM	ContractCost
Project Cost Summary Report			**6,186,452**
01 Lands and Damages	**1.00**	**EA**	**296,000**
15 Floodway Control-Diversion Struc	**1.00**	**EA**	**4,739,452**
22 Feasibility Study	**1.00**	**EA**	**228,000**
30 Planning, Engineering and Design	**1.00**	**EA**	**568,000**
31 Construction Management	**1.00**	**EA**	**355,000**

Description	Quantity	UOM	Contractor	DirectCost	SubCMU	CostToPrime	PrimeCMU	ContractCost
Contract Cost Summary Report				**5,152,544**	**69,651**	**5,222,195**	**964,257**	**6,186,452**
01 Lands and Damages	**1.00**	**EA**	**USACE**	**296,000**	**0**	**296,000**	**0**	**296,000**
15 Floodway Control-Diversion Struc	**1.00**	**EA**	**Prime**	**3,705,544**	**69,651**	**3,775,195**	**964,257**	**4,739,452**
1500 Floodway Control-Diversion Struc	**1.00**	**EA**	**Prime**	**3,705,544**	**69,651**	**3,775,195**	**964,257**	**4,739,452**
150001 Mob, Demob & Preparatory Work	**1.00**	**LS**	**Prime**	**373,158**	**0**	**373,158**	**95,312**	**468,470**
150010 Earthwork for Structures	**1.00**	**EA**	**Prime**	**2,829,799**	**0**	**2,829,799**	**722,785**	**3,552,584**
150099 Associated General Items	**1.00**	**EA**	**Generic Subcontractor**	**200,717**	**35,957**	**236,675**	**60,451**	**297,126**
150053 Overflow Structure	**1.00**	**EA**	**Prime**	**301,869**	**33,694**	**335,563**	**85,709**	**421,273**
22 Feasibility Study	**1.00**	**EA**		**228,000**	**0**	**228,000**	**0**	**228,000**
30 Planning, Engineering and Design	**1.00**	**EA**	**USACE**	**568,000**	**0**	**568,000**	**0**	**568,000**
31 Construction Management	**1.00**	**EA**	**USACE**	**355,000**	**0**	**355,000**	**0**	**355,000**

Description	Quantity	UOM	Contractor	DirectLabor	DirectEQ	DirectMatl	DirectSubBid	DirectUserCost	DirectCost	C/O
Project Direct Costs Report				**1,348,581**	**1,742,362**	**612,101**	**1,449,500**	**0**	**5,152,544**	
				0.00	*0.00*	*0.00*	*296,000.00*		*296,000.00*	
01 Lands and Damages	**1.00**	**EA**	**USACE**	**0**	**0**	**0**	**296,000**	**0**	**296,000**	
USR LERRDs	1.00	LS	USACE	0	0	0	296,000	0	296,000	
(Note: No info at this time. Site is approx 35 acres assume $4K/ac fair value + 8 parcels x $7k admin fees/ea and $100k for easements and admin fees.)										
				1,348,581.28	*1,742,361.89*	*612,100.59*	*2,500.00*		*3,705,543.76*	
15 Floodway Control-Diversion Struc	**1.00**	**EA**	**Prime**	**1,348,581**	**1,742,362**	**612,101**	**2,500**	**0**	**3,705,544**	
				1,348,581.28	*1,742,361.89*	*612,100.59*	*2,500.00*		*3,705,543.76*	
1500 Floodway Control-Diversion Struc	**1.00**	**EA**	**Prime**	**1,348,581**	**1,742,362**	**612,101**	**2,500**	**0**	**3,705,544**	
150001 Mob, Demob & Preparatory Work	**1.00**	**LS**	**Prime**	**118,801**	**94,202**	**157,655**	**2,500**	**0**	**373,158**	
150001 01 Mobilization	**1.00**	**LS**	**Prime**	**17,058**	**5,367**	**0**	**2,500**	**0**	**24,925**	
				175.92	*255.55*	*0.00*	*0.00*		*431.47*	
RSM 015436500100 Mobilization or demobilization, dozer, loader, backhoe or excavator, above 150 H.P., up to 50 miles	21.00	EA	Prime	3,694	5,367	0	0	0	9,061	
(Note: (1) 365C EXCAVATOR, (2) D8 DOZER, (1) GRADER, (1) WATER TRUCK, (1) COMPACTOR, (15) DUMP TRUCKS. ASSUME 4 HRS EACH.)										
				0.00	*0.00*	*0.00*	*2,500.00*		*2,500.00*	
USR Setup Job Site Trailer	1.00	EA	Prime	0	0	0	2,500	0	2,500	
(Note: Allowance)										
				1,336.41	*0.00*	*0.00*	*0.00*		*1,336.41*	
RSM 017123131200 Boundary & survey markers, crew for building layout, 3 person crew	10.00	DAY	Prime	13,364	0	0	0	0	13,364	
				3.29	*3.89*	*9.46*	*0.00*		*16.64*	
150001 02 Construction Access & Haul Roads	**15,833.00**	**SY**	**Prime**	**52,126**	**61,529**	**149,755**	**0**	**0**	**263,410**	
(Note: Estimator uses arrbitary 3,500 LF EA. Assume one route into the site and another out of the site.)										
				19.69	*3.60*	*65.00*	*0.00*		*88.29*	
RSM 334113402180 Public Storm Utility Drainage Piping, corrugated metal pipe, galvanized and bituminous coated with paved invert, 20' lengths, 12 ga., 36" diameter, excludes excavation and backfill	80.00	LF	Prime	1,575	288	5,200	0	0	7,063	
(Note: Assume 20' at two locations for convert on haul routes plus that for disposal areas)										
				0.26	*0.00*	*2.13*	*0.00*		*2.39*	
RSM 313219161500 Geotextile soil stabilization, geotextile fabric, woven, 200 lb. tensile strength	15,833.00	SY	Prime	4,093	0	33,724	0	0	37,817	

Description	Quantity	UOM	Contractor	DirectLabor	DirectEQ	DirectMatl	DirectSubBid	DirectUserCost	DirectCost	C/O
				0.52	*0.49*	*7.00*	*0.00*		*8.00*	
RSM 321123230302 Base course drainage layers, aggregate base course for roadways and large paved areas, crushed stone base, compacted, crushed 1-1/2" stone base, to 6" deep	15,833.00	SY	Prime	8,199	7,694	110,831	0	0	126,724	
				366.47	*357.97*	*0.00*	*0.00*		*724.45*	
RSM 312323202600 Hauling, haul road maintenance (Note: Assume 1 day per wk)	38.00	DAY	Prime	13,926	13,603	0	0	0	27,529	
				0.01	*0.01*	*0.00*	*0.00*		*0.02*	
HNC 320190264930 Watering, water, by truck (Note: Assume 2 passes per day on average)	3,008,270.00	SY	Prime	19,052	29,539	0	0	0	48,591	
				66.00	*130.06*	*0.00*	*0.00*		*196.06*	
USR 329113233850 Soil preparation, 300 HP dozer (Note: Assume 2 weeks for spoil area(s) work)	80.00	HR	Prime	5,280	10,405	0	0	0	15,685	
				3,694.42	*5,366.50*	*0.00*	*0.00*		*9,060.92*	
150001 03 Demobilization	**1.00**	**EA**	**Prime**	**3,694**	**5,367**	**0**	**0**	**0**	**9,061**	
				175.92	*255.55*	*0.00*	*0.00*		*431.47*	
RSM 015436500100 Mobilization or demobilization, dozer, loader, backhoe or excavator, above 150 H.P., up to 50 miles (Note: (1) 365C EXCAVATOR, (2) D8 DOZER, (1) GRADER, (1) WATER TRUCK, (1) COMPACTOR, (15) DUMP TRUCKS. ASSUME 4 HRS EACH.)	21.00	EA	Prime	3,694	5,367	0	0	0	9,061	
150001 04 Erosion Control	**1.00**	**LS**	**Prime**	**45,922**	**21,940**	**7,900**	**0**	**0**	**75,762**	
				1.85	*0.63*	*0.79*	*0.00*		*3.27*	
RSM 312513101120 Erosion control, silt fence, polypropylene, 3' high, includes 7.5' posts	10,000.00	LF	Prime	18,464	6,293	7,900	0	0	32,657	
				528.04	*300.91*	*0.00*	*0.00*		*828.95*	
RSM 312319201100 Dewatering, pumping, 8 hr., attended 8 hours per day, 6" centrifugal pump, includes 20 L.F. of suction hose and 100 L.F. of discharge hose (Note: Assume 1 EA per weather day for each excavation crew.)	52.00	DAY	Prime	27,458	15,648	0	0	0	43,105	
				1,106,435.75	*1,612,885.18*	*110,478.02*	*0.00*		*2,829,798.94*	
150010 Earthwork for Structures	**1.00**	**EA**	**Prime**	**1,106,436**	**1,612,885**	**110,478**	**0**	**0**	**2,829,799**	
				1,106,435.75	*1,612,885.18*	*110,478.02*	*0.00*		*2,829,798.94*	
15001002 Site Work	**1.00**	**EA**	**Prime**	**1,106,436**	**1,612,885**	**110,478**	**0**	**0**	**2,829,799**	
				316.82	*624.27*	*0.00*	*0.00*		*941.09*	

Description	Quantity	UOM	Contractor	DirectLabor	DirectEQ	DirectMatl	DirectSubBid	DirectUserCost	DirectCost	C/O
15001002 01 Clearing and Grubbing	**1.00**	**EA**	**Prime**	**317**	**624**	**0**	**0**	**0**	**941**	
				10.56	*20.81*	*0.00*	*0.00*		*31.37*	
RSM 311110109030 Site clearing trees, with 335 H.P. dozer, to 36" diameter (Note: Assume 1/2 day effort; minimal trees 15-20.)	30.00	EA	Prime	317	624	0	0	0	941	
				0.26	*0.52*	*0.00*	*0.00*		*0.78*	
15001002 02 Stripping	**34,170.00**	**LCY**	**Prime**	**9,021**	**17,776**	**0**	**0**	**0**	**26,798**	
				0.26	*0.52*	*0.00*	*0.00*		*0.78*	
RSM 311413230200 Topsoil stripping and stockpiling, topsoil, sandy loam, ideal conditions, 300 H.P. dozer	34,170.00	CY	Prime	9,021	17,776	0	0	0	26,798	
				1.89	*2.80*	*0.00*	*0.00*		*4.68*	
15001002 03 Excavation, Common	**553,000.00**	**LCY**	**Prime**	**1,042,638**	**1,546,594**	**0**	**0**	**0**	**2,589,232**	
				0.19	*0.33*	*0.00*	*0.00*		*0.51*	
RSM 312316434300 Excavating, large volume projects, 200,000 plus B.C.Y., 4.5 C. Y. bucket, excavator, 100 % fill factor, no truck loading	553,000.00	LCY	Prime	103,919	180,576	0	0	0	284,495	
				1.39	*2.10*	*0.00*	*0.00*		*3.49*	
RSM 312323204066 Cycle hauling(wait, load,travel, unload or dump & return) time per cycle, excavated or borrow, loose cubic yards, 15 min load/wait/unload, 20 CY truck, cycle 10 miles, 35 MPH, excludes loading equipment (Note: 10 mile haul / 35 MPH = 17 min travel + 15 mins WLU = 32 mins/cycle = 1.875 cycles/hr * 17 LCY/CYC = 31.875 LCY/HR. 950 LCY/31.875 LCY/TRUCK = 30 Trucks)	553,000.00	LCY	Prime	768,050	1,160,987	0	0	0	1,929,038	
				0.18	*0.27*	*0.00*	*0.00*		*0.46*	
RSM 312323145010 Backfill, structural, sandy clay & loam, 300 H.P. dozer, 50' haul (Note: Spoil area(s) placement)	529,500.00	LCY	Prime	96,090	144,979	0	0	0	241,069	
				0.18	*0.15*	*0.00*	*0.00*		*0.33*	
HNC 312323239330 Compact, enbankment, 8" lift, self propelled roller (Note: Spoil area(s) placement)	407,715.00	ECY	Prime	74,578	60,052	0	0	0	134,630	
				1.74	*1.87*	*0.00*	*0.00*		*3.60*	
15001002 08 Structural Backfill (Note: 10' crown berm around detention basin.)	**18,050.00**	**ECY**	**Prime**	**31,378**	**33,688**	**0**	**0**	**0**	**65,066**	
				0.57	*0.87*	*0.00*	*0.00*		*1.44*	
RSM 312323145010 Backfill, structural,	23,441.54	LCY	Prime	13,471	20,325	0	0	0	33,796	

Description	Quantity	UOM	Contractor	DirectLabor	DirectEQ	DirectMatl	DirectSubBid	DirectUserCost	DirectCost	C/O
sandy clay & loam, 300 H.P. dozer, 50' haul										
(Note: Estimator reduces production rate to 150 LCY/HR each for structural placement and shaping.)										
				0.58	*0.47*	*0.00*	*0.00*		*1.05*	
HNC 312323239330 Compact, enbankment, 8" lift, self propelled roller, includes water	18,050.00	ECY	Prime	10,455	8,419	0	0	0	18,874	
(Note: Matches dozer placement)										
				0.42	*0.28*	*0.00*	*0.00*		*0.69*	
RSM 312216101020 Fine grading, loam or topsoil fine grade for large area, 15,000 S.Y. or more	17,929.00	SY	Prime	7,451	4,945	0	0	0	12,396	
				1.14	*0.70*	*5.47*	*0.00*		*7.31*	
15001002 12 Seeding	**20,200.00**	**SY**	**Prime**	**23,082**	**14,203**	**110,478**	**0**	**0**	**147,763**	
				30.09	*5.00*	*0.00*	*0.00*		*35.09*	
RSM 329113230100 Soil preparation, structural soil mixing, rake topsoil, site materials, ideal conditions, harley rock rake	181.80	MSF	Prime	5,471	908	0	0	0	6,379	
(Note: Berm area only)										
				0.12	*0.13*	*0.19*	*0.00*		*0.44*	
RSM 329219131000 Seeding, mechanical seeding hydro or air seeding for large areas, includes lime, fertilizer and seed	20,200.00	SY	Prime	2,364	2,612	3,838	0	0	8,814	
(Note: Berm area only)										
				20.95	*10.07*	*313.20*	*0.00*		*344.22*	
RSM 329219144900 Seeding athletic fields, seeding turf mix, 4 lb. per M.S.F., tractor spreader	200.00	ACR	Prime	4,190	2,014	62,640	0	0	68,844	
(Note: For spoil.....Assume 2 ac per hour for pto spreader. $60/#50 bag of KY31 = $4.80/MSF or $210/AC, leave to account for fert and lime)										
				55.29	*43.34*	*220.00*	*0.00*		*318.63*	
RSM 329113160350 Soil preparation, mulching, hay, 1" deep, power mulcher, large	200.00	ACR	Prime	11,057	8,669	44,000	0	0	63,726	
(Note: For spoil.....Estimator experience 1 straw bale per 800 SF blown @ $4/bale = 55 bales = $220)										
				69,992.11	*19,397.16*	*111,328.00*	*0.00*		*200,717.27*	
150099 Associated General Items	**1.00**	**EA**	**Generic Subcontractor**	**69,992**	**19,397**	**111,328**	**0**	**0**	**200,717**	
				69,992.11	*19,397.16*	*111,328.00*	*0.00*		*200,717.27*	
15009902 Site Work	**1.00**	**EA**	**Generic Subcontractor**	**69,992**	**19,397**	**111,328**	**0**	**0**	**200,717**	
				15.40	*4.27*	*24.50*	*0.00*		*44.17*	

Description	Quantity	UOM	Contractor	DirectLabor	DirectEQ	DirectMatl	DirectSubBid	DirectUserCost	DirectCost	C/O
15009902 01 Fencing	**4,544.00**	**LF**	**Generic Subcontractor**	**69,992**	**19,397**	**111,328**	**0**	**0**	**200,717**	
				13.71	*3.93*	*24.50*	*0.00*		*42.14*	
HNC 323113104650 Fence, chain link, security, 3 strands barb wire, 10' high, 9 ga. Mesh, 2-1/2" line post, 3" pull post, excludes excavation	4,544.00	LF	Generic Subcontractor	62,298	17,859	111,328	0	0	191,485	
(Note: Estimator assumes due to the basin size and characteristics that it would be a safety liability and would need a fence to deter the public from access.)										
				16.91	*3.38*	*0.00*	*0.00*		*20.29*	
RSM 323113307925 Chain link fence gates and posts, auger fence post hole, medium soil, 3' deep, by machine, includes excavation	455.00	EA	Generic Subcontractor	7,694	1,538	0	0	0	9,232	
(Note: Assume 1 week; reduced from 21)										
				53,352.77	*15,877.21*	*232,639.28*	*0.00*		*301,869.26*	
150053 Overflow Structure	**1.00**	**EA**	**Prime**	**53,353**	**15,877**	**232,639**	**0**	**0**	**301,869**	
				29,814.48	*10,208.80*	*148,060.28*	*0.00*		*188,083.56*	
15005303 Concrete	**1.00**	**EA**	**Generic Subcontractor**	**29,814**	**10,209**	**148,060**	**0**	**0**	**188,084**	
				19.73	*6.76*	*97.99*	*0.00*		*124.48*	
15005303 01 Concrete, in Place:	**1,511.00**	**CY**	**Generic Subcontractor**	**29,814**	**10,209**	**148,060**	**0**	**0**	**188,084**	
				0.00	*0.00*	*97.00*	*0.00*		*97.00*	
RSM 033105350150 Structural concrete, ready mix, normal weight, 3000 psi, includes local aggregate, sand, Portland cement and water, delivered, excludes all additives and treatments	1,511.00	CY	Generic Subcontractor	0	0	146,567	0	0	146,567	
				6.62	*0.00*	*1.22*	*0.00*		*7.84*	
RSM 031113652050 C.I.P. concrete forms, slab on grade, curb, wood, 6" to 12" high, 2 use, includes erecting, bracing, stripping and cleaning	1,224.00	SFC	Generic Subcontractor	8,107	0	1,493	0	0	9,601	
(Note: Assume 8 pours of less than 200CY. 68 LF x 2 ft x 8 EA + 1 start.)										
				14.37	*6.76*	*0.00*	*0.00*		*21.12*	
RSM 033105704650 Structural concrete, placing, slab on grade, pumped, over 6" thick, includes strike off & consolidation, excludes material	1,511.00	CY	Generic Subcontractor	21,707	10,209	0	0	0	31,916	
				23,538.29	*5,668.41*	*84,579.00*	*0.00*		*113,785.70*	
15005313 Special Construction	**1.00**	**EA**	**Prime**	**23,538**	**5,668**	**84,579**	**0**	**0**	**113,786**	
(Note: Drop Structure)										

Description	Quantity	UOM	Contractor	DirectLabor	DirectEQ	DirectMatl	DirectSubBid	DirectUserCost	DirectCost	C/O
				32.81	*6.01*	*53.50*	*0.00*		*92.32*	
RSM 334113602060 Public Storm Utility Drainage Piping, reinforced concrete pipe (RCP), 36" diameter, 8' lengths, class 3, excludes excavation or backfill, gaskets (Note: Assume 3 EA outlets @ 150 LF each)	450.00	LF	Prime	14,766	2,703	24,075	0	0	41,544	
				1,181.31	*216.24*	*1,850.00*	*0.00*		*3,247.55*	
RSM 330516130040 Utility structures, utility vaults precast concrete, 4' x 6' x 6' high, I.D., 6" thick, excludes excavation and backfill (Note: Assume some sort of drop structure will be required to drain basin below spillway elevation.)	3.00	EA	Prime	3,544	649	5,550	0	0	9,743	
				26.93	*0.00*	*221.00*	*0.00*		*247.93*	
RSM 334413131579 Utility Area Drains, catch basins or manholes covers only for pipe bells, gray iron, medium duty, 36" diameter pipe, excludes footing, excavation, and backfill (Note: Assumes for grate intake)	3.00	EA	Prime	81	0	663	0	0	744	
				131.09	*10.96*	*997.50*	*0.00*		*1,139.55*	
HNC 334113604300 Reinforced concrete pipe (RCP), precast end section, 36" diameter pipe, excludes excavation or backfill	3.00	EA	Prime	393	33	2,993	0	0	3,419	
				2.88	*1.38*	*31.09*	*0.00*		*35.36*	
USR Rip Rap, excavator placed	1,650.00	CY	Prime	4,754	2,284	51,299	0	0	58,336	
				0.00	*0.00*	*0.00*	*228,000.00*		*228,000.00*	
22 Feasibility Study	**1.00**	**EA**		**0**	**0**	**0**	**228,000**	**0**	**228,000**	
USR Feasibility Study	1.00	LS	USACE	0	0	0	228,000	0	228,000	
				0.00	*0.00*	*0.00*	*568,000.00*		*568,000.00*	
30 Planning, Engineering and Design	**1.00**	**EA**	**USACE**	**0**	**0**	**0**	**568,000**	**0**	**568,000**	
				0.00	*0.00*	*0.00*	*568,000.00*		*568,000.00*	
USR PED (Note: Assume roughly 12.0%)	1.00	EA	USACE	0	0	0	568,000	0	568,000	
				0.00	*0.00*	*0.00*	*355,000.00*		*355,000.00*	
31 Construction Management	**1.00**	**EA**	**USACE**	**0**	**0**	**0**	**355,000**	**0**	**355,000**	
USR S&A (Note: 7.5% of Construction Costs)	1.00	LS	USACE	0	0	0	355,000	0	355,000	

**** TOTAL PROJECT COST SUMMARY ****

PROJECT: **Haw Creek Detension Basin**
LOCATION: Columbus, IN

DISTRICT: LRL Louisville
POC: CHIEF, COST ENGINEERING, James Vermillion
PREPARED: 12/13/2012

This Estimate reflects the scope and schedule in report; Section 205 Fact Sheet

WBS Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
						Program Year (Budget EC): 2015 Effective Price Level Date: 1 OCT 14								
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Spent Thru: 1-Oct-12 ($K)		COST ($K)	CNTG ($K)	FULL ($K)
A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*K*	*L*	*M*	*N*	*O*
15	FLOODWAY CONTROL & DIVERSION STR	$4,739	$1,185	25%	$5,924	3.4%	$4,902	$1,225	$6,127			$5,035	$1,259	$6,294
	CONSTRUCTION ESTIMATE TOTALS:	$4,739	$1,185		$5,924	3.4%	$4,902	$1,225	$6,127			$5,035	$1,259	$6,294
01	LANDS AND DAMAGES	$296	$74	25%	$370	3.4%	$306	$77	$383			$309	$77	$386
22	FEASIBILITY STUDY (CAP studies)	$228	$57	25%	$285		$237	$59	$296	$50		$230	$57	$337
30	PLANNING, ENGINEERING & DESIGN	$568	$142	25%	$710	6.9%	$607	$152	$759			$623	$156	$778
31	CONSTRUCTION MANAGEMENT	$355	$89	25%	$444	6.9%	$379	$95	$474			$402	$100	$502
	PROJECT COST TOTALS:	$6,186	$1,547	25%	$7,733		$6,431	$1,608	**$8,039**	$50		$6,599	$1,650	$8,298

Mandatory by Regulation — CHIEF, COST ENGINEERING, James Vermillion

Mandatory by Regulation — PROJECT MANAGER, Nathan Moulder

Mandatory by Regulation — CHIEF, REAL ESTATE, xxx

ESTIMATED FEDERAL COST:	65%	**$5,512**
ESTIMATED NON-FEDERAL COST:	35%	**$2,685**
FEDERAL FEASIBILITY CAP COSTS:	100%	**$100**
ESTIMATED TOTAL PROJECT COST:		**$8,298**

O&M OUTSIDE OF TOTAL PROJECT COST:

**** TOTAL PROJECT COST SUMMARY ****

**** CONTRACT COST SUMMARY ****

PROJECT: Haw Creek Detension Basin
LOCATION: Columbus, IN
This Estimate reflects the scope and schedule in report; Section 205 Fact Sheet

DISTRICT: LRL Louisville
POC: CHIEF, COST ENGINEERING, James Vermillion
PREPARED: 12/13/2012

WBS Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 7-Dec-12 Effective Price Level: 1-Oct-12				Program Year (Budget EC): 2015 Effective Price Level Date: 1 OCT 14								
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	RISK BASED CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	INFLATED (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*P*	*L*	*M*	*N*	*O*
15	FLOODWAY CONTROL & DIVERSION STR	$4,739	$1,185	25%	$5,924	3.4%	$4,902	$1,225	$6,127	2016Q3	2.7%	$5,035	$1,259	$6,294
	CONSTRUCTION ESTIMATE TOTALS:	$4,739	$1,185	25%	**$5,924**		$4,902	$1,225	$6,127			$5,035	$1,259	$6,294
01	LANDS AND DAMAGES	$296	$74	25%	$370	3.4%	$306	$77	$383	2015Q3	0.9%	$309	$77	$386
22	FEASIBILITY STUDY	$228	$57	25%	$285	3.9%	$237	$59	$296	2014Q2	-2.9%	$230	$57	$287
30	PLANNING, ENGINEERING & DESIGN													
2.5%	Project Management	$118	$30	25%	$148	6.9%	$126	$32	$158	2015Q3	1.9%	$129	$32	$161
1.5%	Planning & Environmental Compliance	$71	$18	25%	$89	6.9%	$76	$19	$95	2015Q3	1.9%	$77	$19	$97
5.0%	Engineering & Design	$237	$59	25%	$296	6.9%	$253	$63	$317	2015Q3	1.9%	$258	$65	$323
0.5%	Engineering Tech Review ITR & VE	$24	$6	25%	$30	6.9%	$26	$6	$32	2015Q3	1.9%	$26	$7	$33
0.5%	Contracting & Reprographics	$24	$6	25%	$30	6.9%	$26	$6	$32	2015Q3	1.9%	$26	$7	$33
1.0%	Engineering During Construction	$47	$12	25%	$59	6.9%	$50	$13	$63	2016Q3	5.9%	$53	$13	$66
1.0%	Planning During Construction	$47	$12	25%	$59	6.9%	$50	$13	$63	2016Q3	5.9%	$53	$13	$66
	Project Operations			25%										
31	CONSTRUCTION MANAGEMENT													
7.5%	Construction Management	$355	$89	25%	$444	6.9%	$379	$95	$474	2016Q3	5.9%	$402	$100	$502
	Project Operation:			25%										
	Project Management			25%										
	CONTRACT COST TOTALS:	$6,186	$1,547		**$7,733**		$6,431	$1,608	$8,039			$6,599	$1,650	**$8,248**

Haw Creek Channel Modification

Columbus, IN

P2 353575

Estimated by	U.S. ARMY CORPS OF ENGINEERS CELRL-ED-M-C
Designed by	U.S. ARMY CORPS OF ENGINEERS CELRL-ED-T-H
Prepared by	Justin Tabor
Preparation Date	7/8/2013
Effective Date of Pricing	7/8/2013
Estimated Construction Time	365 Days

Checked By: Mr. Taylor Canfield, CCC

File Path: \\lrl-fs01lou\org\ED\Public\MCACES\ED-M-C\Civil\FY13\353575- Haw Creek Columbus, IN\Channel Modification Analysis\Estimate

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Designed by
U.S. ARMY CORPS OF ENGINEERS CELRL-ED-T-H

Estimated by
U.S. ARMY CORPS OF ENGINEERS CELRL-ED-M-C

Prepared by
Justin Tabor

Design Document	Section 205 Fact Sheet - Supplemental
Document Date	7/1/2013
District	Louisville District
Contact	Justin Tabor
Budget Year	2013
UOM System	Original

Direct Costs
LaborCost
EQCost
MatlCost
SubBidCost

Timeline/Currency

Preparation Date	7/8/2013
Escalation Date	7/8/2013
Eff. Pricing Date	7/8/2013
Estimated Duration	365 Day(s)
Currency	US dollars
Exchange Rate	1.000000

Costbook CB12EB-b: MII English Cost Book 2012-b

Labor NLS2012: National Labor Library - Seattle 2012

Note: http://www.wdol.gov is the website for current Davis Bacon & Service Labor Rates. Fringes paid to the laborers are taxable. In a non-union job the whole fringes are taxa
vaca

Labor Rates
LaborCost1
LaborCost2
LaborCost3
LaborCost4

Equipment EP11R02: MII Equipment 2011 Region 02

02 MIDEAST

Sales Tax	5.90
Working Hours per Year	1,450
Labor Adjustment Factor	1.01
Cost of Money	2.50
Cost of Money Discount	25.00
Tire Recap Cost Factor	1.50
Tire Recap Wear Factor	1.80
Tire Repair Factor	0.15
Equipment Cost Factor	1.00
Standby Depreciation Factor	0.50

Fuel

Electricity	0.096
Gas	3.620
Diesel Off-Road	3.360
Diesel On-Road	3.900

Shipping Rates

Over 0 CWT	9.67
Over 240 CWT	8.90
Over 300 CWT	8.01
Over 400 CWT	7.19
Over 500 CWT	4.67
Over 700 CWT	4.67
Over 800 CWT	7.09

Date	Author	Note
7/8/2013 4:23:55 PM	Tabor	**Estimator's Notes** **Key Assumptions:** **Estimate is based on 3 separate channel modification areas. These areas are identified as Agriculture Extended, Agriculture, and Golf Course.** Means and Methods: - Clearing and Grubbing- All areas include wooded areas along the existing channel. Assume an excavator and tub grinder will be used to chip with hauling included. - Erosion Control- It is assumed a silt fence will be placed at the bottom of the bank on both side of the channel. - Channel Excavation- Bank excavation will be performed by hydraulic excavator(s) with a supporting tracked loader due to potential channel and slope restraints. - Stone Protection- Placement by hydraulic excavator given specs generally does not allow tracked equipment on riprap. Assume rock can be delivered and dump adjacent to placement area. Through discussion with H&H, the present channel is in decent condition in regards to erosion and that erosion protection would likely only be needed around bridge abutments. For this analysis 10% of the back is assumed to get rock protection. - Seeding- Assume disturbed areas will be hydroseeded with a INDNR approved mix along with native tree plantings. Contractor Hierarchy: - Estimator assumes that due to value of estimated construction cost that this will be MATOC procurement. Estimator assumes that Prime will self-perform excavation items and subcontract other items including clearing and grubbing, erosion control, seeding and planting, and. Project Information: - No disposal site(s) have been identified by PDT or local sponsor Schedule: - Estimator has included no overtime and estimate is based on a 5/8s schedule. With weather days, the project should be able to be completed in 12 months on this schedule. Contingency: - Captured in the TPCS. Estimator has applied a 35% contingency to the estimate given the lack of design information at this point. This is considered reasonable for

Date **Author** **Note**

a reconnaissance level estimate. Contingency accounts for typical 25% and a additional 10% for design unknowns. Major risk items include how a

Escalation:

- Captured in the TPCS. Design is assumed to PED will start in FY15 and will be one year in duration. Construction would be scheduled for FY16 and completed in latter FY17.

Real Estate:

- There was no involvement from RE Division in this effort. Real Estate costs are a function of size, number of parcels, legal fees, etc. Estimator used best judgment and referenced some cost from previous projects to use a a placeholder in this analysis. Applied in TPCS.

Planning, Engineering, & Design:

- 12.5%; applied in TPCS. Allow $400k for Feasibility Study.

Supervision & Administration:

- 7.5%; applied in TPCS.

Direct Cost Markups	**Category**	**Method**
Productivity	Productivity	Productivity
Overtime	Overtime	Overtime

	Days/Week	*Hours/Shift*	*Shifts/Day*	*1st Shift*	*2nd Shift*	*3rd Shift*
Standard	*5.00*	*8.00*	*1.00*	*8.00*	*0.00*	*0.00*
Actual	*5.00*	*8.00*	*1.00*	*10.00*	*0.00*	*0.00*

Day	*OT Factor*	*Working*	*OT Percent*	*FCCM Percent*
Monday	*1.50*	*Yes*	*10.00*	*(20.00)*
Tuesday	*1.50*	*Yes*		
Wednesday	*1.50*	*Yes*		
Thursday	*1.50*	*Yes*		
Friday	*1.50*	*Yes*		
Saturday	*1.50*	*No*		
Sunday	*2.00*	*No*		

Sales Tax	TaxAdj	Running % on Selected Costs
MatlCost		

Contractor Markups	**Category**	**Method**
JOOH (Small Tools)	JOOH	% of Labor
JOOH	JOOH	JOOH (Calculated)
SUBJOOH	Allowance	Running %
HOOH	HOOH	Running %
Profit	Profit	Running %
Bond	Bond	Bond Table
Class B, Tiered, 24 months, 1.00% Surcharge		

Contract Price	*Bond Rate*
500,000	*15.84*
2,000,000	*9.57*
2,500,000	*7.59*
2,500,000	*6.93*
7,500,000	*6.34*

Excise Tax	Excise	Running %

Owner Markups	**Category**	**Method**
Escalation	Escalation	Escalation

StartDate	*StartIndex*	*EndDate*	*EndIndex*	*Escalation*

Contingency	Contingency	Running %
SIOH	SIOH	Running %

Description	Quantity	UOM	ContractCost
Project Cost Summary Report			**7,622,194**
09 Channels and Canals	**1.00**	**LS**	**7,622,194**

Description	Quantity	UOM	Contractor	DirectCost	SubCMU	CostToPrime	PrimeCMU	ContractCost
Contract Cost Summary Report				**4,160,938**	**1,265,341**	**5,426,279**	**2,195,915**	**7,622,194**
09 Channels and Canals	**1.00**	**LS**		**4,160,938**	**1,265,341**	**5,426,279**	**2,195,915**	**7,622,194**
0901 Agriculture Extended Area	**10,200.00**	**LF**	**Prime - AG EXT**	**2,056,893**	**625,501**	**2,682,394**	**1,021,702**	**3,704,096**
0901 Agriculture Area	**3,700.00**	**LF**	**Prime - AG**	**883,905**	**268,796**	**1,152,701**	**506,398**	**1,659,099**
0901 Golf Course Area	**2,700.00**	**LF**	**Prime - GC**	**1,220,140**	**371,044**	**1,591,184**	**667,814**	**2,258,998**

Description	Quantity	UOM	Contractor	DirectLabor	DirectEQ	DirectMatl	DirectSubBid	DirectUserCost	DirectCost	C/O
Project Direct Costs Report				**1,449,980**	**1,497,183**	**541,774**	**672,000**	**0**	**4,160,938**	
09 Channels and Canals	**1.00**	**LS**		**1,449,980**	**1,497,183**	**541,774**	**672,000**	**0**	**4,160,938**	
				78.12	*79.72*	*29.60*	*14.22*		*201.66*	
0901 Agriculture Extended Area	**10,200.00**	**LF**	**Prime - AG EXT**	**796,774**	**813,169**	**301,950**	**145,000**	**0**	**2,056,893**	
090101 Channel Modification	**1.00**	**LS**	**Generic Subcontractor**	**796,774**	**813,169**	**301,950**	**145,000**	**0**	**2,056,893**	
09010101 Mobilization and Demobilization	**1.00**	**LS**	**Generic Subcontractor**	**0**	**0**	**0**	**145,000**	**0**	**145,000**	
USR Mob and Demob	1.00	LS	Generic Subcontractor	0	0	0	145,000	0	145,000	
(Note: Allow approximately 4% of contract value. Historically 3-5%.)										
				3,873.82	*7,034.83*	*0.00*	*0.00*		*10,908.64*	
09010102 Clearing and Grubbing	**27.00**	**ACR**	**Generic Subcontractor**	**104,593**	**189,940**	**0**	**0**	**0**	**294,533**	
				3,873.82	*7,034.83*	*0.00*	*0.00*		*10,908.64*	
RSM 311110100260 Clearing & grubbing, dense brush, including stumps, clear and grub	27.00	ACR	Generic Subcontractor	104,593	189,940	0	0	0	294,533	
				3.51	*0.74*	*2.06*	*0.00*		*6.30*	
09010103 Erosion Control	**10,200.00**	**LF**	**Generic Subcontractor**	**35,780**	**7,506**	**21,019**	**0**	**0**	**64,305**	
				1.62	*0.28*	*0.79*	*0.00*		*2.69*	
RSM 312513101120 Erosion control, silt fence, polypropylene, 3' high, includes 7.5' posts	20,400.00	LF	Generic Subcontractor	32,959	5,731	16,116	0	0	54,806	
				2,821.49	*1,774.38*	*4,902.50*	*0.00*		*9,498.37*	
Temporary Construction Entrance (Note: Assume 800 ft x 10 ft = 800)	**1.00**	**EA**	**Generic Subcontractor**	**2,821**	**1,774**	**4,903**	**0**	**0**	**9,498**	
				4.00	*5.10*	*14.80*	*0.00*		*23.90*	
RSM 312323170020 Fill, dumped material, spread, by dozer, excludes compaction	220.00	TON	Generic Subcontractor	881	1,121	3,256	0	0	5,258	
				0.25	*0.00*	*1.85*	*0.00*		*2.10*	
RSM 313219161500 Geotextile soil stabilization, geotextile fabric, woven, 200 lb. tensile strength	890.00	SY	Generic Subcontractor	225	0	1,647	0	0	1,872	
				11.46	*4.36*	*0.00*	*0.00*		*15.83*	
RSM 024119233080 Selective demolition, rubbish handling, loading & trucking, machine loading truck, includes 2 mile haul, cost to be added to demolition cost. (Note: Removal at end of job)	149.66	CY	Generic Subcontractor	1,715	653	0	0	0	2,368	
				6.69	*6.98*	*0.00*	*0.00*		*13.67*	

Description	Quantity	UOM	Contractor	DirectLabor	DirectEQ	DirectMatl	DirectSubBid	DirectUserCost	DirectCost	C/O
09010104 Channel Excavation & Disposal (Note: Quantity based on H&H RAS model.)	**84,300.00**	**BCY**	**Generic Subcontractor**	**563,888**	**588,409**	**0**	**0**	**0**	**1,152,298**	
				5.74	*5.58*	*0.00*	*0.00*		*11.32*	
USR Excavation, channel bank, includes hauling to disposal site (Note: Quantity based on H&H RAS model.)	84,300.00	BCY	Generic Subcontractor	483,498	470,422	0	0	0	953,920	
				9.70	*16.02*	*0.00*	*0.00*		*25.71*	
HNC 312213103010 Grading w/ dozer; channel bank (Note: Assume an average bank height of 10 ft @ 1V:3H slope plus 50 ft both sides of channel.)	1,850.08	CSY	Generic Subcontractor	17,940	29,633	0	0	0	47,573	
				0.45	*0.75*	*0.00*	*0.00*		*1.20*	
RSM 312323144210 Backfill, structural, sandy clay & loam, 200 H.P. dozer, 150' haul, from existing stockpile, excludes compaction (Note: Disposal embankment)	105,375.00	LCY	Generic Subcontractor	47,685	78,764	0	0	0	126,449	
				0.42	*0.28*	*0.00*	*0.00*		*0.70*	
RSM 312216101020 Fine grading, loam or topsoil fine grade for large area, 15,000 S.Y. or more (Note: Disposal area. Assume 3 ft depth of material.)	34,773.75	SY	Generic Subcontractor	14,765	9,590	0	0	0	24,355	
				2.92	*1.38*	*28.76*	*0.00*		*33.06*	
09010105 Stone Protection	**4,800.00**	**CY**	**Generic Subcontractor**	**14,029**	**6,644**	**138,036**	**0**	**0**	**158,709**	
				2.92	*1.38*	*21.76*	*0.00*		*26.07*	
USR Bedding Stone, excavator placed	1,200.00	CY	Generic Subcontractor	3,507	1,661	26,112	0	0	31,280	
				2.92	*1.38*	*31.09*	*0.00*		*35.40*	
USR Rip Rap, excavator placed	3,600.00	CY	Generic Subcontractor	10,522	4,983	111,924	0	0	127,429	
				7,134.80	*1,879.06*	*12,990.50*	*0.00*		*22,004.36*	
09010106 Seeding and Plantings	**11.00**	**ACR**	**Generic Subcontractor**	**78,483**	**20,670**	**142,896**	**0**	**0**	**242,048**	
				30.55	*5.00*	*0.00*	*0.00*		*35.54*	
RSM 329113230100 Soil preparation, structural soil mixing, rake topsoil, site materials, ideal conditions, harley rock rake	479.16	MSF	Generic Subcontractor	14,637	2,393	0	0	0	17,030	
				0.12	*0.13*	*0.40*	*0.00*		*0.65*	
RSM 329219131000 Seeding, mechanical seeding hydro or air seeding for large areas, includes lime, fertilizer and seed (Note: .)	53,240.00	SY	Generic Subcontractor	6,412	6,858	21,296	0	0	34,566	

Description	Quantity	UOM	Contractor	DirectLabor	DirectEQ	DirectMatl	DirectSubBid	DirectUserCost	DirectCost	C/O
				9.90	*0.00*	*11.00*	*0.00*		*20.90*	
RSM 329343100300 Planting, trees, shrubs and ground cover, light soil, container, 1 gallon, includes planting only	440.00	EA	Generic Subcontractor	4,354	0	4,840	0	0	9,194	
(Note: Assume 15 minutes per tree by hand after consulting with landscaping/nursery firm. Material pricing based on average cost of container trees from Woody Warehouse on Feather Creek from INDNR plan. Assume 25 per acre plus 15 replaced so 40 EA total.)										
				30.16	*0.00*	*18.95*	*0.00*		*49.11*	
RSM 329450100200 Tree guying, guy wire and wrap, 3" to 4" caliper, includes 3 stakes	440.00	EA	Generic Subcontractor	13,269	0	8,338	0	0	21,607	
				4.32	*3.94*	*0.00*	*0.00*		*8.26*	
RSM 320190267550 Watering, water trees or shrubs, 1" - 3" caliper (Note: Assume 2 times)	880.00	EA	Generic Subcontractor	3,797	3,469	0	0	0	7,267	
				3.96	*3.62*	*0.00*	*0.00*		*7.58*	
RSM 320190264900 Watering, water lawn or planting bed, 1" of water, with hose (Note: Assume 2 times)	958.32	MSF	Generic Subcontractor	3,797	3,469	0	0	0	7,267	
				0.39	*0.00*	*1.32*	*0.00*		*1.71*	
RSM 312514160200 Synthetic erosion control, polypropylene mesh, stapled, 6.5 oz./ S.Y.	71,600.00	SY	Generic Subcontractor	28,028	0	94,512	0	0	122,540	
				0.12	*0.13*	*0.40*	*0.00*		*0.65*	
RSM 329219131000 Seeding, mechanical seeding hydro or air seeding for large areas, includes lime, fertilizer and seed (Note: Disposal Area)	34,773.75	SY	Generic Subcontractor	4,188	4,479	13,910	0	0	22,577	
				89.91	*94.32*	*37.37*	*17.30*		*238.89*	
0901 Agriculture Area	**3,700.00**	**LF**	**Prime - AG**	**332,650**	**348,993**	**138,262**	**64,000**	**0**	**883,905**	
090101 Channel Modification	**1.00**	**LS**	**Generic Subcontractor**	**332,650**	**348,993**	**138,262**	**64,000**	**0**	**883,905**	
09010101 Mobilization and Demobilization	**1.00**	**LS**	**Generic Subcontractor**	**0**	**0**	**0**	**64,000**	**0**	**64,000**	
USR Mob and Demob	1.00	LS	Generic Subcontractor	0	0	0	64,000	0	64,000	
(Note: Allow approximately 4% of contract value. Historically 3-5%.)										
				3,873.82	*7,034.83*	*0.00*	*0.00*		*10,908.64*	
09010102 Clearing and Grubbing	**19.00**	**ACR**	**Generic Subcontractor**	**73,603**	**133,662**	**0**	**0**	**0**	**207,264**	
				3,873.82	*7,034.83*	*0.00*	*0.00*		*10,908.64*	
RSM 311110100260 Clearing & grubbing, dense brush, including stumps, clear and grub	19.00	ACR	Generic Subcontractor	73,603	133,662	0	0	0	207,264	
				3.99	*1.04*	*2.91*	*0.00*		*7.94*	
09010103 Erosion Control	**3,700.00**	**LF**	**Generic**	**14,777**	**3,853**	**10,749**	**0**	**0**	**29,379**	

Description	Quantity	UOM	Contractor Subcontractor	DirectLabor	DirectEQ	DirectMatl	DirectSubBid	DirectUserCost	DirectCost	C/O
				1.62	*0.28*	*0.79*	*0.00*		*2.69*	
RSM 312513101120 Erosion control, silt fence, polypropylene, 3' high, includes 7.5' posts	7,400.00	LF	Generic Subcontractor	11,956	2,079	5,846	0	0	19,881	
				2,821.49	*1,774.38*	*4,902.50*	*0.00*		*9,498.37*	
Temporary Construction Entrance (Note: Assume 800 ft x 10 ft = 800)	**1.00**	**EA**	**Generic Subcontractor**	**2,821**	**1,774**	**4,903**	**0**	**0**	**9,498**	
				4.00	*5.10*	*14.80*	*0.00*		*23.90*	
RSM 312323170020 Fill, dumped material, spread, by dozer, excludes compaction	220.00	TON	Generic Subcontractor	881	1,121	3,256	0	0	5,258	
				0.25	*0.00*	*1.85*	*0.00*		*2.10*	
RSM 313219161500 Geotextile soil stabilization, geotextile fabric, woven, 200 lb. tensile strength	890.00	SY	Generic Subcontractor	225	0	1,647	0	0	1,872	
				11.46	*4.36*	*0.00*	*0.00*		*15.83*	
RSM 024119233080 Selective demolition, rubbish handling, loading & trucking, machine loading truck, includes 2 mile haul, cost to be added to demolition cost. (Note: Removal at end of job)	149.66	CY	Generic Subcontractor	1,715	653	0	0	0	2,368	
				7.22	*7.86*	*0.00*	*0.00*		*15.09*	
09010104 Channel Excavation & Disposal (Note: Quantity based on H&H RAS model.)	**24,000.00**	**BCY**	**Generic Subcontractor**	**173,370**	**188,715**	**0**	**0**	**0**	**362,085**	
				5.74	*5.58*	*0.00*	*0.00*		*11.32*	
USR Excavation, channel bank, includes hauling to disposal site (Note: Quantity based on H&H RAS model.)	24,000.00	BCY	Generic Subcontractor	137,651	133,928	0	0	0	271,579	
				9.70	*16.02*	*0.00*	*0.00*		*25.71*	
HNC 312213103010 Grading w/ dozer; channel bank (Note: Assume an average bank height of 10 ft @ 1V:3H slope plus 50 ft both sides of channel.)	1,850.08	CSY	Generic Subcontractor	17,940	29,633	0	0	0	47,573	
				0.45	*0.75*	*0.00*	*0.00*		*1.20*	
RSM 312323144210 Backfill, structural, sandy clay & loam, 200 H.P. dozer, 150' haul, from existing stockpile, excludes compaction (Note: Disposal embankment)	30,000.00	LCY	Generic Subcontractor	13,576	22,424	0	0	0	36,000	
				0.42	*0.28*	*0.00*	*0.00*		*0.70*	
RSM 312216101020 Fine grading, loam or topsoil fine grade for large area, 15,000 S.Y. or more (Note: Disposal area. Assume 3 ft depth of material.)	9,900.00	SY	Generic Subcontractor	4,204	2,730	0	0	0	6,934	

Description	Quantity	UOM	Contractor	DirectLabor	DirectEQ	DirectMatl	DirectSubBid	DirectUserCost	DirectCost	C/O
				2.92	*1.38*	*28.76*	*0.00*		*33.06*	
09010105 Stone Protection	**1,700.00**	**CY**	**Generic Subcontractor**	**4,969**	**2,353**	**48,888**	**0**	**0**	**56,210**	
				2.92	*1.38*	*21.76*	*0.00*		*26.07*	
USR Bedding Stone, excavator placed	425.00	CY	Generic Subcontractor	1,242	588	9,248	0	0	11,078	
				2.92	*1.38*	*31.09*	*0.00*		*35.40*	
USR Rip Rap, excavator placed	1,275.00	CY	Generic Subcontractor	3,727	1,765	39,640	0	0	45,131	
				5,071.68	*1,569.94*	*6,048.15*	*0.00*		*12,689.78*	
09010106 Seeding and Plantings	**13.00**	**ACR**	**Generic Subcontractor**	**65,932**	**20,409**	**78,626**	**0**	**0**	**164,967**	
				30.55	*5.00*	*0.00*	*0.00*		*35.54*	
RSM 329113230100 Soil preparation, structural soil mixing, rake topsoil, site materials, ideal conditions, harley rock rake	566.28	MSF	Generic Subcontractor	17,298	2,829	0	0	0	20,126	
				0.12	*0.13*	*0.40*	*0.00*		*0.65*	
RSM 329219131000 Seeding, mechanical seeding hydro or air seeding for large areas, includes lime, fertilizer and seed (Note: .)	62,920.00	SY	Generic Subcontractor	7,578	8,105	25,168	0	0	40,851	
				9.90	*0.00*	*11.00*	*0.00*		*20.90*	
RSM 329343100300 Planting, trees, shrubs and ground cover, light soil, container, 1 gallon, includes planting only	520.00	EA	Generic Subcontractor	5,146	0	5,720	0	0	10,866	
(Note: Assume 15 minutes per tree by hand after consulting with landscaping/nursery firm. Material pricing based on average cost of container trees from Woody Warehouse on Feather Creek from INDNR plan. Assume 25 per acre plus 15 replaced so 40 EA total.)										
				30.16	*0.00*	*18.95*	*0.00*		*49.11*	
RSM 329450100200 Tree guying, guy wire and wrap, 3" to 4" caliper, includes 3 stakes	520.00	EA	Generic Subcontractor	15,682	0	9,854	0	0	25,536	
				4.32	*3.94*	*0.00*	*0.00*		*8.26*	
RSM 320190267550 Watering, water trees or shrubs, 1" - 3" caliper (Note: Assume 2 times)	1,040.00	EA	Generic Subcontractor	4,488	4,100	0	0	0	8,588	
				3.96	*3.62*	*0.00*	*0.00*		*7.58*	
RSM 320190264900 Watering, water lawn or planting bed, 1" of water, with hose (Note: Assume 2 times)	1,132.56	MSF	Generic Subcontractor	4,488	4,100	0	0	0	8,588	
				0.39	*0.00*	*1.32*	*0.00*		*1.71*	
RSM 312514160200 Synthetic erosion control, polypropylene mesh, stapled, 6.5 oz./ S.Y.	25,700.00	SY	Generic Subcontractor	10,060	0	33,924	0	0	43,984	
				0.12	*0.13*	*0.40*	*0.00*		*0.65*	

Description	Quantity	UOM	Contractor	DirectLabor	DirectEQ	DirectMatl	DirectSubBid	DirectUserCost	DirectCost	C/O
RSM 329219131000 Seeding, mechanical seeding hydro or air seeding for large areas, includes lime, fertilizer and seed (Note: Disposal Area)	9,900.00	SY	Generic Subcontractor	1,192	1,275	3,960	0	0	6,428	
				118.72	*124.08*	*37.62*	*171.48*		*451.90*	
0901 Golf Course Area	**2,700.00**	**LF**	**Prime - GC**	**320,556**	**335,022**	**101,562**	**463,000**	**0**	**1,220,140**	
090101 Channel Modfication	**1.00**	**LS**	**Generic Subcontractor**	**320,556**	**335,022**	**101,562**	**463,000**	**0**	**1,220,140**	
09010101 Mobilization and Demobilization	**1.00**	**LS**	**Generic Subcontractor**	**0**	**0**	**0**	**88,000**	**0**	**88,000**	
USR Mob and Demob (Note: Allow approximately 4% of contract value. Historically 3-5%.)	1.00	LS	Generic Subcontractor	0	0	0	88,000	0	88,000	
				3,873.82	*7,034.83*	*0.00*	*0.00*		*10,908.64*	
09010102 Clearing and Grubbing	**11.00**	**ACR**	**Generic Subcontractor**	**42,612**	**77,383**	**0**	**0**	**0**	**119,995**	
				3,873.82	*7,034.83*	*0.00*	*0.00*		*10,908.64*	
RSM 311110100260 Clearing & grubbing, dense brush, including stumps, clear and grub	11.00	ACR	Generic Subcontractor	42,612	77,383	0	0	0	119,995	
				4.28	*1.22*	*3.40*	*0.00*		*8.89*	
09010103 Erosion Control	**2,700.00**	**LF**	**Generic Subcontractor**	**11,546**	**3,292**	**9,169**	**0**	**0**	**24,006**	
				1.62	*0.28*	*0.79*	*0.00*		*2.69*	
RSM 312513101120 Erosion control, silt fence, polypropylene, 3' high, includes 7.5' posts	5,400.00	LF	Generic Subcontractor	8,724	1,517	4,266	0	0	14,508	
				2,821.49	*1,774.38*	*4,902.50*	*0.00*		*9,498.37*	
Temporary Construction Entrance (Note: Assume 800 ft x 10 ft = 800)	**1.00**	**EA**	**Generic Subcontractor**	**2,821**	**1,774**	**4,903**	**0**	**0**	**9,498**	
				4.00	*5.10*	*14.80*	*0.00*		*23.90*	
RSM 312323170020 Fill, dumped material, spread, by dozer, excludes compaction	220.00	TON	Generic Subcontractor	881	1,121	3,256	0	0	5,258	
				0.25	*0.00*	*1.85*	*0.00*		*2.10*	
RSM 313219161500 Geotextile soil stabilization, geotextile fabric, woven, 200 lb. tensile strength	890.00	SY	Generic Subcontractor	225	0	1,647	0	0	1,872	
				11.46	*4.36*	*0.00*	*0.00*		*15.83*	
RSM 024119233080 Selective demolition, rubbish handling, loading & trucking, machine loading truck, includes 2 mile haul, cost to be added to demolition cost. (Note: Removal at end of job)	149.66	CY	Generic Subcontractor	1,715	653	0	0	0	2,368	
				7.04	*7.56*	*0.00*	*0.00*		*14.60*	

Description	Quantity	UOM	Contractor	DirectLabor	DirectEQ	DirectMatl	DirectSubBid	DirectUserCost	DirectCost	C/O
09010104 Channel Excavation & Disposal (Note: Quantity based on H&H RAS model.)	**31,800.00**	**BCY**	**Generic Subcontractor**	**223,885**	**240,417**	**0**	**0**	**0**	**464,302**	
				5.74	*5.58*	*0.00*	*0.00*		*11.32*	
USR Excavation, channel bank, includes hauling to disposal site (Note: Quantity based on H&H RAS model.)	31,800.00	BCY	Generic Subcontractor	182,387	177,455	0	0	0	359,842	
				9.70	*16.02*	*0.00*	*0.00*		*25.71*	
HNC 312213103010 Grading w/ dozer; channel bank (Note: Assume an average bank height of 10 ft @ 1V:3H slope plus 50 ft both sides of channel.)	1,850.08	CSY	Generic Subcontractor	17,940	29,633	0	0	0	47,573	
				0.45	*0.75*	*0.00*	*0.00*		*1.20*	
RSM 312323144210 Backfill, structural, sandy clay & loam, 200 H.P. dozer, 150' haul, from existing stockpile, excludes compaction (Note: Disposal embankment)	39,750.00	LCY	Generic Subcontractor	17,988	29,712	0	0	0	47,700	
				0.42	*0.28*	*0.00*	*0.00*		*0.70*	
RSM 312216101020 Fine grading, loam or topsoil fine grade for large area, 15,000 S.Y. or more (Note: Assume 3 ft depth of material.)	13,117.50	SY	Generic Subcontractor	5,570	3,618	0	0	0	9,187	
				2.92	*1.38*	*28.76*	*0.00*		*33.06*	
09010105 Stone Protection	**1,400.00**	**CY**	**Generic Subcontractor**	**4,092**	**1,938**	**40,261**	**0**	**0**	**46,290**	
				2.92	*1.38*	*21.76*	*0.00*		*26.07*	
USR Bedding Stone, excavator placed	350.00	CY	Generic Subcontractor	1,023	484	7,616	0	0	9,123	
				2.92	*1.38*	*31.09*	*0.00*		*35.40*	
USR Rip Rap, excavator placed	1,050.00	CY	Generic Subcontractor	3,069	1,453	32,645	0	0	37,167	
				5,488.70	*1,713.23*	*7,447.57*	*0.00*		*14,649.50*	
09010106 Seeding and Plantings	**7.00**	**ACR**	**Generic Subcontractor**	**38,421**	**11,993**	**52,133**	**0**	**0**	**102,547**	
				30.55	*5.00*	*0.00*	*0.00*		*35.54*	
RSM 329113230100 Soil preparation, structural soil mixing, rake topsoil, site materials, ideal conditions, harley rock rake	304.92	MSF	Generic Subcontractor	9,314	1,523	0	0	0	10,837	
				0.12	*0.13*	*0.40*	*0.00*		*0.65*	
RSM 329219131000 Seeding, mechanical seeding hydro or air seeding for large areas, includes lime, fertilizer and seed (Note: .)	33,880.00	SY	Generic Subcontractor	4,080	4,364	13,552	0	0	21,997	

Description	Quantity	UOM	Contractor	DirectLabor	DirectEQ	DirectMatl	DirectSubBid	DirectUserCost	DirectCost	C/O
				9.90	*0.00*	*11.00*	*0.00*		*20.90*	
RSM 329343100300 Planting, trees, shrubs and ground cover, light soil, container, 1 gallon, includes planting only	280.00	EA	Generic Subcontractor	2,771	0	3,080	0	0	5,851	
(Note: Assume 15 minutes per tree by hand after consulting with landscaping/nursery firm. Material pricing based on average cost of container trees from Woody Warehouse on Feather Creek from INDNR plan. Assume 25 per acre plus 15 replaced so 40 EA total.)										
				30.16	*0.00*	*18.95*	*0.00*		*49.11*	
RSM 329450100200 Tree guying, guy wire and wrap, 3" to 4" caliper, includes 3 stakes	280.00	EA	Generic Subcontractor	8,444	0	5,306	0	0	13,750	
				4.32	*3.94*	*0.00*	*0.00*		*8.26*	
RSM 320190267550 Watering, water trees or shrubs, 1" - 3" caliper (Note: Assume 2 times)	560.00	EA	Generic Subcontractor	2,417	2,208	0	0	0	4,624	
				3.96	*3.62*	*0.00*	*0.00*		*7.58*	
RSM 320190264900 Watering, water lawn or planting bed, 1" of water, with hose (Note: Assume 2 times)	609.84	MSF	Generic Subcontractor	2,417	2,208	0	0	0	4,624	
				0.39	*0.00*	*1.32*	*0.00*		*1.71*	
RSM 312514160200 Synthetic erosion control, polypropylene mesh, stapled, 6.5 oz./ S.Y.	18,900.00	SY	Generic Subcontractor	7,398	0	24,948	0	0	32,346	
				0.12	*0.13*	*0.40*	*0.00*		*0.65*	
RSM 329219131000 Seeding, mechanical seeding hydro or air seeding for large areas, includes lime, fertilizer and seed (Note: Disposal Area)	13,117.50	SY	Generic Subcontractor	1,580	1,690	5,247	0	0	8,517	
09010107 Misc	**1.00**	**LS**	**Generic Subcontractor**	**0**	**0**	**0**	**375,000**	**0**	**375,000**	
				0.00	*0.00*	*0.00*	*125,000.00*		*125,000.00*	
USR Repair Golf Course per hole	3.00	9HL	Generic Subcontractor	0	0	0	375,000	0	375,000	
(Note: Average cost to build a hole per average 18 hole course is $123,000. Source: Golf Course Builders Association of America, ASGCA, and DGA. http://www.tmgolfdesign.com/cost.pdf)										

**** TOTAL PROJECT COST SUMMARY ****

PROJECT: **Haw Creek Channel Modification - Agriculture Extended Area**
LOCATION: Columbus, IN

DISTRICT: LRL Louisville
POC: CHIEF, COST ENGINEERING, James Vermillion
PREPARED: 7/10/2013

This Estimate reflects the scope and schedule in report; Section 205 Fact Sheet - Supplemental

WBS Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
						Program Year (Budget EC): 2015 Effective Price Level Date: 1 OCT 14								
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	**TOTAL ($K)**	Spent Thru: 1-Oct-12 ($K)		COST ($K)	CNTG ($K)	FULL ($K)
A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*K*	*L*	*M*	*N*	*O*
09	CHANNELS & CANALS	$3,704	$1,296	35%	$5,000	3.4%	$3,831	$1,341	$5,172			$3,936	$1,377	$5,313
	CONSTRUCTION ESTIMATE TOTALS:	$3,704	$1,296		$5,000	3.4%	$3,831	$1,341	$5,172			$3,936	$1,377	$5,313
01	LANDS AND DAMAGES	$264	$66	25%	$330	3.4%	$273	$68	$341			$276	$69	$344
22	FEASIBILITY STUDY (CAP studies)	$400	$100	25%	$500		$416	$104	$519			$403	$101	$504
30	PLANNING, ENGINEERING & DESIGN	$464	$162	35%	$626	6.9%	$496	$174	$669	$50		$509	$178	$687
31	CONSTRUCTION MANAGEMENT	$278	$97	35%	$375	6.9%	$297	$104	$401			$315	$110	$425
	PROJECT COST TOTALS:	$5,110	$1,722	34%	$6,832		$5,313	$1,791	**$7,104**	$50		$5,438	$1,835	$7,323

Mandatory by Regulation — CHIEF, COST ENGINEERING, James Vermillion

Mandatory by Regulation — PROJECT MANAGER, Nathan Moulder

Mandatory by Regulation — CHIEF, REAL ESTATE

ESTIMATED FEDERAL COST:	65%	**$4,400**
ESTIMATED NON-FEDERAL COST:	35%	**$2,369**
FEDERAL FEASIBILITY CAP COSTS:		**$327**
NON-FEDERAL FEASIBILITY CAP COSTS:		**$227**
ESTIMATED TOTAL PROJECT COST:		**$7,323**

O&M OUTSIDE OF TOTAL PROJECT COST:

**** TOTAL PROJECT COST SUMMARY ****

**** CONTRACT COST SUMMARY ****

PROJECT: Haw Creek Channel Modification - Agriculture Extended Area
LOCATION: Columbus, IN
This Estimate reflects the scope and schedule in report; Section 205 Fact Sheet - Supplemental

DISTRICT:
POC:
LRL Louisville
CHIEF, COST ENGINEERING, James Vermillion
PREPARED: 7/10/2013

WBS Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 9-Jul-13 Effective Price Level: 1-Oct-12				Program Year (Budget EC): 2015 Effective Price Level Date: 1 OCT 14								
				RISK BASED										
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	INFLATED (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*P*	*L*	*M*	*N*	*O*
09	CHANNELS & CANALS	$3,704	$1,296	35%	$5,000	3.4%	$3,831	$1,341	$5,172	2016Q3	2.7%	$3,936	$1,377	$5,313
	CONSTRUCTION ESTIMATE TOTALS:	$3,704	$1,296	35%	**$5,000**		$3,831	$1,341	$5,172			$3,936	$1,377	$5,313
01	LANDS AND DAMAGES	$264	$66	25%	$330	3.4%	$273	$68	$341	2015Q3	0.9%	$276	$69	$344
22	FEASIBILITY STUDY	$400	$100	25%	$500	3.9%	$416	$104	$519	2014Q2	-2.9%	$403	$101	$504
30	PLANNING, ENGINEERING & DESIGN													
2.5%	Project Management	$93	$33	35%	$126	6.9%	$99	$35	$134	2015Q3	1.9%	$101	$35	$137
2.0%	Planning & Environmental Compliance	$74	$26	35%	$100	6.9%	$79	$28	$107	2015Q3	1.9%	$81	$28	$109
5.0%	Engineering & Design	$185	$65	35%	$250	6.9%	$198	$69	$267	2015Q3	1.9%	$202	$71	$272
0.5%	Engineering Tech Review ITR & VE	$19	$7	35%	$26	6.9%	$20	$7	$27	2015Q3	1.9%	$21	$7	$28
0.5%	Contracting & Reprographics	$19	$7	35%	$26	6.9%	$20	$7	$27	2015Q3	1.9%	$21	$7	$28
1.0%	Engineering During Construction	$37	$13	35%	$50	6.9%	$40	$14	$53	2016Q3	5.9%	$42	$15	$57
1.0%	Planning During Construction	$37	$13	35%	$50	6.9%	$40	$14	$53	2016Q3	5.9%	$42	$15	$57
	Project Operations			35%										
31	CONSTRUCTION MANAGEMENT													
7.5%	Construction Management	$278	$97	35%	$375	6.9%	$297	$104	$401	2016Q3	5.9%	$315	$110	$425
	Project Operation:			35%										
	Project Management			35%										
	CONTRACT COST TOTALS:	$5,110	$1,722		**$6,832**		$5,313	$1,791	$7,104			$5,438	$1,835	**$7,273**

**** TOTAL PROJECT COST SUMMARY ****

PROJECT: **Haw Creek Channel Modification - Agriculture Area**
LOCATION: Columbus, IN

DISTRICT: LRL Louisville
POC: CHIEF, COST ENGINEERING, James Vermillion
PREPARED: 7/10/2013

This Estimate reflects the scope and schedule in report; Section 205 Fact Sheet - Supplemental

WBS Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
						Program Year (Budget EC): 2015 Effective Price Level Date: 1 OCT 14								
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	**TOTAL ($K)**	Spent Thru: 1-Oct-12 ($K)		COST ($K)	CNTG ($K)	FULL ($K)
A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*K*	*L*	*M*	*N*	*O*
09	CHANNELS & CANALS	$1,659	$581	35%	$2,240	3.4%	$1,716	$601	$2,317			$1,763	$617	$2,380
	CONSTRUCTION ESTIMATE TOTALS:	$1,659	$581		$2,240	3.4%	$1,716	$601	$2,317			$1,763	$617	$2,380
01	LANDS AND DAMAGES	$232	$58	25%	$290	3.4%	$240	$60	$300			$242	$61	$303
22	FEASIBILITY STUDY (CAP studies)	$400	$100	25%	$500		$416	$104	$519	$50		$403	$101	$554
30	PLANNING, ENGINEERING & DESIGN	$207	$72	35%	$279	6.9%	$221	$77	$299			$227	$79	$306
31	CONSTRUCTION MANAGEMENT	$124	$43	35%	$167	6.9%	$133	$46	$179			$140	$49	$189
	PROJECT COST TOTALS:	$2,622	$855	33%	$3,477		$2,725	$888	**$3,614**	$50		$2,776	$907	$3,732

Mandatory by Regulation — CHIEF, COST ENGINEERING, James Vermillion

Mandatory by Regulation — PROJECT MANAGER, Nathan Moulder

Mandatory by Regulation — CHIEF, REAL ESTATE

ESTIMATED FEDERAL COST:	65%	**$2,033**
ESTIMATED NON-FEDERAL COST:	35%	**$1,095**
FEDERAL FEASIBILITY CAP COSTS:		**$352**
NON-FEDERAL FEASIBILITY CAP COSTS:		**$252**
ESTIMATED TOTAL PROJECT COST:		**$3,732**

O&M OUTSIDE OF TOTAL PROJECT COST:

**** TOTAL PROJECT COST SUMMARY ****

**** CONTRACT COST SUMMARY ****

PROJECT: Haw Creek Channel Modification - Agriculture Area
LOCATION: Columbus, IN
This Estimate reflects the scope and schedule in report; Section 205 Fact Sheet - Supplemental

DISTRICT: LRL Louisville
POC: CHIEF, COST ENGINEERING, James Vermillion
PREPARED: 7/10/2013

WBS Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 9-Jul-13 Effective Price Level: 1-Oct-12				Program Year (Budget EC): 2015 Effective Price Level Date: 1 OCT 14								
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	RISK BASED CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	INFLATED (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*P*	*L*	*M*	*N*	*O*
09	CHANNELS & CANALS	$1,659	$581	35%	$2,240	3.4%	$1,716	$601	$2,317	2016Q3	2.7%	$1,763	$617	$2,380
	CONSTRUCTION ESTIMATE TOTALS:	$1,659	$581	35%	**$2,240**		$1,716	$601	$2,317			$1,763	$617	$2,380
01	LANDS AND DAMAGES	$232	$58	25%	$290	3.4%	$240	$60	$300	2015Q3	0.9%	$242	$61	$303
22	FEASIBILITY STUDY	$400	$100	25%	$500	3.9%	$416	$104	$519	2014Q2	-2.9%	$403	$101	$504
30	PLANNING, ENGINEERING & DESIGN													
2.5%	Project Management	$41	$14	35%	$55	6.9%	$44	$15	$59	2015Q3	1.9%	$45	$16	$60
2.0%	Planning & Environmental Compliance	$33	$12	35%	$45	6.9%	$35	$12	$48	2015Q3	1.9%	$36	$13	$49
5.0%	Engineering & Design	$83	$29	35%	$112	6.9%	$89	$31	$120	2015Q3	1.9%	$90	$32	$122
0.5%	Engineering Tech Review ITR & VE	$8	$3	35%	$11	6.9%	$9	$3	$12	2015Q3	1.9%	$9	$3	$12
0.5%	Contracting & Reprographics	$8	$3	35%	$11	6.9%	$9	$3	$12	2015Q3	1.9%	$9	$3	$12
1.0%	Engineering During Construction	$17	$6	35%	$23	6.9%	$18	$6	$25	2016Q3	5.9%	$19	$7	$26
1.0%	Planning During Construction	$17	$6	35%	$23	6.9%	$18	$6	$25	2016Q3	5.9%	$19	$7	$26
	Project Operations			35%										
31	CONSTRUCTION MANAGEMENT													
7.5%	Construction Management	$124	$43	35%	$167	6.9%	$133	$46	$179	2016Q3	5.9%	$140	$49	$189
	Project Operation:			35%										
	Project Management			35%										
	CONTRACT COST TOTALS:	$2,622	$855		**$3,477**		$2,725	$888	$3,614			$2,776	$907	**$3,682**

**** TOTAL PROJECT COST SUMMARY ****

PROJECT: **Haw Creek Channel Modification - Golf Course Area**
LOCATION: Columbus, IN

DISTRICT: LRL Louisville
POC: CHIEF, COST ENGINEERING, James Vermillion
PREPARED: 7/10/2013

This Estimate reflects the scope and schedule in report; Section 205 Fact Sheet - Supplemental

WBS Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
						Program Year (Budget EC): 2015 Effective Price Level Date: 1 OCT 14								
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	**TOTAL ($K)**	Spent Thru: 1-Oct-12 ($K)		COST ($K)	CNTG ($K)	FULL ($K)
A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*K*	*L*	*M*	*N*	*O*
09	CHANNELS & CANALS	$2,259	$791	35%	$3,050	3.4%	$2,337	$818	$3,154			$2,400	$840	$3,240
	CONSTRUCTION ESTIMATE TOTALS:	$2,259	$791		$3,050	3.4%	$2,337	$818	$3,154			$2,400	$840	$3,240
01	LANDS AND DAMAGES	$232	$58	25%	$290	3.4%	$240	$60	$300			$242	$61	$303
22	FEASIBILITY STUDY (CAP studies)	$400	$100	25%	$500		$416	$104	$519	$50		$403	$101	$554
30	PLANNING, ENGINEERING & DESIGN	$282	$99	35%	$381	6.9%	$301	$105	$407			$309	$108	$417
31	CONSTRUCTION MANAGEMENT	$169	$59	35%	$228	6.9%	$181	$63	$244			$191	$67	$258
	PROJECT COST TOTALS:	$3,342	$1,107	33%	$4,449		$3,474	$1,150	**$4,625**	$50		$3,546	$1,177	$4,773

Mandatory by Regulation — CHIEF, COST ENGINEERING, James Vermillion

Mandatory by Regulation — PROJECT MANAGER, Nathan Moulder

Mandatory by Regulation — CHIEF, REAL ESTATE

ESTIMATED FEDERAL COST:	65%	**$2,710**
ESTIMATED NON-FEDERAL COST:	35%	**$1,459**
FEDERAL FEASIBILITY CAP COSTS:		**$352**
NON-FEDERAL FEASIBILITY CAP COSTS:		**$252**
ESTIMATED TOTAL PROJECT COST:		**$4,773**

O&M OUTSIDE OF TOTAL PROJECT COST:

**** TOTAL PROJECT COST SUMMARY ****

**** CONTRACT COST SUMMARY ****

PROJECT: Haw Creek Channel Modification - Golf Course Area
LOCATION: Columbus, IN
This Estimate reflects the scope and schedule in report; Section 205 Fact Sheet - Supplemental

DISTRICT: LRL Louisville
POC: CHIEF, COST ENGINEERING, James Vermillion
PREPARED: 7/10/2013

WBS Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 9-Jul-13 Effective Price Level: 1-Oct-12				Program Year (Budget EC): 2015 Effective Price Level Date: 1 OCT 14								
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	RISK BASED CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	INFLATED (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*P*	*L*	*M*	*N*	*O*
09	CHANNELS & CANALS	$2,259	$791	35%	$3,050	3.4%	$2,337	$818	$3,154	2016Q3	2.7%	$2,400	$840	$3,240
	CONSTRUCTION ESTIMATE TOTALS:	$2,259	$791	35%	**$3,050**		$2,337	$818	$3,154			$2,400	$840	$3,240
01	LANDS AND DAMAGES	$232	$58	25%	$290	3.4%	$240	$60	$300	2015Q3	0.9%	$242	$61	$303
22	FEASIBILITY STUDY	$400	$100	25%	$500	3.9%	$416	$104	$519	2014Q2	-2.9%	$403	$101	$504
30	PLANNING, ENGINEERING & DESIGN													
2.5%	Project Management	$56	$20	35%	$76	6.9%	$60	$21	$81	2015Q3	1.9%	$61	$21	$82
2.0%	Planning & Environmental Compliance	$45	$16	35%	$61	6.9%	$48	$17	$65	2015Q3	1.9%	$49	$17	$66
5.0%	Engineering & Design	$113	$40	35%	$153	6.9%	$121	$42	$163	2015Q3	1.9%	$123	$43	$166
0.5%	Engineering Tech Review ITR & VE	$11	$4	35%	$15	6.9%	$12	$4	$16	2015Q3	1.9%	$12	$4	$16
0.5%	Contracting & Reprographics	$11	$4	35%	$15	6.9%	$12	$4	$16	2015Q3	1.9%	$12	$4	$16
1.0%	Engineering During Construction	$23	$8	35%	$31	6.9%	$25	$9	$33	2016Q3	5.9%	$26	$9	$35
1.0%	Planning During Construction	$23	$8	35%	$31	6.9%	$25	$9	$33	2016Q3	5.9%	$26	$9	$35
	Project Operations			35%										
31	CONSTRUCTION MANAGEMENT													
7.5%	Construction Management	$169	$59	35%	$228	6.9%	$181	$63	$244	2016Q3	5.9%	$191	$67	$258
	Project Operation:			35%										
	Project Management			35%										
	CONTRACT COST TOTALS:	$3,342	$1,107		**$4,449**		$3,474	$1,150	$4,625			$3,546	$1,177	**$4,723**

Columbus, Indiana

Haw Creek

Section 205 Study

Flood Risk Management

Appendix D – Sponsor Letter of Intent

U.S. Army Corps of Engineers

Louisville District

July 2013

columbusindiana
unexpected.**unforgettable.**

Kristen Brown, Mayor

April 19, 2012

Ms. Sharon Bond
Chief, Planning Branch
U. S. Army Engineer District, Louisville
P.O. Box 59
Louisville, Kentucky 40201-0059

Dear Ms. Bond:

The City of Columbus, Indiana, hereinafter called the "Sponsor", is interested in obtaining Corps of Engineers assistance in addressing flooding problems in the City of Columbus. The City is located at the confluence for several regionally significant streams and smaller tributaries and periodically experiences flooding. The most significant local flood event occurred on June 7, 2008 when flood waters from Haw Creek, Clifty Creek, the Driftwood River, the Flatrock River, and the East Fork of the White River inundated significant portions of the City. This flooding resulted in 3 fatalities locally, damage to an estimated 3,000 homes, damage to significant local employers, and the closure of Columbus Regional Hospital for over 6 months. The City is currently seeking options for limiting exposure to future flood hazards and mitigating flood risk for existing neighborhoods and business areas. As part of that effort, the City has initiated the creation of a comprehensive flood management plan for the community that will identify possible mitigation projects. The sponsor is aware of the following non-federal cost sharing requirements associated with the Corps' flood control projects completed under authority of Section 205 of the 1948 Flood Control Act.

a. **Feasibility Study.** The Corps will conduct a Feasibility Study which is 100% federally funded up to $100,000. Costs over the $100,000 are cost shared with the non-federal sponsor on a 50/50 basis (the non-federal share can be in the form of either cash, in-kind services, or a mixture of both). An initial assessment early in the Feasibility Study will determine if Section 205 authority appears applicable and provides a basis for determining scope and cost of an entire Feasibility Study.

b. **Preparation of Plans and Specifications.** Detailed design and preparation of plans and specifications are treated as part of total project costs for purposes of cost sharing and the non-federal cost share for these activities is collected with the construction cost share.

c. **Non-Federal Share of Construction.** The non-federal share of construction consists of provision of lands, easements, rights-of-way, relocations and disposal areas necessary for the project (LERRD), plus a cash contribution of 5% of the total project costs; in the event that the value of LERRD furnished, plus 5% cash, does not equal at least 35% of the total project cost, the non-federal sponsor must contribute additional cash to equal 35%. If LERRD plus 5% exceeds 35%, the sponsor is responsible up to a maximum of 50% of the total project costs.

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The sponsor is aware of the following:

Operation and Maintenance. The sponsor will be responsible for operation and maintaining the project upon completion.

Feasibility Study. The sponsor understands that the Corps will undertake the first phase of study when funds are available which may vary 18 - 24 months depending upon the size of the potential project and the federal budget cycle. An initial assessment at the beginning of the Feasibility Study normally takes 3 - 6 months and will provide the basis for determining the scope of study and whether the Section 205 authority appears appropriate to address the community's flooding problem.

Expression of Intent. The sponsor is aware that this letter constitutes an expression of intent and not a contractual obligation and that the sponsor or the Corps may opt to discontinue the project development process at each stage as described in "a" and "b" above.

If you need additional information, please contact Columbus Planning Director Jeff Bergman at 812.376.2550.

Sincerely,

Kristen S. Brown, Mayor

Kelly S. Benjamin, City Attorney

cc: Louisville District Corps of Engineers
ATTN: Mr. Brandon.R. Brummett, P.E., PMP
PM-P (Outreach Coordinator)
P.O. Box 59
Louisville, Kentucky 40201-0059