

# Attachment A

## Proposed Scope of Services

### Davis Run Floodplain Study

The Davis Run Floodplain Study involves the development of hydrologic and hydraulic models for the watershed. These models will be used to map the floodplain and floodway and to support the preparation of an application for a Letter of Map Revision (LOMR) from the Federal Emergency Management Agency (FEMA). Our detailed scope of work is described below.

#### Task 1 - Obtain and Review Existing Information

CDM will obtain and review pertinent reports, construction plans, and other existing data that will be needed to adequately perform the modeling of the Davis Run watershed. This may include, but is not limited to, the following sources of information:

- City of Mason as-built construction plans and storm sewer maps;
- Warren County Auditor's GIS;
- Federal Emergency Management Agency (FEMA) flood insurance study (FIS) and rate map;
- FIS hydraulic model of Davis Run (if available);
- SCS Soils Map for Warren County;
- land use coverages;
- hydrologic data including typical rainfall frequency, distributions, and amounts (Bulletin 71, Rainfall Frequency Atlas of the Midwest); and
- rain gage data.

In addition, CDM will interview City staff to obtain historical high water marks for storm events, including the July 17-18, 2001 storm event, that may be used for calibration. CDM proposes to use rain gage data from the State of Ohio Rain/Snow Monitoring System (STORMS) Network or other nearby rain gage data, if available, to simulate these historic storm events.

#### Task 2 - Surveying and Field Investigations

Per the FIS, a detailed analysis was previously performed in 1977 using HEC-2 for the section of Davis Run between the confluence with Muddy Creek and 300 feet downstream of East Indianwood Boulevard. The effective FIS model has become outdated, however, due to development and changes to the stream channel caused by

sedimentation, vegetation, and the July 17-18, 2001 storm event. Since the previous study, new culverts have also been added at Villas Creek Drive, Aspen Drive, and the Tylersville Road culvert on Muddy Creek. For this reason, new cross-sections and culvert data will be needed to develop the hydraulic models of Davis Run.

CDM will obtain cross-sections and culvert inventory information through surveying provided by the City through a qualified professional surveying firm. The selected surveying firm will obtain 33 cross-sections between the downstream side of the Tylersville Road culvert and the upstream sides of both the west and east branch culverts at Western Row Road. The surveyed cross-sections will include the main channel only; CDM will develop the flood plain cross-sections from the Warren County Auditor's GIS topographic mapping or the topographic mapping developed for this study. The selected surveying firm will also survey seven culverts to obtain dimensions, inverts, and overtop cross-sections. CDM reviewed the City's as-built drawings and determined that sufficient information is available to model the Villas Creek Drive, Willow Lane, and Tylersville Road culverts; therefore these culverts are not included in the surveying.

The surveying firm will also have orthophotos taken of Davis Run and will develop digital topographic mapping for approximately 400 feet on each side of the stream with either 2- or 1-foot contour intervals. This topographic mapping will be used to determine the floodplain boundary. The 2- or 1-foot contour intervals will allow more accurate floodplain delineations than will the 4-foot contours of the Warren County Auditor's GIS. Either of these contour intervals will also more than satisfy FEMA's LOMR requirement that the topographic contour interval be equal to or less than the interval used in the effective FIS (the effective FIS used 10-foot contour intervals).

The surveyed information will be referenced to state plane coordinates and to the 1929 USGS NGVD. The 1929 datum will be used because that is the datum used in the effective model and Flood Insurance Rate Map (FIRM). To satisfy FEMA LOMR requirements, all collected survey data should be certified to NGVD by a registered surveyor or engineer. The cost to provide these surveying services is the responsibility of the City and has not been included in CDM's proposed project cost.

As part of this task, CDM will also conduct a field investigation of Davis Run. Manning's n-values will be developed based on observations made during these field inspections as well as from pictures and notes provided from the cross-section survey.

### **Task 3 - Hydrologic and Hydraulic Analysis**

For this study, CDM proposes to use the EPA StormWater Management Model (SWMM) and HEC-RAS. SWMM version 4.3 and HEC-RAS are both accepted models by the Federal Emergency Management Agency (FEMA). The SWMM RUNOFF block will be used to simulate the dynamic rate of runoff generated from the subwatersheds. The resulting hydrographs will be saved for input to the EXTRAN block of SWMM. The EXTRAN model will be used to perform dynamic routing of

stormwater flows through the major storm drainage system, including the Davis Run open channel, stormwater detention facilities, and the main trunk sewers that are necessary to accurately simulate stormwater detention and routing in the Davis Run watershed. The resulting peak flows from EXTRAN will be input into the HEC-RAS model to determine the floodplain extents.

CDM has found that watershed-wide evaluations can be performed more accurately and for less cost if SWMM is used with HEC-RAS versus using HEC-1 with HEC-RAS. First, SWMM allows continuous simulation for evaluation of periods of multiple small storms that affect water quality and erosion. Second, SWMM is more accurately calibrated and verified because of its ability to evaluate rainfall-runoff based on actual rainfall intensities, infiltration rates, and runoff/routing response times. Third, SWMM does not need a separate hydrologic routing that requires the assumption of uniform flow and/or the development of rating curves for channel reaches that must be recalculated for each alternative. Fourth, SWMM allows for direct input of runoff hydrographs into the dynamic routing network and automatically considers runoff inflow and headwater/tailwater variations throughout a given storm event in the routing. This gives more direct solutions, eliminates guesswork on system tributary timing, and can save analysis time and costs. This approach will result in proposed facility improvements that are sized more accurately and not over or under designed. This approach will also enable CDM to evaluate the stage-area relationships of detention basins and their outlet structures in the Pine Run watershed more directly and recommend modifications, if necessary, to optimize their performance.

In summary, dynamic simulation of watershed-wide responses (versus steady-state analyses) allow more accurate simulation of regional facilities, development criteria, surcharge, varying tailwater, and hydrograph timing. This will save analysis and capital costs and can also help to ensure that problems are not simply "moved downstream to someone else's door step" as solutions are developed.

### ***Task 3.1 - Duplicate Effective Model***

A requirement of the LOMR application is the submission of the duplicate effective model (i.e., the HEC-2 model used to compute flood elevations for the FIS). To meet this requirement, CDM will submit a written request with fee to PBS&J (FEMA's Flood Insurance Specialist for Region 5) to obtain a digital copy of the effective model, or hardcopy if a digital copy is unavailable. If the model is available, CDM will rerun the model using HEC-2 and include the model in the LOMR application. If the effective model is unavailable, no additional work will be necessary for this task.

### ***Task 3.2 - Model Input Development and Calibration***

CDM will develop the SWMM and HEC-RAS models using the Warren County Auditor's GIS; the City's as-built construction plans and storm sewer maps; the SCS Soils Map for Warren County; available land use coverages; and the cross-section, culvert data, and digital topographic mapping developed under Task 2.

The graphic pre- and post-processor interface that CDM will use to create and view the SWMM input and output files will be MIKE SWMM, which is Microsoft Windows compatible. MIKE SWMM is a versatile modeling package that CDM developed in conjunction with the Danish Hydraulic Institute (DHI) and uses the public domain version of SWMM.

To calibrate the models, CDM will use high water marks obtained from City staff. CDM will attempt to calibrate the models using the July 17-18, 2001 storm event. As previously mentioned under task 1.1, CDM proposes to use rain gage data from the State of Ohio Rain/Snow Monitoring System (STORMS) Network or other nearby rain gage data if available for this storm event.

### ***Task 3.3 - Flood Profile Development & Floodplain Delineation***

Using the calibrated models, CDM will simulate the hydrologic and hydraulic response within the study area for the 10-, 50-, 100-, and 500-year design storms and will compare the profile results with the FEMA Flood Insurance Study (FIS) for the City of Mason, Ohio. The SWMM model results for this project will likely differ from the FIS flood elevation due to differences in the model computations and because the model will extend upstream of the FIS. The model likely used for the FIS study, HEC-2, computes steady-state hydraulics in the open channel, while the SWMM model computes dynamic, gradually-varied unsteady-state flow.

Using the flood elevations determined by the HEC-RAS model at each cross-section and interpolating the elevations between cross-sections, CDM will develop the flood boundary for the 100- and 500-year floods in ArcView.

### **Task 4 - Preparation of the Final Report and LOMR Application**

All of the above tasks will be summarized in a draft report, which will include tables, maps and other graphics where appropriate.

In addition, CDM will complete Forms 1, 3, 4, 5, and 7 of the FEMA MT-2 LOMR Application Forms. The application will be included in the draft report and incorporate all the required application forms, maps, figures, and diskettes. All maps will be prepared using ArcView GIS. The maps and figures to be produced include the following:

1. Hydrologic data maps that depict sub-basin boundaries, overland flow paths, and channel centerlines;
2. A hydrologic model schematic for the SWMM RUNOFF and EXTRAN model that indicates sub-basin and routing reaches;
3. A floodplain work map that illustrates the 100- and 500-year flood boundaries, the floodway boundaries, and the cross-section locations;

4. Profile plots of the 10-, 50-, 100-, and 500-year floods for the study reach in the FEMA format; and
5. An annotated FIRM showing the 100-year and 500-year flood boundaries, base flood elevations, and cross section locations.

CDM will prepare and submit to both the City and FEMA a final report, which contains the FEMA MT-2 LOMR Application Forms and incorporates and/or addresses the City's draft review comments.

The \$4,000 application fee that is required to be submitted with the application will be the responsibility of the City and is not included in CDM's proposed project cost.

### **Task 5 - Response to Agency Comments**

From CDM's experience, the LOMR application review typically requires three to four months before comments are received and includes at least one request for additional information. CDM has budgeted 40 hours to address comments received from FEMA. Additional time beyond these 40 hours has not been budgeted for and would be considered outside the scope of this contract.

### **Task 6 - Monthly Progress Meetings**

CDM will prepare for and attend monthly progress meetings with the City. The meetings will be used to present and review draft model results and mapping products and to identify any constraints which may be encountered that affect the project's schedule and budget. For this task, CDM will provide minutes of the monthly meetings to the City.

## **Proposed Schedule and Estimated Project Cost**

Based upon the scope of services described in Tasks 1 through 6, CDM estimates expending approximately 960 hours at a total labor cost of \$69,460. In addition to the labor costs, CDM estimates expending approximately \$4,525 in Other Direct Costs (ODCs), for a total project cost of \$73,985. The table attached at the end of the proposal shows the hours and costs allocated for each task and the attached figure shows our proposed schedule. The schedule indicates a start date of March 1, 2001 because of the timing necessary to generate the orthophotos. A surveying firm cannot fly the area until after the fall season, which means the 2- or 1-foot contour interval maps will not be available until at least mid-December. Some work can be completed prior to mid-December, but the bulk of Task 3.2, Model Input Development and Calibration, cannot begin until the orthophotos and maps are created.

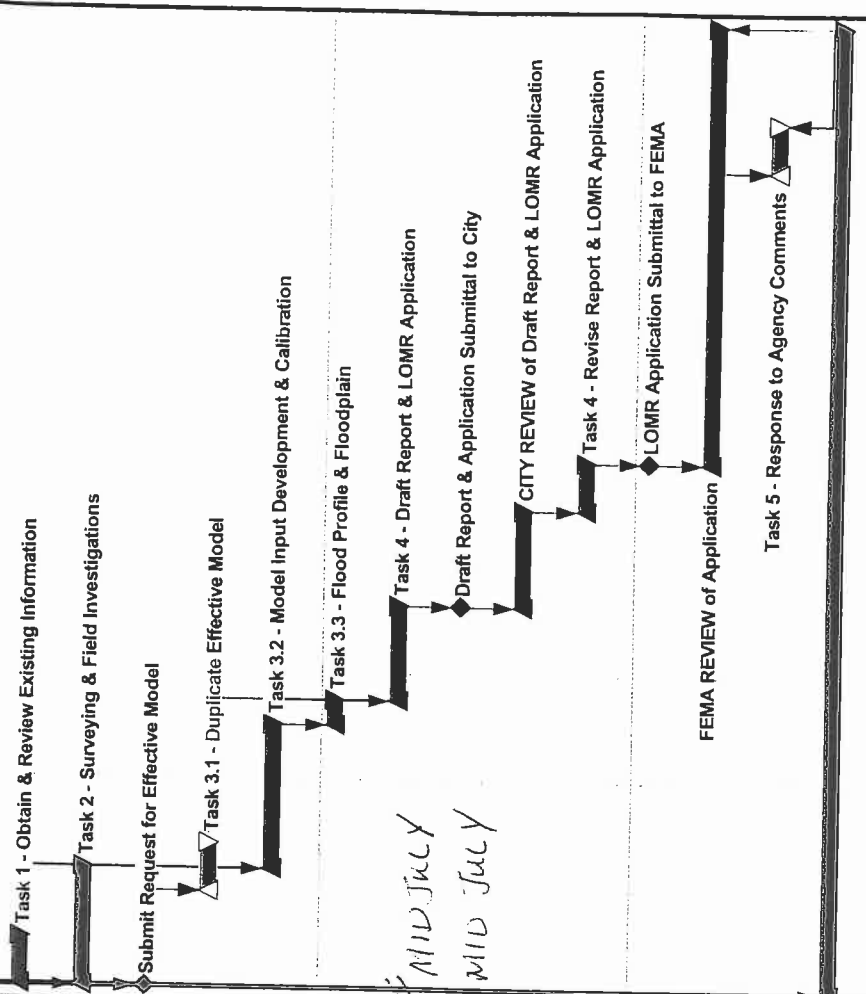
**Table 1**  
**City of Mason**  
**Davis Run Floodplain Study**  
**Estimated Hours and Cost**

Task	Task Description	Tech Advisor/Officer	PM/Sr. Engineer	Project Engineer	Staff Engineer	Senior Drafter	Engineer Technician	Clerical	Total Hours	Total Labor	Reimbursable Cost	Total Cost
<b>Task 1 - Obtain &amp; Review Existing Information</b>		2		12	24			2	40	\$3,148	\$150	\$3,298
<b>Task 2 - Surveying &amp; Field Investigations</b>		4		24	16		8	4	56	\$4,272	\$250	\$4,522
<i>Task 2 Subtotal</i>		4	0	24	16	0	8	4	56	\$4,272	\$250	\$4,522
<b>Task 3 - Hydrologic &amp; Hydraulic Analysis</b>		2	2	16	40		24	2	86	\$5,750	\$275	\$6,025
3.1 Duplicate Effective Model		4	2	80	180		40		306	\$21,990	\$1,200	\$23,190
3.2 Model Input Development & Calibration		2	4	24	48		40	2	120	\$7,836	\$400	\$8,236
3.3 Flood Profile Development & Floodplain Delineation		8	8	120	268	0	104	4	512	\$35,576	\$1,875	\$37,451
<i>Task 3 Subtotal</i>		8	8	120	268	0	104	4	512	\$35,576	\$1,875	\$37,451
<b>Task 4 - Preparation of the Final Report &amp; LOMR Application</b>		4	8	40	100	16	40	16	224	\$15,560	\$750	\$16,310
<i>Task 4 Subtotal</i>		4	8	40	100	16	40	16	224	\$15,560	\$750	\$16,310
<b>Task 5 - Response to Agency Comments</b>		2		16	16	4		2	40	\$3,152	\$500	\$3,652
<b>Task 6 - Monthly Progress Meetings</b>		16		40	16			16	88	\$7,752	\$1,000	\$8,752
	Total Proposal Hours	36	16	252	440	20	152	44	960			
	Hourly Billing Rate (\$/hr)	140	135	85	72	60	35	60				
	Total Labor Costs											
	Total Reimbursable Costs										\$4,525	
	Outside Professionals (Subconsultants)								\$69,460			
	<b>Total Project Costs</b>											<b>\$73,985</b>



### Davis Run Floodplain Study

Activity Description	Orig Dur	Early Start	Early Finish
Task 1 - Obtain & Review Existing Information	10	01MAR02	14MAR02
Task 2 - Surveying & Field Investigations	25	01MAR02	04APR02
Submit Request for Effective Model	0	01MAR02	
Task 3.1 - Duplicate Effective Model	10	29MAR02	11APR02
Task 3.2 - Model Input Development & Calibration	30	05APR02	16MAY02
Task 3.3 - Flood Profile & Floodplain	5	17MAY02	23MAY02
Task 4 - Draft Report & LOMR Application	20	24MAY02	20JUN02
Draft Report & Application Submittal to City	0		20JUN02
CITY REVIEW of Draft Report & LOMR Application	20	21JUN02	18JUL02
Task 4 - Revise Report & LOMR Application	10	19JUL02	01AUG02
LOMR Application Submittal to FEMA	0		01AUG02
FEMA REVIEW of Application	90	02AUG02	05DEC02
Task 5 - Response to Agency Comments	10	25OCT02	07NOV02
Task 6 - Monthly Progress Meetings	200*	01MAR02	05DEC02



MDR1

Sheet 1 of 1

## City of Mason Davis Run Floodplain Study Proposed Schedule

