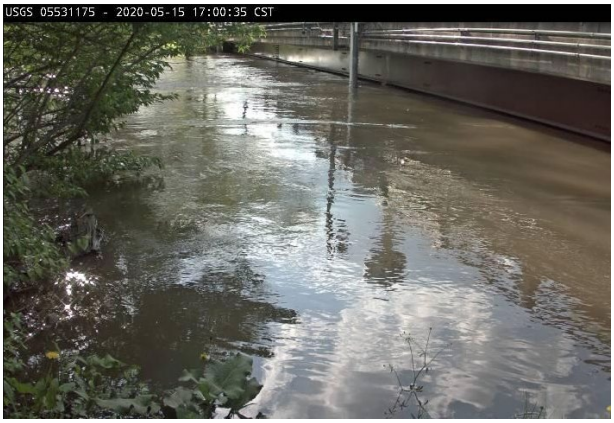
A PROPOSAL SUBMITTED TO:
County of DuPage, Stormwater Management Department

Flood-Simulation System Support for Salt Creek, East Branch DuPage River, and West Branch DuPage River in DuPage County, Illinois through November 2025



U.S. Geological Survey
Central Midwest Water Science Center

USGS Contact: Terry Ortel, *tortel@usgs.gov*
Date: 09/05/2024

Flood-Simulation System Support for Salt Creek, East Branch DuPage River, and West Branch DuPage River in DuPage County, Illinois through November 2025

CENTRAL MIDWEST WATER SCIENCE CENTER

Summary

The Salt Creek, East Branch DuPage River, and West Branch DuPage River are small headwater watersheds in northeastern Illinois. A near real-time streamflow simulation system has been developed and is being tested and enhanced by the USGS Central Midwest Water Science Center (CMWSC) in cooperation with the DuPage County Stormwater Management Department (DPC-SMD) to evaluate different rainfall amounts and/or structure operation scenarios.

Background/Introduction

DuPage County, Illinois is highly urbanized and is one of five collar counties that border Chicago's Cook County in northeastern Illinois. The DuPage County Stormwater Management Department (DPC-SMD) selected continuous simulation and dynamic routing models for use in watershed analysis and floodplain mapping, instead of single-event steady-state models, so that the impacts of antecedent moisture on runoff volumes and peaks, non-uniform precipitation distributions, backwater, flood plain storage, and complex urban stream systems could be studied (County of DuPage, 2020). The County uses the Hydrologic Simulation Program – FORTRAN (HSPF) (U.S. Environmental Protection Agency, 2017) model for hydrologic modeling and the one-dimensional dynamic-wave model Full Equations (FEQ) (Franz, D.D., and Melching, C.S., 1997a) for hydraulic modeling and has developed models for the watersheds in the County.

The USGS CMWSC and DPC-SMD have continued a cooperative program that began in approximately 1985 to install and maintain a precipitation and streamflow gaging network. In 2022, the cooperative gaging network consisted of ten discharge sites (streamgages), three continuous stage sites, 29 tipping-bucket precipitation sites, and one Ott Pluvio precipitation gage site located throughout the county (fig 1). The DPC-SMD operates and maintains three

stage sites in the Salt Creek watershed at Irving Park Road, Elmhurst Quarry, and Harger Road; and one stage site in the West Branch DuPage River watershed at Fawell Dam.

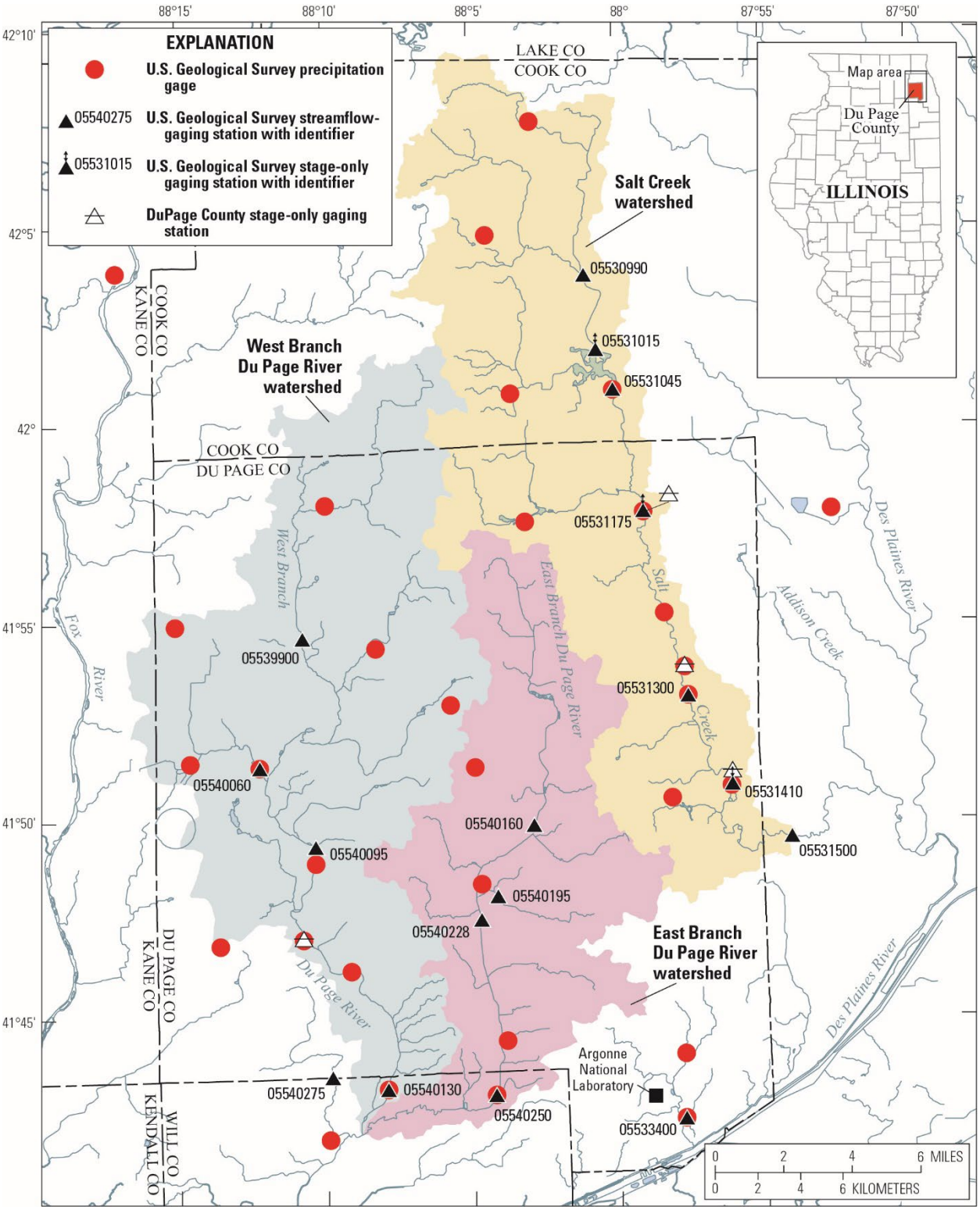


Figure 1. Salt Creek, East Branch DuPage River, and West Branch DuPage River watersheds in Northeastern, Illinois.

The USGS CMSWC in cooperation with DPC-SMD started development in approximately 1997 of a near real-time streamflow simulation system for the Salt Creek watershed to evaluate different rainfall amounts and/or hydraulic structure operation scenarios. The near real-time streamflow simulation system used existing HSPF and FEQ models furnished and used by DPC-SMD in watershed analysis and floodplain mapping studies. The models were modified for use in the simulation system, and programs were developed for retrieving and processing near real-time streamflow and precipitation data from the gaging network (Ortel and Martin, 2010; Bera, ScienceBase data releases), National Weather Service (NWS) Next Generation Radar (NEXRAD) Multisensor Precipitation Estimates (MPE) data (Bera and Ortel, 2018; Ortel and Spies, 2015), U.S. Department of Energy Argonne National Laboratory (ANL) meteorological data (Murphy, 2005; Murphy, 2006; Over and others, 2010; Bera, ScienceBase data releases), NWS precipitation and meteorological forecast data, and computation of potential evapotranspiration (PET) estimates (Murphy, 2005) using the retrieved meteorological data. The runoff time series generated by HSPF are input to the FEQ model for routing (Ishii and others, 1998). The GENeration and analysis of model simulation SCeNarios (GENSCN) module of the U.S. Environmental Protection Agency's Better Assessment Science Integrating Point and Non-point Sources (BASINS) (U.S. Environmental Protection Agency, 2017) system was utilized for data input, HSPF simulation, display of the meteorologic and hydrologic data, and for display and analysis of the observed and simulated stage and discharge hydrographs. The hydraulic model was also used to create a flood inundation map library for a 1.6 mile section of the Salt Creek (Soong and others, 2012).

The near real-time streamflow simulation system developed for the Salt Creek was applied to the West Branch DuPage River watershed in 2010 and the East Branch DuPage River watershed in 2018 by the USGS CMWSC in cooperation with the DPC-SMD. The Salt Creek watershed is 115 square miles to the downstream streamgage 05531500 (Salt Creek at Western Springs, IL) and contains several offline flood-control reservoirs whose operations can be optimized by using accurate estimates of the timing and elevation of flood peaks. The West Branch DuPage River watershed is 123 square miles to the downstream streamgage 05540130 (West Branch Du Page River near Naperville, IL) and contains one operable in-line dam. The East Branch DuPage River is 75.8 square miles to the downstream streamgage 05540250 (East Branch Du Page River at Bolingbrooke, IL) and does not have flood-control structures to help reduce flood damages from major storm events.

The USGS CMSWC in cooperation with DPC-SMD has supported and documented the FEQ model (Franz and Melching, 1997a; Franz and Melching, 1997b), applied it in verification studies (Ishii and Turner, 1996; Turner and others, 1996), and developed utility software for data input and review (Ancalle and others, 2017; Ern and others, 2019) from approximately 1996 to present. As part of the flood simulation system development, an FEQ output file of computed water surface elevations and flows has been reformatted for input and display in HEC-RAS software (Brunner, 2016). HEC-RAS can be used with RAS Mapper to create inundation maps of the streamflow-simulation system water-surface profiles from the FEQ simulations.

Problem

The highly urbanized land use in DuPage County combined with extreme hydrologic events such as high intensity or long duration rainfall can produce flooding that is a risk to life and property. In August 1987, extreme rainfall in the Chicago area flooded thousands of homes along the Des Plaines River and Salt Creek resulting in $78 million in damages and parts of Cook and DuPage Counties being declared disaster areas (McCoppin, 2007). Continued urban growth in DuPage County since 1987 and the construction of additional flood control structures and updated hydrologic and hydraulic models necessitates ongoing testing, updates, and enhancements for a near real-time flood simulation system that utilizes real-time and forecast data to evaluate forecast precipitation and hydraulic structure operation scenarios. Real-time precipitation and streamflow data are needed to monitor local conditions and for streamflow simulation. This will allow for the simulation results to be based on the most current conditions in the watershed using up-to-date hydrologic and hydraulic models.

Objectives and Scope

The USGS proposes to continue testing, updating, and enhancing flood-simulation systems for three watersheds in DuPage County according to the most current watershed conditions of Salt Creek, West Branch DuPage River, and East Branch DuPage River using updated hydrologic and hydraulic models and near real-time input data. The flood-simulation systems are comprised of furnished hydrologic (HSPF) and hydraulic (FEQ) models. The systems use real-time data from the USGS-DuPage County network streamgages, continuous stage gages, and precipitation gages. The system also utilizes NWS NEXRAD MPE precipitation data, NWS precipitation and meteorologic forecast data, and ANL meteorological data in the simulations. Furnished stream stage data at DuPage County gages are compared to simulation results.

Study objectives include:

1. Maintain an existing USGS-DuPage County cooperative gage network of ten streamgages, three continuous stage gages, 31 precipitation gages, and one co-located webcam.
2. Refinement of furnished hydrologic and hydraulic models for running in a near real-time continuous simulation system.
3. Update and enhance processes for real-time data acquisition, conversion, and filling of missing data from multiple agencies for input to hydrologic and hydraulic models and to verify model results.
4. Support for FEQ and FEQUTL, and support for HSPF recalibration processes.
5. Develop, update, and maintain web pages for custom data display.

Relevance and Benefits

The gage network and flood simulation system updates will allow DuPage County managers and decision makers to evaluate alternative scenarios of forecast precipitation amounts and/or hydraulic structure operations to better prepare and respond to flooding risks and potentially reduce stormwater damages. It will provide emergency responders with a tool to protect life and property, and emergency responders and public works will have better anticipation of road

closures, evacuation areas, routes of egress, and overall planning during flooding. U.S. Geological Survey water mission goals addressed by this study include addressing the anticipation and response to water-related emergencies (flooding), prediction of changes in the quantity of water resources in response to land use and management changes and contributing to the advancement of hydrologic monitoring networks and delivery of timely hydrologic data (Everson and others, 2013).

Approach

Five tasks will be completed to accomplish the objectives of this study. These tasks are: 1) network gage data collection and compilation, 2) model assessment and refinement, 3) near real-time scenario simulations, 4) hydraulic and hydrologic model updates and support, and 5) reporting. A general timeline for the completion of these tasks is provided in the Timeline and Budget section of this proposal.

Task 1: Network Gage Data Collection

The USGS and DuPage County will maintain a gage network consisting of ten streamgages, three continuous stage gages, and 31 precipitation gages (table 1). The gage data are critical for running forecast simulations in near real-time and for model calibration. The gage data are published according to USGS standards and provide water data for the nation. The USGS and DuPage County will maintain one webcam located at USGS streamgage 05531175, Salt Creek at Wood Dale, IL, to provide visual confirmation of stream stage at a critical location.

Station Number and Name	Gage Code
05531015 - SALT CREEK AT HIGGINS RD NR ELK GROVE VILLAGE, IL	STGCONT
05531175 - SALT CREEK AT WOOD DALE, IL	STGCONT
05531300 - SALT CREEK AT ELMHURST, IL	QCONT
05531300 - SALT CREEK AT ELMHURST, IL	PRECIPCONT
05531410 – SALT CREEK AT 22ND STREET AT OAK BROOK, IL	STGCONT
05531410 – SALT CREEK AT 22ND STREET AT OAK BROOK, IL	PRECIPCONT
05533400 - SAWMILL CREEK NEAR LEMONT, IL	QCONT
05533400 - SAWMILL CREEK NEAR LEMONT, IL	PRECIPCONT
05539900 - WEST BRANCH DU PAGE RIVER NEAR WEST CHICAGO, IL	QCONT
05540060 - KRESS CREEK AT WEST CHICAGO, IL	PRECIPCONT
05540060 - KRESS CREEK AT WEST CHICAGO, IL	QCONT
05540130 - WEST BRANCH DU PAGE RIVER NEAR NAPERVILLE, IL	QCONT
05540130 - WEST BRANCH DU PAGE RIVER NEAR NAPERVILLE, IL	PRECIPCONT
05540160 - EAST BRANCH DU PAGE RIVER NEAR DOWNERS GROVE, IL	QCONT
05540195 - ST. JOSEPH CREEK AT ROUTE 34 AT LISLE, IL	QCONT
05540228 – EAST BRANCH DU PAGE RIVER AT SHORT ST AT LISLE, IL	QCONT
05540250 - EAST BRANCH DU PAGE RIVER AT BOLINGBROOK, IL	QCONT
05540275 - SPRING BROOK AT 87TH STREET NEAR NAPERVILLE, IL	QCONT

414158088095600 - SPRING BROOK WWTF NR NAPERVILE, IL	PRECIPCONT
414306088042100 - BOLINGBROOK WWTF AT BOLINGBROOK, IL	PRECIPCONT
414411087575000 - MARIENBROOK WWTF AT DARIEN, IL	PRECIPCONT
414430088035600 - WOODRIDGE WWTF AT WOODRIDGE, IL	PRECIPCONT
414613088091000 - NAPERVILLE MUNICIPAL BUILDING AT NAPERVILLE, IL	PRECIPCONT
414652088133800 - NAPERVILLE TOWNSHIP HWY DIVISION AT NAPERVILLE, IL	PRECIPCONT
414702088104801 - RAIN GAGE AT NAPERVILLE, IL	PRECIPCONT
414826088044501 - RAIN GAGE AT LISLE, IL	PRECIPCONT
414903088101701 - RAIN GAGE AT WB DUPAGE RIVER AT WARRENVILLE, IL	PRECIPCONT
415037087581700 - OAK BROOK WELL AT OAK BROOK, IL	PRECIPCONT
415125088045700 - WHEATON SEWER DEPARTMENT AT WHEATON, IL	PRECIPCONT
415131088143600 - NATIONAL ACCELERATOR LAB NR WEST CHICAGO, IL	PRECIPCONT
415300088054600 - WHEATON WATER DEPARTMENT AT WHEATON, IL	PRECIPCONT
415356087575000 - ELMHURST QUARRY AT ELMHURST, IL	PRECIPCONT
415423088081500 - CAROL STREAM WWTF AT CAROL STREAM, IL	PRECIPCONT
415457088150600 - DUPAGE COUNTY AIRPORT NEAR ST CHARLES IL	PRECIPCONT
415518087583000 - ADDISON WWTF AT ADDISON, IL	PRECIPCONT
415737088031100 - SPRING CREEK RESERVOIR NEAR BLOOMINGDALE, IL	PRECIPCONT
415755087525300 - OHARE AIRPORT AT CHICAGO, IL	PRECIPCONT
415801088095700 - BARTLETT WWTF NEAR BARTLETT, IL	PRECIPCONT
415817087591901 - RAIN GAGE AT WOOD DALE, IL	PRECIPCONT
420052088034200 - SCHAUMBURG PUBLIC WORKS AT SCHAUMBURG, IL	PRECIPCONT
420057088001700 - BUSSE WOODS NEAR ELK GROVE VILLAGE, IL	PRECIPCONT
420354088170500 - ELGIN WATER TREATMENT FACILITY AT ELGIN, IL	PRECIPCONT
420453088043200 - RAIN GAGE AT HARPER COLLEGE AT PALATINE, IL	PRECIPCONT
420745088025901 - RAIN GAGE AT SUNDLING JR HS AT PALATINE, IL	PRECIPCONT

Table 1. Streamgages (QCONT), continuous stage gages (STGCONT), and precipitation gages (PRECIPCONT) in the USGS and the DuPage County – Stormwater Management Department cooperative program.

Task 2. Model Assessment and Refinement to Maintain Continuous Simulation

The hydrologic model continuous-simulation period spans multiple years; to reduce computer run times the hydrologic model initial conditions will be periodically moved forward in time to maintain a simulation time span of nine months or less. The start and end dates of the hydraulic model simulations will be moved forward in conjunction with the hydrologic model. The hydraulic models will be modified as needed by adding cross sections, changing baseflow, or changing the numerical solution parameters and/or coefficients to prevent numerical breakdowns during low flow periods or sudden changes in flow. The hydraulic models will be periodically reviewed to help determine causes for differences between simulated and observed elevations and flows at streamgage sites. The hydraulic models also create output files that can be input to HEC-RAS and RASmapper for creating inundation surfaces.

Task 3. Conduct Near Real-Time Scenario Simulations

Programs to retrieve and process the near real-time data, run the hydrologic and hydraulic models, and create time-series graphs of the results at selected locations will be tested, updated, and enhanced. The USGS CMWSC will maintain a Local Data Manager (LDM) connection with the NWS to receive the NWS NEXRAD MPE data from the North Central River Forecast Center. Computer programs for processing DuPage County streamgage data and NWS NEXRAD MPE precipitation data will be maintained and updated as needed to process future changes in the retrieved data files. Separate scenario simulations will be run using precipitation gage data and NWS NEXRAD MPE data and the results compared between the two precipitation data sources. Hydraulic simulations using different upstream boundary conditions will be run and the results compared.

The Salt Creek simulation will be updated to not run older hydraulic models of the upper Salt Creek and Spring Brook tributary because they are primarily in Cook County; however, the older hydraulic model of the lower Salt Creek in DuPage County will continue to be ran for results comparison with the newer hydraulic models of the same area. The East Branch DuPage River simulation results will be updated to only show one set of results instead of multiple results from iterative runs. All three simulation systems will be updated to run an user-defined precipitation forecast as the only forecast option in case the NWS Quantitative Precipitation Forecast (QPF) is unavailable or problematic; currently, the systems require the NWS QPF data.

The forecast simulation systems will be run daily using a scheduling program and the results will be reviewed two or more times per week by USGS CMWSC staff to check for data and simulation errors. Databases of the processed input data will be published according to USGS standards.

Task 4. Hydraulic and Hydrologic Model Support

Support for the FEQ (Franz, D.D., and Melching, C.S., 1997a) and FEQUTL (Franz, D.D, and Melching, C.S. 1997b) programs will be provided. The FEQ and FEQUTL code for the latest versions will be made available on the USGS Git website (https://code.usgs.gov) and the manuals will be published. Support provided will be limited in scope, for example answering questions on model application or providing existing support programs; support requiring an extensive time commitment may be conducted under separate agreement.

The computer programs and Graphical User Interface (GUI) to assist with HSPF recalibration due to land-use and precipitation changes using DPC-SMD hydrologic procedures will be updated based on continued user testing. The GUI is used to retrieve, process, review, and store the input data in a Watershed Data Management (WDM) database; disaggregate daily rainfall totals to hourly values; edit and run HSPF model input files; and process and review the HSPF model results. The hydrologic procedures programs were initially developed to use a command-line interface and a GUI was added to assist users and gain efficiencies with editing configuration files, program execution, and results review. The GUI will be made available on the USGS Git website and a user's manual will be published. The programs and GUI used in the periodic recalibration of the HSPF model will be transferrable to other studies that use HSPF.

Task 5. Reporting

Network gage data collected under Task 1 will be available on the USGS Water Data for the Nation (WDFN) web sites. Processed data used in the hydrologic simulations will be published

as annual updates to USGS ScienceBase data releases (Bera and Over, 2024; Bera, 2024a; Bera, 2024b). The USGS CMWSC will maintain and update a public web page showing USGS precipitation gage totals and NWS NEXRAD data for reviewing precipitation amounts and spatial distribution. The USGS CMWSC will also maintain a restricted access web site for sharing results and processed data with DPC-SMD. The DPC-SMD maintains a public web page containing forecast discussions and recent simulation results for public dissemination.

Quality Assurance Plan

Quality assurance (QA) measures will be followed to ensure the completeness of the information communicated during the study. The QA objectives for the collection and communication of information will:

- Withstand scientific scrutiny
- Be obtained by methods appropriate for its intended use, and
- Be representative and of known completeness and comparability.

Data used in the modeling process will be derived from reliable host sources, including the USGS National Water Information System for precipitation, stage, and streamflow data, the U.S. Department of Energy ANL for meteorological data, and the NWS for forecast data. USGS streamflow and precipitation data will be collected and published as documented in Rantz (1982) and Office of Surface Water (OSW) Technical Memorandum 2017.10. All digital data and models will be reviewed by USGS personnel to ensure proper documentation and technical standards documented in OSW Technical Notes 2015.03 and recent OSW guidance for hydraulic modeling studies documented in OSW Technical Notes 2015.37 and 2016.25. The models, modeling results, and data releases will be archived in accordance with OSW Technical Memorandum 2015.01 (Model Archive Memo). Policies and procedures for archiving Surface-Water data and project information also provided in the Central Midwest Water Science Center data management plans. The project and project budget will be reviewed by USGS management on a quarterly basis to ensure project timelines are met.

Deliverables

USGS ScienceBase data releases will reflect annual updates for the Salt Creek database, West Branch DuPage River database, and Argonne National Laboratory meteorological database. FEQ, FEQUTL, and the hydrologic procedures GUI will be made available on the USGS Git website. Precipitation, stage, and streamflow data will be archived and available through the National Water Information System (NWIS) database.

Timeline and Budget

The columns in the timeline and the budget tables show the federal fiscal years running from October 1 through September 30 of the following year, and the period of this proposal covers the DuPage County fiscal year running from December 1 through November 30 of the following

year. Thus, the proposal covers December 2024 in quarter 1 of federal fiscal year 2025 and October and November 2025 in quarter 1 of federal fiscal year 2026.

Task	FY2025				FY2026			
	Q1 (Dec)	**Q2** (Jan-Mar)	**Q3** (Apr-Jun)	**Q4** (Jul-Sep)	**Q1** (Oct-Nov)	**Q2**	**Q3**	**Q4**
Task 1: Network Gage Data Collection								
Task 2: Model Assessment and Refinement								
Task 3: Conduct Near Real-Time Scenario Simulations								
Task 4: Hydraulic and Hydrologic Model Support								
Task 5: Reporting								

The budget consists of $304,800 for the network gage data collection (task 1) and $257,200 for the model assessment and refinement, near real-time scenario simulations, hydraulic and hydrologic model support, and reporting (tasks 2-5).

	FY2025	**FY2026**	**Total**
DuPage County	$292,400	$101,000	$393,400
USGS Appropriations	$125,400	$43,200	$168,600
Total	$417,800	$144,200	$562,000

Personnel

Staff from the USGS CMWSC will work collaboratively with DuPage County Stormwater Management to meet the objectives of the proposed study.

GS-12 Hydrologist, GS-11 Data Scientist, GS-9 Hydrologist, and GS4/5 student contractor will support the near real-time simulation system and reporting with additional Hydrologists and Hydrologic Technician support to maintain the streamgage, continuous stage gage, and precipitation gage network.

References

Ancalle, D.S., Ancalle, P.J., Domanski, M.M., 2017, FEQinput—An editor for the full equations (FEQ) hydraulic modeling system, U.S. Geological Survey Fact Sheet 2017-3072, 4 p. (Also available at https://pubs.er.usgs.gov/publication/fs20173072)

Bera, M. and Over, T.M., Meteorological Database, Argonne National Laboratory, Illinois, U.S. Geological Survey ScienceBase, accessed August 26, 2024, at https://www.sciencebase.gov/catalog/item/660ad9d2d34e4df16bd58a23

Bera, M., Watershed Data Management (WDM) Database for West Branch DuPage River Streamflow Simulation, DuPage County, Illinois, U.S. Geological Survey ScienceBase, accessed August 26, 2024a, at https://www.sciencebase.gov/catalog/item/65f2279dd34e1403329846b5

Bera, M., Watershed Data Management (WDM) Database for Salt Creek Streamflow Simulation, DuPage County, Illinois, U.S. Geological Survey ScienceBase, accessed August 26, 2024b, at https://www.sciencebase.gov/catalog/item/65f22722d34e140332984 6b0

Bera, M., and Ortel, T.W., 2018, Processing of next generation weather radar-multisensor precipitation estimates and quantitative precipitation forecast data for the DuPage County streamflow simulation system, U.S. Geological Survey Open-File Report 2017-1159, 15 p. (Also available at https://pubs.er.usgs.gov/publication/ofr20171159)

Brunner, G.W., 2016, Hydrologic Modeling System HEC-RAS User's Manual, Version 5.0: U.S. Army Corps of Engineers, Hydrologic Engineering Center: Davis, CA, 962 p. (Also available at https://www.hec.usace.army.mil/software/hec-ras/documentation/HEC-RAS%205.0%20Users%20Manual.pdf)

County of DuPage, DuPage County's Watershed Modeling and Mapping Methodology, accessed September 1, 2020, at https://www.dupageco.org/EDP/Stormwater_Management/1225/

Ern., J.L., Ortel, T.W., Ishii, A.L., Bera, B., 2019, Full Equations Model Graphical Data Inspector (FEQ–GDI) User Guide, U.S. Geological Survey Open-File Report 2019-1113, 11 p. (Also available at https://pubs.er.usgs.gov/publication/ofr20191113)

Evenson, E.J., Orndorff, R.C., Blome, C.D., Böhlke, J.K., Hershberger, P.K., Langenheim, V.E., McCabe, G.J., Morlock, S.E., Reeves, H.W., Verdin, J.P., Weyers, H.S., and Wood, T.M., 2013, U.S. Geological Survey water science strategy—Observing, understanding, predicting, and delivering water science to the Nation: U.S. Geological Survey Circular 1383–G, 49 p.

Franz, D.D., and Melching, C.S., 1997a, Full Equations (FEQ) model for the solution of the full, dynamic equations of motion for one-dimensional unsteady flow in open channels and through control structures, U.S. Geological Survey Water-Resources Investigations Report 96-4240, 258 p. (Also available at https://pubs.er.usgs.gov/publication/wri964240)

Franz, D.D., and Melching, C.S., 1997b, Full equations utilities (FEQUTL) model for the approximation of hydraulic characteristics of open channels and control structures during unsteady flow, U.S. Geological Survey Water-Resources Investigations Report 97-4037, 205 p. (Also available at https://pubs.er.usgs.gov/publication/wri974037)

Ishii, A.L, and Turner, M.J., 1996, Verification of a one-dimensional, unsteady-flow model for the Fox River in Illinois, U.S. Geological Survey Water Supply Paper 2477, 65 p. (Also available at https://pubs.er.usgs.gov/publication/wsp2477)

Ishii, A.L.,Charlton, T.J., Ortel,T.W., and Vonnahme, C.C., 1998, Operational modeling system with dynamic-wave routing, ASCE Proceedings of the 1998 25th Annual Conference on Water Resources Planning and Management, pp. 147-152

McCoppin, R., 2007, Take heart, flood of 1987 was much worse, Daily Herald, Chicago, accessed September 3, 2020, at http://prev.dailyherald.com/story/?id=25160

Murphy, E.A., 2005, Comparison of potential evapotranspiration calculated by the LXPET (Lamoreux Potential Evapotranspiration) Program and by the WDMUtil (Watershed Data Management Utility) Program, U.S. Geological Survey Open-File Report 2005-1020, 20 p. (Also available at https://pubs.er.usgs.gov/publication/ofr20051020)

Murphy, E.A., 2006, Watershed Data Management (WDM) Database for Salt Creek Streamflow Simulation, DuPage County, Illinois, U.S. Geological Survey Open-File Report 2006-1248, 34 p. (Also available at https://pubs.er.usgs.gov/publication/ofr20061248)

Ortel, T.W., and Martin, A.M.Jr., 2010, User's guide for MAGIC-Meteorologic and hydrologic genscn (generate scenarios) input converter, U.S. Geological Survey Open-File Report 2010-1221, 10 p. (Also available at https://pubs.er.usgs.gov/publication/ofr20101221)

Ortel, T.W., and Spies, R.R., 2015, NEXRAD quantitative precipitation estimates, data acquisition, and processing for the DuPage County, Illinois, streamflow-simulation modeling system, U.S. Geological Survey Fact Sheet 2015-3076, 2 p. (Also available at https://pubs.er.usgs.gov/publication/fs20153076)

Over, T.M., Price, T.H., and Ishii, A.L., 2010, Development and analysis of a meteorological database, Argonne National Laboratory, Illinois, U.S. Geological Survey Open-File Report 2010-1220, 23 p. (Also available at https://pubs.er.usgs.gov/publication/ofr20101220)

Rantz, S.E., 1982, Measurement and Computation of Streamflow, U.S. Geological Survey Water Supply Paper 2175 (Also available at https://doi.org/10.3133/wsp2175)

Soong, D.T., Murphy, E.A., and Sharpe, J.B., 2012, Flood-Inundation Maps for a 1.6-Mile Reach of Salt Creek, Wood Dale, Illinois, U.S. Geological Survey Scientific Investigations Map 3185, 8 p. (Also available at https://pubs.er.usgs.gov/publication/sim3185)

Spies, R.R., Over, T.M., and Ortel, T.W., 2018, Comparison of NEXRAD multisensor precipitation estimates to rain gage observations in and near DuPage County, Illinois, 2002–12, U.S. Geological Survey Open-File Report 2018-1061, 30 p. (Also available at https://pubs.er.usgs.gov/publication/ofr20181061)

Turner, M.J., Pulokas, A.P., and Ishii, A.L., 1996, Implementation and verification of a one-dimensional, unsteady-flow model for Spring Brook near Warrenville, Illinois, U.S. Geological Survey Water Supply Paper 2455, 35 p. (Also available at https://pubs.er.usgs.gov/publication/wsp2455)

U.S. Environmental Protection Agency, 2017, BASINS 4.1.1 (Better Assessment Science Integrating point and Non-point Sources) Modeling Framework, National Exposure Research Laboratory, RTP, North Carolina, accessed August 20, 2020, at https://19january2017snapshot.epa.gov/exposure-assessment-models/basins-download-and-installation_.html