SSO 700 IWAP
Task 2.7.1 Watershed Collection System Hydraulic Models Gap Analysis and Update Assessment

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Executive Summary

The SSO 700 Integrated Watershed Action Plan (IWAP) project includes review and assessment of the Metropolitan Sewer District of Greater Cincinnati's (MSDGC's) current Mill Creek System-Wide Model to evaluate its representation of the SSO 700 watershed and its applicability to support development of the IWAP. A validated and calibrated hydraulic model is required to support the IWAP. MSDGC's System-Wide model was originally calibrated using flow monitor data collected during the spring of 2001 representing a wet, spring condition. To understand the calibration and validation deficiencies in the current model, the model must be validated to assess its ability to simulate the observed conditions in the collection system. The model validation process included assessing the ability of the model to properly account for the amount of infiltration and inflow (I/I) entering the sewer system due to antecedent moisture from changing ground soil moisture conditions and back to back storm events, documenting the manholes within the SSO 700 IWAP study area that are predicted to flood, comparing the representation and operation of SSO 700 Storage & Treatment Facility (STF) in the model against actual field operating data, and comparing SSO and CSO activations recorded by MSDGC to model results.

The Mill Creek System-Wide model, provided by MSDGC, was clipped at the downstream boundary of the East Branch Mill Creek (EBMC) sewershed to isolate the SSO 700 IWAP study area. Clipping the model reduces the number of model elements and controls and significantly reduces model runtime. Flow and depth results at select locations throughout the EBMC were compared for the typical year model run for both full Mill Creek System-Wide model and the clipped model to ensure that the clipped model properly represents conditions exhibited in the full system-wide model. After the results were verified and it was confirmed that the clipped model was sufficient for the model validation, model runs were set up to represent each year during the model validation period.

Model results were compared to observed data at 19 flow monitoring locations throughout the EBMC. For a location to be considered validated, it must meet the current *MSDGC Modeling Guidelines and Standards, Revision 3*, dated February 2013 for model calibration and validation for peak flow (+25%, -15%), volume (+20%, -10%), and depth (±15%). Out of the 19 flow monitoring locations selected for validation, all flow monitors had less than 40% of the total events with good data meet MSDGC modeling guidelines for peak flow, volume, and depth. Only three flow monitors (16%) met modeling guidelines for at least 20% of the total events with good data. Eight locations, over 40% of the flow monitors, did not meet modeling guidelines for any events. There was a mix of flow monitors over-predicting and under-predicting flows and depths with no clear correlation among locations within the EBMC or for the model validation year. Additionally, model-predicted SSO and CSO discharges were compared to overflow discharges recorded by

MSDGC during the validation period. In general, the model significantly under-predicted the number of SSO and CSO discharge events and the total volume of CSO discharge. However, the model significantly over-predicted the total volume of discharge from the SSO 700 Storage and Treatment Facility (STF) during the model validation period. In addition to the enumerated SSOs, CSOs, and the SSO 700 STF, the model predicts 68 flooding manholes during the model validation period. Two of the flooding manholes predicted by the model are currently being monitored by MSDGC as potential SSOs.

The results of the model validation illustrate that the current model does not adequately represent observed conditions in the EBMC sewershed and is not sufficient for development of the IWAP. It is recommended that the entire EBMC hydraulic model be recalibrated. The proposed method for recalibration will be presented for approval in an upcoming technical memorandum that will address the model recalibration scope of work and level of effort. Because the current model does not meet calibration standards, model-predicted overflowing manholes and surcharged pipes will likely change as the model is refined. During the model recalibration, the model-predicted overflowing manholes will be field verified and compared to MSDGC's potential SSOs. Also, model-predicted surcharged pipes will be compared to areas of known sewer backups and basement backups to further validate the model.

Section 1.0 – Introduction

The scope of Task 2.7.1 of the SSO 700 IWAP project includes review and assessment of the Metropolitan Sewer District of Greater Cincinnati's (MSDGC's) current Mill Creek System-Wide Model to evaluate its representation of the SSO 700 watershed and its applicability to support development of the Integrated Watershed Action Plan (IWAP). A validated and calibrated hydraulic model is required to support the IWAP. MSDGC's System-Wide model was originally calibrated using flow monitor data collected during the spring of 2001 representing a wet, spring condition. To understand any calibration and validation deficiencies in the current model, the model must be validated to assess its ability to simulate the observed conditions in the collection system. The *Model Validation Period Selection Technical Memorandum,* dated 02/27/2015, is included as Appendix A of this technical memorandum. It describes how flow monitoring data and rainfall data were selected to validate the current system-wide model for the SSO 700 study area. In addition to simply running the model for selected rainfall periods and comparing the results to collected data, the model validation process also included the following:

- Assess the ability of the model to properly account for the amount of infiltration and inflow (I/I) entering the sewer system due to antecedent moisture from changing ground soil moisture conditions and back to back storm events.
- Document the manholes within the SSO 700 IWAP study area that are predicted to flood during the typical year of rainfall by the current hydraulic model. Flooding of manholes will be field verified once the model meets MSDGC's current calibration and validation standards.
- Compare the representation and operation of SSO 700 Storage & Treatment Facility (STF) in the model against actual field operating data to validate if the hydraulic model accurately represents the STF field operations, flows, and volumes.
- Compare SSO and CSO activations documented in MSDGC's monthly SSO reports and annual CSO reports, respectively, to model results.

The results of these comparisons will inform the recommendations for update and recalibration of the model for the SSO 700 IWAP project.

The purpose of this technical memorandum is to document the results of the model assessment and validation and provide recommendations for recalibration of the SSO 700 IWAP project model. This document describes development and preparation of the model that will be used for the validation, presents results of the model validation, and provides recommendation for a path forward.

Section 2.0 – Model Extraction and Comparison

Existing Model

The current Mill Creek System-Wide Model (Mill Creek.inp) was provided by MSDGC to the project team on January 15, 2015. No version number or version date accompanied the model file. The model area covers the entire Mill Creek basin.

Dry weather flow is generated in the current Mill Creek model by applying an average flow associated with an inflow node to weekday and weekend diurnal patterns. Generally, there are separate diurnal patterns associated with different sewersheds. Wet weather flow is generated in the model using yearly RTK values. Additionally, wet weather flow is generated based on runoff area for combined portions of the model.

CH2M will be performing all hydraulic collection system modeling for the IWAP project in PCSWMM by Computational Hydraulics Int. (CHI). The modeling performed for the model validation was completed using EPA SWMM version 5.1007.

Model Extraction

The computing time of the typical year model scenario for the Mill Creek model is approximately 6 days on a typical desktop workstation. It is inefficient and unnecessary to use the full Mill Creek model to perform the modeling tasks required for the SSO 700 IWAP. Therefore, the Mill Creek basin model was clipped at appropriate locations to generate a clipped, project model. The clipped model has fewer nodes and links, reducing model simulation time. In order to make sure the clipped model properly represents the original model within the study area, results from the clipped model were compared to the original model for the typical year.

The Inventory and Gap Analysis Technical Memorandum, dated 3/9/2015, describes the process used to develop the SSO 700 IWAP study area boundary. The study area aligns closely with the East Branch Mill Creek (EBMC) sewershed. The EBMC is an upstream sewershed within the Mill Creek, and flows from the entire sewershed are directed to the Mill Creek interceptor, which crosses the downstream sewershed boundary at a single location. Thus, the model only required clipping at one location on the downstream end of the sewershed.

Ideally, the model would be clipped at a location meeting at least one of the following criteria:

1. A flow monitoring location with available flow data for the entire model validation period, or
2. A location with no surcharge exhibited during the typical year model run such that the location clipped could be represented as a free-outfall.

Neither of these criteria could be met. Flow monitoring data (MC-EB-030) was available for one manhole along the Mill Creek interceptor near the downstream end of the EBMC (MH 40001012); however, data were not available for all selected model validation periods (as discussed in detail in the *Model Validation Period Selection Technical Memorandum* and summarized in Section 4.0 of this TM). Further, for the typical year model run, the entire Mill Creek interceptor downstream of SSO 700 exhibited surcharge during wet weather events.

Just downstream of the EBMC, the West Branch Mill Creek (WBMC) sewershed ties into the Mill Creek interceptor. The EBMC was clipped between MH 40001012 representing flow monitor MC_EB-030 and the location that the WBMC ties into the Mill Creek interceptor. Clipping the downstream end of the study area model between these two locations allows for MC-EB-030 to be used in the model assessment and validation (even though sufficient data isn't available at the location for use as the downstream boundary condition) and ensures that model representing the flow in the study area does not include inflows from other sewersheds. MH 40001003 was selected as the clipping location. Figure 2-1 shows the resulting EBMC model area.

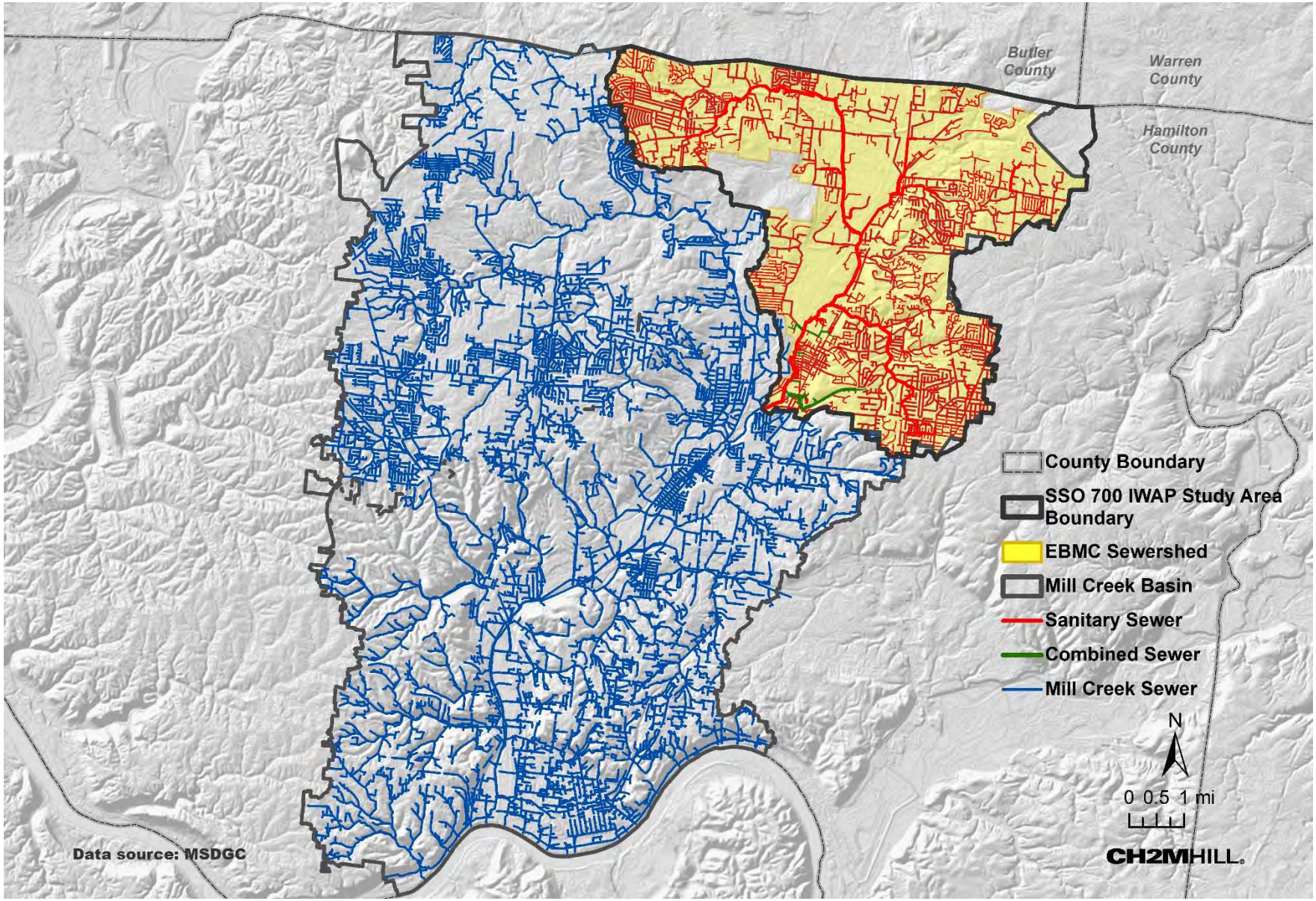


FIGURE 2-1
EBMC Model Area

The location selected as the downstream boundary for the EBMC clipped model is a location that exhibits frequent surcharge during wet weather according to the Mill Creek typical year model run. This is corroborated by available flow and depth data at nearby locations. Therefore, a boundary condition must be added to the downstream end of the EBMC clipped model to represent the depth that would likely occur at the clipping location due to conditions in the interceptor downstream of the EBMC clipped model. Because flow and depth data was not available for the entire model validation period, the depth timeseries at MH 40001003 for the typical year model run was used as the boundary condition for each model validation year. Figure 2-2 shows the depth timeseries at MH 40001003 for the typical year model run.

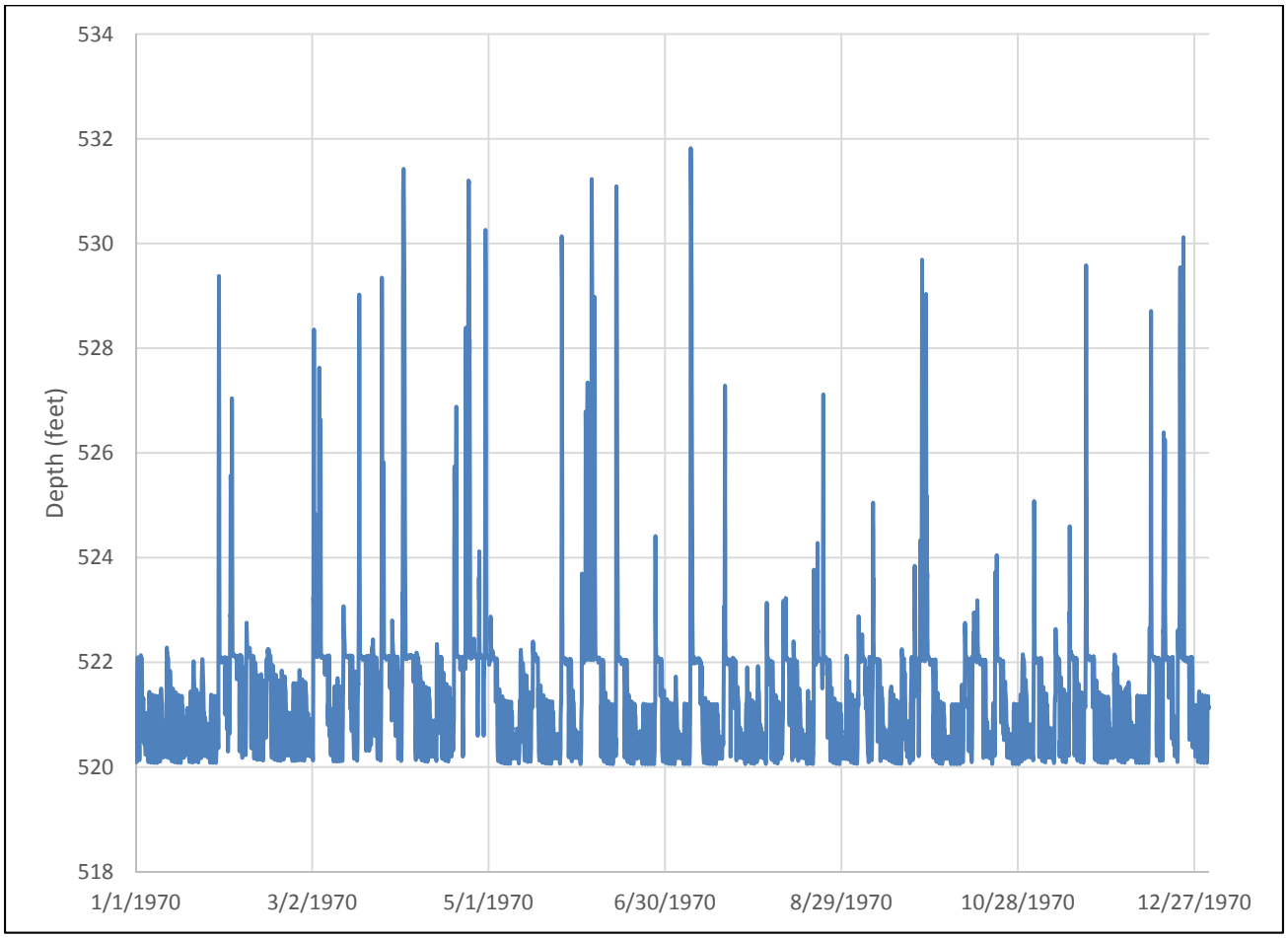


FIGURE 2-2
Typical Year Depth at MH 40001003

The model network was physically clipped by selecting the downstream boundary clipping manhole in the model and using the model trace tool to trace upstream since the entire area upstream of that manhole is included in the EBMC clipped model. All model components upstream of MH 40001003 were retained in the clipped model, including model conduits, junctions, SSO and CSO outfalls and operations, and the SSO 700 Storage & Treatment Facility (STF). The real-time controls set-up at SSO 700 STF were also retained in the clipped model. A comparison of the number of model conduits, total length of conduits, and total number of junctions for the Mill Creek model and the EBMC clipped model is summarized in Table 2-1. The extracted model network is shown in Figure 2-3.

The clipped model was reviewed to verify the model was clipped and extracted properly without accidental deletion of model components and the remaining model components represent the original model network. The results of this review are provided in the following section.

TABLE 2-1
Comparison of Mill Creek Model and EBMC Clipped Model

Items	Mill Creek Model	EBMC Clipped Model
Total Number of Model Links	29,885	4,736
Total Length of Model Links (miles)	1,033	196
Total Number of Model Junctions	29,517	4,685

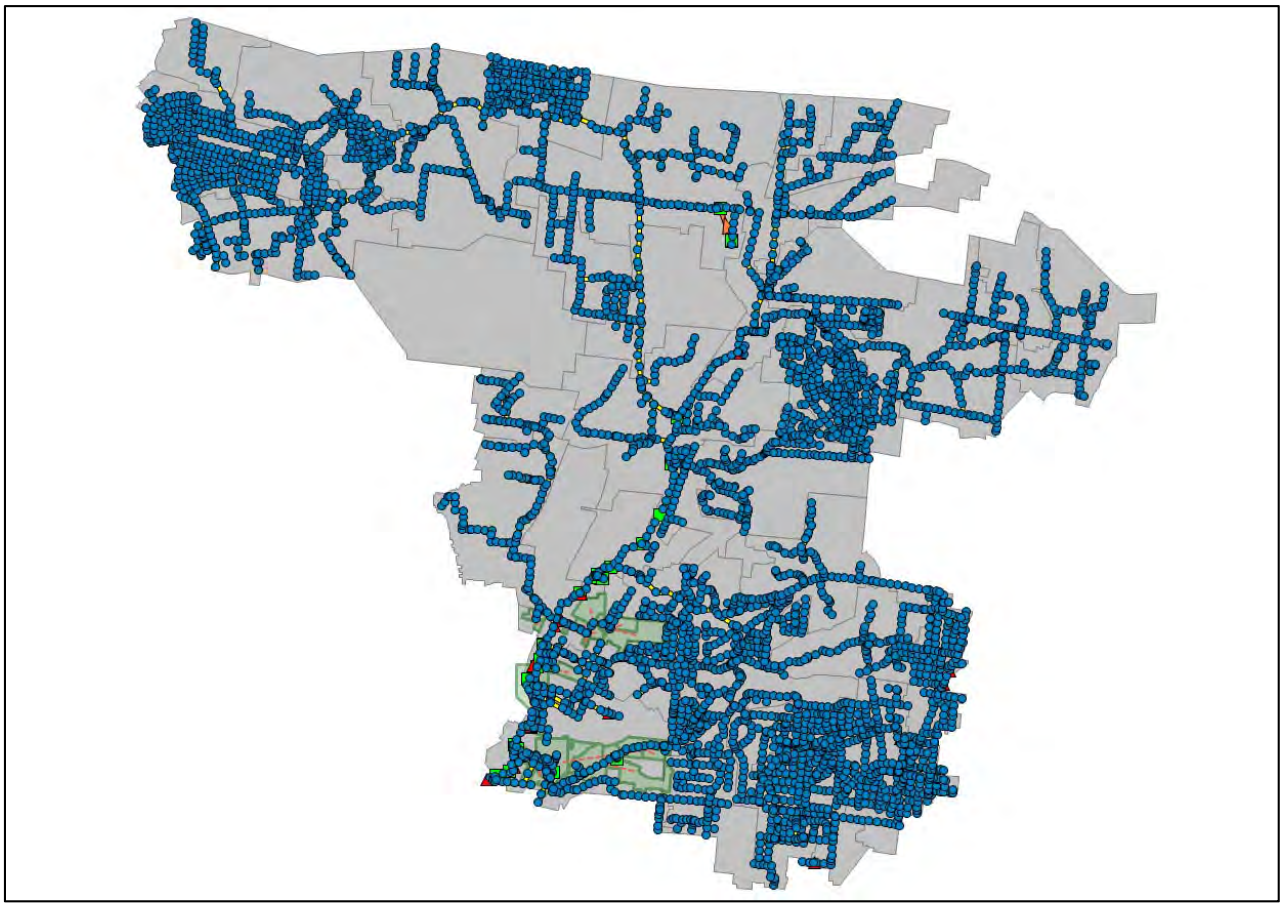


FIGURE 2-3
Extracted Model Network

Hydraulic Comparison

The full system-wide model and the clipped model were run for the typical year rainfall, and flows and depths were compared at selected flow monitoring locations throughout the EBMC sewershed, including MC-EB-030 (representing flow in the interceptor near the downstream end of the EBMC), MC-EB-019 (representing flow in the interceptor upstream of the SSO 700 STF), MC-EB-017 (representing flow into the interceptor from the west), and MC-EB-016 (representing flow into the interceptor from the east). Inflow and depth comparison plots are shown in Figures 2-4 through 2-11 below.

The simulated flows in the clipped model match the flows in the Mill Creek model at the four selected flow monitoring locations. The water depths have small differences at one monitoring location, MC-EB-019, but the differences are negligible for the purpose of this study. It can be concluded that the clipped model is verified and representative of the Mill Creek model.

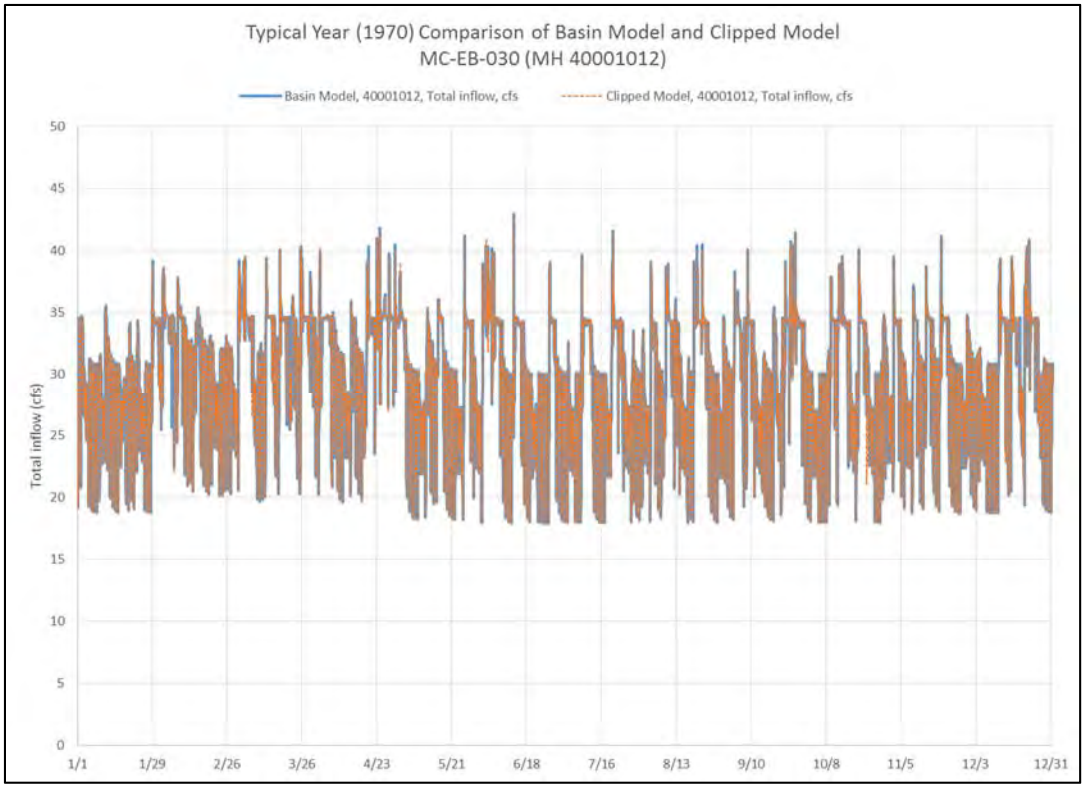


FIGURE 2-4
Total Inflow Comparison, MC-EB-030 (MH 40001012)

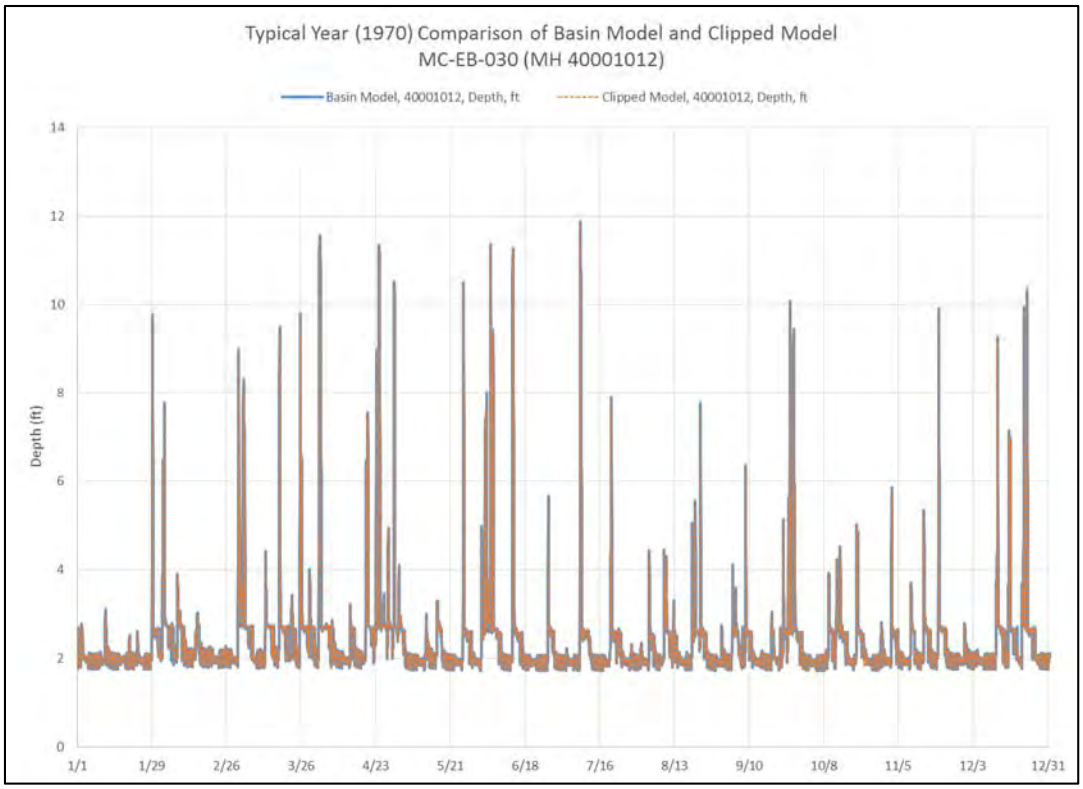


FIGURE 2-5
Depth Comparison, MC-EB-030 (MH 40001012)

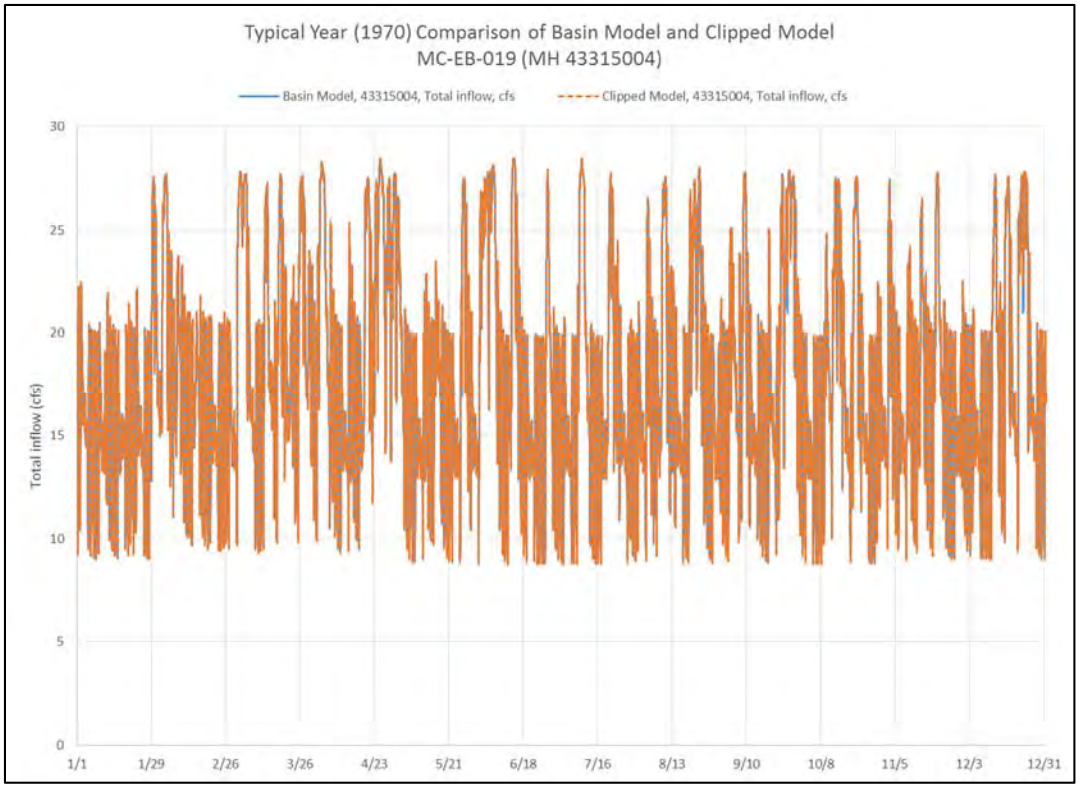


FIGURE 2-6
Total Inflow Comparison, MC-EB-019 (MH 43315004)

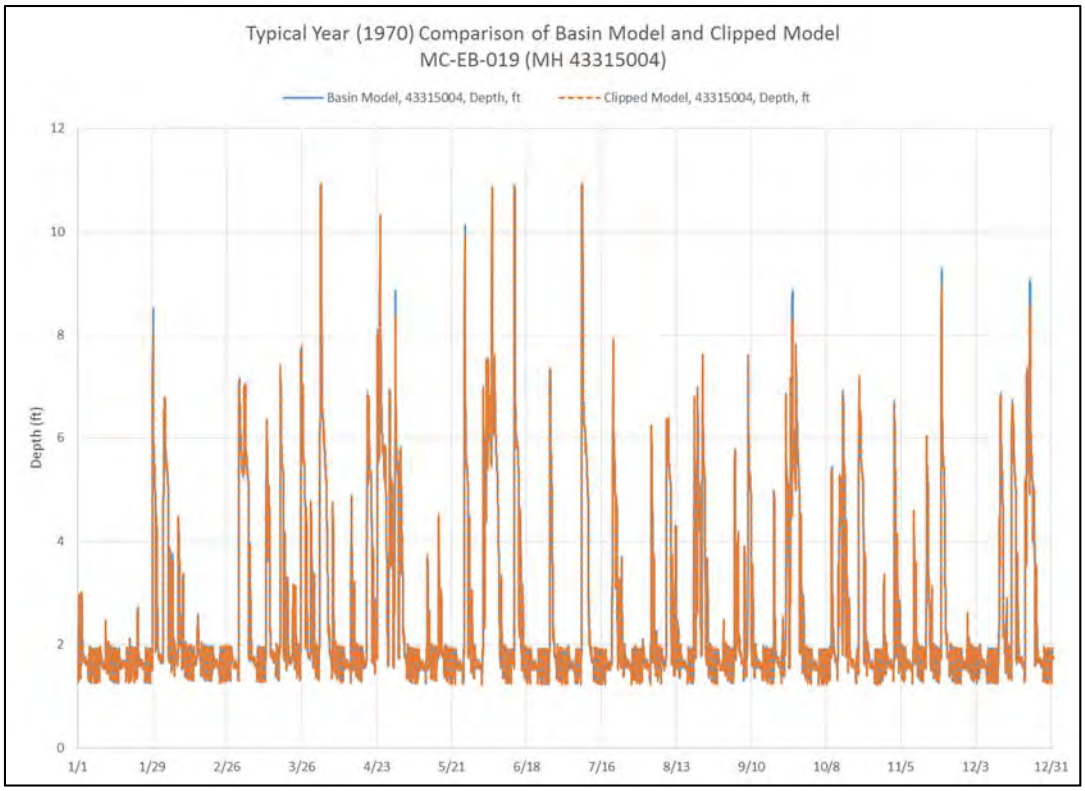


FIGURE 2-7
Depth Comparison, MC-EB-019 (MH 43315004)

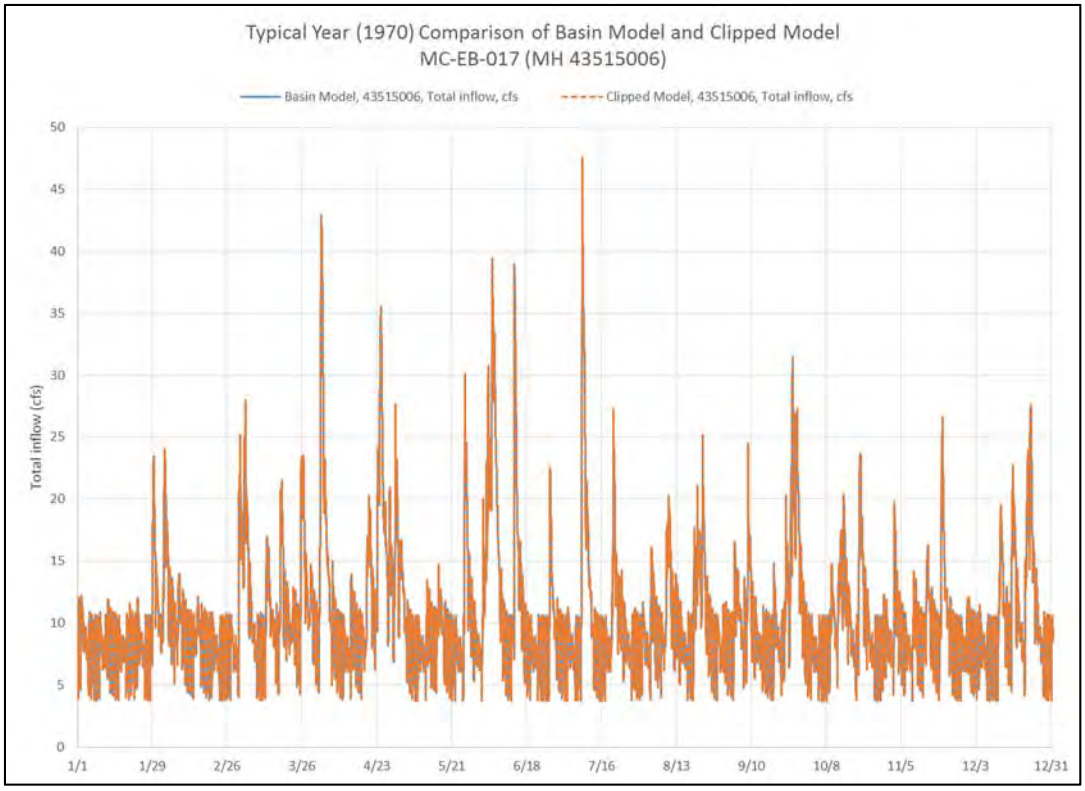


FIGURE 2-8
Total Inflow Comparison, MC-EB-017 (MH 43515006)

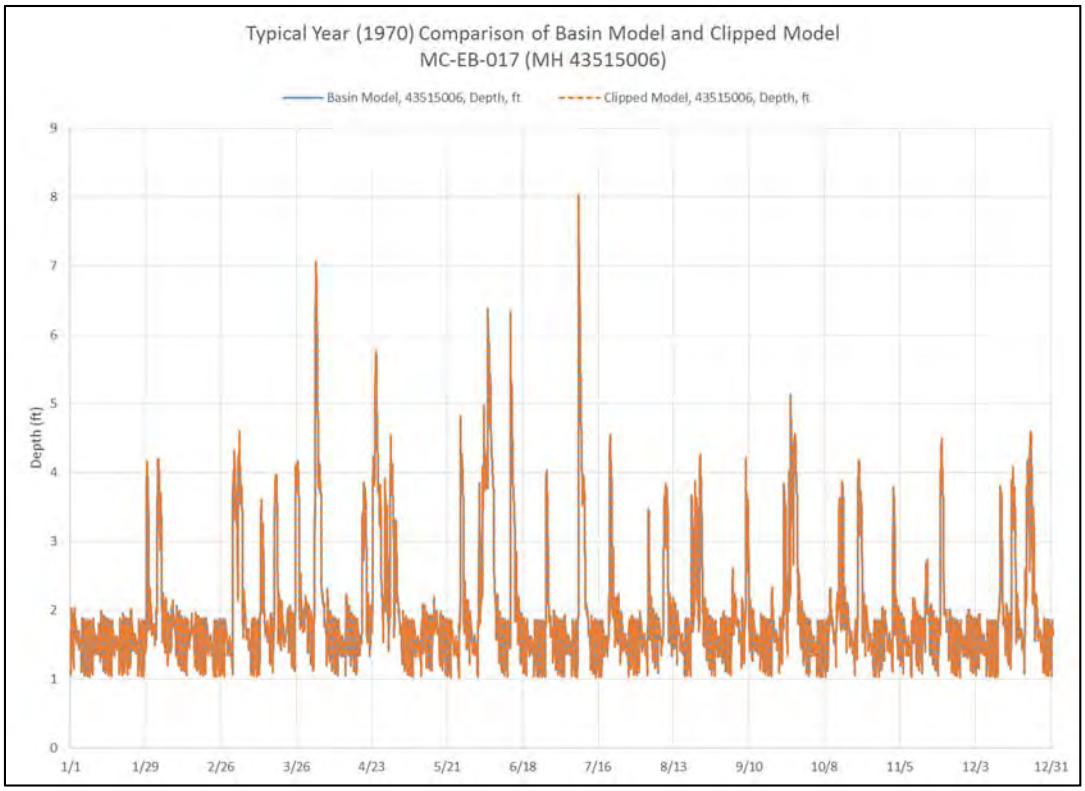


FIGURE 2-9
Depth Comparison, MC-EB-017 (MH 43515006)

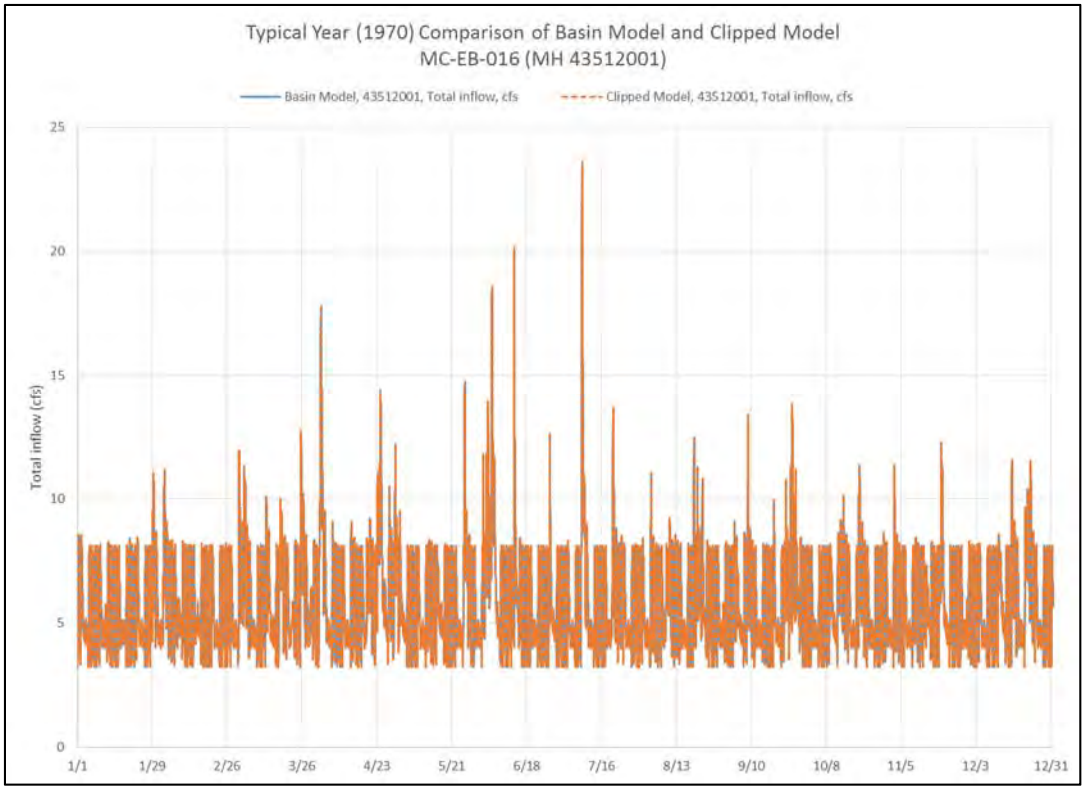


FIGURE 2-10
Total Inflow Comparison, MC-EB-016 (MH 43512001)

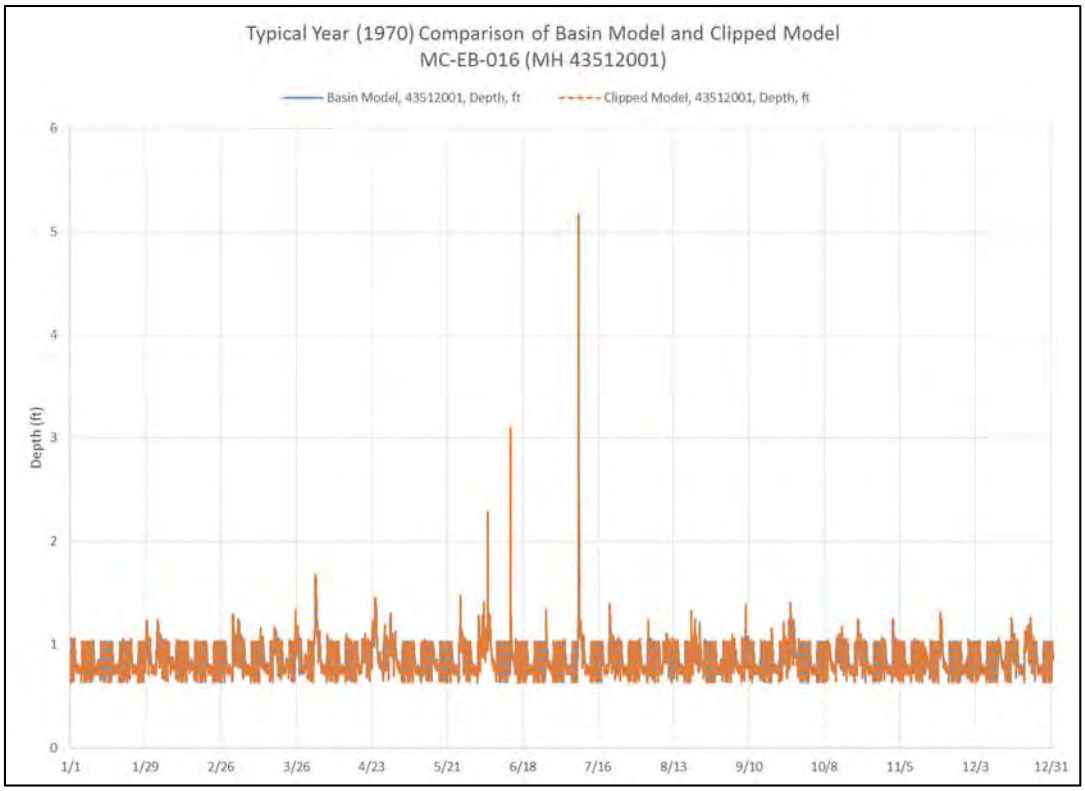


FIGURE 2-11
Depth Comparison, MC-EB-016 (MH 43512001)

Section 3.0 - Model Preparation

Flow monitoring data and rainfall data were collected for 2006 to present. These data were reviewed to identify the validation period for each flow monitor, as discussed in detail in the *Model Validation Period Selection Technical Memorandum*. Validation periods were selected for each flow monitor based on the availability and quality of data. Yearly model runs were set-up for the selected model validation periods: 2006, 2007, 2008, 2009, 2010, 2011, and 2012.

Rainfall Data

The Mill Creek model provided by MSDGC used rain gauge data in the model set-up. There is a rain gauge for each sewershed, and the rain gauges for the sewersheds within the EBMC were retained in the clipped model.

Gauge-adjusted radar rainfall (GARR) data was available for 2006 – 2012 by sewershed for the MSDGC service area. These data were collected from the Vieux Inc. website (http://www.vieuxinc.com/rainvieux.htlm) and MSDGC directly. The rainfall data by sewershed for this time period were applied to the sewershed rain gauges in the model.

Flow Parameters for Previously Calibrated Sewersheds

In 2011, MSDGC and CH2M HILL performed a study piloting a model calibration and validation method, which included development of a yearly dry weather flow pattern (this pattern included sanitary flow and groundwater infiltration), yearly RTK sets, and monthly initial abstraction (IA) values. The pilot was performed for three sewersheds within the EBMC: MC-EB-004, MC-EB-031, MC-EB-035 (at the time of the pilot study, referred to as MC-EB-023, MC-EB-014, and MC-EB-036, respectively). Each sewershed was calibrated to a year of data as follows:

- MC-EB-004: 2008
- MC-EB-031: 2007
- MC-EB-035: 2009

The study showed that the piloted calibration method provided a significant improvement in model calibration, as documented in the *Rainfall Dependent Inflow and Infiltration Pilot Study Results Technical Memorandum*. This method resulted in a calibration that met the Wastewater Planning Users Group (WaPUG) model calibration guidelines for peak flow and volume, which were used by MSDGC at the time of the pilot study. Because the work had already been completed and met the calibration guidelines, the calibrated values were leveraged for the IWAP model validation runs. The values in the clipped model were replaced with the calibrated values from the pilot study model for each calibrated sewershed for the model run representing the validation period for each sewershed. The diurnal patterns and the average dry weather inflow for each junction within the sewershed were replaced with the yearly dry weather flow pattern and the average dry weather inflow from the pilot study model. The average dry weather inflows in the individual pilot study sewersheds were then scaled by the same factor to account for the difference in the total dry weather inflow between the pilot study model and the current Mill Creek model. The yearly RTK sets within the sewershed were also adjusted, and the monthly IA values were added.

Boundary Conditions

As discussed in Section 2.0, the model was clipped at the downstream end of the EBMC sewershed at MH 40001003. The depth (head) at the manhole for the typical year run was imported to the model as a time series and used as the boundary condition since observed depth data was unavailable.

Flow Data

Flow data (flow, depth, and velocity) were obtained for the flow monitors within the EBMC that met specific criteria and were ultimately selected for the model assessment and validation, as outlined in the *Model Validation Period Selection Technical Memorandum*. These data were collected from the FlowWorks website (www.flowworks.com) and from MSDGC. The flow and depth data for the model validation period selected for each flow monitor were imported to the model as time series. This allowed for the comparison of observed and simulated results directly within PCSWMM.

Operations/Controls

All controls from the Mill Creek model for elements within the EBMC were retained in the clipped model. The only controls within the EMBC portion of the model were those associated with the SSO 700 STF. These controls, listed in Table 3-1, were used for all of the model validation runs.

TABLE 3-1

SSO 700 STF Model Control Rules

RULE SSO700_HRT1 IF NODE SSO700Tank2 DEPTH > 14 AND NODE SSO700Tank3 DEPTH > 20 THEN PUMP PUMP18@SSO700Tank2-43308034 status = ON PRIORITY 0
RULE SSO700_HRT2 IF NODE SSO700Tank2 DEPTH < 10 AND NODE SSO700Tank3 DEPTH > 20 THEN PUMP PUMP18@SSO700Tank2-43308034 status = OFF PRIORITY 0
RULE SSO700_HRT3 IF NODE SSO700Tank3 DEPTH < 20 THEN PUMP PUMP18@SSO700Tank2-43308034 status = OFF PRIORITY 0
RULE SSO700_LEVEL1 IF NODE 43308014 DEPTH > 5 THEN ORIFICE ORIFICE126@43308015-43308015A setting = 0 PRIORITY 0
RULE SSO700_LEVEL2 IF NODE 43308014 DEPTH < 5 THEN ORIFICE ORIFICE126@43308015-43308015A setting = 1 PRIORITY 0
RULE SSO700_SLUDGE IF NODE 43308014 DEPTH < 5 THEN ORIFICE ORIFICE135@43308038-43308038A setting = 1 AND ORIFICE ORIFICE2@43308038-43308038B setting = 0 ELSE ORIFICE ORIFICE135@43308038-43308038A setting = 0 AND ORIFICE ORIFICE2@43308038-43308038B setting = 1 PRIORITY 0

TABLE 3-1

SSO 700 STF Model Control Rules

RULE SSO700_SLUDGEPUMP IF PUMP PUMP18@SSO700Tank2-43308034 status = ON THEN PUMP PUMP19@SSO700Tank2-43308038 status = ON ELSE PUMP PUMP19@SSO700Tank2-43308038 status = OFF PRIORITY 0
RULE SSO700_TANKDRAIN1 IF LINK WEIR25@43308015-43308027 FLOW > 0 OR NODE 43308014 DEPTH > 5 THEN ORIFICE ORIFICE129@SSO700Tank1-43308020 setting = 0 ELSE ORIFICE ORIFICE129@SSO700Tank1-43308020 setting = 1 PRIORITY 0
RULE SSO700_TANKDRAIN2 IF NODE SSO700Tank1 DEPTH > 0.05 THEN ORIFICE ORIFICE128@SSO700Tank2-43308021 setting = 0 ELSE ORIFICE ORIFICE128@SSO700Tank2-43308021 setting = 1 PRIORITY 0
RULE SSO700_TANKDRAIN3 IF NODE SSO700Tank2 DEPTH > 0.05 THEN ORIFICE ORIFICE127@SSO700Tank3-43308022 setting = 0 ELSE ORIFICE ORIFICE127@SSO700Tank3-43308022 setting = 1 PRIORITY 0

Section 4.0 - Model Assessment

Methodology

Flow data were available for 78 monitor locations throughout the EBMC sewershed over varying time periods. An initial review and screening of the data involved elimination of flow monitors and flow data that did not meet two basic criteria:

1. **Data must be collected after January 2006:** GARR data were only provided by MSDGC beginning January 2006; therefore, flow data collected prior to 2006 were not reviewed and were not be used for the hydraulic model gap analysis.
2. **Monitors must have at least one year of continuous data:** The model was evaluated at each flow monitor location for a year-long period using a continuous model simulation. A continuous model simulation ensures that antecedent groundwater conditions are considered during simulation of the wet weather events. Therefore, any monitors that did not have one year of continuous data were not used to validate the model.

This initial screening eliminated 59 monitors from consideration. The 19 remaining flow monitors were selected for use in the model assessment and validation, as discussed in the *Model Validation Period Selection Technical Memorandum*. Figure 4-1 shows an overview of the EBMC sewershed with the flow monitors selected for validation and the SSOs and CSOs. Figure 4-2 shows the bubble diagram, or the hydraulic relationship, between the selected flow monitors and the SSOs and CSOs.

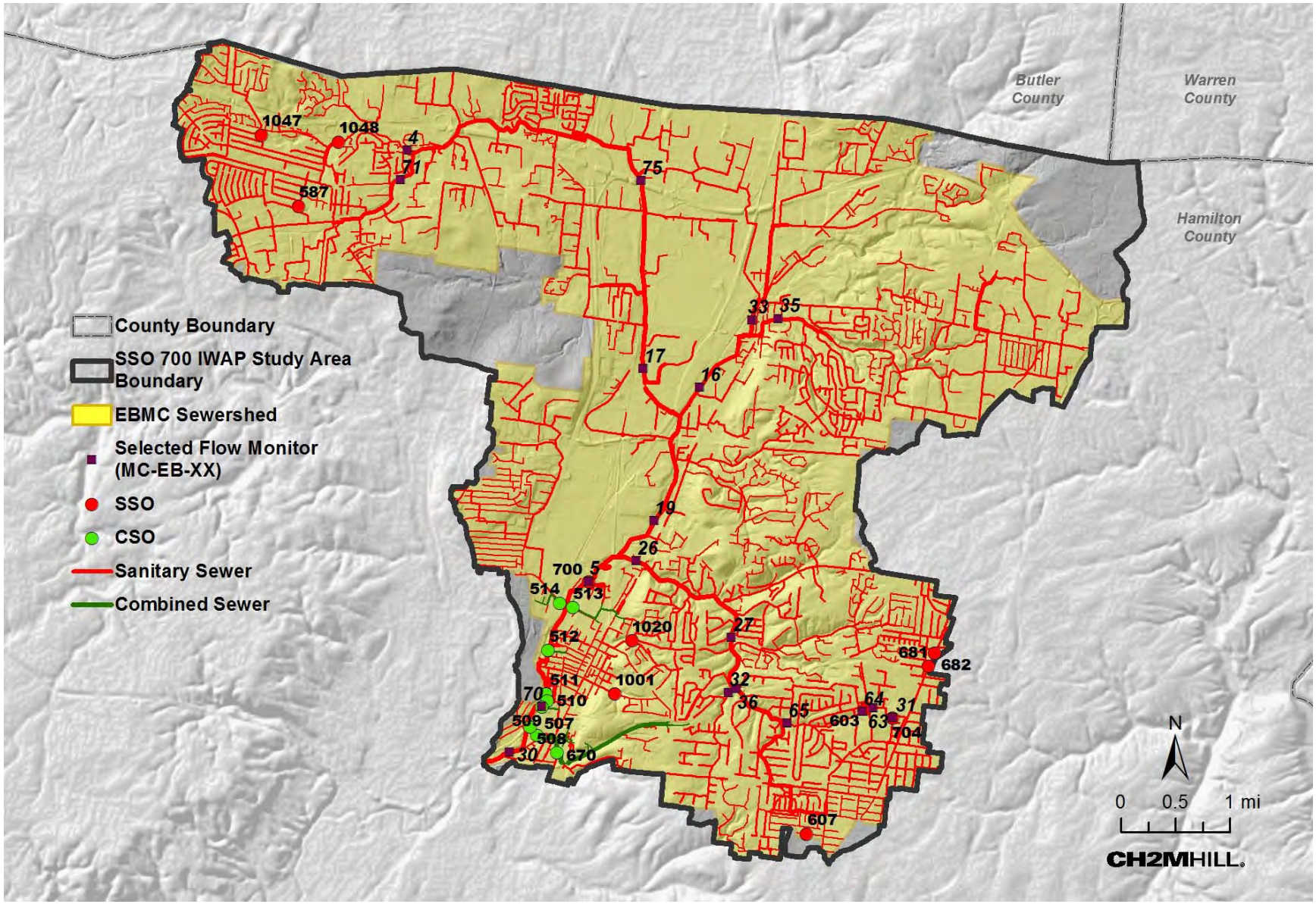


FIGURE 4-1
EBMC Overview Map

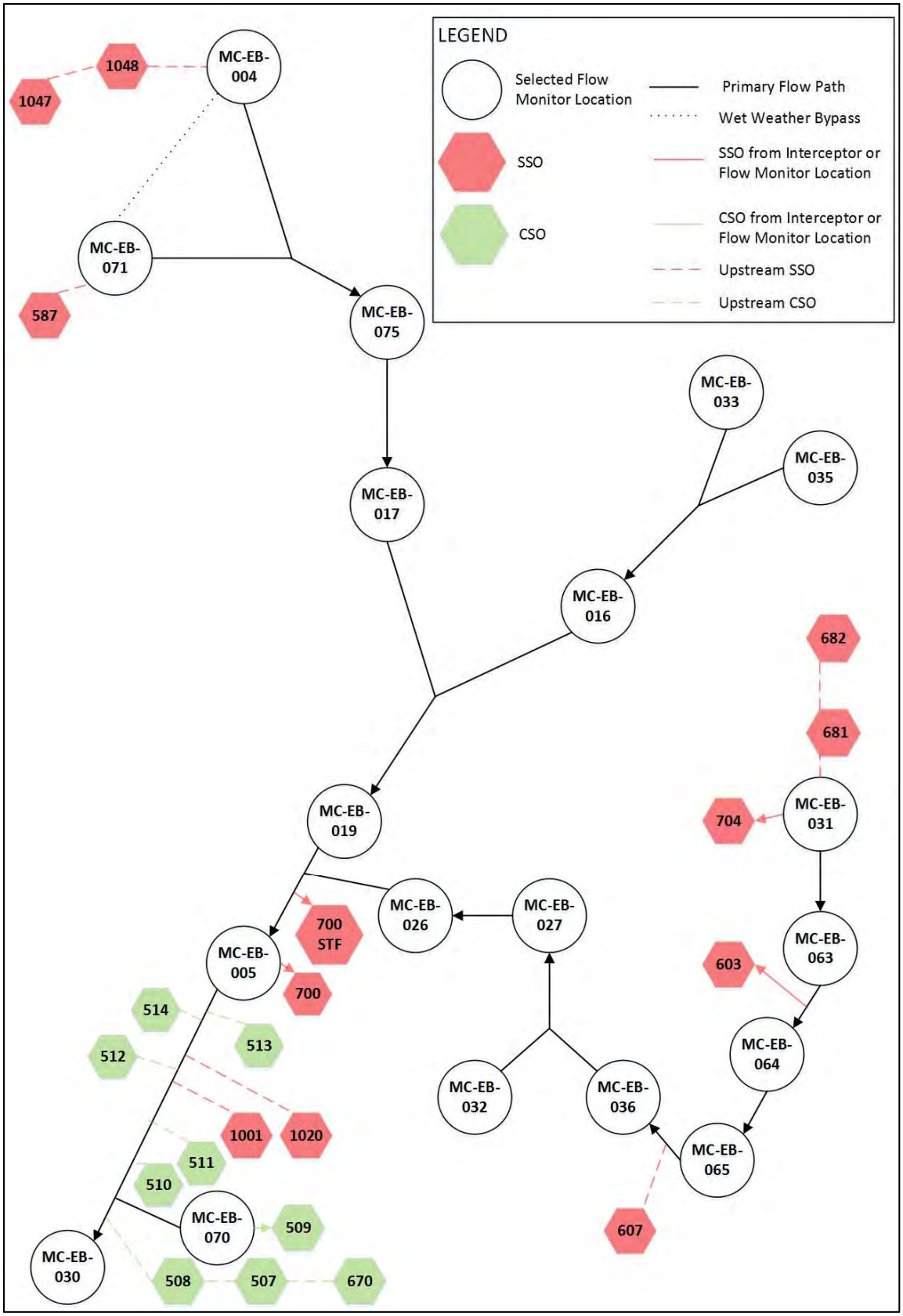


FIGURE 4-2
EBMC Flow Monitor Bubble Diagram

The available flow data for each of the remaining monitors were reviewed to determine the best model validation period for that monitor. The model validation period selected for each monitor was based on the following criteria:

- **Dataset for validation period is as complete and accurate as possible**: The dataset contained no large periods of missing data or clearly inaccurate data such as dropouts or flatlines. (Flatlines are identified by a constant value over a period of time generally caused by debris stuck on the probe.)
- **Dataset for validation period contained at least one wet weather event per month where the monitor exhibited a reasonable response to the rainfall**.
- **Dataset for validation period contained a combination of event durations and rainfall depths** (i.e., combination or back-to-back wet weather events, large events, medium events, small events, etc.)

A common validation period could not be selected for all monitors due to data quality and availability since there was not one continuous year in which all monitors had available data. Additionally, three of the flow monitors (MC-EB-004, MC-EB-031, and MC-EB-035, which correspond to monitors MC-EB-023, MC-EB-014, and MC-EB-036, respectively, as named during the time of the RDII pilot study) were evaluated and calibrated as part of the Pilot RDII Study conducted in 2011. A similar approach was used for that task to review and identify the model calibration periods. In order to leverage that work, the SSO 700 IWAP hydraulic model validation used the same time periods used for that study for these three flow monitors. Table 4-1 identifies the selected validation period for each flow monitor. Table 4-2 summarizes the flow monitors used in each validation period and provides the percentage of flow monitors using each validation period.

TABLE 4-1
Model Validation Period Selection

Flow Meter	Manhole ID	Model Validation Period
MC-EB-004 [MC-EB-023 from RDII Pilot Study]	39007013	January 2008 – December 2008
MC-EB-005[1]	39804005	January 2011 – December 2011
MC-EB-016	43512001	January 2011 – December 2011
MC-EB-017	43515006	January 2012 – December 2012
MC-EB-019	43315004	January 2011 – December 2011
MC-EB-026	43307006	July 2011 – June 2012
MC-EB-027	44709002	January 2009 – December 2009
MC-EB-030	40001012	January 2009 – December 2009
MC-EB-031 [MC-EB-014 from RDII Pilot Study]	48111019	January 2007 – December 2007
MC-EB-032	44816004	January 2011 – December 2011
MC-EB-033	44307022	January 2012 – December 2012
MC-EB-035 [MC-EB-036 from RDII Pilot Study]	44306022	January 2009 – December 2009
MC-EB-036	44816019	April 2006 – March 2007
MC-EB-063	48110013	January 2009 – December 2009
MC-EB-064	48110002	January 2009 – December 2009
MC-EN-065	4806017	January 2009 – December 2009

TABLE 4-1
Model Validation Period Selection

Flow Meter	Manhole ID	Model Validation Period
MC-EB-070	40010011	January 2010 – December 2010
MC-EB-071	39001020	October 2011 – September 2012
MC-EB-075	43802018	October 2011 – September 2012

(1) Velocity data is unreliable for MC-EB-005 for the entire range of flow data received; therefore, only depth will be compared during model assessment.

TABLE 4-2
Validation Period Summary

Validation Period	Flow Monitors	% of Total Flow Monitors
April 2006 – March 2007	MC-EB-036	5%
January 2007 – December 2007	MC-EB-031	5%
January 2008 – December 2008	MC-EB-004	5%
January 2009 – December 2009	MC-EB-027, MC-EB-030, MC-EB-035, MC-EB-063, MC-EB-064, MC-EB-065	32%
January 2010 – December 2010	MC-EB-070	5%
January 2011 – December 2011	MC-EB-005, MC-EB-016, MC-EB-019, MC-EB-032	21%
July 2011 – June 2012	MC-EB-026	5%
October 2011 – September 2012	MC-EB-071, MC-EB-075	11%
January 2012 – December 2012	MC-EB-017, MC-EB-033	11%

After selection of the model validation periods for each flow monitor, wet weather events were selected throughout the validation period, using a wet weather inter-event time of 6 hours. All wet weather events were identified within a dataset. A wet weather event was defined as a period of rainfall with increased flow above typical dry weather flow exhibited at the flow monitor location. These events were used to compare peak flow, volume, and depth of flow between the observed data and the modeled data to determine model performance. The calibration and validation (C&V) criteria used for model validation follow *MSDGC Modeling Guidelines and Standards Volume 1 System Wide Model, Revision 3, dated February 2013* and are summarized in Table 4-3. After model validation was completed, it was suggested that the depth calibration/validation criteria be relaxed to absolute values (± 0.33 feet in non-surcharge conditions and -0.33 feet to +1.64 feet in surcharge conditions) from the Wastewater Planning Users Group (WaPUG) *Code of Practice for the Hydraulic Modelling of Sewer Systems, Version 3.001, amended December 2002*. While this criteria would improve depth calibration for some events, it will not change the overall results of the validation and the subsequent recommendations.

TABLE 4-3
Model Validation Criteria

Criterion	Description
Peak Flow	-15 to +25% of observed flow
Total Flow Volume	-10 to 20% of observed flow
Depth of Water	-15 to + 15% of observed flow
Shape	The shape of predicted hydrographs should closely follow the observed one

Flow Monitor Validation Results

This section summarizes the model validation results at each flow monitoring location. The sub-section for each flow monitor includes a table summarizing each event identified during the model validation period and provides the percent difference between the modeled and observed peak flow, volume, and peak depth. The events for each flow monitor were given an event ID according to the quality of flow and depth data exhibited during the event. Events with a numerical ID exhibit good flow and depth data quality and will be used to validate performance of the model. Events with an alphabetical ID exhibit poor data quality and will not be used to validate performance of the model. The events exhibiting poor data quality are categorized as such due to flow and/or depth dropouts and snowmelt. Though snowmelt data is accurate, the events caused by snowmelt are categorized as poor quality for the purpose of model calibration and validation because MSDGC desires a model that represents flows during the growth period, not a model that represents snowmelt.

A tabular summary is provided for each flow monitor indicating the percent difference between the observed and model results for peak flow, volume, and peak depth. The tables provide information for all events identified during the validation period: both numerical (good quality data events) and alphabetical (poor quality data events). The good quality data events meeting MSDGC's C&V guidelines for all three parameters are shaded in green, and the poor quality data events are shaded in gray. Events meeting C&V guidelines for peak flow and volume, but not depth, are shaded in yellow. The model results for the good quality, numerical events are summarized to provide an overall assessment of how the model performed at the flow monitoring locations. Peak flow, volume, and depth scattergraphs are also provided. The scattergraphs include the C&V guideline envelopes according to the MSDGC C&V guidelines that were provided in Table 4-3. Points above the 0% line represent the events in which the model is over-predicting relative to the observed data, and points below the 0% line represent events in which the model is under-predicting relative to the observed data. Appendix B provides the flow and depth hydrographs for each flow monitor for their respective validation period.

Monitor MC-EB-004

The model validation period for MC-EB-004 is January 2008 – December 2008. Eighteen (18) total events were identified during the validation period, and all 18 are considered to have good data. Of the 18 events with good data, 22% (4 events) met MSDGC's C&V guidelines and standards for peak flow, volume, and depth. Table 4-4 summarizes the events and the C&V results for each. MC-EB-004 was calibrated during the RDII Pilot Study (MC-EB-023). For the pilot study 17 events (94%) met WaPUG guidelines for peak flow and volume. Twelve (12) events (67%), highlighted in yellow and green in the table below, met MSDGC C&V guidelines for peak flow and volume (which are the same as the WaPUG peak flow and volume guidelines used during the pilot study). The remaining five events that were calibrated during the pilot study no longer meet the guidelines for peak flow and volume most likely because of updates to the current version of the model made after the pilot study was performed. Figures 4-3, 4-4, and 4-5 show the peak flow, volume, and peak depth scattergraphs, respectively. The model is generally under-predicting peak flow, volume, and depth at MC-EB-004.

TABLE 4-4
Events and Simulation Results, MC-EB-004

Event	Date	Duration (h)	Difference in Peak Flow (%)	Difference in Volume (%)	Difference in Peak Depth (%)
1	1/7/2008 0:00	408	-2.54	-9.71	-20.94
2	5/2/2008 0:00	120	-14.05	-3.2	-27.82
3	5/7/2008 0:00	576	16.88	-9.46	-11.58
4	6/2/2008 0:00	432	23.95	-15.95	-12.25
5	6/20/2008 0:00	264	-4.88	3.24	-25.55
6	7/2/2008 0:00	120	-26.32	-0.53	-32.78
7	7/7/2008 0:00	264	-40.18	-22.07	-40.02
8	7/19/2008 0:00	216	3.36	0	-20.46
9	8/3/2008 0:00	168	-6.19	-4.81	-19.66
10	8/23/2008 0:00	168	-62.67	-17.51	-51.9
11	9/3/2008 0:00	168	-36.3	-15.58	-33.99
12	9/10/2008 0:00	168	-12.04	0.24	-26.66
13	10/6/2008 0:00	168	11.05	10.09	-4.32
14	10/22/2008 0:00	216	22.75	2.9	-0.32
15	11/11/2008 0:00	216	0.02	-1.79	-9.28
16	11/20/2008 0:00	168	-9.85	-9.8	-21.71
17	12/6/2008 0:00	168	-31.94	-10.19	-30.3
18	12/14/2008 0:00	216	-7.33	-2.36	-27.05

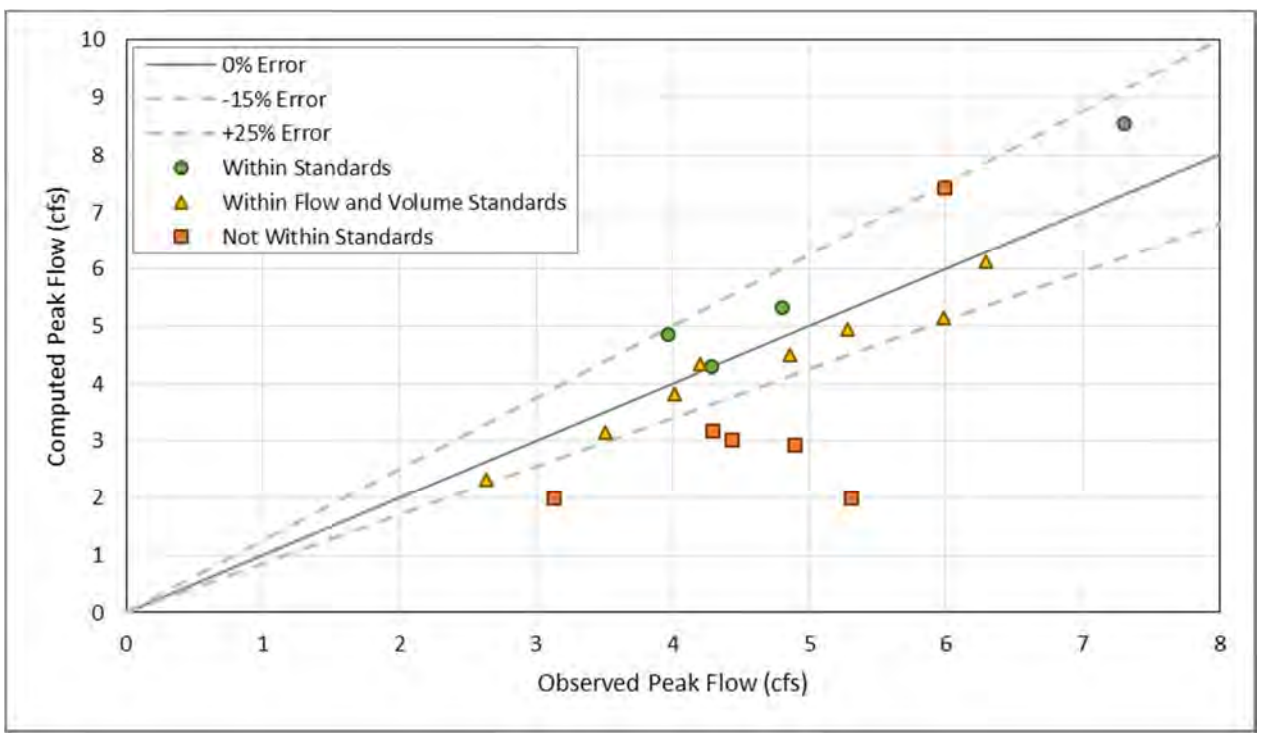


FIGURE 4-3
Scattergraph of Peak Flow, MC-EB-004

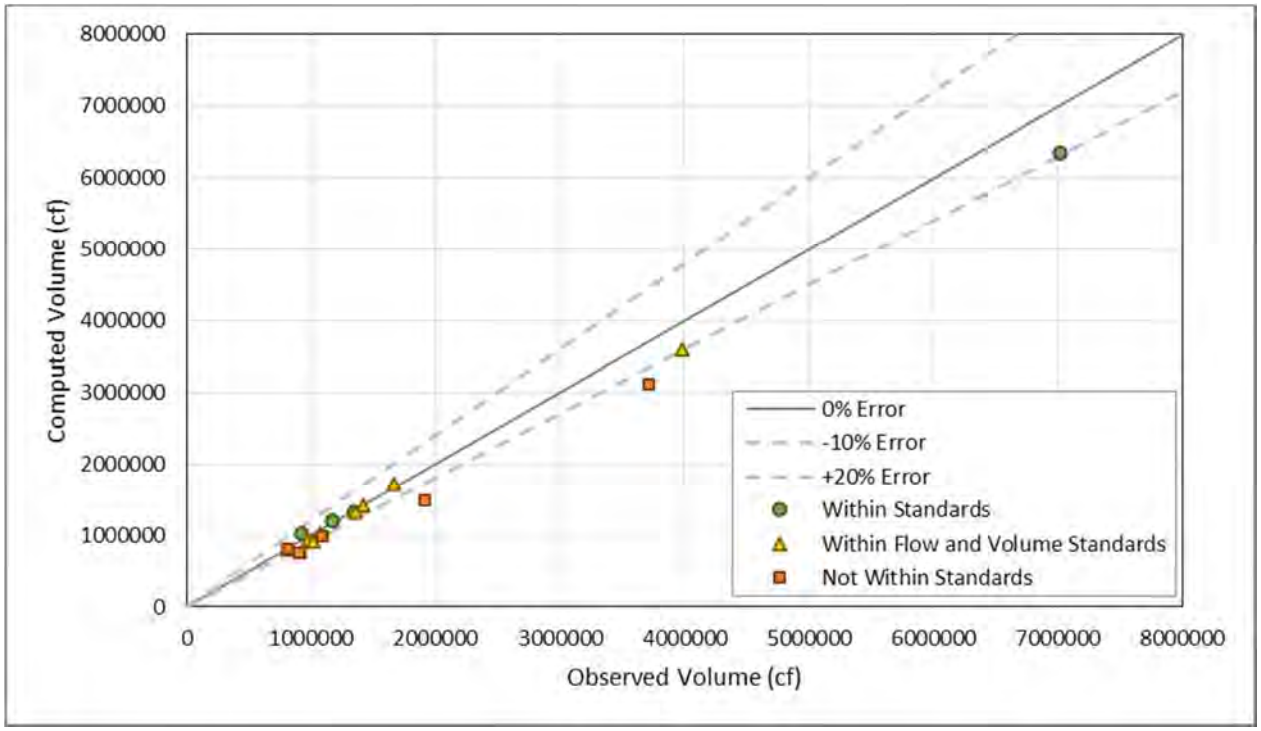


FIGURE 4-4
Scattergraph of Volume, MC-EB-004

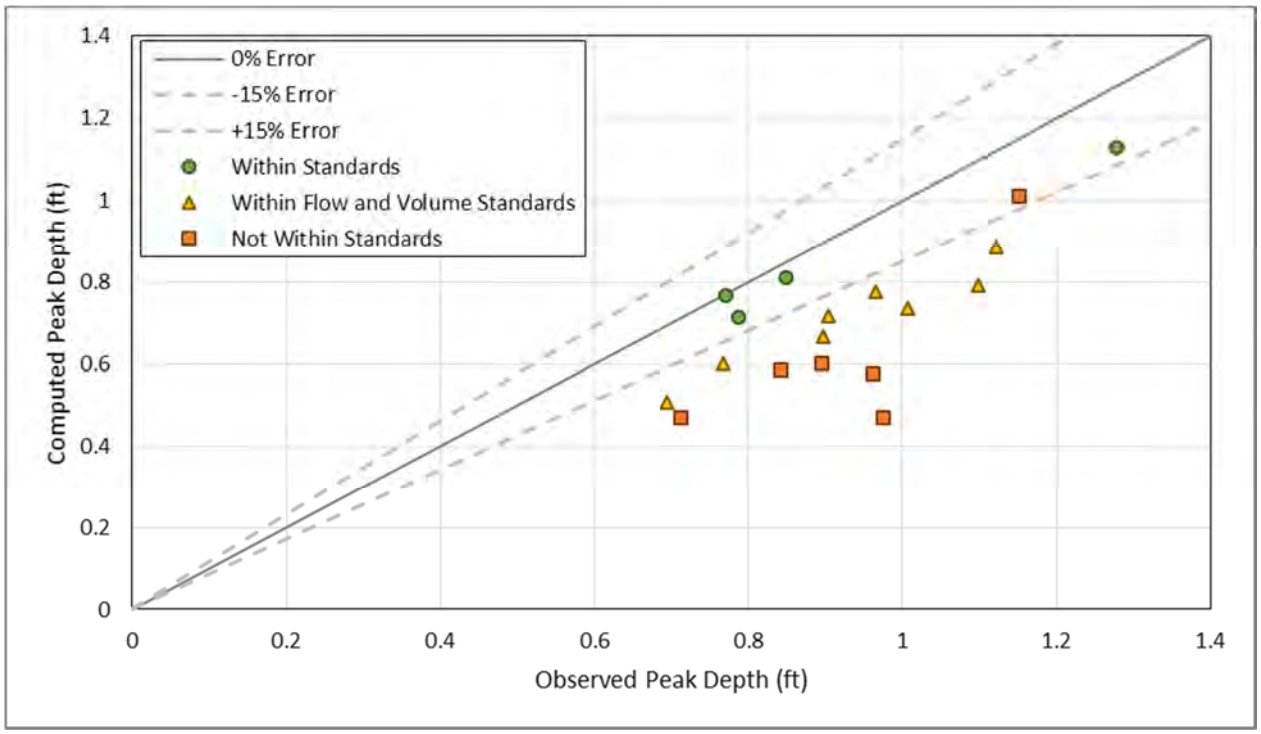


FIGURE 4-5
Scattergraph of Peak Depth, MC-EB-004

Monitor MC-EB-005

The model validation period for MC-EB-005 is January 2011 – December 2011. The observed velocity data at this location was unreliable for the duration of monitoring so only depths were compared. Thirty-six (36) total events were identified during the validation period, and 31 are considered to have good data. Of the 31 events with good data, 35% (11 events) met MSDGC's C&V guidelines and standards for depth. Table 4-5 summarizes the events and the C&V results for each. The model over-predicts some events and under-predicts other events at this location.

TABLE 4-5
Events and Simulation Results, MC-EB-005

Event	Date	Duration (h)	Difference in Depth (%)
1	1/1/2011 1:00	51	-5.58
2	1/18/2011 10:30	12	-31.15
A	2/1/2011 5:00	187	
3	2/21/2011 8:00	250	-48.72
4	3/4/2011 12:00	234	-36.96
5	3/15/2011 6:00	42	-44.27
6	3/18/2011 16:00	38	2.01
B	3/21/2011 16:00	14	
7	3/23/2011 21:00	8	58.75
8	4/4/2011 13:00	107	-32.85
9	4/9/2011 12:00	756	-50.21
10	5/13/2011 15:00	12	4.98
11	5/14/2011 9:00	9	36.19
12	5/15/2011 18:00	6	-21.83
C	5/18/2011 0:00	24	
13	5/22/2011 17:00	175	-17.02
14	6/11/2011 3:00	15	5.89
15	6/15/2011 11:00	13	41.47
16	6/19/2011 15:00	39	13.78
17	6/21/2011 12:00	66	-0.23
18	6/26/2011 0:00	54	3.82
19	7/8/2011 0:00	30	34.9
20	7/24/2011 12:00	24	44.17
21	8/3/2011 4:00	26	28.71
22	8/7/2011 4:00	119	-12.44
23	9/6/2011 18:00	63	32.07
D	9/19/2011 9:00	45	
24	9/23/2011 0:00	146	-40.62
25	9/29/2011 18:00	24	6.82
26	10/19/2011 0:00	144	-6.44
27	10/26/2011 18:00	87	23.77
28	11/4/2011 12:00	66	23.33
29	11/14/2011 18:00	278	2.19

TABLE 4-5
Events and Simulation Results, MC-EB-005

Event	Date	Duration (h)	Difference in Depth (%)
E	12/15/2011 3:00	75	
30	12/19/2011 18:00	156	-35
31	12/27/2011 0:00	105	-26.14

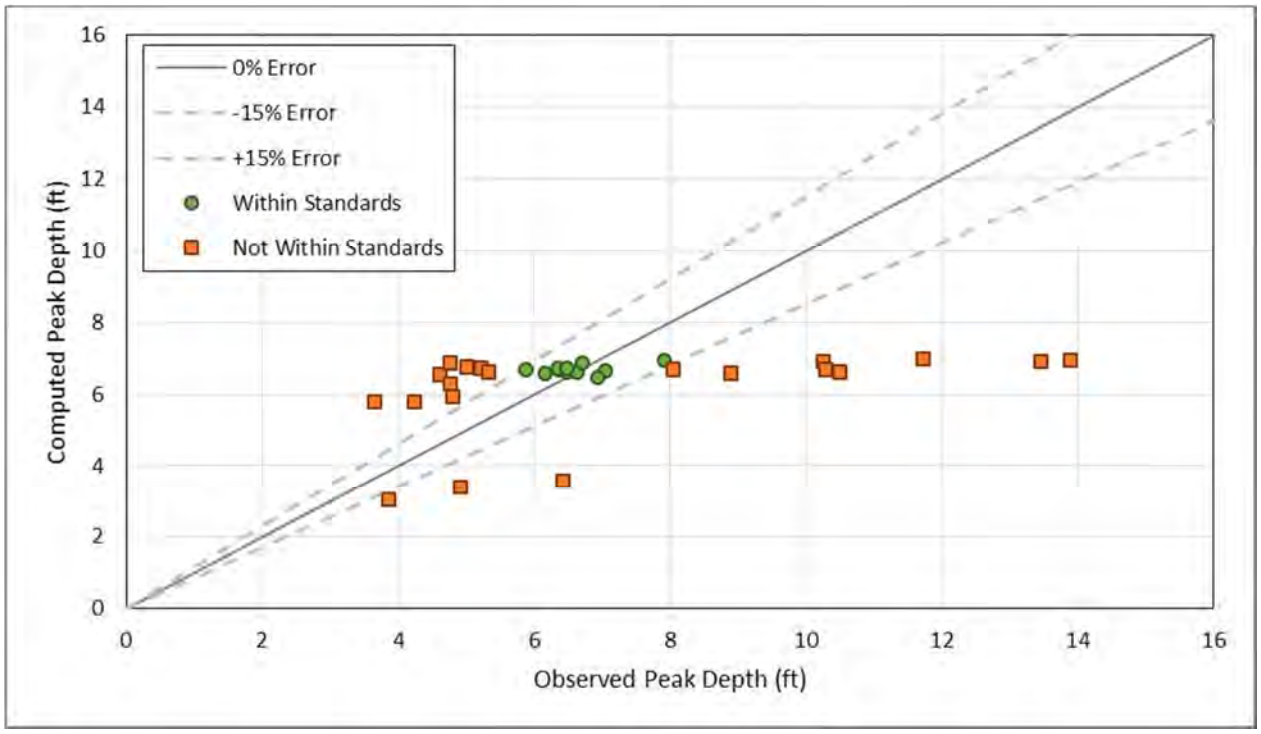


FIGURE 4-6
Scattergraph of Peak Depth, MC-EB-005

Monitor MC-EB-016

The model validation period for MC-EB-016 is January 2011 – December 2011. Forty (40) total events were identified during the validation period, and 39 are considered to have good data. Of the 39 events with good data, 23% (9 events) met MSDGC's C&V guidelines and standards for peak flow, volume, and depth. Table 4-6 summarizes the events and the C&V results for each. Figures 4-7, 4-8 and 4-9 show the peak flow, volume, and peak depth scattergraphs, respectively. The model is generally under-predicting peak flow, volume, and depth at MC-EB-016.

TABLE 4-6
Events and Simulation Results, MC-EB-016

Event	Date	Duration (h)	Difference in Peak Flow (%)	Difference in Volume (%)	Difference in Depth (%)
1	1/1/2011 0:00	48	6.7	-2.16	-8.13
2	1/11/2011 3:00	96	-6.9	-2.47	-19.11
3	1/18/2011 0:00	144	-13.58	-8.47	-21.02
4	2/1/2011 18:00	12	-43.09	-36.97	-84.26
5	2/21/2011 0:00	72	1.5	8.71	-75.06

TABLE 4-6
Events and Simulation Results, MC-EB-016

Event	Date	Duration (h)	Difference in Peak Flow (%)	Difference in Volume (%)	Difference in Depth (%)
6	2/23/2011 18:00	78	-9.01	-15.82	-86.63
7	3/4/2011 0:00	96	-44.24	-37.41	-90.53
8	3/8/2011 18:00	108	-36.04	-31.44	-89.58
9	3/18/2011 12:00	20	18.94	17.15	-3.63
10	4/4/2011 8:00	40	27.94	28.91	-72.19
11	4/9/2011 0:00	120	-28.42	-12.88	-89
12	4/15/2011 21:00	54	8.77	-13.29	-84.7
13	4/19/2011 0:00	72	2.25	-17.05	-74.85
14	4/22/2011 12:00	186	3.04	-24.7	-74.86
15	5/2/2011 0:00	120	-31.23	-30.67	-89.21
16	5/13/2011 12:00	15	16.4	18.06	-22.82
17	5/22/2011 12:00	180	-16.1	-21.47	-76.65
18	6/11/2011 0:00	27	19.39	3.91	-8.23
19	6/15/2011 6:00	24	11.13	10.98	-11.31
20	6/20/2011 6:00	18	3.53	19.22	-11.17
21	6/22/2011 16:00	56	-16.51	-4.71	-31.56
22	6/26/2011 0:00	27	-28.07	-20.63	-31.41
23	7/4/2011 3:00	21	20.71	31.64	0.29
24	7/8/2011 0:00	24	39.46	14.91	-0.51
25	7/24/2011 12:00	15	40.18	29.27	-2.79
26	8/8/2011 18:00	12	15.75	18.98	-18.45
27	9/3/2011 22:00	29	-7.24	15.45	-11.47
28	9/7/2011 3:00	45	-11.63	4.09	-16.22
29	9/23/2011 0:00	24	1.6	5.54	-11.25
30	9/25/2011 0:00	96	26.91	19.08	-48.36
31	10/14/2011 3:00	24	14.07	17.82	3.79
32	10/19/2011 0:00	96	-22.24	-20.39	-76.7
33	10/26/2011 16:00	32	16.81	1.43	1.68
34	11/3/2011 8:00	304	9.2	14.34	-85.16
35	11/14/2011 21:00	123	9.2	-12.05	-85.16
36	11/22/2011 0:00	96	5.77	-16.48	-85.75
37	11/27/2011 16:00	104	-50.22	-44.71	-90.46
A	12/4/2011 12:00	156			
38	12/21/2011 0:00	72	-14.45	-8.4	-80.6
39	12/27/2011 0:00	48	7.58	-3.64	-46.99

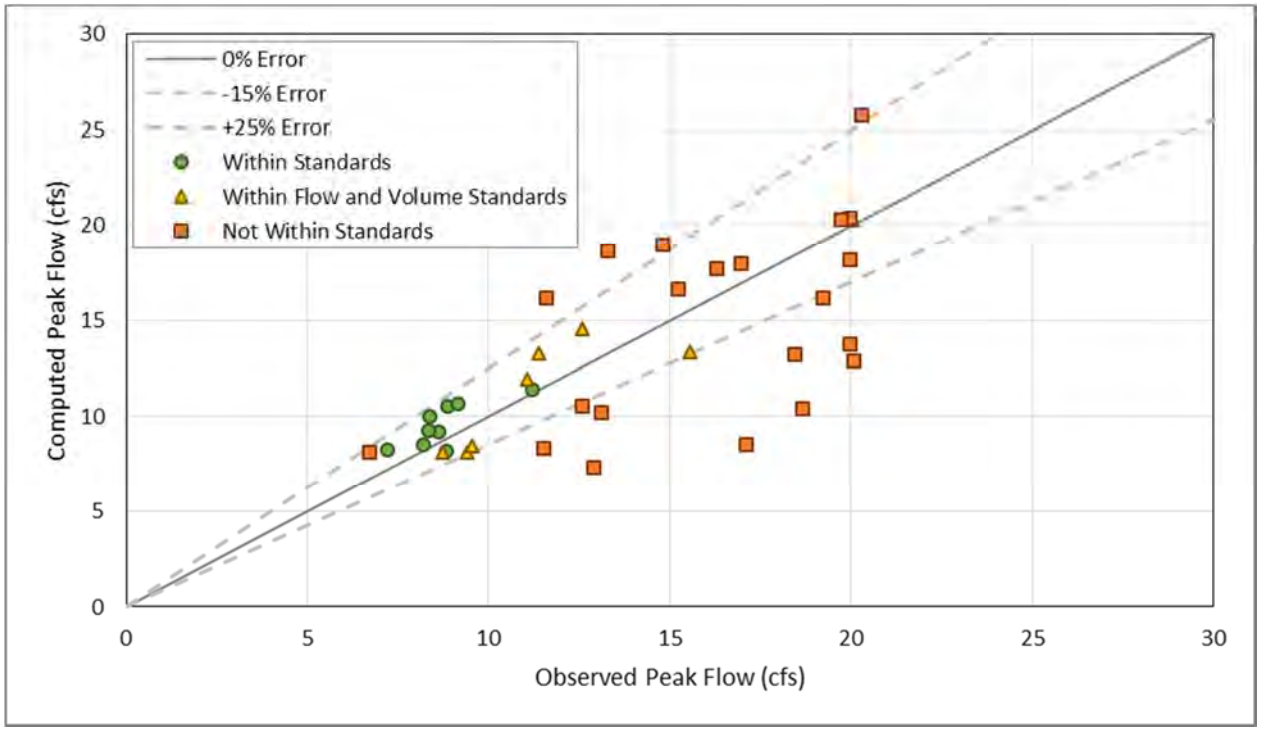


FIGURE 4-7
Scattergraph of Peak Flow, MC-EB-016

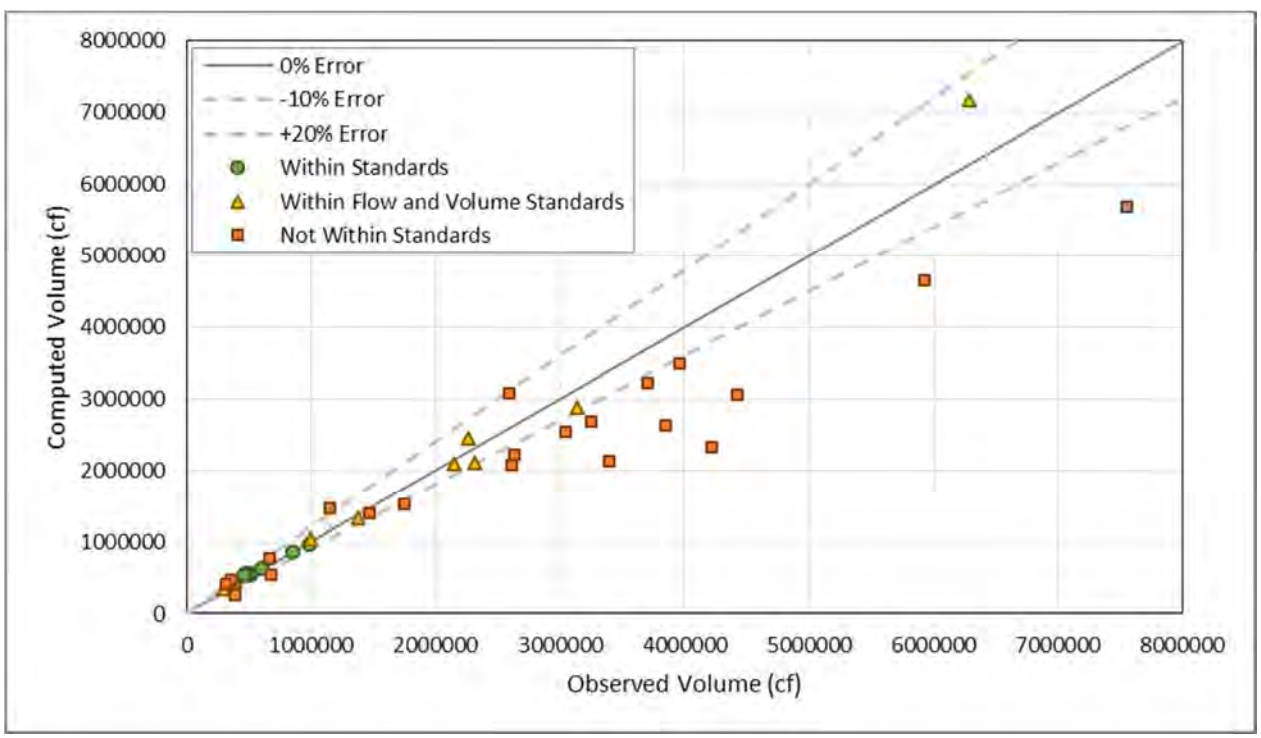


FIGURE 4-8
Scattergraph of Volume, MC-EB-016

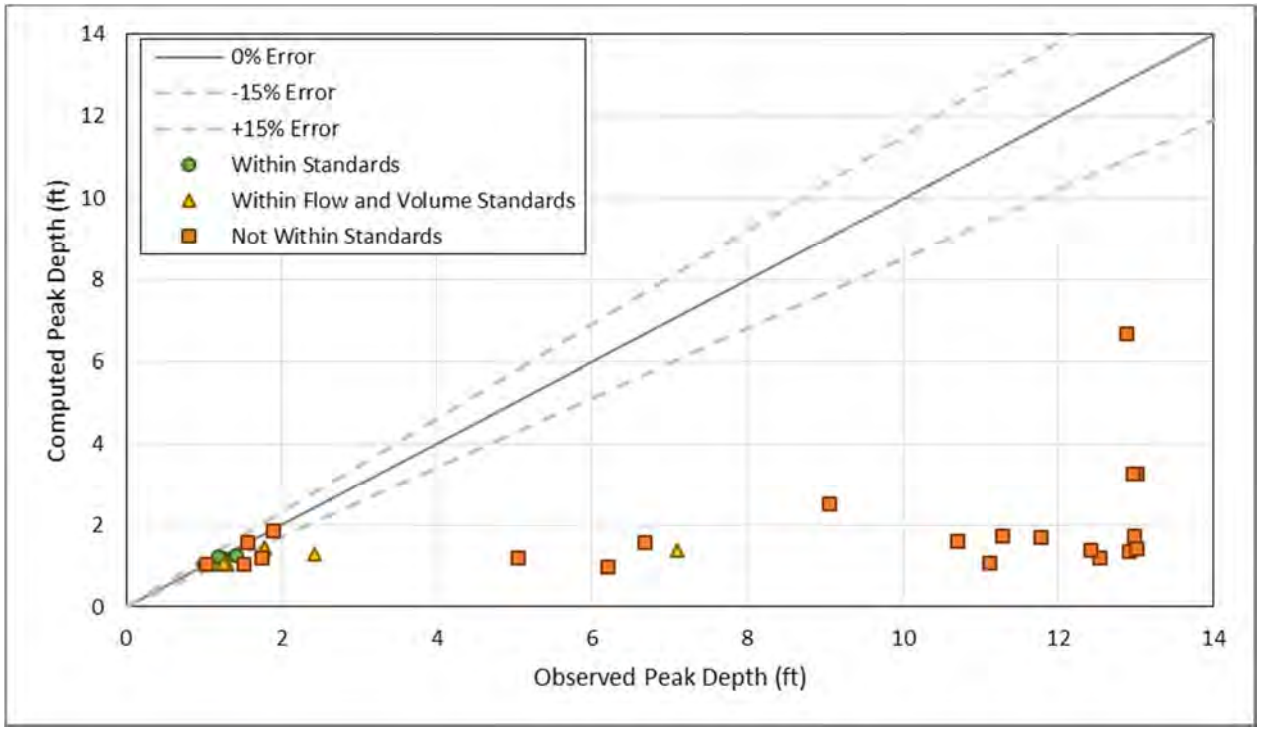


FIGURE 4-9
Scattergraph of Peak Depth, MC-EB-016

Monitor MC-EB-017

The model validation period for MC-EB-017 is January 2012 – December 2012. Thirty-five (35) total events were identified during the validation period, and 25 are considered to have good data. Of the 25 events with good data, 0% (0 events) met MSDGC's C&V guidelines and standards for peak flow, volume, and depth. Table 4-7 summarizes the events and the C&V results for each. Figures 4-10, 4-11 and 4-12 show the peak flow, volume, and peak depth scattergraphs, respectively. The model is generally over-predicting peak flow, volume, and depth at MC-EB-017.

TABLE 4-7
Events and Simulation Results, MC-EB-017

Event	Date	Duration (h)	Difference in Peak Flow (%)	Difference in Volume (%)	Difference in Depth (%)
1	1/11/2012 10:00	93	82.28	63.32	72.12
2	1/17/2012 3:00	122	63.26	77.35	-60.88
3	1/23/2012 0:00	174	61.72	53.58	-60.32
4	3/2/2012 12:00	36	72.48	78.5	63.18
5	3/8/2012 5:00	72	124.88	68.58	-24.38
A	3/23/2012 5:00	69			
6	4/1/2012 19:00	82	136.16	91.11	-40.1
B	4/14/2012 9:00	114			
7	4/25/2012 18:00	85	80.64	127.9	-49.08
C	5/1/2012 17:00	127			
D	5/7/2012 18:00	110			
E	5/13/2012 10:00	114			
8	5/29/2012 17:30	36.5	55.44	68.19	-0.1

TABLE 4-7
Events and Simulation Results, MC-EB-017

Event	Date	Duration (h)	Difference in Peak Flow (%)	Difference in Volume (%)	Difference in Depth (%)
F	5/30/2012 21:00	104			
9	6/11/2012 7:00	46	49.72	66.82	-1.51
10	6/22/2012 3:00	26	59.64	86.65	3.14
11	7/5/2012 10:00	14	89.96	135.08	61.34
12	7/14/2012 6:00	48	103.42	150.03	61.47
G	7/19/2012 9:30	18.5			
H	7/24/2012 11:00	37			
I	7/26/2012 16:00	38			
13	8/10/2012 0:00	28	113.59	164.97	42.37
14	9/2/2012 15:00	85	208.68	212.55	9.55
J	9/7/2012 23:00	54			
15	9/22/2012 0:00	52	224.01	171.03	112.59
16	10/1/2012 14:00	64	164.62	134.13	12
17	10/5/2012 20:00	34	199.52	158.01	60.36
18	10/26/2012 12:00	42	148.32	160.69	93.7
19	10/30/2012 6:00	30	106.89	117.28	45.95
20	11/3/2012 12:00	18	68.82	113.23	2.91
21	11/12/2012 4:30	67.5	131.98	133.92	89.17
22	12/2/2012 7:30	40.5	79.56	118.23	64.43
23	12/6/2012 23:00	151	96.47	80.17	19.76
24	12/17/2012 12:00	156	92.89	72.17	-39.44
25	12/26/2012 5:00	97	206.92	113.53	132.98

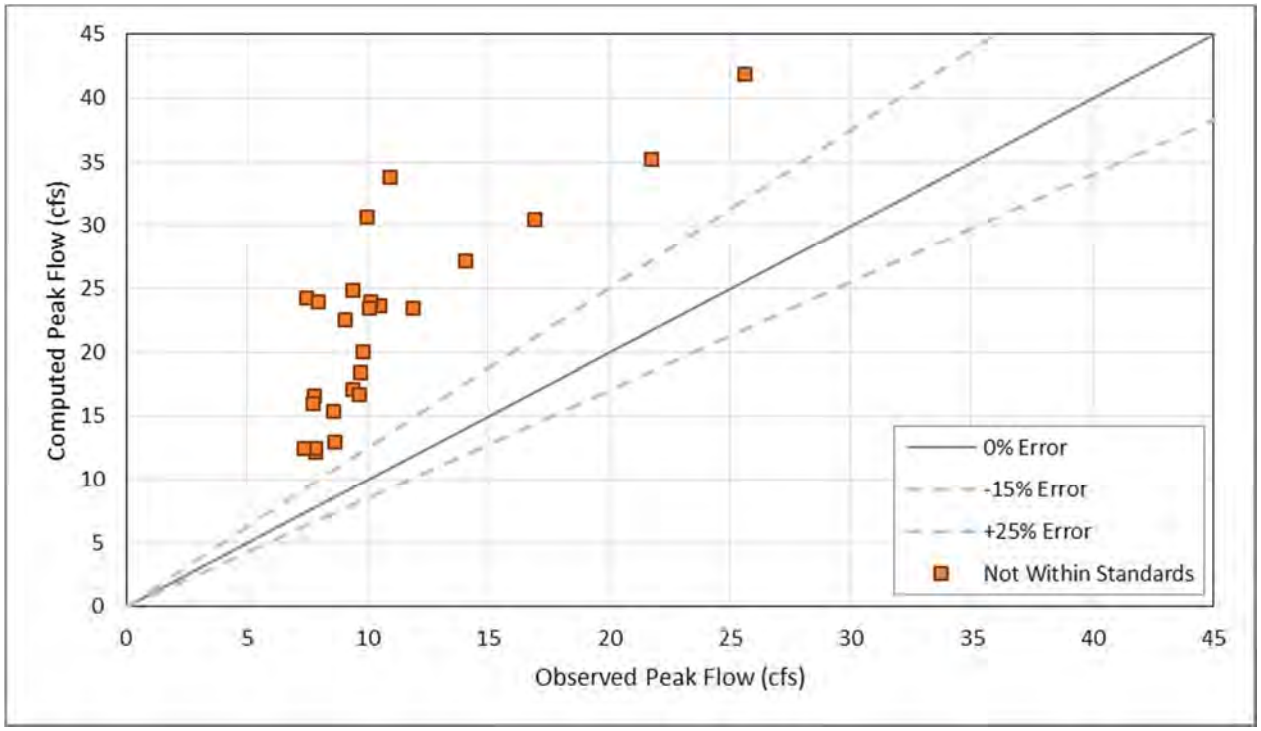


FIGURE 4-10
Scattergraph of Peak Flow, MC-EB-017

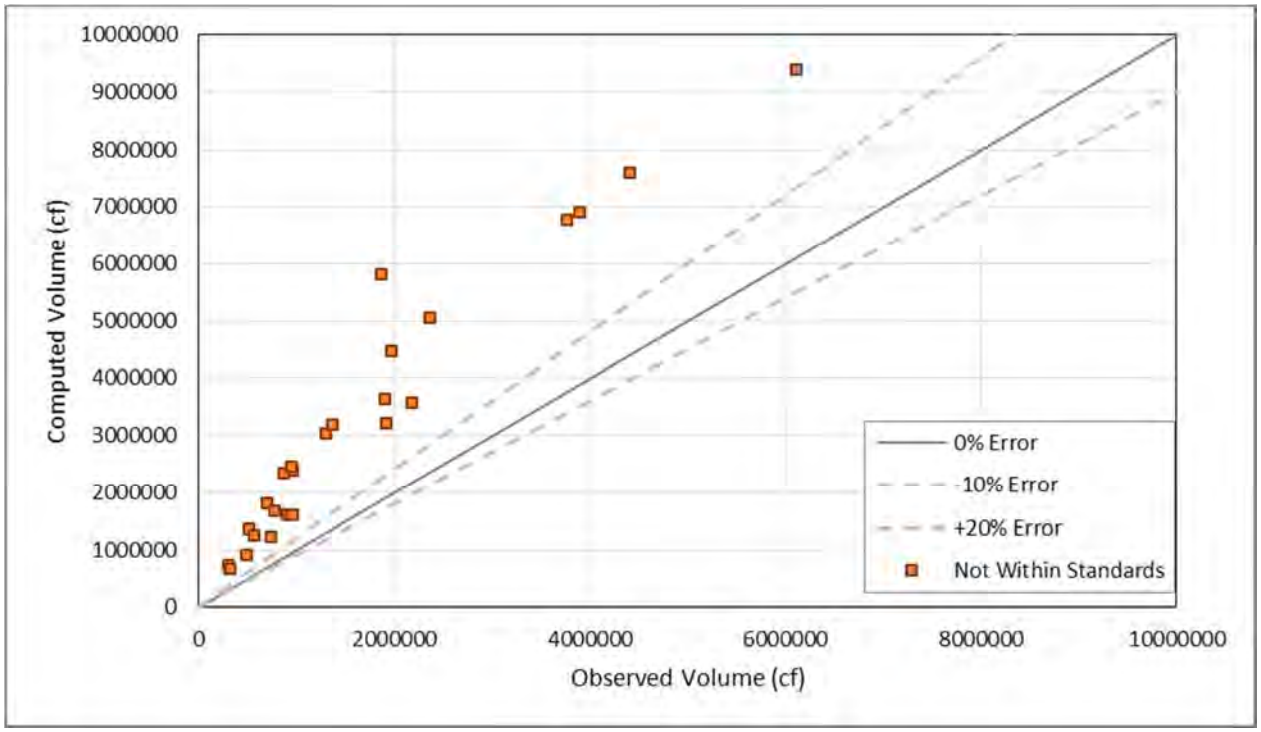


FIGURE 4-11
Scattergraph of Volume, MC-EB-017

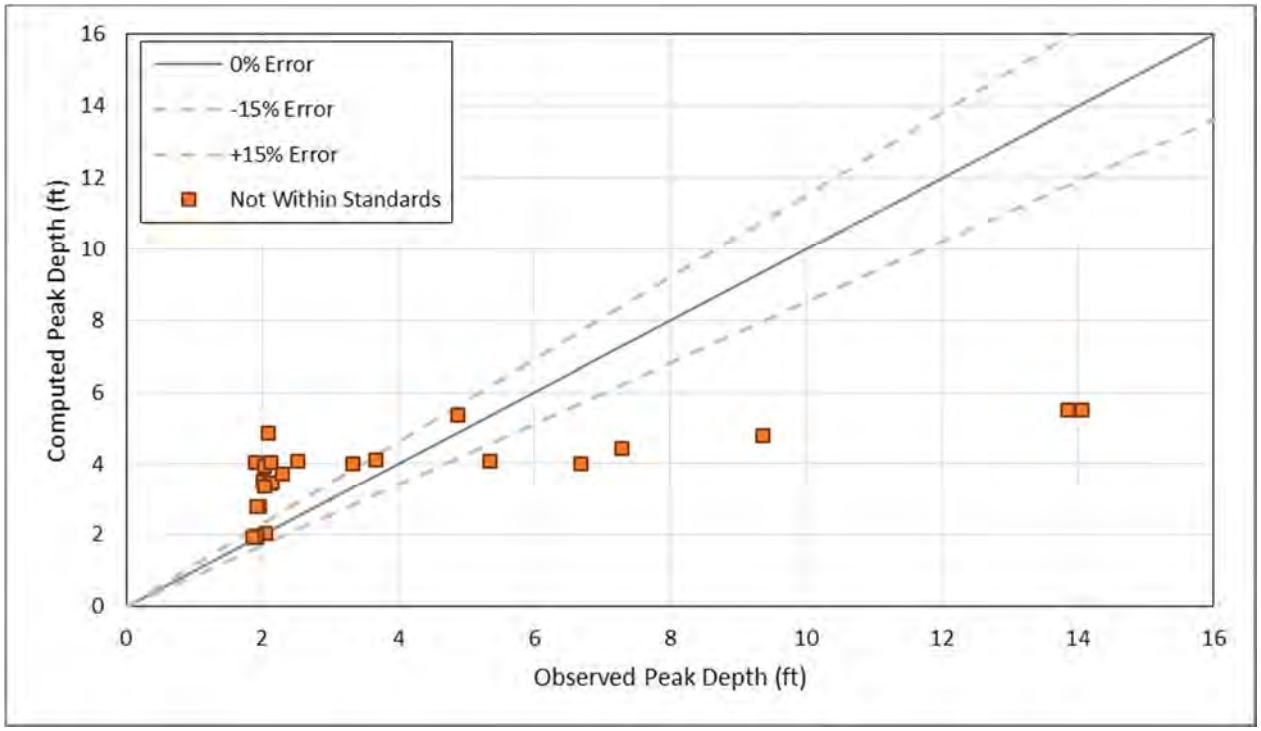


FIGURE 4-12
Scattergraph of Peak Depth, MC-EB-017

Monitor MC-EB-019

The model validation period for MC-EB-019 is January 2011 – December 2011. Forty (40) total events were identified during the validation period, and 35 are considered to have good data. Of the 35 events with good data, 0% (0 events) met MSDGC's C&V guidelines and standards for peak flow, volume, and depth. Table 4-8 summarizes the events and the C&V results for each. Figures 4-13, 4-14 and 4-15 show the peak flow, volume, and peak depth scattergraphs, respectively. The model is both over-predicting and under-predicting peak flow, volume, and depth at MC-EB-019 for the identified events.

TABLE 4-8
Events and Simulation Results, MC-EB-019

Event	Date	Duration (h)	Difference in Peak Flow (%)	Difference in Volume (%)	Difference in Depth (%)
1	1/1/2011 7:00	47	9.72	35.72	57.3
2	1/18/2011 10:00	33	1.46	6.52	15.32
3	2/1/2011 7:00	116	-20.83	-0.19	-57
A	2/21/2011 11:00	67			
B	2/24/2011 21:00	58			
C	2/28/2011 6:30	65.5			
4	3/24/2011 7:00	66	16.22	13.07	152.14
5	4/4/2011 12:00	67	-22.25	13.24	-16.78
6	4/9/2011 12:00	36	-1.76	19.2	34.4
7	4/11/2011 8:00	63	-32.96	-6.29	-37.06
8	4/15/2011 23:00	48	-30.28	-5.13	-17.75
9	4/19/2011 4:00	74	-29.89	-14.53	-20.99

TABLE 4-8
Events and Simulation Results, MC-EB-019

Event	Date	Duration (h)	Difference in Peak Flow (%)	Difference in Volume (%)	Difference in Depth (%)
10	4/22/2011 19:00	173	-35.51	-15.62	-19.57
11	5/2/2011 3:00	115	-30.5	-14.81	-37.15
12	5/13/2011 15:30	8	-1.18	-0.15	54.34
13	5/22/2011 16:00	56	-25.19	-6.84	-15.87
14	5/26/2011 6:00	42	-25.92	-16.83	-15.95
15	6/11/2011 8:00	11	35.49	35.61	249.61
16	6/15/2011 12:00	12	30.06	27.9	249.54
17	6/20/2011 11:00	10	21.62	49.55	133.4
D	6/22/2011 18:30	51			
18	6/26/2011 8:00	16.5	-1.78	13.08	37.92
19	7/8/2011 5:00	25	-7.54	19.88	42.9
20	7/24/2011 16:00	9.5	-33.03	-20.6	47.62
21	8/3/2011 9:00	13	39.68	48.01	357.01
E	8/8/2011 19:00	39			
22	8/25/2011 0:00	6	23.83	25.67	26.06
23	9/4/2011 3:00	24	59.27	86.84	309.46
24	9/7/2011 11:00	64	-4.6	32.92	25.4
25	9/19/2011 11:30	9.5	-17.6	23.14	159.39
26	9/23/2011 6:00	10	7.75	8.92	71.8
27	9/26/2011 1:00	49.5	-19.65	4	-18.45
28	10/19/2011 8:00	93	-23.67	-9.79	-37.75
29	10/26/2011 21:00	75	9.16	23.16	88.32
30	11/3/2011 21:00	33	-5.23	29.76	35.35
31	11/14/2011 21:00	129	-24.01	2.04	-19.33
32	11/22/2011 7:00	95	-24.6	-3.28	-36.26
33	12/21/2011 6:00	27	-27.78	-7.7	-33.69
34	12/22/2011 21:00	27	-21.93	1.64	-19.11
35	12/27/2011 9:00	42	-20.95	5.52	-7.25

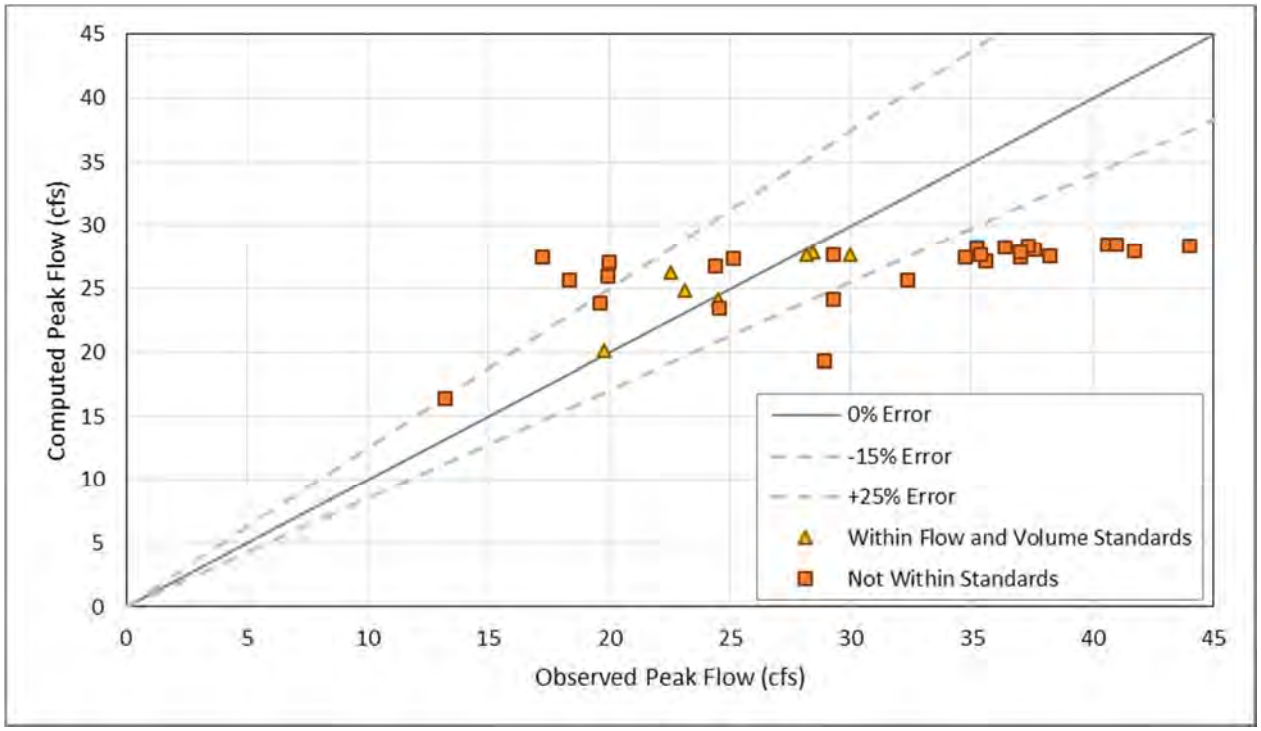


FIGURE 4-13
Scattergraph of Peak Flow, MC-EB-019

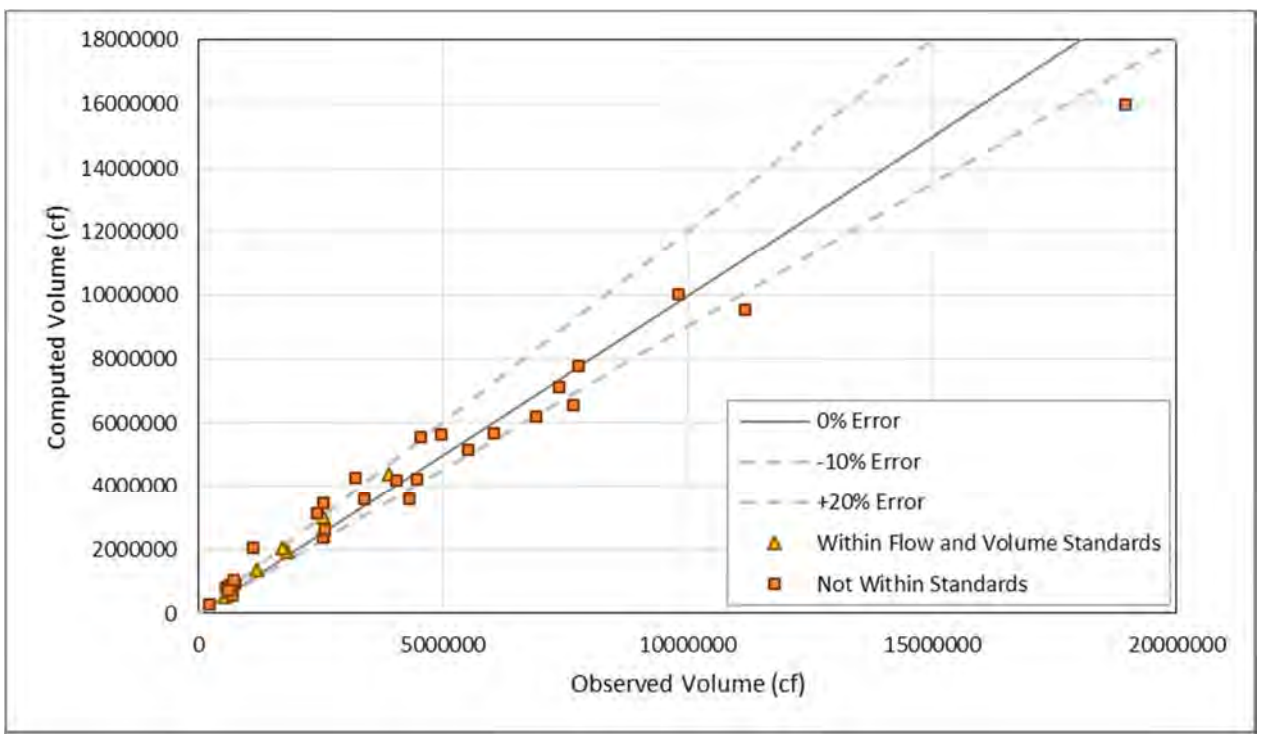


FIGURE 4-14
Scattergraph of Volume, MC-EB-019

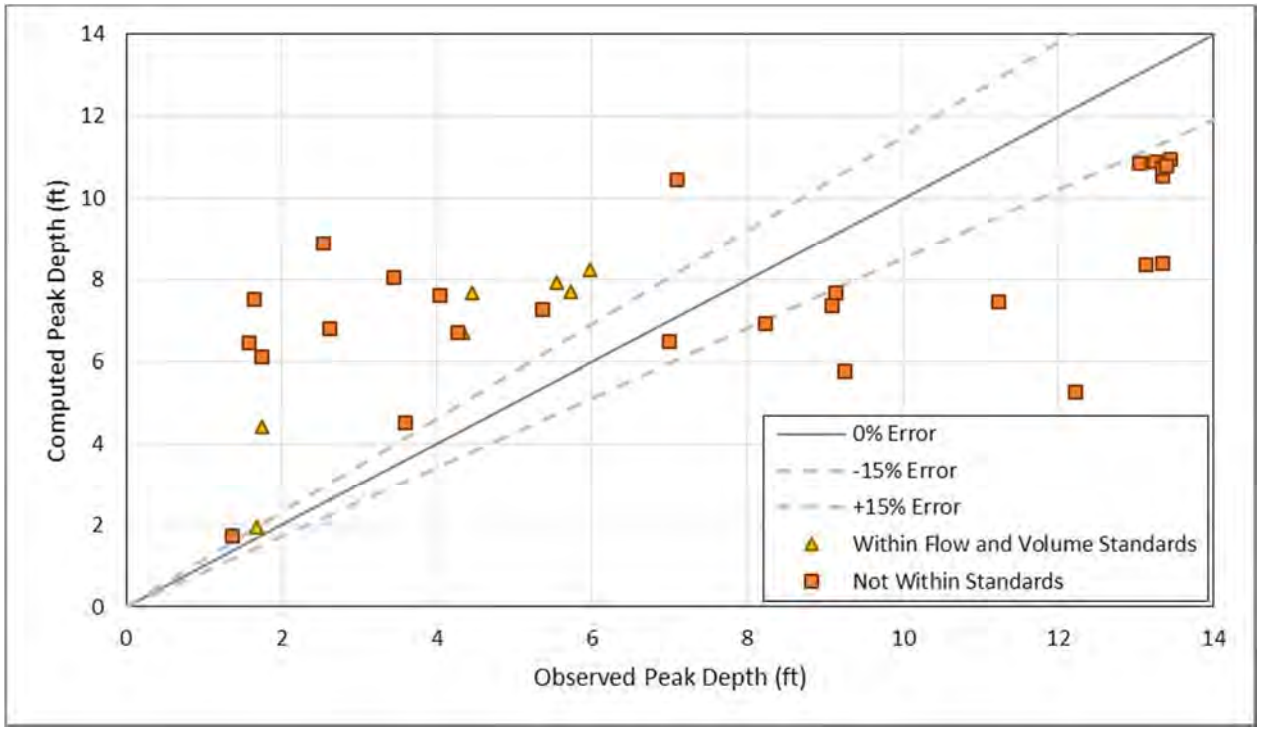


FIGURE 4-15
Scattergraph of Peak Depth, MC-EB-019

Monitor MC-EB-026

The model validation period for MC-EB-026 is July 2011 – June 2012. Fifty-six (56) total events were identified during the validation period, and 53 are considered to have good data. Of the 53 events with good data, 0% (0 events) met MSDGC's C&V guidelines and standards for peak flow, volume, and depth. Table 4-9 summarizes the events and the C&V results for each. Figures 4-16, 4-17, and 4-18 show the peak flow, volume, and peak depth scattergraphs, respectively. The model is generally over-predicting peak flow, volume, and depth at MC-EB-026.

TABLE 4-9
Events and Simulation Results, MC-EB-026

Event	Date	Duration (h)	Difference in Peak Flow (%)	Difference in Volume (%)	Difference in Depth (%)
1	7/4/2011 6:00	18	-32.31	-3.71	-1.81
2	7/8/2011 0:00	27	99.52	81.28	134.61
3	7/19/2011 20:00	4	-43.38	-5.86	-7.38
4	7/23/2011 0:00	24	-56.16	1.52	-10.8
5	7/24/2011 15:00	21	89.79	129.18	489.19
6	8/3/2011 3:00	21	70.01	124.28	86.68
7	8/7/2011 5:00	91	7.79	84.43	20.69
8	9/1/2011 8:00	7	17.9	34.19	21.56
9	9/3/2011 23:00	49	71.87	108.89	48.56
10	9/7/2011 3:00	45	3.64	16.3	23.12
11	9/14/2011 21:00	21	120.32	107.8	62.59
12	9/19/2011 8:00	28	71.59	61.57	52.46
13	9/21/2011 8:00	16	33.13	37.3	25.26

TABLE 4-9
Events and Simulation Results, MC-EB-026

Event	Date	Duration (h)	Difference in Peak Flow (%)	Difference in Volume (%)	Difference in Depth (%)
14	9/23/2011 4:00	32	61.34	40.24	65.5
A	9/25/2011 23:00	49			
15	9/29/2011 18:00	27	53.77	30.3	41.14
16	10/13/2011 8:00	16	57.51	53.52	40.29
17	10/18/2011 18:00	102	-41.8	-25.86	-44.47
B	10/26/2011 18:00	78			
18	11/3/2011 12:00	60	64.37	26.29	57.39
19	11/14/2011 20:00	130	28.53	1.33	56.67
20	11/21/2011 6:00	96	-16.87	-14.08	-41.21
21	11/27/2011 0:00	144	-38.62	-53.06	-74.26
C	12/4/2011 12:00	156			
22	12/15/2011 2:00	46	28.53	-3.67	34.98
23	12/19/2011 18:00	153	-11	-12.62	-61.5
24	12/27/2011 2:00	70	37.98	-13.82	36.75
25	1/11/2012 6:00	84	142.64	51.79	55.86
26	1/17/2012 1:00	71	36.99	49.11	-19.03
27	1/20/2012 21:00	30	127.74	46.52	63.63
28	1/22/2012 18:00	60	32.46	9.14	-28.72
29	1/25/2012 18:00	126	13.42	16.14	-43.51
30	1/31/2012 18:00	60	55.47	28.06	29.31
31	2/4/2012 8:00	46	109.97	31.4	37.24
32	2/16/2012 0:00	24	91.28	69.13	33.67
33	2/29/2012 3:00	21	144.42	112.96	49.37
34	3/2/2012 9:00	63	93.48	46.8	39.58
35	3/8/2012 6:00	150	120.51	33.28	48.22
36	3/15/2012 9:00	111	112.17	35.94	40.3
37	3/23/2012 10:00	137	95.92	46.66	45.3
38	3/30/2012 19:00	23	183.32	121.89	55.29
39	4/1/2012 21:00	81	129.94	81.04	96.59
40	4/14/2012 6:00	66	95.76	108.09	64.9
41	4/20/2012 18:00	30	122.51	100.69	47.55
42	4/25/2012 17:00	55	184.84	145.92	198.13
43	4/28/2012 6:00	42	180.99	110.31	62.3
44	4/30/2012 18:00	81	69.19	74.4	-16.34
45	5/4/2012 15:00	60	97.21	38.15	37.4
46	5/7/2012 18:00	54	64.38	50.41	24.02
47	5/13/2012 6:00	114	54.6	40.64	-10.11
48	5/21/2012 14:00	28	165.47	185.1	95.73
49	5/29/2012 7:00	11	81.76	113.53	28.77
50	5/31/2012 18:00	102	55.02	99.75	-23.1

TABLE 4-9
Events and Simulation Results, MC-EB-026

Event	Date	Duration (h)	Difference in Peak Flow (%)	Difference in Volume (%)	Difference in Depth (%)
51	6/11/2012 4:00	11	92.8	113.61	33.43
52	6/17/2012 12:00	12	113.43	147.54	30.58
53	6/29/2012 16:00	14	211.12	302.76	60.24

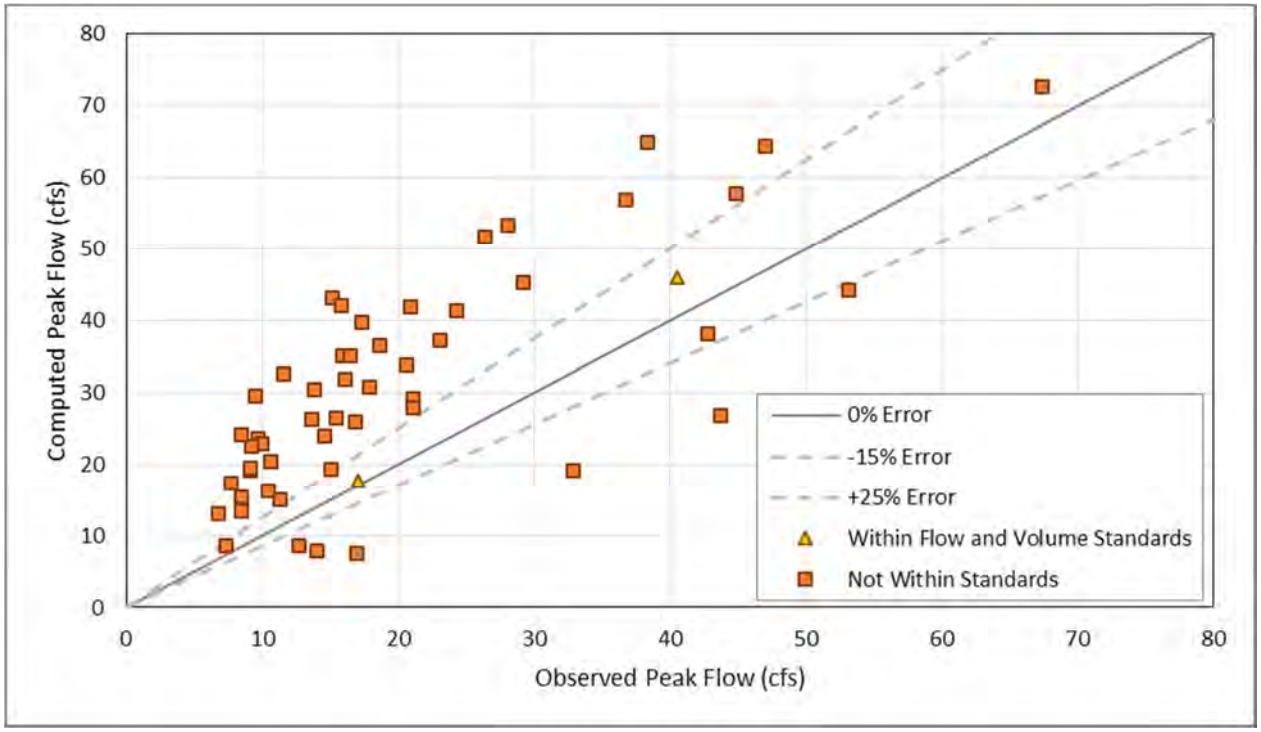


FIGURE 4-16
Scattergraph of Peak Flow, MC-EB-026

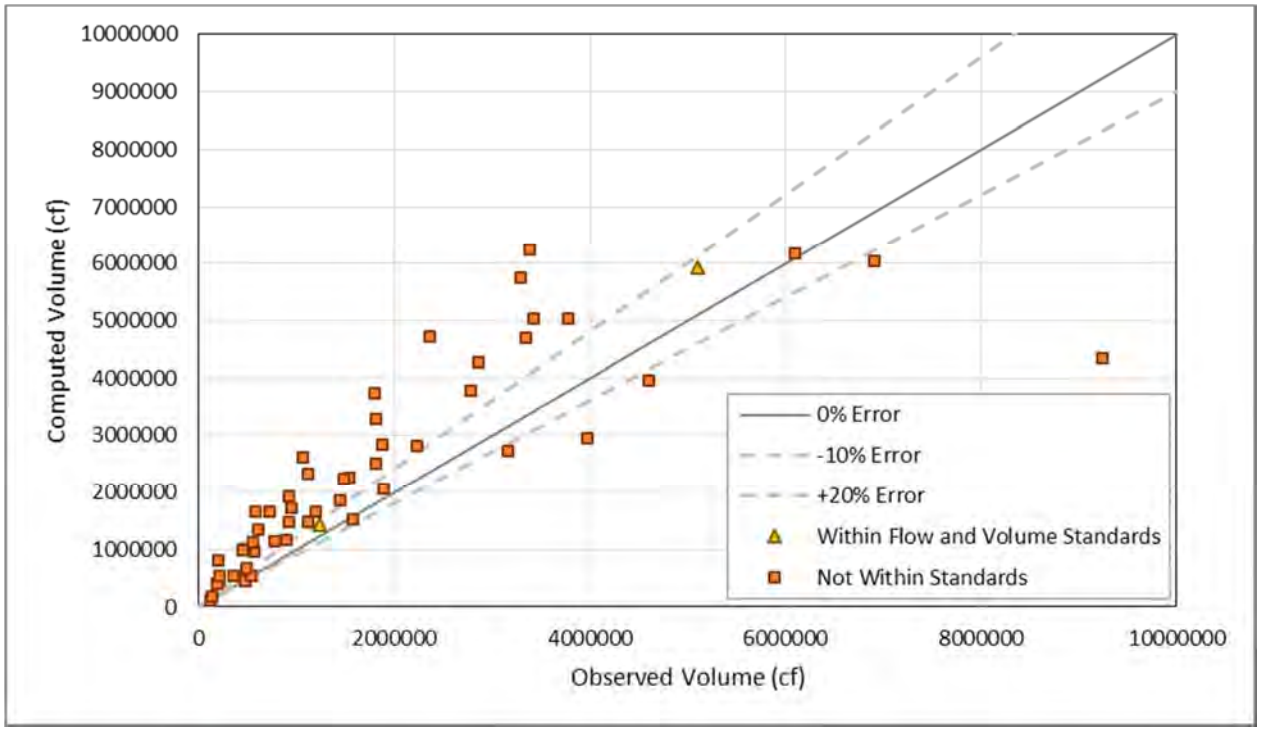


FIGURE 4-17
Scattergraph of Volume, MC-EB-026

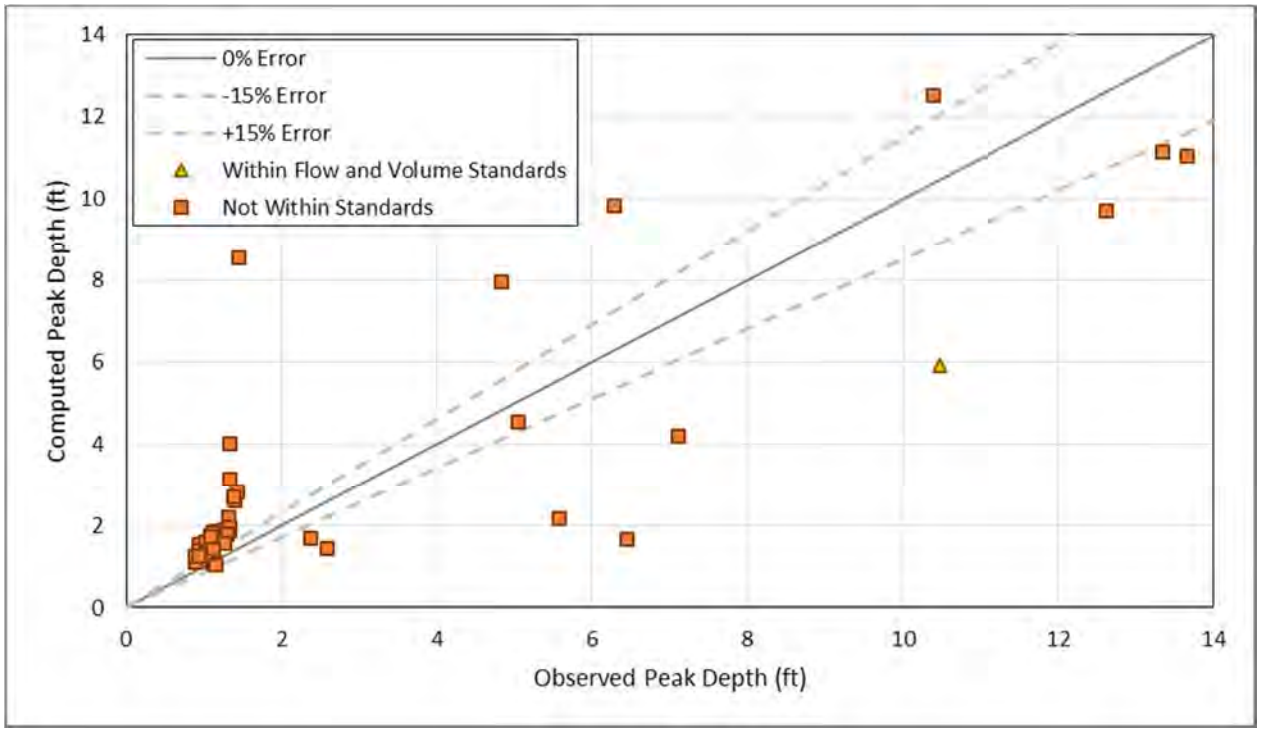


FIGURE 4-18
Scattergraph of Peak Depth, MC-EB-026

Monitor MC-EB-027

The model validation period for MC-EB-027 is January 2009 – December 2009. Forty-eight (48) total events were identified during the validation period, and 45 are considered to have good data. Of the 45 events with good data, 9% (4 events) met MSDGC's C&V guidelines and standards for peak flow, volume, and depth. Table 4-10 summarizes the events and the C&V results for each. Figures 4-19, 4-20 and 4-21 show the peak flow, volume, and peak depth scattergraphs, respectively. The model is generally over-predicting peak flow, volume, and depth at MC-EB-027.

TABLE 4-10
Events and Simulation Results, MC-EB-027

Event	Date	Duration (h)	Difference in Peak Flow (%)	Difference in Volume (%)	Difference in Depth (%)
1	1/6/2009 0:00	78	31.36	-3.77	10.08
2	1/9/2009 21:00	63	80.87	6.05	20.87
3	1/26/2009 0:00	96	-38.24	-9.24	-27.27
4	2/1/2009 0:00	108	-36	-26.04	-25.67
A	2/7/2009 0:00	168			
5	2/18/2009 0:00	48	40.31	14.34	11.38
6	2/26/2009 0:00	96	43.31	20	9.67
7	3/8/2009 0:00	48	77.03	25.79	32.06
8	3/11/2009 0:00	72	21.35	-4.93	2.93
9	3/18/2009 0:00	48	123.49	36.17	51.79
10	3/25/2009 0:00	72	42.16	-7.39	11.55
11	4/2/2009 0:00	120	7.19	18.58	1.99
12	4/9/2009 0:00	216	43.44	-28.94	13.17
13	4/30/2009 0:00	15	-35.37	-30.88	-29.4
14	5/13/2009 0:00	120	57.09	-0.57	19.17
15	5/30/2009 18:30	5.5	-44.62	-29.32	-20.63
16	6/2/2009 20:00	100	21.05	22.88	71.89
17	6/10/2009 0:00	72	22.14	17.18	15.17
18	6/14/2009 0:00	48	3.63	3.08	13.39
19	6/16/2009 12:00	60	74.55	15.01	36.11
20	6/20/2009 0:00	24	17.87	-1.05	20.9
21	6/25/2009 0:00	96	-79.38	-30.95	-59.63
22	7/4/2009 16:00	8	-28.62	-25.27	-12.16
23	7/22/2009 4:00	38	96.45	68.76	57.72
24	7/25/2009 5:00	55	108.12	35.31	67.77
25	7/29/2009 0:00	30	21.46	28.71	21.77
26	7/30/2009 15:00	33	109.41	153.85	66.67
27	8/4/2009 6:00	54	43.64	59.21	37.63
28	8/10/2009 14:00	46	68.16	22.42	42.28
29	8/17/2009 14:00	14	-48.57	-13.86	-22.29
30	8/20/2009 8:00	8	-18.57	-15.29	-4.28
31	8/27/2009 18:00	6	-52.89	-24.95	-26.76
32	9/7/2009 5:00	25	30.1	125.27	213.17
33	9/8/2009 18:00	12	21.85	50.19	28.15

TABLE 4-10
Events and Simulation Results, MC-EB-027

Event	Date	Duration (h)	Difference in Peak Flow (%)	Difference in Volume (%)	Difference in Depth (%)
34	9/20/2009 8:00	40	22.2	24.91	15.83
35	9/22/2009 16:00	32	-36.02	-29.17	-14.39
36	9/24/2009 11:00	121	33.92	-20.82	19.74
37	10/2/2009 4:00	38	7.7	1.67	12.56
38	10/23/2009 5:00	79	90.61	16.94	63.69
39	10/27/2009 18:00	54	66.47	8.35	50.37
40	10/30/2009 23:00	25	28	-7.97	29.33
41	11/17/2009 16:00	8	13.66	-5.35	15.34
42	11/18/2009 6:00	42	-15.92	-14.99	0.59
43	12/2/2009 9:30	26.5	26.44	23.48	27.57
44	12/8/2009 18:00	78	81.26	12.41	47.64
B	12/13/2009 6:00	21			
C	12/19/2009 6:00	69			
45	12/25/2009 2:00	48	46.15	-7.46	38.08

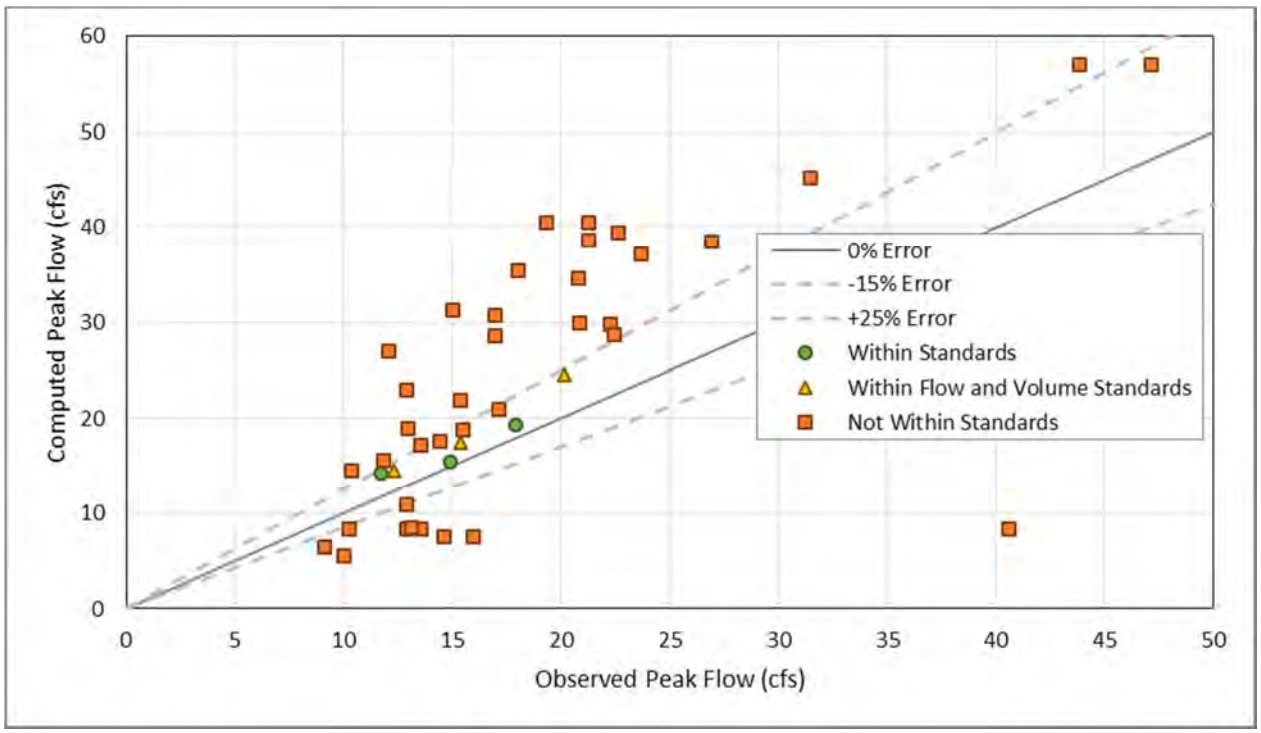


FIGURE 4-19
Scattergraph of Peak Flow, MC-EB-027

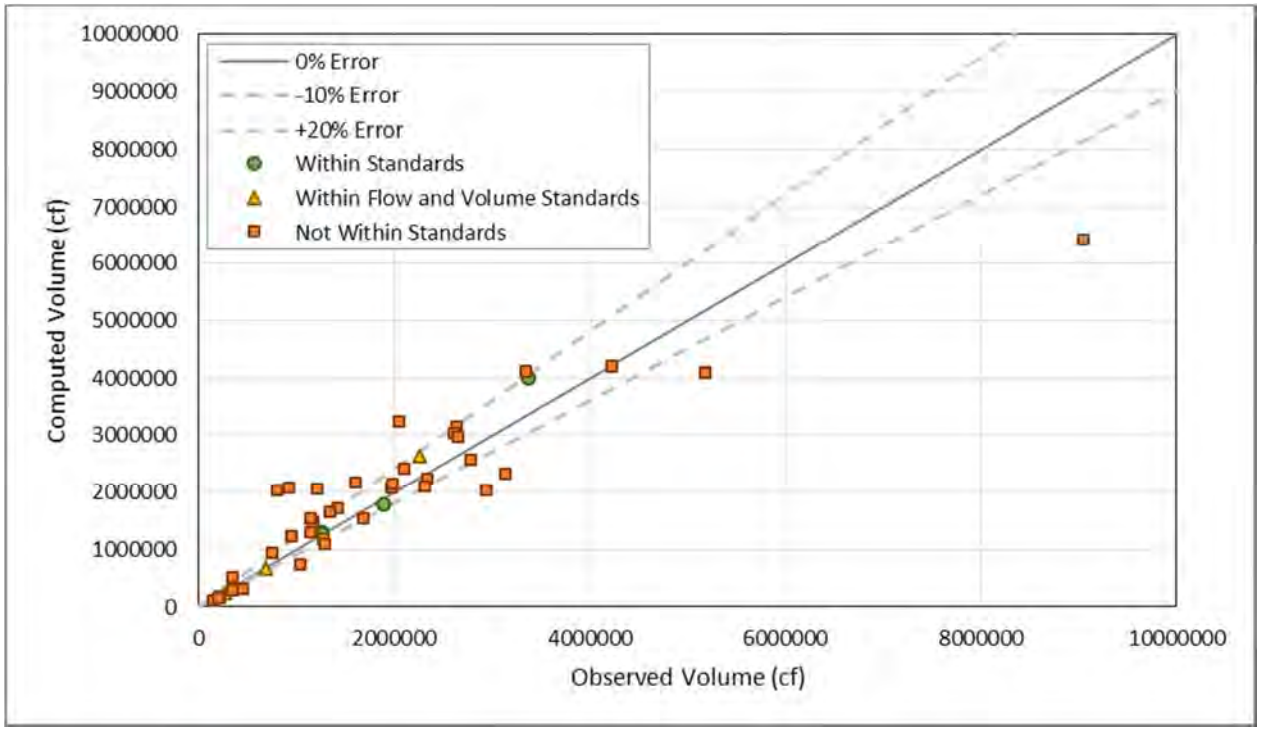


FIGURE 4-20
Scattergraph of Volume, MC-EB-027

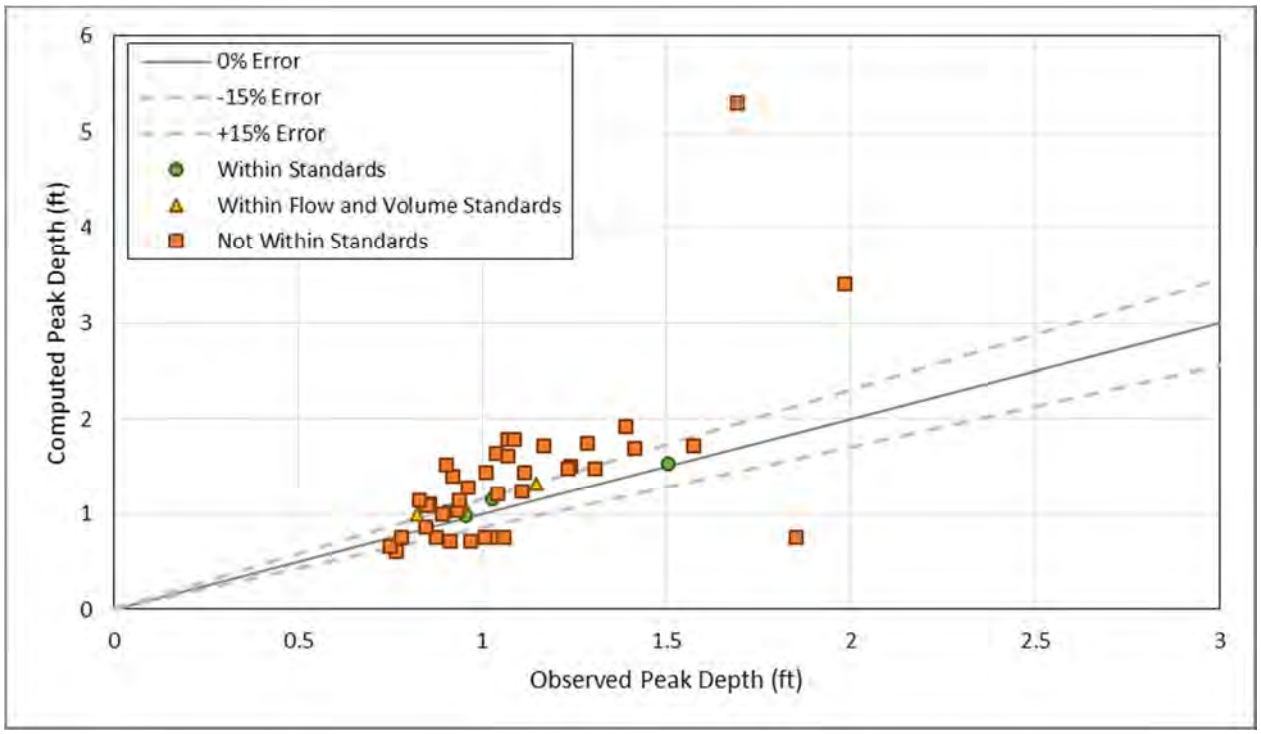


FIGURE 4-21
Scattergraph of Peak Depth, MC-EB-027

Monitor MC-EB-030

The model validation period for MC-EB-030 is January 2009 – December 2009. Thirty-seven (37) total events were identified during the validation period, and 31 are considered to have good data. Of the 31 events with good data, 19% (6 events) met MSDGC's C&V guidelines and standards for peak flow, volume, and depth. Table 4-11 summarizes the events and the C&V results for each. Figures 4-22, 4-23, and 4-24 show the peak flow, volume, and peak depth scattergraphs, respectively. At this location, there are many events that meet the C&V guidelines for peak flow and volume but are not considered validated because of depth. It was found that the downstream boundary condition used for the model validation runs impacts the depths at this location since this flow monitor is located on the interceptor just upstream of the EBMC sewershed boundary. In the table the events meeting C&V guidelines based on just peak flow and volume are highlighted in yellow. Of the 31 events with good data, 58% (18 events) met MSDGC's C&V guidelines and standards for peak flow and volume (ignoring depth). The model is generally over-predicting peak flow, volume, and depth at MC-EB-030.

TABLE 4-11
Events and Simulation Results, MC-EB-030

Event	Date	Duration (h)	Difference in Peak Flow (%)	Difference in Volume (%)	Difference in Depth (%)
1	1/10/2009 0:00	78	11.77	37.24	-58.76
2	1/15/2009 0:00	53	-7.16	1.99	-11.71
3	1/28/2009 0:00	51	-13.04	-6.56	259.2
A	2/1/2009 10:00	38	-14.7		
B	2/7/2009 0:00	72	3.34		
4	2/18/2009 0:00	60	4.18	9.57	-8.97
C	2/27/2009 0:00	144	17.51		
5	3/11/2009 3:00	90	-6.01	1.4	34.37
6	3/18/2009 18:00	30	-3.23	16.34	21.2
7	3/25/2009 0:00	48	23.92	29.1	274.9
8	4/2/2009 21:00	75	0.43	20.34	37.33
9	4/6/2009 8:00	40	-4.58	13.68	18.44
10	4/10/2009 0:00	72	-11.45	4.45	-40.69
11	4/14/2009 0:00	120	-17.06	0	10.25
12	5/6/2009 0:00	36	10.27	11.92	-5.81
13	5/8/2009 12:00	24	12.39	46	-1.08
14	5/13/2009 0:00	72	7.88	17.66	-12.8
15	5/26/2009 12:00	18	15.08	41.9	19.29
D	6/2/2009 21:00	147	17.42		
E	6/10/2009 7:00	89	-1.25		
16	6/14/2009 12:00	36	-10.4	4.13	0.53
17	6/16/2009 18:00	102	7.34	2.54	-27.65
18	6/26/2009 0:00	96	-22.78	-11.44	3.77
19	7/22/2009 0:00	72	2.96	6.12	25.52
20	7/25/2009 6:00	34	2.91	11.66	-15.04
21	7/29/2009 0:00	30	-3.89	9.94	-17.57
22	8/4/2009 0:00	96	12.39	13.79	-47.08
23	8/10/2009 12:00	24	20.8	45.94	25.12

TABLE 4-11
Events and Simulation Results, MC-EB-030

Event	Date	Duration (h)	Difference in Peak Flow (%)	Difference in Volume (%)	Difference in Depth (%)
24	9/7/2009 0:00	24	33.9	23.93	-9.48
F	9/8/2009 10:00	38	10.31		
25	9/20/2009 0:00	48	27.82	36.61	9.15
26	9/27/2009 0:00	24	6.08	17.78	106.54
27	10/2/2009 0:00	26	4.44	24.15	-7.38
28	10/8/2009 12:00	132	5.88	-1.58	-29.85
29	10/27/2009 12:00	60	9.51	2.28	3.39
30	11/17/2009 12:00	60	22.78	34.38	7.28
31	12/8/2009 12:00	24	56.99	96.12	34.04

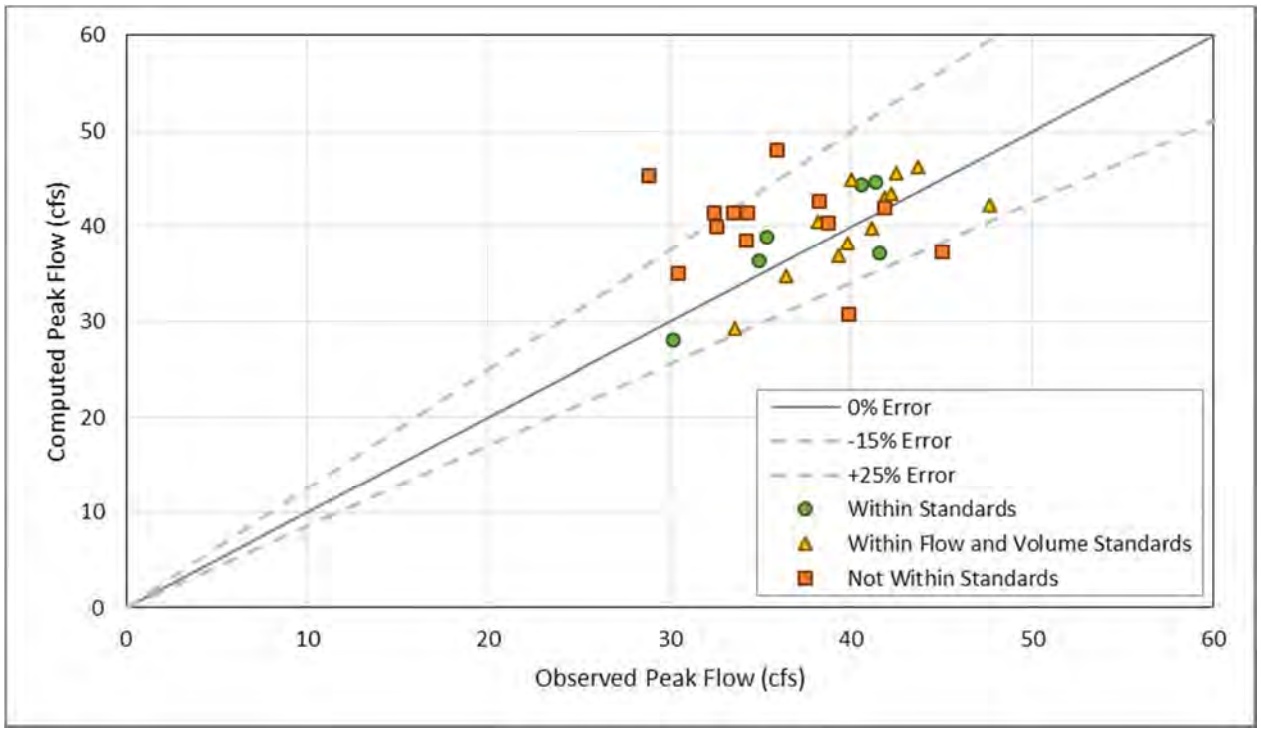


FIGURE 4-22
Scattergraph of Peak Flow, MC-EB-030

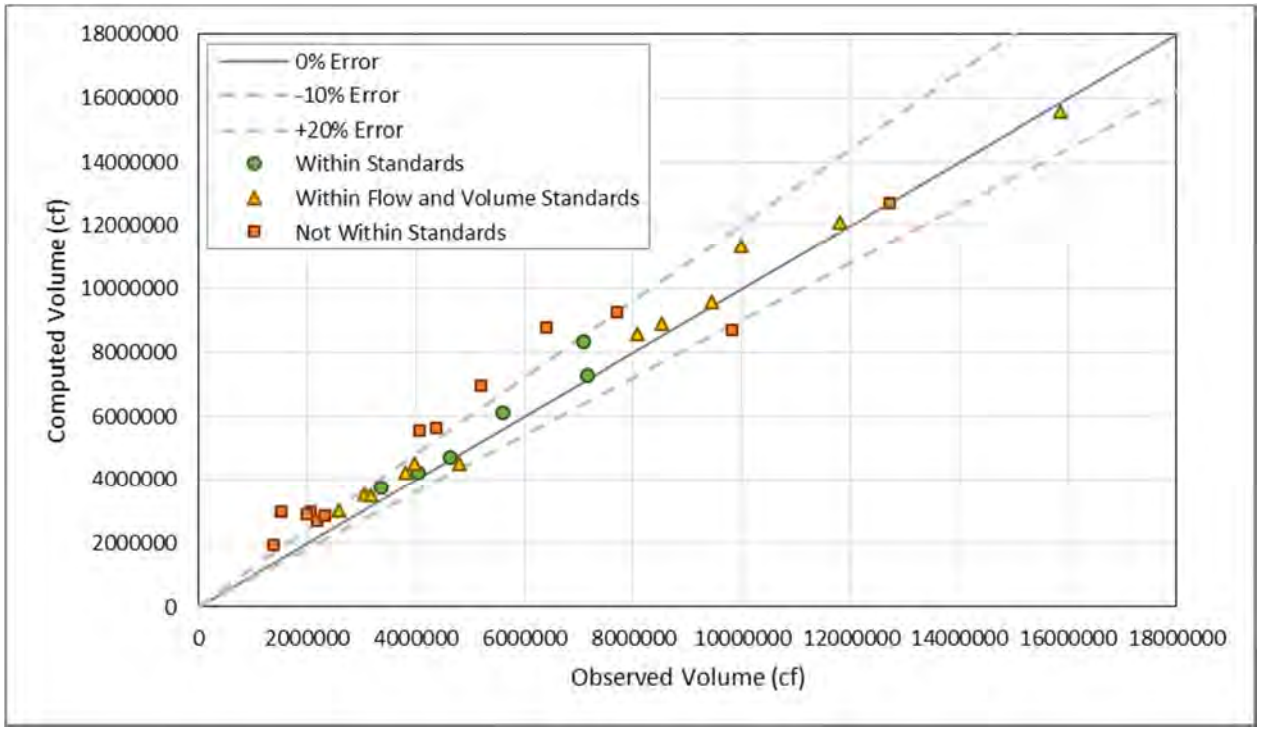


FIGURE 4-23
Scattergraph of Volume, MC-EB-030

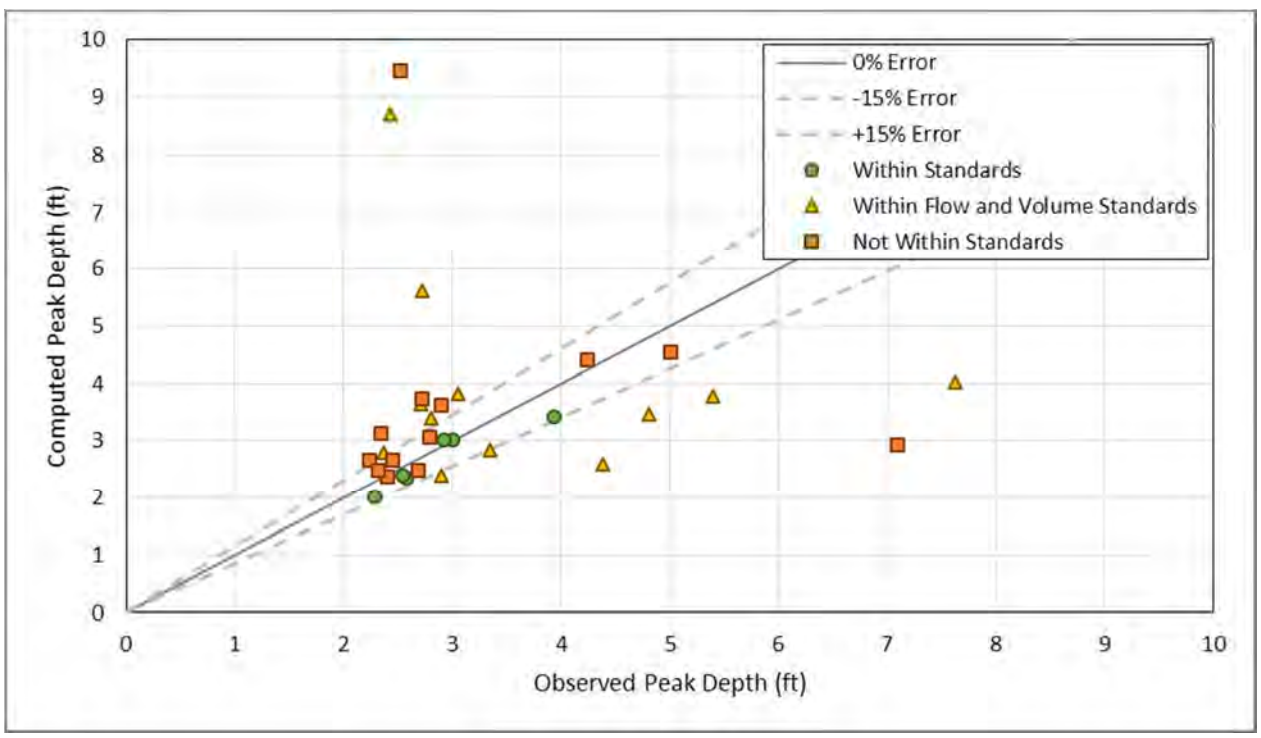


FIGURE 4-24
Scattergraph of Peak Depth, MC-EB-030

Monitor MC-EB-031

The model validation period for MC-EB-031 is January 2007 – December 2007. Thirty (30) total events were identified during the validation period, and all 30 are considered to have good data. Of the 30 events with good data, 0% (0 events) met MSDGC's C&V guidelines and standards for peak flow, volume, and depth. Table 4-12 summarizes the events and the C&V results for each. MC-EB-031 was calibrated during the RDII Pilot Study (MC-EB-014). For the pilot study 17 events (57%) met WaPUG guidelines for peak flow and volume. Eleven (11) events (37%), highlighted in yellow in the table below, met MSDGC C&V guidelines for peak flow and volume (which are the same as the WaPUG peak flow and volume guidelines used during the pilot study). During the pilot study, the sewershed was clipped just below the boundary and the typical year depth timeseries at the clipping location was used as the downstream boundary condition. It is likely that the change in boundary conditions (the model was not clipped at this point during this validation) or updates to the current version of the model made after the pilot study was performed changed the results for the remaining six events that were calibrated during the pilot study. Figures 4-25, 4-26, and 4-27 show the peak flow, volume, and peak depth scattergraphs, respectively. The model is generally under-predicting peak flow, volume, and depth at MC-EB-031.

TABLE 4-12
Events and Simulation Results, MC-EB-031

Event	Date	Duration (h)	Difference in Peak Flow (%)	Difference in Volume (%)	Difference in Depth (%)
1	1/11/2007 0:00	216	-54.21	-46.17	-65.29
2	2/17/2007 0:00	264	-53.47	-38.8	-59.95
3	3/13/2007 0:00	96	-13.62	-4.5	28.32
4	3/18/2007 0:00	72	33.3	15.65	69.67
5	3/21/2007 0:00	120	2.23	-2.96	42.69
6	3/26/2007 0:00	96	-14.3	2.6	28.12
7	3/30/2007 0:00	192	6.45	-10.42	39.06
8	4/9/2007 0:00	264	36.06	-4.31	71.17
9	4/23/2007 0:00	168	-31.5	9.33	15.77
10	5/3/2007 0:00	120	-29.96	-1.31	2.96
11	5/13/2007 0:00	144	7.28	8.34	42.66
12	6/2/2007 0:00	144	-25.58	-1.79	17.68
13	6/20/2007 0:00	96	-1.56	16.83	41.19
14	6/25/2007 0:00	120	-62.68	-34.17	-17.6
15	7/3/2007 0:00	120	-63.84	-7.23	-19.59
16	7/9/2007 0:00	96	-67.03	-15.33	-20.34
17	7/14/2007 0:00	72	-45.54	-12.37	5.27
18	7/18/2007 0:00	120	-53.88	-8.15	-2.81
19	8/3/2007 0:00	96	-67.15	-6.73	-14.36
20	8/7/2007 0:00	96	-59.31	-8.27	-6.99
21	8/19/2007 0:00	96	-2.6	6.38	31.47
22	9/7/2007 0:00	144	-0.68	-11.89	24.54
23	9/25/2007 0:00	120	8.62	-0.8	184.52
24	10/15/2007 0:00	48	-9.28	5.49	26.02
25	10/17/2007 0:00	72	-10.53	6.03	133.06
26	10/21/2007 0:00	144	-22.9	-5.95	-34.55

TABLE 4-12
Events and Simulation Results, MC-EB-031

Event	Date	Duration (h)	Difference in Peak Flow (%)	Difference in Volume (%)	Difference in Depth (%)
27	11/9/2007 0:00	96	41.34	11.86	60.11
28	11/19/2007 0:00	120	-7.25	-8.81	17.14
29	11/24/2007 0:00	144	5.91	-9.42	120.82
30	12/1/2007 0:00	96	-28.32	-29.33	-19.44

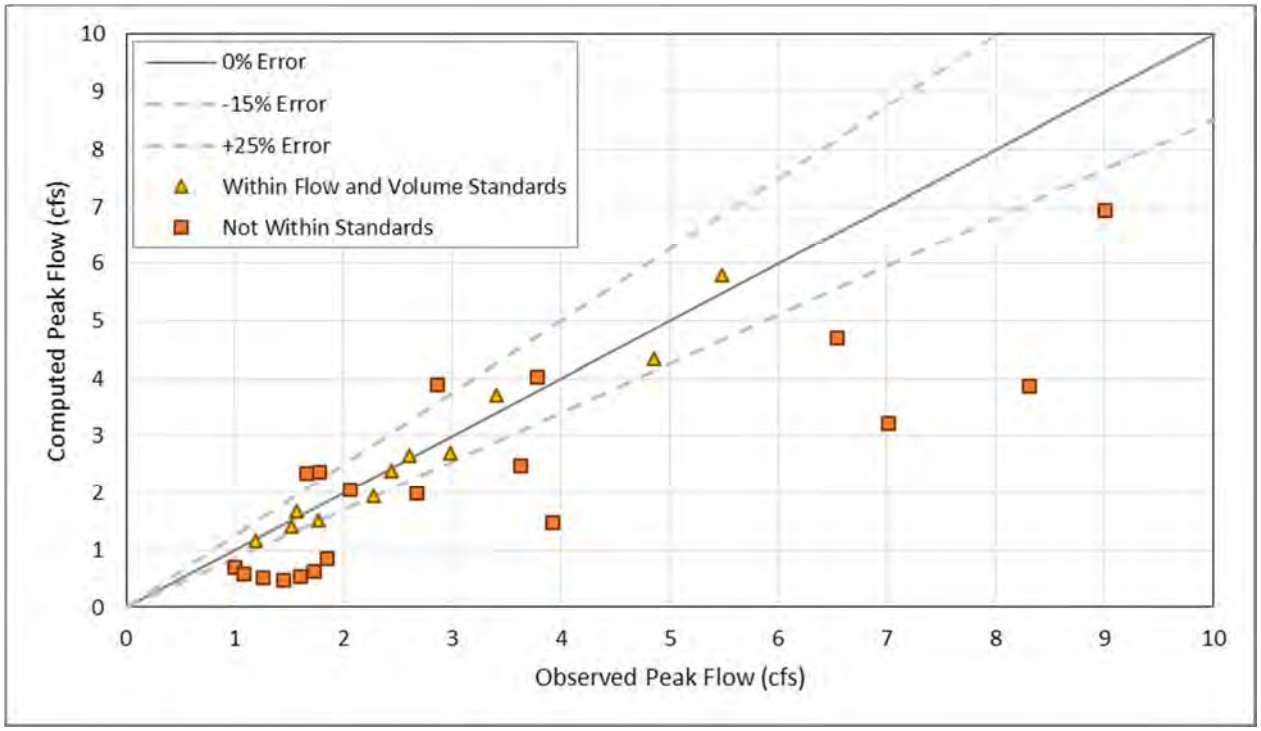


FIGURE 4-25
Scattergraph of Peak Flow, MC-EB-031

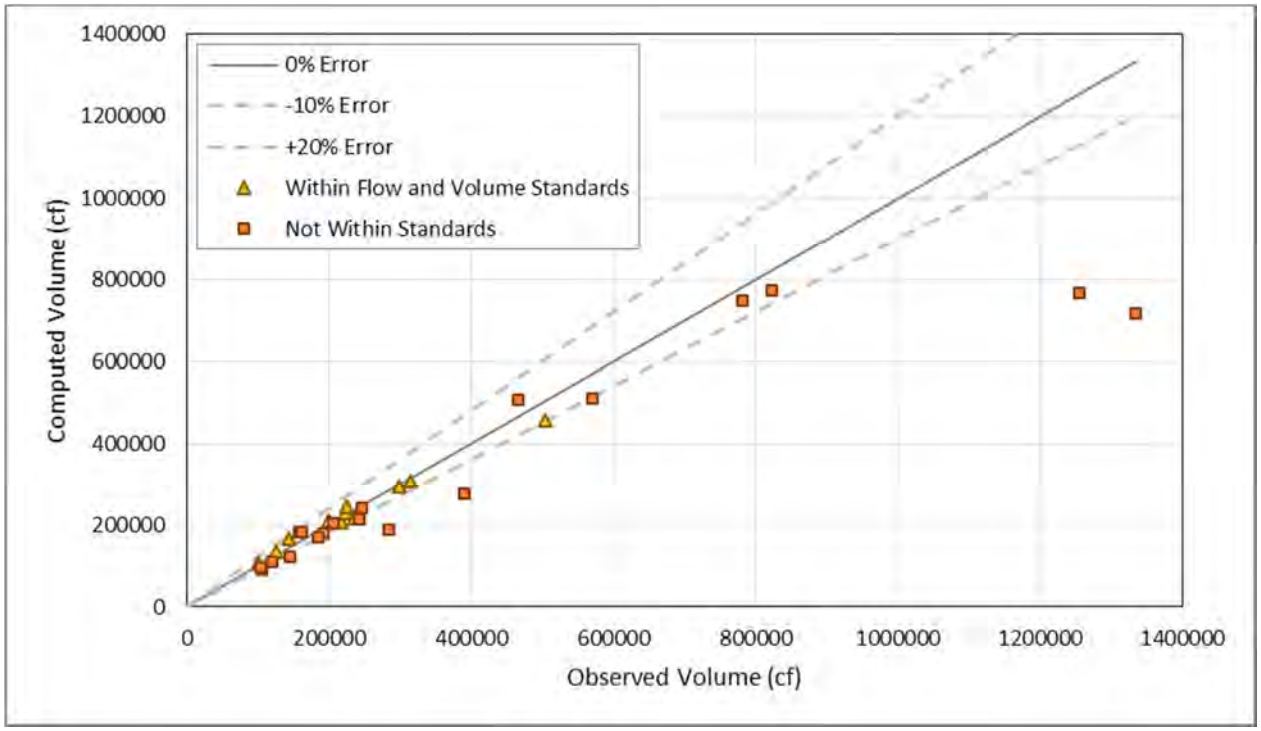


FIGURE 4-26
Scattergraph of Volume, MC-EB-031

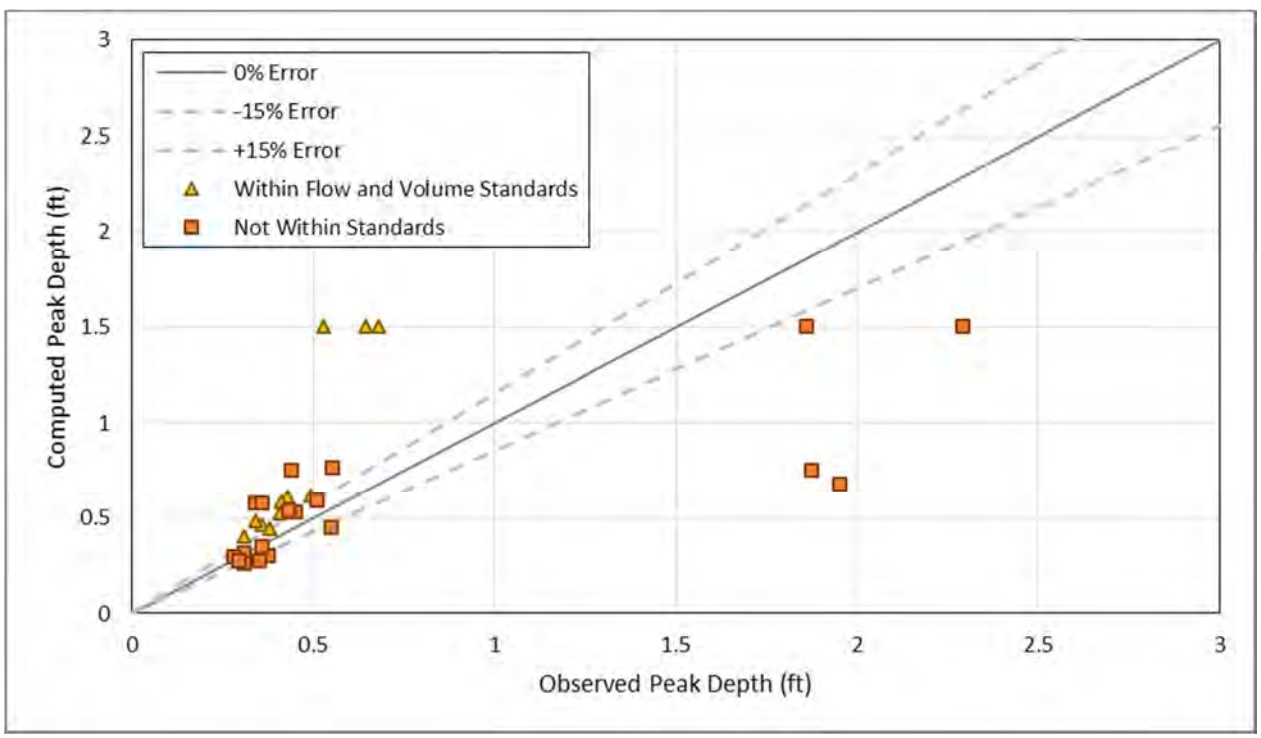


FIGURE 4-27
Scattergraph of Peak Depth, MC-EB-031

Monitor MC-EB-032

The model validation period for MC-EB-032 is January 2011 – December 2011. Fifty-three (53) total events were identified during the validation period, and 52 are considered to have good data. Of the 52 events with good data, 6% (3 events) met MSDGC's C&V guidelines and standards for peak flow, volume, and depth. Table 4-13 summarizes the events and the C&V results for each. Figures 4-28, 4-29, and 4-30 show the peak flow, volume, and peak depth scattergraphs, respectively. The model is generally over-predicting peak flow, volume, and depth at MC-EB-031.

TABLE 4-13
Events and Simulation Results, MC-EB-032

Event	Date	Duration (h)	Difference in Peak Flow (%)	Difference in Volume (%)	Difference in Depth (%)
1	1/1/2011 0:00	48	72.72	27.87	44.79
2	1/11/2011 6:00	42	9.49	38.18	-7.22
3	1/18/2011 0:00	96	-12.45	1.45	-13.22
4	2/1/2011 0:00	84	-21.68	-9.04	-11.84
5	2/5/2011 3:00	33	12.91	4.96	3.13
6	2/7/2011 6:00	48	-12.32	-14.3	-8.79
7	2/21/2011 8:00	148	50.87	36.31	36.24
8	2/28/2011 3:00	69	91.41	27.64	65.55
9	3/4/2011 6:00	90	19.78	-11.94	19.48
10	3/8/2011 21:00	123	20.72	-6.58	21.09
11	3/18/2011 15:00	39	102.89	37.79	62.22
12	4/1/2011 18:00	12	28.74	47.48	19.71
13	4/4/2011 11:00	97	60.57	4.75	41.53
14	4/9/2011 9:00	39	61.22	10.54	33.78
15	4/11/2011 6:00	90	23.93	-13.28	19.34
16	4/15/2011 12:00	72	55.17	-4.27	40.76
17	4/18/2011 21:00	279	24.03	-1.01	19.27
18	5/1/2011 18:00	222	29.76	-22.46	39.15
19	5/13/2011 12:00	180	64.57	-17.71	14.09
20	5/22/2011 21:00	195	33.05	-8.34	10.55
21	6/10/2011 10:00	65	205.37	147.09	115.61
22	6/15/2011 9:00	39	134.03	109.9	47.97
23	6/19/2011 9:00	138	93.83	73.54	51.12
24	6/26/2011 3:00	96	93.66	33.16	47.01
25	7/4/2011 6:00	18	6.36	23.73	-6.97
26	7/8/2011 0:00	96	173.83	52.48	83.97
27	7/23/2011 11:00	10	-13.82	5.14	-14.66
28	7/24/2011 14:00	13	177.62	152.87	86.47
29	8/3/2011 3:00	24	163.36	289.86	71.35
30	8/7/2011 3:00	141	102.01	218.68	78.95
31	8/14/2011 0:00	9	101.34	162.36	36.23
32	8/14/2011 18:00	9	63.56	150.49	27.31
33	8/21/2011 12:00	12	73.99	108.72	37.28

TABLE 4-13
Events and Simulation Results, MC-EB-032

Event	Date	Duration (h)	Difference in Peak Flow (%)	Difference in Volume (%)	Difference in Depth (%)
34	8/25/2011 0:00	12	116.28	166.87	46.46
35	9/4/2011 0:00	30	149.97	252.47	69.43
36	9/7/2011 0:00	48	67.15	108.47	40.54
37	9/14/2011 21:00	15	305.75	277.84	120.62
38	9/19/2011 7:00	29	237.28	201.2	115.37
39	9/21/2011 2:00	34	69.78	91.64	32.49
40	9/23/2011 3:00	47	126.16	120.62	69.32
A	9/25/2011 21:00	51			
41	9/29/2011 15:00	36	161.52	138.46	71.96
42	10/13/2011 8:00	18	95.19	136.09	34.34
43	10/18/2011 17:00	85	14.54	24.18	17.13
44	10/26/2011 18:00	78	178.86	80.53	106.6
45	11/3/2011 12:00	108	91.77	27.13	58.43
46	11/14/2011 15:00	117	36.49	18.82	26.89
47	11/21/2011 4:00	116	38.05	11.5	46.91
48	11/27/2011 0:00	144	-11.11	-18.66	4.23
49	12/4/2011 12:00	162	-21.88	-0.54	-10.6
50	12/15/2011 2:00	22	48.55	64.55	30.19
51	12/19/2011 18:00	156	31.65	26.83	29.33
52	12/27/2011 0:00	120	37.97	-2.59	17.54

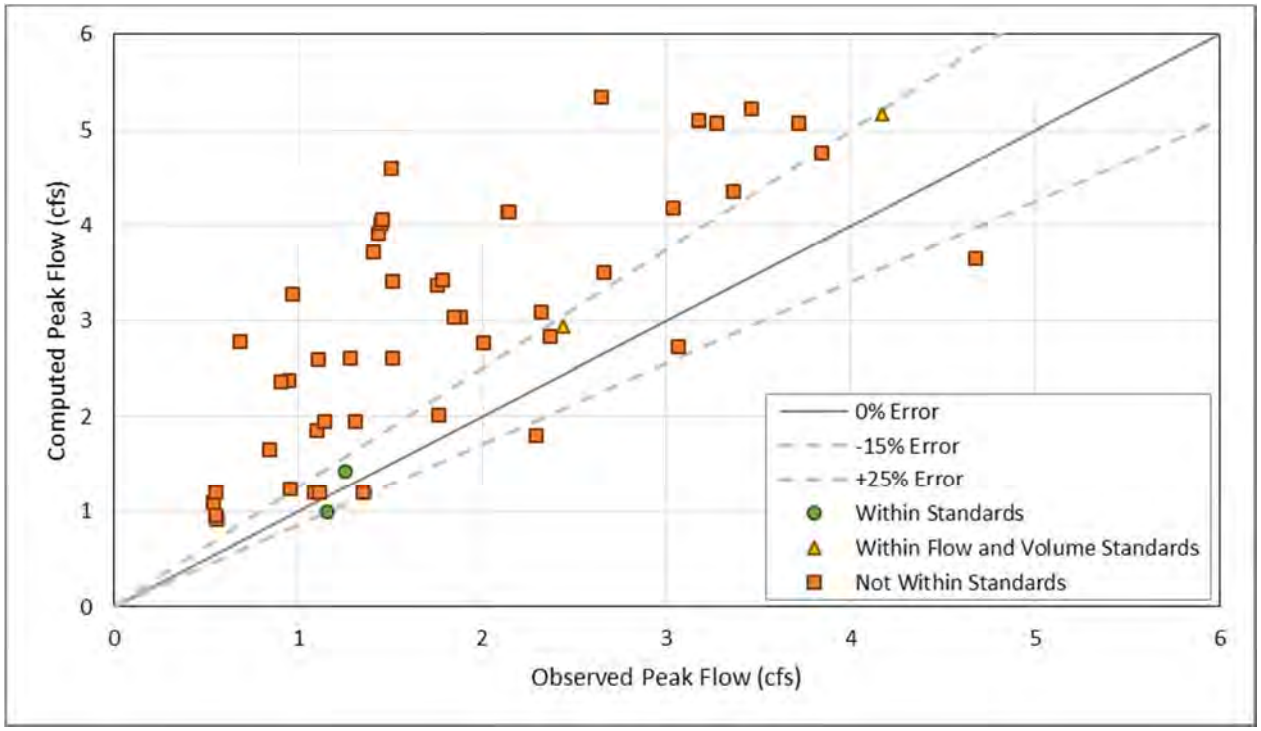


FIGURE 4-28
Scattergraph of Peak Flow, MC-EB-032

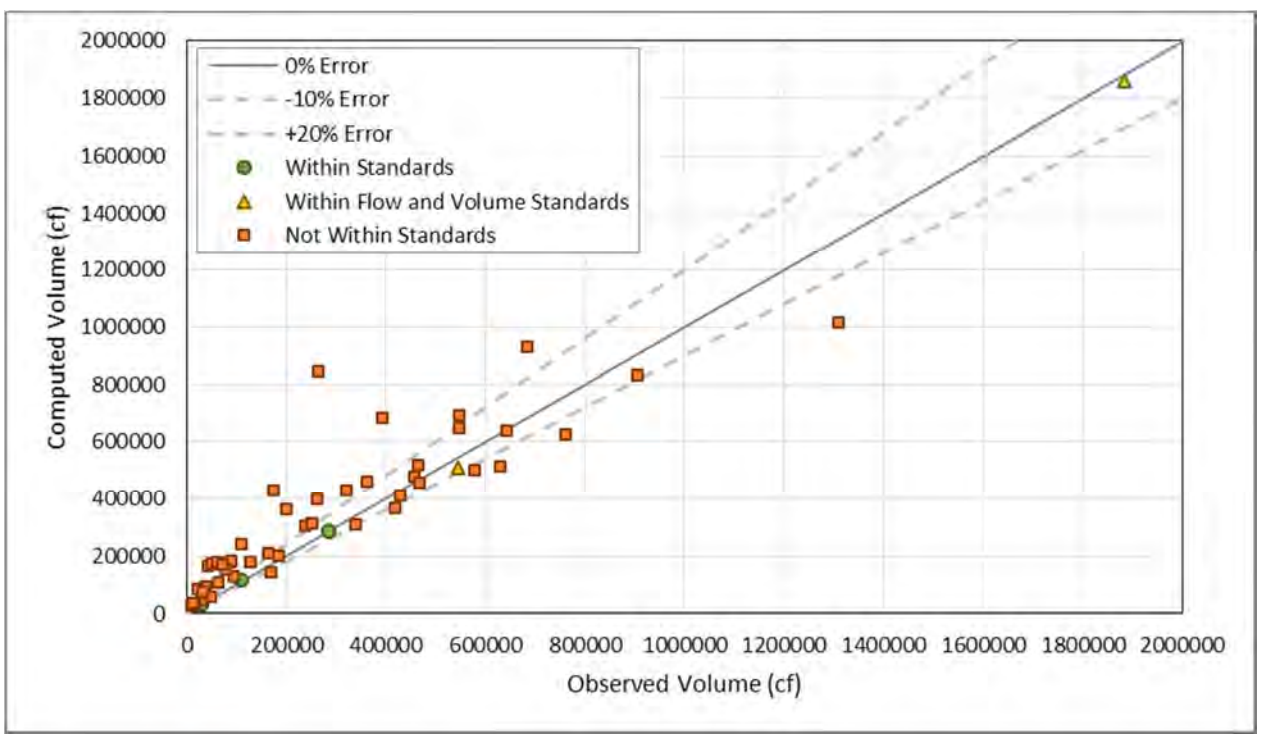


FIGURE 4-29
Scattergraph of Volume, MC-EB-032

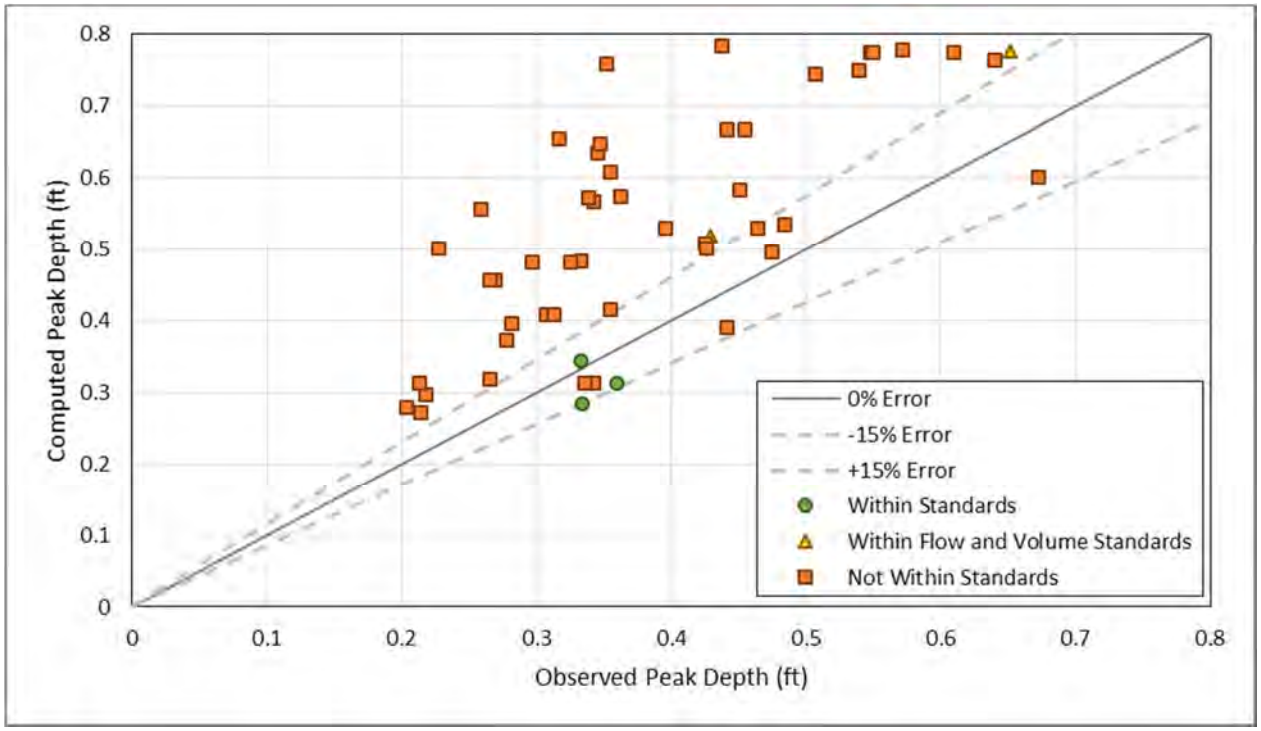


FIGURE 4-30
Scattergraph of Peak Depth, MC-EB-032

Monitor MC-EB-033

The model validation period for MC-EB-033 is January 2012 – December 2012. Fifty-three (53) total events were identified during the validation period, and 51 are considered to have good data. Of the 51 events with good data, 0% (0 events) met MSDGC's C&V guidelines and standards for peak flow, volume, and depth. Table 4-14 summarizes the events and the C&V results for each. Figures 4-3, 4-32, and 4-33 show the peak flow, volume, and peak depth scattergraphs, respectively. The model is generally overpredicting peak flow, volume, and depth at MC-EB-033.

TABLE 4-14
Events and Simulation Results, MC-EB-033

Event	Date	Duration (h)	Difference in Peak Flow (%)	Difference in Volume (%)	Difference in Depth (%)
1	1/11/2012 3:00	21	62.93	25.61	4
2	1/13/2012 0:00	24	-1.62	-0.88	-19.15
3	1/17/2012 0:00	120	38.43	-30.14	-45.2
4	1/23/2012 0:00	48	-28.52	-36.47	-36.48
5	1/26/2012 0:00	96	-21.35	-50.72	-92.03
6	2/4/2012 3:00	24	-12.89	-37.77	-20.48
7	2/16/2012 0:00	24	26	-1.53	-8.48
8	2/24/2012 0:00	24	-20.33	-14.45	-28.5
9	2/29/2012 0:00	24	14.02	15.75	-20.42
10	3/2/2012 12:00	12	14.84	11.58	-16.24
11	3/8/2012 0:00	96	50.47	-28.5	-3.47
A	3/15/2012 12:00	12			
12	3/16/2012 6:00	21	86.84	-6.95	3.8

TABLE 4-14
Events and Simulation Results, MC-EB-033

Event	Date	Duration (h)	Difference in Peak Flow (%)	Difference in Volume (%)	Difference in Depth (%)
13	3/23/2012 0:00	96	10.22	-33.67	-24.17
14	3/30/2012 16:00	8	36.83	-8.68	-12.36
15	4/1/2012 21:00	51	65.21	2.36	-15.85
16	4/14/2012 6:00	42	67.41	0.43	-16.71
17	4/20/2012 21:00	9	13.5	31.13	-26.75
18	4/25/2012 16:00	32	109.07	43.24	-14.58
19	4/28/2012 6:00	15	17.03	-3.95	-25.45
20	4/30/2012 0:00	36	30.67	24.95	-24.57
B	5/1/2012 12:00	60			
21	5/4/2012 12:00	36	32.84	-28.08	-23.05
22	5/7/2012 16:00	32	30.16	-9.66	-24.61
23	5/13/2012 0:00	96	-4.38	-32.45	-32.44
24	5/29/2012 0:00	24	49.17	19.93	-5.84
25	6/1/2012 0:00	24	139.2	87.54	-51.46
26	6/17/2012 12:00	12	3.1	-14.78	-23.37
27	6/22/2012 0:00	24	-1.44	25.74	-24.53
28	6/29/2012 12:00	15	112.36	70.33	20.87
29	7/1/2012 16:00	14	111.25	96.33	-7.4
30	7/5/2012 8:00	19	60.8	131.55	-18.49
31	7/14/2012 3:00	27	30.68	79.79	-22.67
32	7/19/2012 3:00	24	67.17	124.95	-19.4
33	7/24/2012 3:00	21	114.09	166.87	-10.14
34	7/26/2012 12:00	39	84.71	114.67	-12.56
35	8/10/2012 0:00	12	72.63	74.49	-1.18
36	8/21/2012 0:00	24	25.6	45.61	-9.36
37	9/5/2012 12:00	12	42.04	92.77	-12.25
38	9/7/2012 12:00	42	88.61	52.37	0
39	9/21/2012 8:00	13	46.99	62.1	1.53
40	10/1/2012 12:00	18	59.41	85.67	-4.09
41	10/5/2012 21:00	33	41.07	16.38	-8.97
42	10/26/2012 12:00	42	102.6	43.5	15.23
43	10/30/2012 3:00	24	75.08	36.83	3.97
44	11/3/2012 12:00	15	28.35	11.48	-9.04
45	11/12/2012 0:00	48	77.48	46.68	-6.09
46	12/2/2012 8:00	16	106.61	65.46	-4.82
47	12/7/2012 0:00	30	62.63	124.96	-15.6
48	12/9/2012 21:00	9	57.76	81.75	-23.34
49	12/17/2012 6:00	42	63.11	69.95	-18.01
50	12/20/2012 3:00	69	61.71	23.26	-10.26
51	12/26/2012 0:00	51	243.96	68.25	46.22

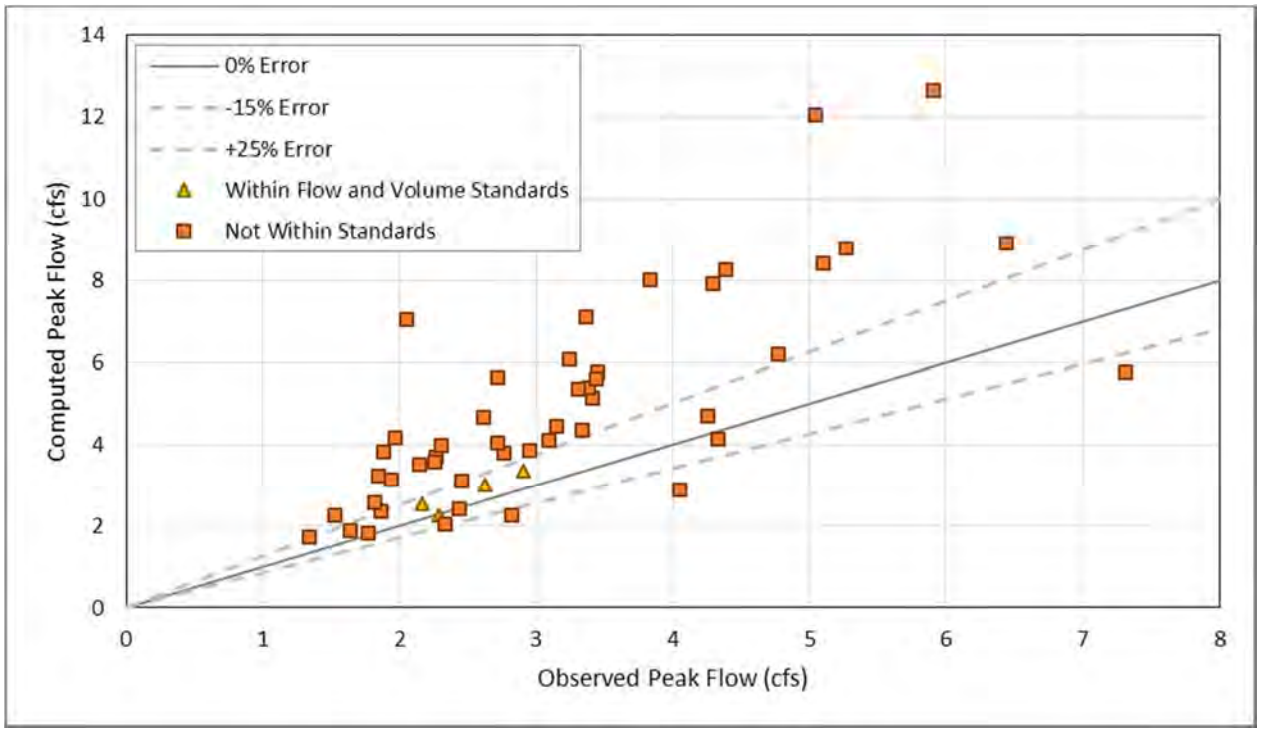


FIGURE 4-31
Scattergraph of Peak Flow, MC-EB-033

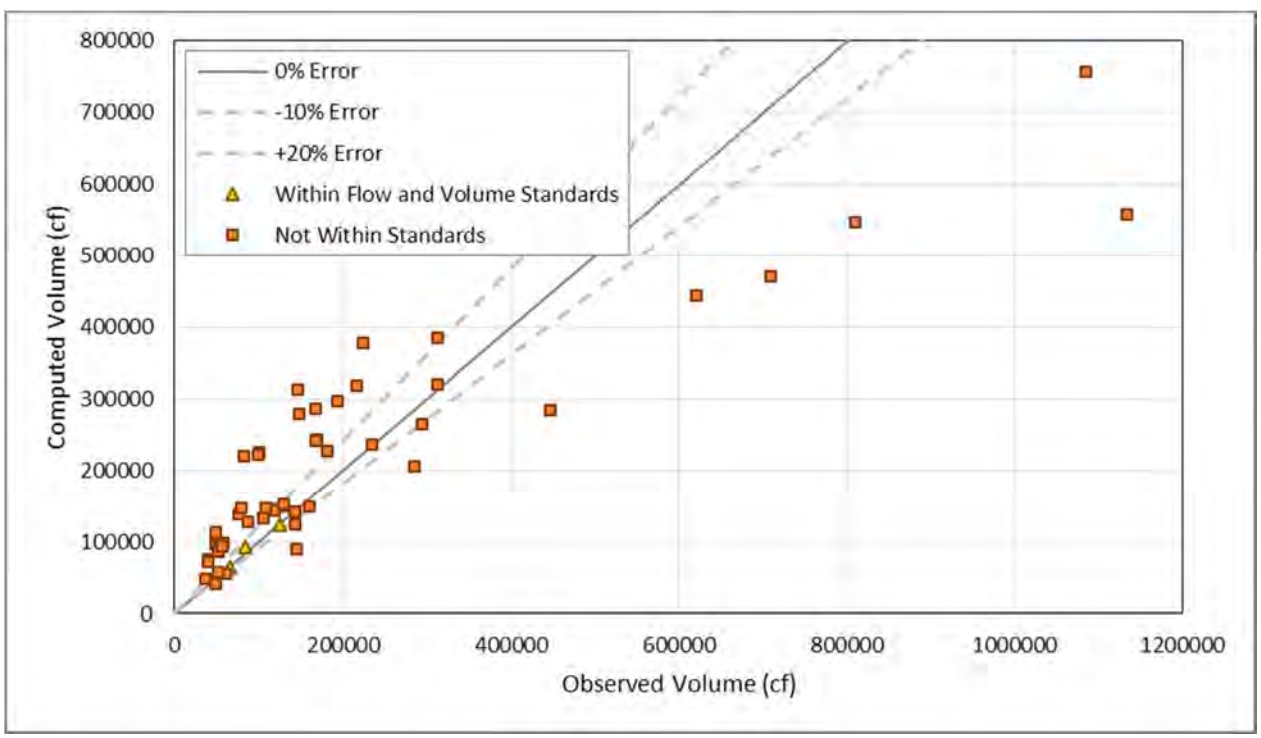


FIGURE 4-32
Scattergraph of Volume, MC-EB-033

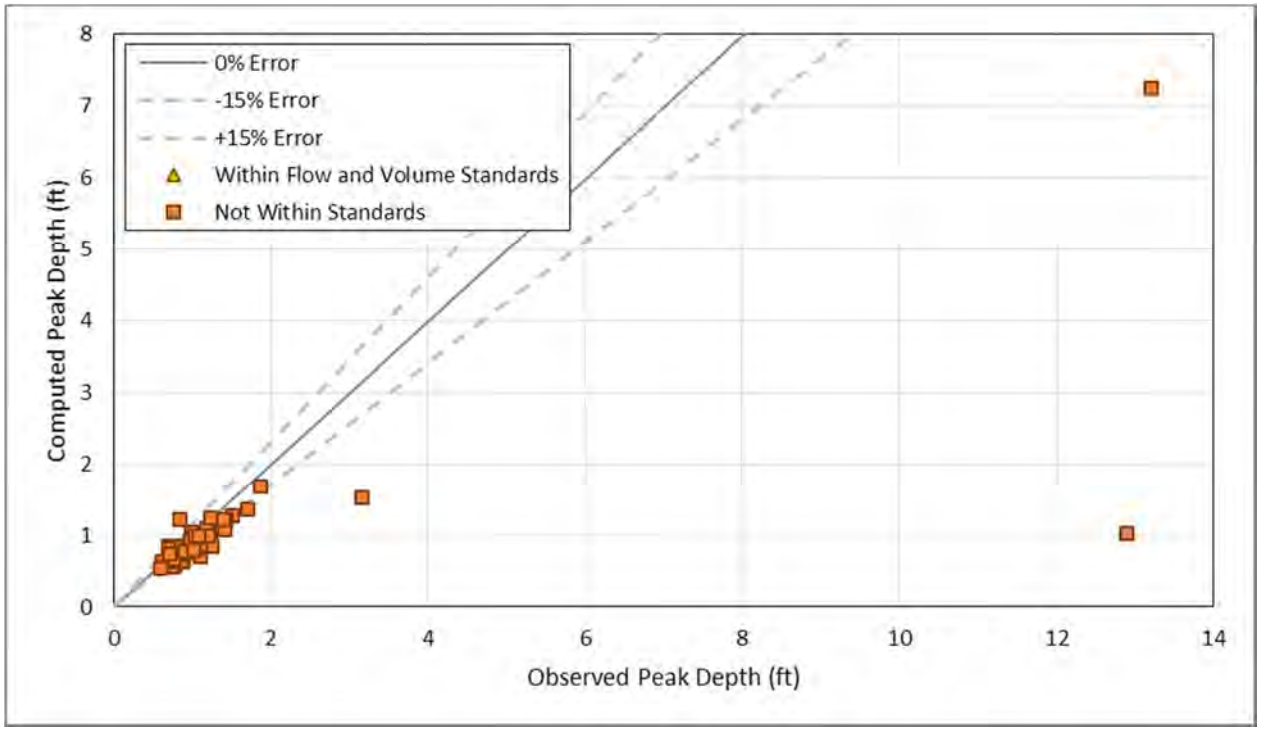


FIGURE 4-33
Scattergraph of Peak Depth, MC-EB-033

Monitor MC-EB-035

The model validation period for MC-EB-035 is January 2009 – December 2009. Eighteen (18) total events were identified during the validation period, and all 18 are considered to have good data. Of the 18 events with good data, 6% (1 event) met MSDGC's C&V guidelines and standards for peak flow, volume, and depth. Table 4-15 summarizes the events and the C&V results for each. MC-EB-035 was calibrated during the RDII Pilot Study (MC-EB-036). For the pilot study 14 events (74%) met WaPUG guidelines for peak flow and volume. No events met MSDGC C&V guidelines for peak flow and volume (which are the same as the WaPUG peak flow and volume guidelines used during the pilot study). It is likely that the events do not meet the guidelines for peak flow and volume at this time because of updates to the current version of the model made after the pilot study was performed. Figures 4-34, 4-35, and 4-36 show the peak flow, volume, and peak depth scattergraphs, respectively. The model is generally under-predicting peak flow, volume, and depth at MC-EB-035.

TABLE 4-15
Events and Simulation Results, MC-EB-035

Event	Date	Duration (h)	Difference in Peak Flow (%)	Difference in Volume (%)	Difference in Depth (%)
1	1/9/2009 0:00	96	-15.17	-29.7	5.06
2	2/9/2009 0:00	168	-59.22	-35.81	-30.97
3	2/23/2009 0:00	216	-24.07	-22.74	-2.16
4	3/21/2009 0:00	144	-11.56	-18.97	2.95
5	4/2/2009 0:00	168	1.66	-20.94	7.14
6	4/9/2009 0:00	168	-1.67	-12.4	10.29
7	4/18/2009 0:00	168	-20.7	-21.13	-8.19
8	5/11/2009 0:00	168	-22.2	-40.66	2.7

TABLE 4-15
Events and Simulation Results, MC-EB-035

Event	Date	Duration (h)	Difference in Peak Flow (%)	Difference in Volume (%)	Difference in Depth (%)
9	5/24/2009 0:00	168	-46.53	-33.19	-20.99
10	7/22/2009 0:00	144	-19.11	-21.43	-10.15
11	8/2/2009 0:00	168	-17.85	-25.14	-2.9
12	8/25/2009 0:00	144	-40.46	-28.84	-17.7
13	9/5/2009 0:00	192	-44.95	-9.32	-37.77
14	9/20/2009 0:00	192	-31.05	-17.62	-10.05
15	10/6/2009 0:00	168	2.43	-16.22	6.31
16	10/24/2009 0:00	192	-16.51	-14.09	-2
17	11/15/2009 0:00	192	-19.03	-13.58	-2.51
18	12/5/2009 0:00	192	6.23	0.31	1.11

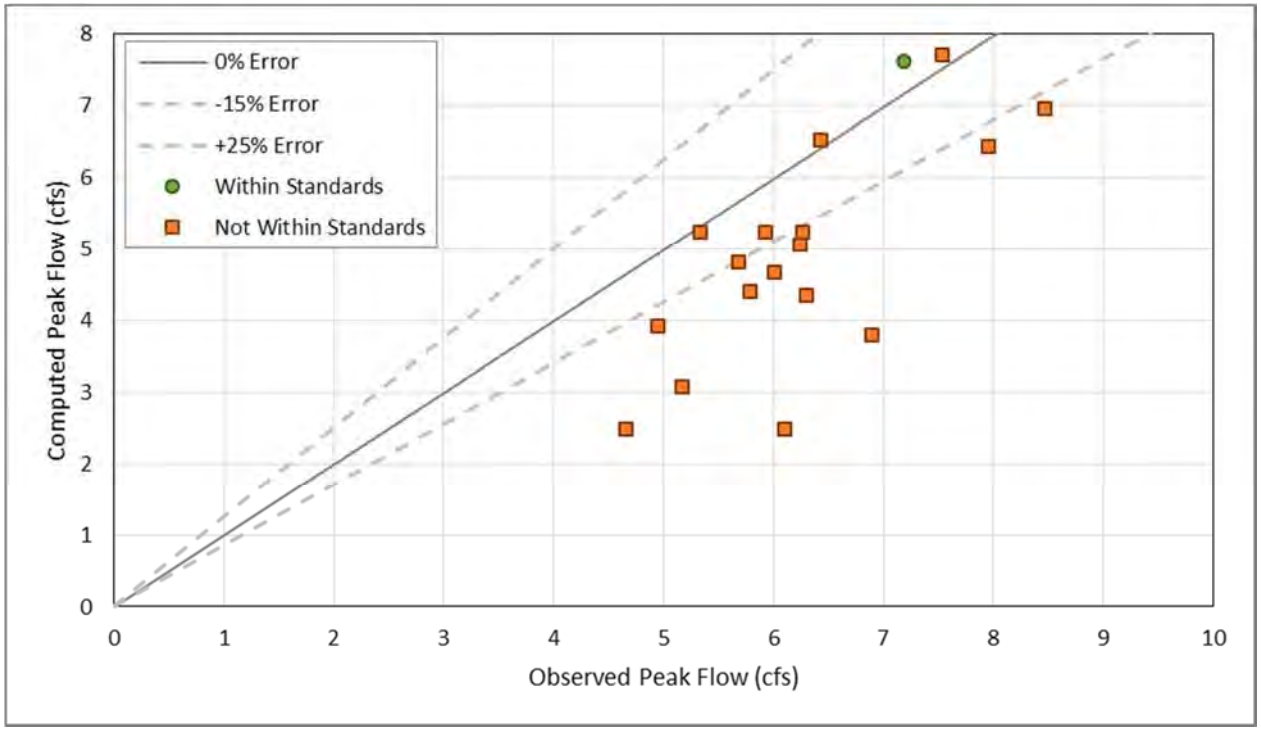


FIGURE 4-34
Scattergraph of Peak Flow, MC-EB-035

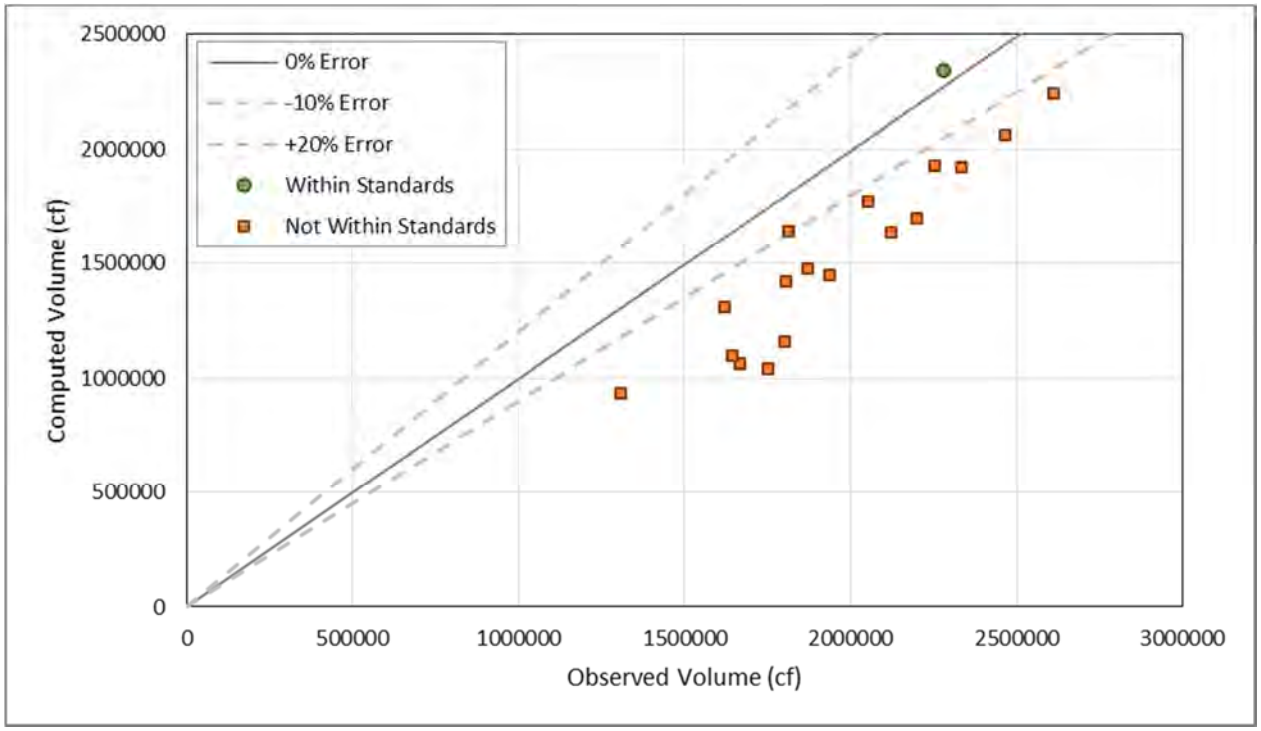


FIGURE 4-35
Scattergraph of Volume, MC-EB-035

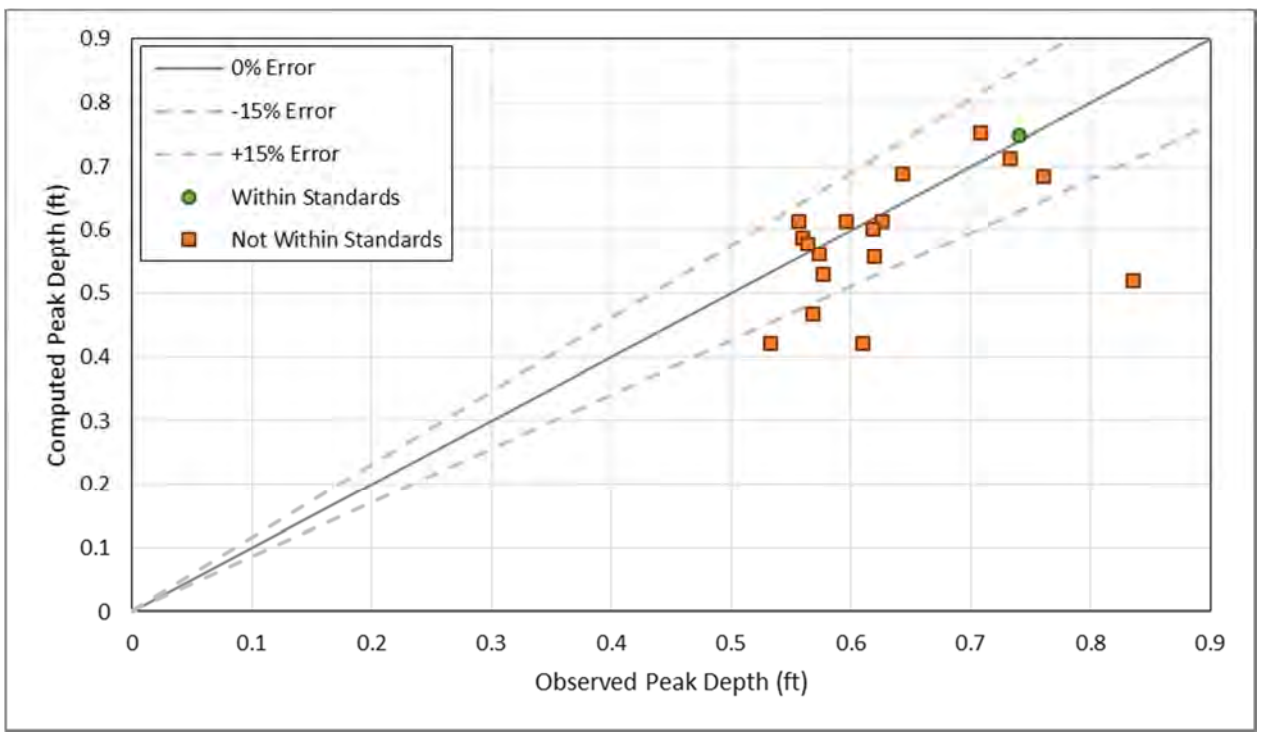


FIGURE 4-36
Scattergraph of Peak Depth, MC-EB-035

Monitor MC-EB-036

The model validation period for MC-EB-036 is April 2006 – March 2007. Thirty-eight (38) total events were identified during the validation period, and 31 are considered to have good data. Of the 31 events with good data, 0% (0 events) met MSDGC's C&V guidelines and standards for peak flow, volume, and depth.
Table 4-16 summarizes the events and the C&V results for each. Figures 4-37, 4-38, and 4-39 show the peak flow, volume, and peak depth scattergraphs, respectively. The model is generally over-predicting peak flow, volume, and depth at MC-EB-036.

TABLE 4-16
Events and Simulation Results, MC-EB-036

Event	Date	Duration (h)	Difference in Peak Flow (%)	Difference in Volume (%)	Difference in Depth (%)
1	4/2/2006 21:00	33	97.81	52.14	43.12
A	4/14/2006 5:00	55			
2	4/17/2006 0:00	48	370.63	305.26	132.67
3	4/21/2006 15:00	39	279.43	300.36	81.79
4	5/10/2006 17:00	59	204.01	225.46	109.14
5	5/17/2006 22:00	50	414.71	417.77	143.32
6	5/25/2006 0:00	53	129.82	281.62	68.89
7	6/1/2006 17:00	55	300.09	229.45	137.06
8	6/10/2006 8:00	66.5	276.29	235.28	116.19
9	6/19/2006 16:30	31	303.28	546.53	96.68
10	6/22/2006 17:00	59	384.78	293.18	137.74
11	6/26/2006 23:00	30	-55.81	22.64	-27.61
12	6/28/2006 21:30	8.5	209.39	207.41	91.99
13	7/4/2006 15:00	13	-9.7	53.93	-2.79
14	7/11/2006 12:00	21.5	144.96	330.69	74.78
15	7/27/2006 12:00	41	469.73	443.78	174.64
16	8/3/2006 21:00	6	-8.88	1.11	-15.18
17	8/10/2006 14:00	16	-19.71	20.13	-19.76
B	9/1/2006 0:00	28			
18	9/12/2006 13:00	35	309.3	488.55	111.22
19	10/4/2006 22:00	28	344.7	221.96	148
20	10/11/2006 17:00	18	147.82	165.43	68.93
C	10/16/2006 17:00	31			
21	10/19/2006 21:00	22	313.95	551.56	148.25
D	11/15/2006 11:30	60.5			
22	11/23/2006 7:00	44	-26.96	20.68	-1.59
E	12/21/2006 12:00	49			
F	1/5/2007 3:00	45			
G	1/13/2007 3:00	30			
23	2/13/2007 9:30	46.5	-67.76	-29.89	-38.66
24	2/20/2007 11:00	56.5	50.84	64.58	24.26
25	2/24/2007 19:00	51	34.45	70.44	42.77
26	3/1/2007 15:20	26.67	107.17	219.7	84.6

TABLE 4-16
Events and Simulation Results, MC-EB-036

Event	Date	Duration (h)	Difference in Peak Flow (%)	Difference in Volume (%)	Difference in Depth (%)
27	3/6/2007 3:00	16	-74.71	-14.92	-52.44
28	3/15/2007 6:00	23	85.01	89.17	55.46
29	3/19/2007 11:15	16.75	214.85	111.32	114.06
30	3/22/2007 9:30	19.5	153.2	92.14	82.04
31	3/28/2007 10:00	46	156.87	103.09	90.66

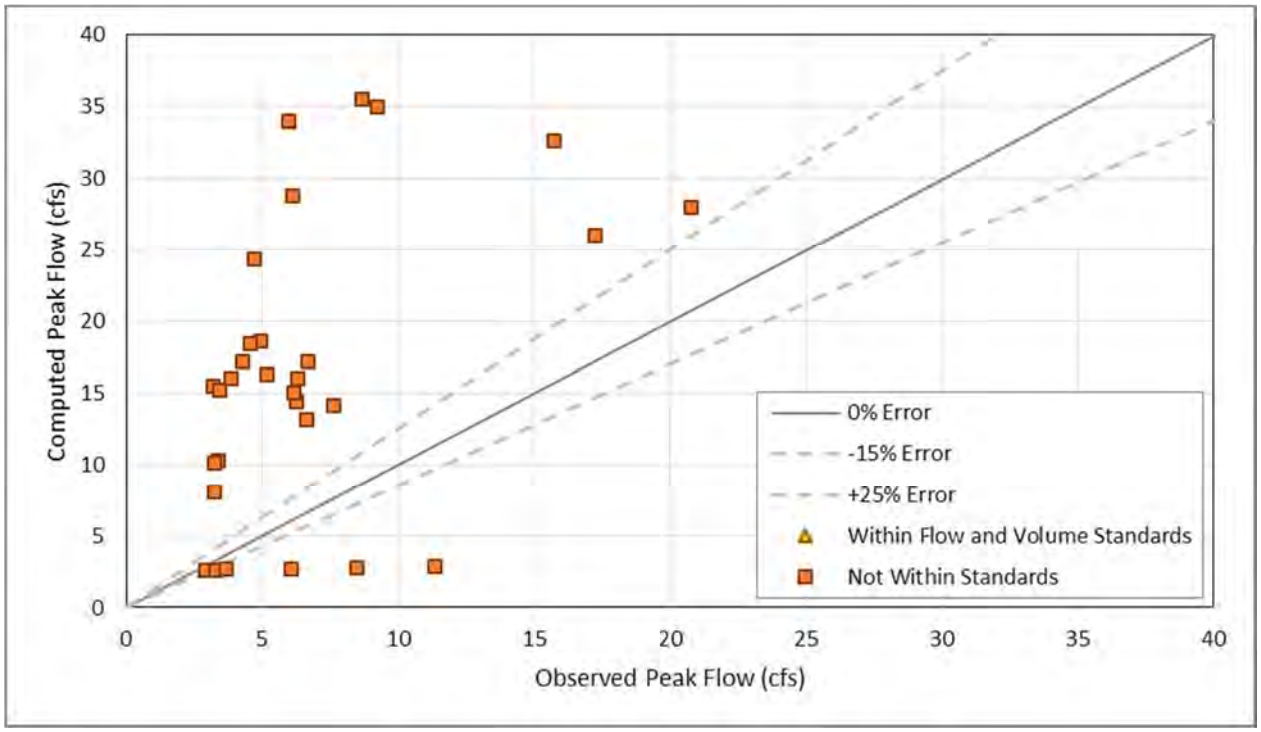


FIGURE 4-37
Scattergraph of Peak Flow, MC-EB-036

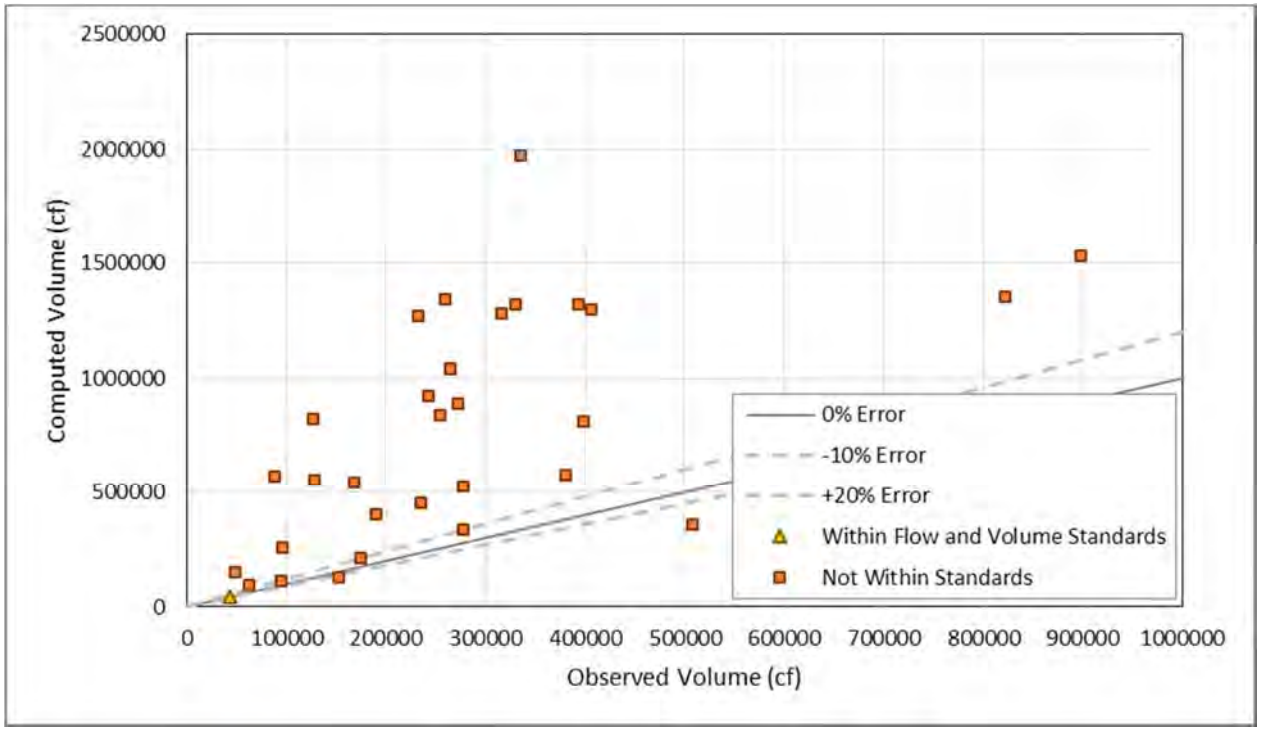


FIGURE 4-38
Scattergraph of Volume, MC-EB-036

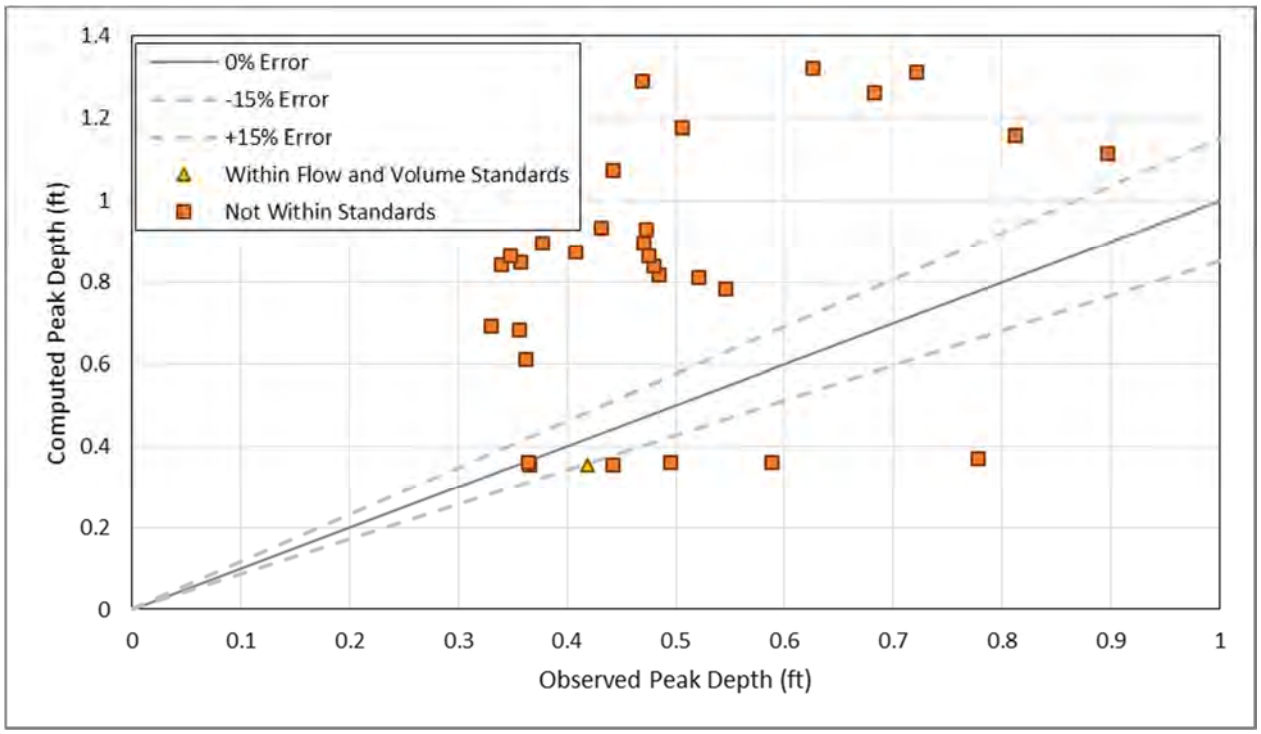


FIGURE 4-39
Scattergraph of Peak Depth, MC-EB-036

Monitor MC-EB-063

The model validation period for MC-EB-063 is January 2009 – December 2009. Fifty-seven (57) total events were identified during the validation period, and 55 are considered to have good data. Of the 55 events with good data, 4% (2 events) met MSDGC's C&V guidelines and standards for peak flow, volume, and depth. Table 4-17 summarizes the events and the C&V results for each. Figures 4-40, 4-41, and 4-42 show the peak flow, volume, and peak depth scattergraphs, respectively. The model is generally underpredicting peak flow, volume, and depth at MC-EB-063.

TABLE 4-17
Events and Simulation Results, MC-EB-063

Event	Date	Duration (h)	Difference in Peak Flow (%)	Difference in Volume (%)	Difference in Depth (%)
1	1/4/2009 6:00	18	-8.07	-15.24	-5.7
2	1/6/2009 6:00	66	-10.36	-22.01	-15.1
3	1/10/2009 6:00	90	1.32	-34.6	399.14
4	1/28/2009 0:00	24	-76.6	-63.4	-48.26
A	2/1/2009 9:00	15			
B	2/7/2009 6:00	42			
5	2/10/2009 16:00	80	-56.01	-61.53	-27.82
6	2/18/2009 0:00	24	-24.77	-35.1	-3.17
7	2/21/2009 12:00	12	-39.04	-42.7	-23.15
8	2/27/2009 0:00	96	-12.86	-37.96	51.19
9	3/8/2009 12:00	18	5.42	9.2	9.86
10	3/11/2009 0:00	24	-4.8	-21.79	-2.22
11	3/18/2009 21:00	27	24.48	12.78	28.71
12	3/25/2009 0:00	72	6.49	-23.79	11.97
13	3/29/2009 0:00	24	-37.24	-42.92	-2.95
14	4/2/2009 16:00	56	-17.16	-28.2	417.46
15	4/5/2009 21:00	9	-16.46	-20.43	11.6
16	4/10/2009 0:00	72	-8.97	-29.8	452.78
17	4/13/2009 16:00	56	-21.92	-50.34	5.3
18	4/19/2009 12:00	36	-4.71	-21.32	-9.33
19	4/30/2009 3:00	21	29.73	-17.57	26.77
20	5/6/2009 12:00	18	-16.85	-32.63	-5.58
21	5/8/2009 12:00	18	-29.5	-24.34	-9.78
22	5/13/2009 12:00	36	2.37	6.67	671.23
23	5/16/2009 0:00	24	-33.47	-46.56	-8.48
24	5/26/2009 12:00	18	-37.39	-9.7	-11.58
25	6/2/2009 16:00	35	-4.13	15.91	34.65
26	6/10/2009 0:00	72	-37.46	-27.33	-14.28
27	6/14/2009 12:00	36	-56.47	-49.16	-27.94
28	6/16/2009 16:00	56	-6.04	-28.61	626.13
29	6/20/2009 0:00	16	-28.04	-27.52	-24.13
30	6/25/2009 21:00	51	-92.25	-71.95	-95.05
31	7/22/2009 0:00	48	2.91	27.53	451.33
32	7/25/2009 0:00	24	31.21	25.73	581

TABLE 4-17
Events and Simulation Results, MC-EB-063

Event	Date	Duration (h)	Difference in Peak Flow (%)	Difference in Volume (%)	Difference in Depth (%)
33	7/29/2009 0:00	24	-20.89	-7.65	-3.26
34	7/30/2009 12:00	36	14.28	10.29	676.28
35	8/4/2009 0:00	72	-3.24	0.23	62.5
36	8/10/2009 12:00	36	-10.15	-2.03	-13.55
37	8/17/2009 12:00	12	-74.05	-49.96	-56.38
38	8/27/2009 16:00	8	-68.67	-45.17	-47.49
39	9/7/2009 0:00	24	-4.95	117.64	111.64
40	9/8/2009 16:00	16	22.84	67.37	26.32
41	9/20/2009 8:00	40	13.29	8.31	20.66
42	9/24/2009 3:00	33	5.96	20.34	21.69
43	9/26/2009 21:00	33	-9.92	-22.15	-18.1
44	10/2/2009 0:00	24	-36.8	-7.66	-19.86
45	10/8/2009 12:00	60	-5.37	20.68	69.12
46	10/15/2009 3:00	21	-25.69	-14.24	-30.28
47	10/23/2009 0:00	48	32.25	24.31	889.02
48	10/27/2009 21:00	51	6.24	-19.49	426.88
49	10/31/2009 0:00	72	-21.18	-37.64	-6.93
50	11/17/2009 12:00	18	4.6	15.32	17.76
51	12/2/2009 8:00	24	2.27	-9.65	15.9
52	12/8/2009 0:00	80	28.97	-7.71	885.14
53	12/13/2009 3:00	24	-76.04	-65.72	-52.7
54	12/19/2009 3:00	24	-73.77	-60.72	-48.61
55	12/25/2009 0:00	32	2.76	-21.97	1.62

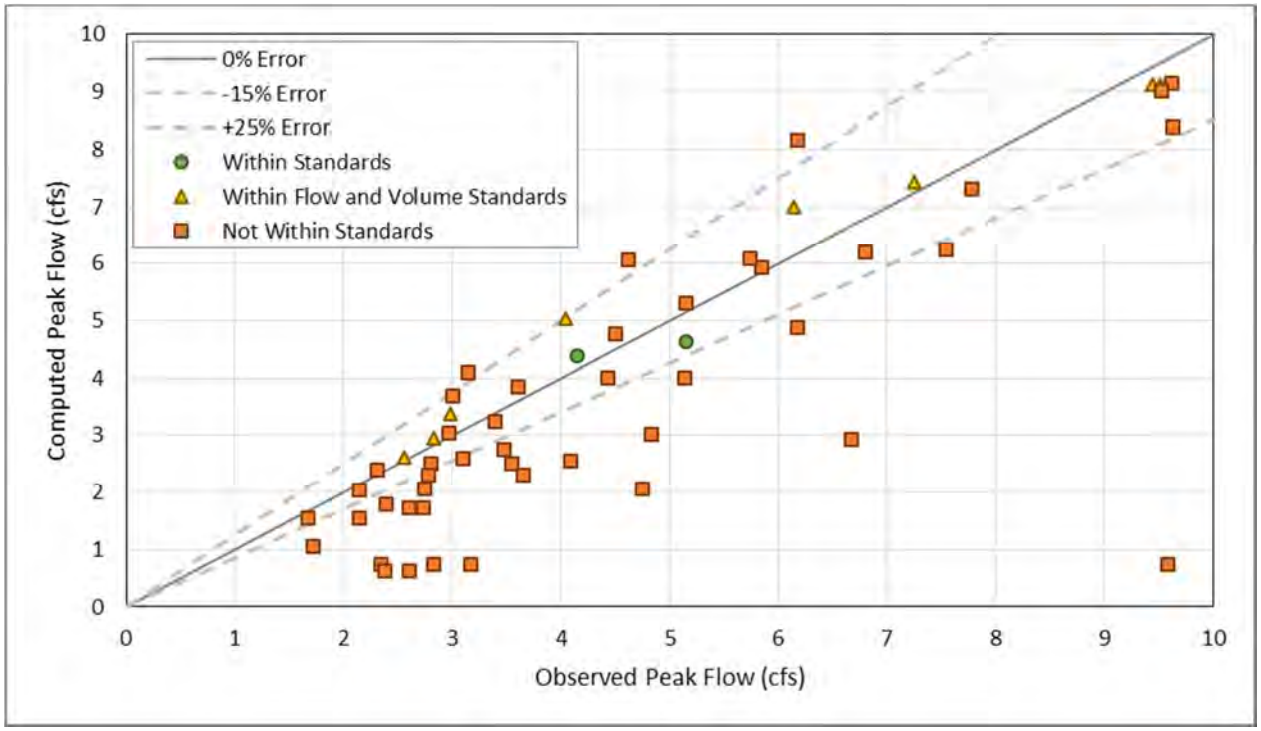


FIGURE 4-40
Scattergraph of Peak Flow, MC-EB-063

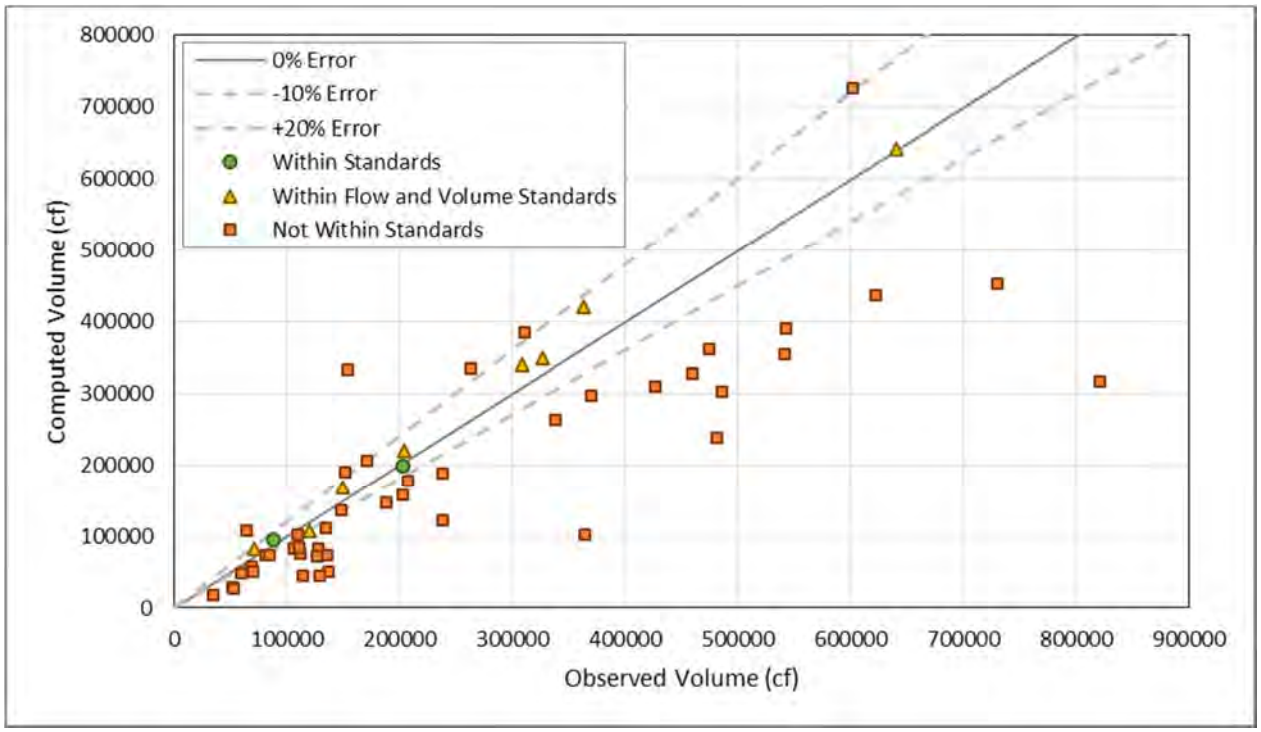


FIGURE 4-41
Scattergraph of Volume, MC-EB-063

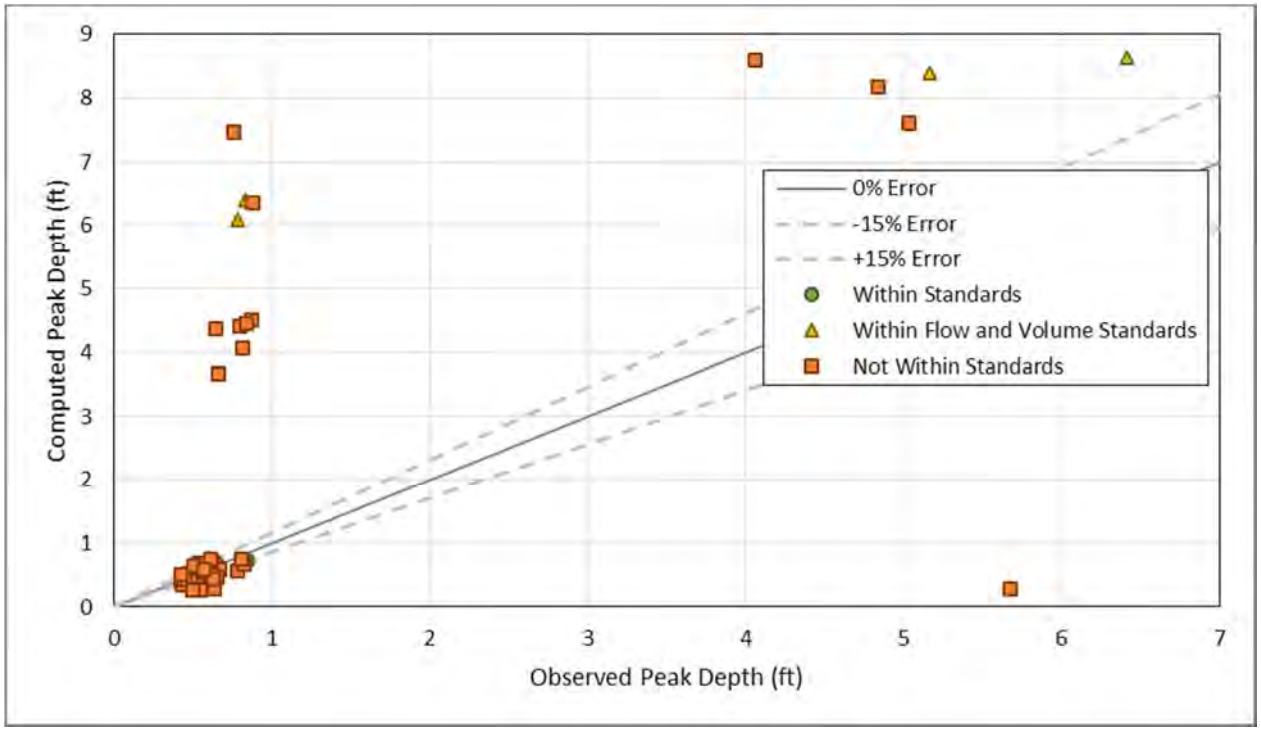


FIGURE 4-42
Scattergraph of Peak Depth, MC-EB-063

Monitor MC-EB-064

The model validation period for MC-EB-064 is January 2009 – December 2009. Fifty-seven (57) total events were identified during the validation period, and 55 are considered to have good data. Of the 55 events with good data, 7% (4 events) met MSDGC's C&V guidelines and standards for peak flow, volume, and depth. Table 4-18 summarizes the events and the C&V results for each. Figures 4-43, 4-44, and 4-45 show the peak flow, volume, and peak depth scattergraphs, respectively. The model is under-predicting peak flow, volume, and depth for some events and over-predicting others at MC-EB-064.

TABLE 4-18
Events and Simulation Results, MC-EB-064

Event	Date	Duration (h)	Difference in Peak Flow (%)	Difference in Volume (%)	Difference in Depth (%)
1	1/4/2009 6:00	18	0.85	-24.98	0.81
2	1/6/2009 3:00	69	-3.06	-24.51	2.75
3	1/10/2009 3:00	93	22.35	-33.18	690.41
4	1/28/2009 0:00	24	-73.93	-59.41	-45.55
A	2/1/2009 9:00	15			
B	2/7/2009 3:00	45			
5	2/10/2009 16:00	80	-45.74	-50.11	-25.04
6	2/18/2009 0:00	24	-10.84	-30.35	3.47
7	2/21/2009 8:00	16	-38.12	-51.08	-17.23
8	2/27/2009 0:00	96	-31.75	-33.29	14.88
9	3/8/2009 12:00	15	35.18	-5.1	29.35
10	3/11/2009 0:00	24	31.86	-6.6	27.97
11	3/18/2009 21:00	27	57.21	47.11	55.05

TABLE 4-18
Events and Simulation Results, MC-EB-064

Event	Date	Duration (h)	Difference in Peak Flow (%)	Difference in Volume (%)	Difference in Depth (%)
12	3/25/2009 0:00	72	34.48	-7.01	27.45
13	3/28/2009 21:00	27	-8.81	-37.7	6.63
14	4/2/2009 18:00	54	-4.78	-8.53	610.75
15	4/5/2009 12:00	18	6.75	-32.84	18.63
16	4/10/2009 0:00	51	2.36	-8.76	644.82
17	4/13/2009 16:00	56	0.09	-37.14	14.26
18	4/19/2009 3:00	45	16.91	-24.43	12.26
19	4/30/2009 3:00	48	66.19	-16.7	40.82
20	5/6/2009 12:00	18	-2.71	-30.47	2.4
21	5/8/2009 12:00	18	-22.83	-16.2	-9.42
22	5/13/2009 12:00	36	-4.82	27.67	624.6
23	5/16/2009 0:00	24	15.63	-26.12	13.51
24	5/26/2009 12:00	18	-9.29	0.33	-1.04
25	6/2/2009 16:00	35	-30.68	29.27	0.08
26	6/10/2009 0:00	72	-10.47	-17.53	-2.84
27	6/14/2009 12:00	36	-47.39	-41.8	-24.73
28	6/16/2009 16:00	56	-5.91	-24.68	676.22
29	6/20/2009 0:00	16	-30.68	-42.25	-21.39
30	6/25/2009 21:00	51	-91.08	-69.99	-95.85
31	7/22/2009 0:00	48	14.94	34.29	672.08
32	7/25/2009 0:00	24	41.4	36.53	845.21
33	7/29/2009 0:00	24	-2.1	-8.66	0.88
34	7/30/2009 16:00	32	8.11	15.71	763.45
35	8/4/2009 0:00	72	-31.02	2.9	15.06
36	8/10/2009 12:00	36	20.89	8.74	11.42
37	8/17/2009 12:00	12	-75.69	-60.13	-51.04
38	8/27/2009 16:00	8	-68.49	-40.04	-39.32
39	9/7/2009 0:00	24	-30.83	119.84	43.95
40	9/8/2009 16:00	16	124.51	127.12	62.18
41	9/20/2009 8:00	40	61.89	34.77	38.08
42	9/24/2009 3:00	33	22.31	18.11	26.11
43	9/26/2009 21:00	33	4.11	-38.22	5.59
44	10/2/2009 0:00	24	-16.38	-13.16	-6.65
45	10/8/2009 12:00	60	-29.74	27.56	21.53
46	10/15/2009 3:00	21	-31.61	-33.89	-20.9
47	10/23/2009 0:00	48	5.81	3.69	756.26
48	10/27/2009 21:00	51	11.73	-17.53	727.41
49	10/31/2009 0:00	48	12.33	-32.11	18.98
50	11/17/2009 12:00	18	1.82	-7.48	5.09
51	12/2/2009 8:00	24	-23.25	-27.78	-19.64

TABLE 4-18
Events and Simulation Results, MC-EB-064

Event	Date	Duration (h)	Difference in Peak Flow (%)	Difference in Volume (%)	Difference in Depth (%)
52	12/9/2009 12:00	44	4.27	-21.75	13.56
53	12/13/2009 3:00	24	-81.42	-73.91	-54.65
54	12/19/2009 3:00	24	-75.57	-70.33	-49.64
55	12/25/2009 0:00	32	11.34	-27.3	9.04

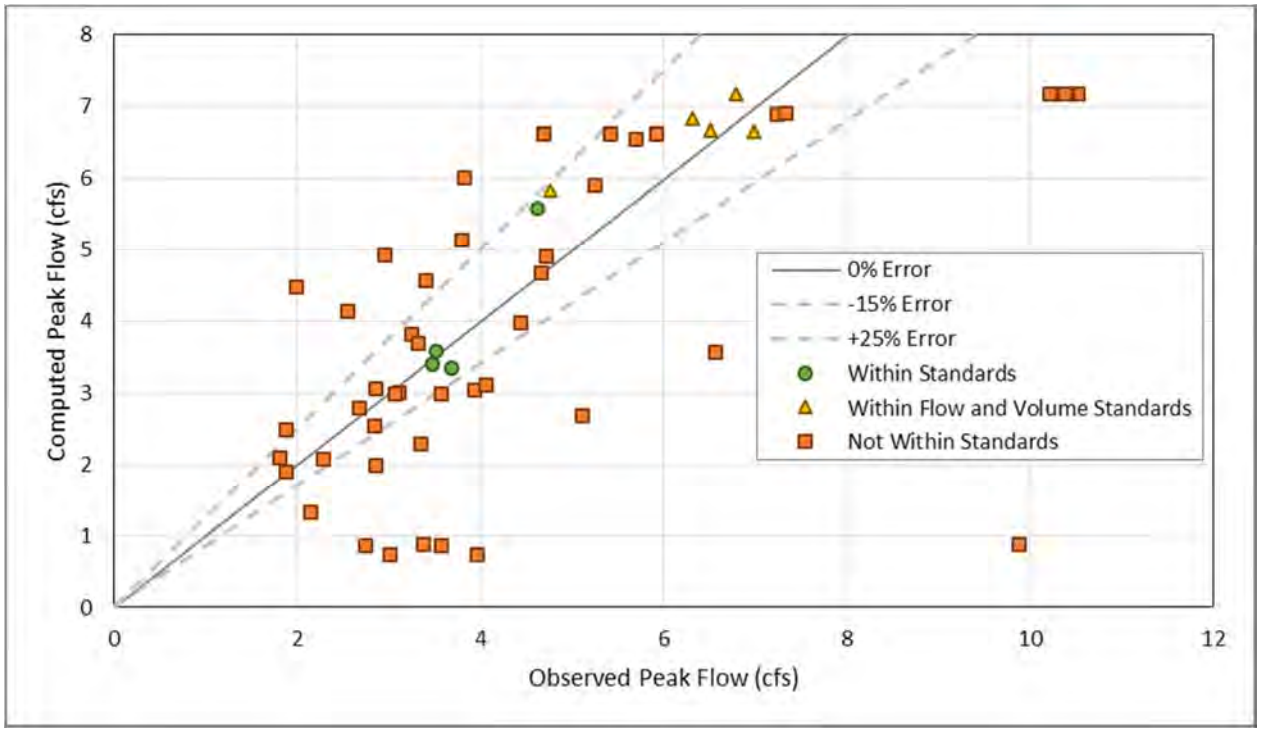


FIGURE 4-43
Scattergraph of Peak Flow, MC-EB-064

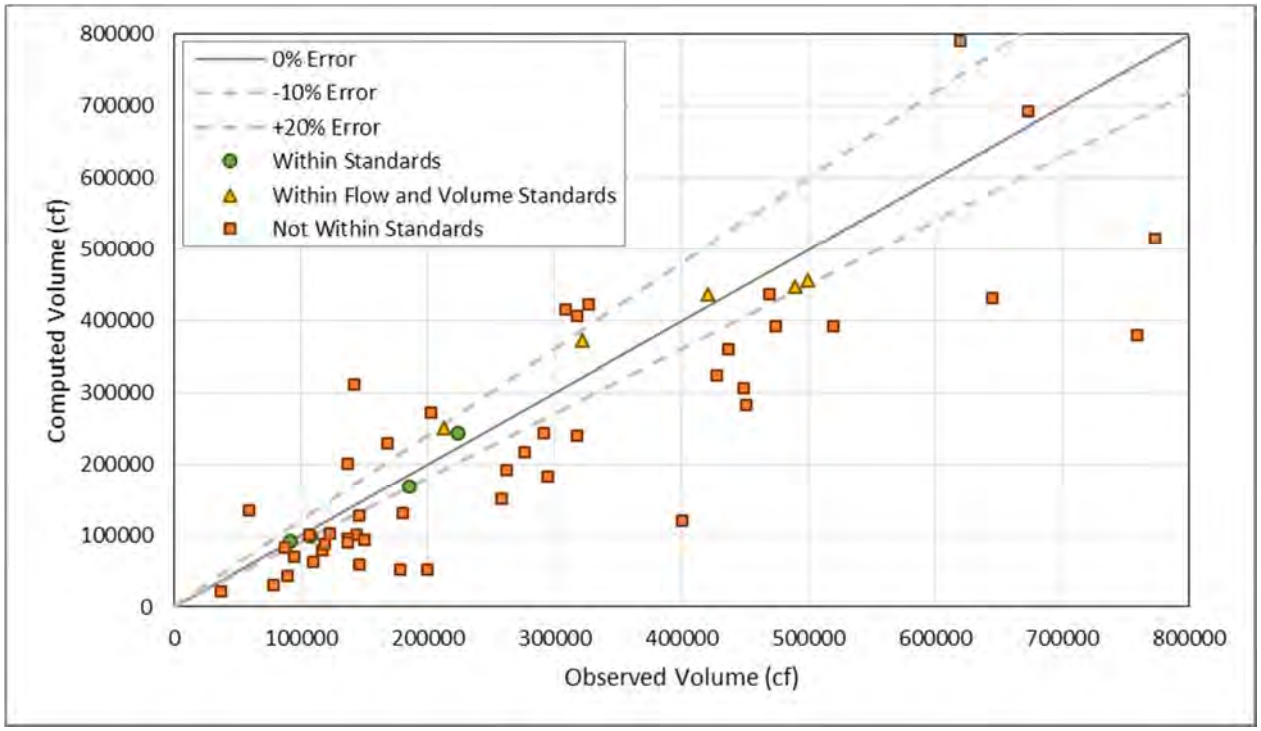


FIGURE 4-44
Scattergraph of Volume, MC-EB-064

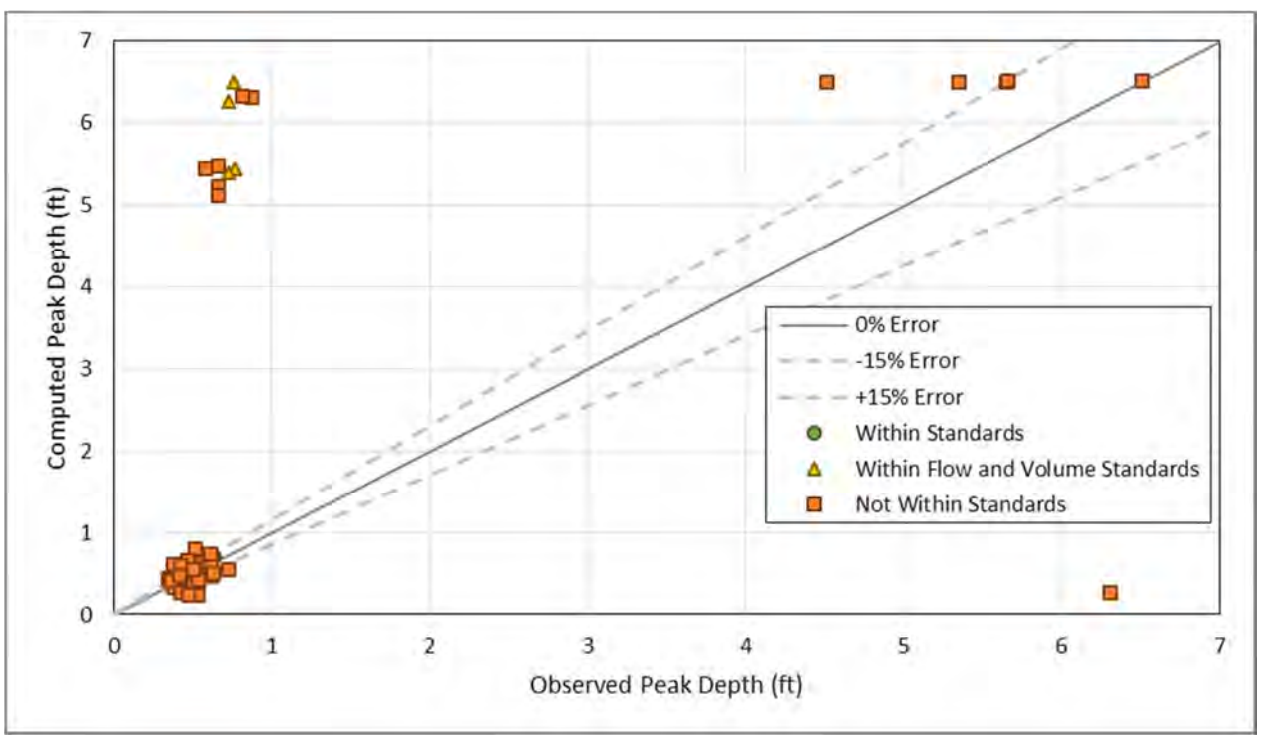


FIGURE 4-45
Scattergraph of Peak Depth, MC-EB-064

Monitor MC-EB-065

The model validation period for MC-EB-065 is January 2009 – December 2009. Fifty-seven (57) total events were identified during the validation period, and 55 are considered to have good data. Of the 55 events with good data, 0% (0 events) met MSDGC's C&V guidelines and standards for peak flow, volume, and depth. Table 4-19 summarizes the events and the C&V results for each. Figures 4-46, 4-47, and 4-48 show the peak flow, volume, and peak depth scattergraphs, respectively. The model is under-predicting peak flow, volume, and depth for some events and over-predicting others at MC-EB-065.

TABLE 4-19
Events and Simulation Results, MC-EB-065

Event	Date	Duration (h)	Difference in Peak Flow (%)	Difference in Volume (%)	Difference in Depth (%)
1	1/4/2009 3:00	24	-6.98	-29	13.15
2	1/6/2009 6:00	66	-35.69	-41.22	-7.53
3	1/10/2009 3:00	93	1.73	-28.2	36.15
4	1/28/2009 0:00	24	-84.57	-63.13	-48.39
A	2/1/2009 9:00	63			
B	2/7/2009 3:00	45			
5	2/10/2009 16:00	80	-44.85	-46.62	-3.97
8	2/18/2009 0:00	24	7.23	-10.48	45.73
7	2/21/2009 8:00	16	-39.55	-36.57	2.47
8	2/27/2009 0:00	96	-10.66	-17.61	2.22
9	3/8/2009 12:00	15	56.71	17.12	87.31
10	3/11/2009 0:00	24	-15.8	2.57	34.07
11	3/18/2009 21:00	27	22.94	40.8	43.83
12	3/25/2009 0:00	72	-0.55	12.16	37.52
13	3/28/2009 21:00	27	-35.61	-20.07	17.2
14	4/2/2009 18:00	54	8.99	17.03	43.63
15	4/5/2009 12:00	18	4.72	-16.52	52.17
16	4/10/2009 0:00	51	-9.72	2.44	29.47
17	4/13/2009 16:00	56	26.91	-16.95	69.73
18	4/19/2009 3:00	45	20.75	-8.8	46.84
19	4/30/2009 3:00	48	32.19	-4.43	54.6
20	5/6/2009 12:00	18	-8.9	-11.6	25.93
21	5/8/2009 12:00	18	-24.05	-9	5.41
22	5/13/2009 12:00	36	27.12	59.22	25.42
23	5/16/2009 0:00	24	-18.7	-20.27	21.66
24	5/26/2009 12:00	18	-17.73	-9.61	-2.43
25	6/2/2009 16:00	35	-13.12	50.48	-3.47
26	6/10/2009 0:00	72	-21.57	-3.73	22.87
27	6/14/2009 12:00	36	-12.62	-33.76	7.35
28	6/16/2009 16:00	56	62.12	20.96	51.95
29	6/20/2009 0:00	16	-17.99	-36.65	1.26
30	6/25/2009 21:00	51	-92.76	-66.48	-77.69
31	7/22/2009 0:00	48	87.48	62.94	87.94

TABLE 4-19
Events and Simulation Results, MC-EB-065

Event	Date	Duration (h)	Difference in Peak Flow (%)	Difference in Volume (%)	Difference in Depth (%)
32	7/25/2009 0:00	24	174.9	95.56	107.56
33	7/29/2009 0:00	24	-6.28	2.64	18.32
34	7/30/2009 16:00	32	63.29	73.14	63.24
35	8/4/2009 0:00	72	18.97	59.51	16.41
36	8/10/2009 12:00	36	51.83	0.34	56.61
37	8/17/2009 12:00	12	-72.17	-55.63	-47.64
38	8/27/2009 16:00	8	-68.99	-53.65	-38.77
39	9/7/2009 0:00	24	0	136.38	8.5
40	9/8/2009 16:00	16	78.04	97.62	82.2
41	9/20/2009 8:00	40	51.65	29.44	31.35
42	9/24/2009 3:00	33	38.32	33.69	69.59
43	9/26/2009 21:00	33	-10.64	-20.92	19.1
44	10/2/2009 0:00	24	-3.26	-26.91	4.4
45	10/8/2009 12:00	60	-17.42	60.04	1.3
46	10/15/2009 3:00	21	-34.61	-41.97	-13.84
47	10/23/2009 0:00	48	78.87	54.58	87.99
48	10/27/2009 21:00	51	3.23	-15.55	34.63
49	10/31/2009 0:00	48	-20.2	-22.92	26.29
50	11/17/2009 12:00	18	-29.96	-26.95	9.56
51	12/2/2009 8:00	24	-17.14	-26.94	0.96
52	12/8/2009 12:00	68	37.06	9.55	51.63
53	12/13/2009 3:00	24	-82.53	-61.51	-42.31
54	12/19/2009 3:00	24	-82.77	-59.6	-44.23
55	12/25/2009 0:00	32	15.63	1.15	36.47

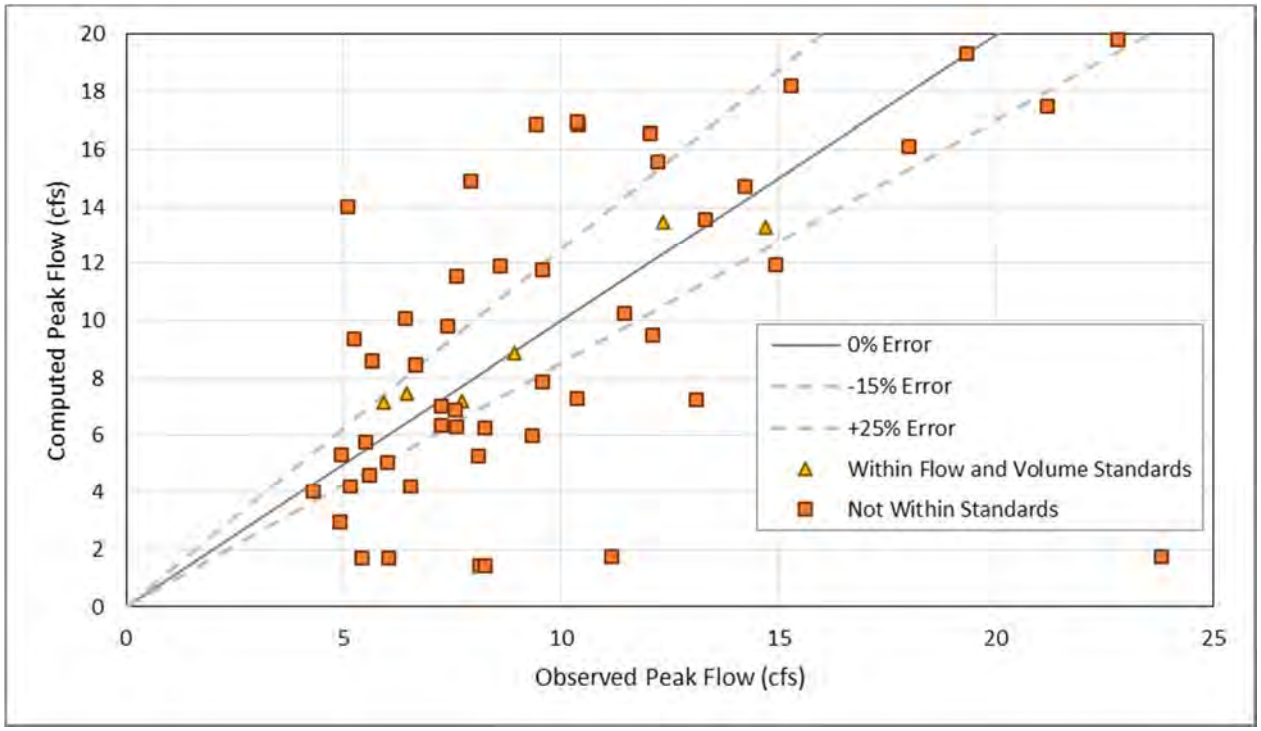


FIGURE 4-46
Scattergraph of Peak Flow, MC-EB-065

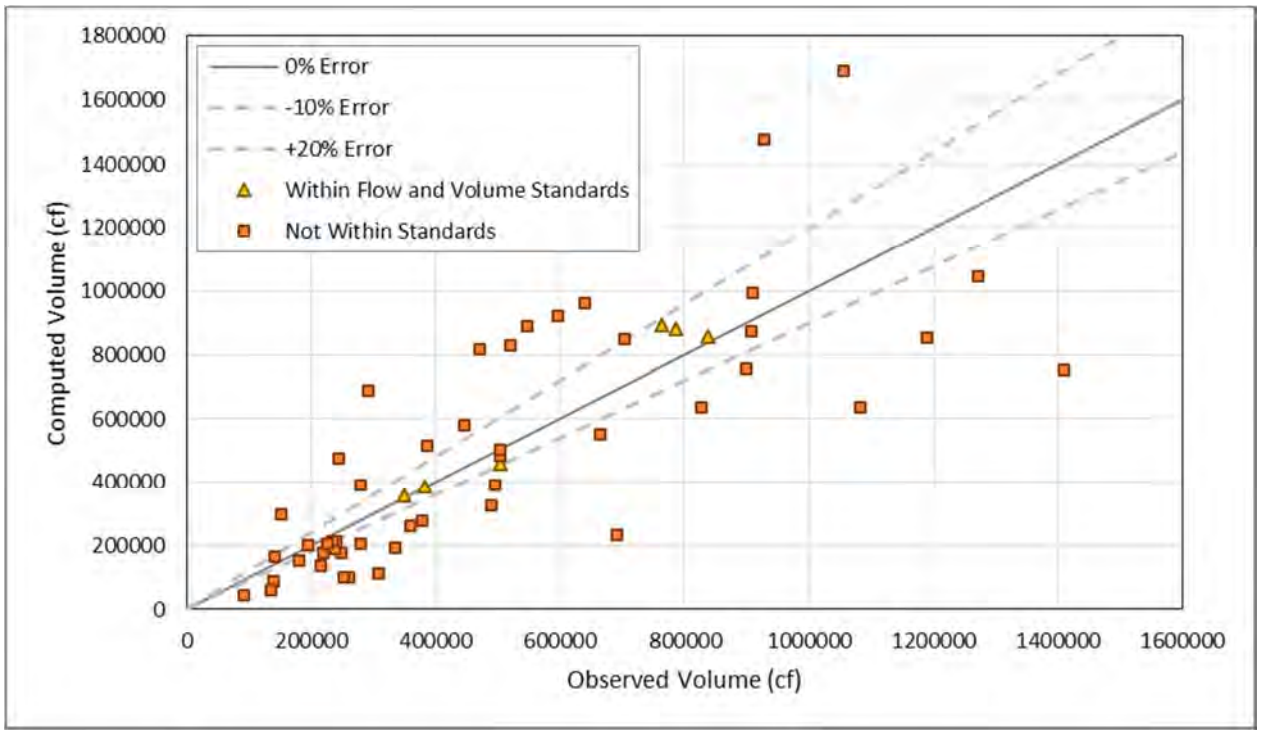


FIGURE 4-47
Scattergraph of Volume, MC-EB-065

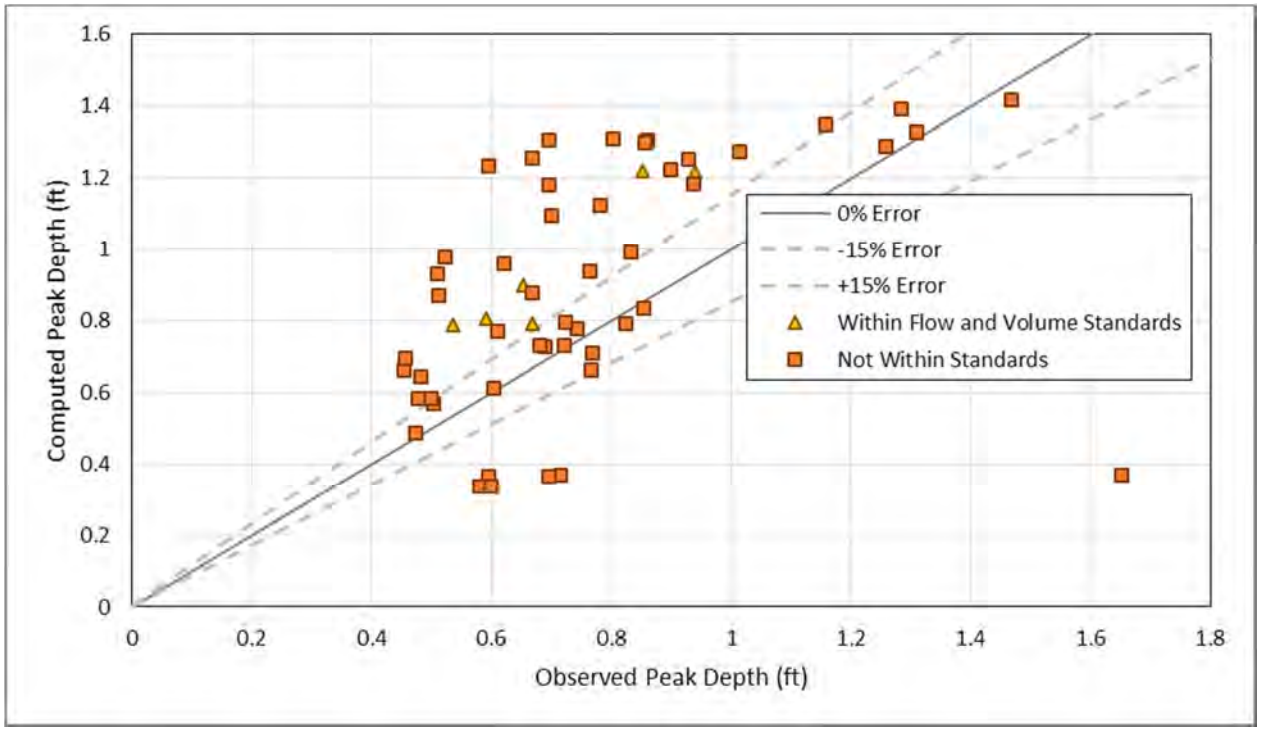


FIGURE 4-48
Scattergraph of Peak Depth, MC-EB-065

Monitor MC-EB-070

The model validation period for MC-EB-070 is January 2010 – December 2010. Forty-eight (48) total events were identified during the validation period, and 47 are considered to have good data. Of the 47 events with good data, 0% (0 events) met MSDGC's C&V guidelines and standards for peak flow, volume, and depth. Table 4-20 summarizes the events and the C&V results for each. Figures 4-49, 4-50, and 4-51 show the peak flow, volume, and peak depth scattergraphs, respectively. The model is under-predicting peak flow, volume, and depth at MC-EB-070.

TABLE 4-20
Events and Simulation Results, MC-EB-070

Event	Date	Duration (h)	Difference in Peak Flow (%)	Difference in Volume (%)	Difference in Depth (%)
1	1/17/2010 0:00	24	-99.95	-99.36	-96.46
2	1/21/2010 12:00	12	-87.89	-88.44	710.47
3	1/24/2010 0:00	72	-97.62	-91.62	169.63
A	3/8/2010 12:00	24			
4	3/12/2010 21:00	35	-80.79	-39.83	1549.5
5	3/22/2010 0:00	12	-81.98	-54.35	1240.38
6	3/25/2010 12:00	20	-93.8	-56.11	1144.48
7	3/30/2010 0:00	8	-99.99	-99.4	-96.26
8	4/8/2010 0:00	21	-88.81	-67.26	749.44
9	4/24/2010 12:00	24	-82.73	-71.82	1504.91
10	5/2/2010 0:00	32	-74.43	-76.47	1376.85
11	5/4/2010 0:00	21	-77.19	-69.52	404.85

TABLE 4-20
Events and Simulation Results, MC-EB-070

Event	Date	Duration (h)	Difference in Peak Flow (%)	Difference in Volume (%)	Difference in Depth (%)
12	5/7/2010 12:00	24	-96.03	-89.76	71.85
13	5/11/2010 0:00	16	-93.26	-92.07	677.68
14	5/12/2010 0:00	24	-86.48	-87.55	836.33
15	5/17/2010 0:00	24	-95.23	-96.28	297.22
16	5/21/2010 0:00	24	-34.4	-7.82	799.83
17	6/1/2010 16:00	44	-84.67	-91.37	2088.79
18	6/6/2010 0:00	45	-97.7	-95.32	1272.11
19	6/9/2010 0:00	12	-90.8	-92.14	656.04
20	6/12/2010 0:00	24	4.94	-36.94	62.34
21	6/15/2010 6:00	15	-99.36	-99.15	1644.39
22	6/19/2010 0:00	24	-86.55	-85.12	753.2
23	6/21/2010 12:00	12	-68.62	-55.69	1667.19
24	6/27/2010 0:00	32	-16.06	34.38	167.14
25	7/9/2010 0:00	48	-44.58	-82.22	2564.5
26	7/13/2010 0:00	48	-64	-83.81	1696.32
27	7/20/2010 12:00	28	-46.5	-80.88	980.88
28	8/7/2010 8:00	13	-99.61	-98.63	-86.19
29	8/10/2010 0:00	12	-99.98	-99.71	-95.44
30	8/12/2010 12:00	60	-99.91	-99.33	-92.28
31	8/13/2010 0:00	8	-99.97	-99.71	-95.07
32	9/5/2010 0:00	21	-99.91	-99.14	-91.22
33	9/11/2010 12:00	33	-99.05	-98.69	-71.22
34	9/15/2010 16:00	20	-99.05	-98.89	124
35	9/21/2010 21:00	27	-99.98	-99.71	-95.57
36	9/30/2010 0:00	12	-99.97	-99.71	-94.8
37	10/8/2010 3:00	21	-99.95	-99.71	-94.86
38	10/13/2010 21:00	27	-98.47	-98.69	403.03
39	10/26/2010 12:00	12	-53.75	-62.07	1483.8
40	10/30/2010 0:00	16	-99.91	-99.22	-91.63
41	11/16/2010 12:00	24	-62.83	-57.14	2104.57
42	11/23/2010 0:00	24	107.69	1.03	1535.06
43	11/24/2010 12:00	44	-19.67	-10.59	299.77
44	11/30/2010 0:00	24	-39.59	-21.37	2038.55
45	12/11/2010 12:00	36	-41.18	-70.23	3467.97
46	12/19/2010 0:00	12	-99.99	-99.55	-96.11
47	12/30/2010 0:00	24	-91.9	-92.18	358.6

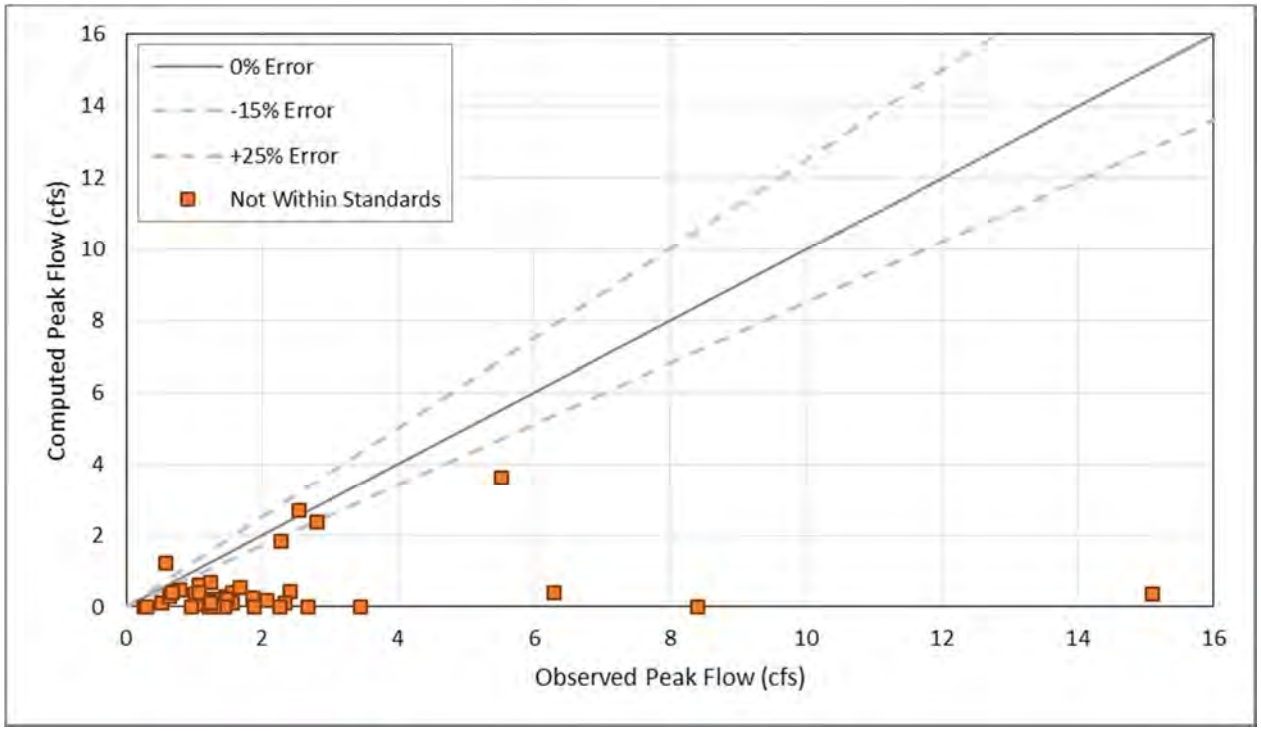


FIGURE 4-49
Scattergraph of Peak Flow, MC-EB-070

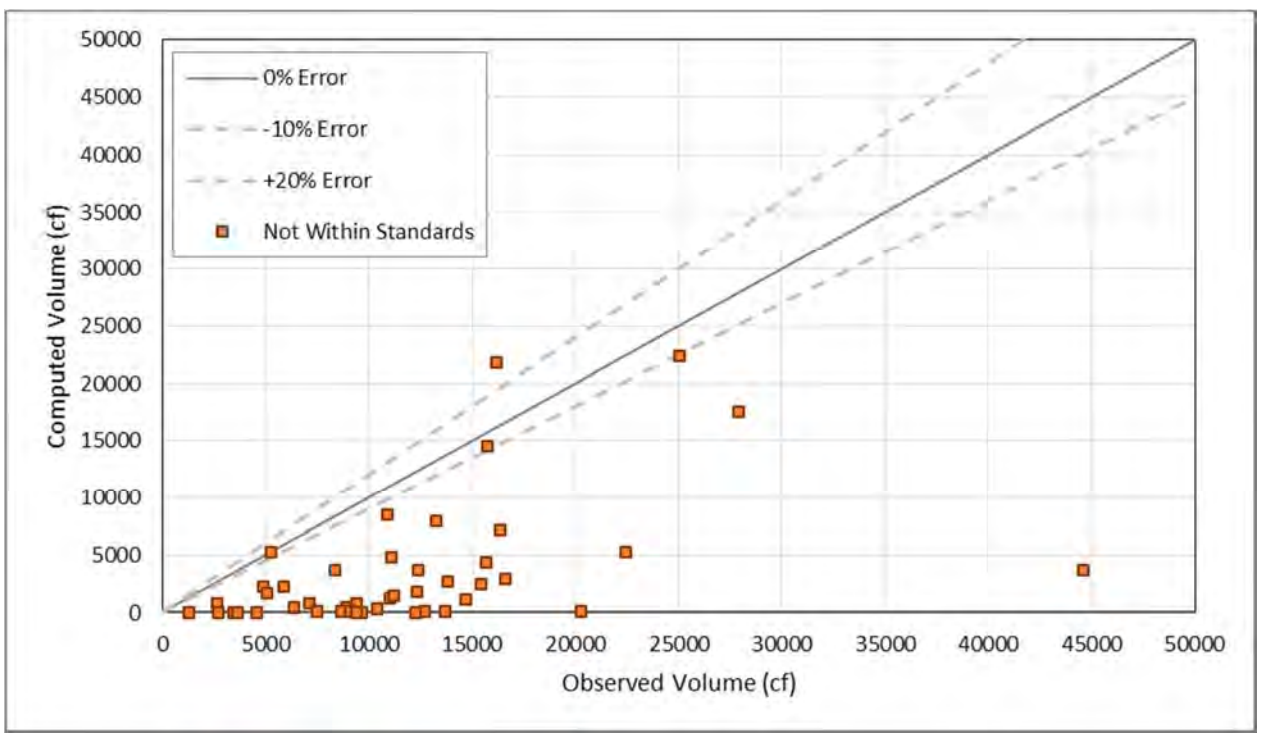


FIGURE 4-50
Scattergraph of Volume, MC-EB-070

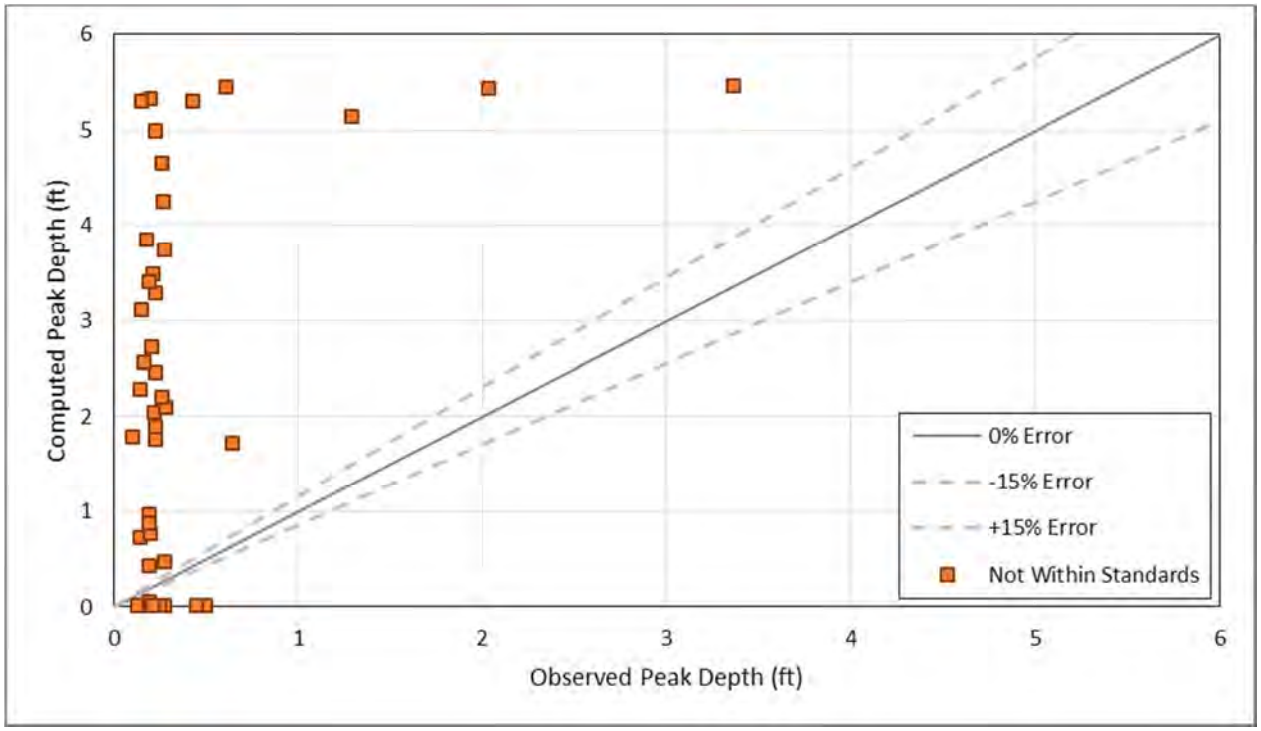


FIGURE 4-51
Scattergraph of Peak Depth, MC-EB-070

Monitor MC-EB-071

The model validation period for MC-EB-071 is October 2011 – September 2012. Forty-eight (48) total events were identified during the validation period, and all 48 are considered to have good data. Of the 48 events with good data, 2% (1 event) met MSDGC's C&V guidelines and standards for peak flow, volume, and depth. Table 4-21 summarizes the events and the C&V results for each. Figures 4-52, 4-53, and 4-54 show the peak flow, volume, and peak depth scattergraphs, respectively. The model is generally over-predicting peak flow, volume, and depth at MC-EB-071.

TABLE 4-21
Events and Simulation Results, MC-EB-071

Event	Date	Duration (h)	Difference in Peak Flow (%)	Difference in Volume (%)	Difference in Depth (%)
1	10/13/2011 8:00	16	80.77	97.64	80.09
2	10/18/2011 12:00	132	-35.08	10.62	-7.46
3	10/27/2011 0:00	96	7.55	18.32	23.27
4	11/3/2011 12:00	84	-23.84	19.84	4.86
5	11/14/2011 12:00	108	-16.01	12.6	7.62
6	11/21/2011 0:00	48	-18.32	-20.25	5.7
7	11/27/2011 0:00	48	-48.88	-22.83	-16.74
8	12/4/2011 12:00	60	-53.92	-8.95	-27.43
9	12/15/2011 0:00	24	-12.91	-7.89	6.58
10	12/20/2011 12:00	84	-27.75	7.33	-0.51
11	12/27/2011 0:00	48	-23.05	-12.99	0.62
12	1/11/2012 6:00	18	116.97	140.73	52.33
13	1/12/2012 12:00	12	71.37	105.72	32.76

TABLE 4-21
Events and Simulation Results, MC-EB-071

Event	Date	Duration (h)	Difference in Peak Flow (%)	Difference in Volume (%)	Difference in Depth (%)
14	1/17/2012 0:00	48	9.29	86.27	-9.12
15	1/23/2012 0:00	48	-26.75	31.51	-22.38
16	1/26/2012 0:00	120	17.6	49.46	0.11
17	2/2/2012 0:00	24	24.13	35.74	10.55
18	2/4/2012 3:00	21	36.07	92.68	23.31
19	2/15/2012 12:00	60	93.42	111.66	43.24
20	2/29/2012 0:00	48	71.29	91.01	31.99
21	3/2/2012 0:00	48	128.97	133.72	57.54
22	3/8/2012 0:00	72	83.87	183.36	41.17
23	3/14/2012 12:00	39	171.38	174.91	76.23
24	3/18/2012 21:00	51	53.28	101.69	25.21
25	3/23/2012 0:00	48	155.63	189.08	74.5
26	3/30/2012 0:00	51	133.39	116.66	52.71
27	4/1/2012 21:00	27	104.16	136.26	44.87
28	4/14/2012 3:00	45	114.28	195.99	52.11
29	4/20/2012 16:00	32	95.96	103.41	43.42
30	4/25/2012 12:00	39	76.47	124.63	25.47
31	4/28/2012 0:00	27	81.1	138.37	33.54
32	4/30/2012 6:00	66	-7.59	69.59	-12.27
33	5/4/2012 12:00	39	163.68	211.85	58.22
34	5/7/2012 12:00	36	57.53	79.71	6.5
35	5/13/2012 0:00	72	81.8	194.73	15.77
36	5/29/2012 0:00	27	201.29	359.56	59.72
37	6/1/2012 0:00	27	60.29	213.39	2.95
38	6/29/2012 12:00	15	157.61	275.93	66.42
39	7/5/2012 0:00	27	207.14	240.03	77.38
40	7/14/2012 0:00	24	205.68	254.11	87.5
41	7/18/2012 12:00	36	210.76	264.23	90.33
42	7/26/2012 12:00	63	177.82	181.54	78.49
43	8/9/2012 0:00	24	133.91	175.43	61.52
44	9/3/2012 0:00	48	146.37	352.35	62.81
45	9/5/2012 12:00	15	317.85	489.48	127.38
46	9/7/2012 21:00	51	108	175.36	46.42
47	9/21/2012 21:00	27	209.45	194.79	78.95
48	9/26/2012 21:00	27	175.46	206.6	76.56

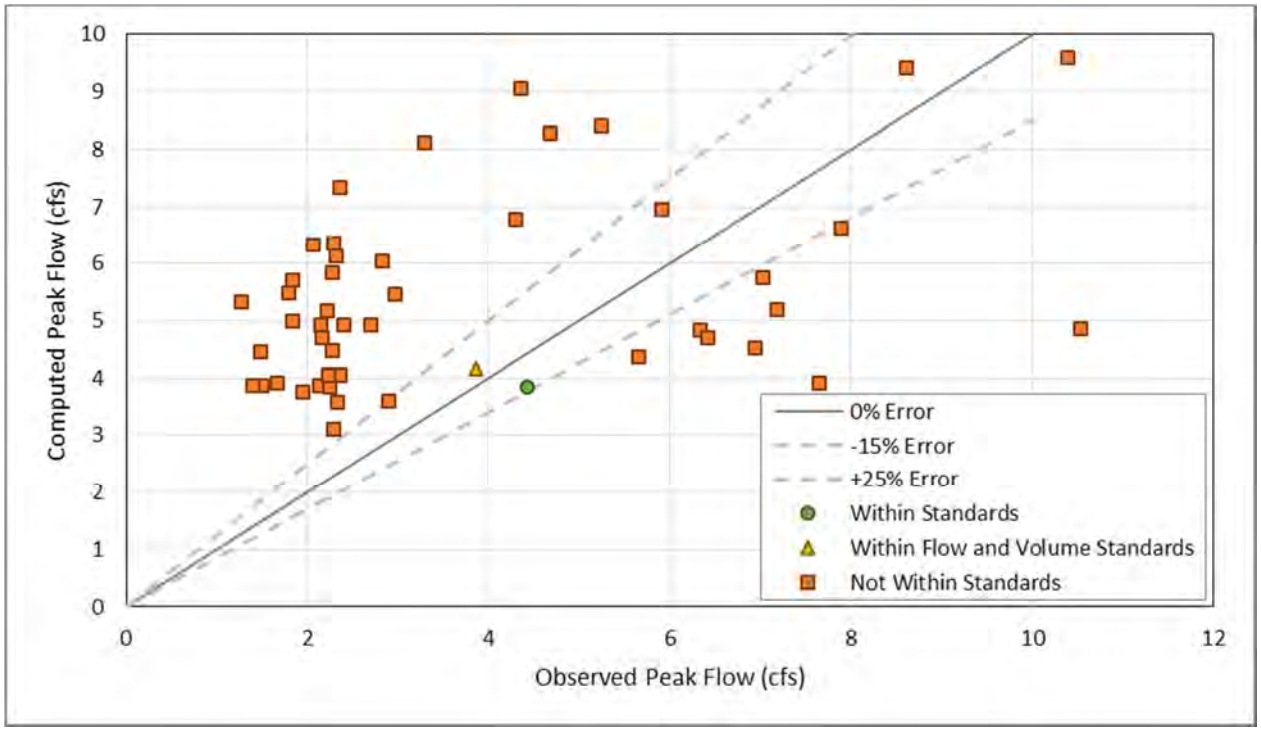


FIGURE 4-52
Scattergraph of Peak Flow, MC-EB-071

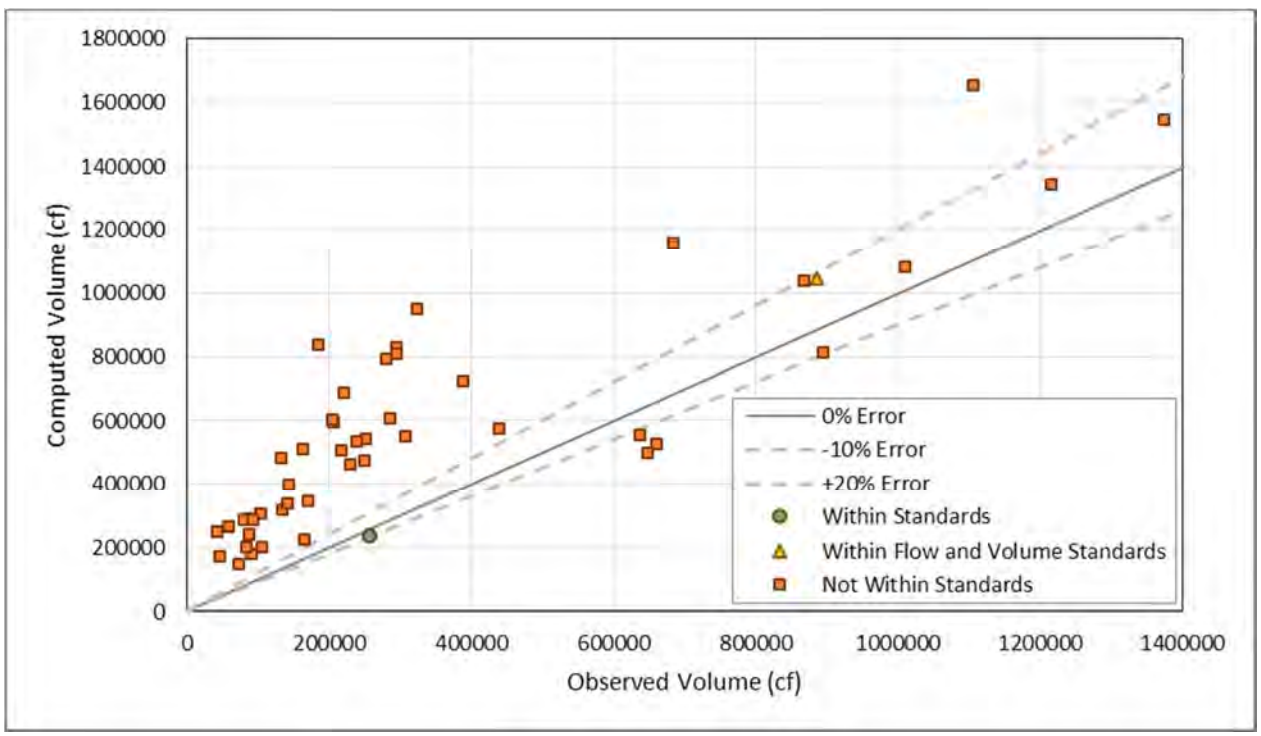


FIGURE 4-53
Scattergraph of Volume, MC-EB-071

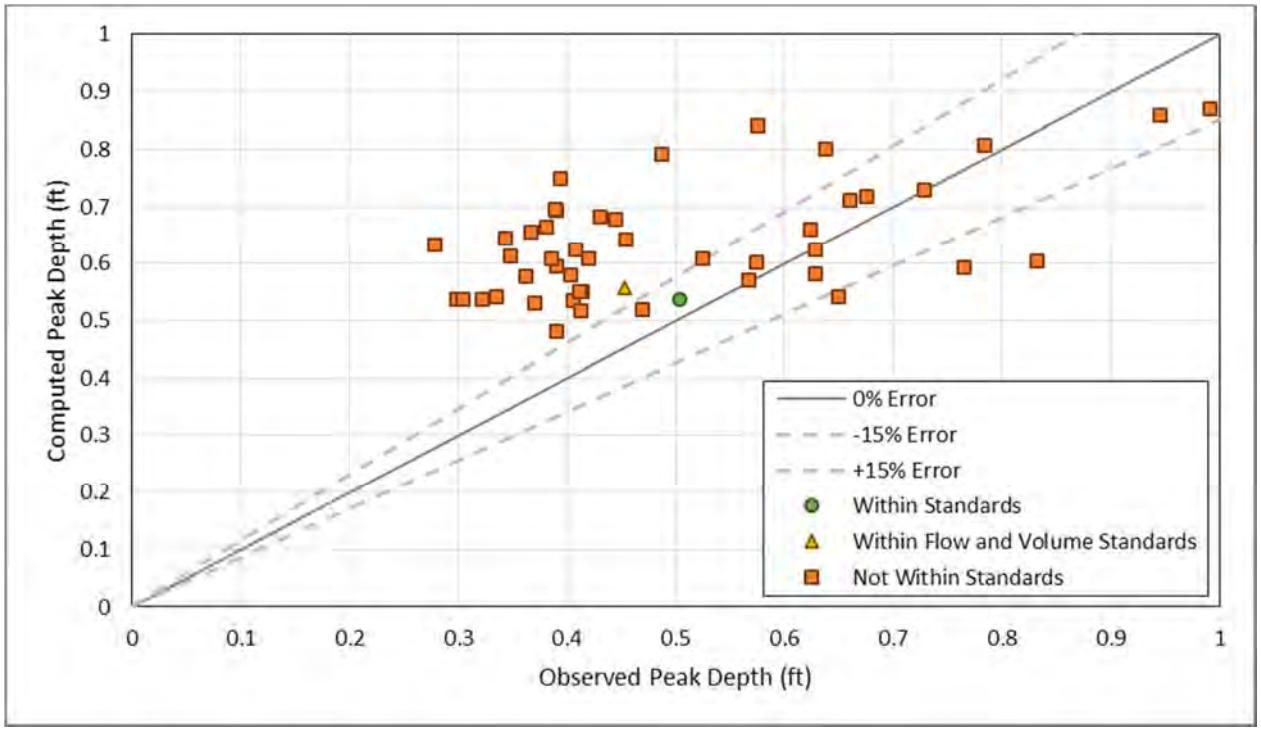


FIGURE 4-54
Scattergraph of Peak Depth, MC-EB-071

Monitor MC-EB-075

The model validation period for MC-EB-075 is October 2011 – September 2012. Forty-nine (49) total events were identified during the validation period, and 40 are considered to have good data. Of the 40 events with good data, 3% (1 events) met MSDGC's C&V guidelines and standards for peak flow, volume, and depth. Table 4-22 summarizes the events and the C&V results for each. Figures 4-55, 4-56, and 4-57 show the peak flow, volume, and peak depth scattergraphs, respectively. The model is generally over-predicting peak flow, volume, and depth at MC-EB-075.

TABLE 4-22
Events and Simulation Results, MC-EB-075

Event	Date	Duration (h)	Difference in Peak Flow (%)	Difference in Volume (%)	Difference in Depth (%)
1	10/13/2011 3:00	21	28.63	16.7	22.4
2	10/18/2011 12:00	108	-32.5	-22.38	-47.58
3	10/26/2011 21:00	75	34.89	14.76	26.84
4	11/3/2011 8:00	70	-2.42	20.23	9.42
A	11/14/2011 16:00	128			
B	11/21/2011 3:00	93			
C	11/27/2011 3:00	141			
D	12/4/2011 6:00	186			
5	12/15/2011 0:00	24	-11.35	-16.31	2.33
6	12/19/2011 16:00	152	-23.59	-19	-63.07
E	12/27/2011 0:00	72			
7	1/11/2012 0:00	48	79.29	77.59	24.41

TABLE 4-22
Events and Simulation Results, MC-EB-075

Event	Date	Duration (h)	Difference in Peak Flow (%)	Difference in Volume (%)	Difference in Depth (%)
8	1/17/2012 0:00	120	43.62	84.36	-78.55
9	1/22/2012 21:00	54	4.66	19.24	-47.7
F	1/26/2012 0:00	96			
10	2/4/2012 3:00	24	41.39	38.96	5.18
11	2/16/2012 0:00	30	47.6	39.65	7.68
12	2/21/2012 3:00	21	37.84	33.66	7.87
13	2/29/2012 0:00	27	55.63	55.46	8.6
14	3/2/2012 0:00	48	56.5	49.61	10.28
15	3/8/2012 0:00	48	64.24	41.77	13.84
16	3/15/2012 3:00	18	63.05	22.08	11.08
G	3/23/2012 0:00	96			
17	4/1/2012 21:00	9	108.57	70.65	24.58
18	4/14/2012 3:00	51	88.16	116.41	-5.09
19	4/20/2012 21:00	6	85.15	99.32	18.61
20	4/25/2012 21:00	27	115.25	114.84	-9.72
21	4/28/2012 0:00	27	64.6	77.09	9.89
22	4/30/2012 16:00	14	51.1	54.8	11.03
H	5/1/2012 12:00	60			
23	5/4/2012 18:00	30	50.09	45.68	10.14
24	5/7/2012 16:00	80	12.92	18.03	-24.69
25	5/13/2012 3:00	141	16.35	18.36	-7.31
26	5/29/2012 3:00	21	54.09	37.68	6.49
I	6/1/2012 0:00	96			
27	6/11/2012 0:00	24	61.28	73.45	9.09
28	6/29/2012 12:00	15	85.05	102.39	18.56
29	7/1/2012 12:00	12	88.12	108.44	22.97
30	7/5/2012 12:00	12	93.19	167.01	22.36
31	7/14/2012 0:00	27	73.97	157.55	17.55
32	7/18/2012 0:00	48	93.45	129.32	14.23
33	7/26/2012 0:00	24	114.72	108.08	36.29
34	7/27/2012 12:00	18	157.64	217.95	56.3
35	8/10/2012 0:00	24	135.23	142.12	38.17
36	9/1/2012 0:00	27	76.78	94.65	19.01
37	9/3/2012 3:00	45	175.1	285.07	58.13
38	9/5/2012 12:00	12	176.87	203.87	51.32
39	9/7/2012 21:00	51	132.23	192.94	1.02
40	9/21/2012 21:00	11	165.57	176.83	54.66

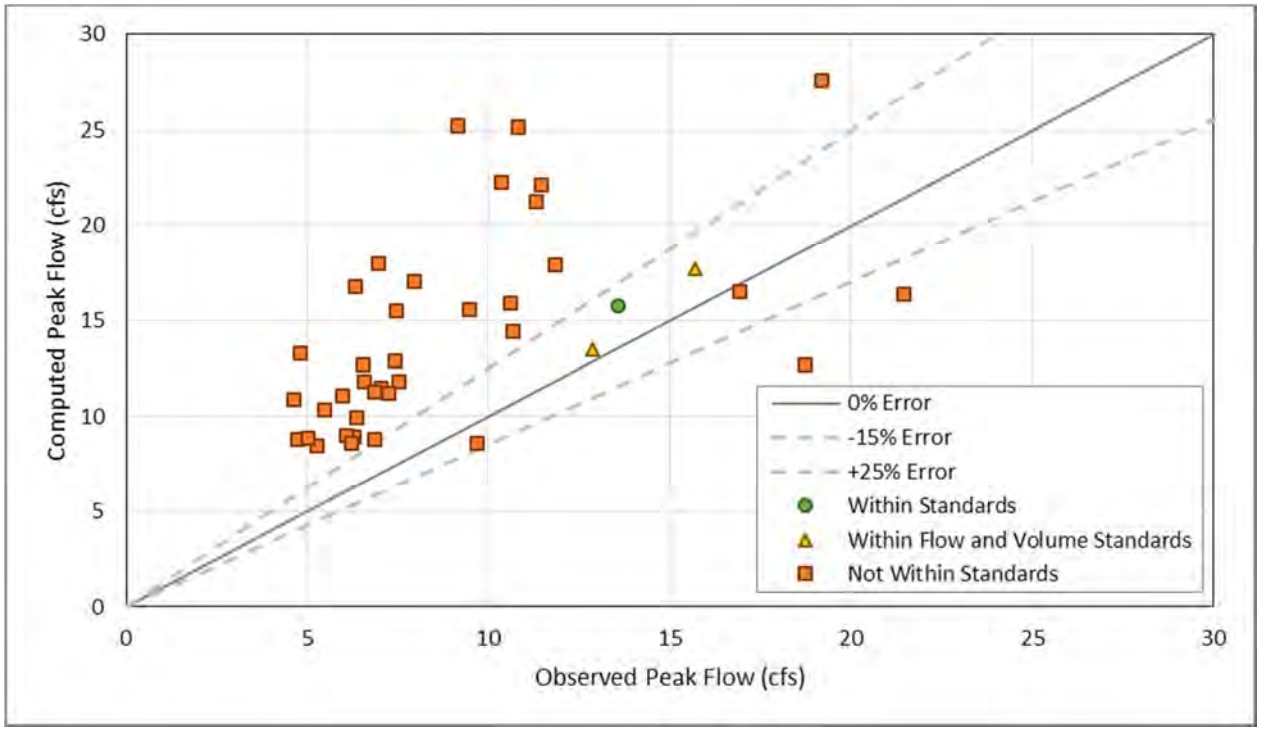


FIGURE 4-55
Scattergraph of Peak Flow, MC-EB-075

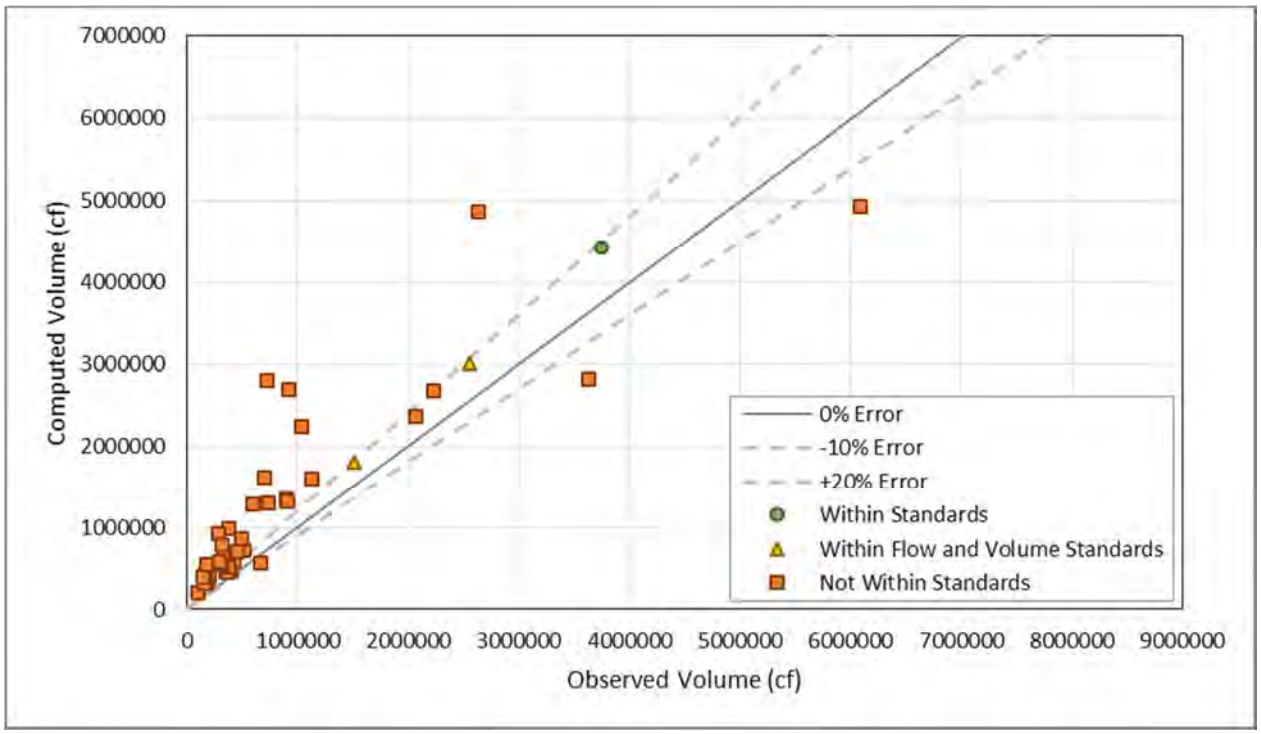


FIGURE 4-56
Scattergraph of Volume, MC-EB-075

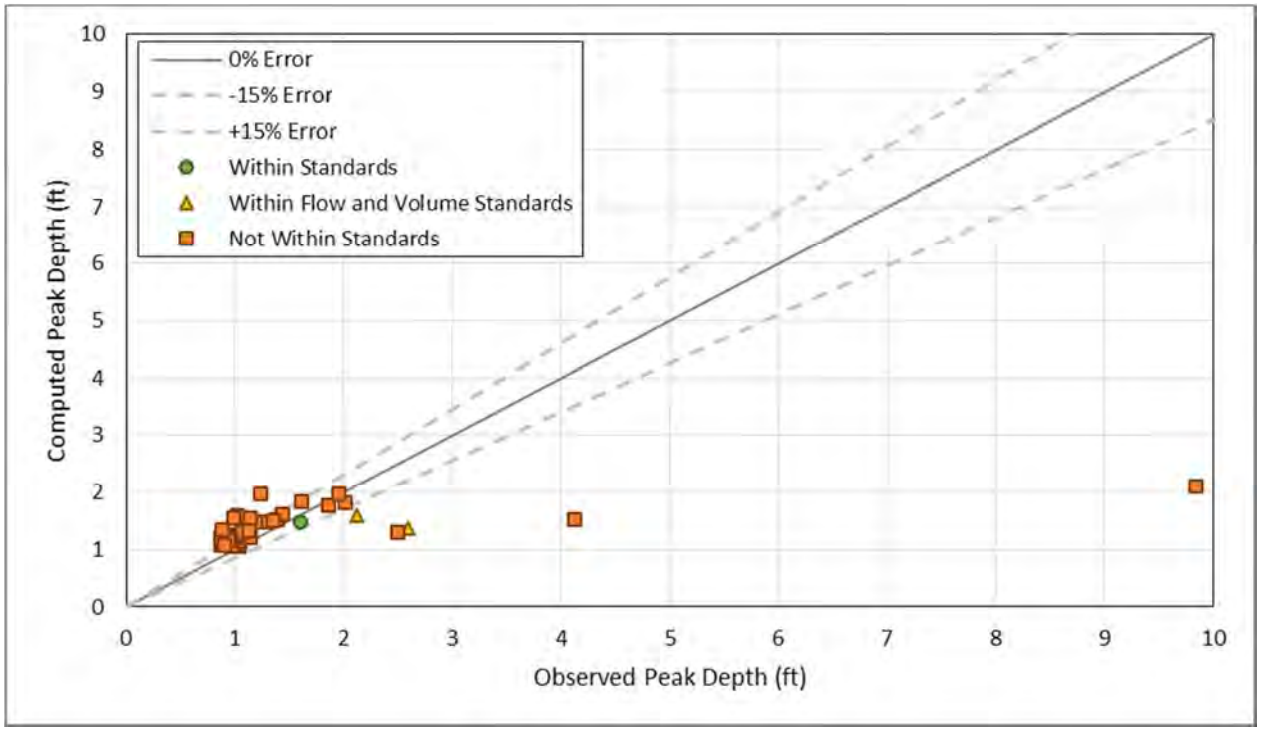


FIGURE 4-57
Scattergraph of Peak Depth, MC-EB-075

Overflows

There are 11 SSOs and 9 CSOs in the EBMC. Additionally, the SSO 700 STF treats portions of wet weather flow from the East Branch Mill Creek interceptor and discharges to the Mill Creek. This section compares modeled overflow occurrences to historical overflow data collected during the model validation period (April 2006 – December 2012) for the SSOs, CSOs, and SSO 700 STF. A summary of model predicted overflows is also provided. An inter-event time of 24-hours was used to define SSO and CSO overflow events.

SSOs

Historical SSO data were provided by MSDGC in the form of monthly SSO reports. The SSO reports identified the estimated discharge events occurring daily. MSDGC visited each SSO at a regular time period. If there was evidence of discharge during the site visit, the date the discharge was estimated based on the total rainfall occurring between the current and previous site visits. Table 4-23 summarizes the total number of observed and model predicted overflows occurring during the model validation period and how many model predicted overflows occurred on the same dates as the predicted overflows. For all SSOs located within the EBMC, except SSO 603, the model predicted significantly fewer overflows than observed during the model validation period. The model predicted almost double the number of overflows at SSO 603 than observed. A monthly summary of discharge events for each SSO within the EBMC is provided in Appendix C.

TABLE 4-23
SSO Performance Summary Table (April 2006 – December 2012)

Overflow	Number of Observed Discharge Events	Number of Modeled Discharge Events	Number of Observed Events Predicted by model	% of Observed Events Predicted by Model
SSO 587	30	10	3	10%
SSO 603	53	94	40	75%
SSO 607	17	0	0	0%
SSO 681	14	5	1	7%
SSO 682	13	0	0	0%
SSO 700	75	0	0	0%
SSO 704	54	34	26	48%
SSO 1001	42	0	0	0%
SSO 1020	22	2	1	5%
SSO 1047	10	0	0	0%
SSO 1048	35	33	19	54%

CSOs

Historical CSO data was provided by MSDGC in the form of annual CSO reports for years 2006 – 2009 and a CSO summary report for years 2010 - 2012. The CSO annual reports for 2006 - 2009 only included information for CSOs 507, 508, and 514 within the EBMC and did not have data for entire years or data for common time periods for those CSOs. The CSO summary report for 2010 – 2012 provided the number of discharges and estimated total overflow volume. A monthly summary of discharge events for the CSOs within the EBMC is provided in Appendix D.

Table 4-24 summarizes the total number of observed and model predicted overflows occurring during the April 2006 – December 2009 model validation period for the time periods in which observed overflow data was available for CSO 507, CSO 508, and CSO 514. Dates of recorded overflow were not provided for this time period. For all three CSOs, the model predicted significantly fewer overflow events and significantly less overflow volume than observed during the respective time periods listed in the table for each CSO between April 2006 and December 2009.

TABLE 4-24
CSO Performance Summary Table (April 2006 – December 2009)

Overflow	Comparison Time Periods	Number of Observed Discharge Events	Total Volume for Observed Events (MG)	Number of Modeled Discharge Events	Total Volume for Modeled Events (MG)
CSO 507	2006 (May, Jul, Sep, Nov); 2007 (Jan, Mar, May, Nov); 2008 (Jan, Mar, May, Jul, Sep); 2009 (Jan, Mar)	60	45	39	25
CSO 508	2006 (May – Dec); 2007 (Jan – Dec); 2008 (Jan – Jul, Sep, Nov); 2009 (Jan, Mar)	100	11	1	0.1
CSO 514	2006 (Apr – Dec); 2007 (Jan – Sep, Nov); 2008 (Jan, Mar, May, Jul, Sep, Nov); 2009 (Jan, Mar)	113	42	0	0

Table 4-25 summarizes the total number of observed and model predicted overflows occurring during the 2010 – 2012 model validation period and how many model predicted overflows occurred on the same dates as the predicted overflows. For the 2010 – 2012 time period, the model predicted fewer overflows at all CSOs within the EBMC; though, the model predicted higher overflow volumes at CSO 508, CSO 509, and CSO 513 even though it predicted a fewer number of overflows.

TABLE 4-25
CSO Performance Summary Table (January 2010 – December 2012)

Overflow	Number of Observed Discharge Events	Total Volume for Observed Events (MG)	Number of Modeled Discharge Events	Total Volume for Modeled Events (MG)	Number of Observed Events Predicted by Model	% of Observed Events Predicted by Model
CSO 507	237	173	112	92	110	46%
CSO 508	113	0.5	6	1.15	2	2%
CSO 509	21	0.2	17	3	9	43%
CSO 510	90	9	2	0.2	2	2%
CSO 511	163	1.2	0	0	0	0%
CSO 512	191	1.4	4	0.6	2	1%
CSO 513	158	15.2	100	56	89	56%
CSO 514	144	53	3	4	1	1%
CSO 670	23	2.1	0	0	0	0%

SSO 700 STF

The SSO 700 STF was designed to relieve the Mill Creek interceptor during wet weather to reduce overflows just downstream at SSO 700. The STF provides a combination of storage and treatment. Flow entering the STF is first sent to storage. If it is anticipated that the storage volume will be exceeded, flow is sent to Chemically Enhanced High Rate Settling (CEHRS) treatment and discharged to the Mill Creek. If flow is still entering the facility and the CEHRS and storage is at capacity, flow from storage can discharge to the Mill Creek. After an event has ended, the volume left in storage drains back into the interceptor when there is available capacity.

Operation data for the SSO 700 STF was provided by Black & Veatch for April 2009 – December 2012 (excluding data from the 2nd quarter of 2011). The overflow volume from the facility was considered to be the CEHRS volume treated plus the tank overflow volume. The total volume discharged from the SSO 700 STF from April 2009 – December 2012 minus the 2nd quarter of 2011 was approximately 830.2 MG (633.8 MG of treated flow and 197.8 MG of tank overflow). The total volume discharged from the STF in the model during the same time period was approximately 1257 MG. Figure 4-39 shows a plot of the observed and model predicted overflow volumes by month. For 2009, the model predictions were generally fairly close to observed. For 2010 - 2012, the model predictions were generally higher than observed aside from the third quarter 2011 in which the model predictions were lower than observed. Appendix E provides a monthly summary table for the SSO 700 STF. MSDGC has indicated that the influent and secondary capacity at the Mill Creek Wastewater Treatment Plant (WWTP) was reduced to approximately 130 MGD around March 23, 2010 and wasn't returned to full capacity until 2013, after the model validation period. Because of the reduced capacity at the WWTP, MSDGC indicated that the Mill Creek interceptor would back up frequently up to SSO 700 STF. This likely increased the usage of the STF during wet weather flow.

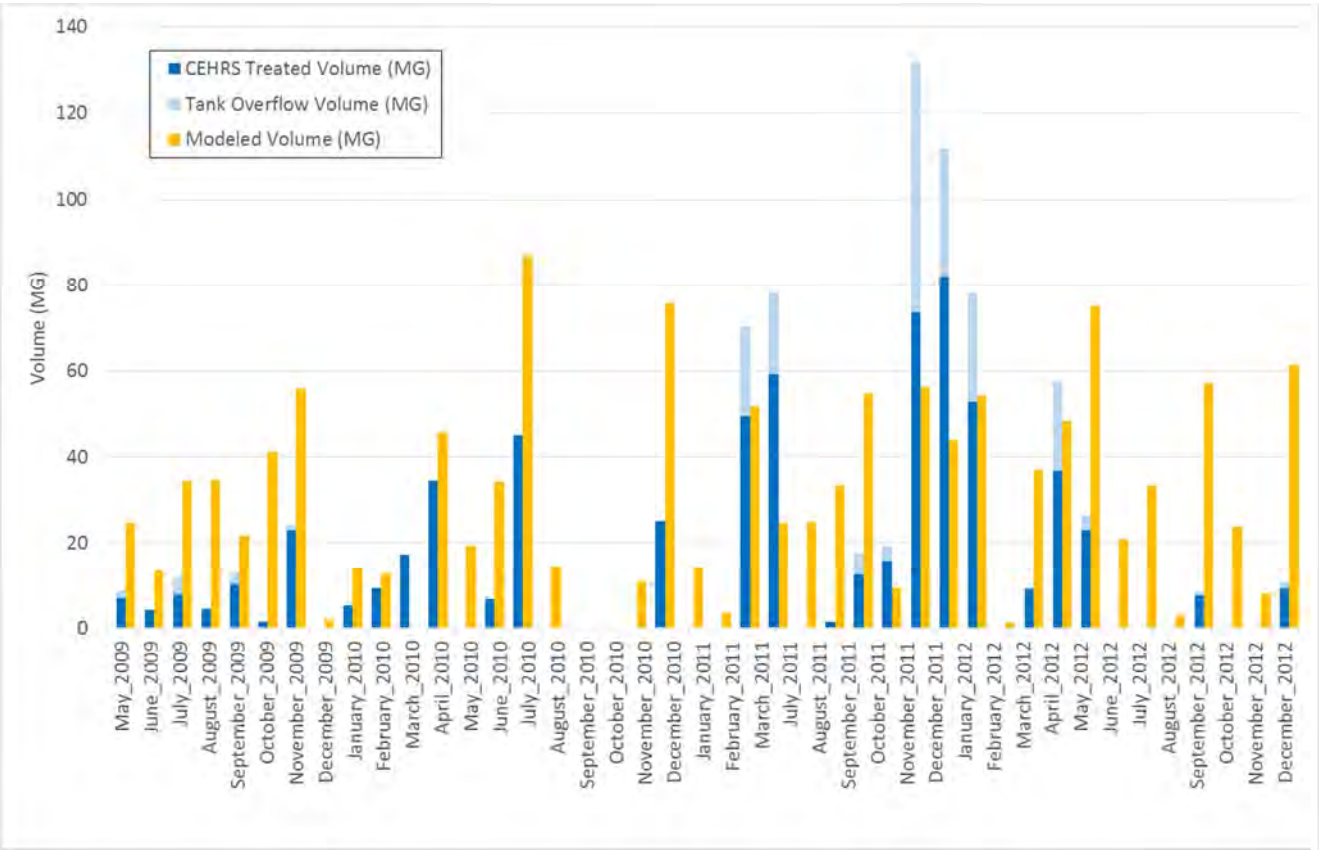


FIGURE 4-39
SSO 700 STF Discharge Volume Comparison

Flooding Manholes

In addition to the enumerated SSOs, CSOs, and the SSO 700 STF discharge, other manholes in the EBMC sewershed exhibited overflow in the model during the validation period. Appendix F lists the manholes exhibiting overflow in the model and summarizes the overflow volume by year. Figure 4-40 illustrates the locations of the overflowing manholes predicted by the model. Sixty eight (68) manholes exhibit overflow at some point during the model validation period as predicted by the current version of the model. Of these 68 manholes, two (just upstream of SSO 700 STF) are considered potential SSOs by MSDGC and are currently being monitored. The flooding manholes in the model will be field verified during recalibration and subsequent validation.

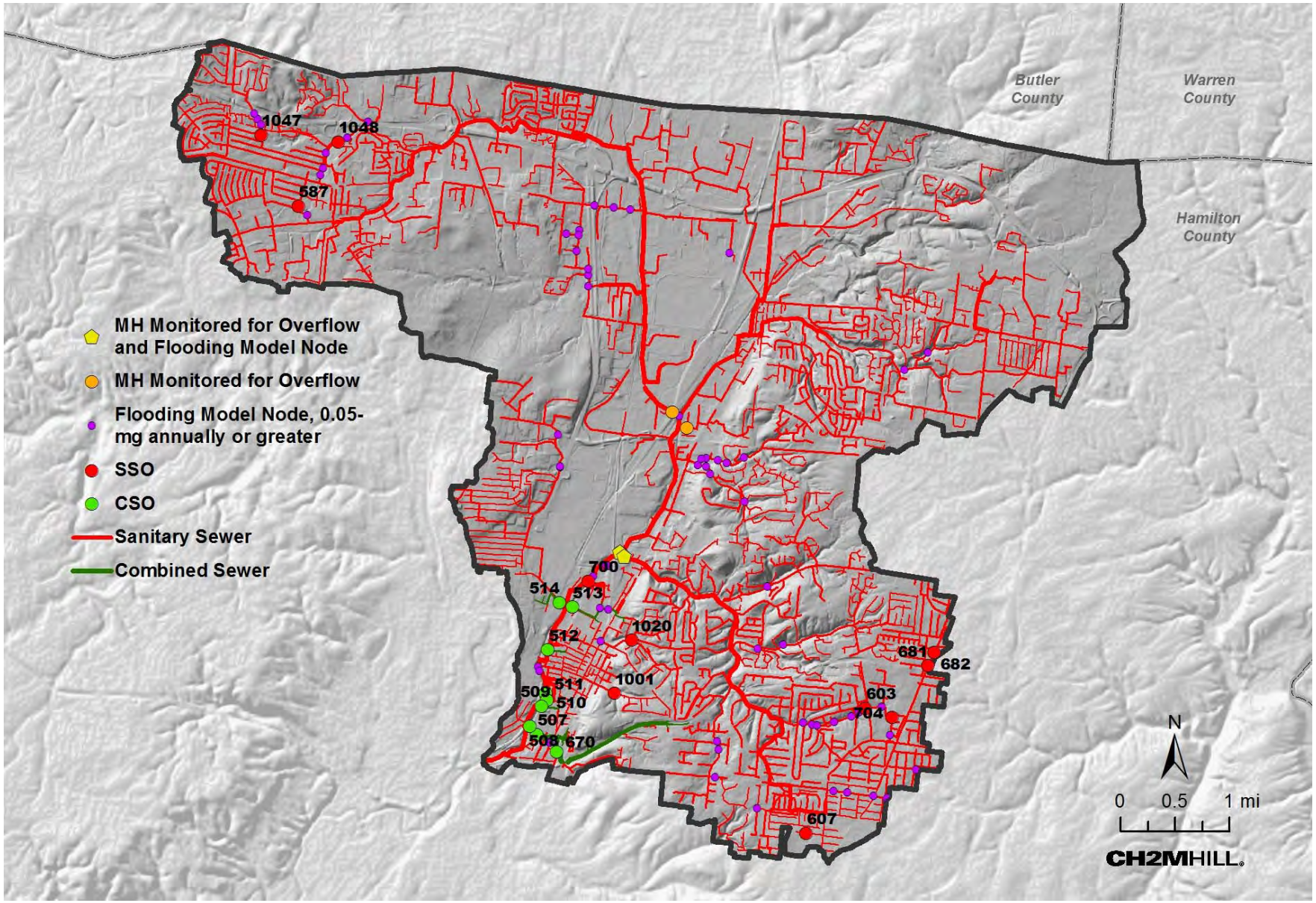


FIGURE 4-40
Model-Predicted Overflowing Manholes

Section 5.0 - Conclusions

Model Assessment

Table 5-1 summarizes the model validation results for the selected flow monitoring locations. In addition to indicating the number and percentage of events that met C&V guidelines for all three parameters, the table indicates how many events met each of the three individual parameters. Out of the 19 flow monitoring locations selected for validation, all flow monitors had less than 40% of the total events with good data meet MSDGC modeling C&V guidelines for peak flow, volume, and depth. Only three flow monitors (16%) met C&V guidelines for at least 20% of the total events with good data. Over 40% of the flow monitors (8) did not meet C&V guidelines for any events. The model over-predicts and under-predicts flows and depths at various flow monitors throughout the study area with no clear correlation between location within the EBMC or for the model validation year.

TABLE 5-1
Summary of Flow Monitor Validation Results

Flow Monitor	Validation Period	Total Validation Events	Events Meeting Peak Flow	Events Meeting Volume	Events Meeting Peak Depth	Events Meeting Peak Flow and Volume	% of Events Meeting Peak Flow and Volume	Events Meeting Peak Flow, Volume, and Peak Depth	% of Events Meeting Peak Flow, Volume, and Depth	Comment
MC-EB-004	2008	18	13	13	5	12	67%	4	22%	generally under-predicting
MC-EB-005	2011	31	N/A	N/A	11	N/A	N/A	11	35%	over and under-predicting
MC-EB-016	2011	39	25	21	12	18	46%	9	23%	generally under-predicting
MC-EB-017	2012	25	0	0	6	0	0%	0	0%	generally over-predicting
MC-EB-019	2011	35	15	20	2	7	20%	0	0%	over and under-predicting
MC-EB-026	7/2011-6/2012	53	5	9	5	2	4%	0	0%	generally over-predicting
MC-EB-027	2009	45	12	20	15	7	16%	4	9%	generally over-predicting
MC-EB-030	2009	31	32	24	15	18	58%	6	19%	generally over-predicting
MC-EB-031	2007	30	13	22	5	11	37%	0	0%	generally under-predicting
MC-EB-032	2011	52	12	14	11	5	10%	3	6%	generally over-predicting

TABLE 5-1
Summary of Flow Monitor Validation Results

Flow Monitor	Validation Period	Total Validation Events	Events Meeting Peak Flow	Events Meeting Volume	Events Meeting Peak Depth	Events Meeting Peak Flow and Volume	% of Events Meeting Peak Flow and Volume	Events Meeting Peak Flow, Volume, and Peak Depth	% of Events Meeting Peak Flow, Volume, and Depth	Comment
MC-EB-033	2012	51	10	15	23	4	8%	0	0%	generally over-predicting
MC-EB-035	2009	18	5	2	14	1	6%	1	6%	generally under-predicting
MC-EB-036	4/2006-3/2007	31	2	1	2	1	3%	0	0%	generally over-predicting
MC-EB-063	2009	55	28	13	18	10	18%	2	4%	generally under-predicting
MC-EB-064	2009	55	28	13	20	9	16%	4	7%	over and under-predicting
MC-EB-065	2009	55	20	14	16	6	11%	0	0%	over and under-predicting
MC-EB-070	2010	47	0	1	2	0	0	0	0%	Under-predicting
MC-EB-071	10/2011-9/2012	48	6	7	13	2	4%	1	2%	generally over-predicting
MC-EB-075	10/2011-9/2012	40	6	6	20	3	8%	1	3%	generally over-predicting

Table 5-2 summarizes the SSO results for the validation period. In general, the model under-predicts the SSO discharge event occurrences for the entire model validation period.

In addition to the SSOs, overflow also occurs at the SSO 700 STF. Recorded overflow data (CEHRS treated volume plus volume of overflow from tanks) was available for April 2009-December 2012, minus the 2nd quarter of 2011. During this time the total recoded overflow volume was 830 MG but the model predicted 1,257 MG, nearly 1.5 times as much overflow as recorded. The model significantly over-predicts the overflow volume from the SSO 700 STF for the latter part of the validation period.

TABLE 5-2
Summary of SSO Results

Overflow	Number of Observed Discharge Events	Number of Modeled Discharge Events	Number of Observed Events Predicted by model	% of Observed Events Predicted by Model
SSO 587	30	10	3	10%
SSO 603	53	94	40	75%
SSO 607	17	0	0	0%
SSO 681	14	5	1	7%
SSO 682	13	0	0	0%
SSO 700	75	0	0	0%
SSO 704	54	34	26	48%
SSO 1001	42	0	0	0%
SSO 1020	22	2	1	5%
SSO 1047	10	0	0	0%
SSO 1048	35	33	19	54%

Table 5-3 summarizes the CSO results for 2010-2012. In general, the model significantly underpredicts the number of CSO discharge events and the total volume discharges during the events. Though for three CSOs (508, 509, and 513) the model predicted a fewer number of discharge events but a higher volume of discharge.

TABLE 5-3
Summary of CSO Results

Overflow	Number of Observed Discharge Events	Total Volume for Observed Events (MG)	Number of Modeled Discharge Events	Total Volume for Modeled Events (MG)	Number of Observed Events Predicted by Model	% of Observed Events Predicted by Model
CSO 507	237	173	112	92	110	46%
CSO 508	113	0.5	6	1.15	2	2%
CSO 509	21	0.2	17	3	9	43%
CSO 510	90	9	2	0.2	2	2%
CSO 511	163	1.2	0	0	0	0%
CSO 512	191	1.4	4	0.6	2	1%
CSO 513	158	15.2	100	56	89	56%

TABLE 5-3
Summary of CSO Results

Overflow	Number of Observed Discharge Events	Total Volume for Observed Events (MG)	Number of Modeled Discharge Events	Total Volume for Modeled Events (MG)	Number of Observed Events Predicted by Model	% of Observed Events Predicted by Model
CSO 514	144	53	3	4	1	1%
CSO 670	23	2.1	0	0	0	0%

Based on the results presented above, the current model does not validate. The current model, as a whole, does not properly account for the amount of I/I entering the sewer system in the EBMC and does not adequately represent the sanitary and combined overflows occurring in the EBMC. The model also does not accurately reflect operations at the SSO 700 STF. There was no trend in model predictions for peak flow, volume, and peak depth at the flow monitoring locations; the model over-predicted for some locations and under-predicted for others, with no trend in model predictions for distinct areas in the model or model validation periods. Generally, the model underpredicted the number and volume of overflows, aside from the SSO 700 STF where the model significantly overpredicted the total overflow volume for the model validation period.

Recommendations

The current model does not adequately represent observed conditions in the EBMC sewershed and is not sufficient for development of the IWAP. It is recommended that the whole EBMC hydraulic model be recalibrated. The current model does not account for seasonal variation in groundwater or antecedent moisture from changing ground soil moisture conditions and back-to-back, or continuous, storm events. It also uses a single RTK set for the entire year. The proposed method for recalibration will be presented for approval in an upcoming technical memorandum which will address the recalibration scope of work and associated level of effort. During recalibration of the model, in addition to evaluating flow and depth at flow monitoring locations and evaluating overflow from the SSOs and CSOs and operations at the SSO 700 STF, the model-predicted overflowing manholes will be field verified and compared to MSDGC's potential SSOs. Also, model-predicted surcharged pipes will be compared to areas of known sewer backups and basement backups.

Appendix A
Model Validation Period Selection

SSO 700 IWAP
Task 2.7.1 Hydraulic Model Gap Analysis: Model Validation Period Selection

PREPARED FOR: Andrew Spurgeon/MSDGC

PREPARED BY: CH2M HILL

DATE: February 27, 2015

Purpose

The purpose of this technical memorandum is to document the selection of flow monitor locations and validation time periods that will be used to validate the current Metropolitan Sewer District of Greater Cincinnati (MSDGC) System-Wide Model within the study area of the SSO 700 Integrated Watershed Action Plan (IWAP) project. A subsequent technical memorandum will summarize the collection system model assessment and gap analysis, including the results of the initial model validation for which the validation periods described in this memo will be utilized.

Introduction

The scope of Task 2.7.1 of the SSO 700 IWAP project includes review and assessment of the current Mill Creek System-Wide Model, provided by MSDGC, to evaluate its representation of the SSO 700 watershed and its applicability to support development of the IWAP. A validated and calibrated hydraulic model is required to support the IWAP. While MSDGC's System-Wide model was originally calibrated using flow monitor data collected during the spring of 2001, it may not have the resolution necessary to meet the detailed needs of the IWAP. To understand the calibration and validation deficiencies in the current model, the model must be validated to assess how well it simulates the observed condition. The first step in model validation is to select the time period or periods for which to run the model and compare the output against observed flow data. This memo summarizes the collection and review of all flow data available in the East Branch Mill Creek Basin and the selection of flow monitors and validation time periods for each monitor, including the criteria by which these data were selected.

Data Collection & Review

Historical flow and rainfall data were collected to support the SSO 700 IWAP hydraulic model gap analysis and assessment. The SSO 700 IWAP study sewershed essentially corresponds to MSDGC's East Branch Mill Creek (EBMC) sewershed and is therefore the focus of the collection of available flow data. This section summarizes the available data and the sources of the data.

Flow Data

Flow data are available for 78 monitor locations throughout the EBMC sewershed over varying time periods. Most flow data were collected from the FlowWorks website (www.flowworks.com) and MSDGC directly, while some data were previously obtained for the Rainfall Dependent Inflow and Infiltration (RDII) Pilot Study performed in 2011. Table 1 summarizes the available flow data for the EBMC per the 'Permanent_Monitors' shapefile dated 1/22/2015, provided by MSDGC as part of the SSO 700 IWAP data request. The monitors in bold, red text in Table 1 were ultimately selected for model validation based on criteria described in the following section of this technical memorandum. Figure 1 provides a map of the EBMC flow monitor locations.

Rainfall Data

The rainfall data, corresponding to the flow monitor collection periods, were collected for this analysis from both the Vieux Inc. website (http://www.vieuxinc.com/rainvieux.html) and MSDGC directly. Historical gauge-adjusted radar rainfall data (GARR) is available for 2006 and after. GARR data for January 2012 through December 2014 is available in 5-minute time steps from the Vieux, Inc. website dashboard by sewershed and by radar pixel. This data was downloaded from the website in text and shapefile format for each sewer basin. For all rainfall events between January 2006 and December 2011, GARR data was provided by MSDGC.

GARR data in 5-minute time steps were provided by MSDGC for all rainfall events from January 2006 through December 2011 in 5-minute time steps. These data were provided in shapefile format. To create a continuous timeseries of GARR data for each flow meter within the SSO 700 watershed, the data were extracted from the shapefiles to Excel, where the time gaps between the rainfall events were filled in with 0 values.

TABLE 1

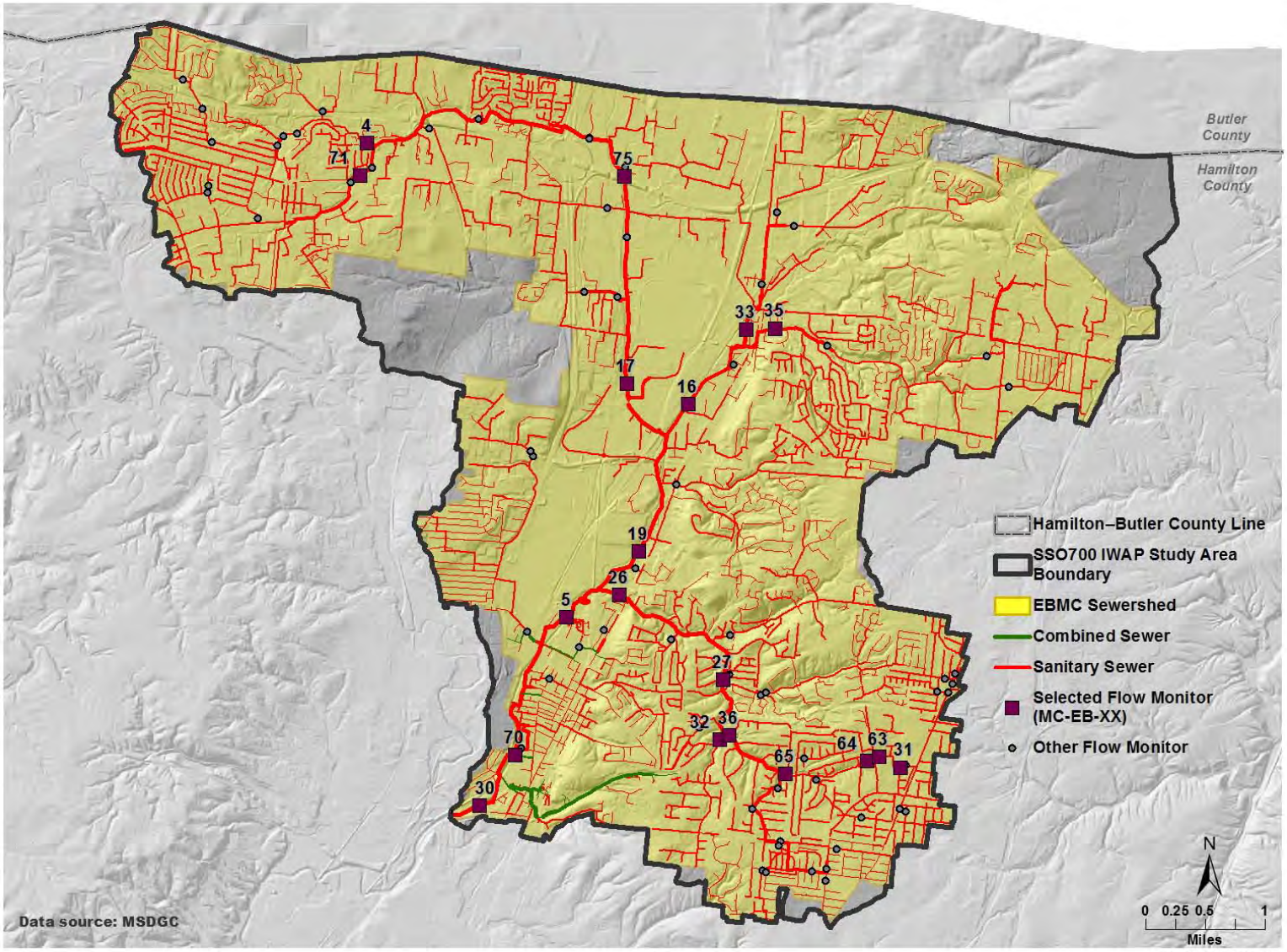
EBMC Flow Monitors

SITE ID	AVAILABLE DATA	SITE ID	AVAILABLE DATA	SITE ID	AVAILABLE DATA	SITE ID	AVAILABLE DATA
MC-EB-001	10/00 – 2/01	MC-EB-022	01/01 – 03/01	MC-EB-042	04/08 – 08/08	MC-EB-062	04/08 – 08/08
MC-EB-002	12/00 – 3/01	MC-EB-023	01/01 – 07/01	MC-EB-043	04/08 – 08/08	***MC-EB-063***	***12/08 – 02/10***
MC-EB-003	01/01 – 08/05	MC-EB-024	01/01 – 07/01	MC-EB-044	04/08 – 08/08	***MC-EB-064***	***12/08 – 02/10***
MC-EB-004	***01/01 – 11/13***	MC-EB-025	01/01 – 07/01	MC-EB-045	04/08 – 08/08	***MC-EB-065***	***12/08 – 02/10***
MC-EB-005	***03/01 – PRES***	***MC-EB-026***	***01/01 – PRES***	MC-EB-046	04/08 – 08/08	MC-EB-066	06/09 – 08/09
MC-EB-006	01/01 – 03/06	***MC-EB-027***	***01/01 – 11/13***	MC-EB-047	04/08 – 08/08	MC-EB-068	06/09 – 08/09
MC-EB-007	01/01 – 07/01	MC-EB-028	01/01 – 07/01	MC-EB-048	04/08 – 08/08	***MC-EB-070***	***06/09 – 05/11***
MC-EB-008	01/01 – 07/01	MC-EB-029	01/01 – 07/01	MC-EB-049	04/08 – 08/08	***MC-EB-071***	***09/11 – 11/13***
MC-EB-009	01/01 – 07/01	***MC-EB-030***	***01/01 – PRES***	MC-EB-050	04/08 – 08/08	MC-EB-072	09/11 – 01/12
MC-EB-011	01/01 – 07/01	***MC-EB-031***	***02/01 – 11/13***	MC-EB-051	04/08 – 08/08	MC-EB-073	09/11 – 01/12
MC-EB-012	01/01 – 07/01	***MC-EB-032***	***02/01 – 11/13***	MC-EB-052	04/08 – 08/08	MC-EB-074	09/11 – 01/12
MC-EB-013	01/01 – 07/01	***MC-EB-033***	***03/04 – 11/13***	MC-EB-053	04/08 – 08/08	***MC-EB-075***	***10/11 – 11/13***
MC-EB-014	01/01 – 07/01	MC-EB-034	07/05 – 06/06	MC-EB-054	04/08 – 08/08	MC-EB-076	12/11 – 05/12
MC-EB-015	01/01 – 07/01	***MC-EB-035***	***02/06 – PRES***	MC-EB-055	04/08 – 08/08	MC-EB-077	12/11 – 05/12
MC-EB-016	***01/01 – 11/13***	***MC-EB-036***	***02/06 – 11/13***	MC-EB-056	04/08 – 08/08	MC-EB-078	12/11 – 05/12

TABLE 1

EBMC Flow Monitors

SITE ID	AVAILABLE DATA	SITE ID	AVAILABLE DATA	SITE ID	AVAILABLE DATA	SITE ID	AVAILABLE DATA
MC-EB-017	***01/01 – 11/13***	MC-EB-037	04/08 – 08/08	MC-EB-057	04/08 – 08/08	MC-EB-079	12/11 – 05/12
MC-EB-018	01/01 – 07/01	MC-EB-038	04/08 – 08/08	MC-EB-058	04/08 – 08/08	MC-EB-080	12/11 – 05/12
MC-EB-019	***01/01 – PRES***	MC-EB-039	04/08 – 08/08	MC-EB-059	04/08 – 08/08	MC-EB-081	12/11 – 05/12
MC-EB-020	01/01 – 07/01	MC-EB-040	04/08 – 08/08	MC-EB-060	04/08 – 08/08		
MC-EB-021	01/01 – 07/01	MC-EB-041	04/08 – 08/08	MC-EB-061	04/08 – 08/08		



\\CANOPUS\PROJ\MSDCINCINNATI\498759EBMC-SSO700IWAP\GIS\MAPS\REPORT\INVENTORY\11X8_5_FLOWMONITORS.MXD DHILL15 2/18/2015 3:24:02 PM

CH2MHILL.

FIGURE 1
East Branch Mill Creek Flow Monitors

Model Validation Period Selection

This section summarizes the selection of flow monitors and their associated validation periods for use in the initial validation of the current MSDGC System Wide model.

Flow data are available for 78 monitor locations throughout the EBMC sewershed over varying time periods. An initial screening of the data involved elimination of flow monitors and flow data that do not meet two basic criteria:

1. **Data must be collected after January 2006:** GARR data were only available beginning January 2006; therefore, flow data collected prior to 2006 were not reviewed and will be not be used for the hydraulic model gap analysis.
2. **Monitors must have at least one year of continuous data:** The model will be evaluated at each flow monitor location for a year-long period using a continuous model simulation. A continuous model simulation will ensure that antecedent groundwater conditions are considered during simulation of the wet weather events. Therefore, any monitors that do not have one year of continuous data will not be used to validate the model and were eliminated from consideration.

This initial screening eliminated 59 monitors from consideration. The available flow data for each of the remaining 19 monitors were then reviewed to determine the best model validation period for that monitor. The model validation period selected for each monitor was based on the following criteria:

- **Dataset for validation period is as complete and accurate as possible**: The dataset contains no large periods of missing data or clearly inaccurate data such as dropouts or flatlines. (Flatlines are identified by a constant value over a period of time generally caused by debris stuck on the probe.)
- **Dataset for validation period contains at least one wet weather event per month where the monitor exhibited a reasonable response to the rainfall**.
- **Dataset for validation period contains a combination of event durations and rainfall depths** (i.e., combination or back-to-back wet weather events, large events, medium events, small events, etc.)

A common validation period could not be selected for all monitors due to data quality and availability. In other words, there was not one continuous year in which all monitors had available data. Additionally, three of the flow monitors (MC-EB-004, MC-EB-031, and MC-EB-035, which correspond to monitors MC-EB-023, MC-EB-014, and MC-EB-036, respectively, as named during the time of the RDII pilot study) were evaluated and calibrated as part of the Pilot RDII Study conducted in 2011. A similar approach was used for that task to review and identify the model calibration periods. In order to leverage that work, the SSO 700 IWAP hydraulic model validation will use the same time periods used for that task for these three flow monitors.

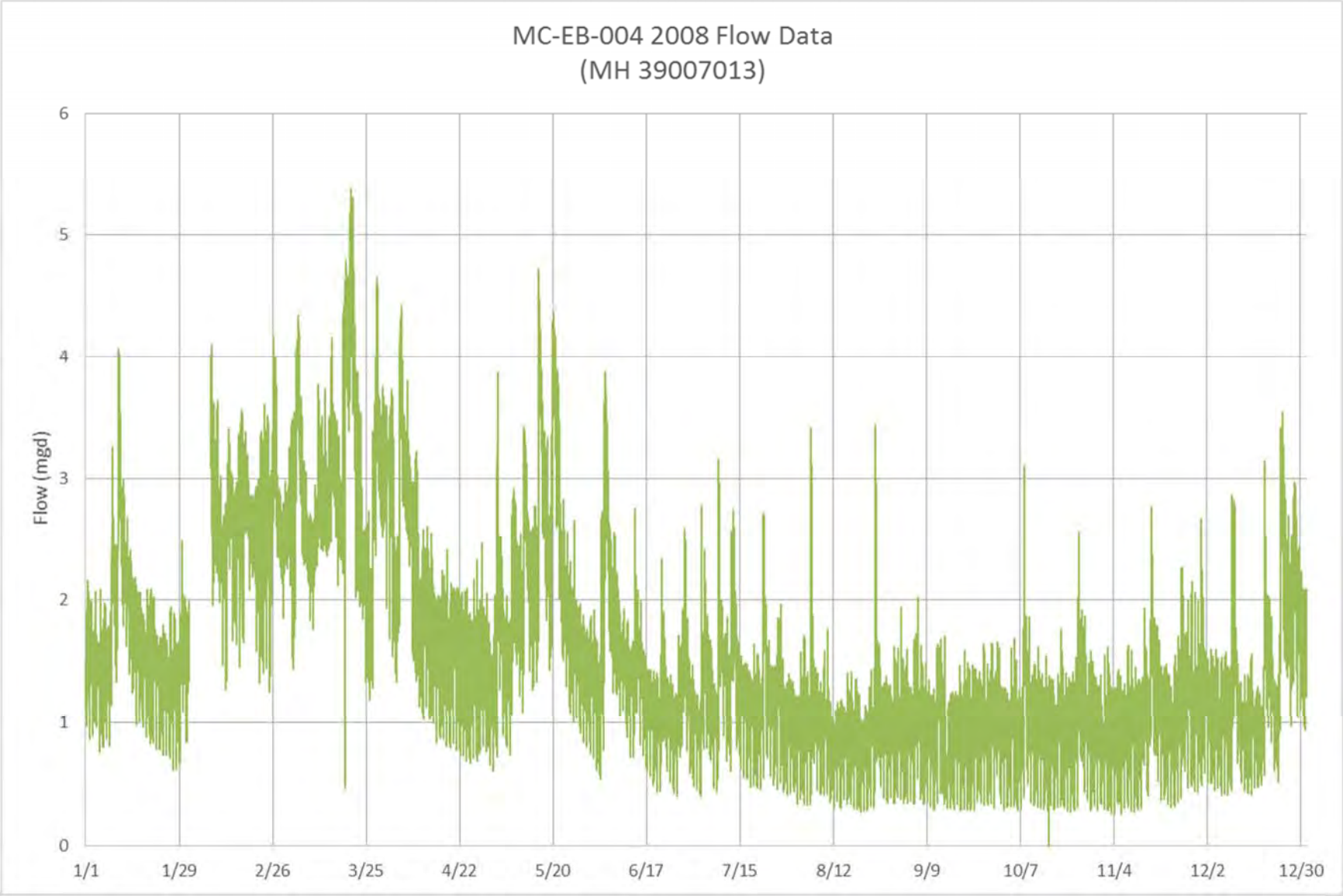
Table 2 summarizes the model validation period selected for each flow meter. Plots of the flow data are provided in Appendix A.

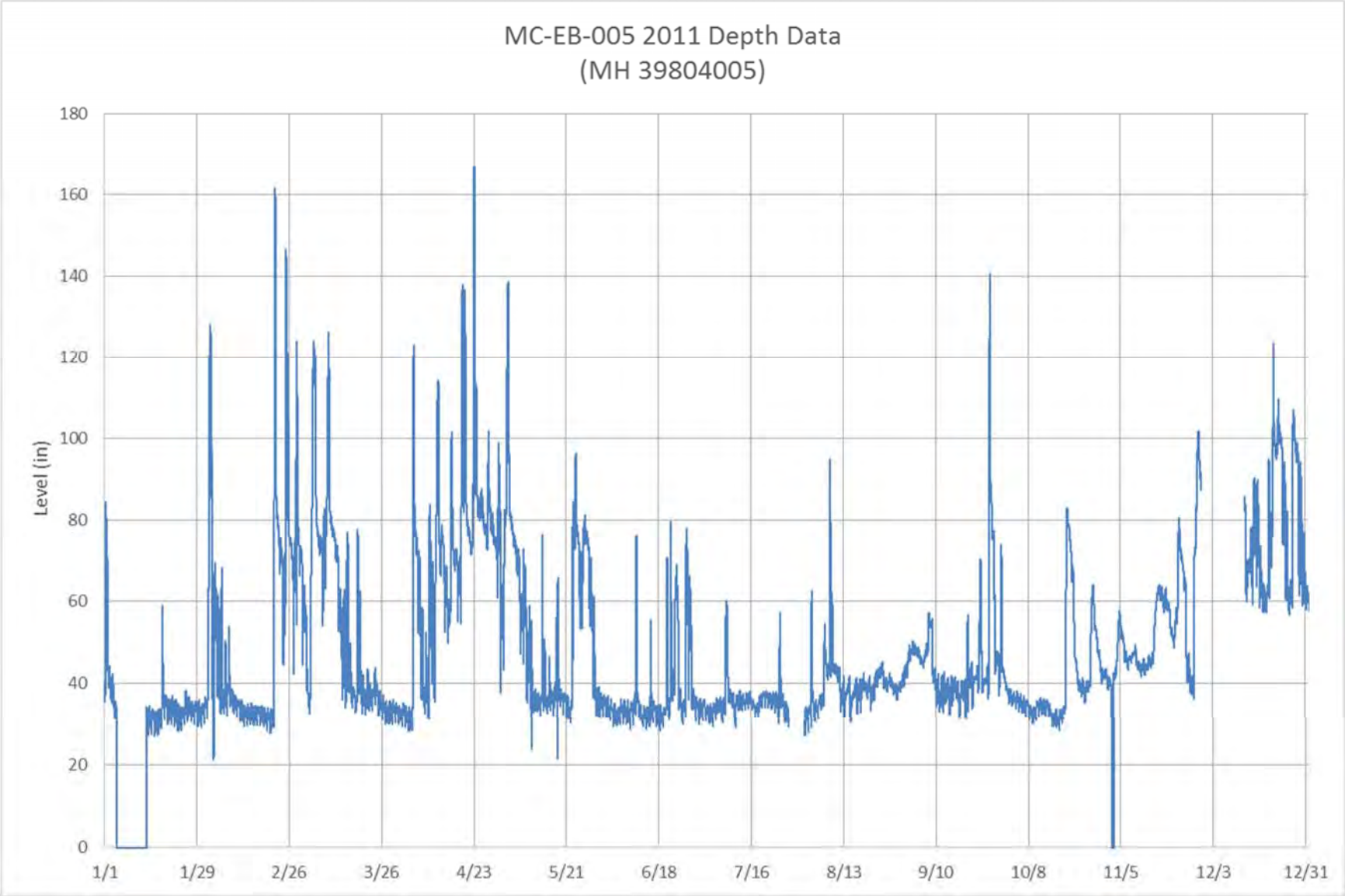
TABLE 2
Model Validation Period Selection

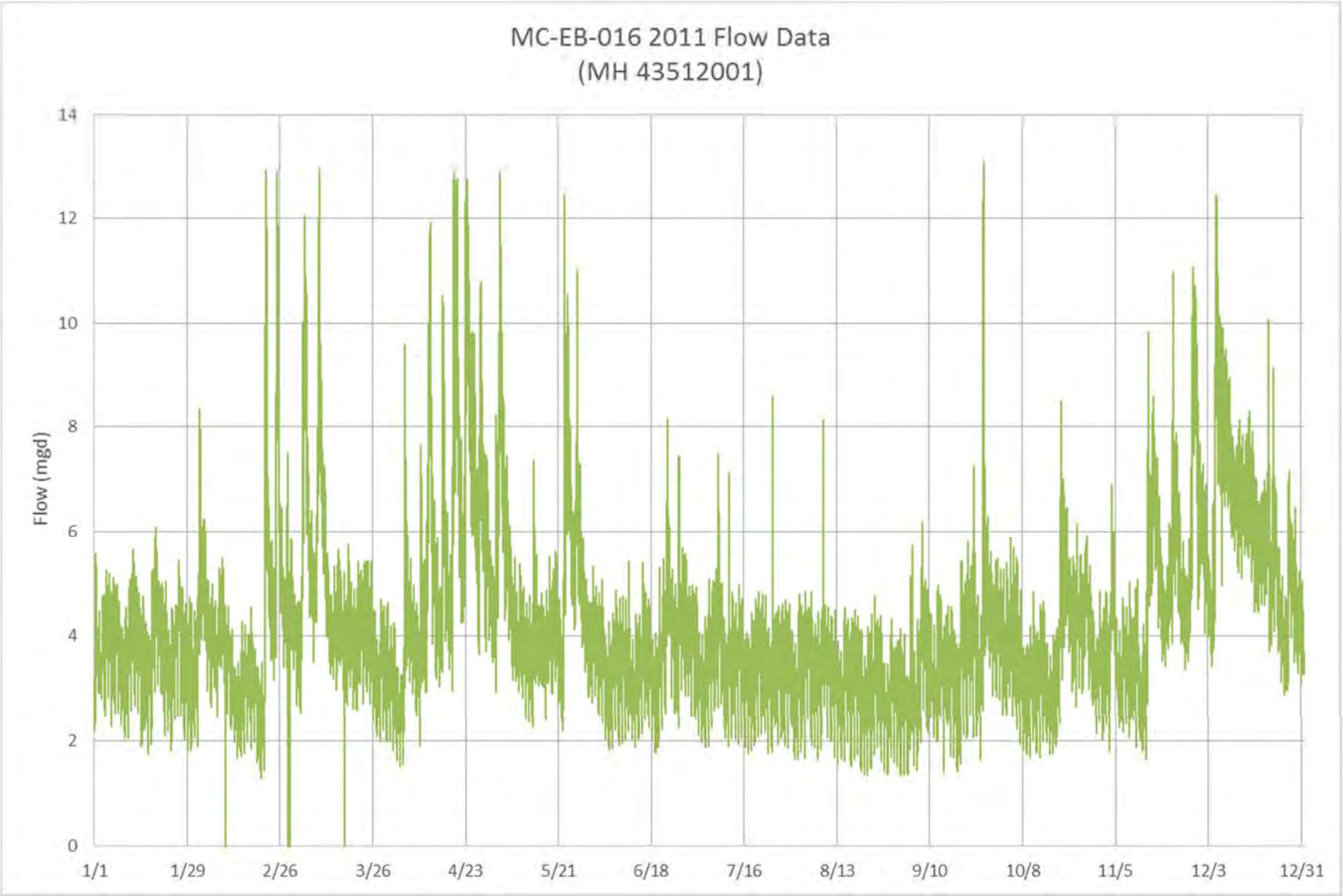
Flow Meter	Manhole ID	Model Validation Period
MC-EB-004 [MC-EB-023 from RDII Pilot Study]	39007013	January 2008 – December 2008
MC-EB-005[1]	39804005	January 2011 – December 2011
MC-EB-016	43512001	January 2011 – December 2011
MC-EB-017	43515006	January 2012 – December 2012
MC-EB-019	43315004	January 2011 – December 2011
MC-EB-026	43307006	July 2011 – June 2012
MC-EB-027	44709002	January 2009 – December 2009
MC-EB-030	40001012	January 2009 – December 2009
MC-EB-031 [MC-EB-014 from RDII Pilot Study]	48111019	January 2007 – December 2007
MC-EB-032	44816004	January 2011 – December 2011
MC-EB-033	44307022	January 2012 – December 2012
MC-EB-035 [MC-EB-036 from RDII Pilot Study]	44306022	January 2009 – December 2009
MC-EB-036	44816019	April 2006 – March 2007
MC_EB-063	48110013	January 2009 – December 2009
MC-EB-064	48110002	January 2009 – December 2009
MC-EB-065	4806017	January 2009 – December 2009
MC-EB-070	40010011	January 2010 – December 2010
MC-EB-071	39001020	October 2011 – September 2012
MC-EB-075	43802018	October 2011 – September 2012

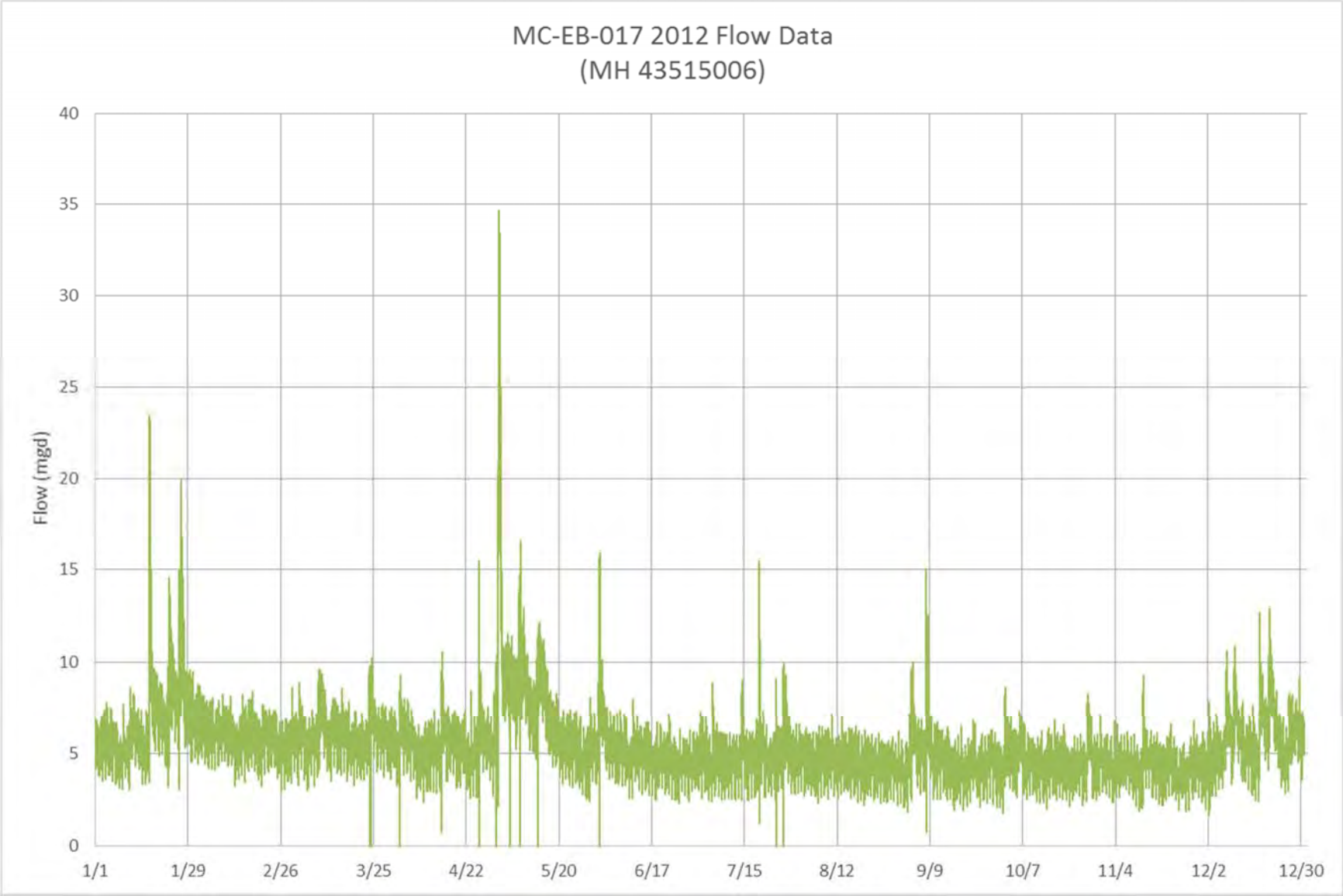
(1) Velocity data is unreliable for MC-EB-005 for the entire range of flow data received; therefore, only depth will be compared during model assessment.

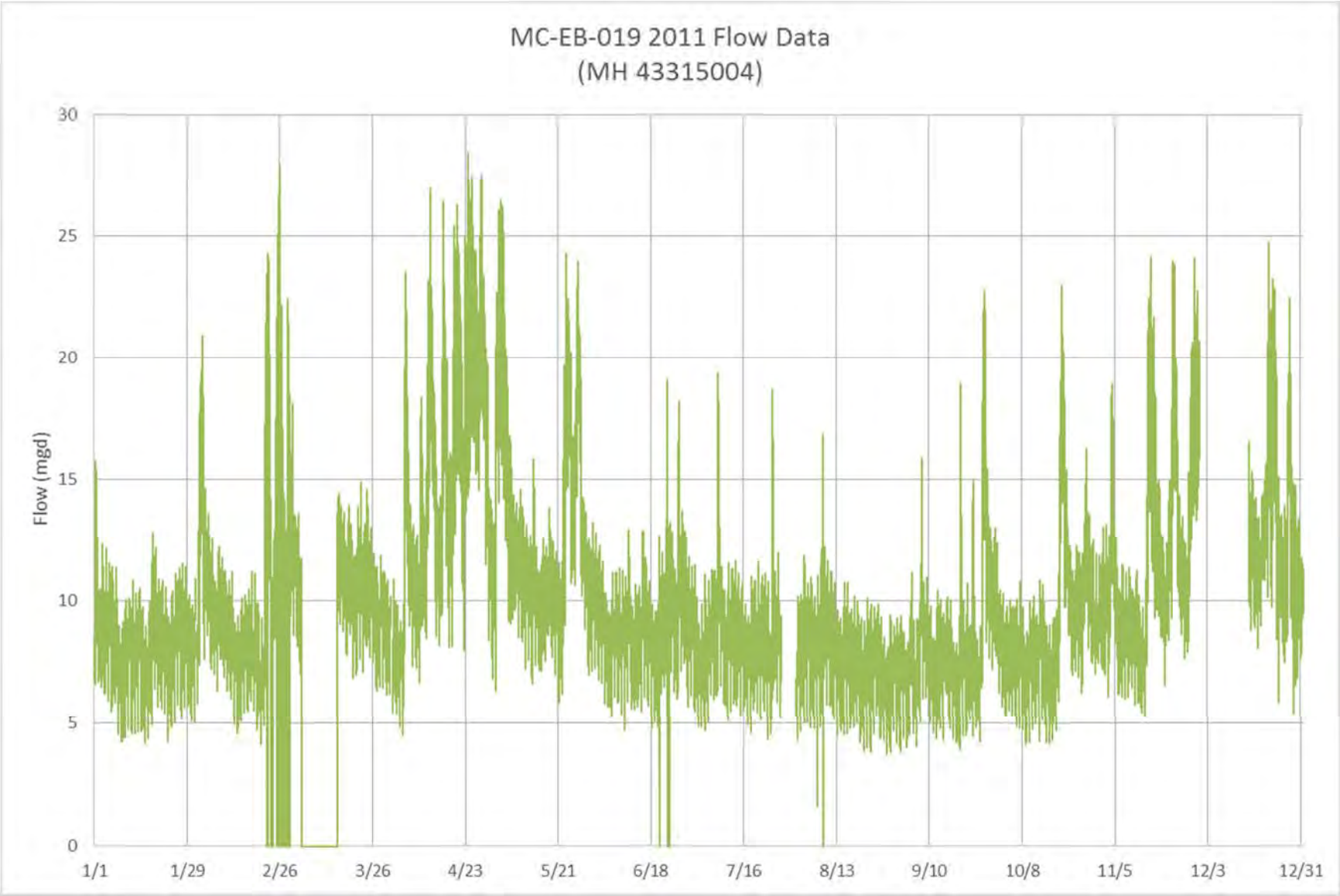
Appendix A: Model Validation Period Flow Monitor Hydrographs

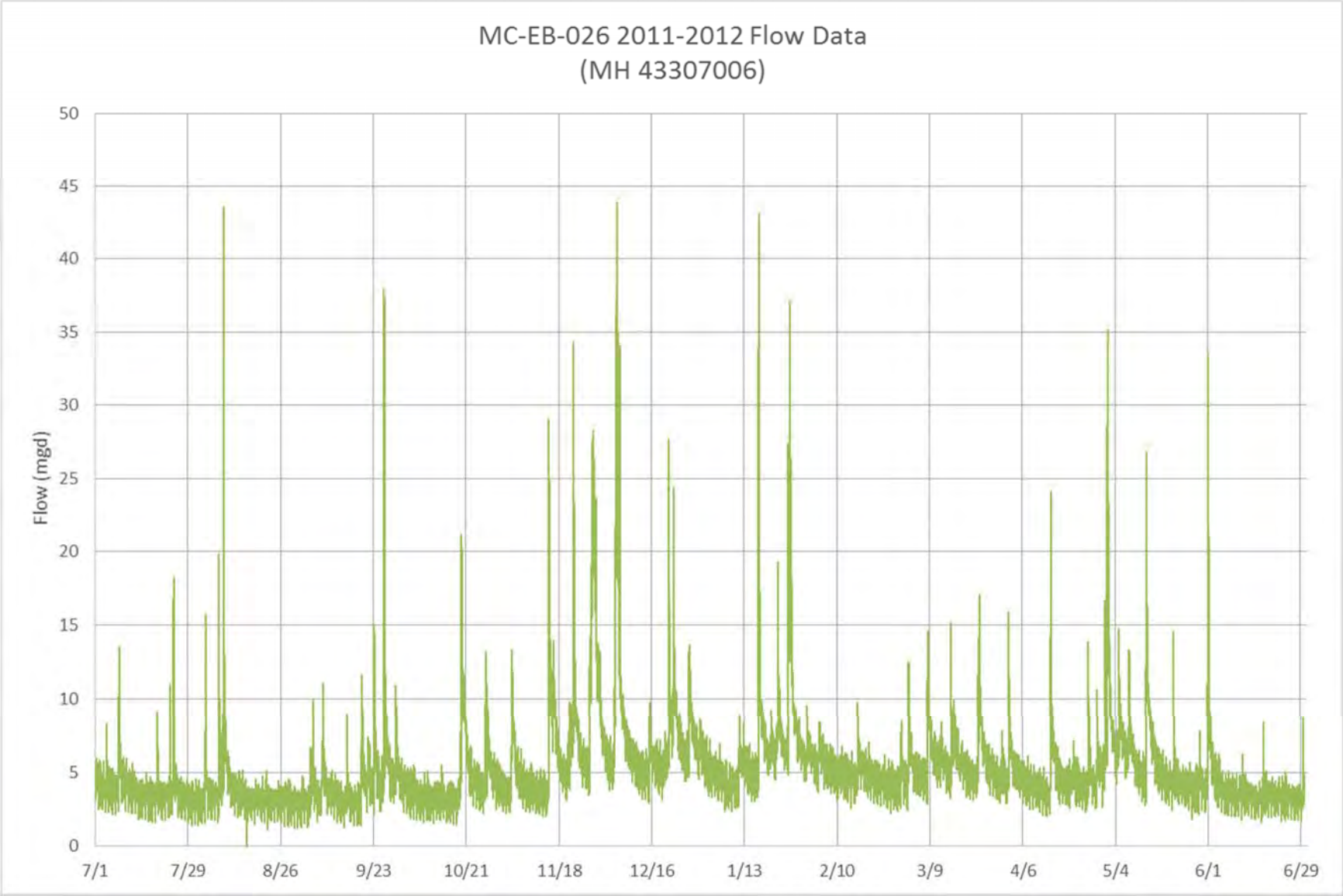

MC-EB-004 2008 Flow Data
(MH 39007013)
Flow (mgd)
0
1
2
3
4
5
6
1/1
1/29
2/26
3/25
4/22
5/20
6/17
7/15
8/12
9/9
10/7
11/4
12/2
12/30

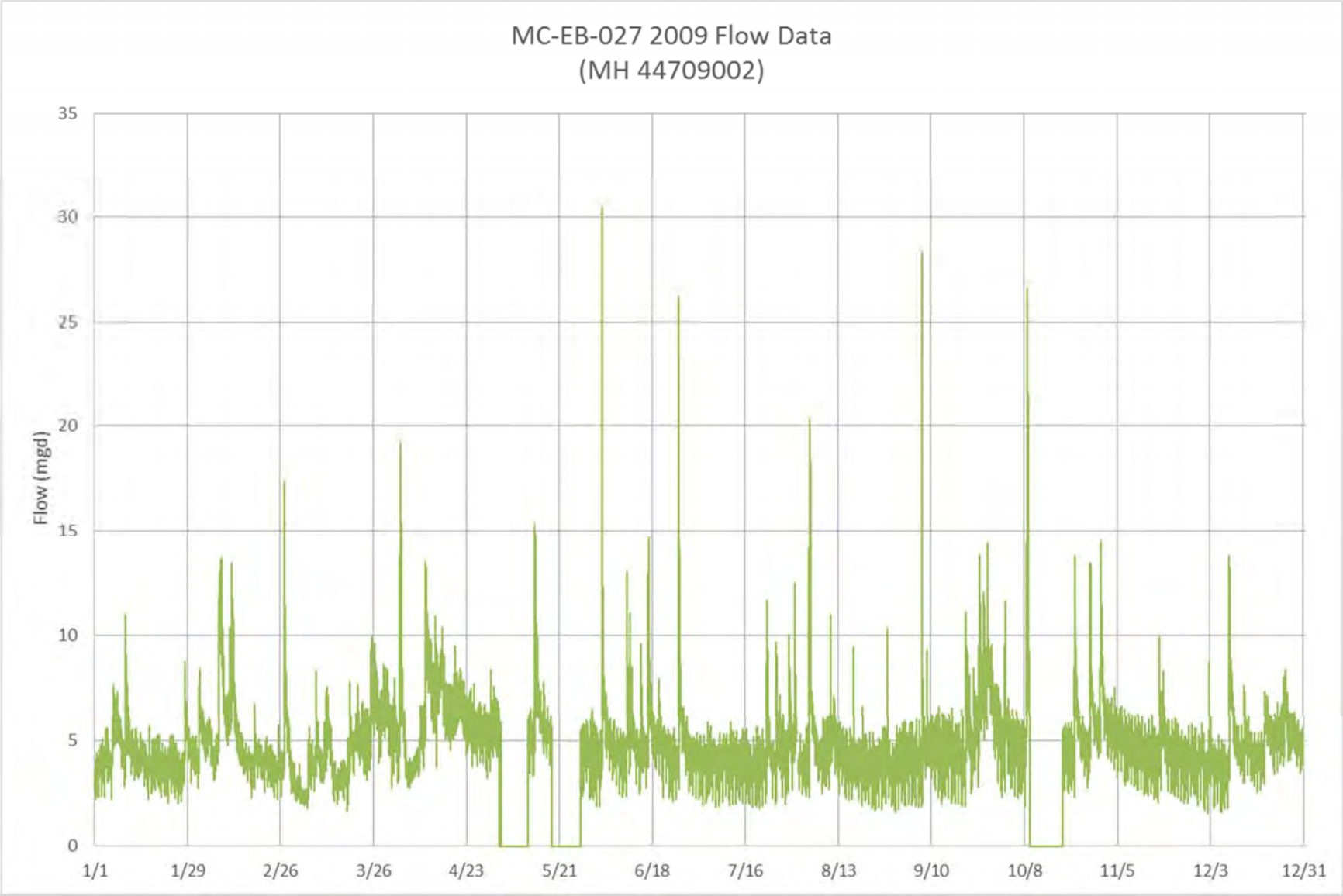

MC-EB-005 2011 Depth Data
(MH 39804005)
Level (in)
180
160
140
120
100
80
60
40
20
0
1/1
1/29
2/26
3/26
4/23
5/21
6/18
7/16
8/13
9/10
10/8
11/5
12/3
12/31

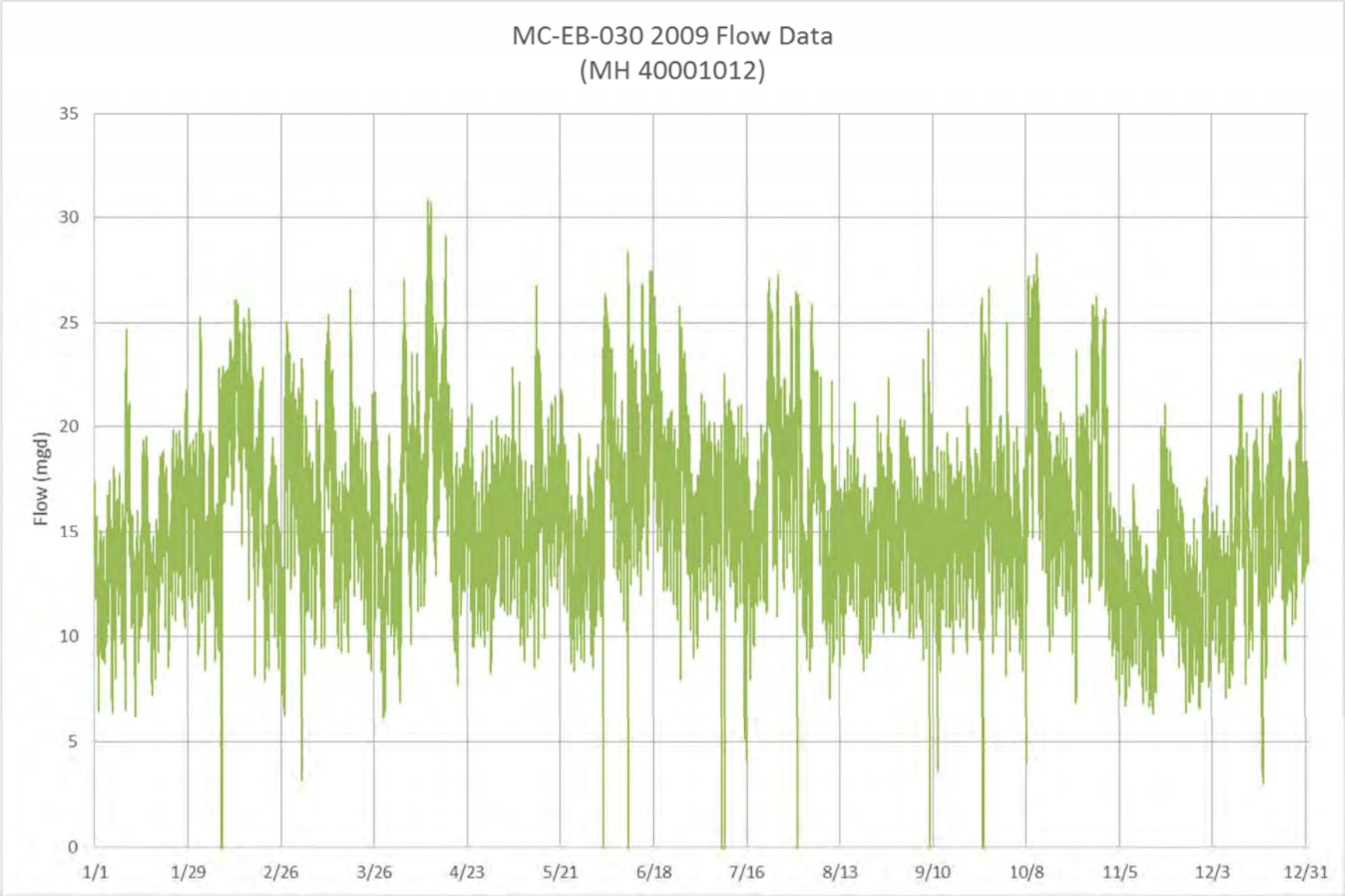

MC-EB-016 2011 Flow Data
(MH 43512001)
Flow (mgd)
0
2
4
6
8
10
12
14
1/1
1/29
2/26
3/26
4/23
5/21
6/18
7/16
8/13
9/10
10/8
11/5
12/3
12/31

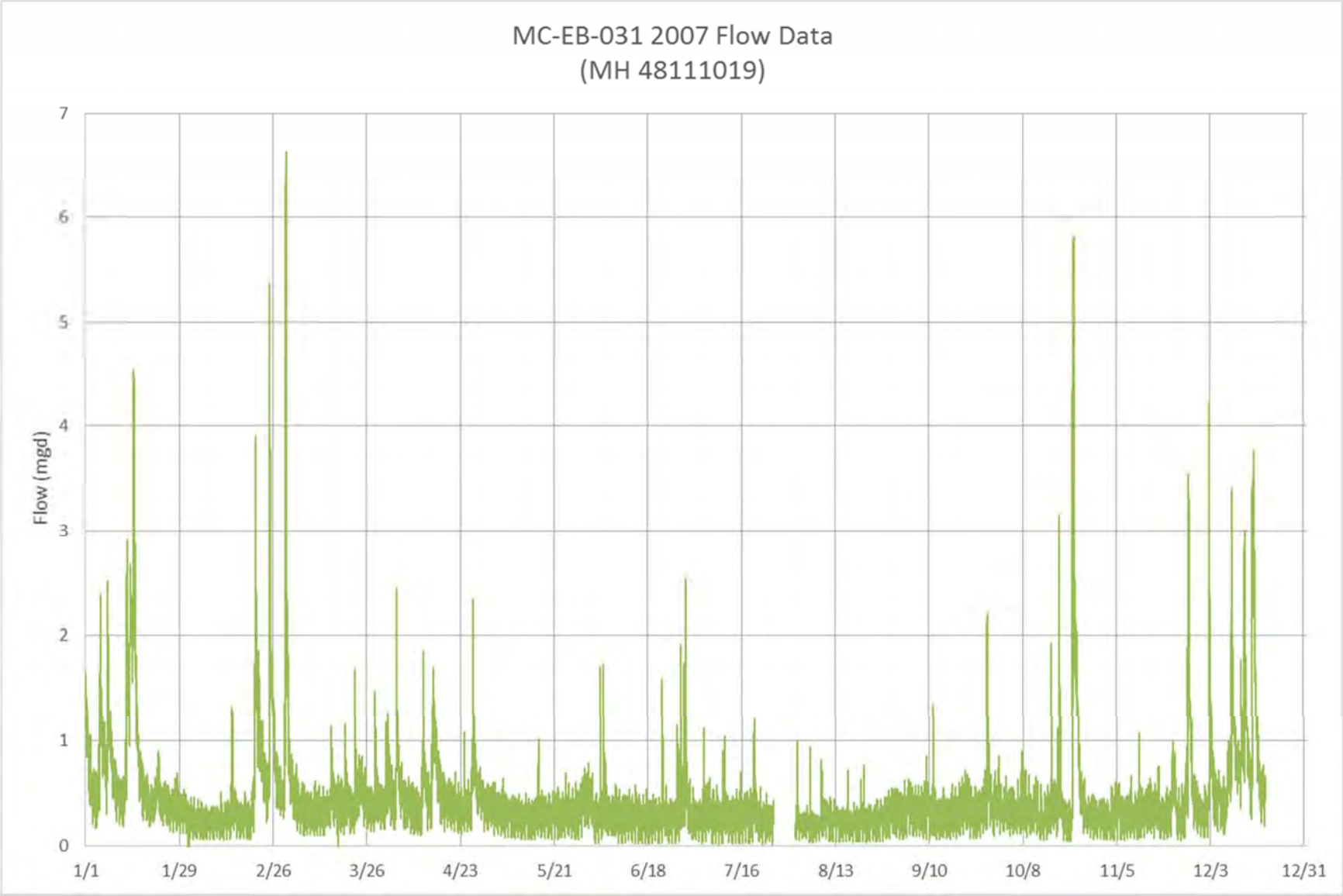

MC-EB-017 2012 Flow Data
(MH 43515006)
Flow (mgd)
40
35
30
25
20
15
10
5
0
1/1
1/29
2/26
3/25
4/22
5/20
6/17
7/15
8/12
9/9
10/7
11/4
12/2
12/30

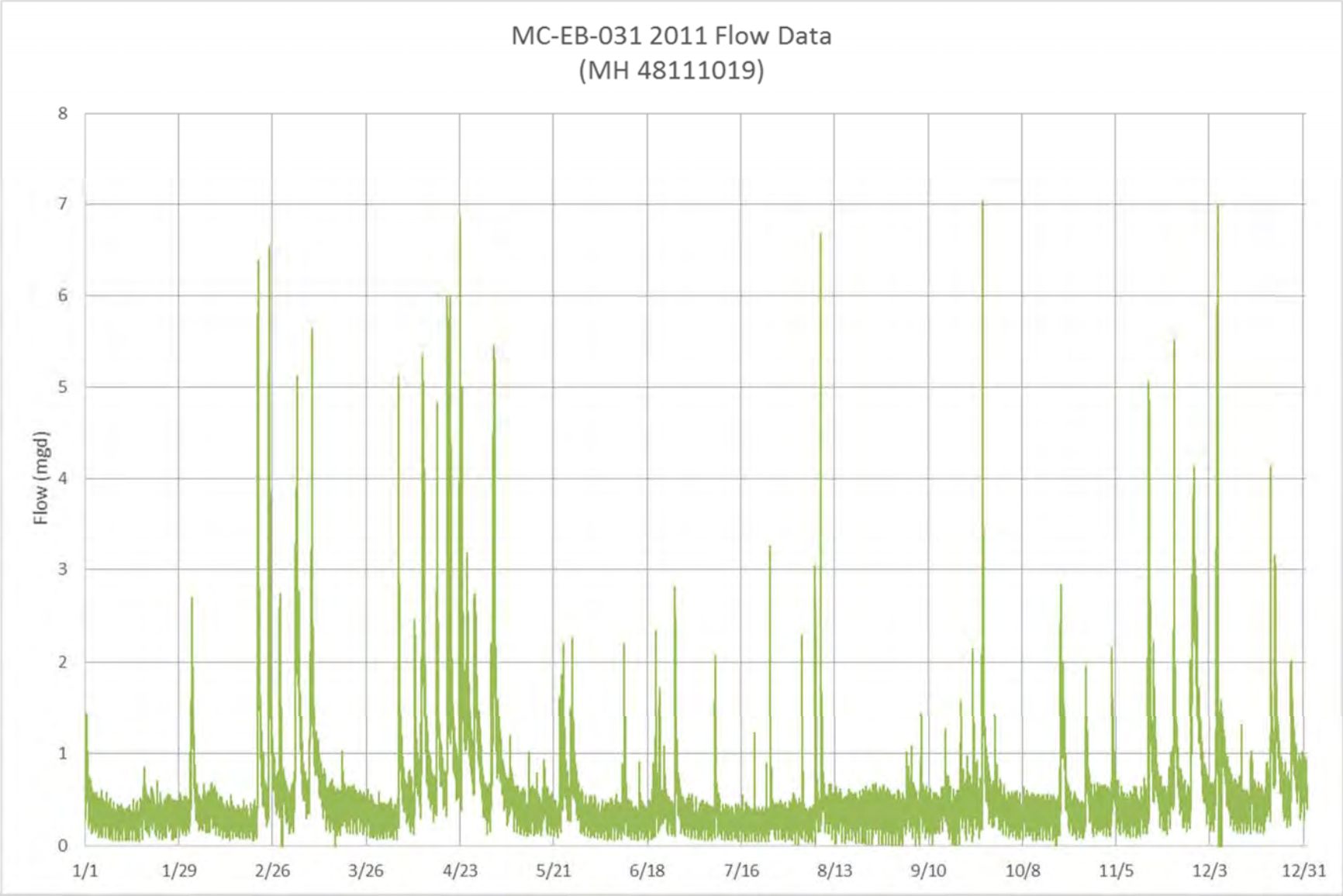

MC-EB-019 2011 Flow Data
(MH 43315004)
Flow (mgd)
30
25
20
15
10
5
0
1/1
1/29
2/26
3/26
4/23
5/21
6/18
7/16
8/13
9/10
10/8
11/5
12/3
12/31

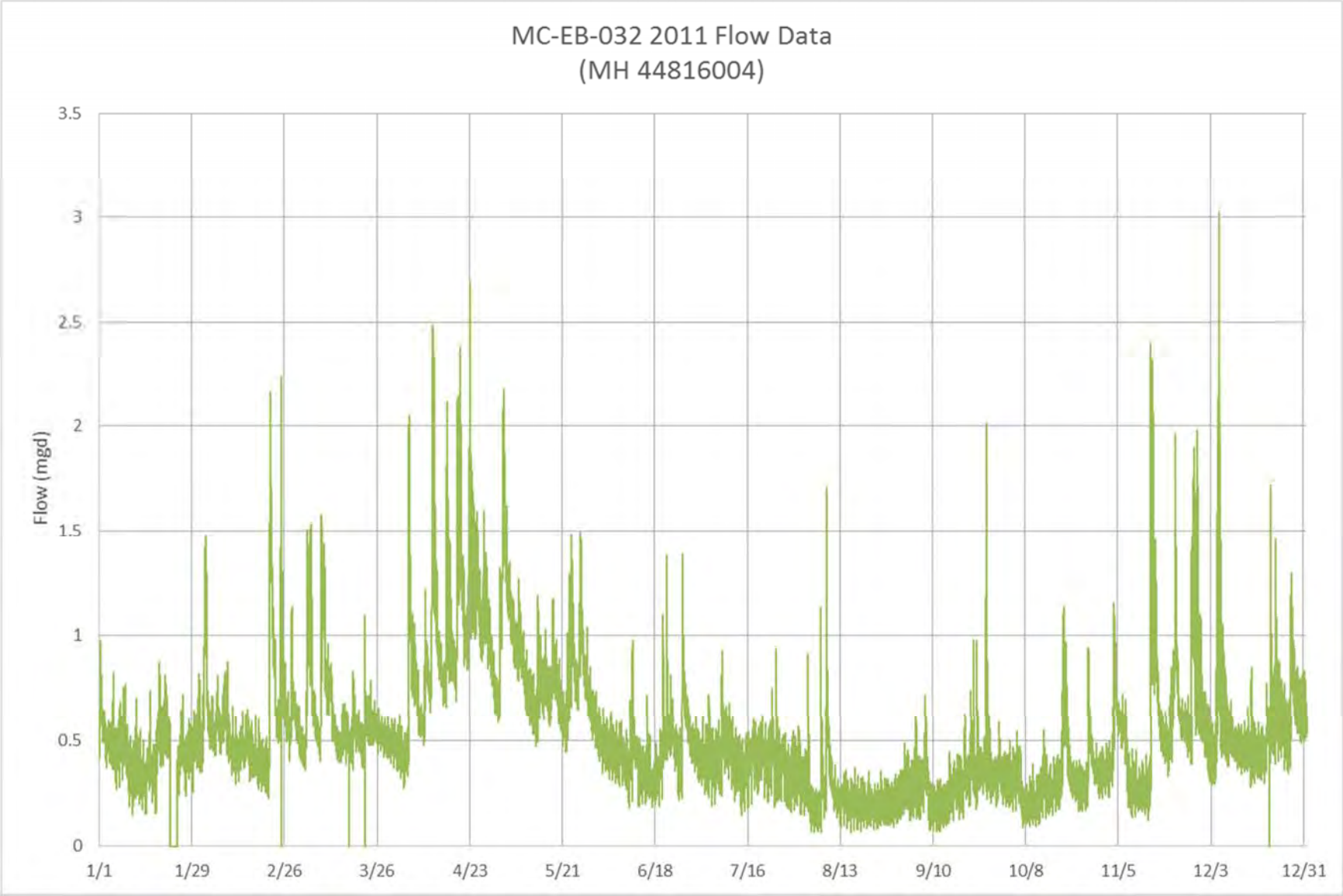

MC-EB-026 2011-2012 Flow Data
(MH 43307006)
Flow (mgd)
50
45
40
35
30
25
20
15
10
5
0
7/1
7/29
8/26
9/23
10/21
11/18
12/16
1/13
2/10
3/9
4/6
5/4
6/1
6/29

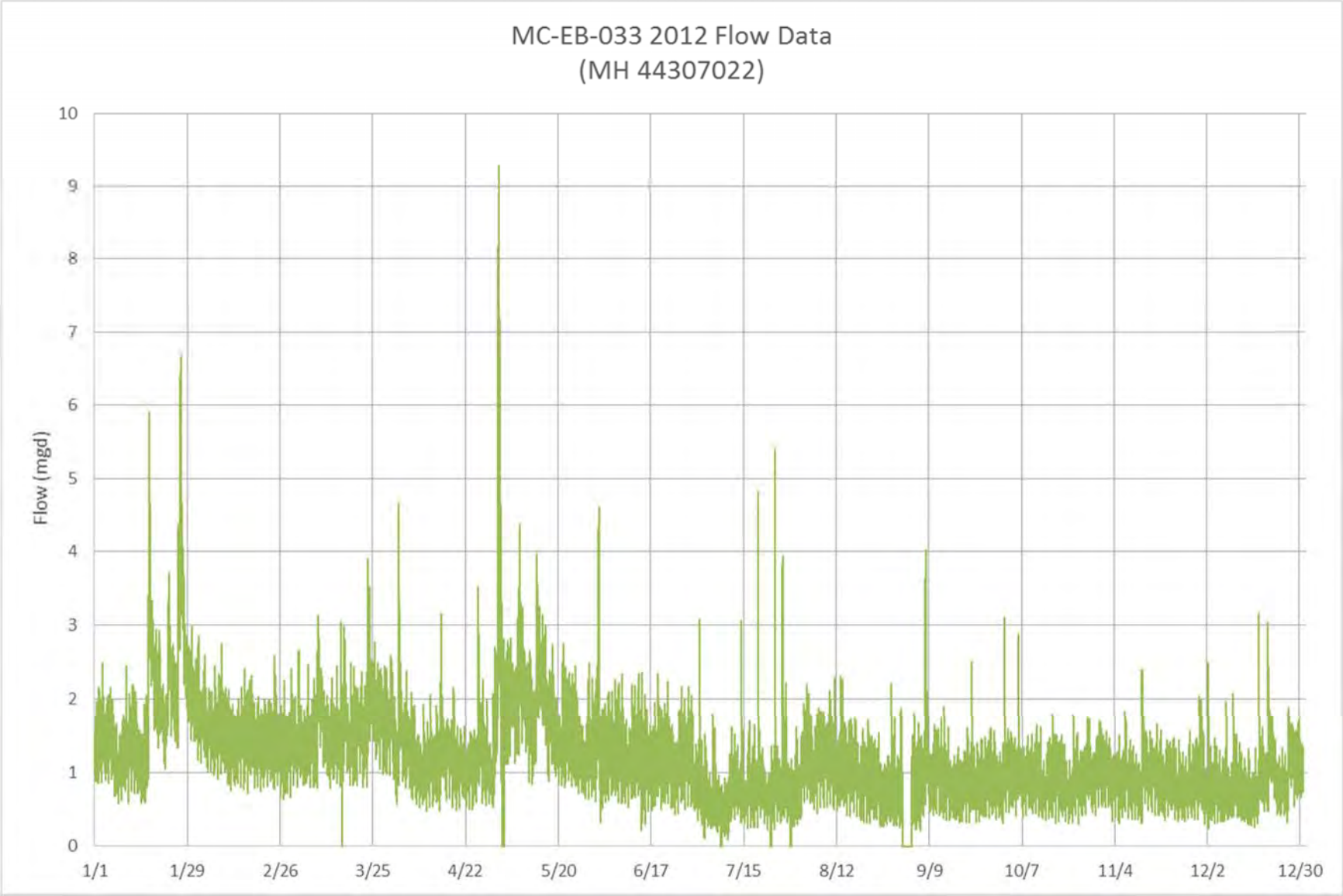

MC-EB-027 2009 Flow Data
(MH 44709002)
Flow (mgd)
35
30
25
20
15
10
5
0
1/1
1/29
2/26
3/26
4/23
5/21
6/18
7/16
8/13
9/10
10/8
11/5
12/3
12/31

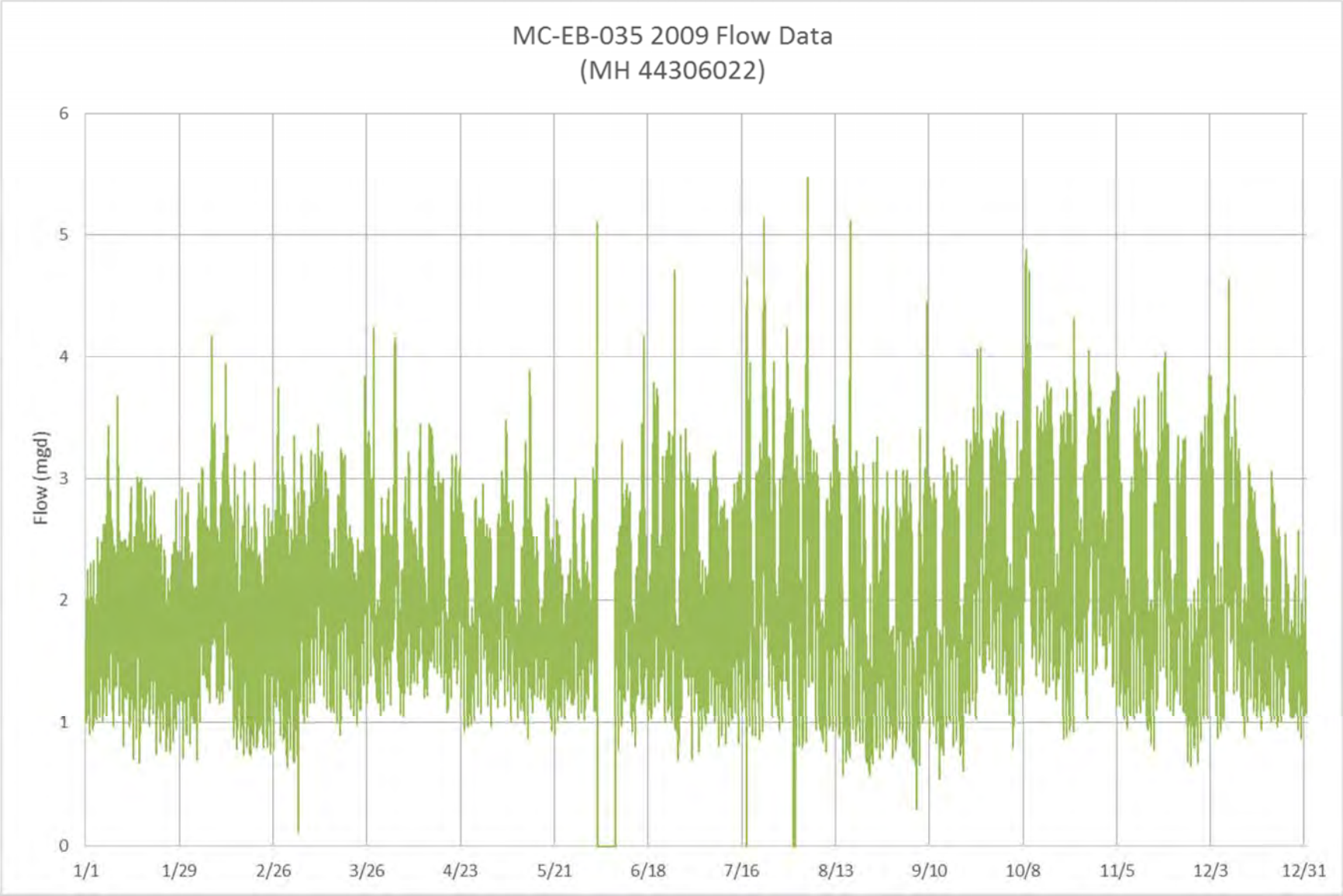

MC-EB-030 2009 Flow Data
(MH 40001012)
Flow (mgd)
35
30
25
20
15
10
5
0
1/1
1/29
2/26
3/26
4/23
5/21
6/18
7/16
8/13
9/10
10/8
11/5
12/3
12/31

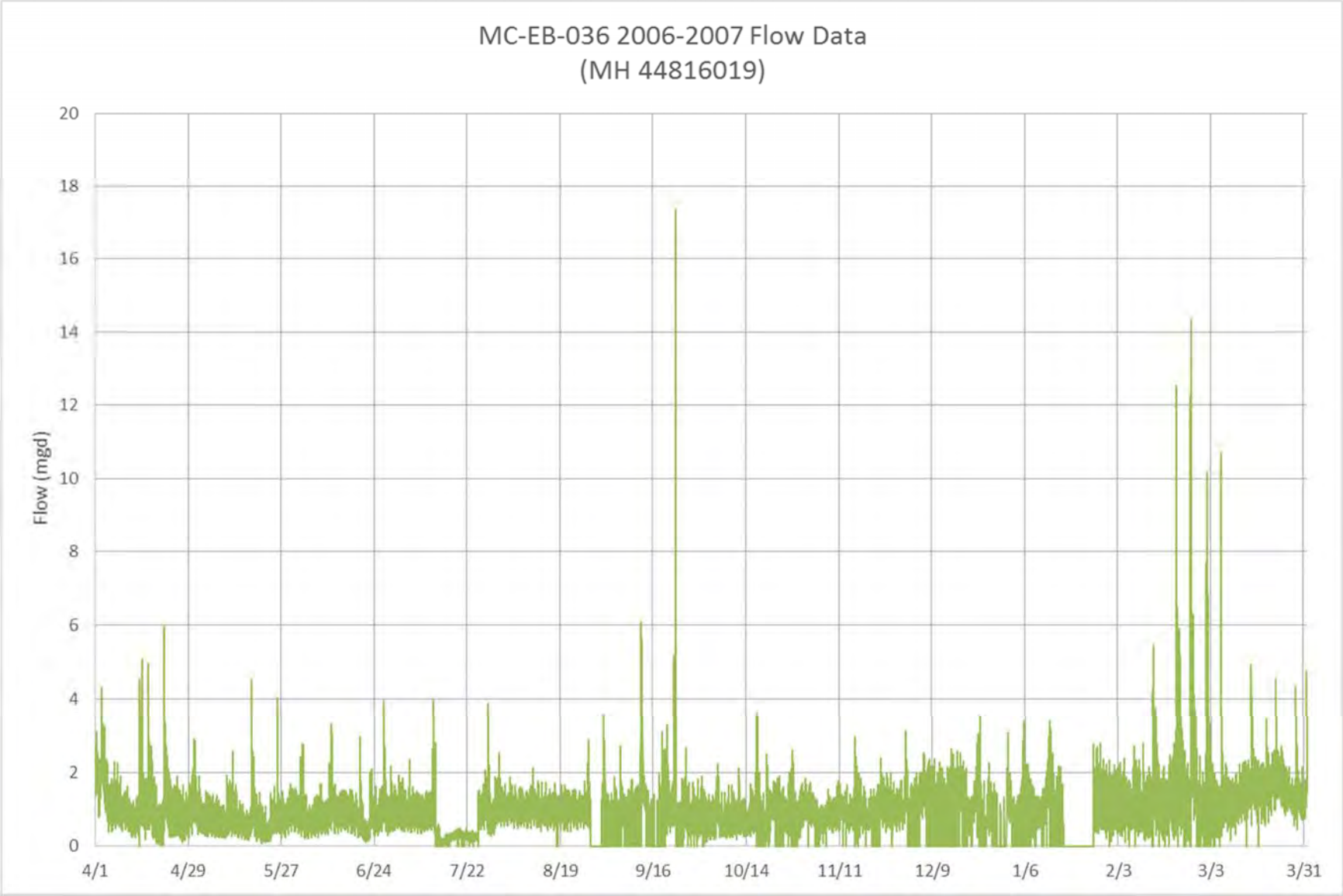

MC-EB-031 2007 Flow Data
(MH 48111019)
Flow (mgd)
0
1
2
3
4
5
6
7
1/1
1/29
2/26
3/26
4/23
5/21
6/18
7/16
8/13
9/10
10/8
11/5
12/3
12/31

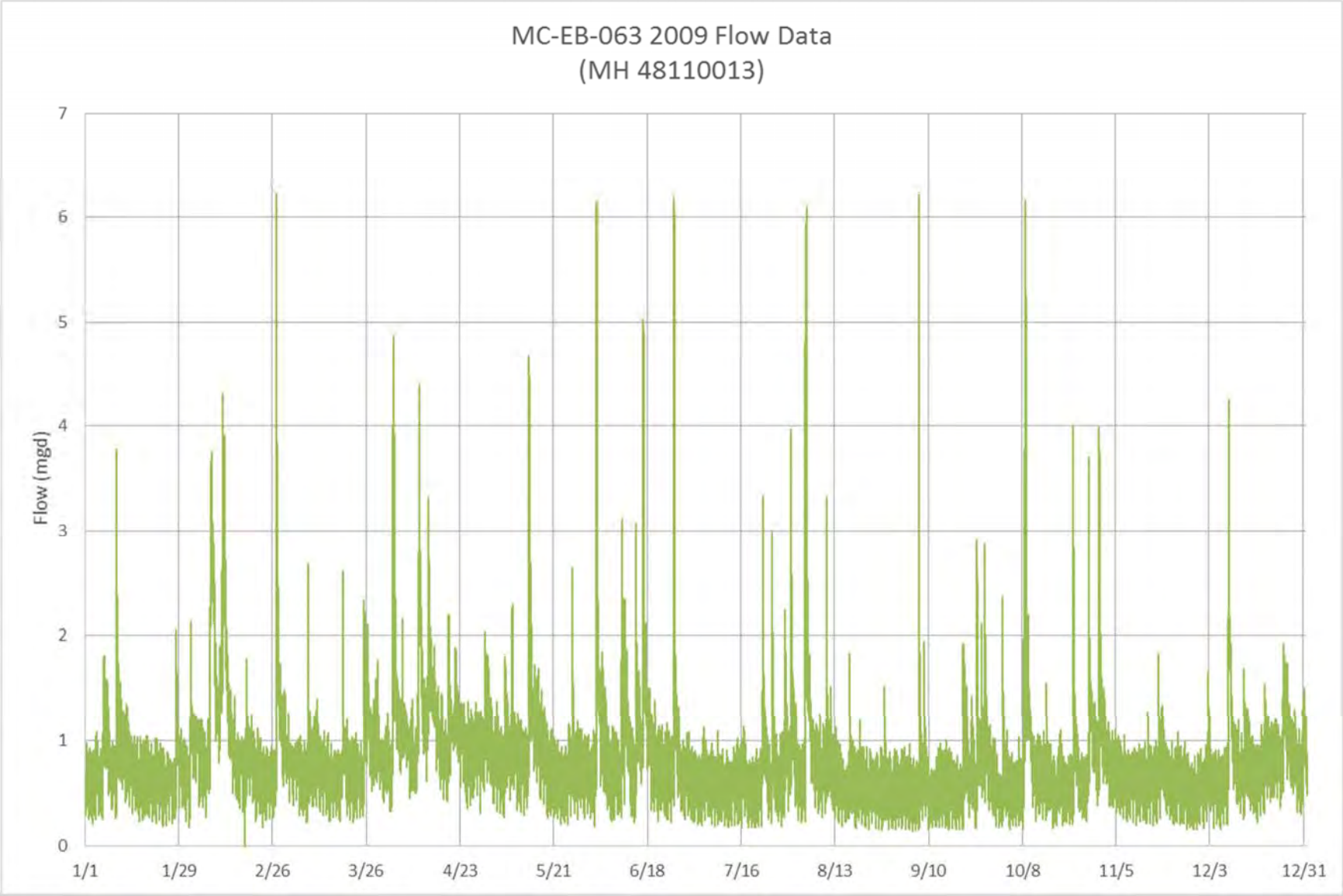

MC-EB-031 2011 Flow Data
(MH 48111019)
Flow (mgd)
0
1
2
3
4
5
6
7
8
1/1
1/29
2/26
3/26
4/23
5/21
6/18
7/16
8/13
9/10
10/8
11/5
12/3
12/31

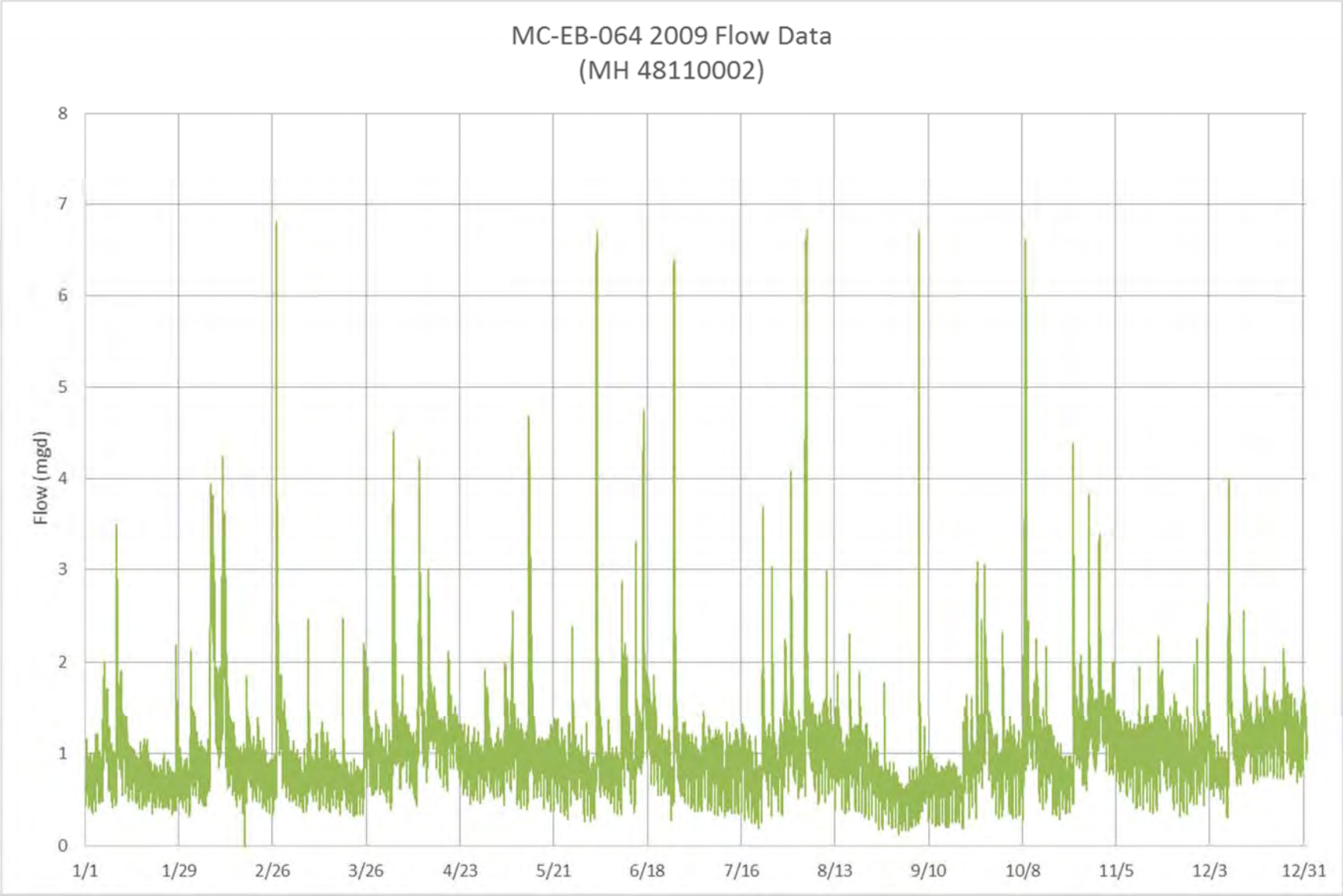

MC-EB-032 2011 Flow Data
(MH 44816004)
Flow (mgd)
3.5
3
2.5
2
1.5
1
0.5
0
1/1
1/29
2/26
3/26
4/23
5/21
6/18
7/16
8/13
9/10
10/8
11/5
12/3
12/31

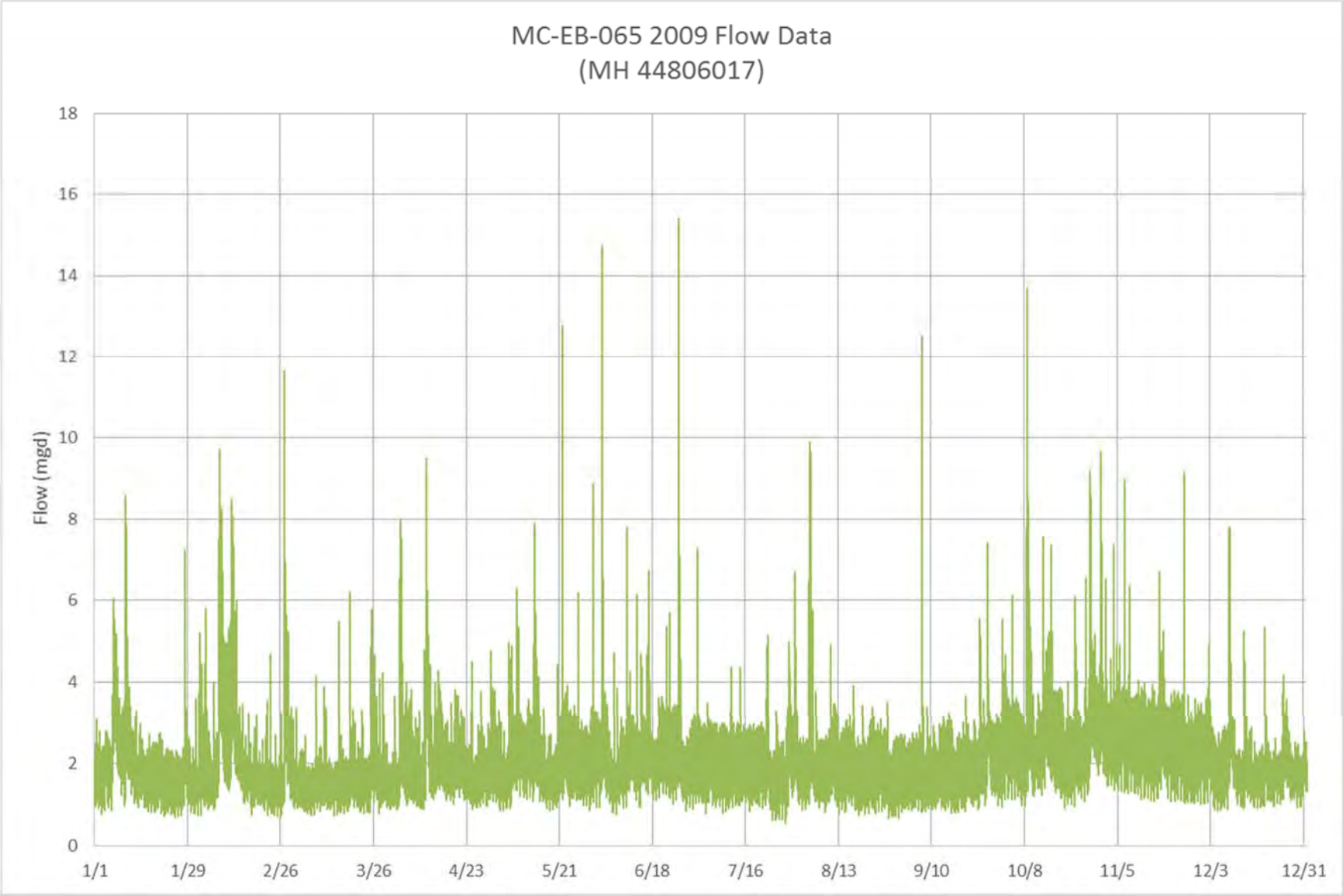

MC-EB-033 2012 Flow Data
(MH 44307022)
Flow (mgd)
0
1
2
3
4
5
6
7
8
9
10
1/1
1/29
2/26
3/25
4/22
5/20
6/17
7/15
8/12
9/9
10/7
11/4
12/2
12/30

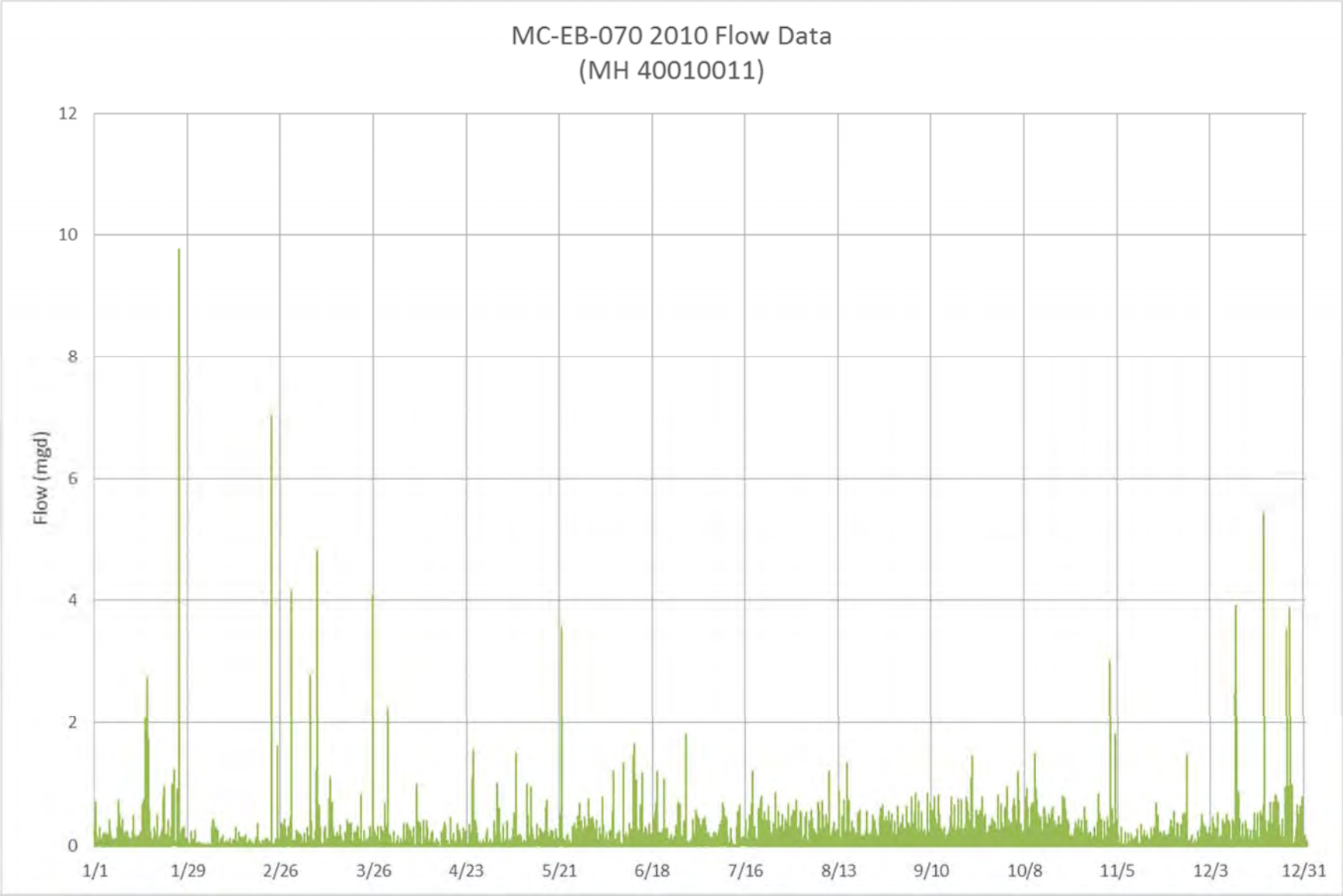

MC-EB-035 2009 Flow Data
(MH 44306022)
Flow (mgd)
0
1
2
3
4
5
6
1/1
1/29
2/26
3/26
4/23
5/21
6/18
7/16
8/13
9/10
10/8
11/5
12/3
12/31

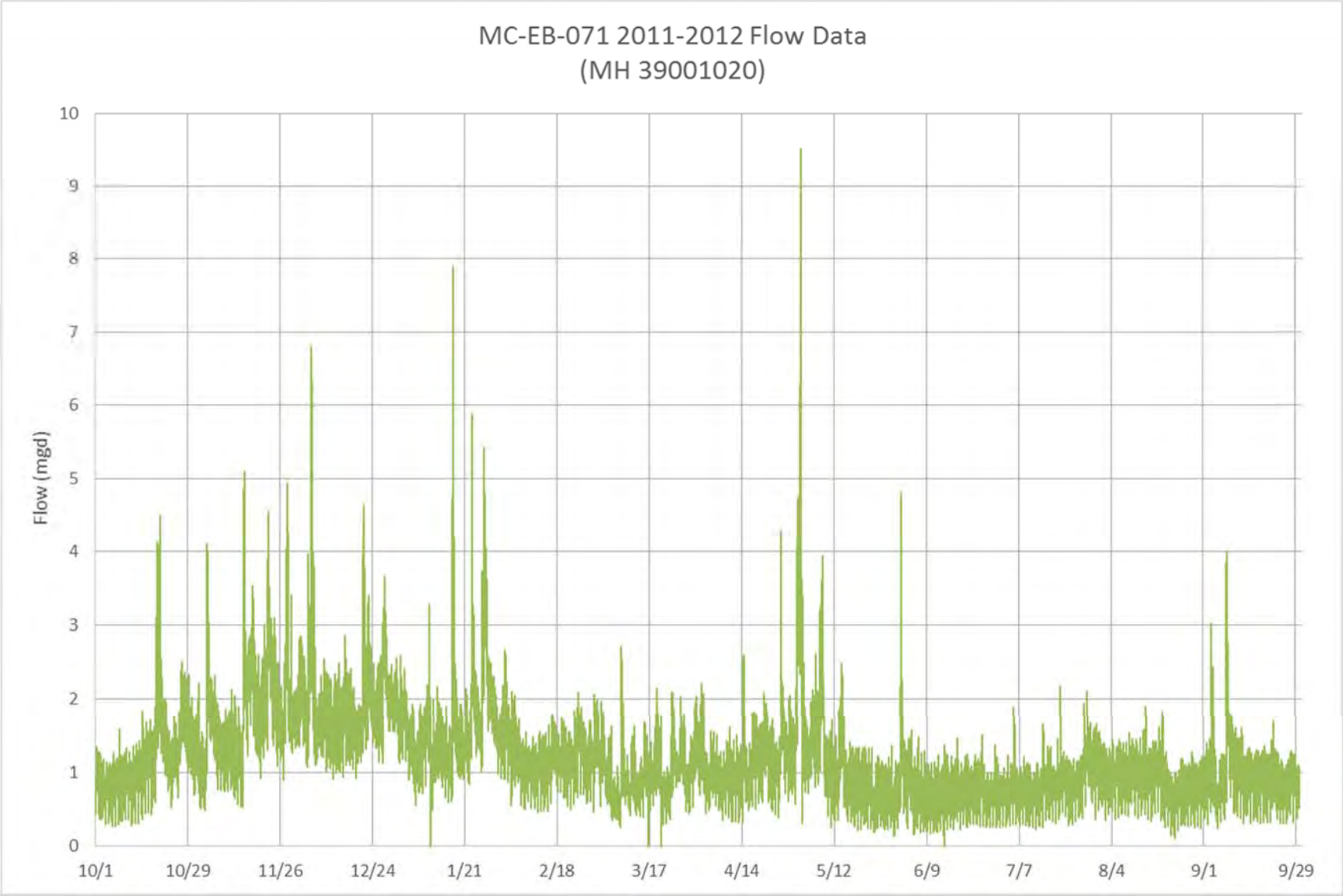

MC-EB-036 2006-2007 Flow Data
(MH 44816019)
Flow (mgd)
20
18
16
14
12
10
8
6
4
2
0
4/1
4/29
5/27
6/24
7/22
8/19
9/16
10/14
11/11
12/9
1/6
2/3
3/3
3/31

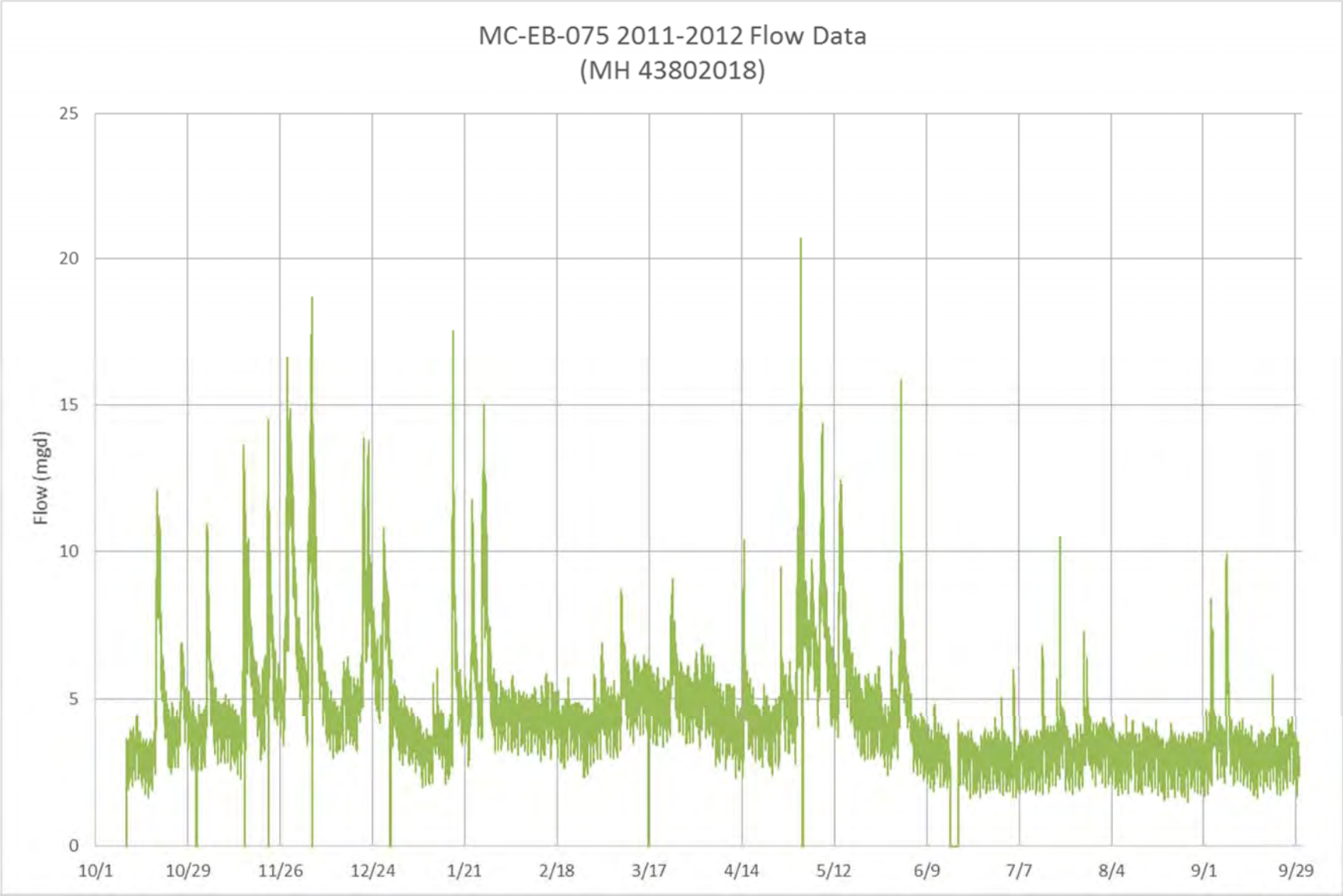

MC-EB-063 2009 Flow Data
(MH 48110013)
Flow (mgd)
0
1
2
3
4
5
6
7
1/1
1/29
2/26
3/26
4/23
5/21
6/18
7/16
8/13
9/10
10/8
11/5
12/3
12/31


MC-EB-064 2009 Flow Data
(MH 48110002)
Flow (mgd)
0
1
2
3
4
5
6
7
8
1/1
1/29
2/26
3/26
4/23
5/21
6/18
7/16
8/13
9/10
10/8
11/5
12/3
12/31

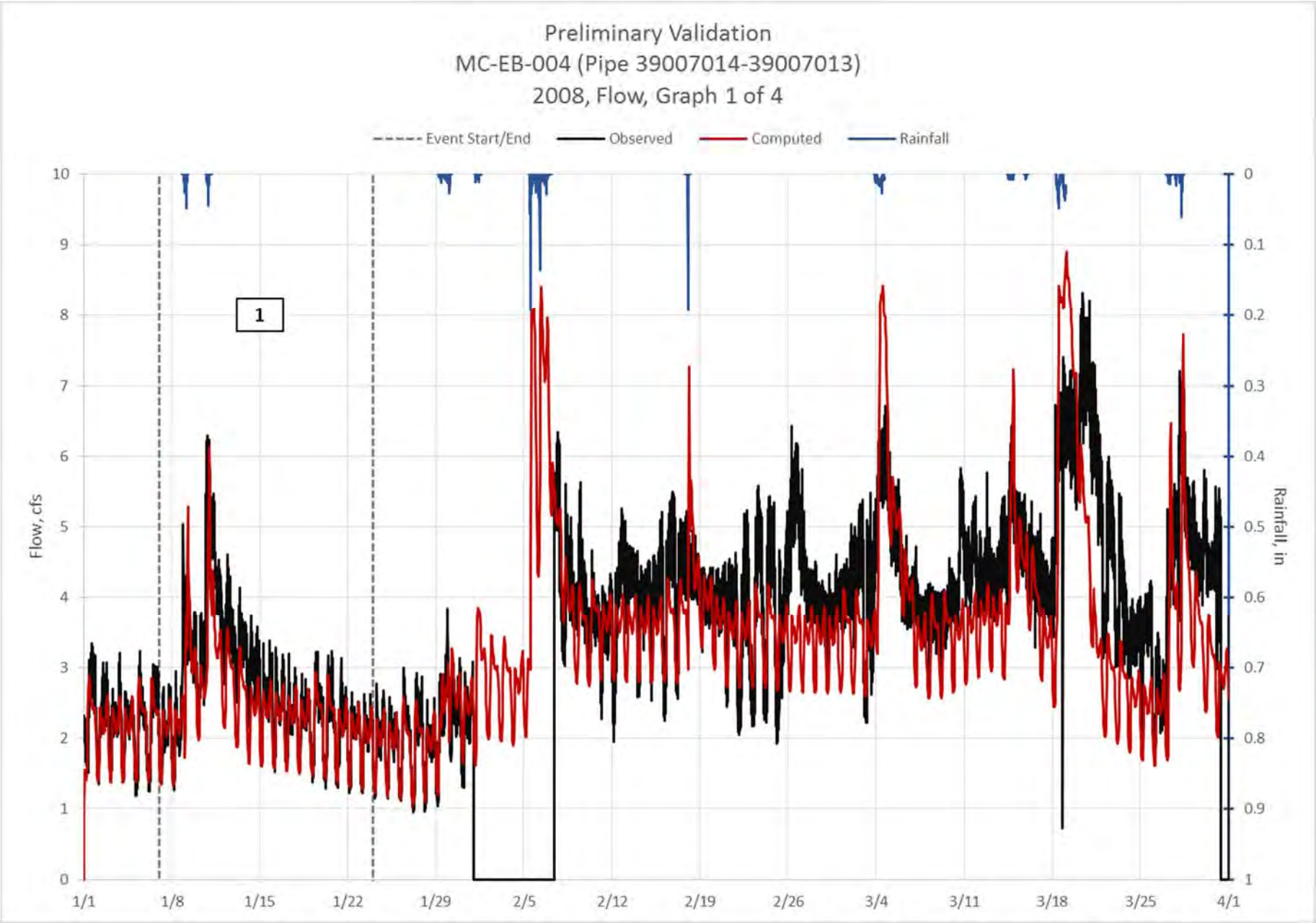

MC-EB-065 2009 Flow Data
(MH 44806017)
Flow (mgd)
18
16
14
12
10
8
6
4
2
0
1/1
1/29
2/26
3/26
4/23
5/21
6/18
7/16
8/13
9/10
10/8
11/5
12/3
12/31

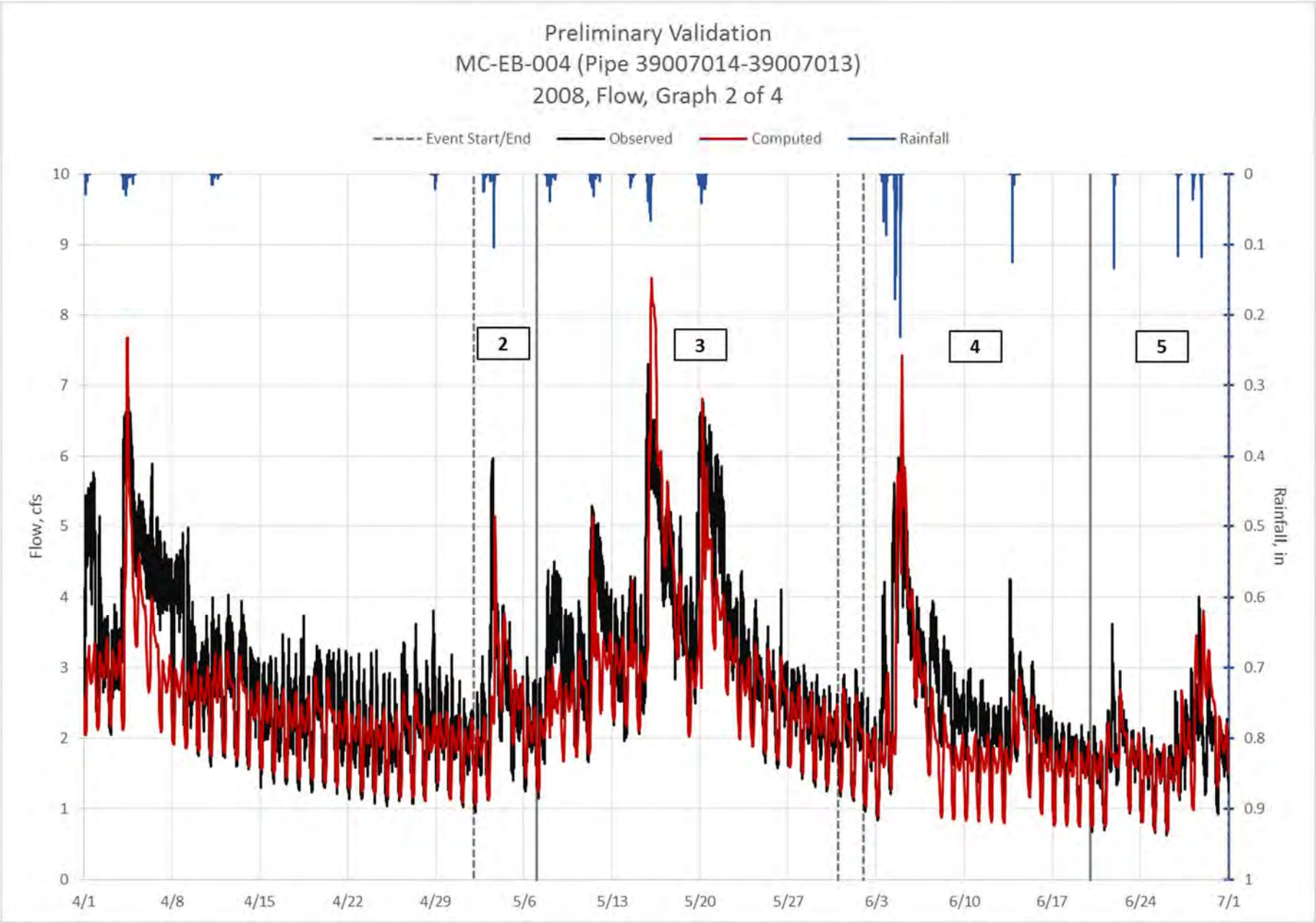

MC-EB-070 2010 Flow Data
(MH 40010011)
Flow (mgd)
12
10
8
6
4
2
0
1/1
1/29
2/26
3/26
4/23
5/21
6/18
7/16
8/13
9/10
10/8
11/5
12/3
12/31


MC-EB-071 2011-2012 Flow Data
(MH 39001020)
Flow (mgd)
0
1
2
3
4
5
6
7
8
9
10
10/1
10/29
11/26
12/24
1/21
2/18
3/17
4/14
5/12
6/9
7/7
8/4
9/1
9/29


MC-EB-075 2011-2012 Flow Data
(MH 43802018)
Flow (mgd)
25
20
15
10
5
0
10/1
10/29
11/26
12/24
1/21
2/18
3/17
4/14
5/12
6/9
7/7
8/4
9/1
9/29

Appendix B- Flow Monitor Flow and Depth Hydrographs


Preliminary Validation
MC-EB-004 (Pipe 39007014-39007013)
2008, Flow, Graph 1 of 4
Event Start/End
Observed
Computed
Rainfall
1
Flow, cfs
Rainfall, in
10
9
8
7
6
5
4
3
2
1
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1/1
1/8
1/15
1/22
1/29
2/5
2/12
2/19
2/26
3/4
3/11
3/18
3/25
4/1


Preliminary Validation
MC-EB-004 (Pipe 39007014-39007013)
2008, Flow, Graph 2 of 4
Event Start/End
Observed
Computed
Rainfall
Flow, cfs
Rainfall, in
2
3
4
5
10
9
8
7
6
5
4
3
2
1
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
4/1
4/8
4/15
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5/6
5/13
5/20
5/27
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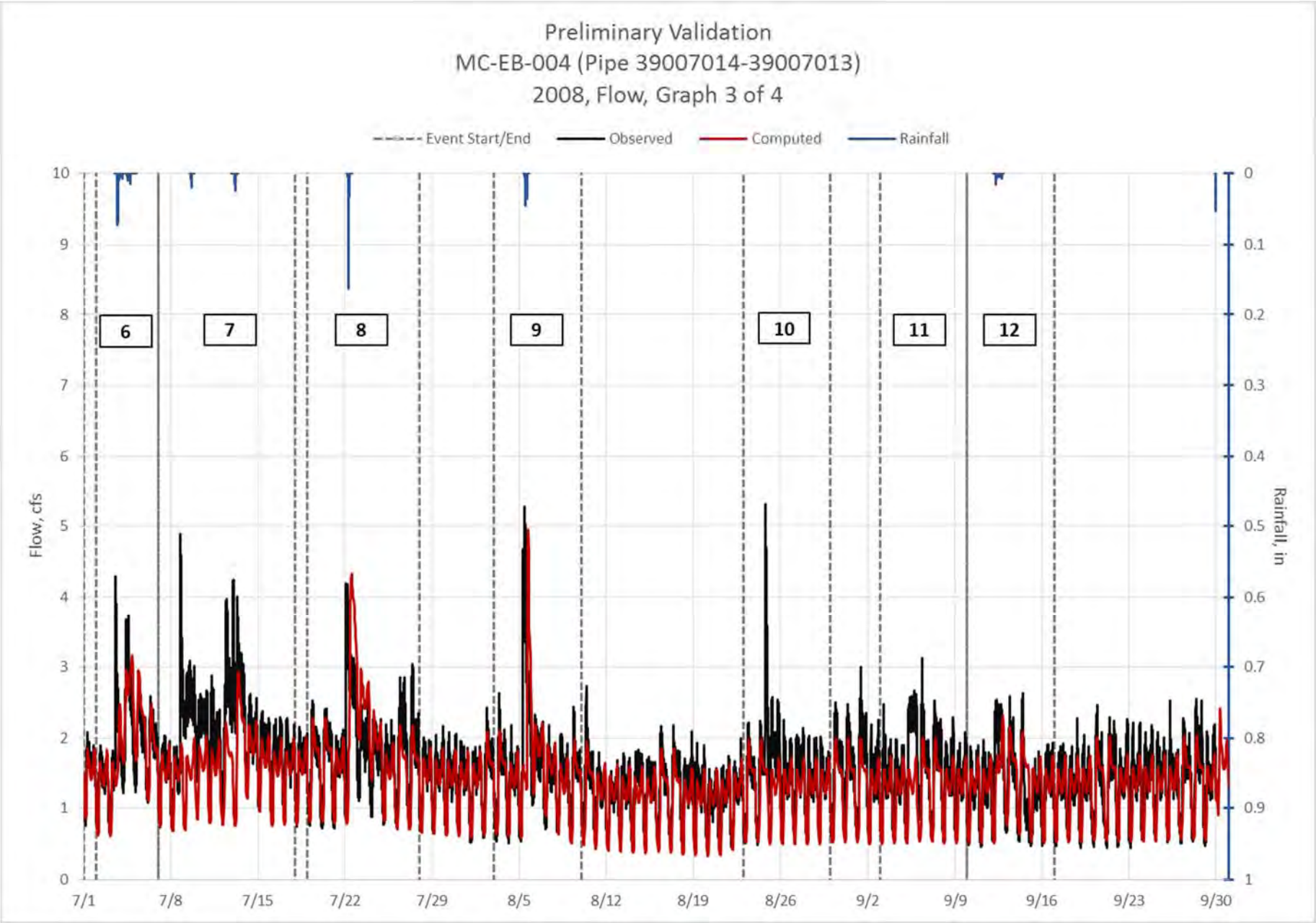
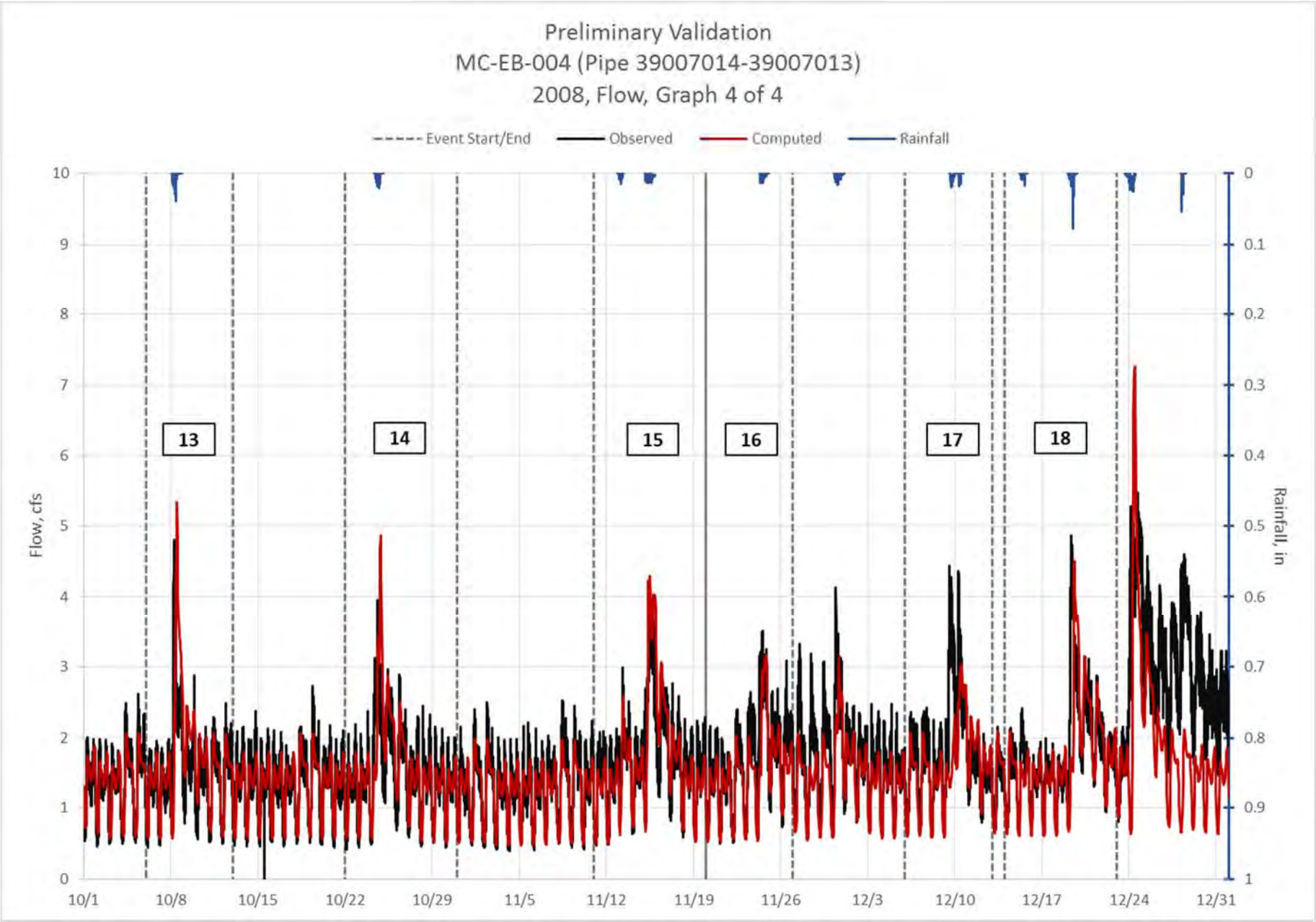
6/10
6/17
6/24
7/1


Preliminary Validation
MC-EB-004 (Pipe 39007014-39007013)
2008, Flow, Graph 3 of 4
Event Start/End
Observed
Computed
Rainfall
Flow, cfs
Rainfall, in
6
7
8
9
10
11
12
7/1
7/8
7/15
7/22
7/29
8/5
8/12
8/19
8/26
9/2
9/9
9/16
9/23
9/30


Preliminary Validation
MC-EB-004 (Pipe 39007014-39007013)
2008, Flow, Graph 4 of 4
Event Start/End
Observed
Computed
Rainfall
Flow, cfs
Rainfall, in
13
14
15
16
17
18
10/1
10/8
10/15
10/22
10/29
11/5
11/12
11/19
11/26
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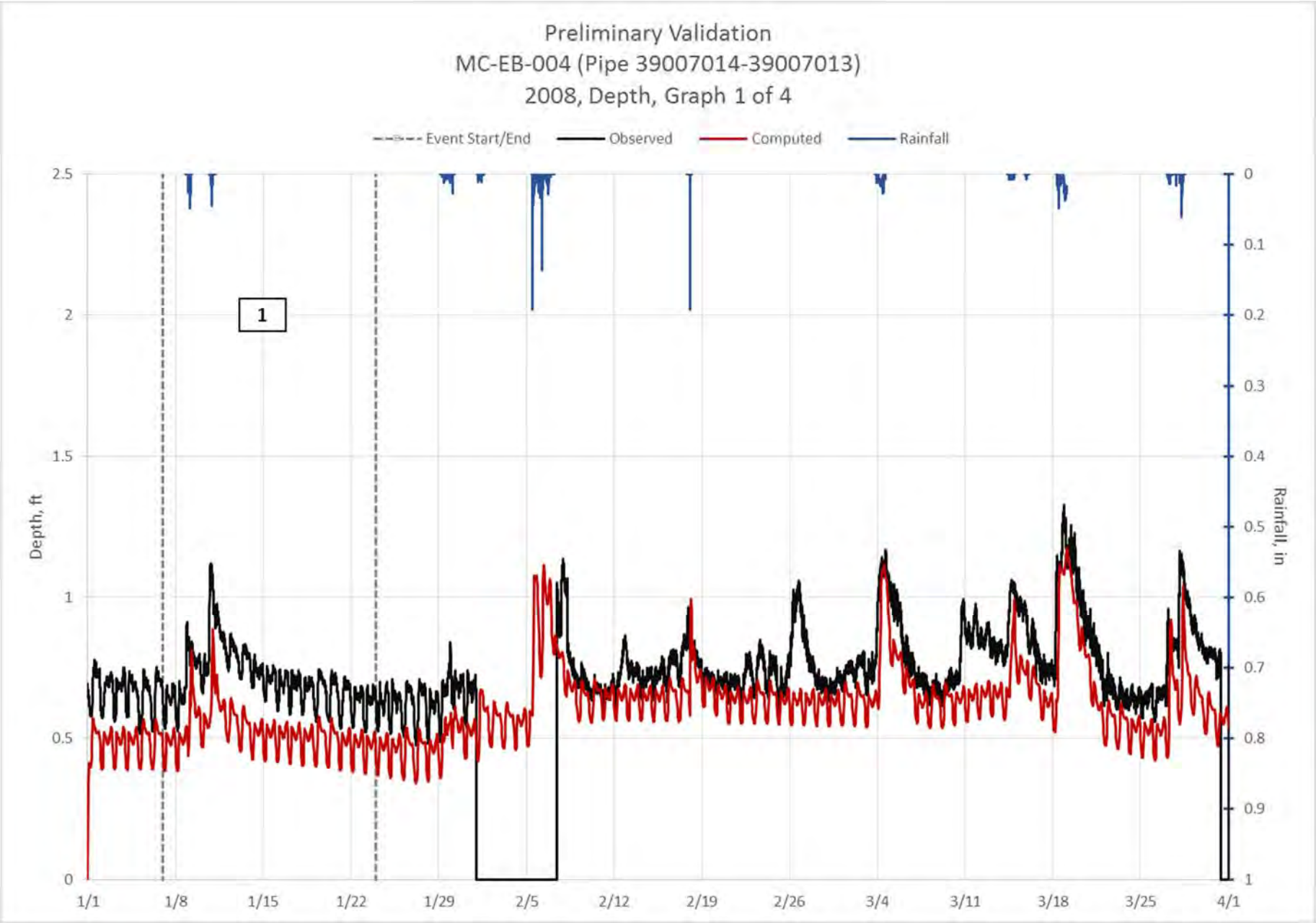
12/10
12/17
12/24
12/31


Preliminary Validation
MC-EB-004 (Pipe 39007014-39007013)
2008, Depth, Graph 1 of 4
Event Start/End
Observed
Computed
Rainfall
1
Depth, ft
Rainfall, in
2.5
2
1.5
1
0.5
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1/1
1/8
1/15
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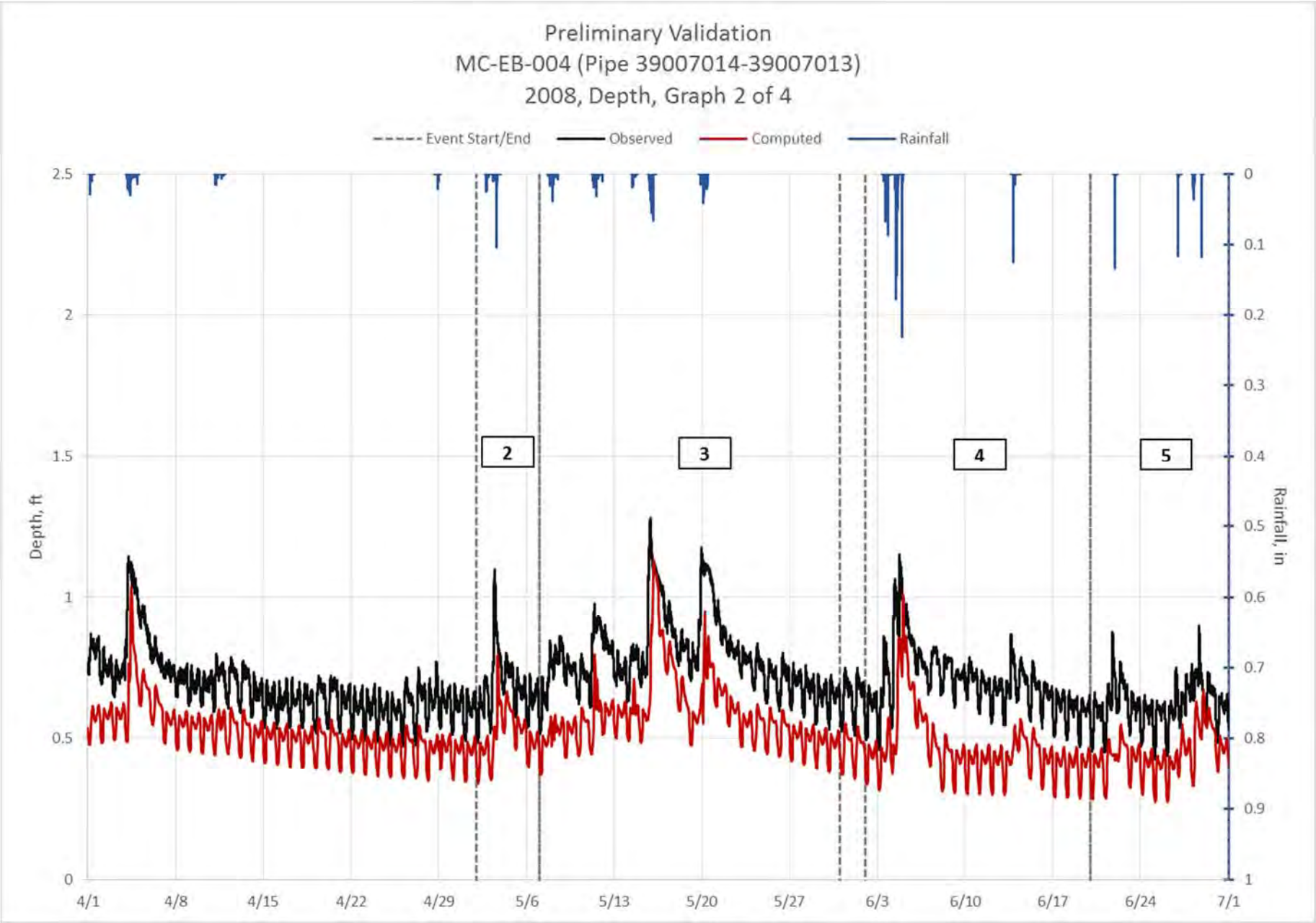
1/29
2/5
2/12
2/19
2/26
3/4
3/11
3/18
3/25
4/1


Preliminary Validation
MC-EB-004 (Pipe 39007014-39007013)
2008, Depth, Graph 2 of 4
Event Start/End
Observed
Computed
Rainfall
Depth, ft
Rainfall, in
2
3
4
5
2.5
2
1.5
1
0.5
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
4/1
4/8
4/15
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5/6
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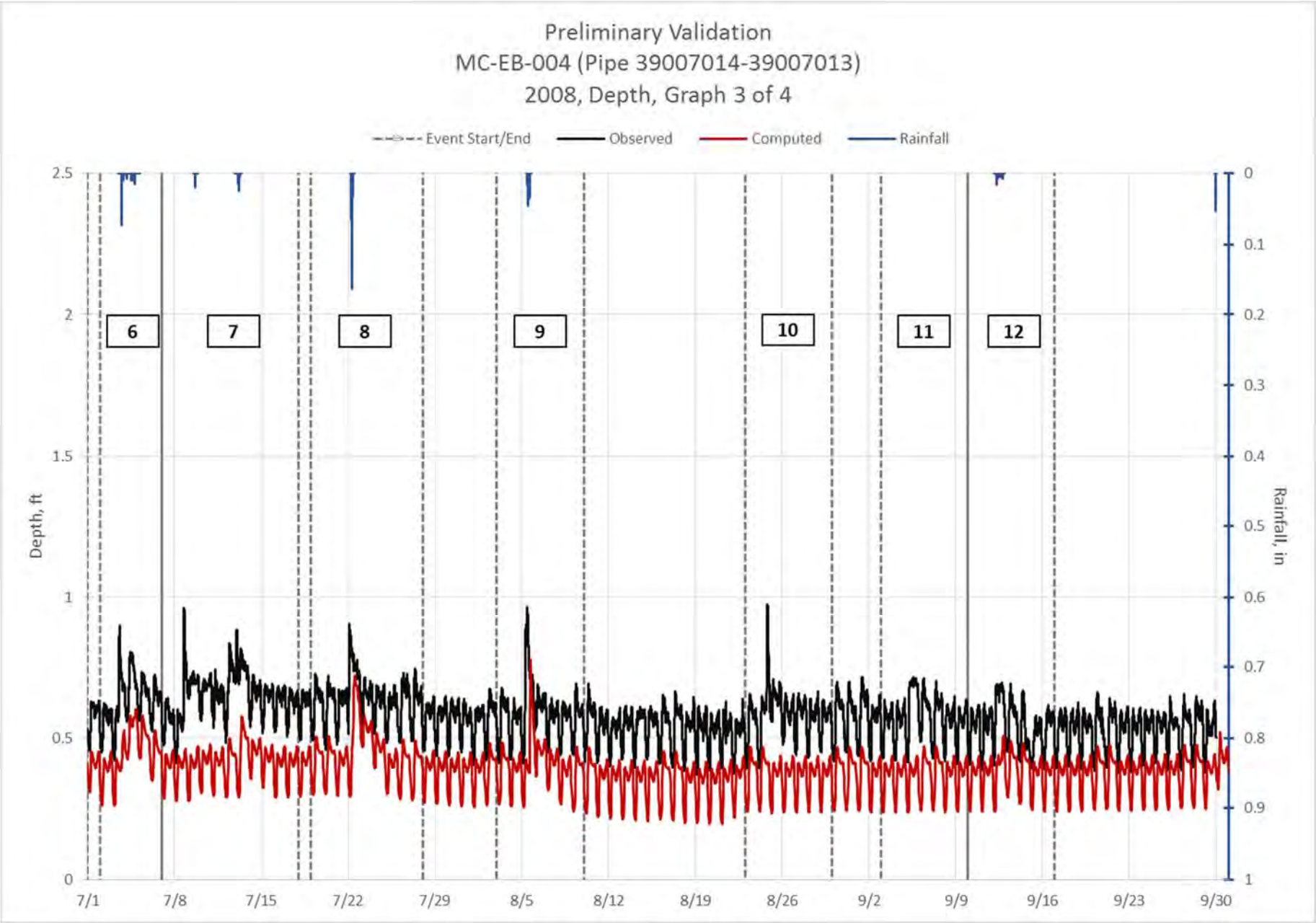
5/27
6/3
6/10
6/17
6/24
7/1


Preliminary Validation
MC-EB-004 (Pipe 39007014-39007013)
2008, Depth, Graph 3 of 4
Event Start/End
Observed
Computed
Rainfall
Depth, ft
Rainfall, in
6
7
8
9
10
11
12
2.5
2
1.5
1
0.5
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
7/1
7/8
7/15
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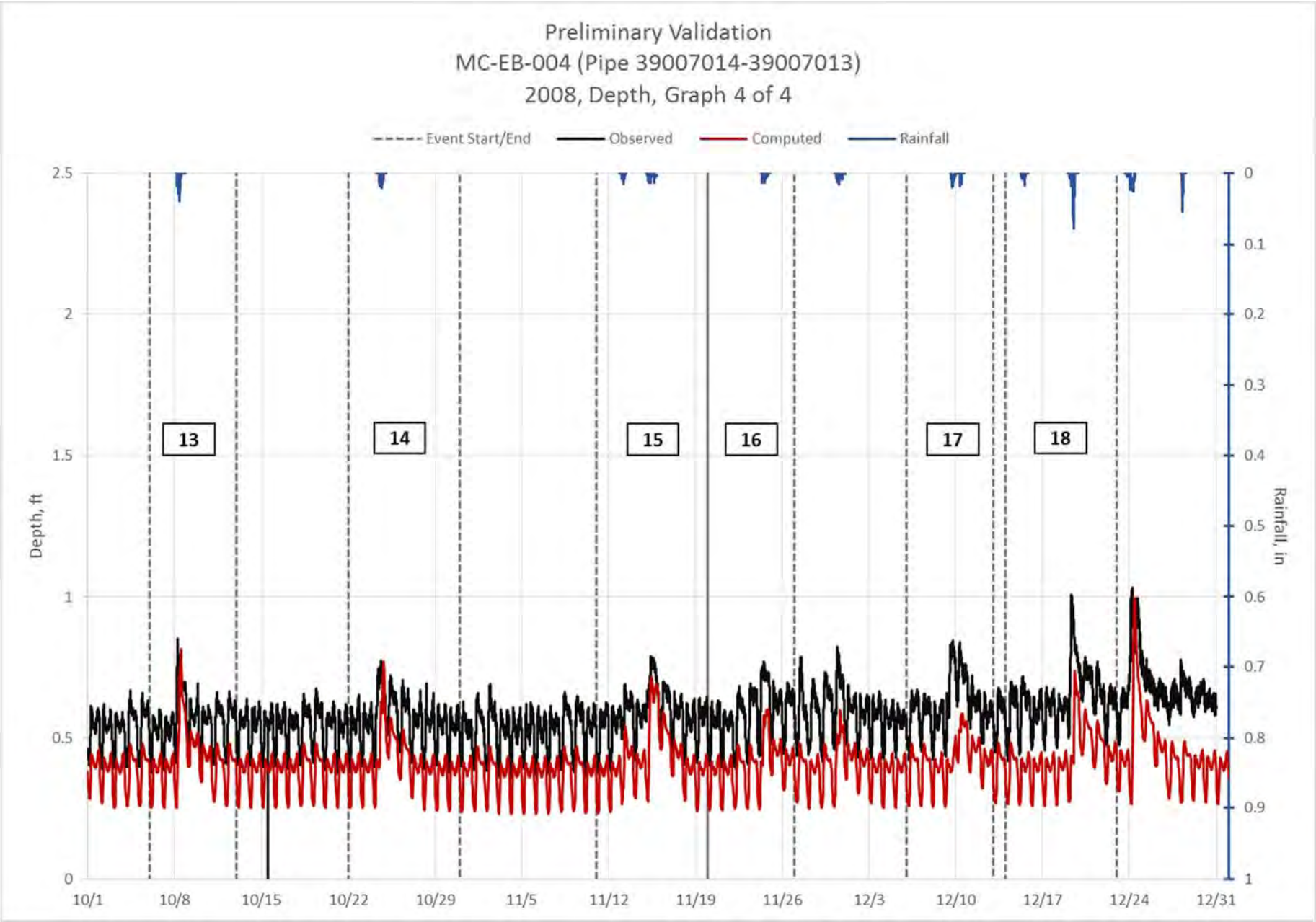
7/29
8/5
8/12
8/19
8/26
9/2
9/9
9/16
9/23
9/30


Preliminary Validation
MC-EB-004 (Pipe 39007014-39007013)
2008, Depth, Graph 4 of 4
Event Start/End
Observed
Computed
Rainfall
Depth, ft
Rainfall, in
13
14
15
16
17
18
2.5
2
1.5
1
0.5
0
0
0.1
0.2
0.3
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0.5
0.6
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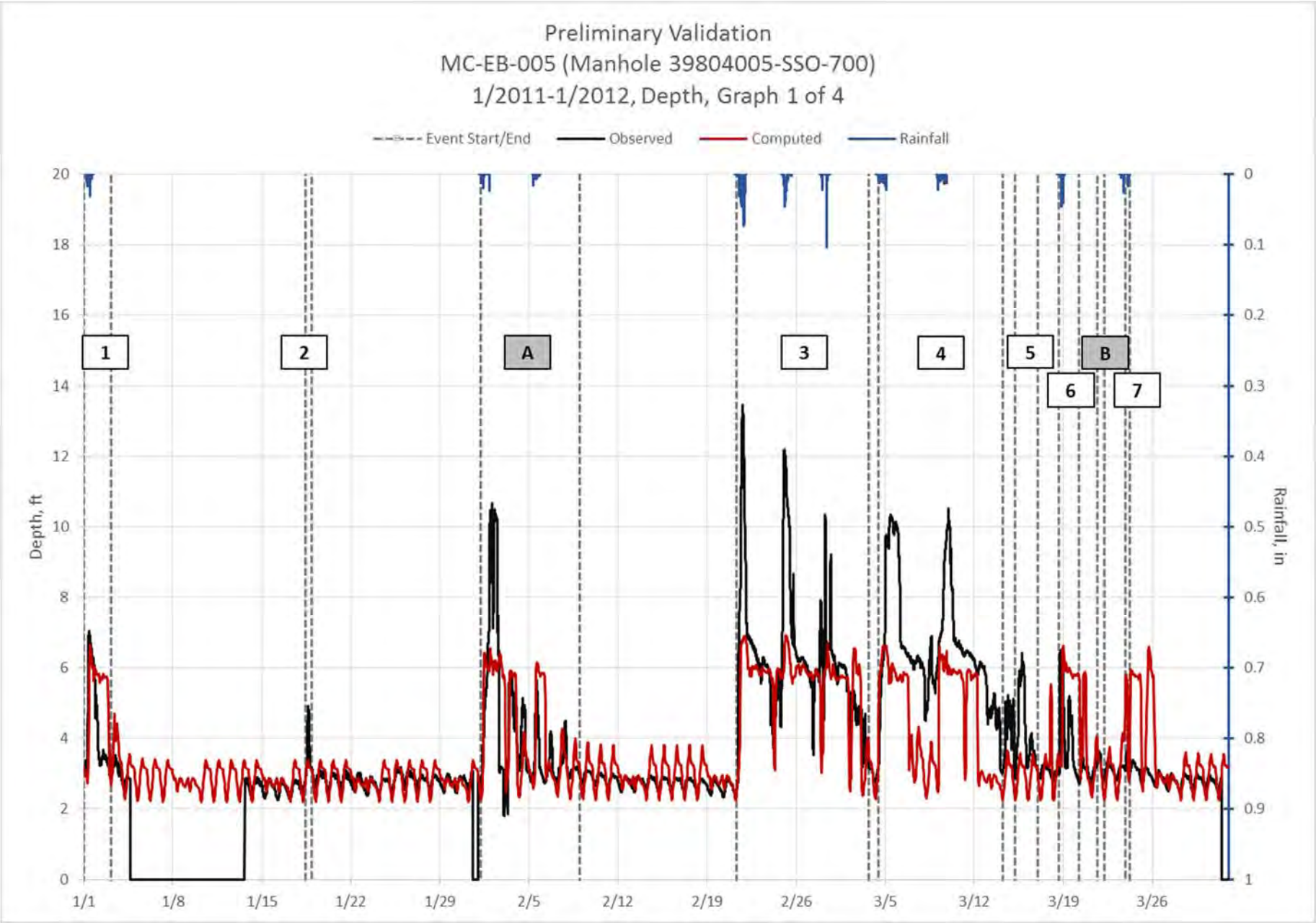
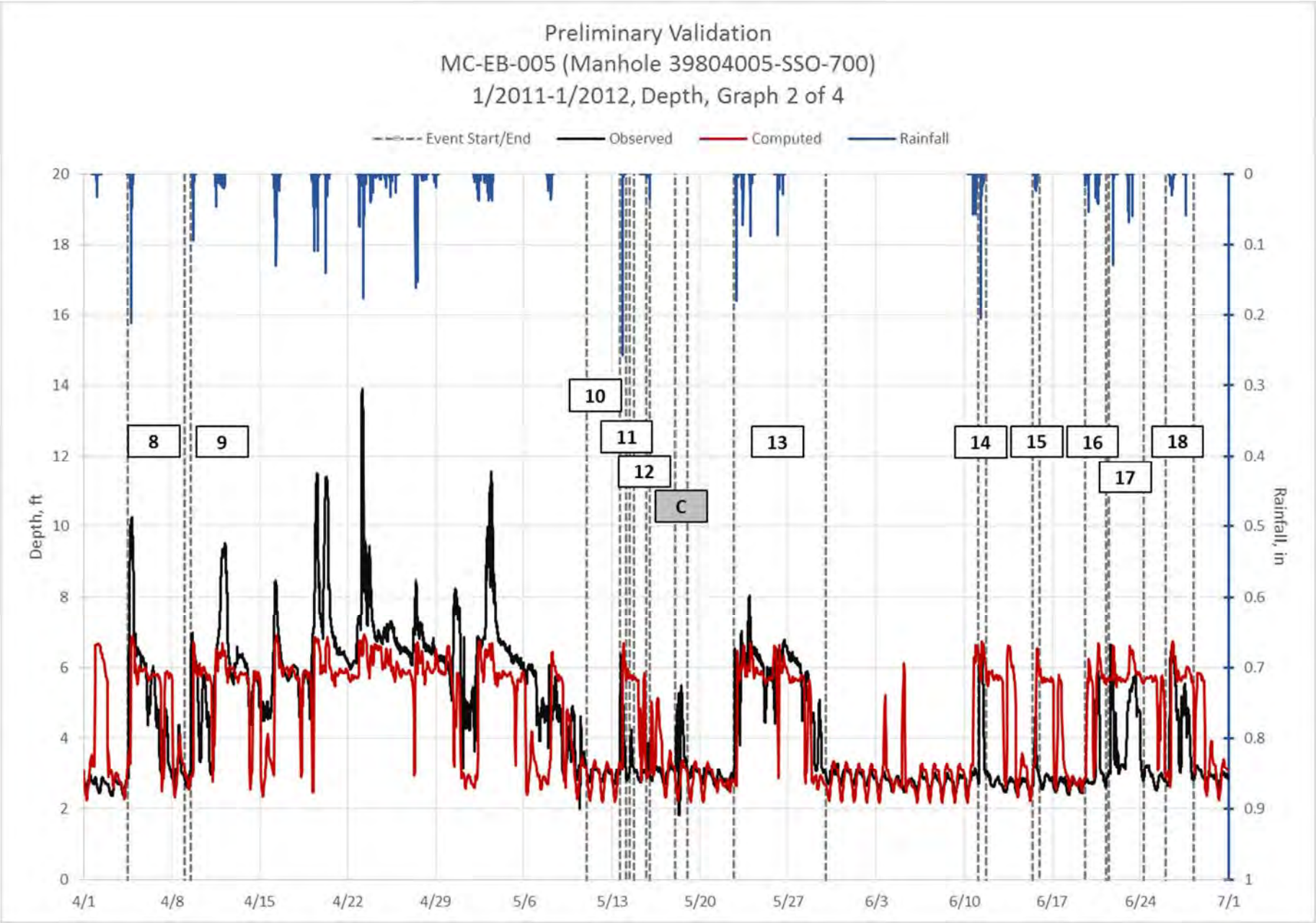
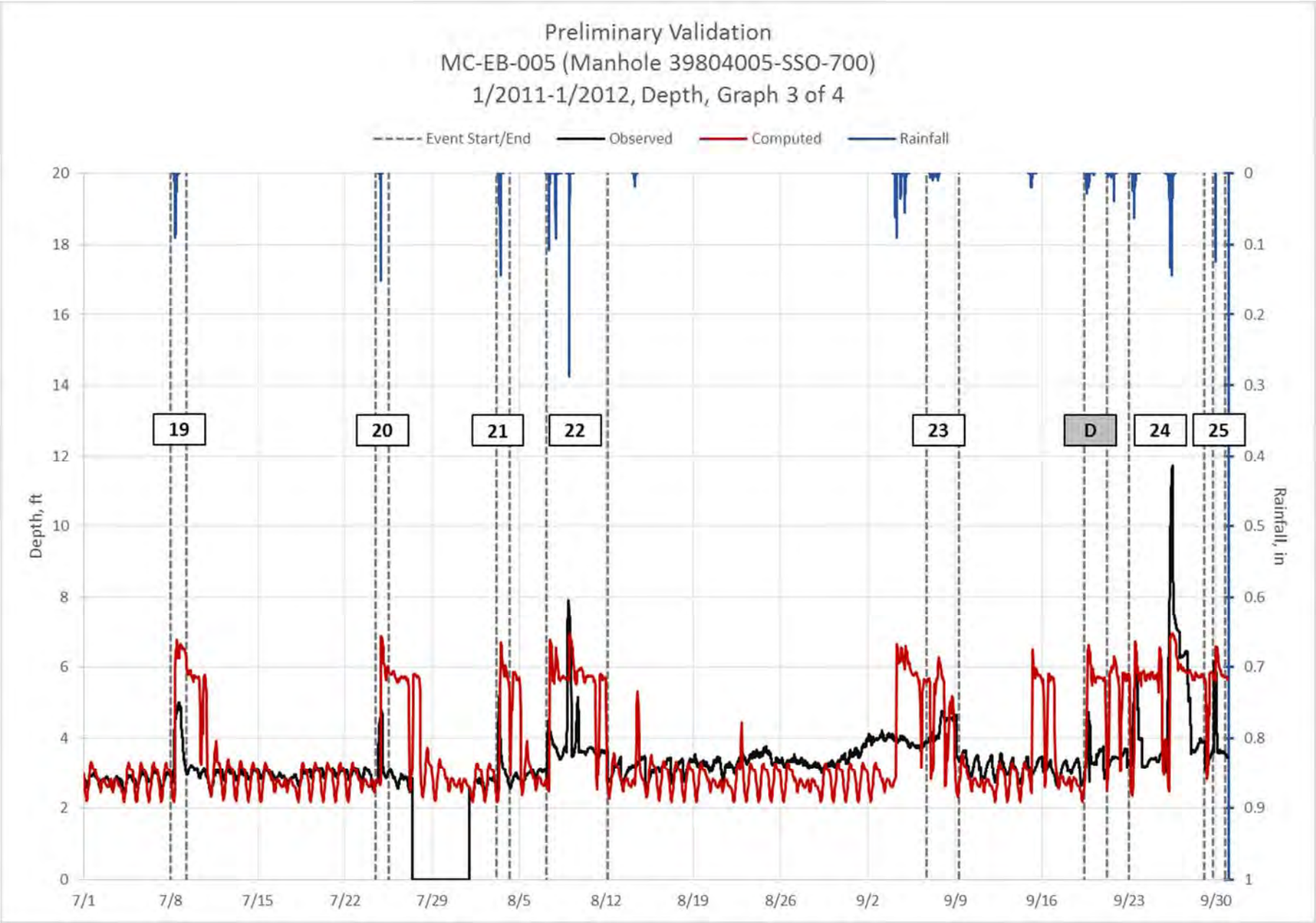
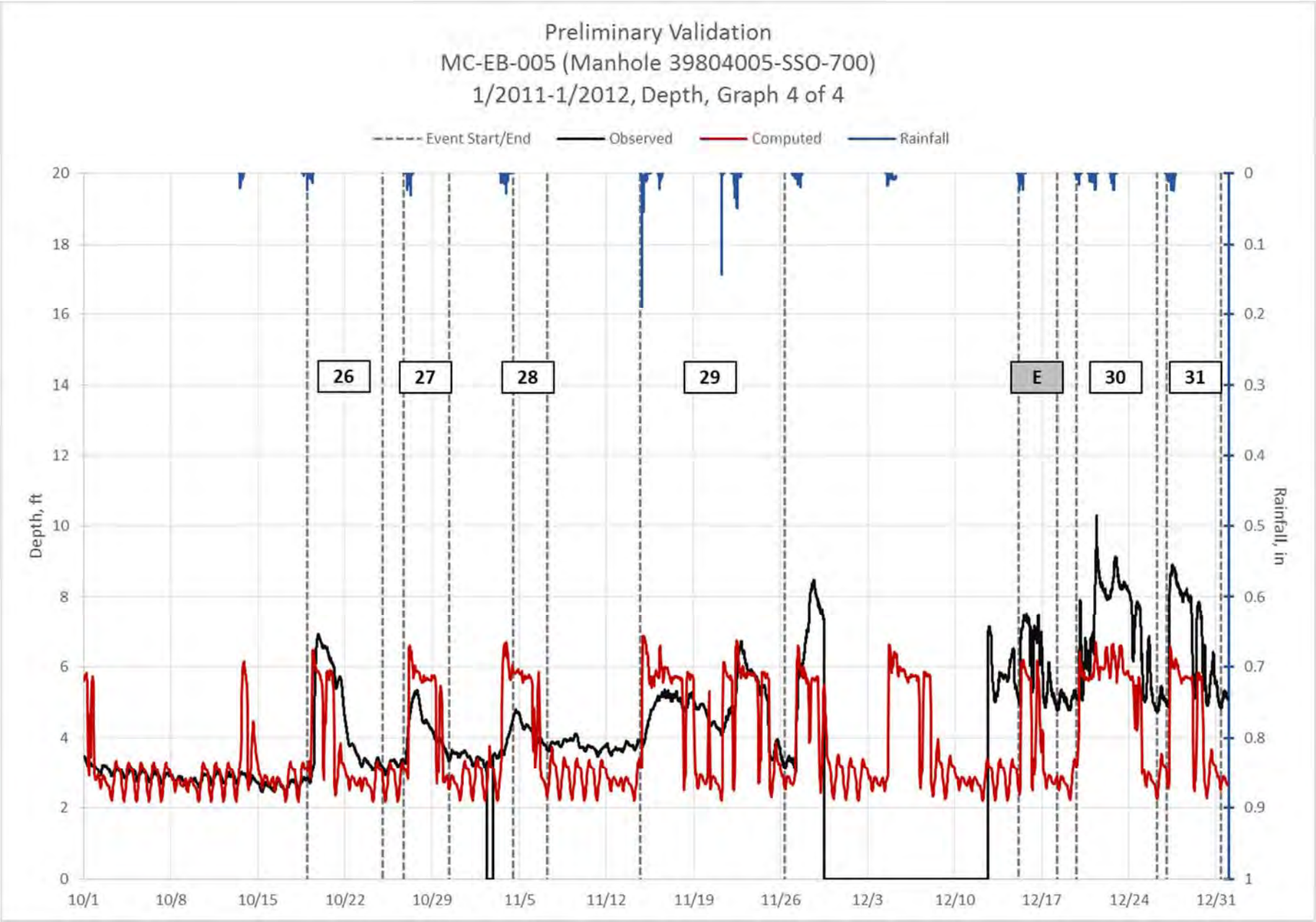
0.9
1
10/1
10/8
10/15
10/22
10/29
11/5
11/12
11/19
11/26
12/3
12/10
12/17
12/24
12/31


Preliminary Validation
MC-EB-005 (Manhole 39804005-SSO-700)
1/2011-1/2012, Depth, Graph 1 of 4
Event Start/End
Observed
Computed
Rainfall
Depth, ft
Rainfall, in
1
2
A
3
4
5
6
7
B
20
18
16
14
12
10
8
6
4
2
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1/1
1/8
1/15
1/22
1/29
2/5
2/12
2/19
2/26
3/5
3/12
3/19
3/26


Preliminary Validation
MC-EB-005 (Manhole 39804005-SSO-700)
1/2011-1/2012, Depth, Graph 2 of 4
Event Start/End
Observed
Computed
Rainfall
Depth, ft
Rainfall, in
8
9
10
11
12
C
13
14
15
16
17
18
4/1
4/8
4/15
4/22
4/29
5/6
5/13
5/20
5/27
6/3
6/10
6/17
6/24
7/1


Preliminary Validation
MC-EB-005 (Manhole 39804005-SSO-700)
1/2011-1/2012, Depth, Graph 3 of 4
Event Start/End
Observed
Computed
Rainfall
Depth, ft
Rainfall, in
19
20
21
22
23
D
24
25
7/1
7/8
7/15
7/22
7/29
8/5
8/12
8/19
8/26
9/2
9/9
9/16
9/23
9/30


Preliminary Validation
MC-EB-005 (Manhole 39804005-SSO-700)
1/2011-1/2012, Depth, Graph 4 of 4
Event Start/End
Observed
Computed
Rainfall
Depth, ft
Rainfall, in
26
27
28
29
E
30
31
10/1
10/8
10/15
10/22
10/29
11/5
11/12
11/19
11/26
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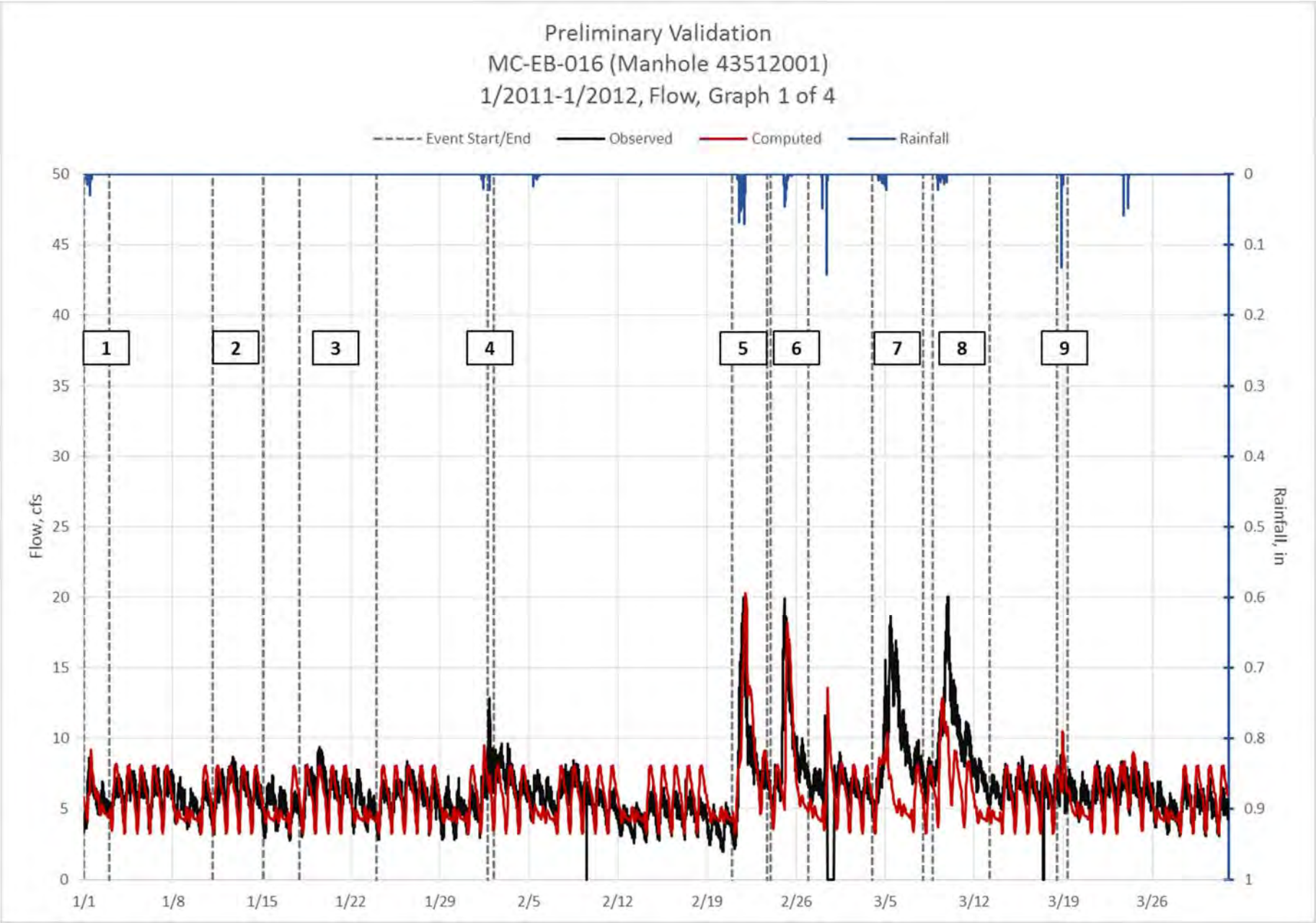
12/10
12/17
12/24
12/31


Preliminary Validation
MC-EB-016 (Manhole 43512001)
1/2011-1/2012, Flow, Graph 1 of 4
Event Start/End
Observed
Computed
Rainfall
Flow, cfs
Rainfall, in
1
2
3
4
5
6
7
8
9
50
45
40
35
30
25
20
15
10
5
0
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1
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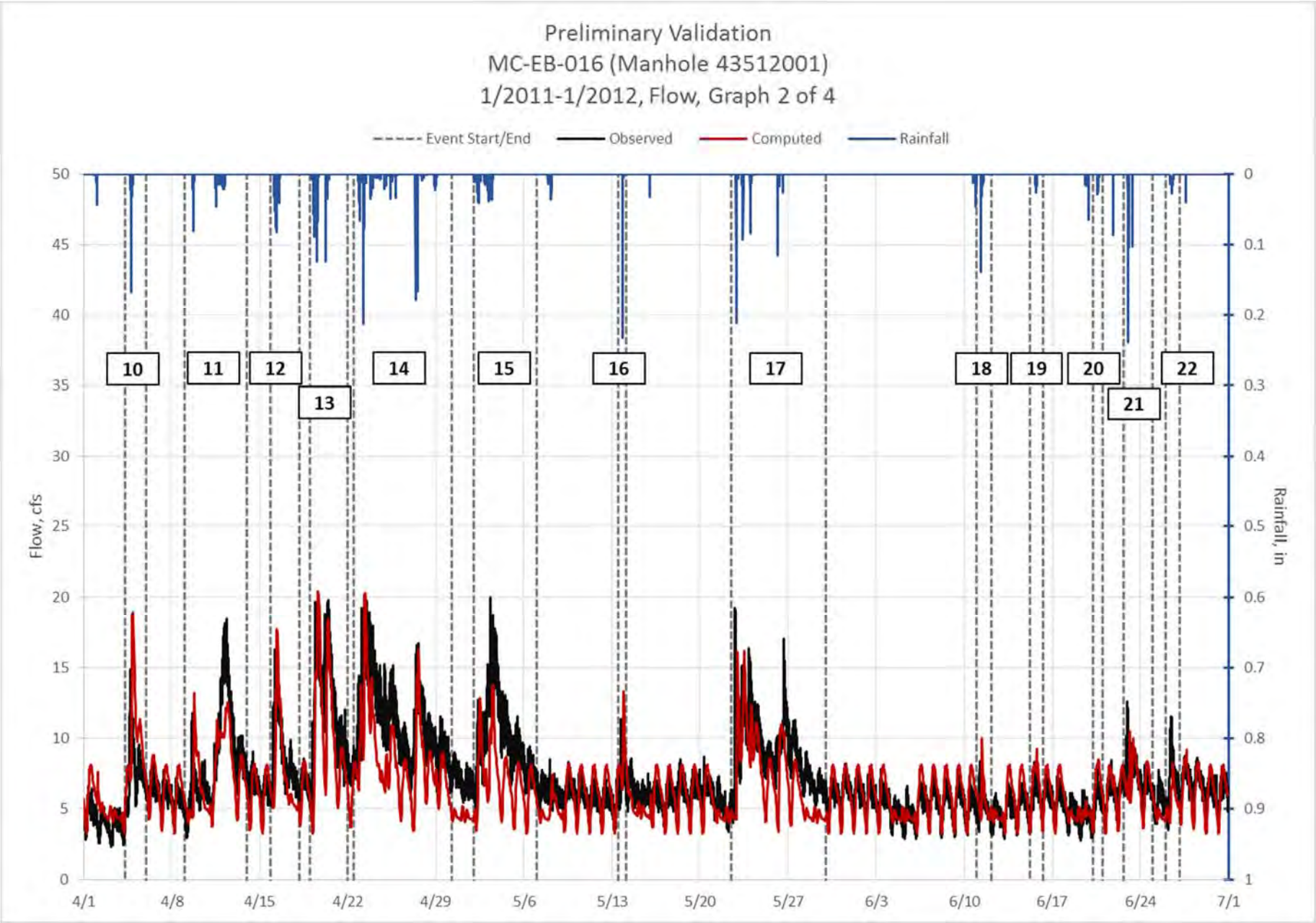
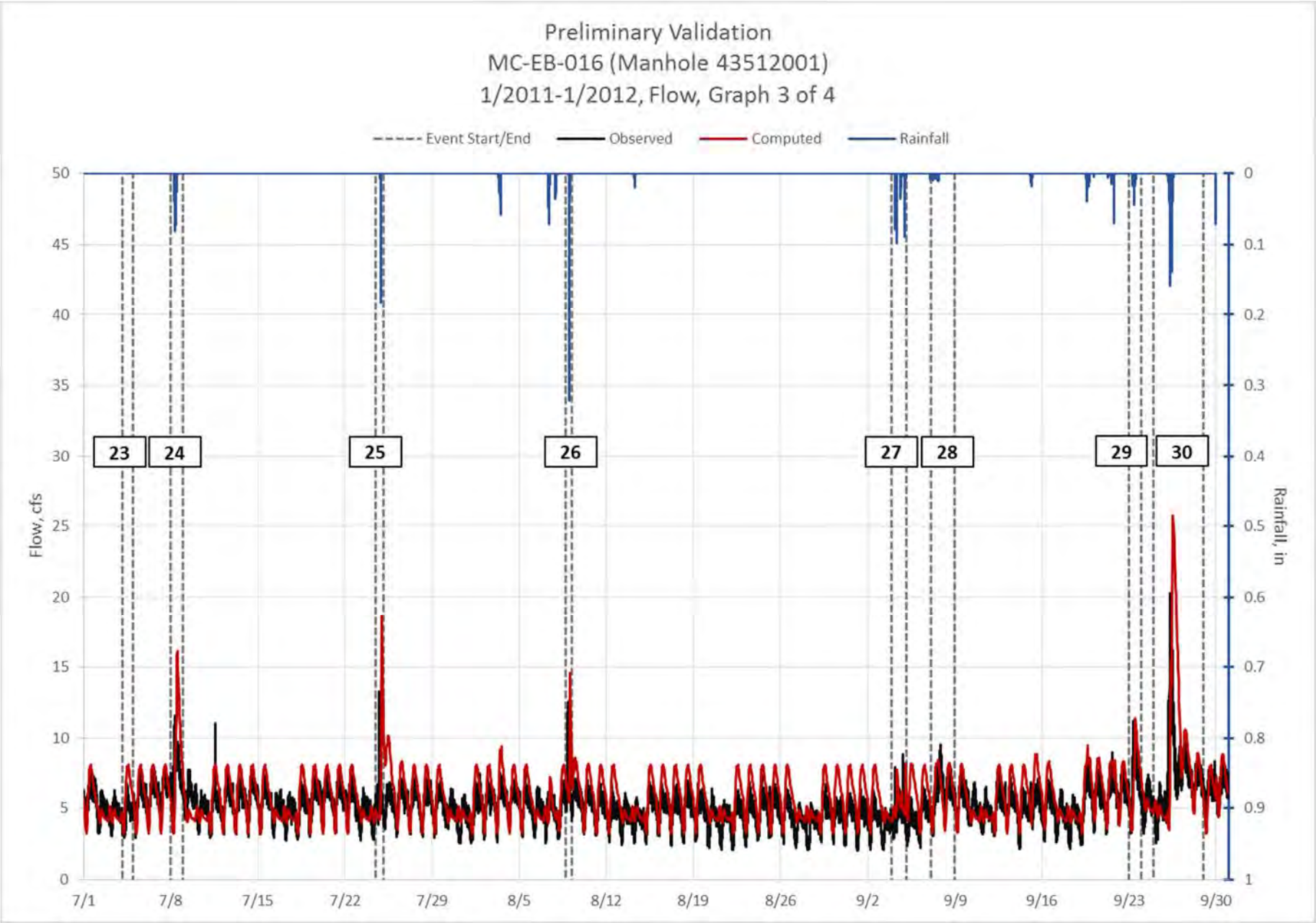
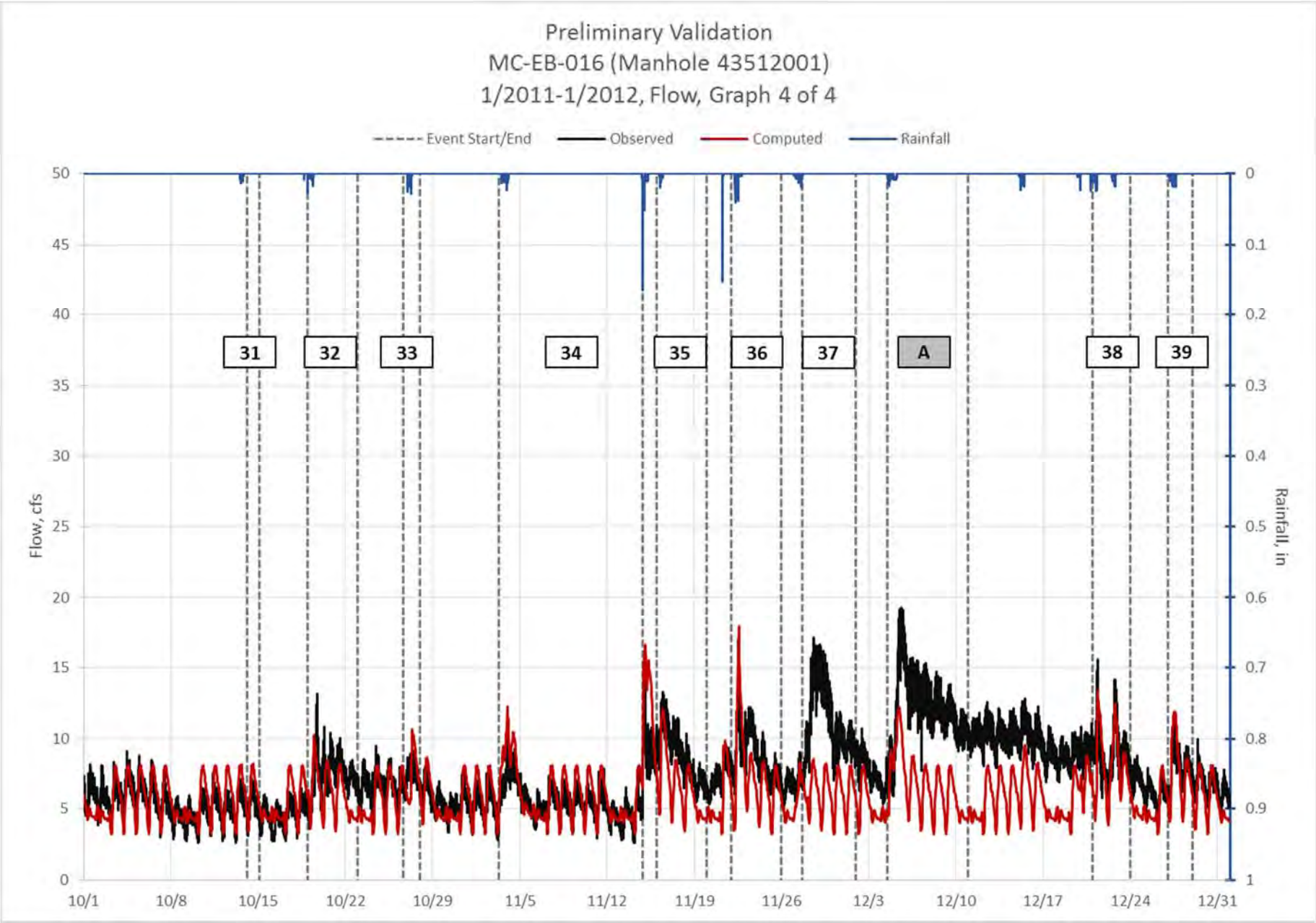
1/22
1/29
2/5
2/12
2/19
2/26
3/5
3/12
3/19
3/26


Preliminary Validation
MC-EB-016 (Manhole 43512001)
1/2011-1/2012, Flow, Graph 2 of 4
Event Start/End
Observed
Computed
Rainfall
Flow, cfs
Rainfall, in
10
11
12
13
14
15
16
17
18
19
20
21
22
4/1
4/8
4/15
4/22
4/29
5/6
5/13
5/20
5/27
6/3
6/10
6/17
6/24
7/1


Preliminary Validation
MC-EB-016 (Manhole 43512001)
1/2011-1/2012, Flow, Graph 3 of 4
Event Start/End
Observed
Computed
Rainfall
Flow, cfs
Rainfall, in
23
24
25
26
27
28
29
30
7/1
7/8
7/15
7/22
7/29
8/5
8/12
8/19
8/26
9/2
9/9
9/16
9/23
9/30


Preliminary Validation
MC-EB-016 (Manhole 43512001)
1/2011-1/2012, Flow, Graph 4 of 4
Event Start/End
Observed
Computed
Rainfall
Flow, cfs
Rainfall, in
31
32
33
34
35
36
37
A
38
39
50
45
40
35
30
25
20
15
10
5
0
0
0.1
0.2
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0.4
0.5
0.6
0.7
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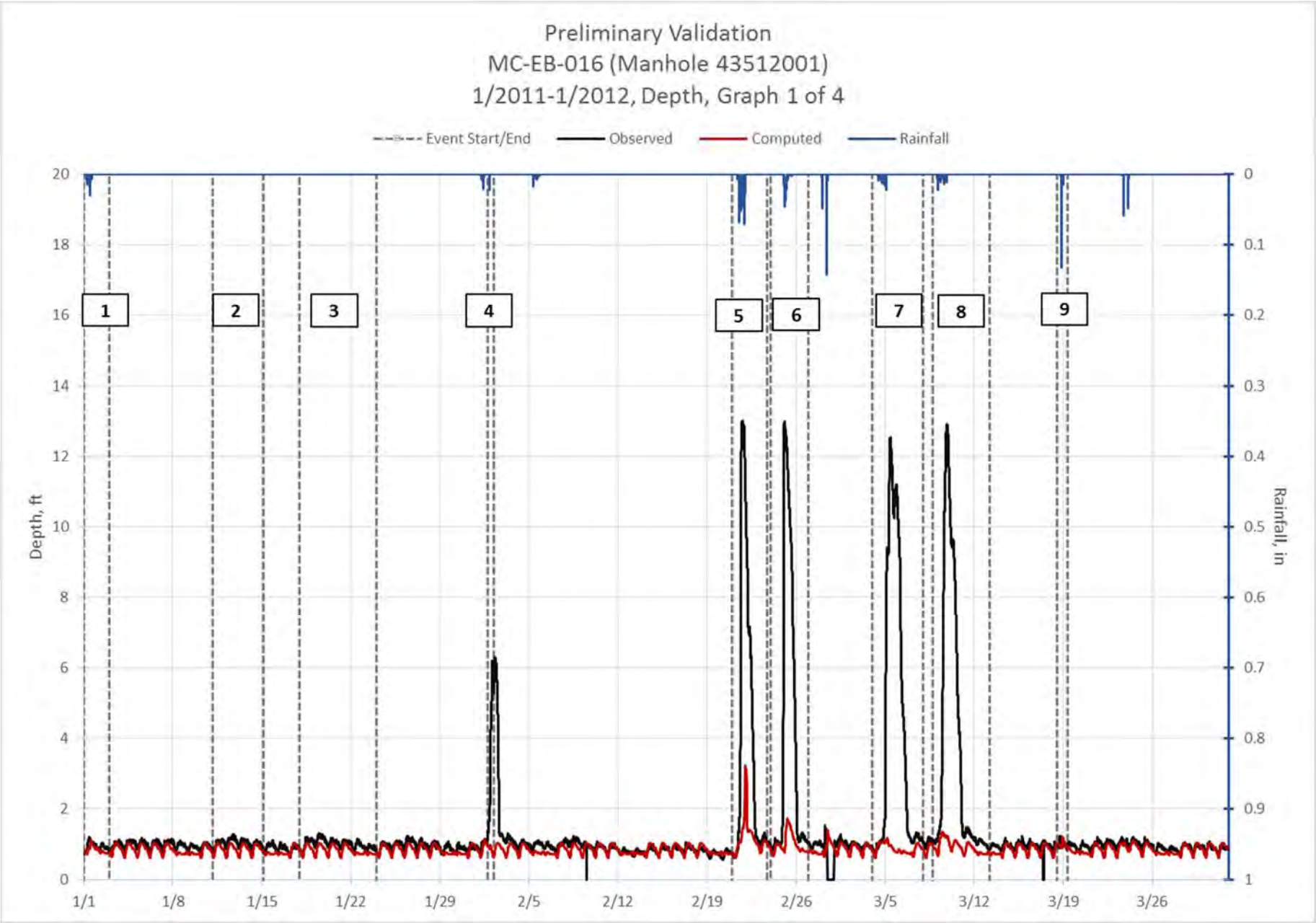
0.9
1
10/1
10/8
10/15
10/22
10/29
11/5
11/12
11/19
11/26
12/3
12/10
12/17
12/24
12/31


Preliminary Validation
MC-EB-016 (Manhole 43512001)
1/2011-1/2012, Depth, Graph 1 of 4
Event Start/End
Observed
Computed
Rainfall
Depth, ft
Rainfall, in
1
2
3
4
5
6
7
8
9
20
18
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14
12
10
8
6
4
2
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1/1
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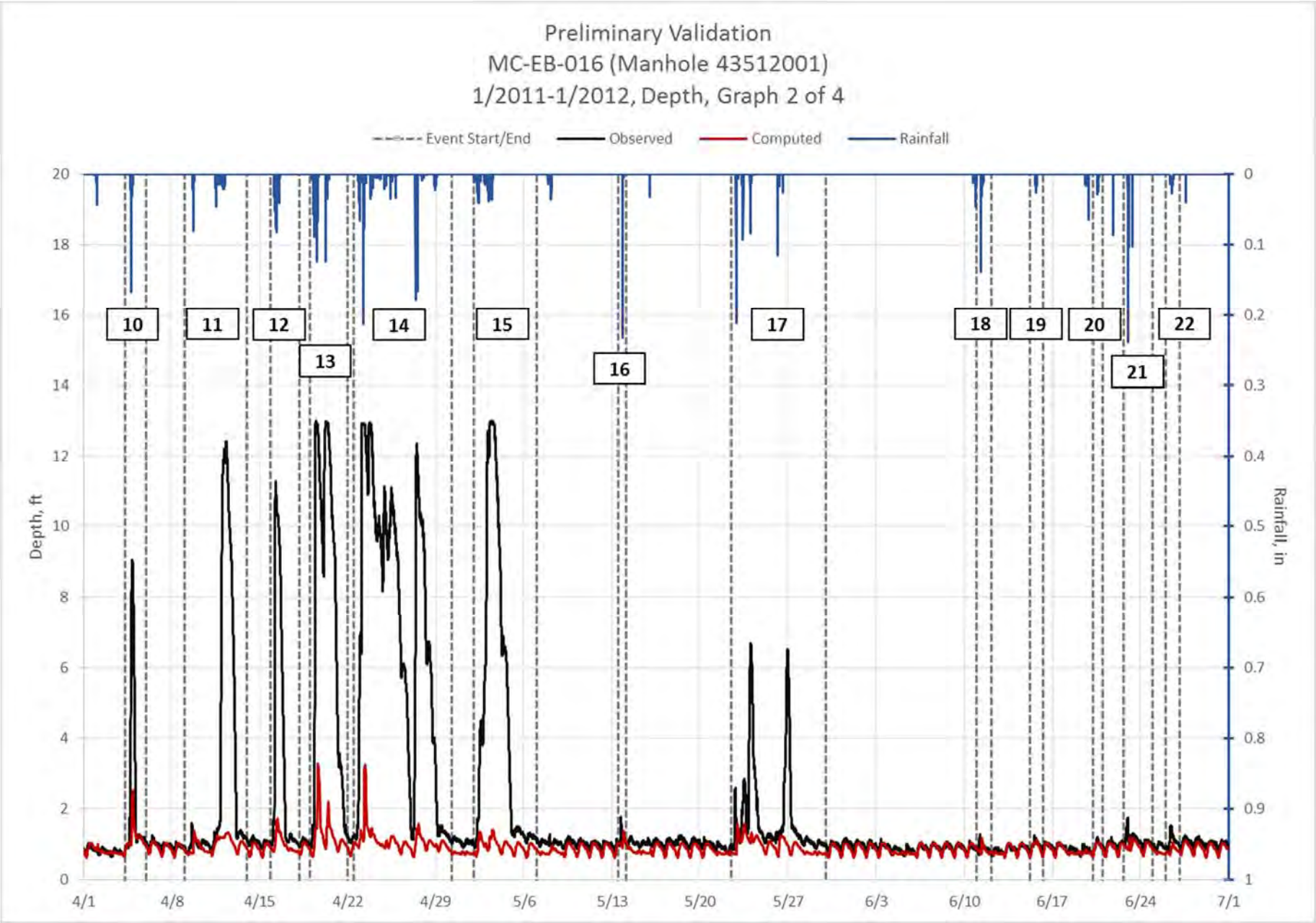
2/5
2/12
2/19
2/26
3/5
3/12
3/19
3/26


Preliminary Validation
MC-EB-016 (Manhole 43512001)
1/2011-1/2012, Depth, Graph 2 of 4
Event Start/End
Observed
Computed
Rainfall
Depth, ft
Rainfall, in
10
11
12
13
14
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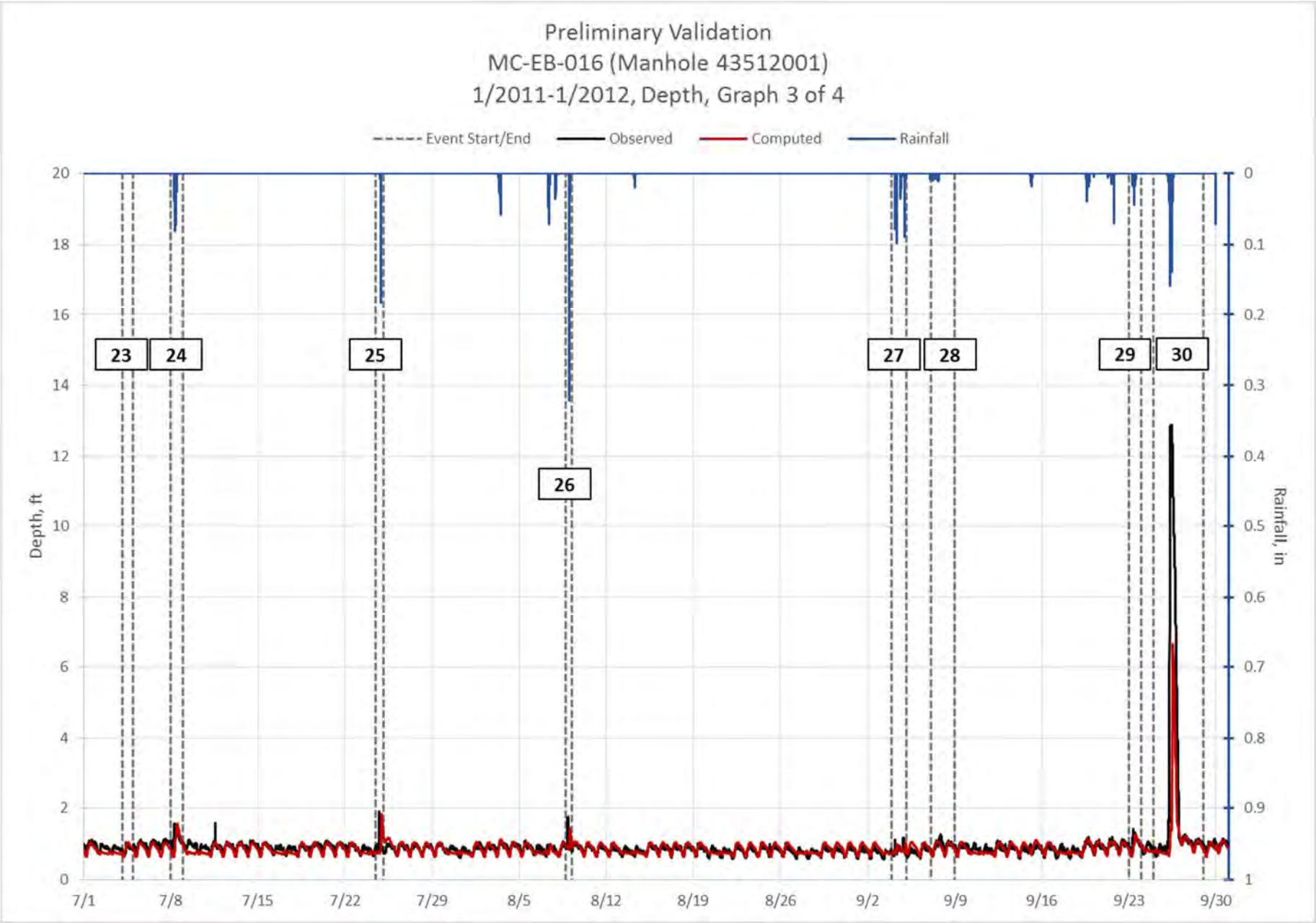
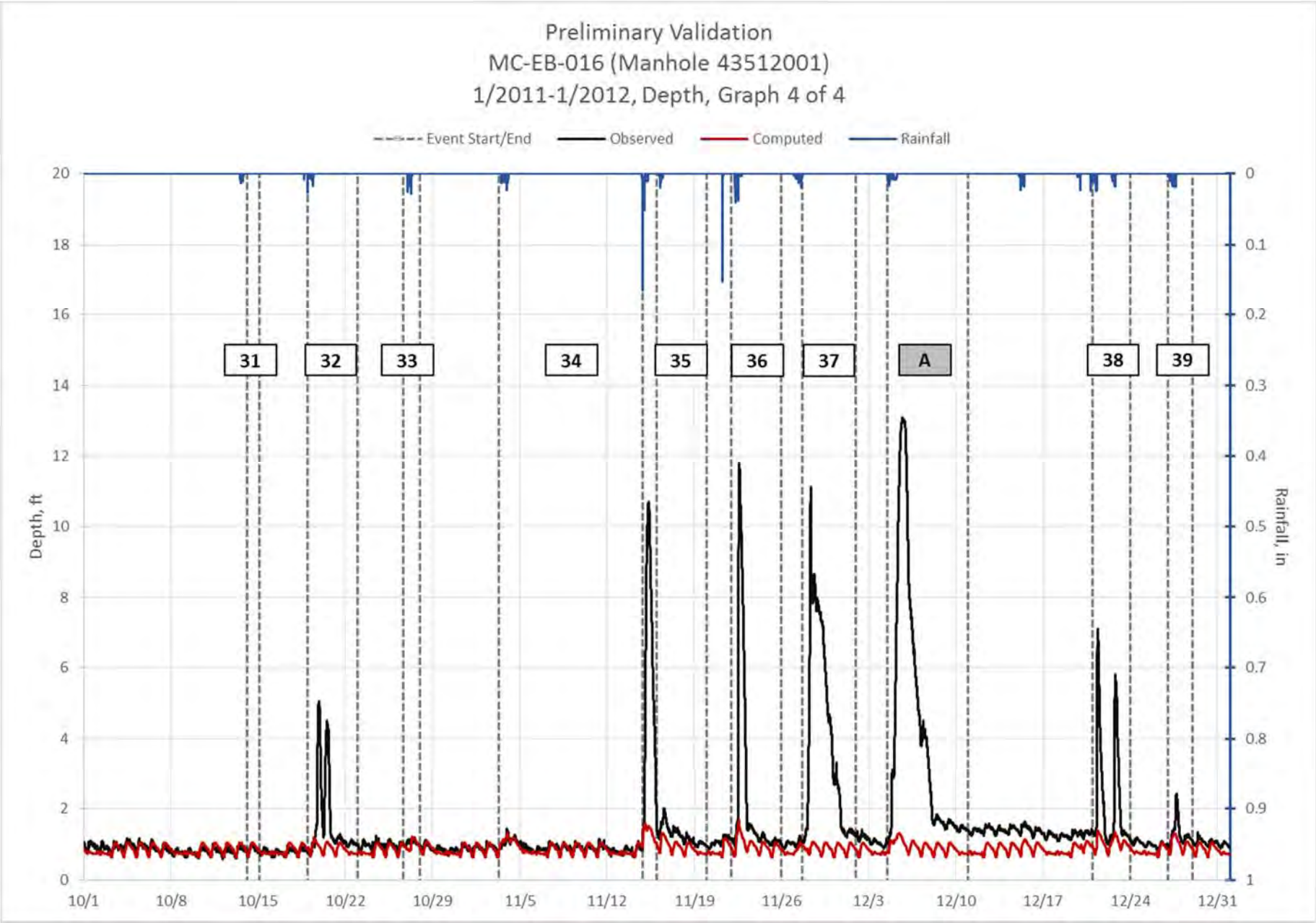
16
17
18
19
20
21
22
4/1
4/8
4/15
4/22
4/29
5/6
5/13
5/20
5/27
6/3
6/10
6/17
6/24
7/1


Preliminary Validation
MC-EB-016 (Manhole 43512001)
1/2011-1/2012, Depth, Graph 3 of 4
Event Start/End
Observed
Computed
Rainfall
Depth, ft
Rainfall, in
23
24
25
26
27
28
29
30
7/1
7/8
7/15
7/22
7/29
8/5
8/12
8/19
8/26
9/2
9/9
9/16
9/23
9/30


Preliminary Validation
MC-EB-016 (Manhole 43512001)
1/2011-1/2012, Depth, Graph 4 of 4
Event Start/End
Observed
Computed
Rainfall
Depth, ft
Rainfall, in
31
32
33
34
35
36
37
A
38
39
20
18
16
14
12
10
8
6
4
2
0
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0.1
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1
10/1
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10/29
11/5
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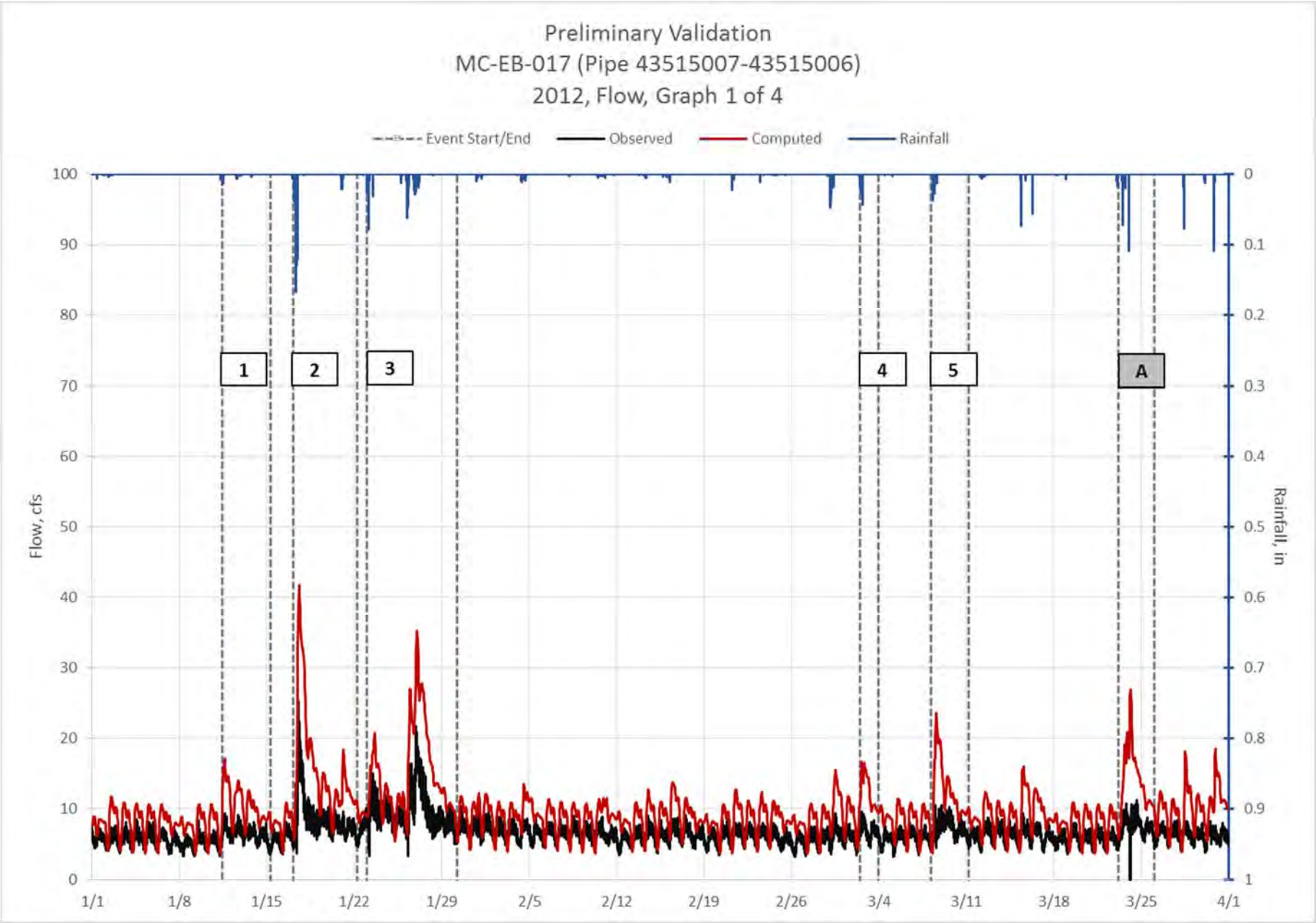
11/26
12/3
12/10
12/17
12/24
12/31


Preliminary Validation
MC-EB-017 (Pipe 43515007-43515006)
2012, Flow, Graph 1 of 4
Event Start/End
Observed
Computed
Rainfall
Flow, cfs
Rainfall, in
1
2
3
4
5
A
100
90
80
70
60
50
40
30
20
10
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1/1
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1/15
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1/29
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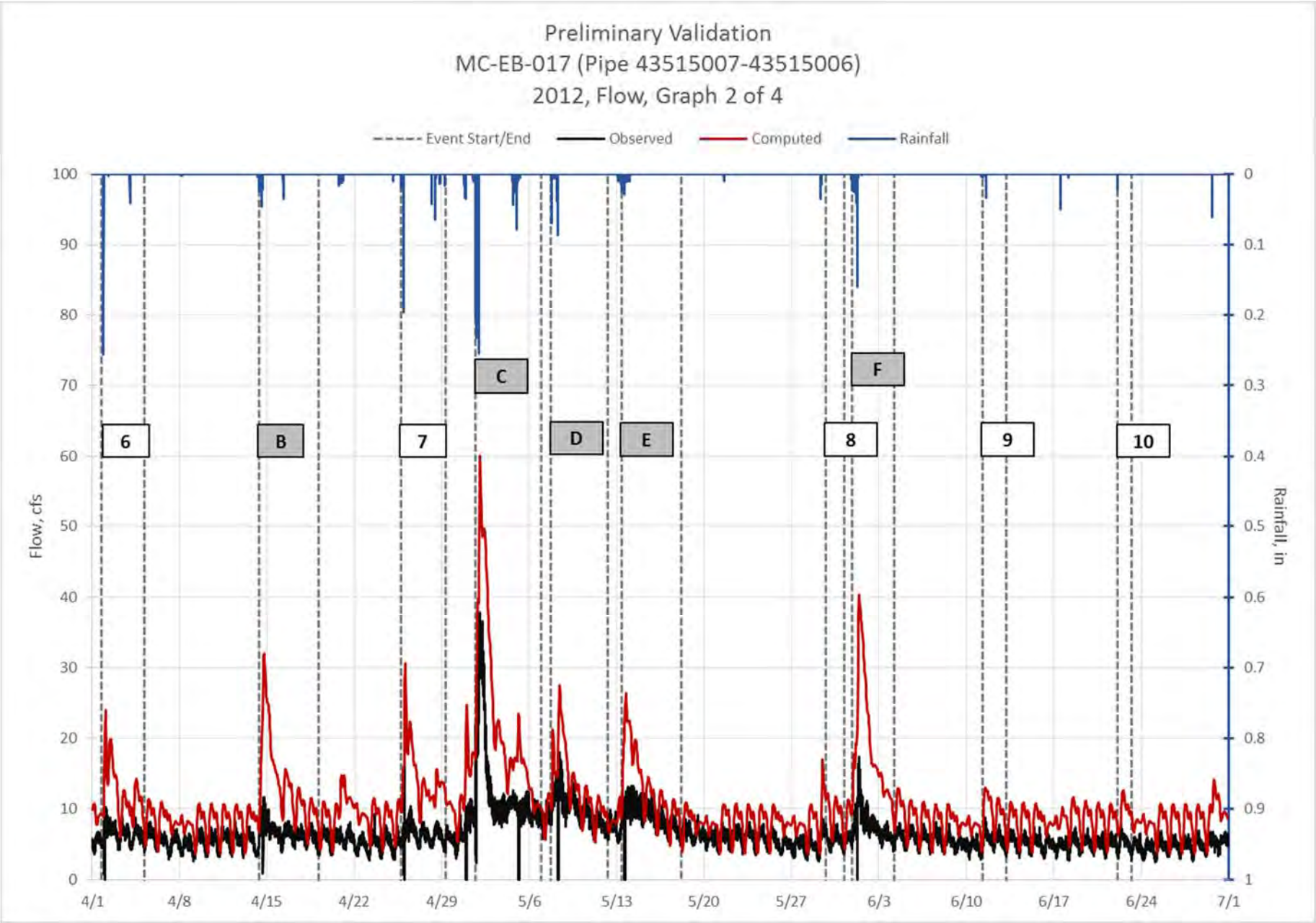
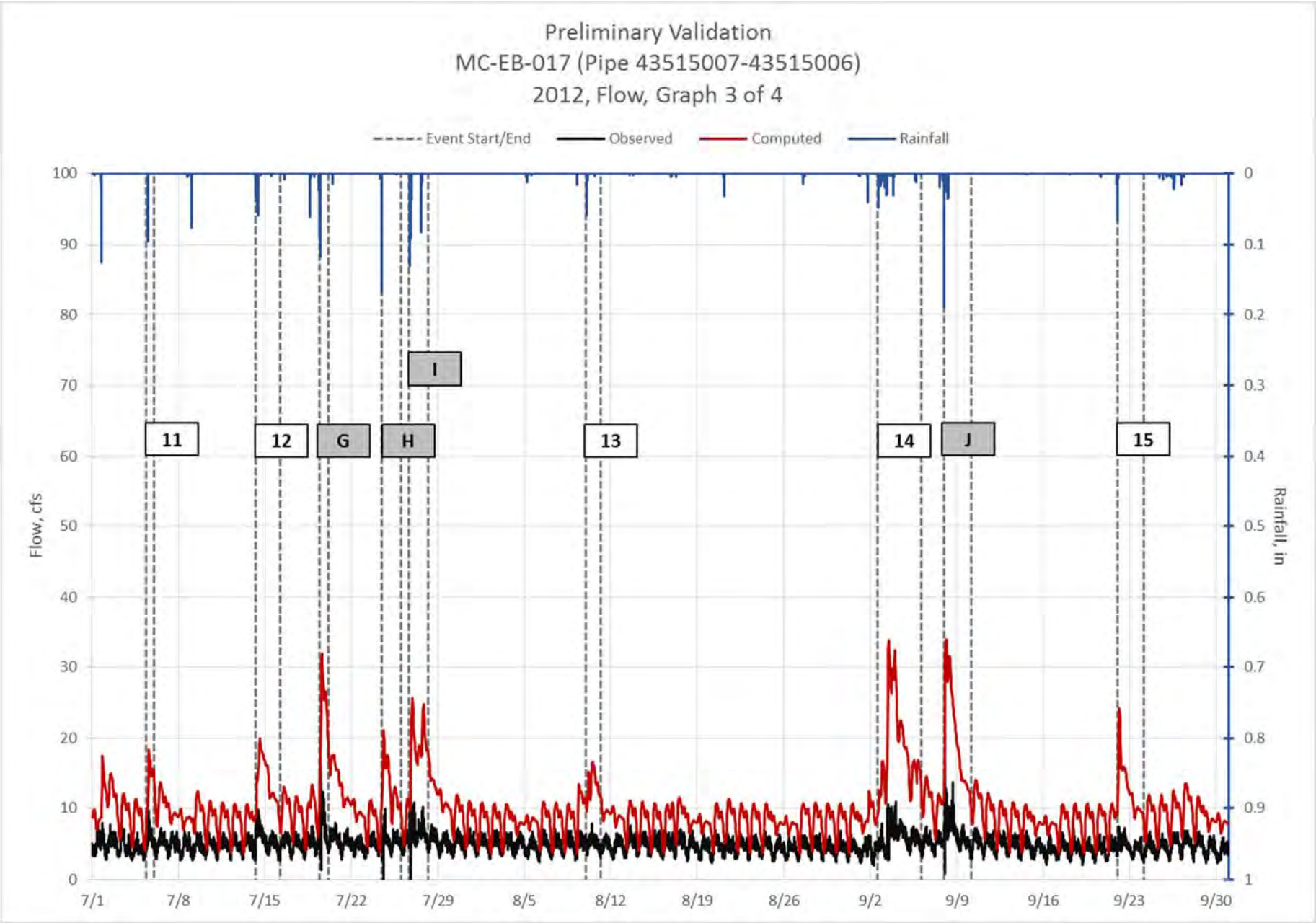
2/26
3/4
3/11
3/18
3/25
4/1


Preliminary Validation
MC-EB-017 (Pipe 43515007-43515006)
2012, Flow, Graph 2 of 4
Event Start/End
Observed
Computed
Rainfall
Flow, cfs
Rainfall, in
6
B
7
C
D
E
F
8
9
10
4/1
4/8
4/15
4/22
4/29
5/6
5/13
5/20
5/27
6/3
6/10
6/17
6/24
7/1


Preliminary Validation
MC-EB-017 (Pipe 43515007-43515006)
2012, Flow, Graph 3 of 4
Event Start/End
Observed
Computed
Rainfall
Flow, cfs
Rainfall, in
11
12
G
H
I
13
14
J
15
7/1
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7/29
8/5
8/12
8/19
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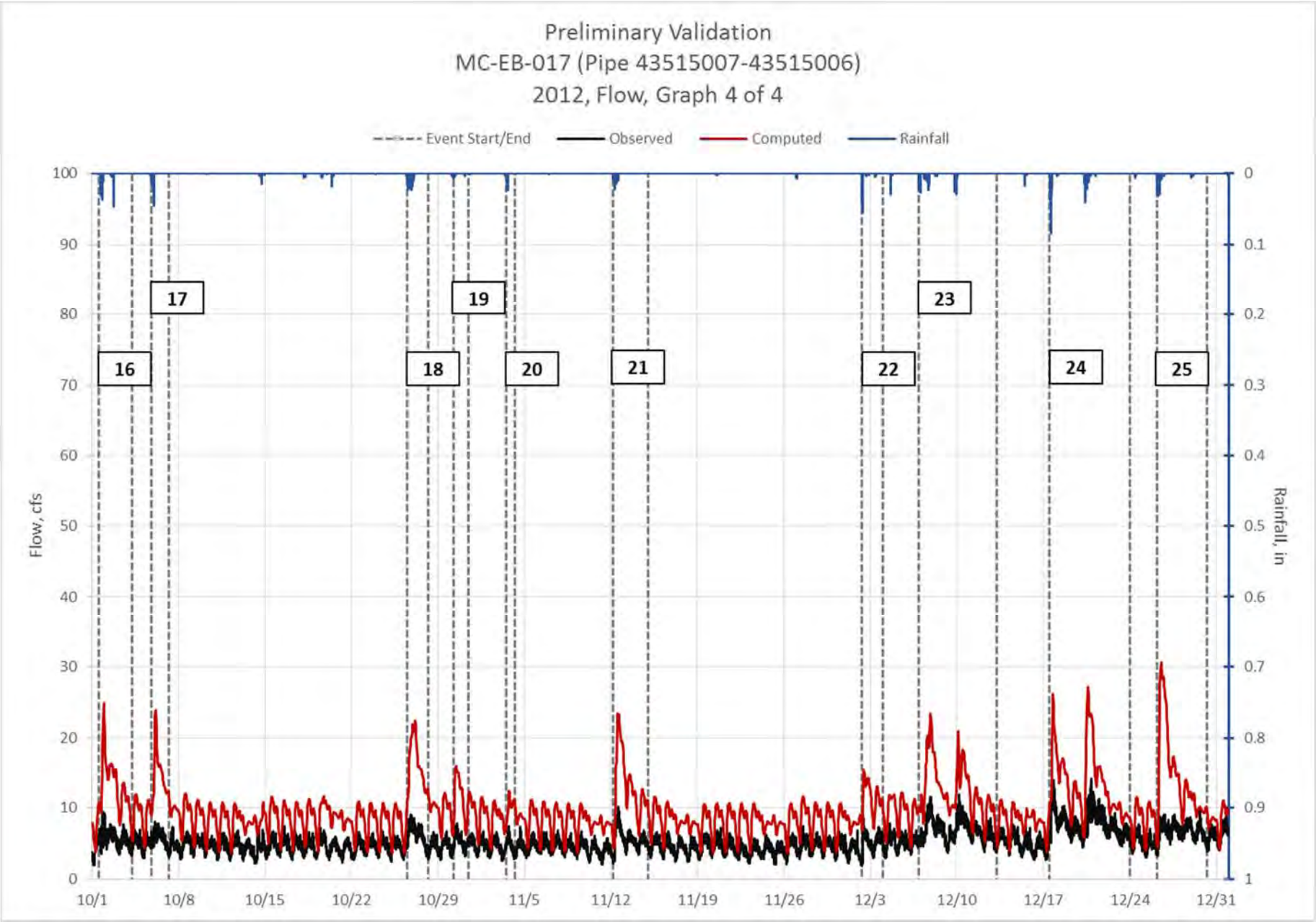
9/16
9/23
9/30


Preliminary Validation
MC-EB-017 (Pipe 43515007-43515006)
2012, Flow, Graph 4 of 4
Event Start/End
Observed
Computed
Rainfall
Flow, cfs
Rainfall, in
16
17
18
19
20
21
22
23
24
25
10/1
10/8
10/15
10/22
10/29
11/5
11/12
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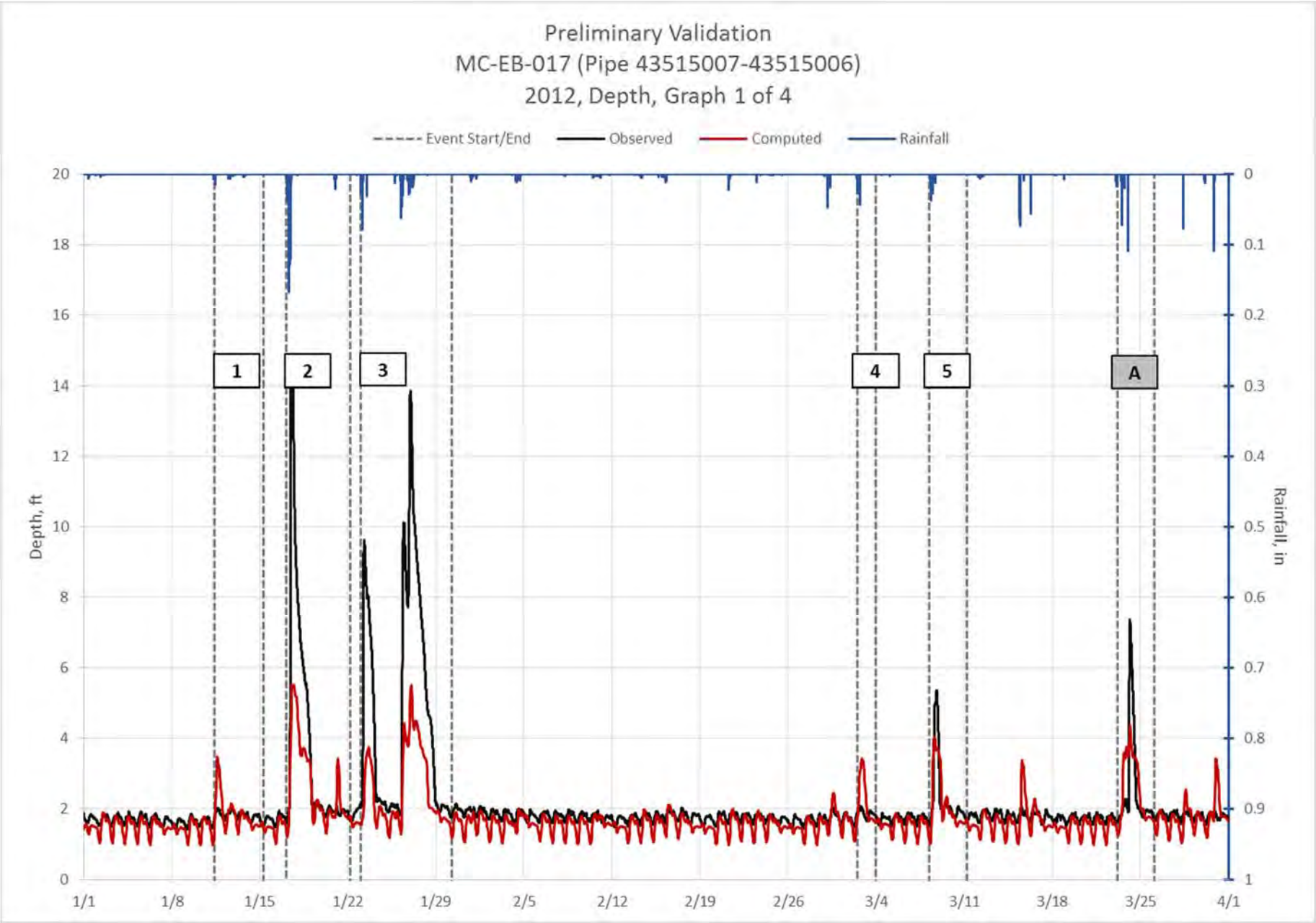
12/17
12/24
12/31


Preliminary Validation
MC-EB-017 (Pipe 43515007-43515006)
2012, Depth, Graph 1 of 4
Event Start/End
Observed
Computed
Rainfall
Depth, ft
Rainfall, in
1
2
3
4
5
A
20
18
16
14
12
10
8
6
4
2
0
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0.9
1
1/1
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1/29
2/5
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2/19
2/26
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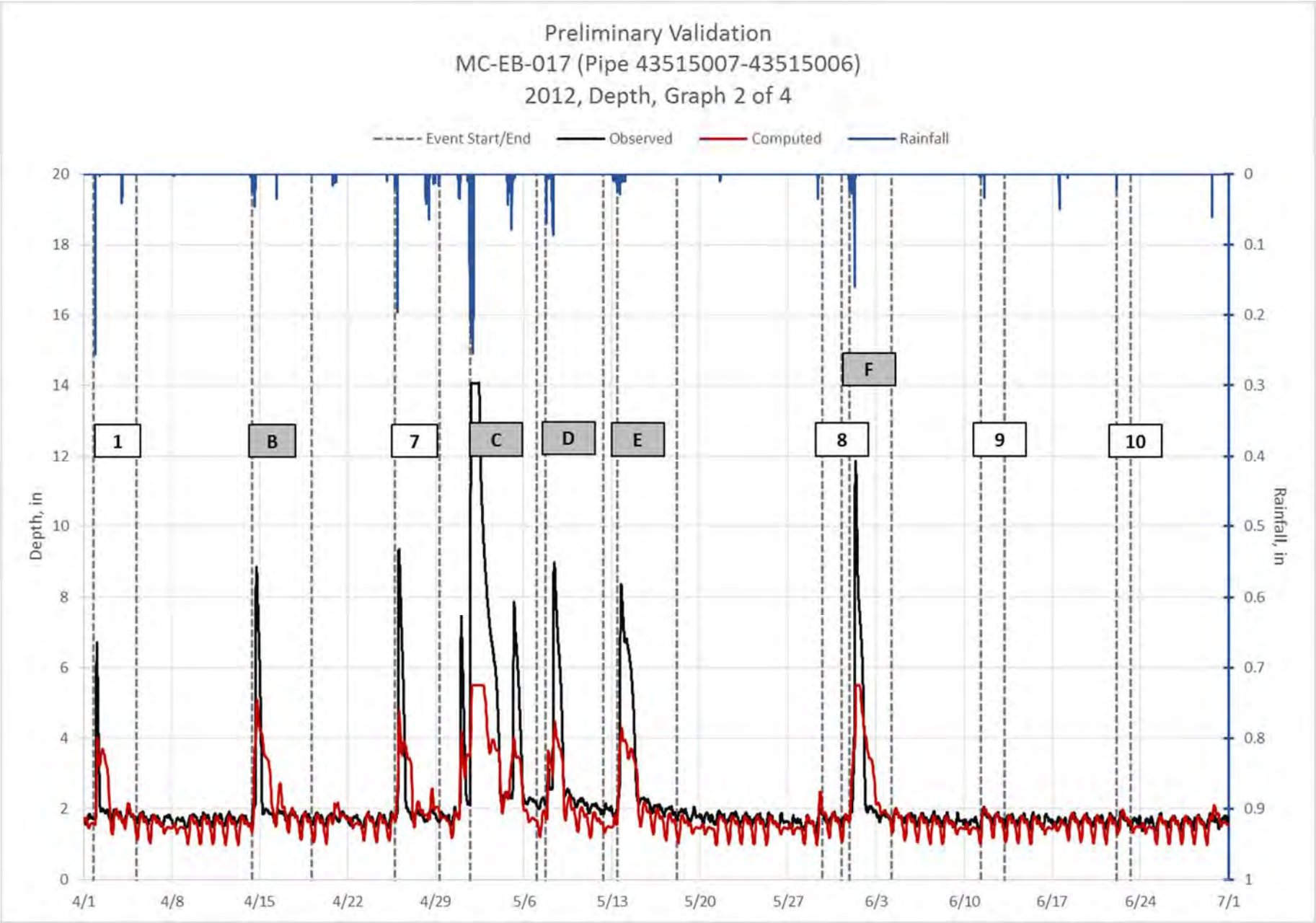
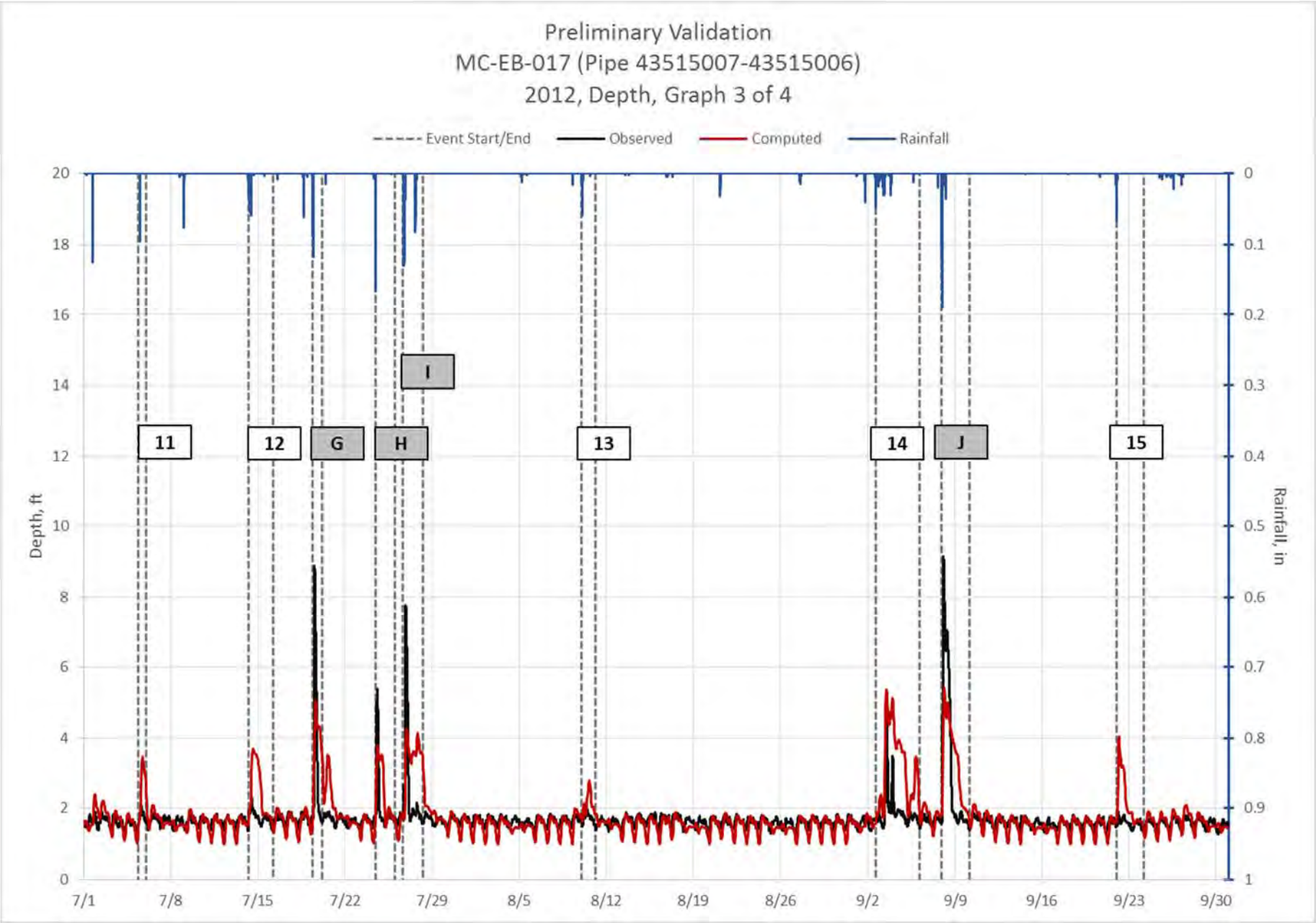
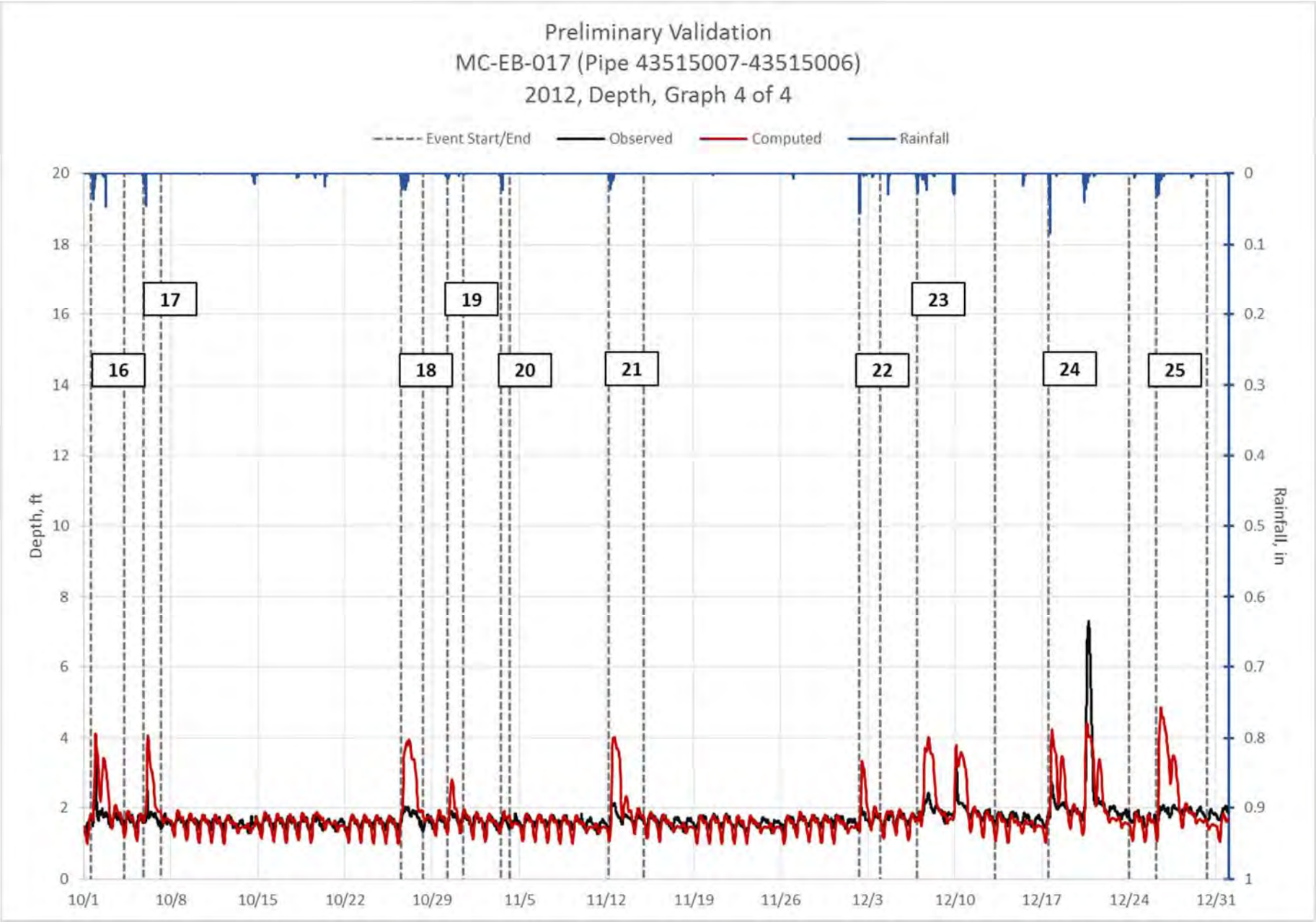
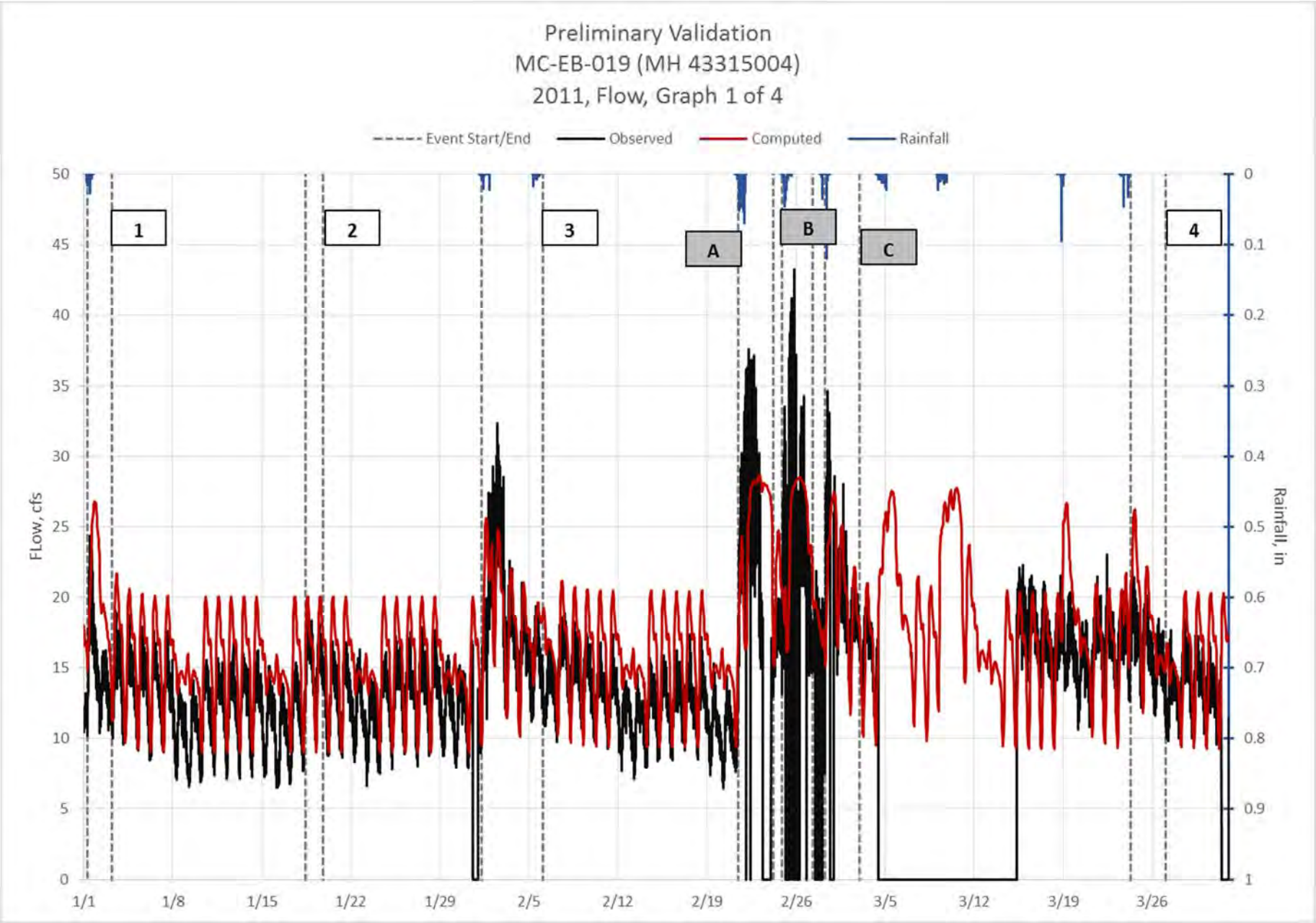
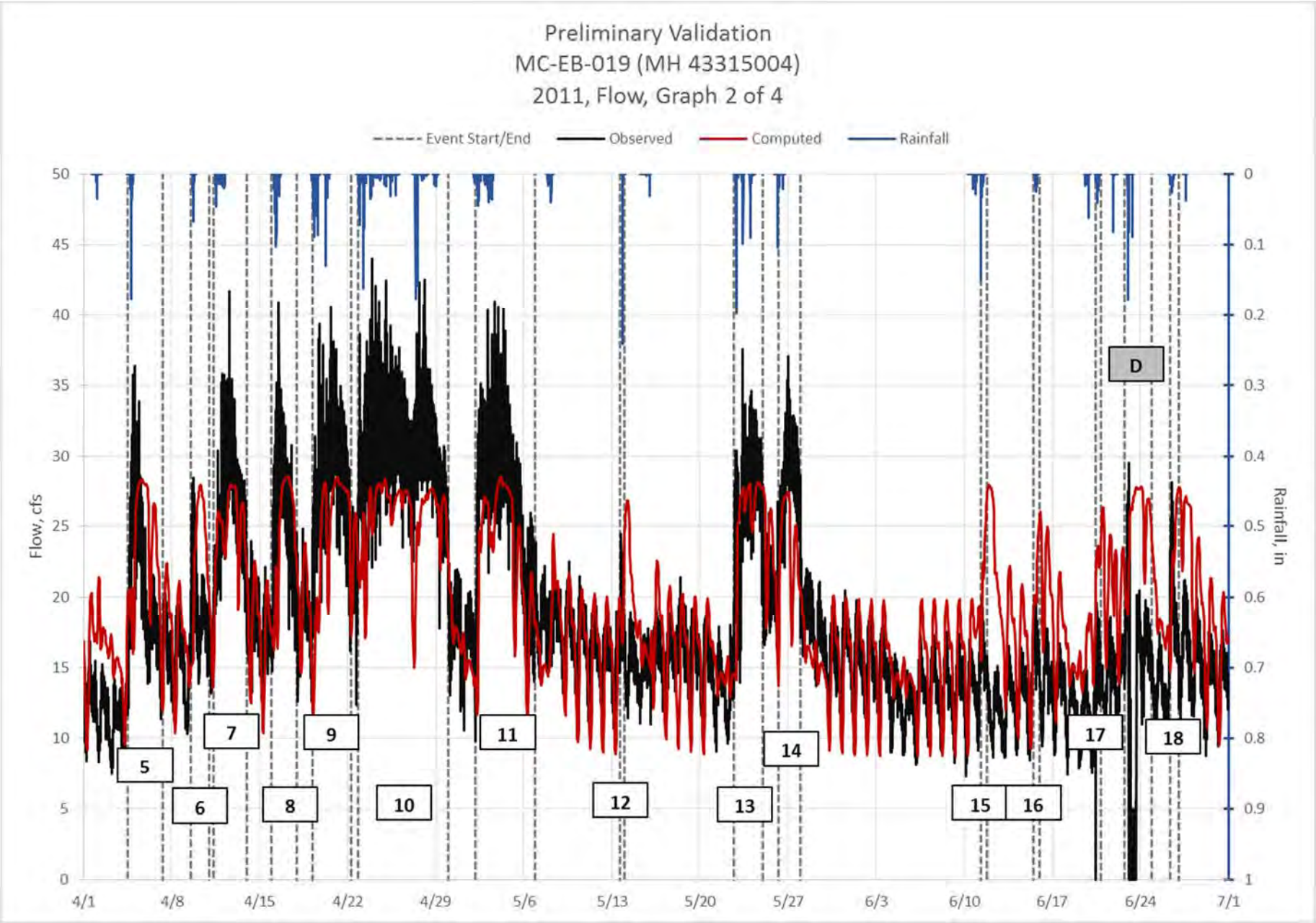
3/18
3/25
4/1


Preliminary Validation
MC-EB-017 (Pipe 43515007-43515006)
2012, Depth, Graph 2 of 4
Event Start/End
Observed
Computed
Rainfall
Depth, in
Rainfall, in
1
B
7
C
D
E
F
8
9
10
4/1
4/8
4/15
4/22
4/29
5/6
5/13
5/20
5/27
6/3
6/10
6/17
6/24
7/1


Preliminary Validation
MC-EB-017 (Pipe 43515007-43515006)
2012, Depth, Graph 3 of 4
Event Start/End
Observed
Computed
Rainfall
Depth, ft
Rainfall, in
11
12
G
H
I
13
14
J
15
7/1
7/8
7/15
7/22
7/29
8/5
8/12
8/19
8/26
9/2
9/9
9/16
9/23
9/30


Preliminary Validation
MC-EB-017 (Pipe 43515007-43515006)
2012, Depth, Graph 4 of 4
Event Start/End
Observed
Computed
Rainfall
Depth, ft
Rainfall, in
16
17
18
19
20
21
22
23
24
25
10/1
10/8
10/15
10/22
10/29
11/5
11/12
11/19
11/26
12/3
12/10
12/17
12/24
12/31


Preliminary Validation
MC-EB-019 (MH 43315004)
2011, Flow, Graph 1 of 4
Event Start/End
Observed
Computed
Rainfall
FLow, cfs
Rainfall, in
1
2
3
A
B
C
4
50
45
40
35
30
25
20
15
10
5
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1/1
1/8
1/15
1/22
1/29
2/5
2/12
2/19
2/26
3/5
3/12
3/19
3/26


Preliminary Validation
MC-EB-019 (MH 43315004)
2011, Flow, Graph 2 of 4
Event Start/End
Observed
Computed
Rainfall
Flow, cfs
Rainfall, in
50
45
40
35
30
25
20
15
10
5
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
4/1
4/8
4/15
4/22
4/29
5/6
5/13
5/20
5/27
6/3
6/10
6/17
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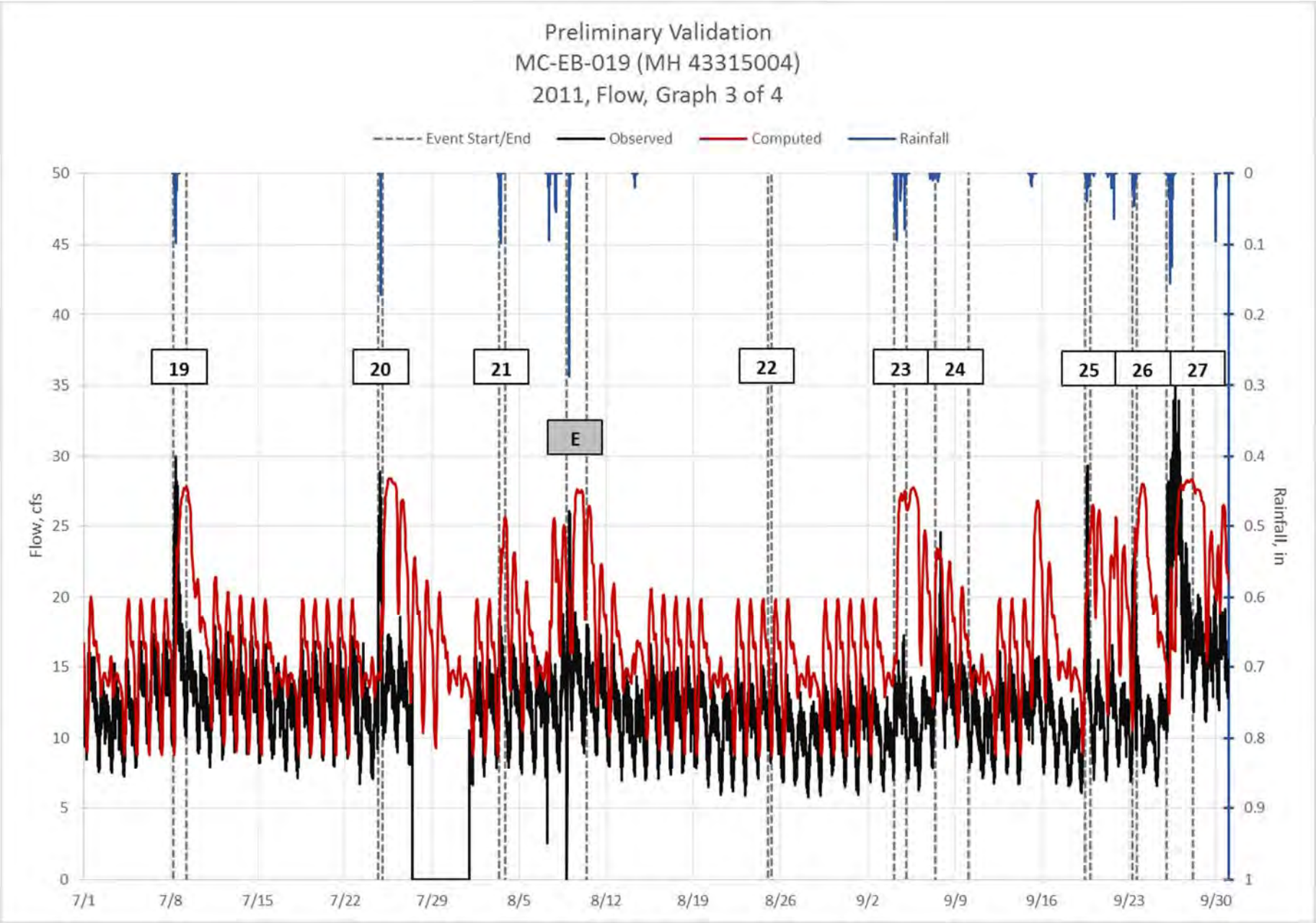
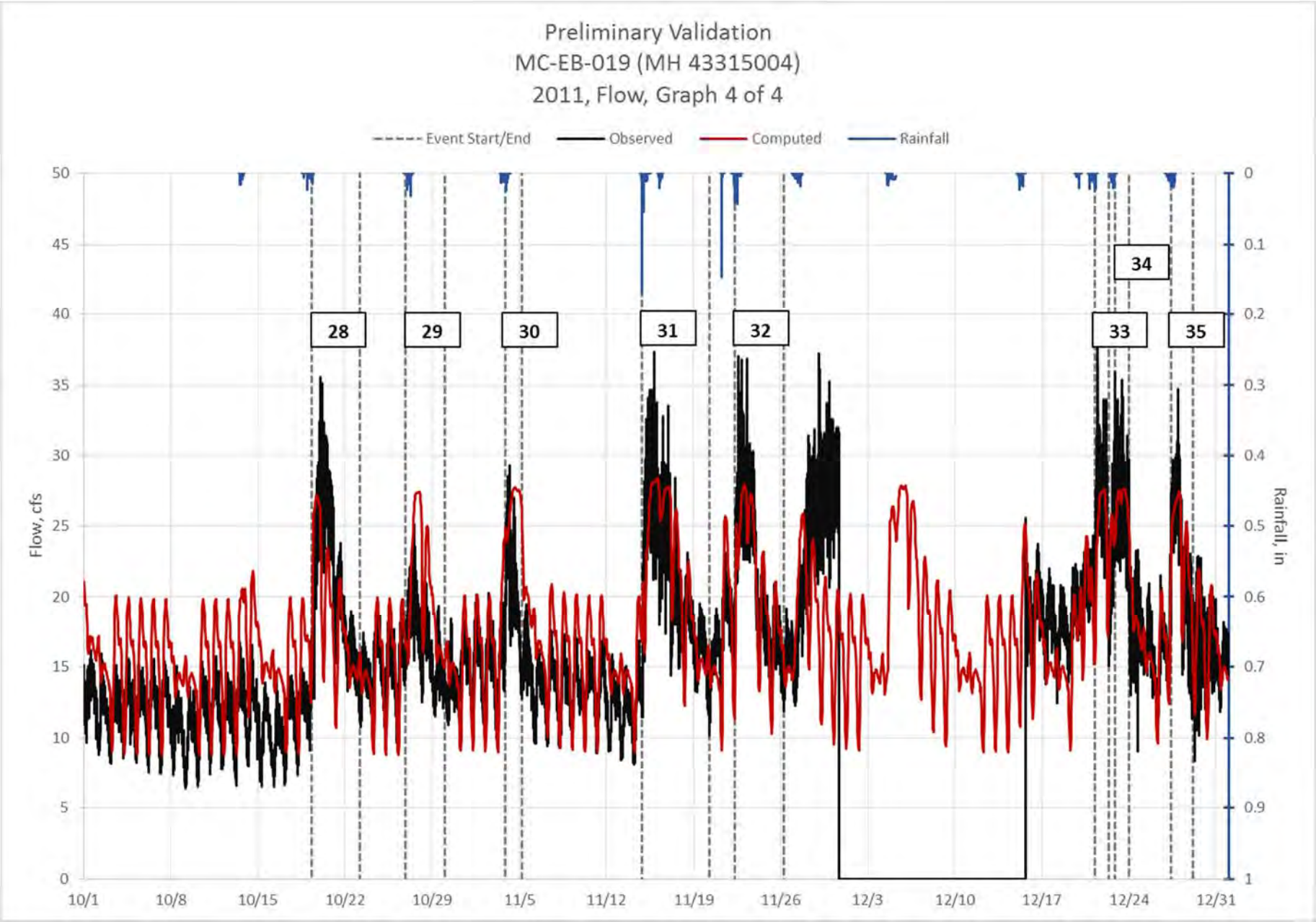
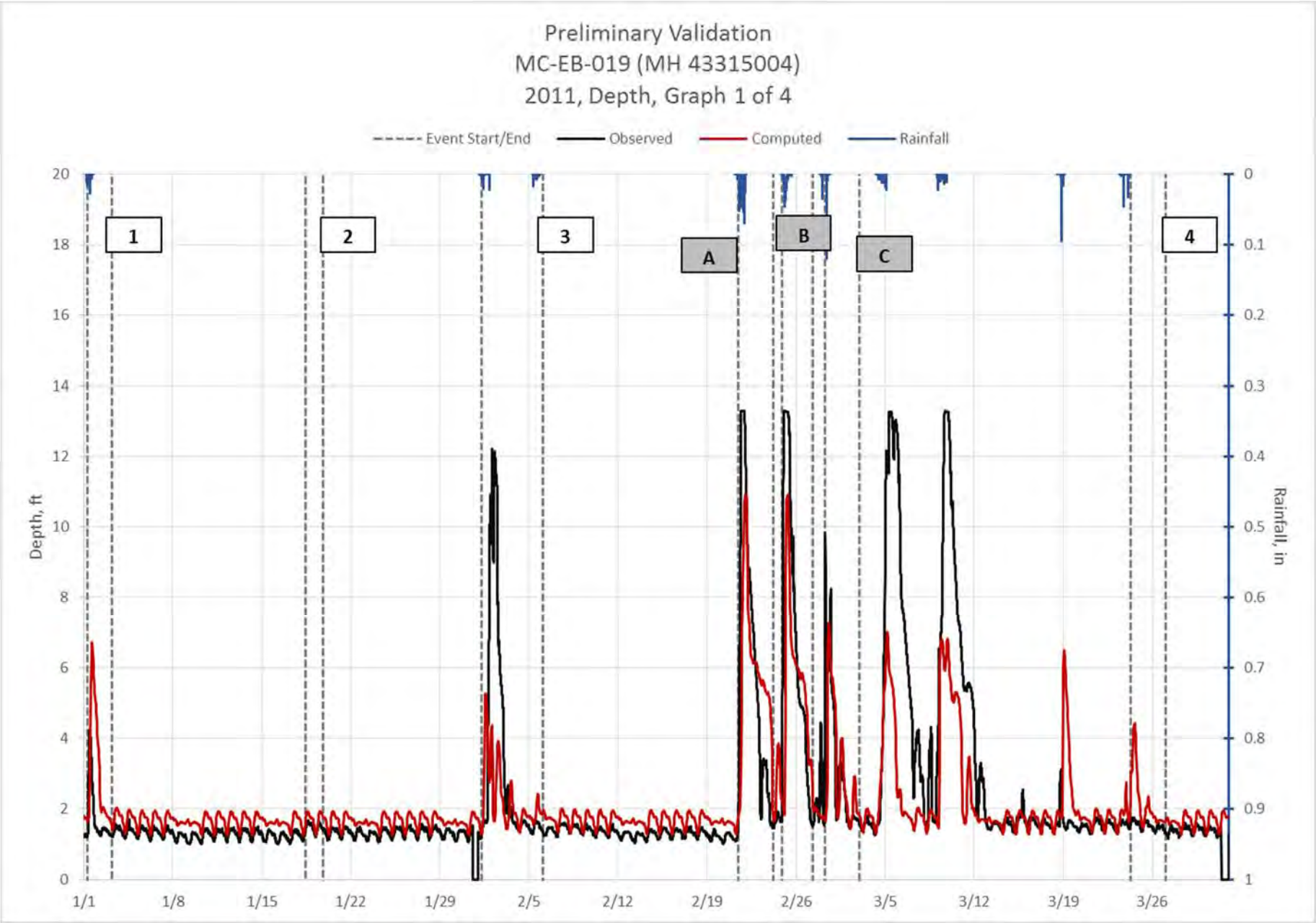
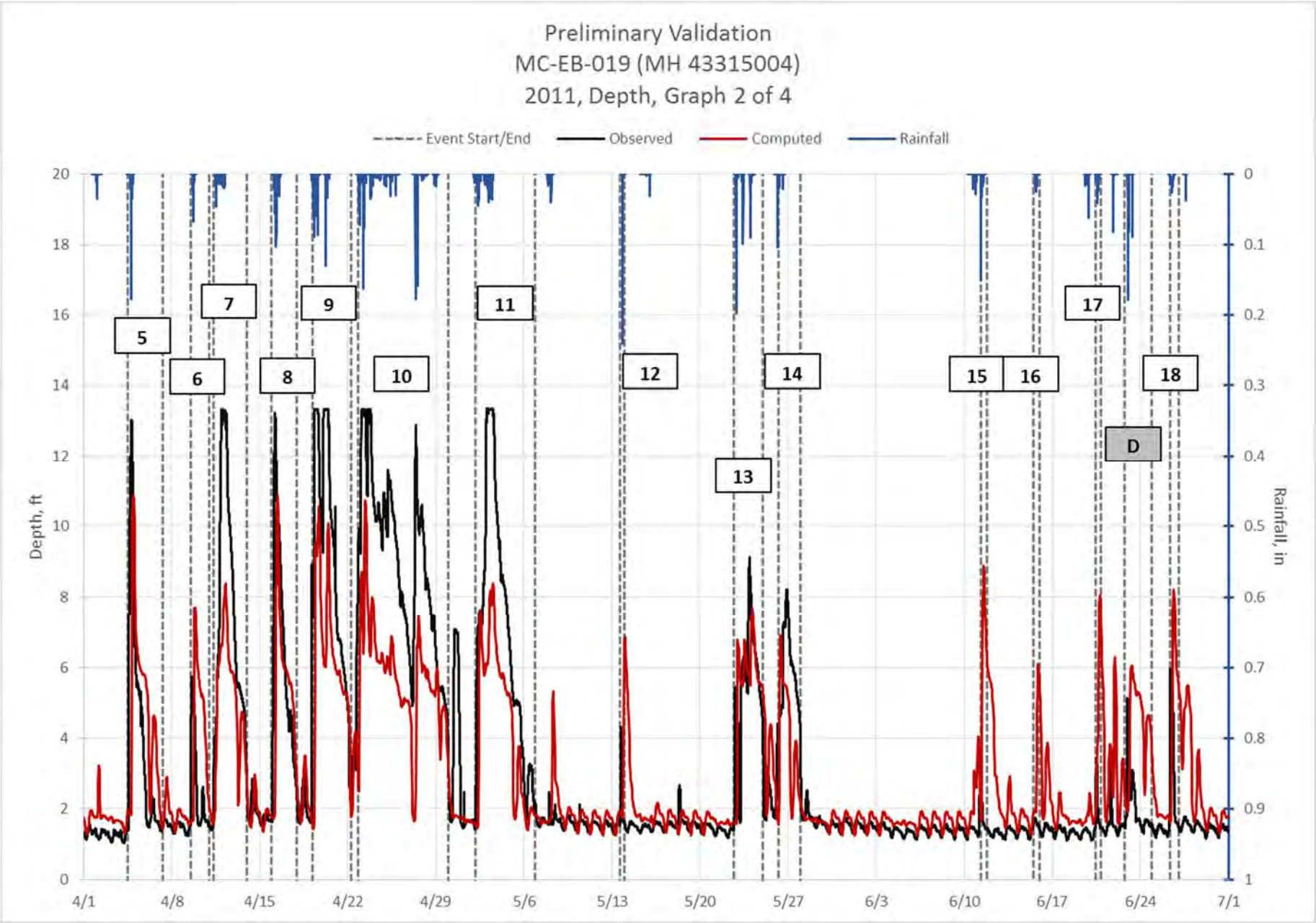
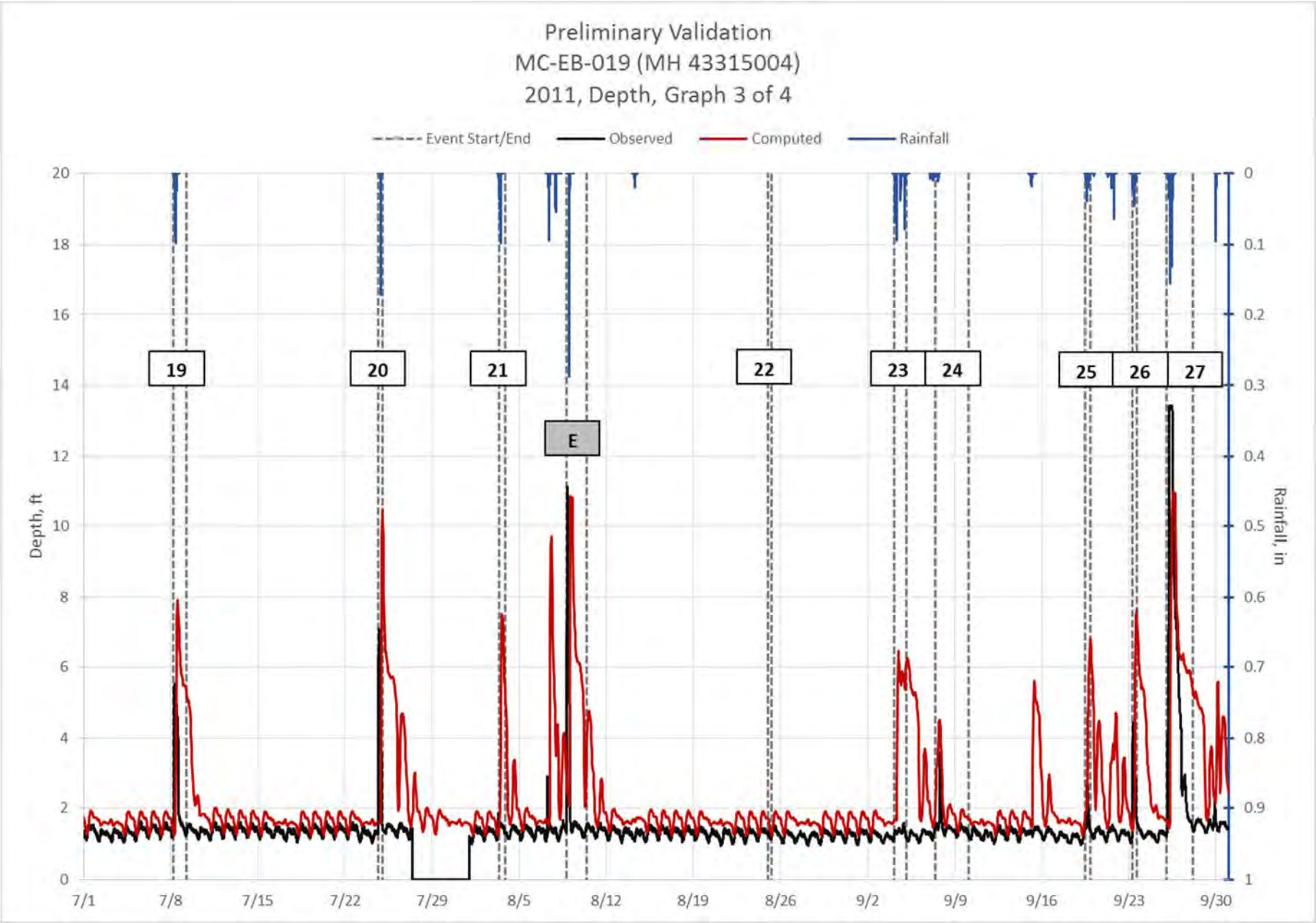
14
15
16
17
18
D

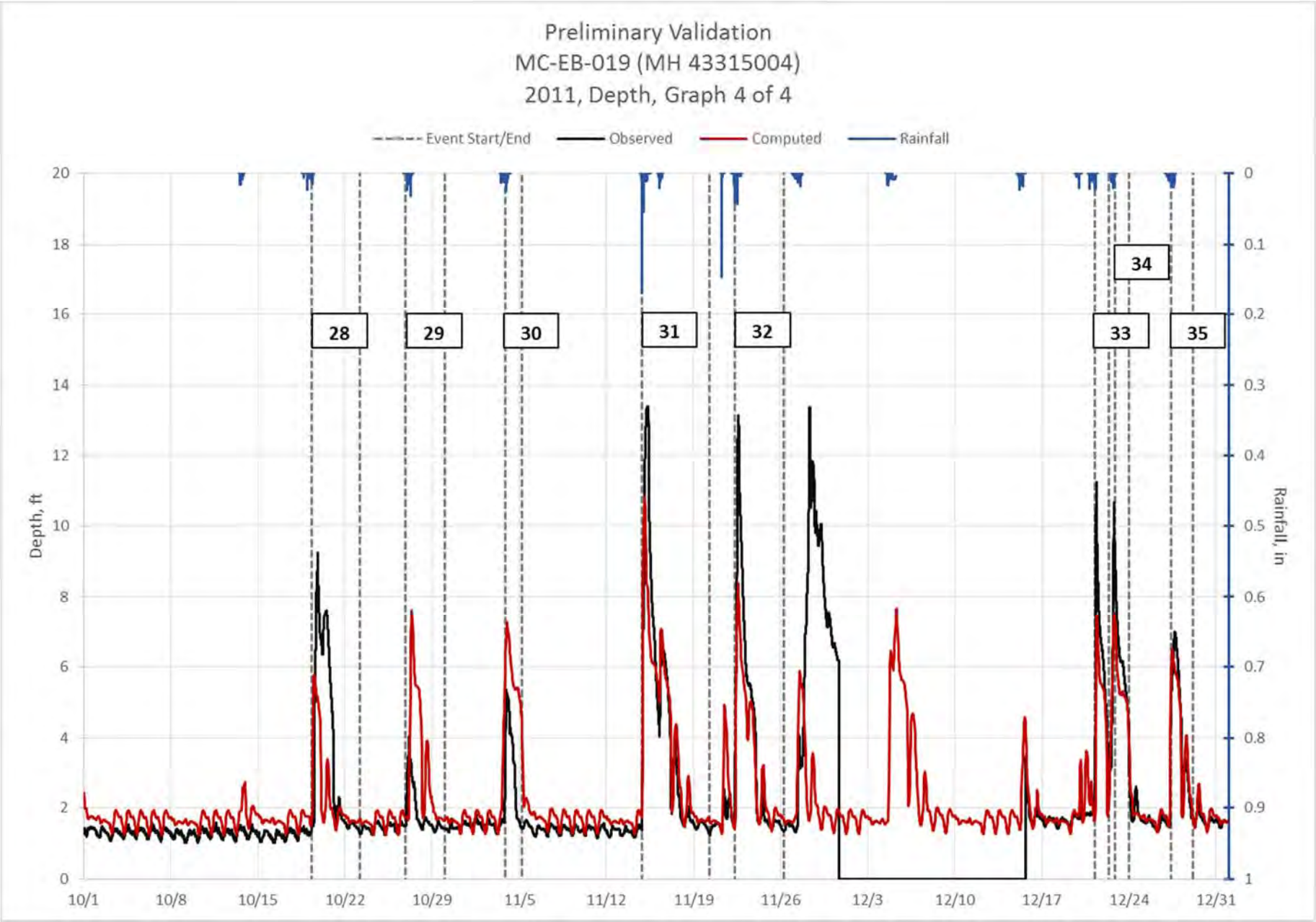

Preliminary Validation
MC-EB-019 (MH 43315004)
2011, Flow, Graph 3 of 4
Event Start/End
Observed
Computed
Rainfall
Flow, cfs
Rainfall, in
19
20
21
E
22
23
24
25
26
27
7/1
7/8
7/15
7/22
7/29
8/5
8/12
8/19
8/26
9/2
9/9
9/16
9/23
9/30

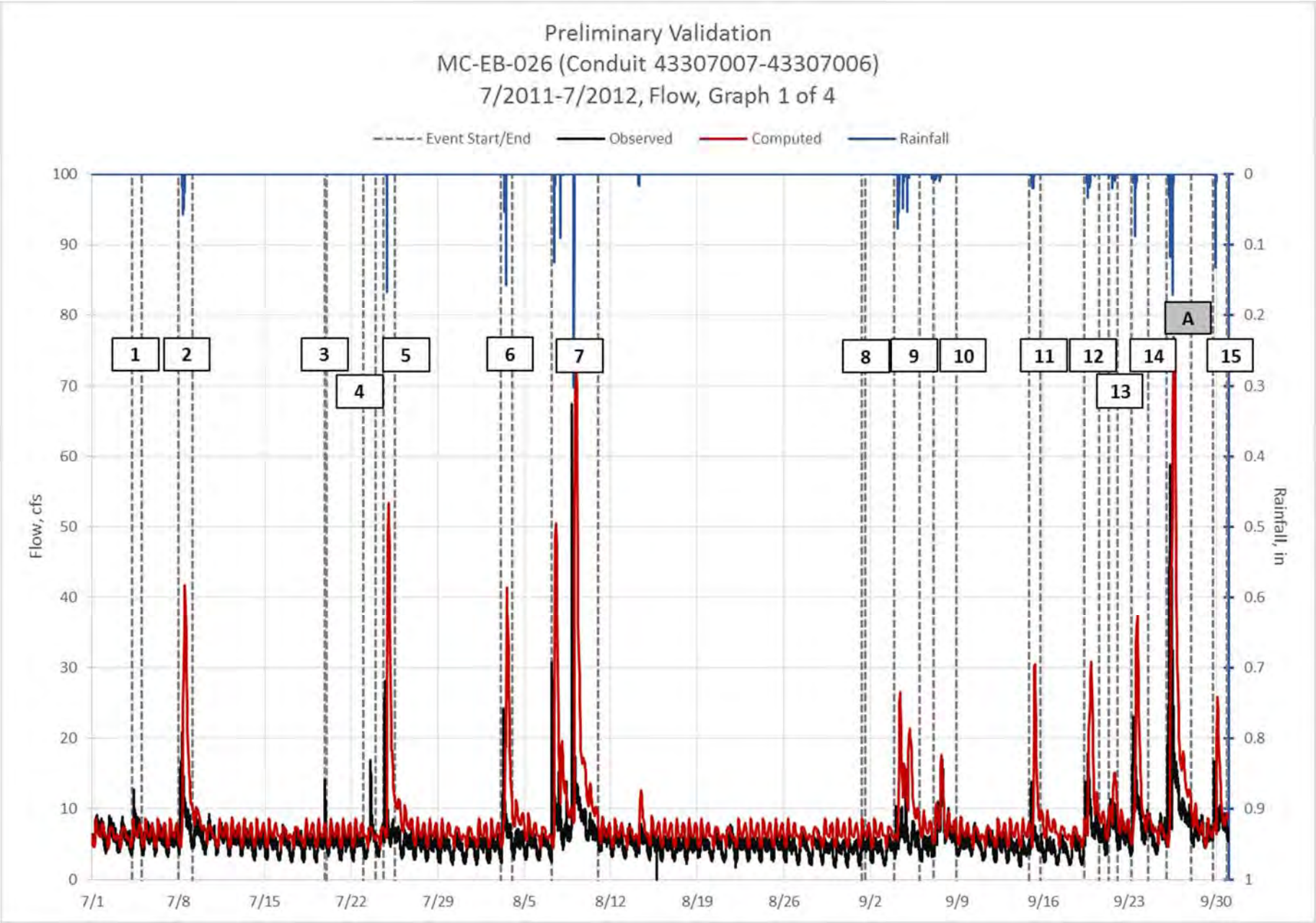

Preliminary Validation
MC-EB-019 (MH 43315004)
2011, Flow, Graph 4 of 4
Event Start/End
Observed
Computed
Rainfall
Flow, cfs
Rainfall, in
28
29
30
31
32
33
34
35
50
45
40
35
30
25
20
15
10
5
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
10/1
10/8
10/15
10/22
10/29
11/5
11/12
11/19
11/26
12/3
12/10
12/17
12/24
12/31

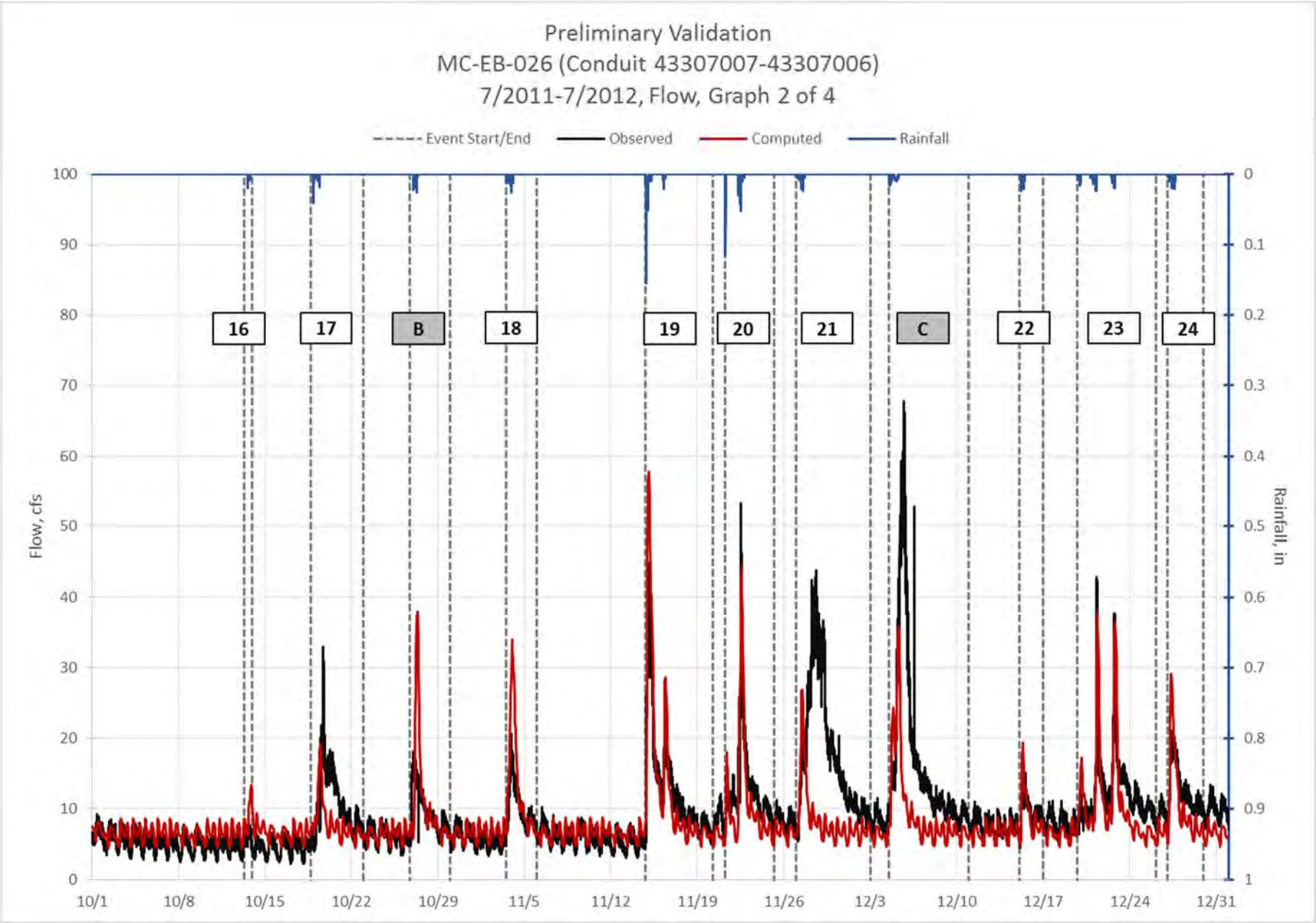

Preliminary Validation
MC-EB-019 (MH 43315004)
2011, Depth, Graph 1 of 4
Event Start/End
Observed
Computed
Rainfall
Depth, ft
Rainfall, in
1
2
3
A
B
C
4
20
18
16
14
12
10
8
6
4
2
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1/1
1/8
1/15
1/22
1/29
2/5
2/12
2/19
2/26
3/5
3/12
3/19
3/26

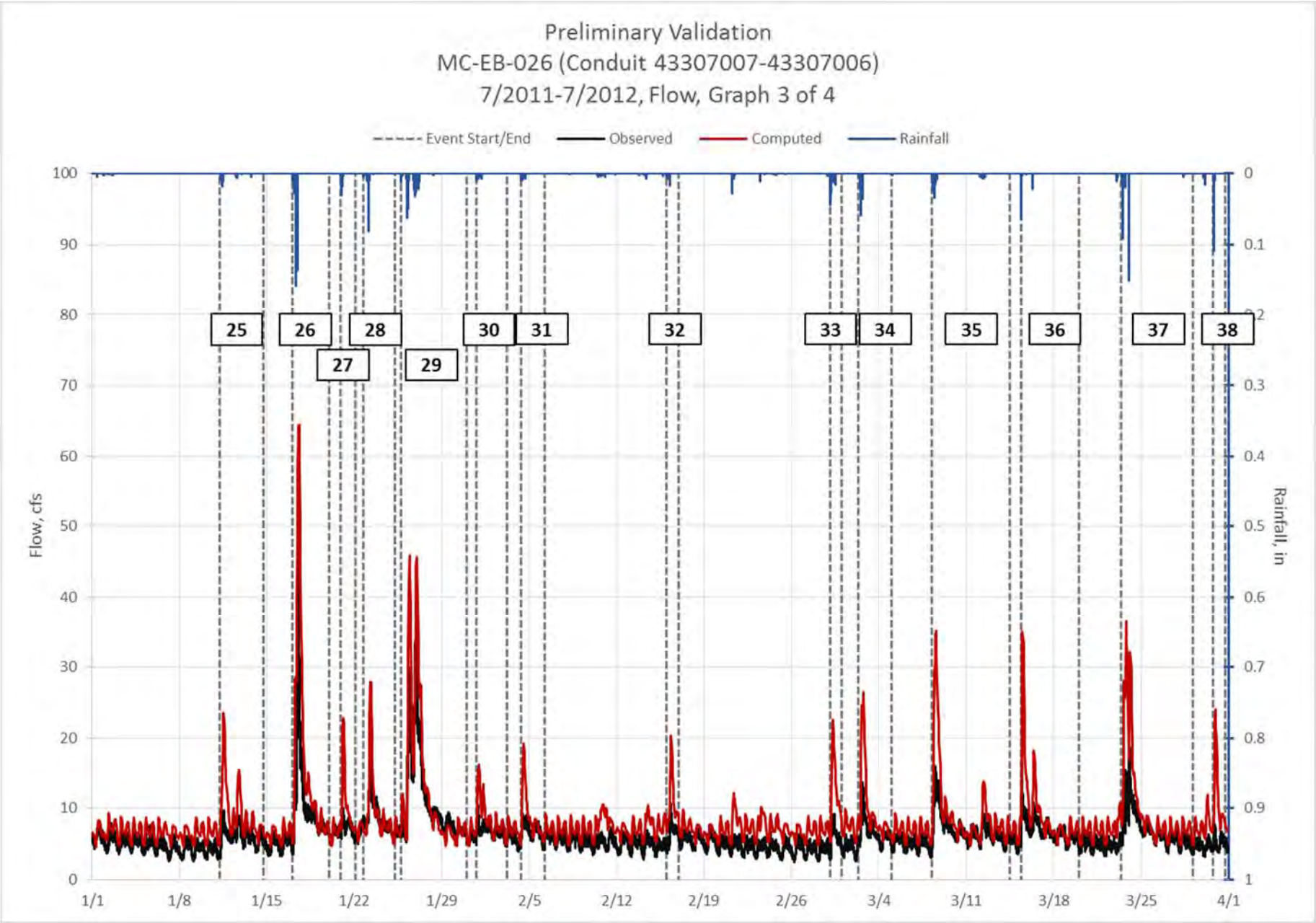

Preliminary Validation
MC-EB-019 (MH 43315004)
2011, Depth, Graph 2 of 4
Event Start/End
Observed
Computed
Rainfall
Depth, ft
Rainfall, in
5
6
7
8
9
10
11
12
13
14
15
16
17
18
D
4/1
4/8
4/15
4/22
4/29
5/6
5/13
5/20
5/27
6/3
6/10
6/17
6/24
7/1

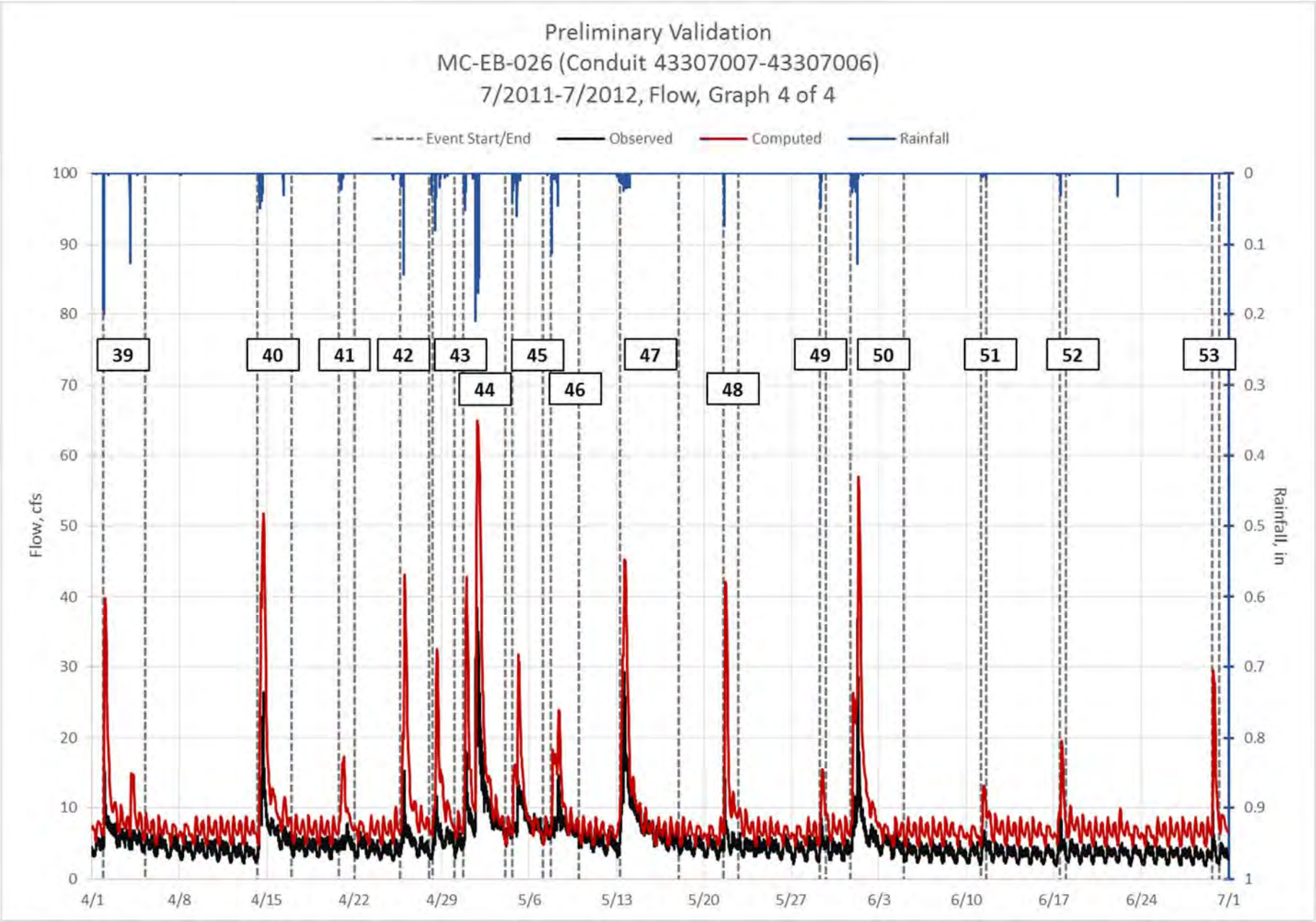

Preliminary Validation
MC-EB-019 (MH 43315004)
2011, Depth, Graph 3 of 4
Event Start/End
Observed
Computed
Rainfall
Depth, ft
Rainfall, in
19
20
21
E
22
23
24
25
26
27
7/1
7/8
7/15
7/22
7/29
8/5
8/12
8/19
8/26
9/2
9/9
9/16
9/23
9/30

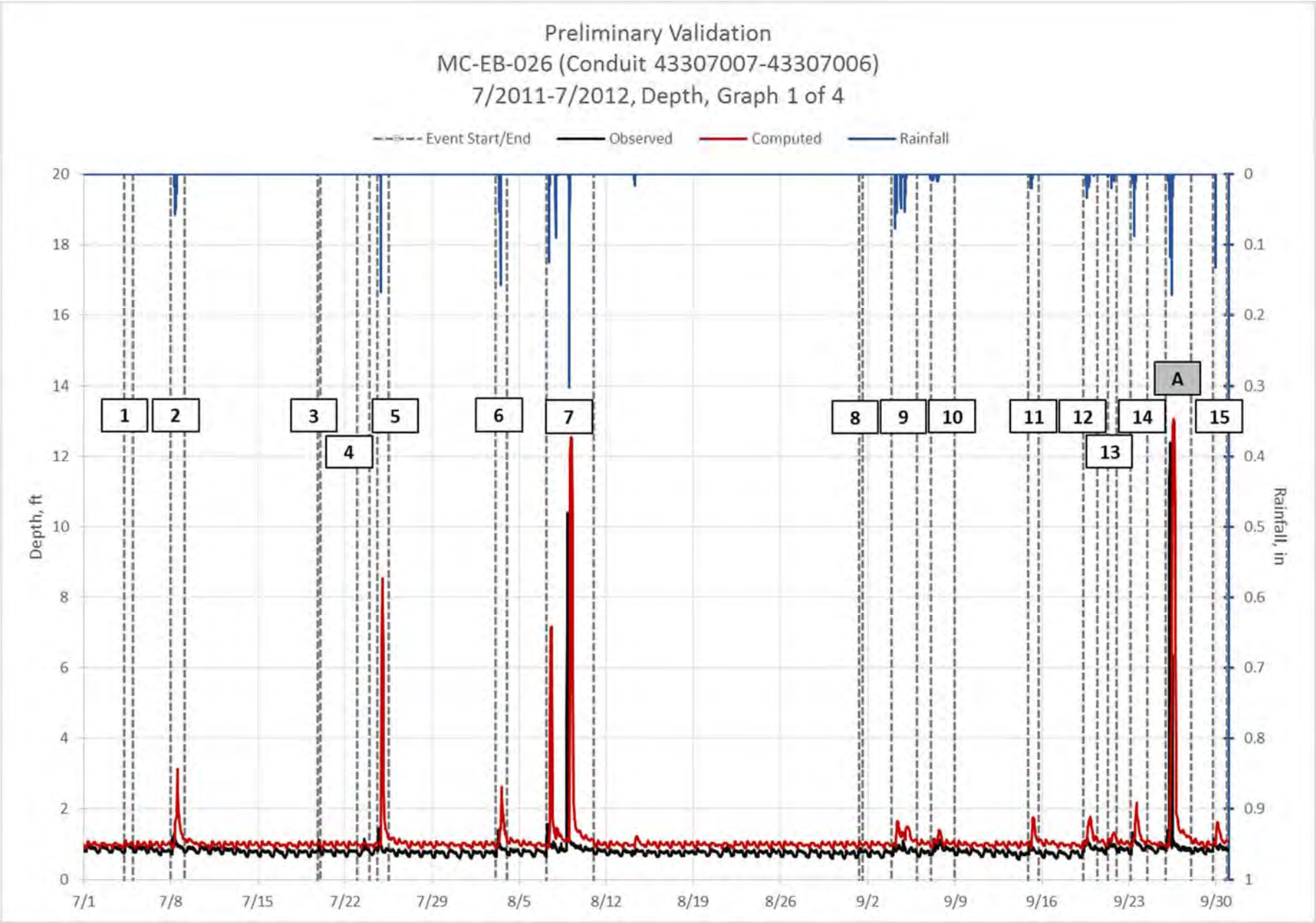

Preliminary Validation
MC-EB-019 (MH 43315004)
2011, Depth, Graph 4 of 4
Event Start/End
Observed
Computed
Rainfall
Depth, ft
Rainfall, in
28
29
30
31
32
33
34
35
10/1
10/8
10/15
10/22
10/29
11/5
11/12
11/19
11/26
12/3
12/10
12/17
12/24
12/31

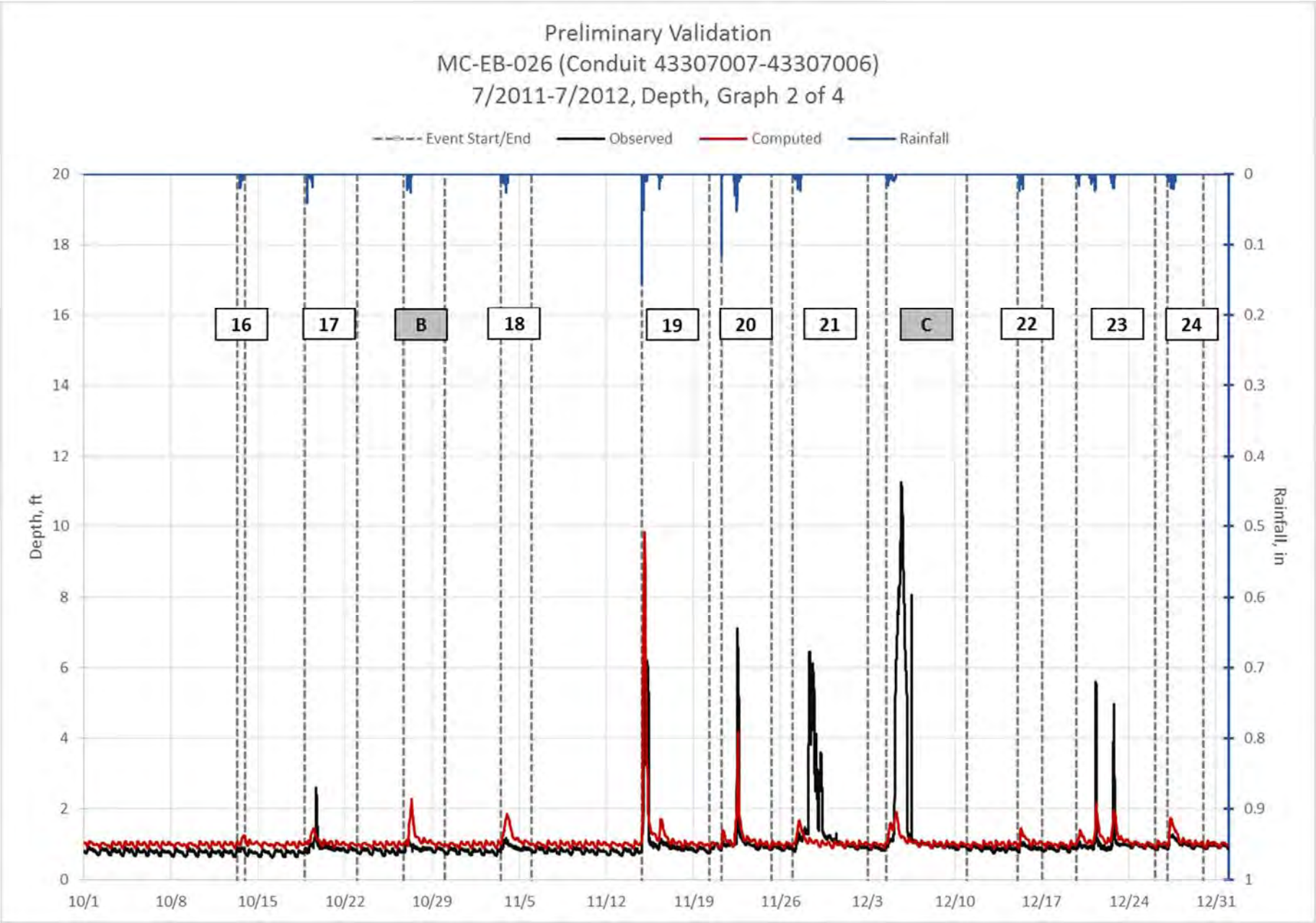

Preliminary Validation
MC-EB-026 (Conduit 43307007-43307006)
7/2011-7/2012, Flow, Graph 1 of 4
Event Start/End
Observed
Computed
Rainfall
Flow, cfs
Rainfall, in
1
2
3
4
5
6
7
8
9
10
11
12
13
14
A
15
7/1
7/8
7/15
7/22
7/29
8/5
8/12
8/19
8/26
9/2
9/9
9/16
9/23
9/30

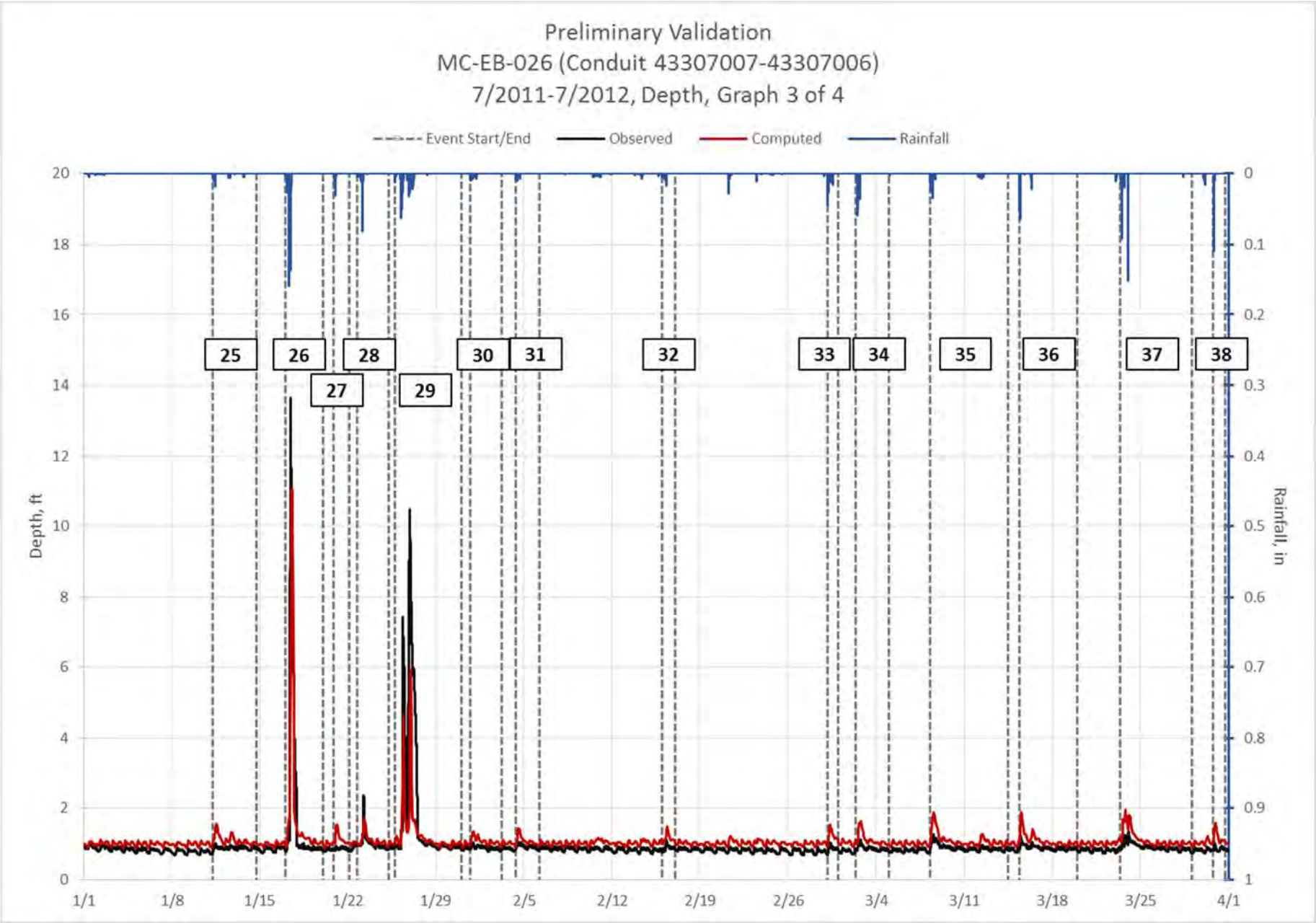

Preliminary Validation
MC-EB-026 (Conduit 43307007-43307006)
7/2011-7/2012, Flow, Graph 2 of 4
Event Start/End
Observed
Computed
Rainfall
Flow, cfs
Rainfall, in
16
17
B
18
19
20
21
C
22
23
24
100
90
80
70
60
50
40
30
20
10
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
10/1
10/8
10/15
10/22
10/29
11/5
11/12
11/19
11/26
12/3
12/10
12/17
12/24
12/31

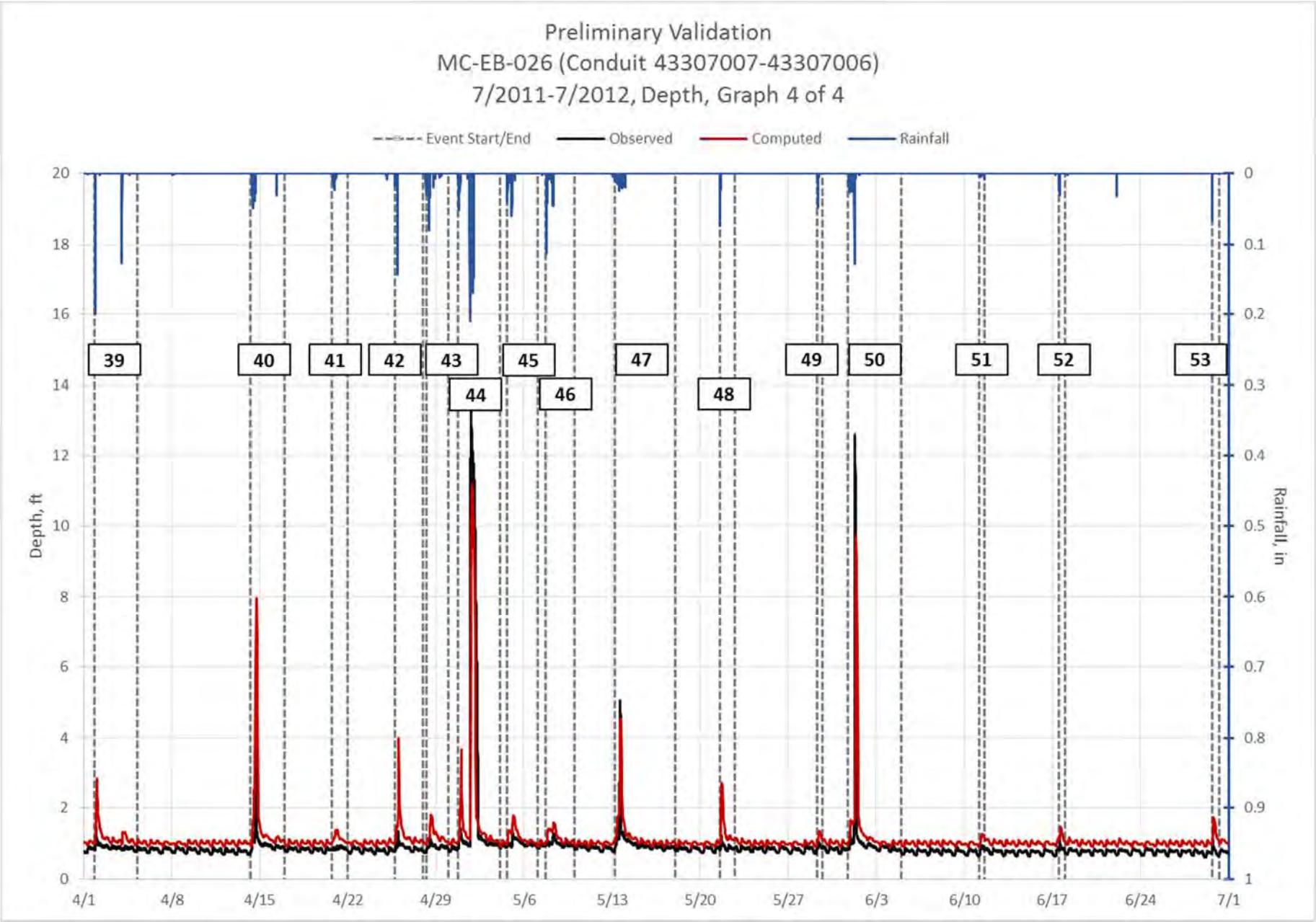

Preliminary Validation
MC-EB-026 (Conduit 43307007-43307006)
7/2011-7/2012, Flow, Graph 3 of 4
Event Start/End
Observed
Computed
Rainfall
Flow, cfs
Rainfall, in
25
26
27
28
29
30
31
32
33
34
35
36
37
38
1/1
1/8
1/15
1/22
1/29
2/5
2/12
2/19
2/26
3/4
3/11
3/18
3/25
4/1

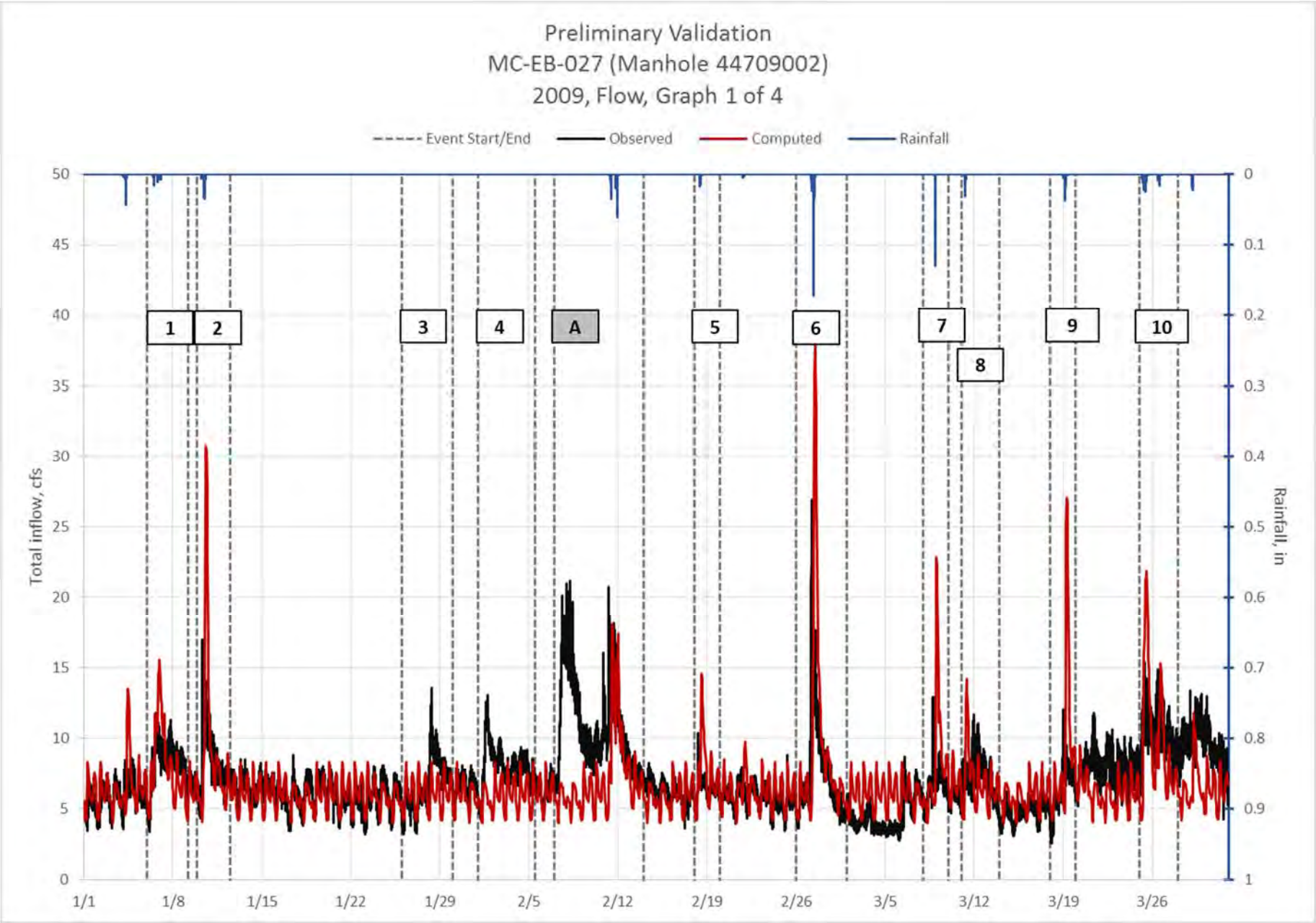

Preliminary Validation
MC-EB-026 (Conduit 43307007-43307006)
7/2011-7/2012, Flow, Graph 4 of 4
Event Start/End
Observed
Computed
Rainfall
Flow, cfs
Rainfall, in
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
4/1
4/8
4/15
4/22
4/29
5/6
5/13
5/20
5/27
6/3
6/10
6/17
6/24
7/1

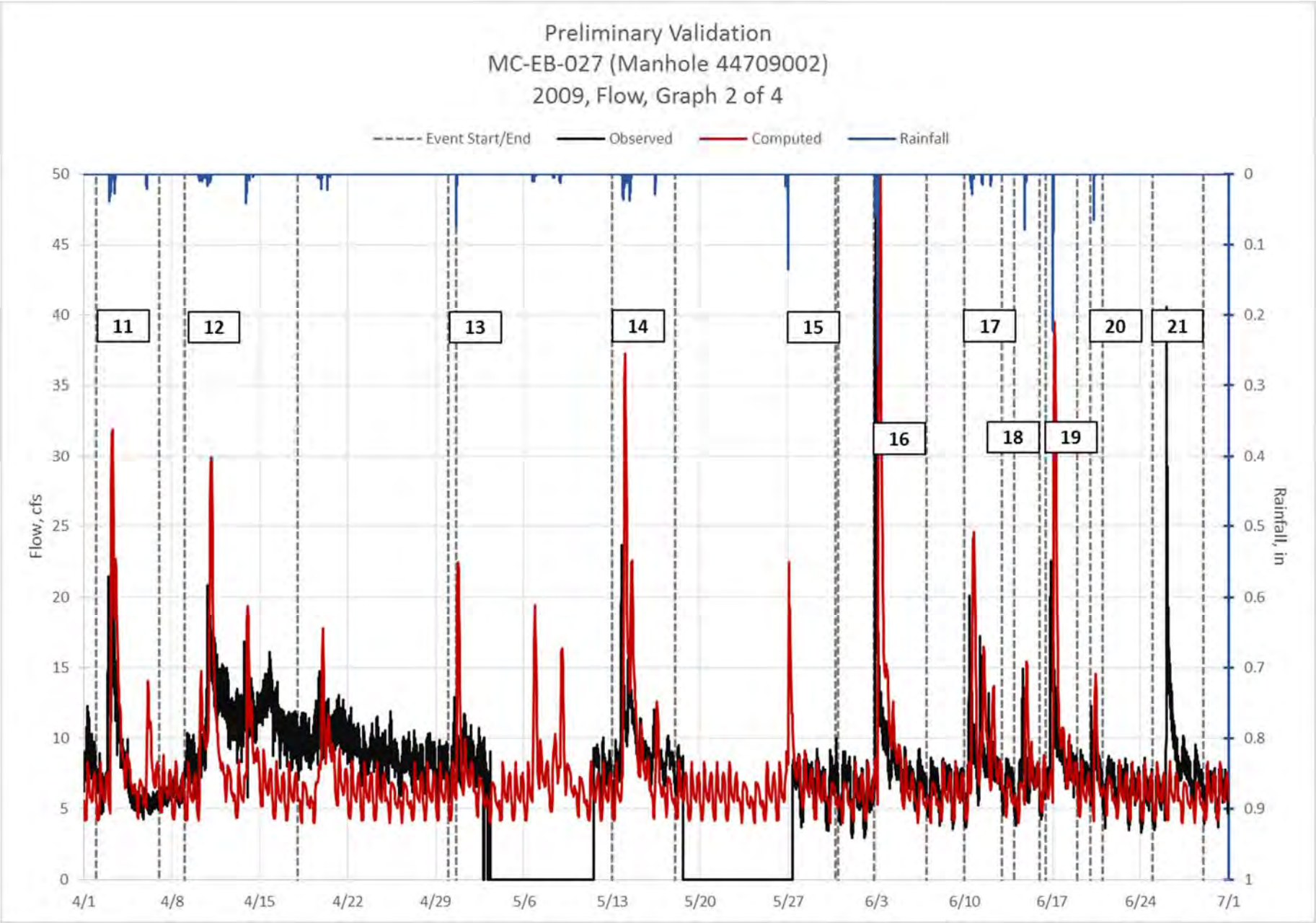

Preliminary Validation
MC-EB-026 (Conduit 43307007-43307006)
7/2011-7/2012, Depth, Graph 1 of 4
Event Start/End
Observed
Computed
Rainfall
Depth, ft
Rainfall, in
1
2
3
4
5
6
7
8
9
10
11
12
13
14
A
15
7/1
7/8
7/15
7/22
7/29
8/5
8/12
8/19
8/26
9/2
9/9
9/16
9/23
9/30

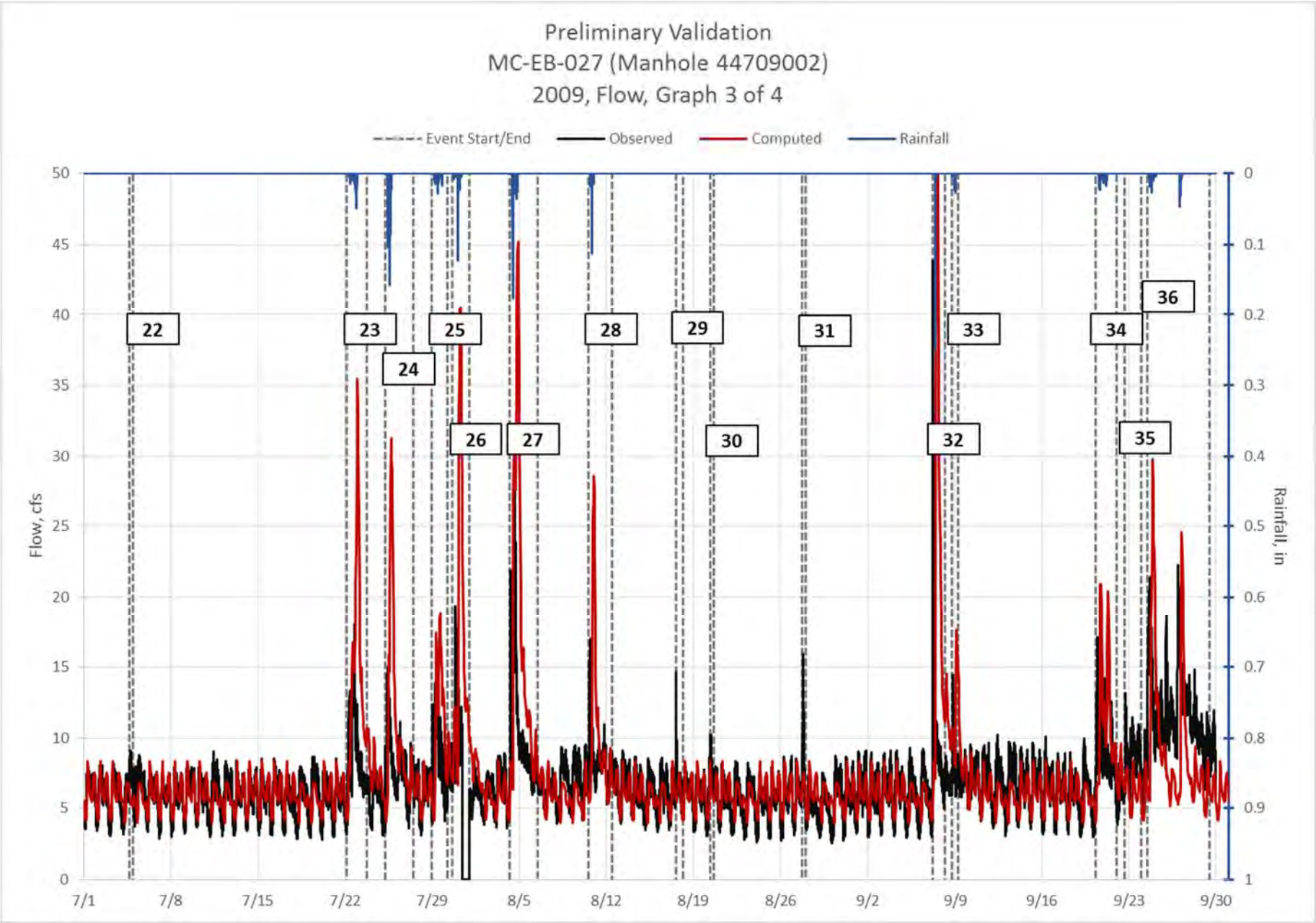

Preliminary Validation
MC-EB-026 (Conduit 43307007-43307006)
7/2011-7/2012, Depth, Graph 2 of 4
Event Start/End
Observed
Computed
Rainfall
Depth, ft
Rainfall, in
16
17
B
18
19
20
21
C
22
23
24
10/1
10/8
10/15
10/22
10/29
11/5
11/12
11/19
11/26
12/3
12/10
12/17
12/24
12/31

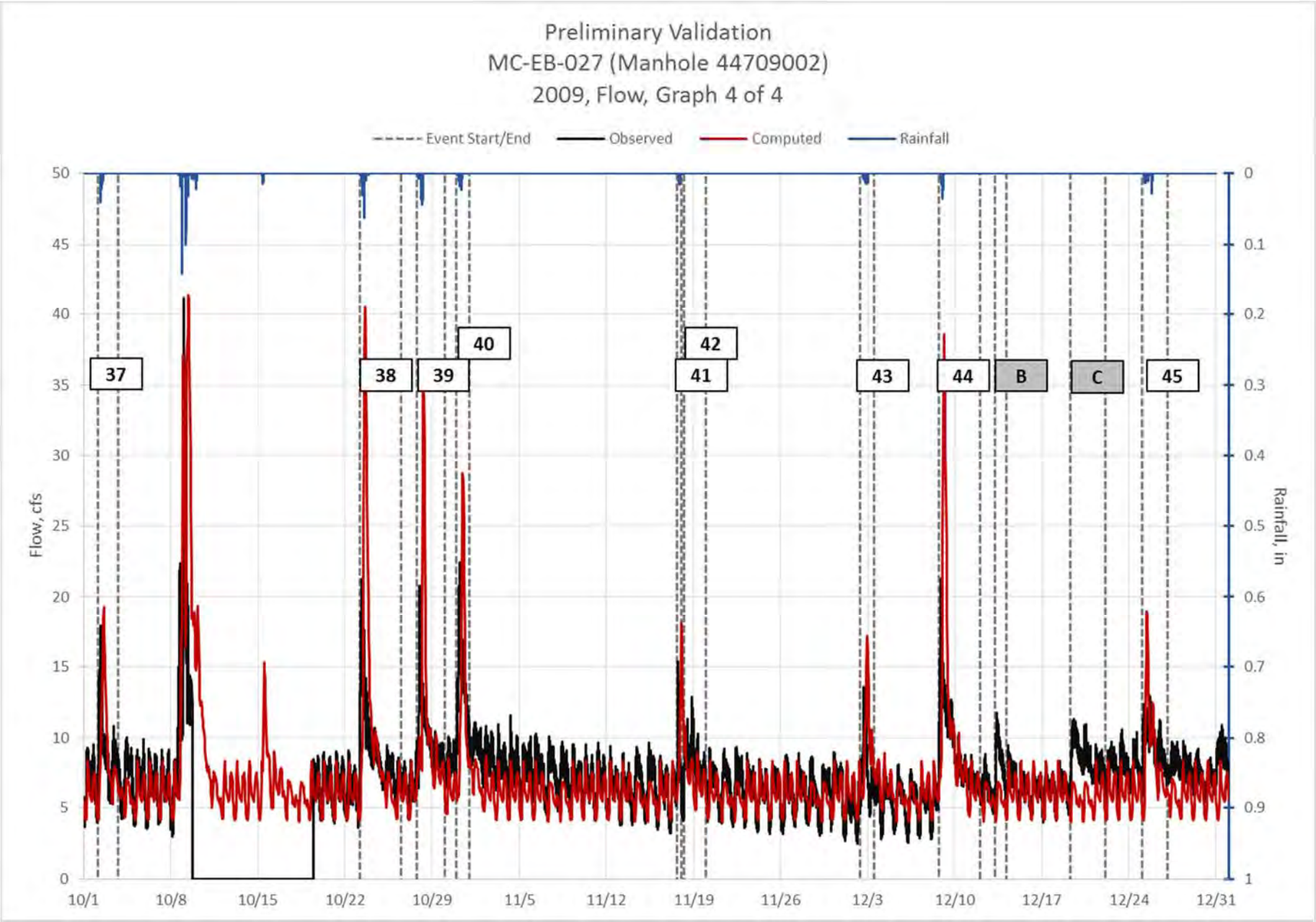

Preliminary Validation
MC-EB-026 (Conduit 43307007-43307006)
7/2011-7/2012, Depth, Graph 3 of 4
Event Start/End
Observed
Computed
Rainfall
Depth, ft
Rainfall, in
25
26
27
28
29
30
31
32
33
34
35
36
37
38
1/1
1/8
1/15
1/22
1/29
2/5
2/12
2/19
2/26
3/4
3/11
3/18
3/25
4/1


Preliminary Validation
MC-EB-026 (Conduit 43307007-43307006)
7/2011-7/2012, Depth, Graph 4 of 4
Event Start/End
Observed
Computed
Rainfall
Depth, ft
Rainfall, in
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
4/1
4/8
4/15
4/22
4/29
5/6
5/13
5/20
5/27
6/3
6/10
6/17
6/24
7/1


Preliminary Validation
MC-EB-027 (Manhole 44709002)
2009, Flow, Graph 1 of 4
Event Start/End
Observed
Computed
Rainfall
Total inflow, cfs
Rainfall, in
1
2
3
4
A
5
6
7
8
9
10
0
5
10
15
20
25
30
35
40
45
50
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1/1
1/8
1/15
1/22
1/29
2/5
2/12
2/19
2/26
3/5
3/12
3/19
3/26


Preliminary Validation
MC-EB-027 (Manhole 44709002)
2009, Flow, Graph 2 of 4
Event Start/End
Observed
Computed
Rainfall
Flow, cfs
Rainfall, in
11
12
13
14
15
16
17
18
19
20
21
4/1
4/8
4/15
4/22
4/29
5/6
5/13
5/20
5/27
6/3
6/10
6/17
6/24
7/1


Preliminary Validation
MC-EB-027 (Manhole 44709002)
2009, Flow, Graph 3 of 4
Event Start/End
Observed
Computed
Rainfall
Flow, cfs
Rainfall, in
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
7/1
7/8
7/15
7/22
7/29
8/5
8/12
8/19
8/26
9/2
9/9
9/16
9/23
9/30


Preliminary Validation
MC-EB-027 (Manhole 44709002)
2009, Flow, Graph 4 of 4
Event Start/End
Observed
Computed
Rainfall
Flow, cfs
Rainfall, in
37
38
39
40
41
42
43
44
B
C
45
50
45
40
35
30
25
20
15
10
5
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
10/1
10/8
10/15
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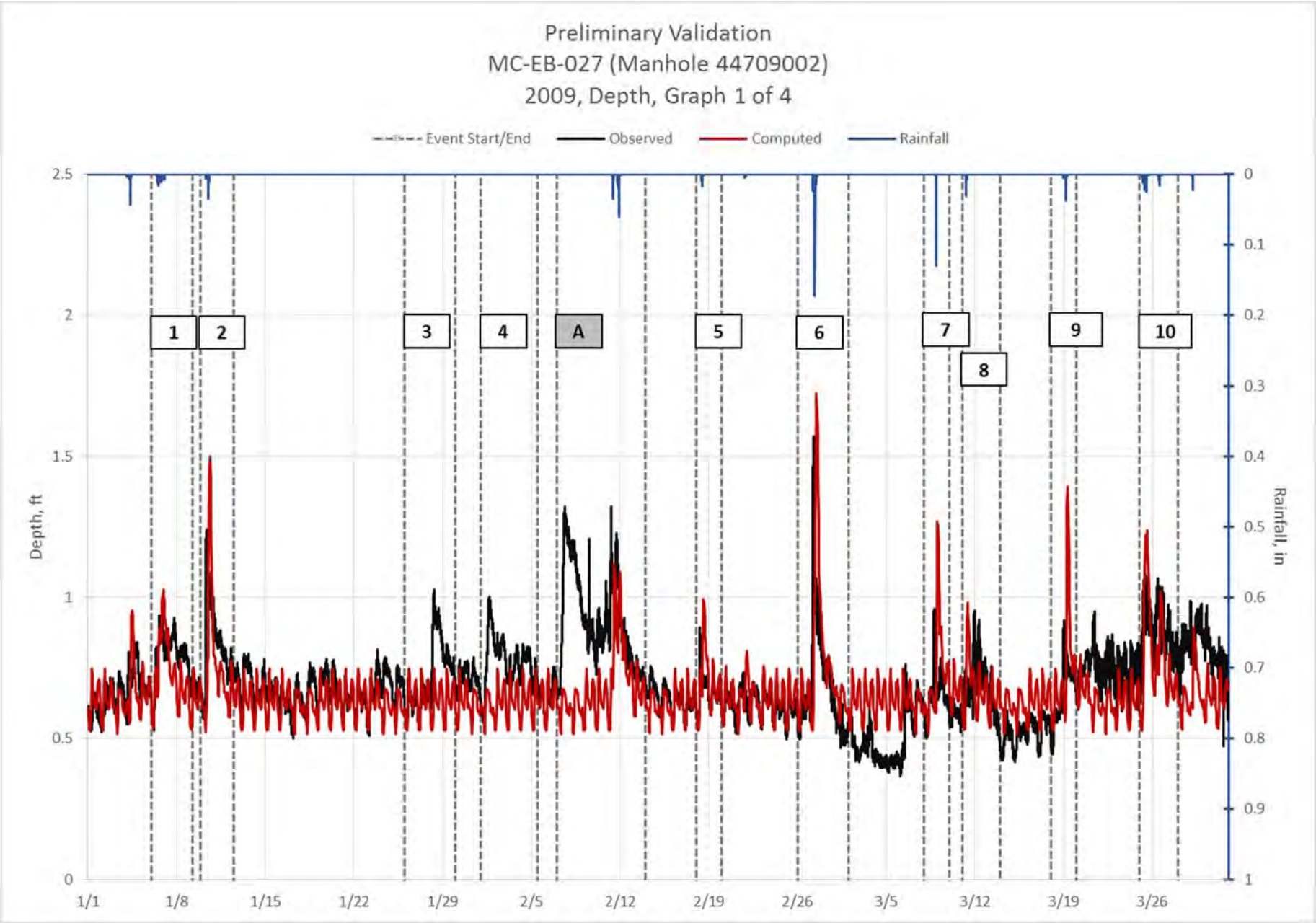
10/29
11/5
11/12
11/19
11/26
12/3
12/10
12/17
12/24
12/31


Preliminary Validation
MC-EB-027 (Manhole 44709002)
2009, Depth, Graph 1 of 4
Event Start/End
Observed
Computed
Rainfall
Depth, ft
Rainfall, in
2.5
2
1.5
1
0.5
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1
2
3
4
A
5
6
7
8
9
10
1/1
1/8
1/15
1/22
1/29
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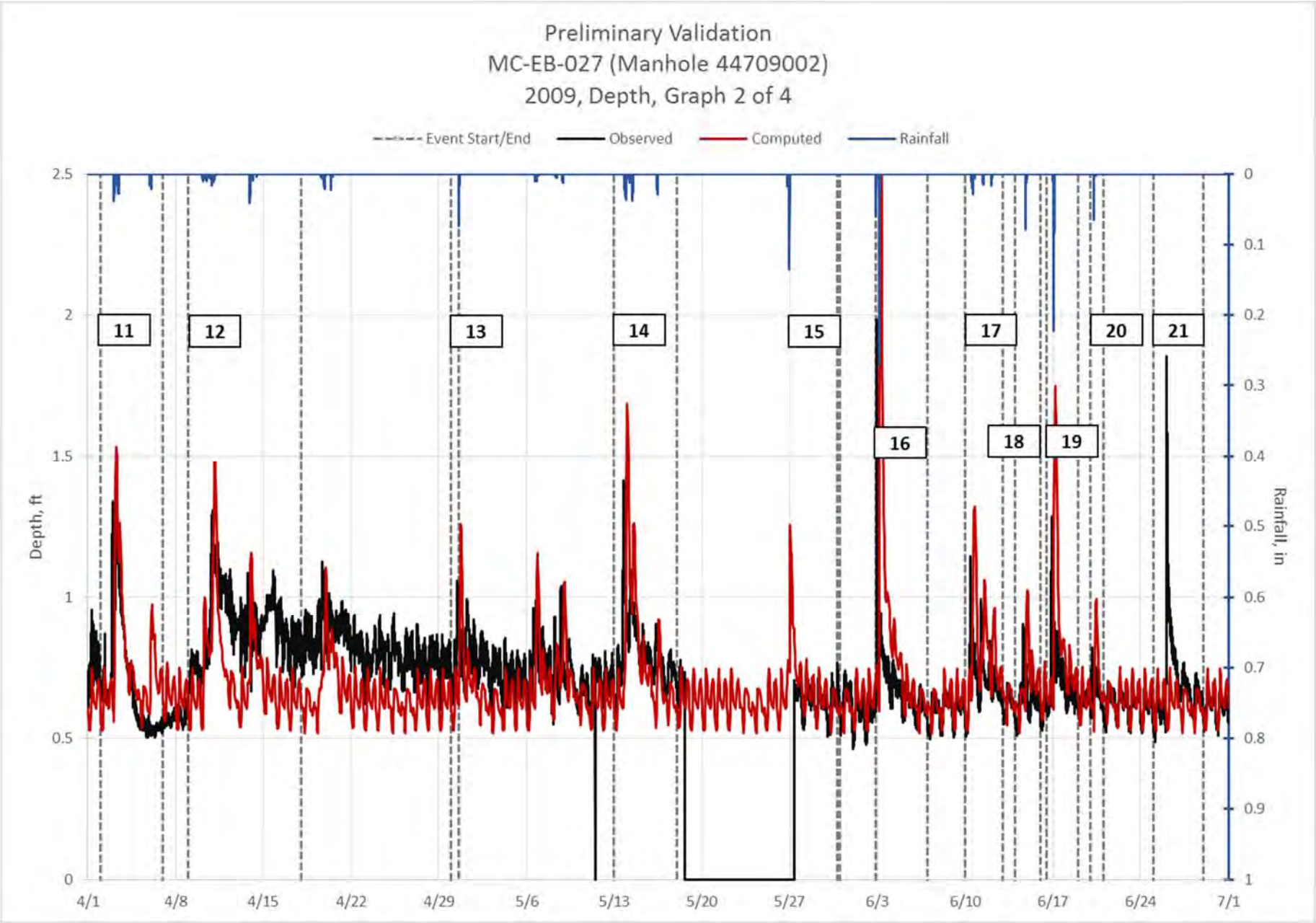
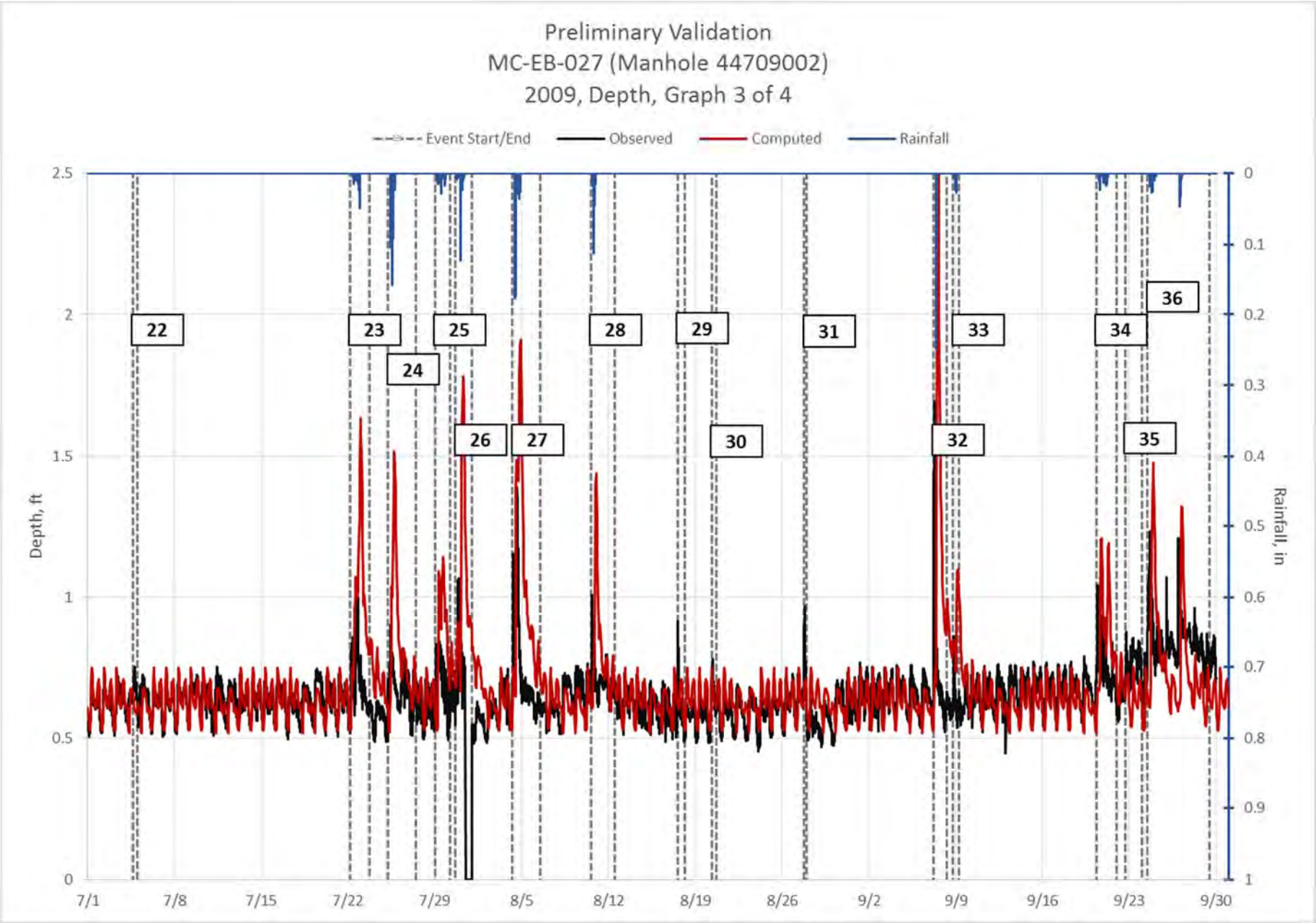
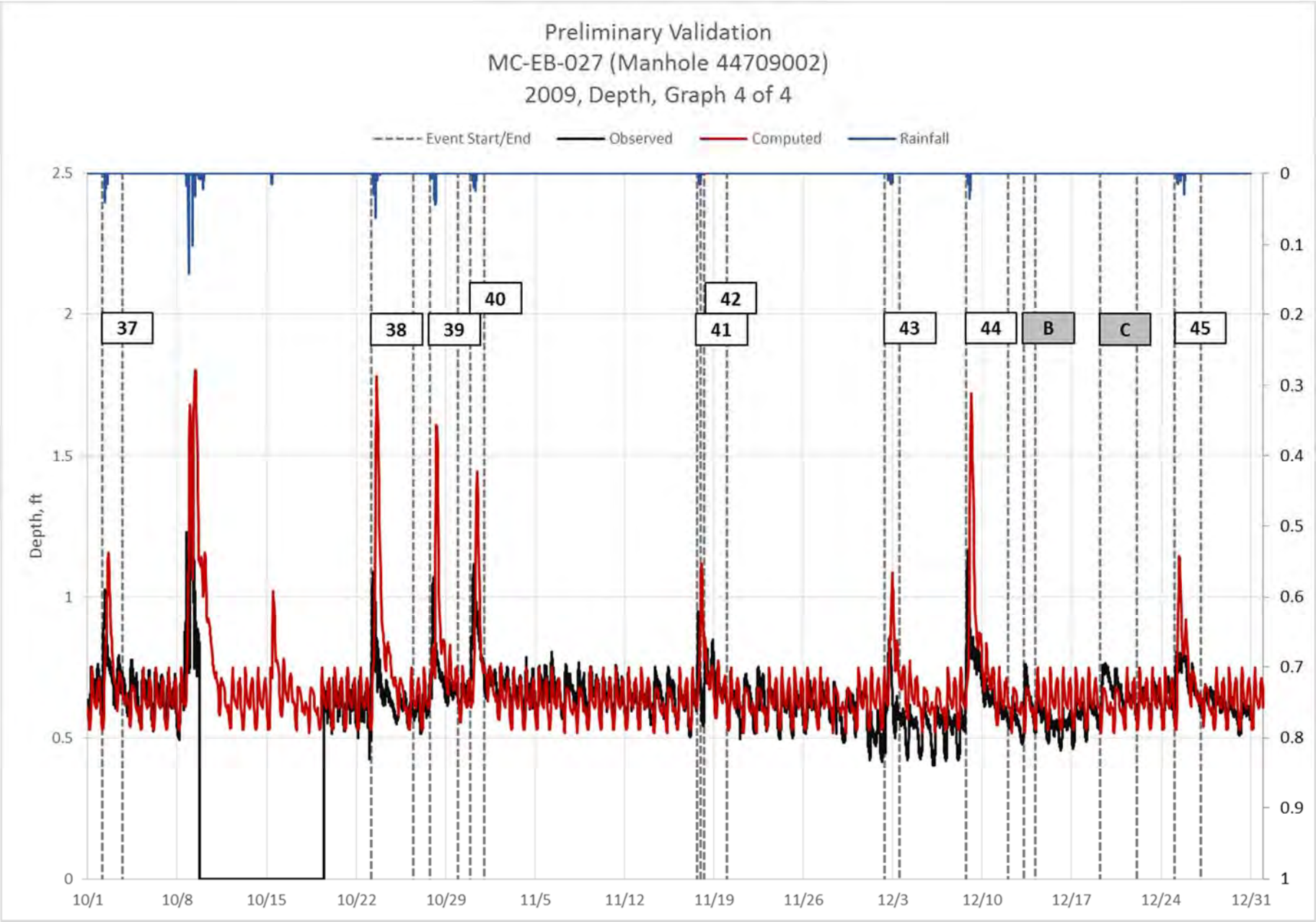
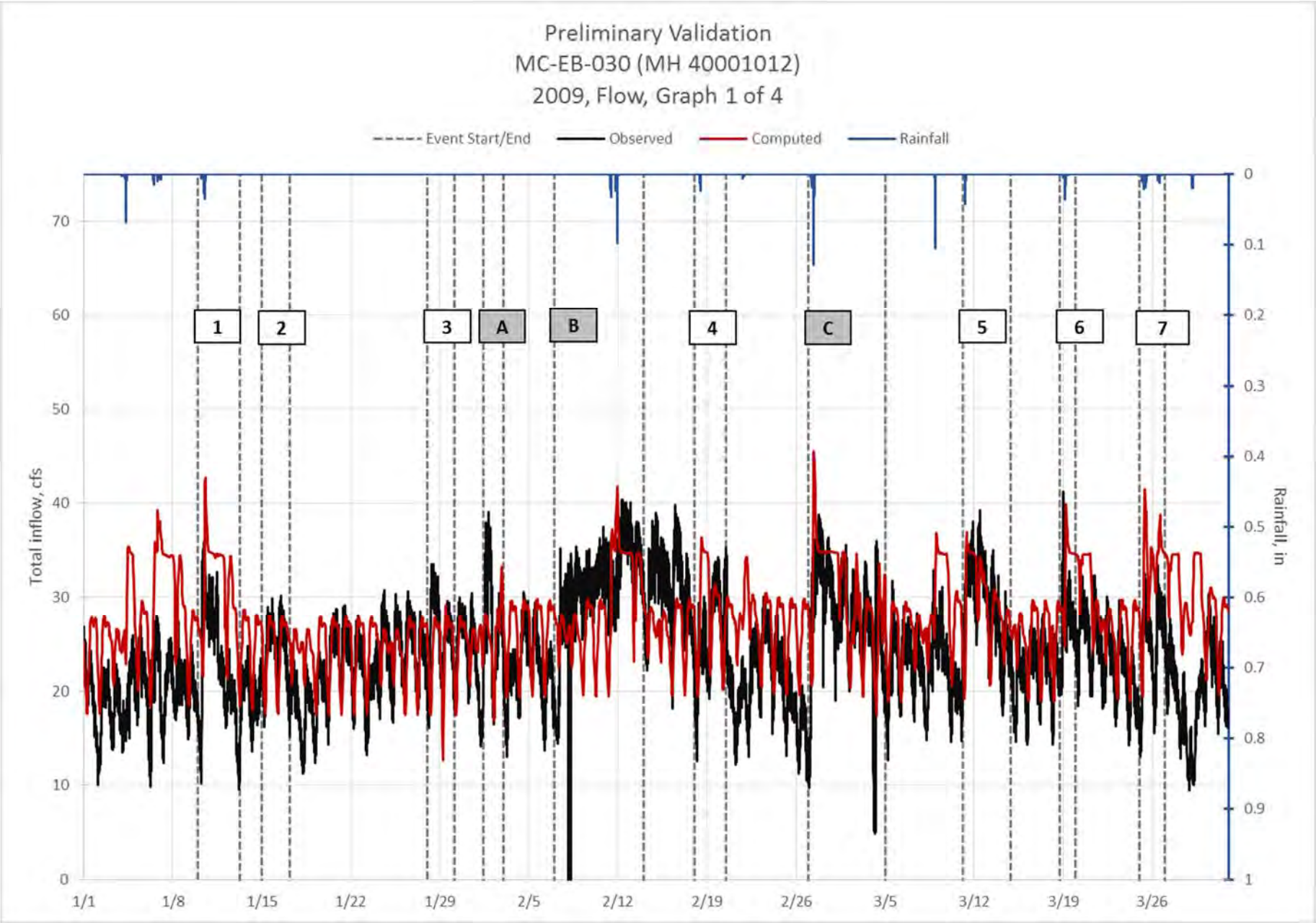
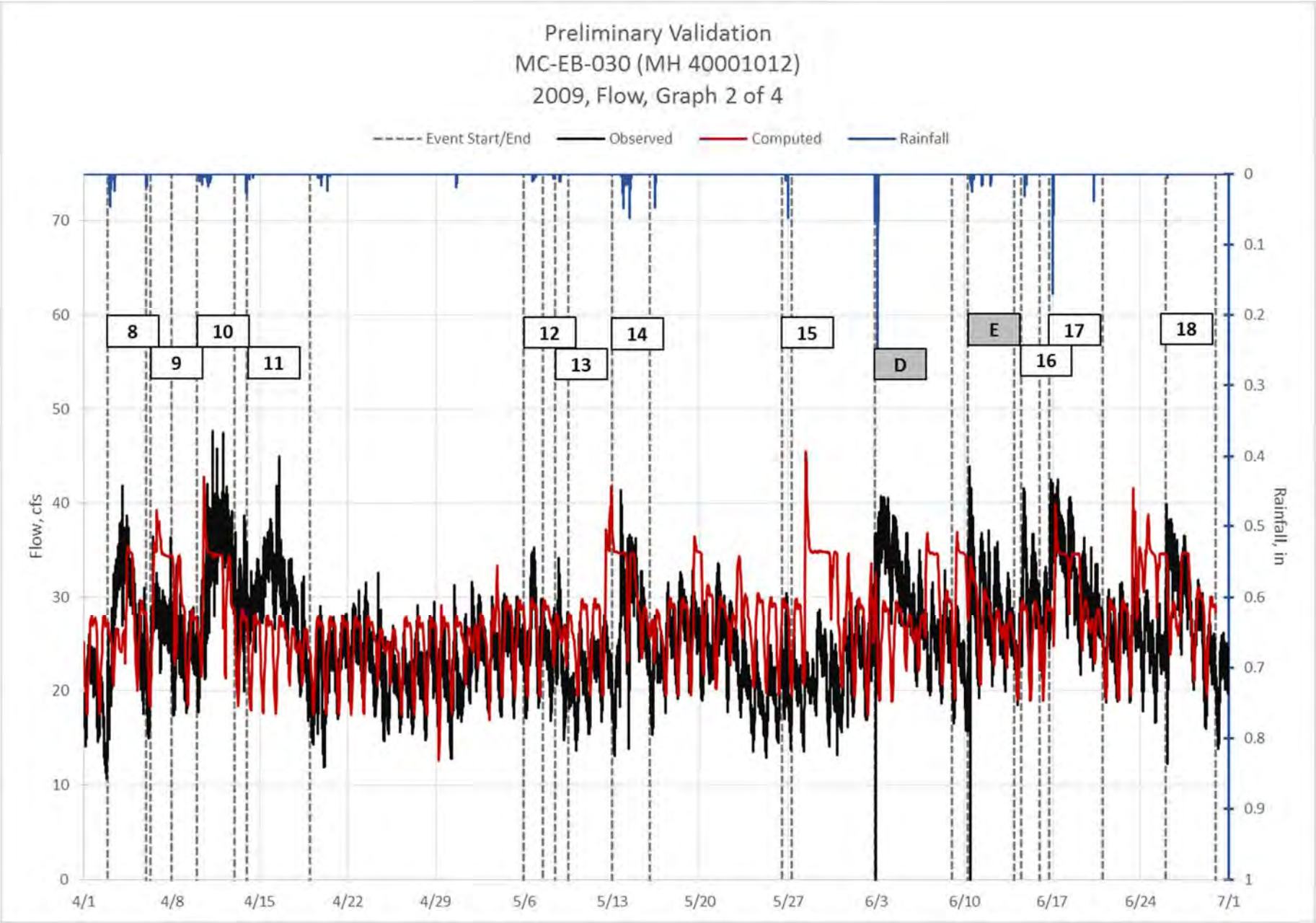
2/12
2/19
2/26
3/5
3/12
3/19
3/26

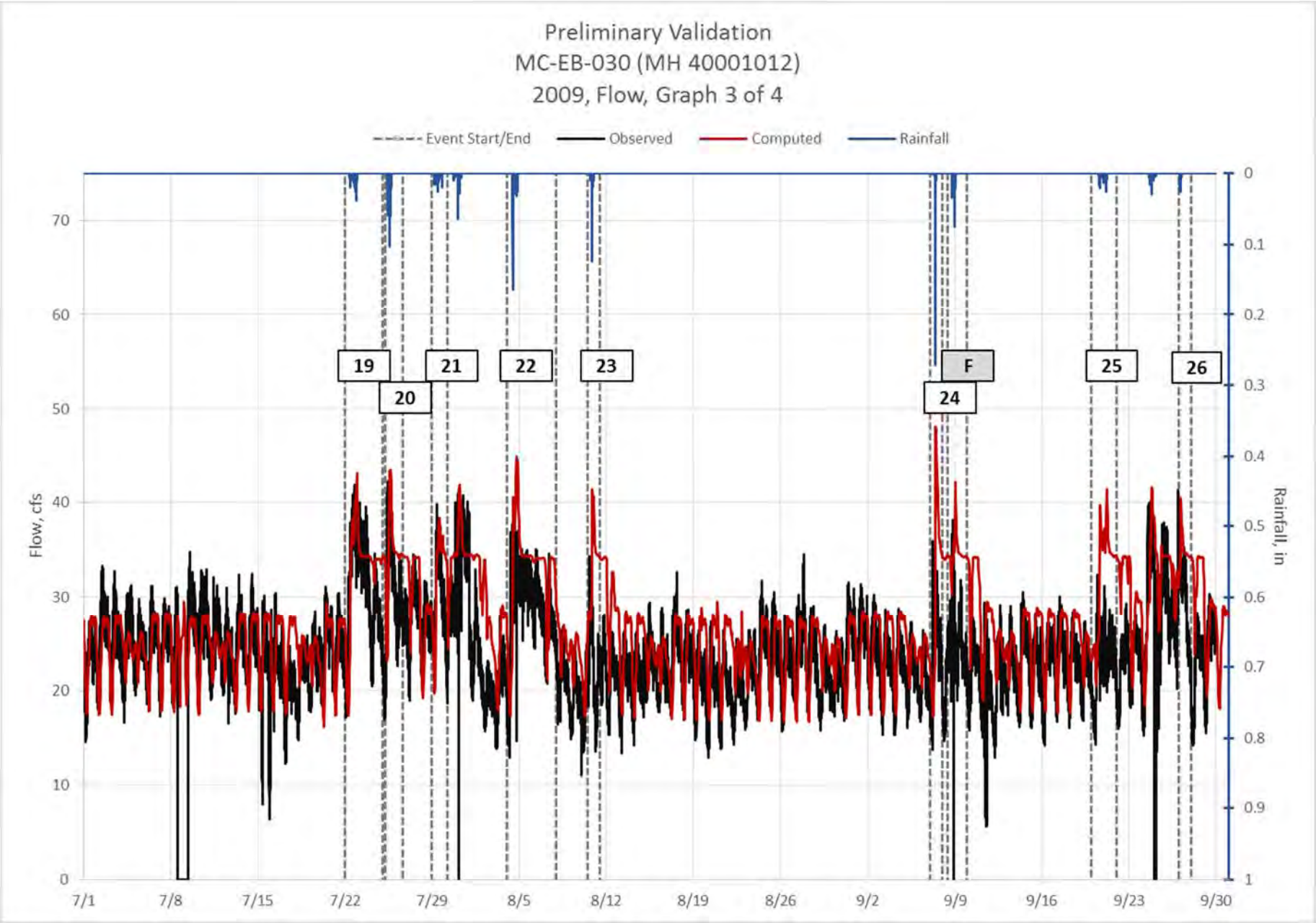

Preliminary Validation
MC-EB-027 (Manhole 44709002)
2009, Depth, Graph 2 of 4
Event Start/End
Observed
Computed
Rainfall
Depth, ft
Rainfall, in
2.5
2
1.5
1
0.5
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
11
12
13
14
15
16
17
18
19
20
21
4/1
4/8
4/15
4/22
4/29
5/6
5/13
5/20
5/27
6/3
6/10
6/17
6/24
7/1

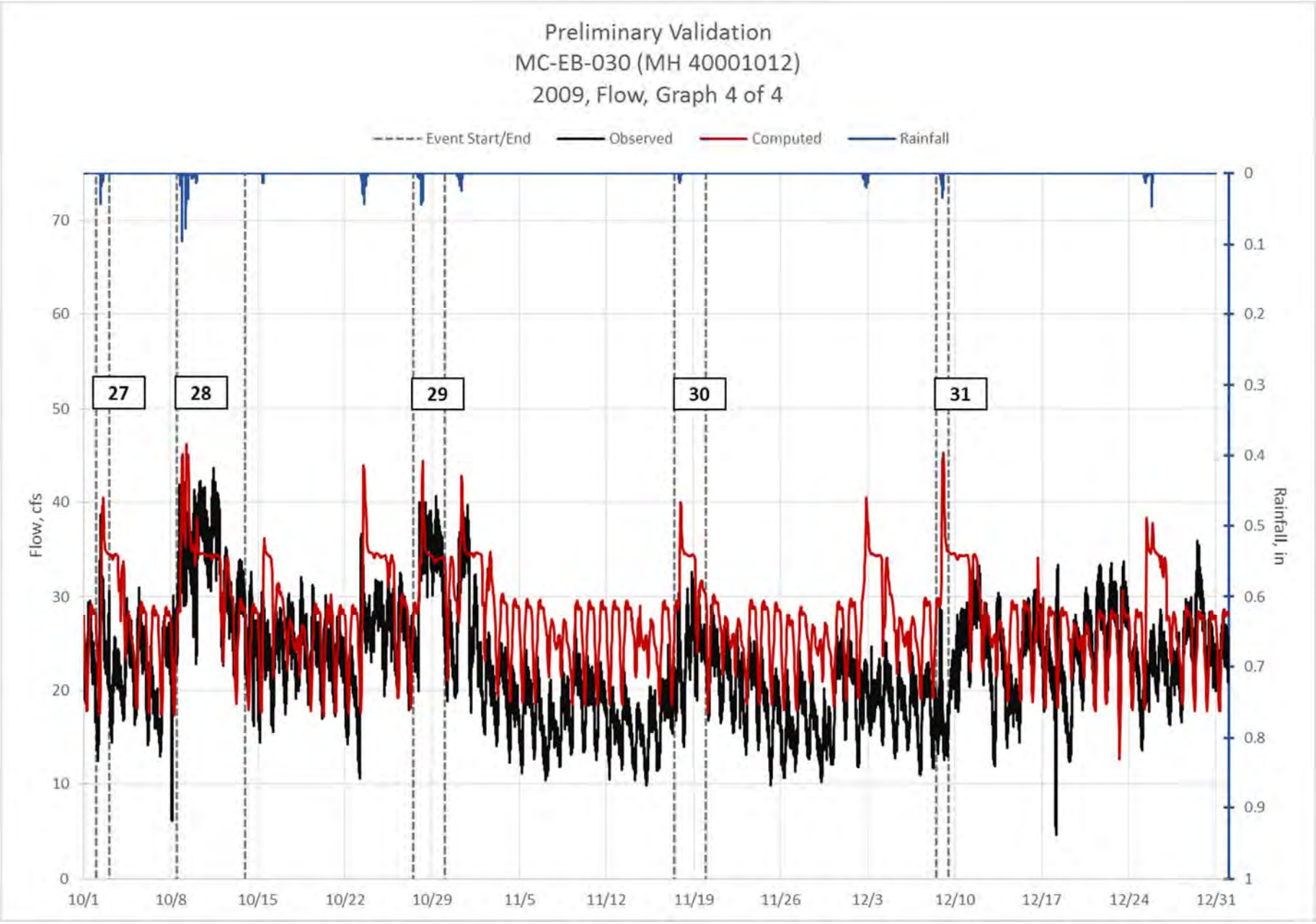

Preliminary Validation
MC-EB-027 (Manhole 44709002)
2009, Depth, Graph 3 of 4
Event Start/End
Observed
Computed
Rainfall
Depth, ft
Rainfall, in
2.5
2
1.5
1
0.5
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
7/1
7/8
7/15
7/22
7/29
8/5
8/12
8/19
8/26
9/2
9/9
9/16
9/23
9/30
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36

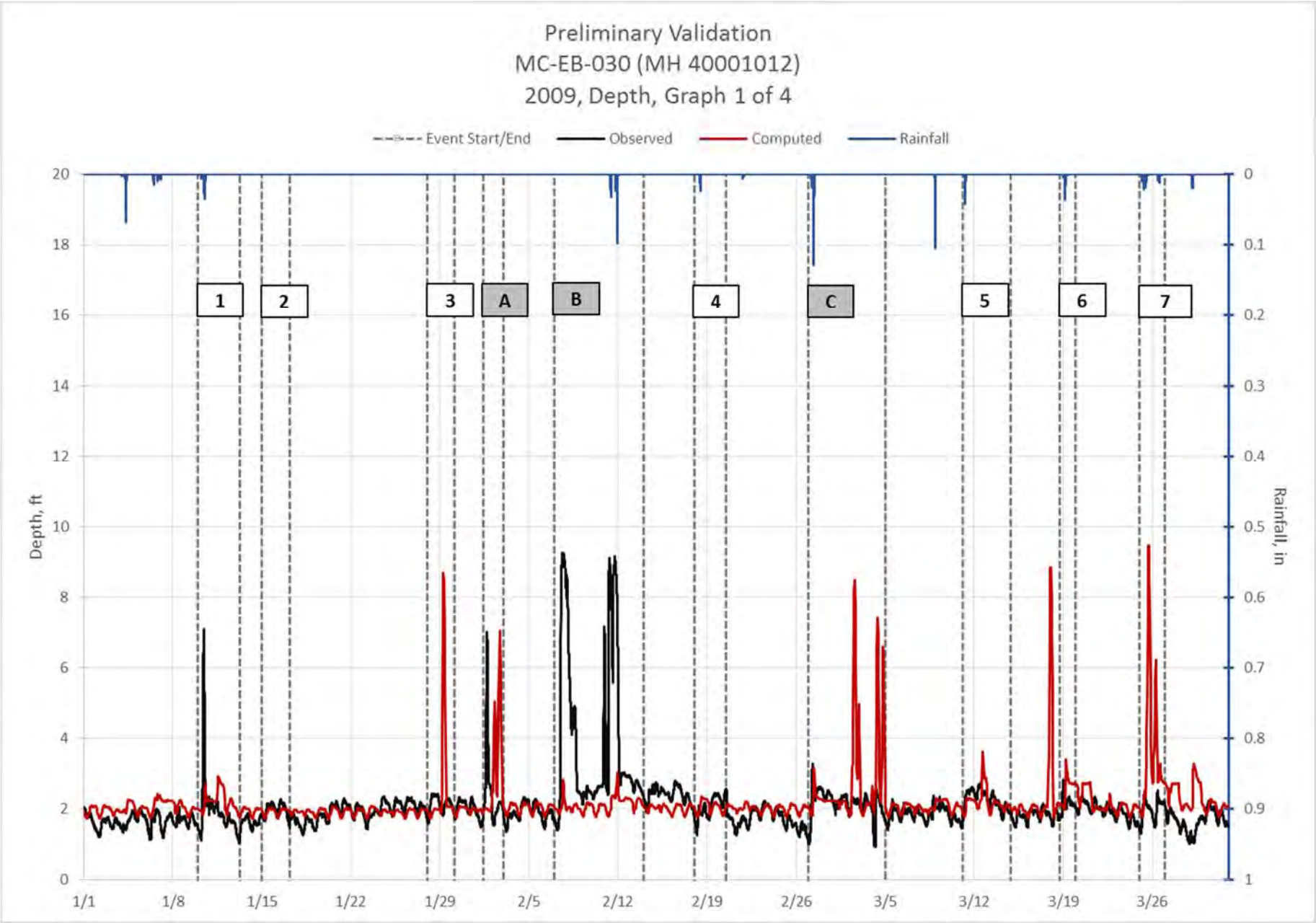

Preliminary Validation
MC-EB-027 (Manhole 44709002)
2009, Depth, Graph 4 of 4
Event Start/End
Observed
Computed
Rainfall
Depth, ft
2.5
2
1.5
1
0.5
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
37
38
39
40
41
42
43
44
B
C
45
10/1
10/8
10/15
10/22
10/29
11/5
11/12
11/19
11/26
12/3
12/10
12/17
12/24
12/31

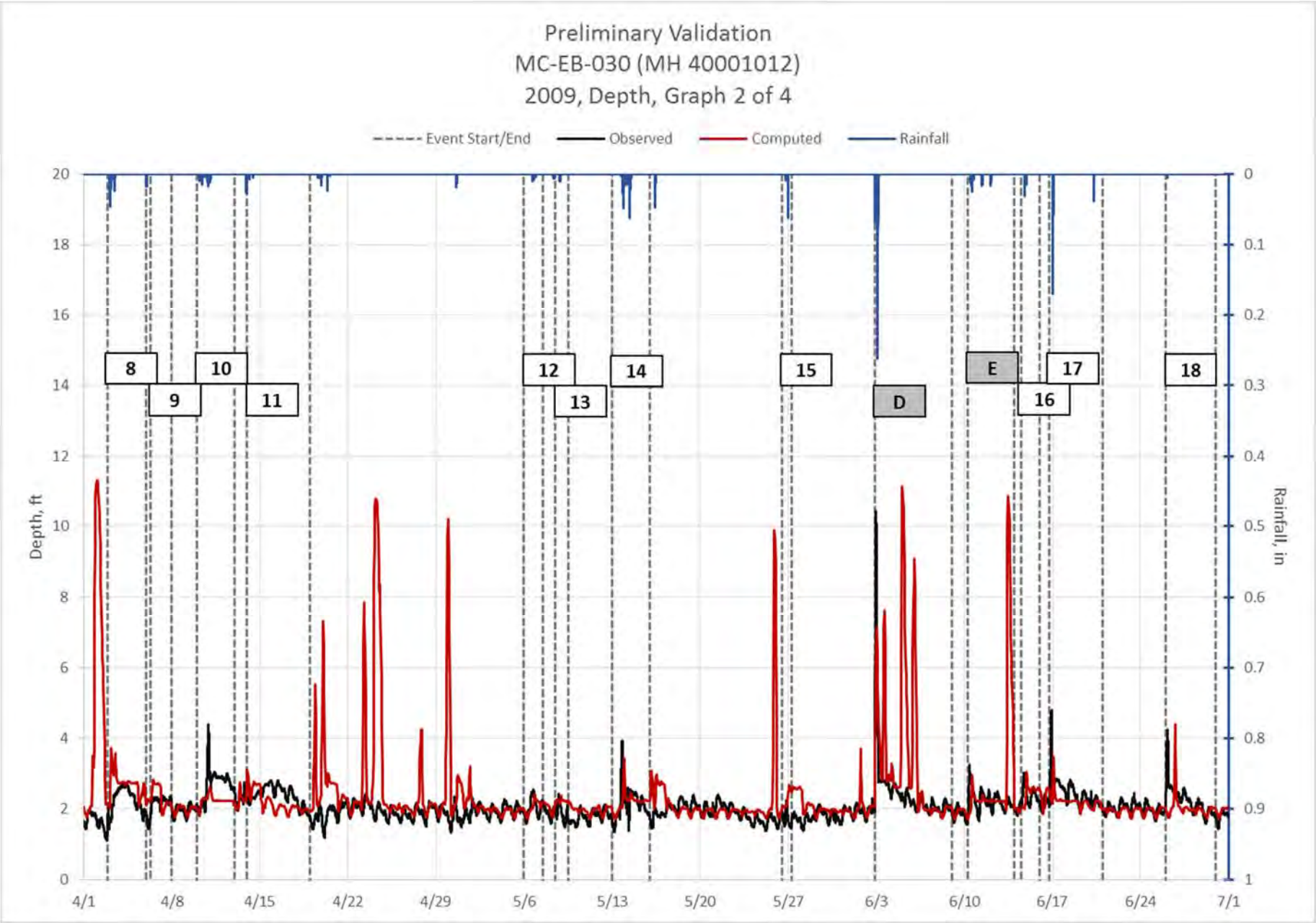

Preliminary Validation
MC-EB-030 (MH 40001012)
2009, Flow, Graph 1 of 4
Event Start/End
Observed
Computed
Rainfall
Total inflow, cfs
Rainfall, in
0
10
20
30
40
50
60
70
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1
2
3
A
B
4
C
5
6
7
1/1
1/8
1/15
1/22
1/29
2/5
2/12
2/19
2/26
3/5
3/12
3/19
3/26

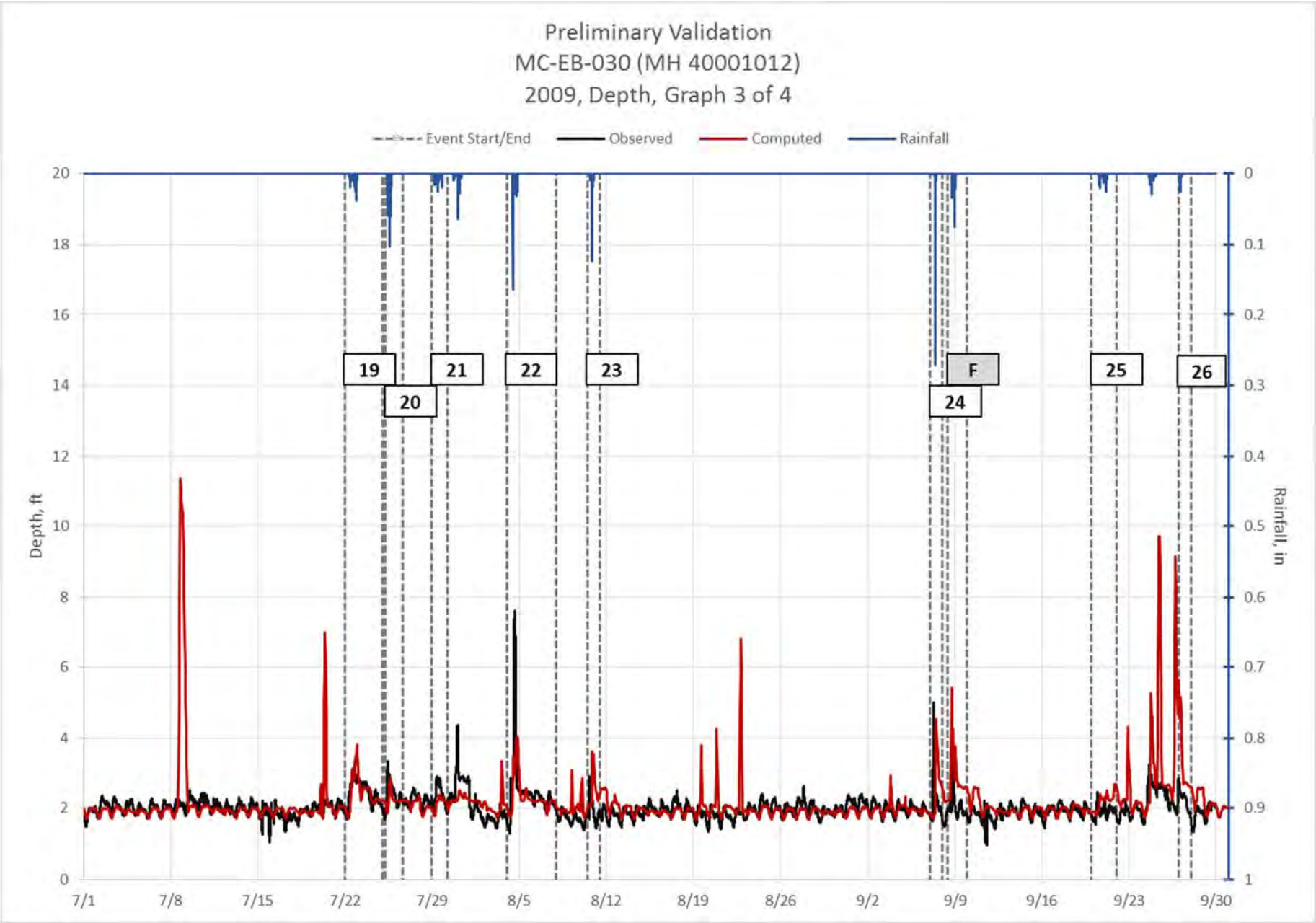

Preliminary Validation
MC-EB-030 (MH 40001012)
2009, Flow, Graph 2 of 4
Event Start/End
Observed
Computed
Rainfall
Flow, cfs
Rainfall, in
8
9
10
11
12
13
14
15
D
E
16
17
18
0
10
20
30
40
50
60
70
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
4/1
4/8
4/15
4/22
4/29
5/6
5/13
5/20
5/27
6/3
6/10
6/17
6/24
7/1

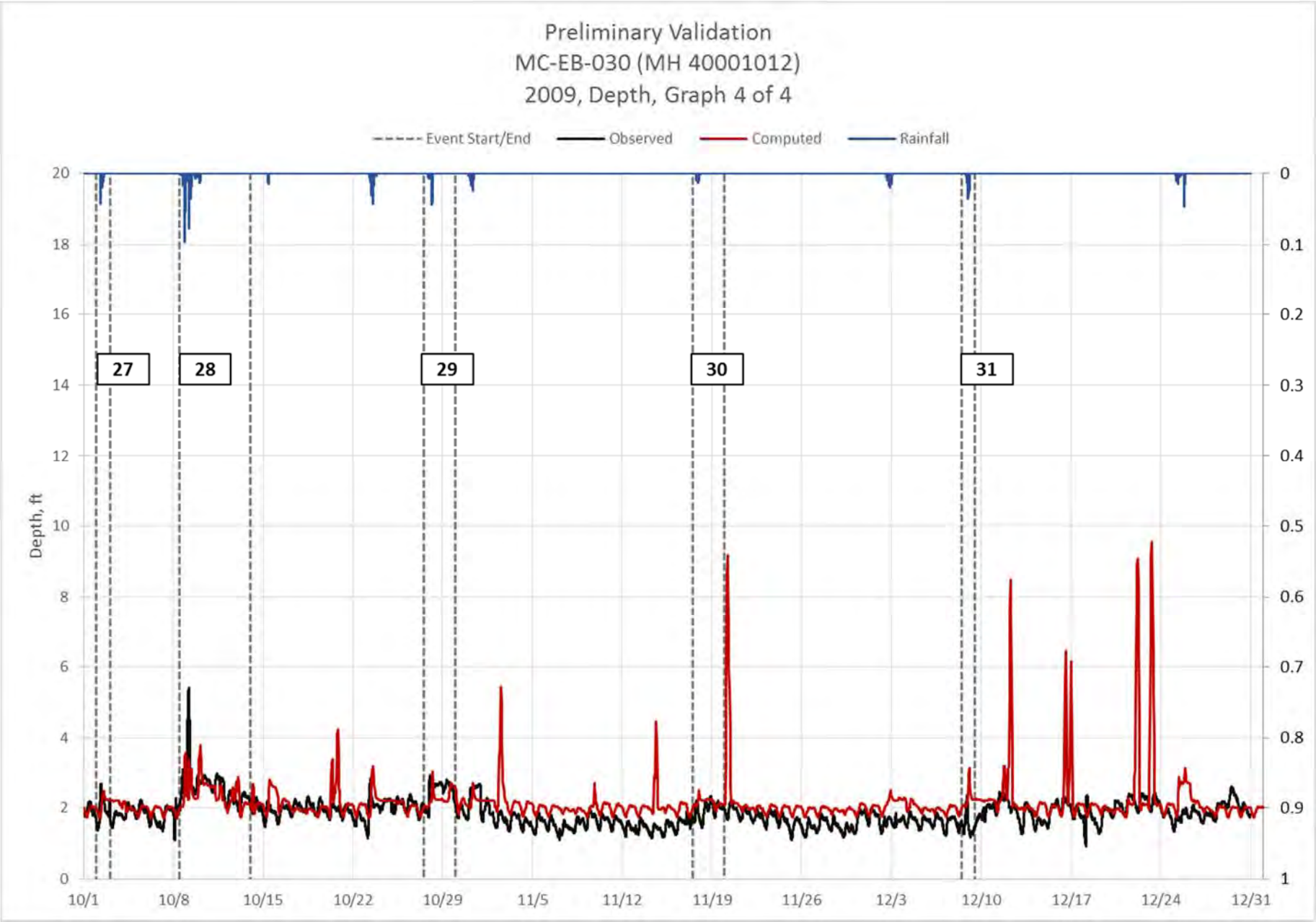

Preliminary Validation
MC-EB-030 (MH 40001012)
2009, Flow, Graph 3 of 4
Event Start/End
Observed
Computed
Rainfall
Flow, cfs
Rainfall, in
19
20
21
22
23
24
F
25
26
0
10
20
30
40
50
60
70
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
7/1
7/8
7/15
7/22
7/29
8/5
8/12
8/19
8/26
9/2
9/9
9/16
9/23
9/30

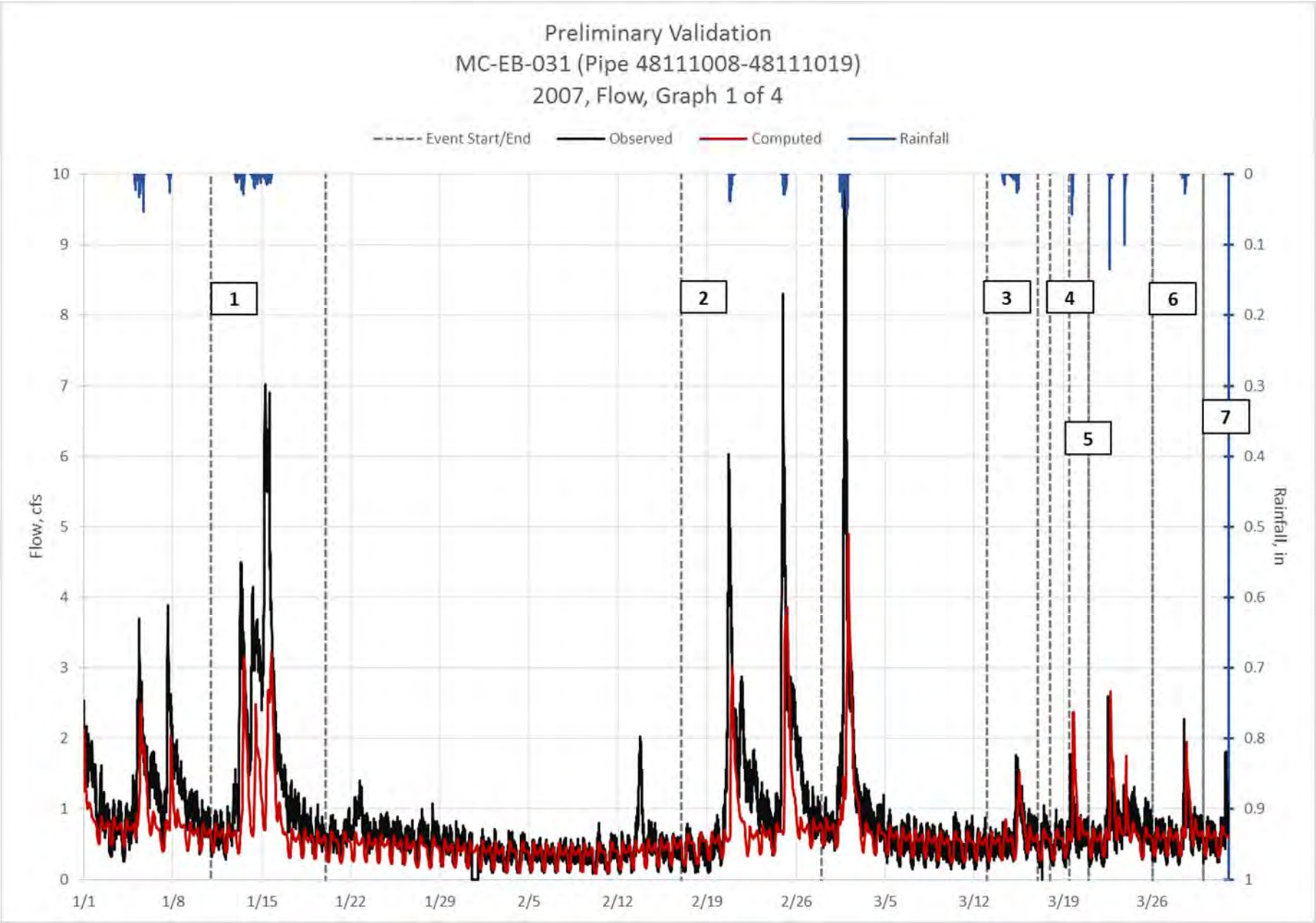

Preliminary Validation
MC-EB-030 (MH 40001012)
2009, Flow, Graph 4 of 4
Event Start/End
Observed
Computed
Rainfall
Flow, cfs
Rainfall, in
27
28
29
30
31
0
10
20
30
40
50
60
70
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
10/1
10/8
10/15
10/22
10/29
11/5
11/12
11/19
11/26
12/3
12/10
12/17
12/24
12/31

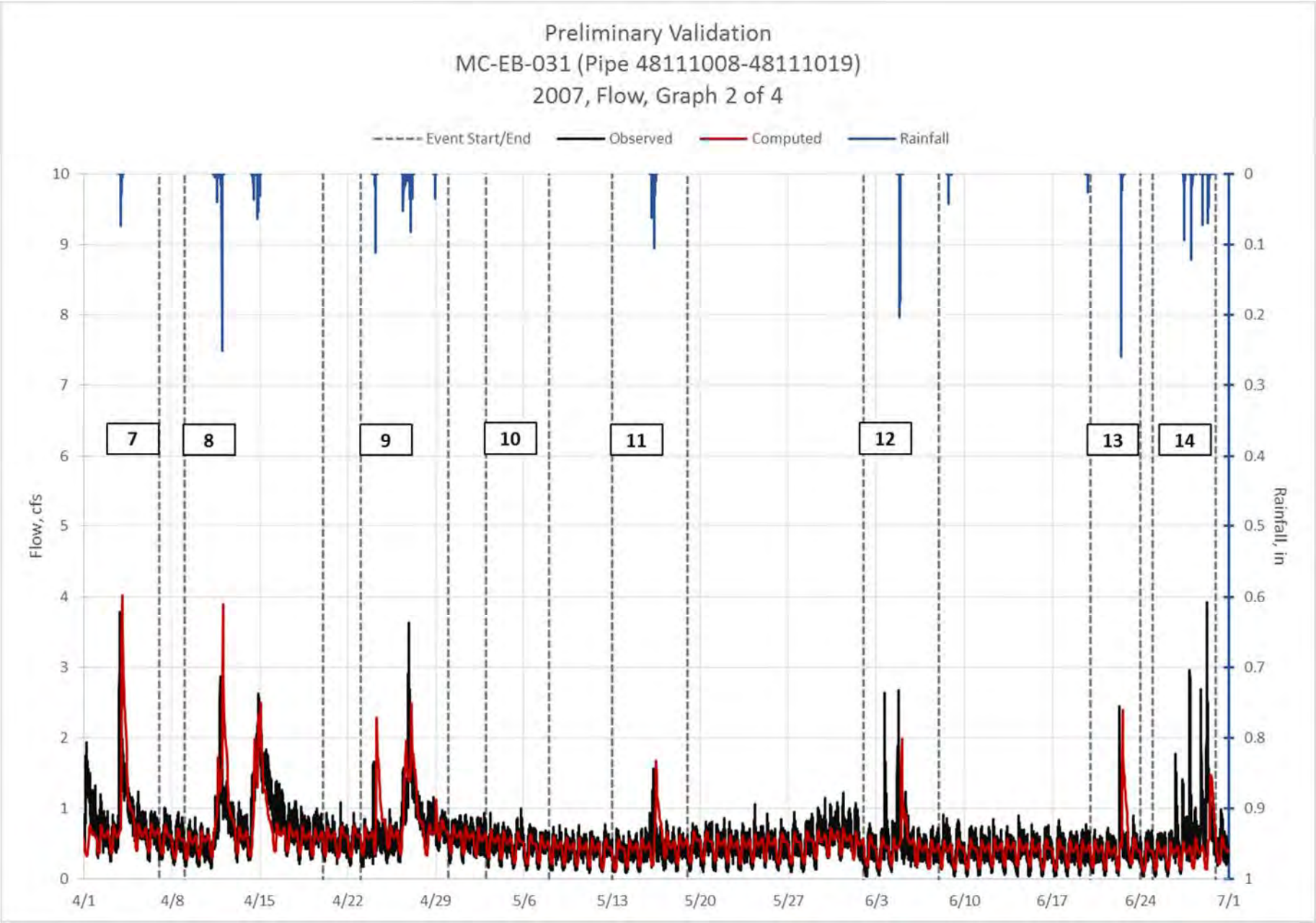

Preliminary Validation
MC-EB-030 (MH 40001012)
2009, Depth, Graph 1 of 4
Event Start/End
Observed
Computed
Rainfall
Depth, ft
Rainfall, in
1
2
3
A
B
4
C
5
6
7
20
18
16
14
12
10
8
6
4
2
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1/1
1/8
1/15
1/22
1/29
2/5
2/12
2/19
2/26
3/5
3/12
3/19
3/26

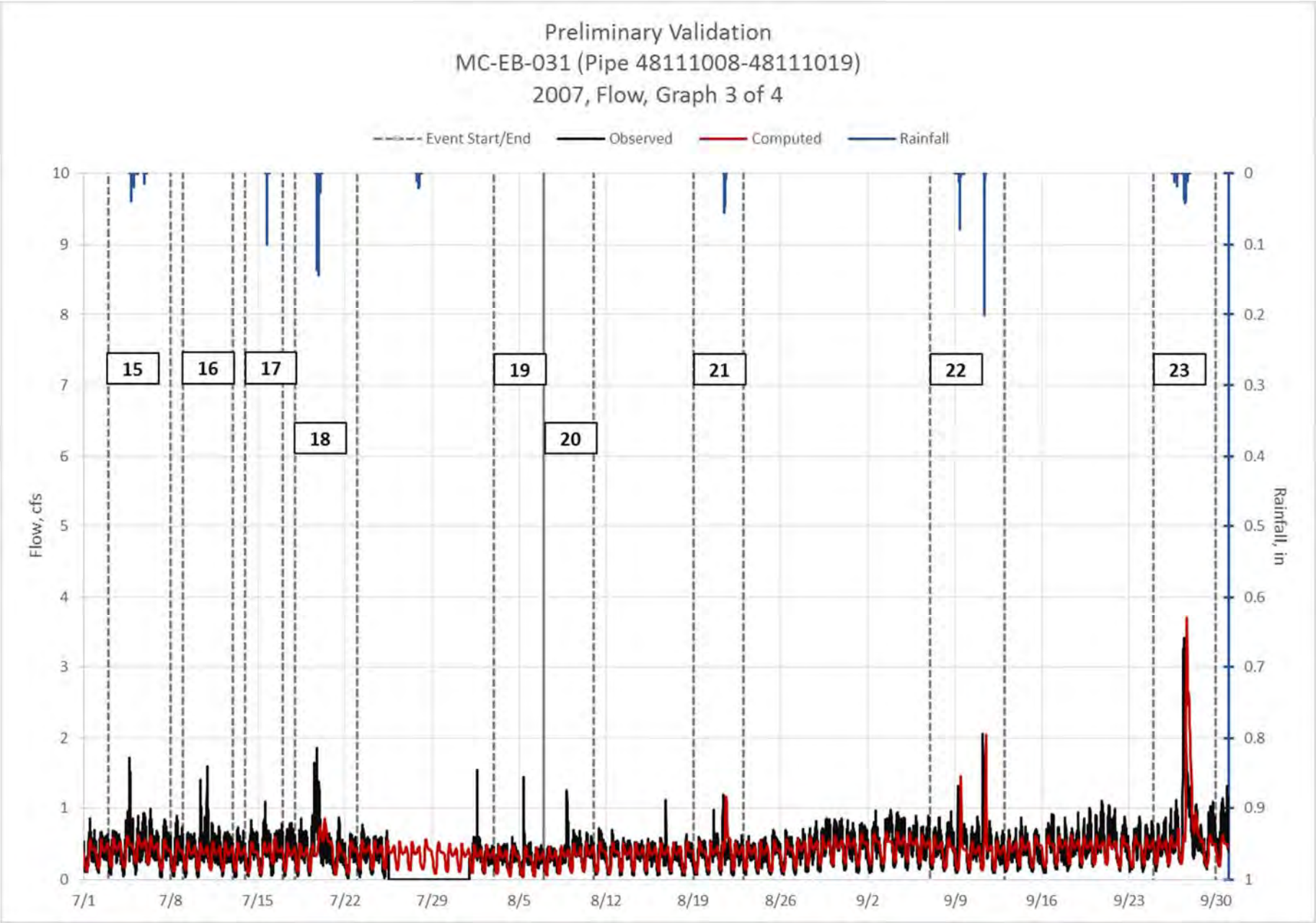

Preliminary Validation
MC-EB-030 (MH 40001012)
2009, Depth, Graph 2 of 4
Event Start/End
Observed
Computed
Rainfall
Depth, ft
Rainfall, in
8
9
10
11
12
13
14
15
D
E
16
17
18
4/1
4/8
4/15
4/22
4/29
5/6
5/13
5/20
5/27
6/3
6/10
6/17
6/24
7/1

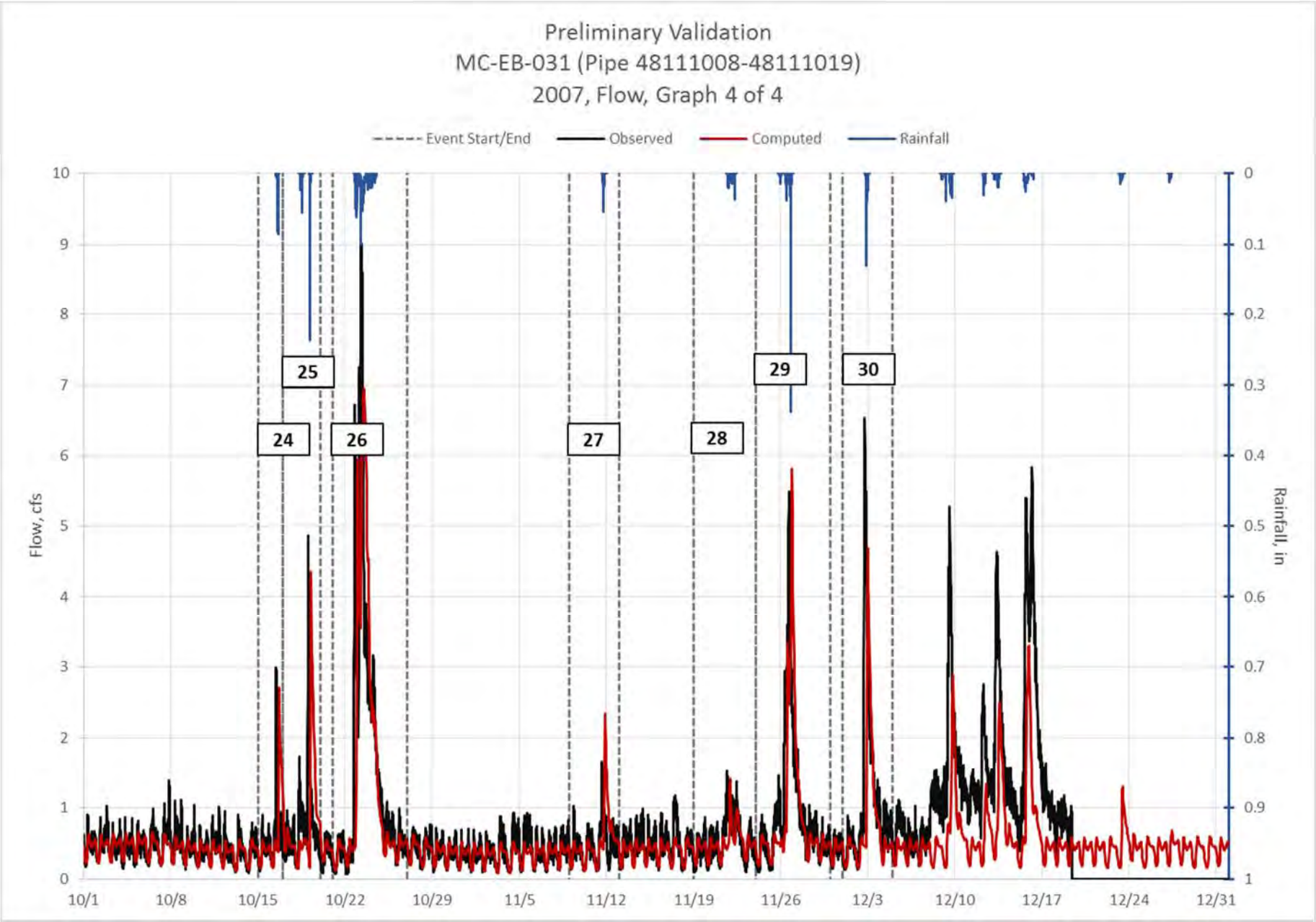

Preliminary Validation
MC-EB-030 (MH 40001012)
2009, Depth, Graph 3 of 4
Event Start/End
Observed
Computed
Rainfall
Depth, ft
Rainfall, in
19
20
21
22
23
24
F
25
26
7/1
7/8
7/15
7/22
7/29
8/5
8/12
8/19
8/26
9/2
9/9
9/16
9/23
9/30

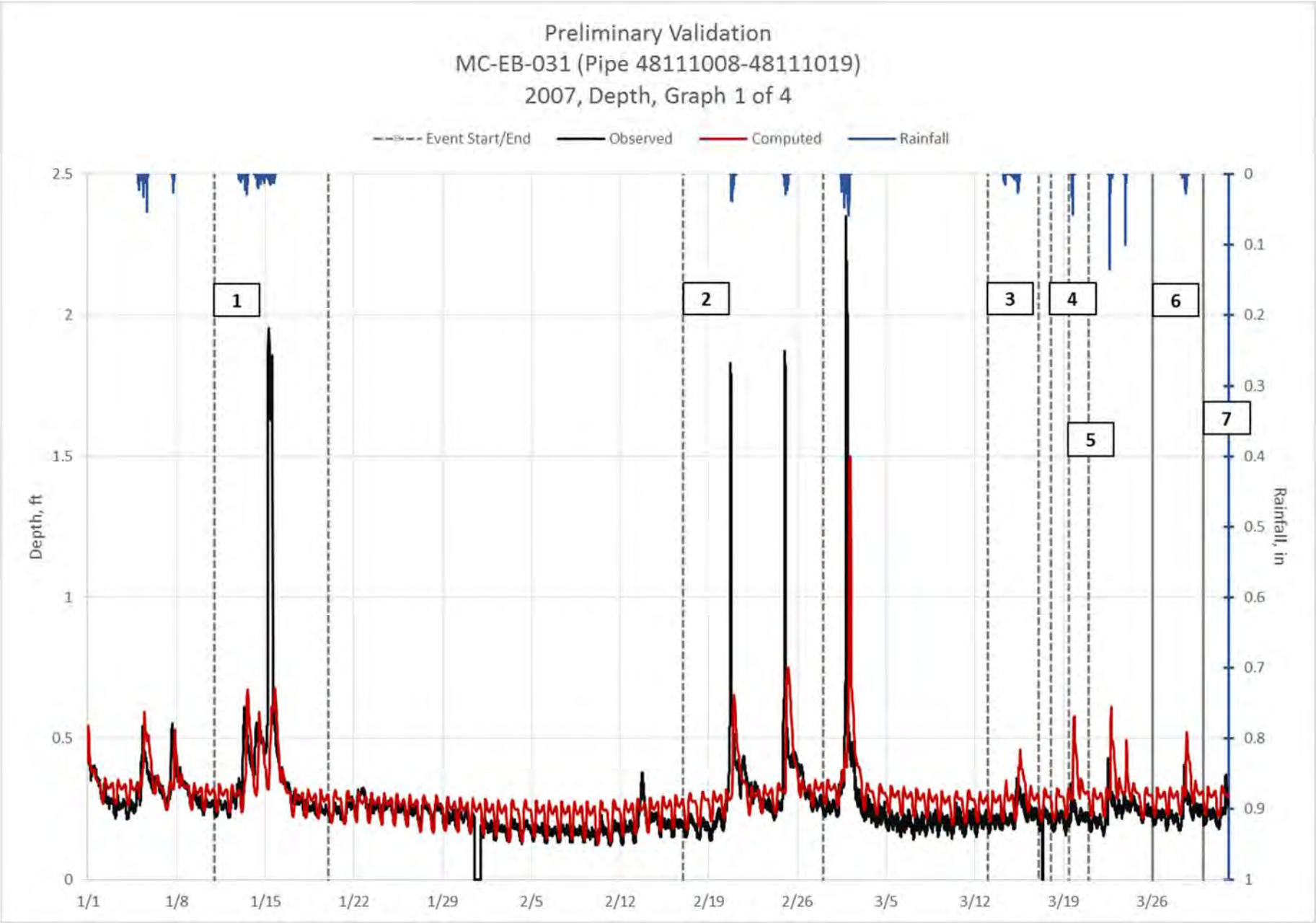

Preliminary Validation
MC-EB-030 (MH 40001012)
2009, Depth, Graph 4 of 4
Event Start/End
Observed
Computed
Rainfall
Depth, ft
27
28
29
30
31
20
18
16
14
12
10
8
6
4
2
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
10/1
10/8
10/15
10/22
10/29
11/5
11/12
11/19
11/26
12/3
12/10
12/17
12/24
12/31

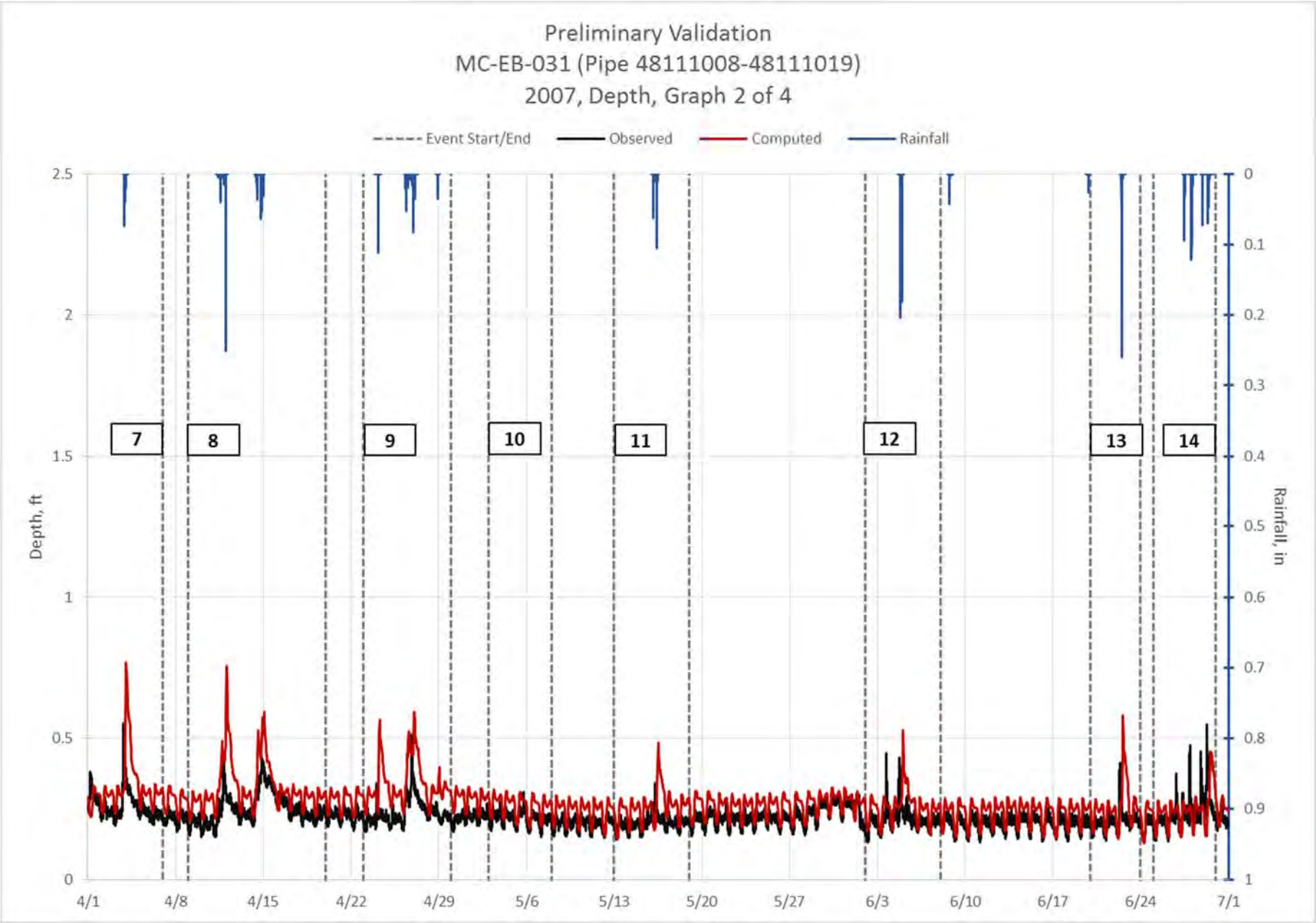

Preliminary Validation
MC-EB-031 (Pipe 48111008-48111019)
2007, Flow, Graph 1 of 4
Event Start/End
Observed
Computed
Rainfall
Flow, cfs
Rainfall, in
1
2
3
4
5
6
7
1/1
1/8
1/15
1/22
1/29
2/5
2/12
2/19
2/26
3/5
3/12
3/19
3/26

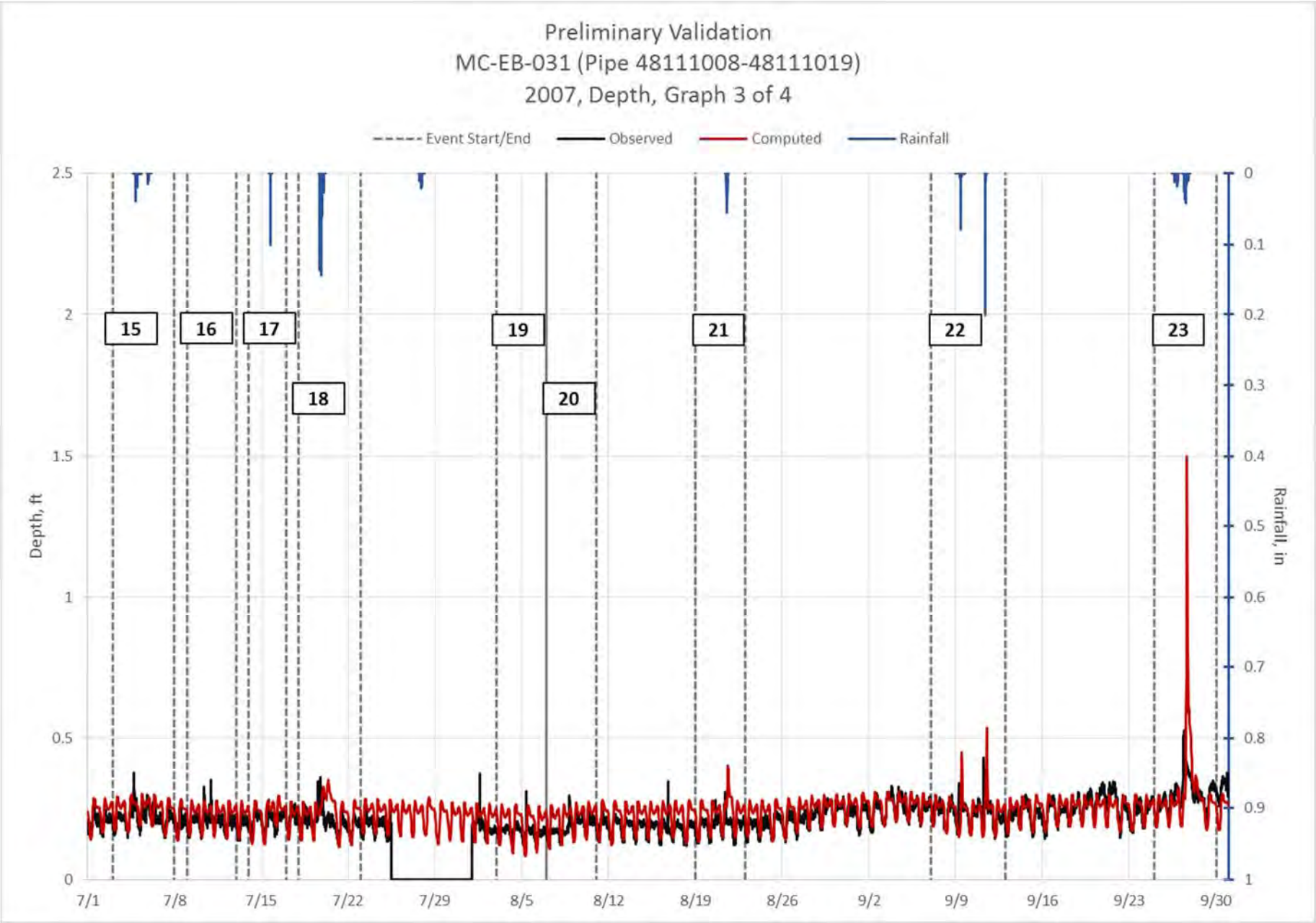

Preliminary Validation
MC-EB-031 (Pipe 48111008-48111019)
2007, Flow, Graph 2 of 4
Event Start/End
Observed
Computed
Rainfall
Flow, cfs
Rainfall, in
7
8
9
10
11
12
13
14
4/1
4/8
4/15
4/22
4/29
5/6
5/13
5/20
5/27
6/3
6/10
6/17
6/24
7/1

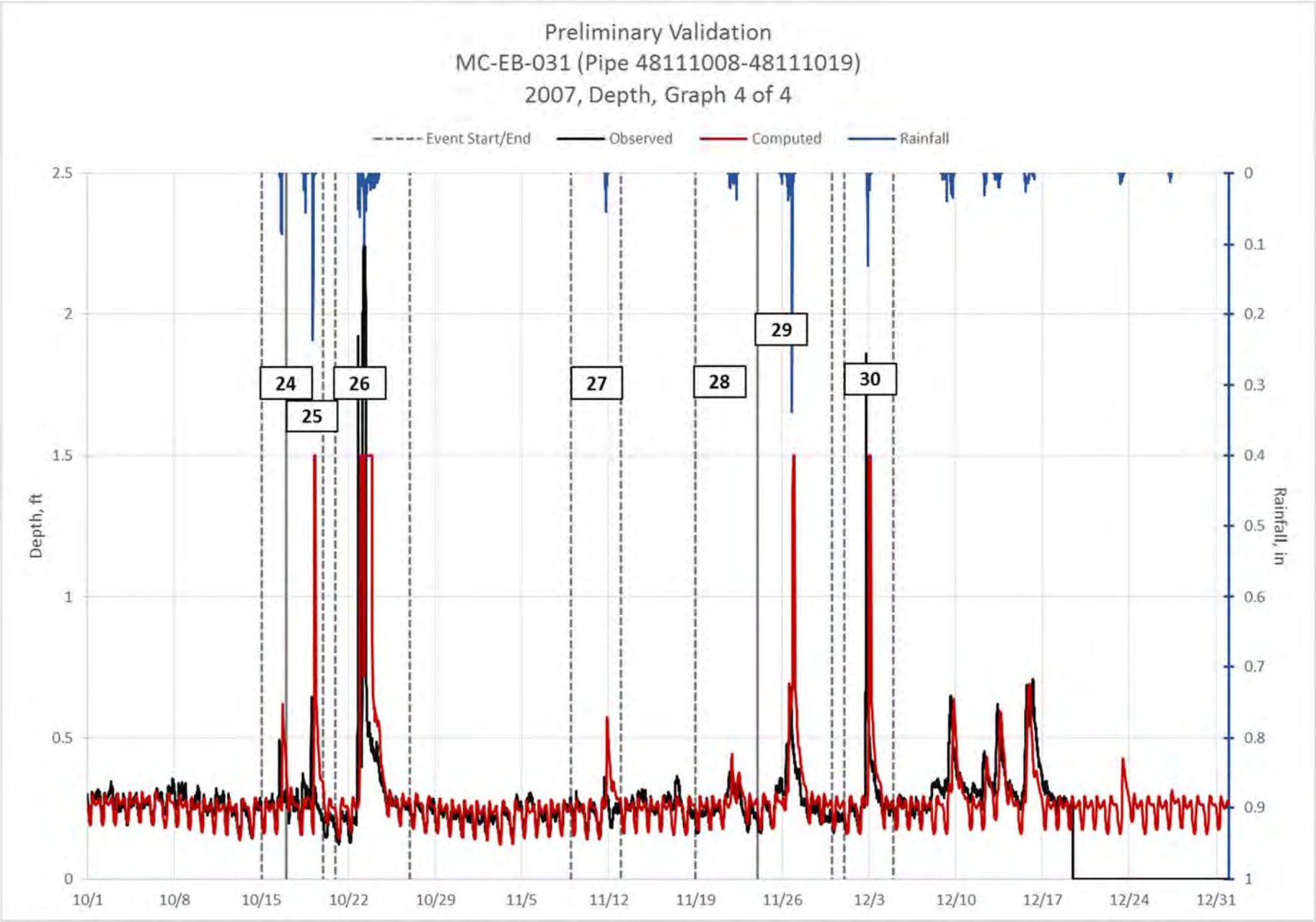

Preliminary Validation
MC-EB-031 (Pipe 48111008-48111019)
2007, Flow, Graph 3 of 4
Event Start/End
Observed
Computed
Rainfall
Flow, cfs
Rainfall, in
15
16
17
18
19
20
21
22
23
7/1
7/8
7/15
7/22
7/29
8/5
8/12
8/19
8/26
9/2
9/9
9/16
9/23
9/30

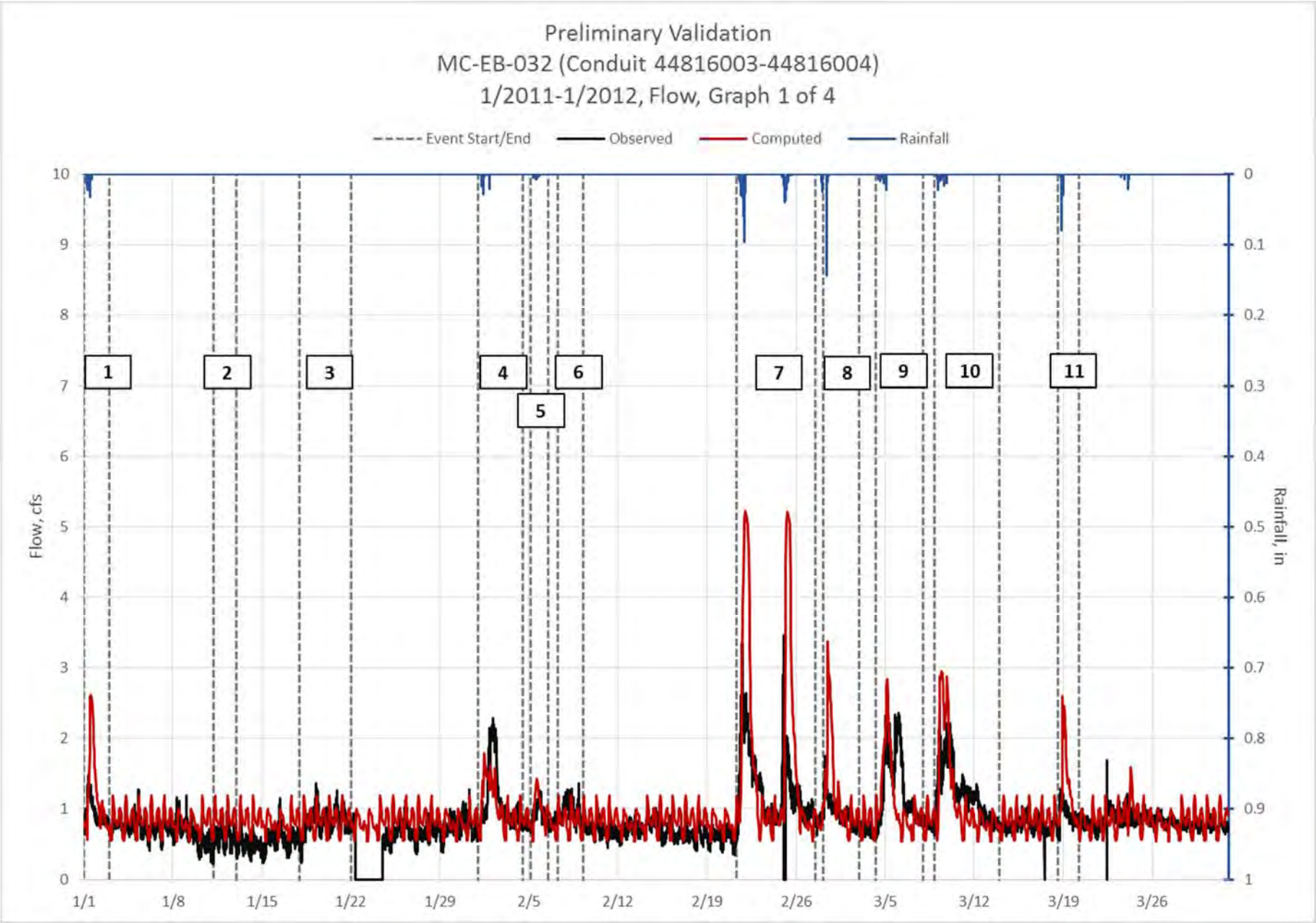

Preliminary Validation
MC-EB-031 (Pipe 48111008-48111019)
2007, Flow, Graph 4 of 4
Event Start/End
Observed
Computed
Rainfall
Flow, cfs
Rainfall, in
24
25
26
27
28
29
30
10/1
10/8
10/15
10/22
10/29
11/5
11/12
11/19
11/26
12/3
12/10
12/17
12/24
12/31

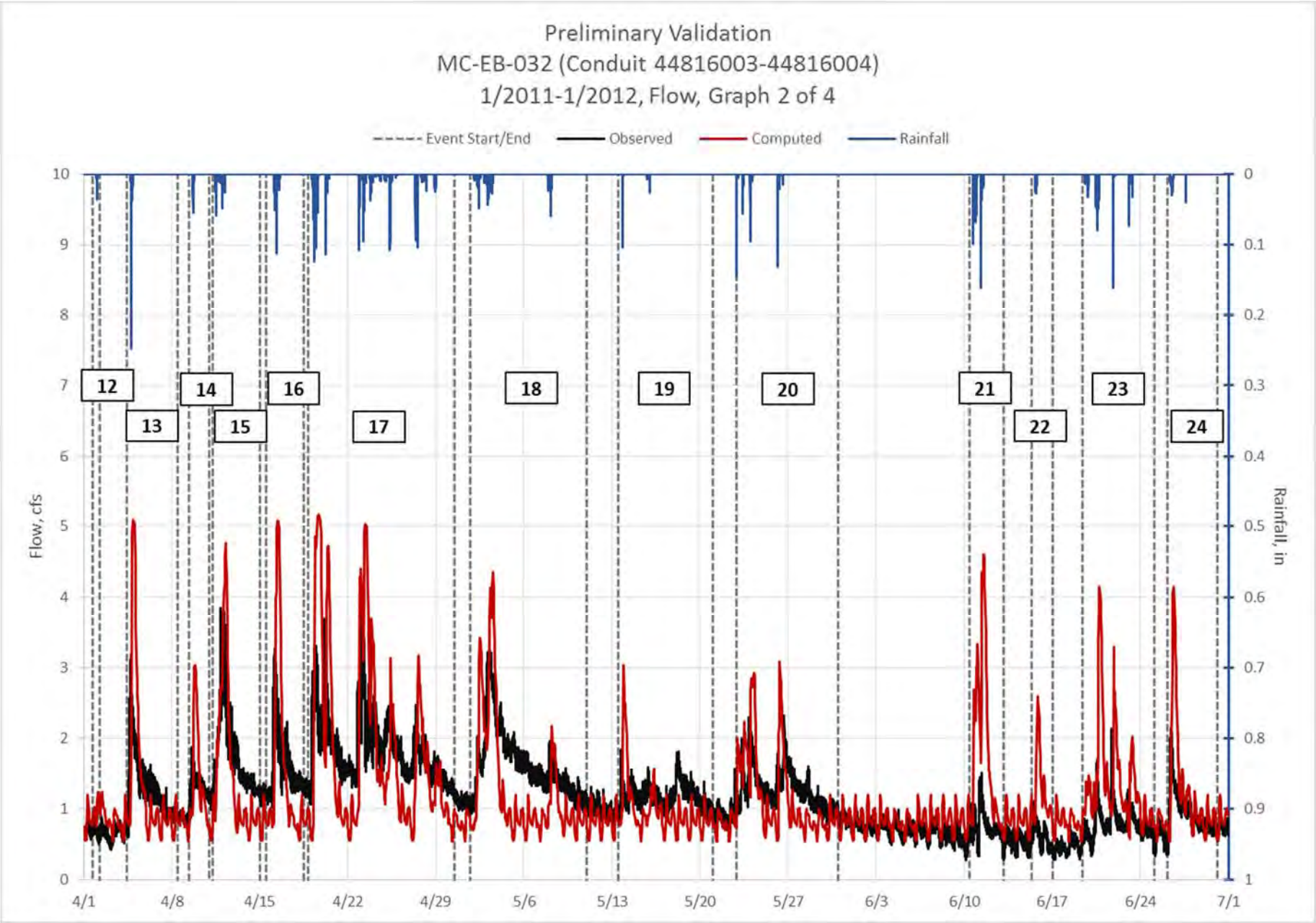

Preliminary Validation
MC-EB-031 (Pipe 48111008-48111019)
2007, Depth, Graph 1 of 4
Event Start/End
Observed
Computed
Rainfall
Depth, ft
Rainfall, in
2.5
2
1.5
1
0.5
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1/1
1/8
1/15
1/22
1/29
2/5
2/12
2/19
2/26
3/5
3/12
3/19
3/26
1
2
3
4
5
6
7

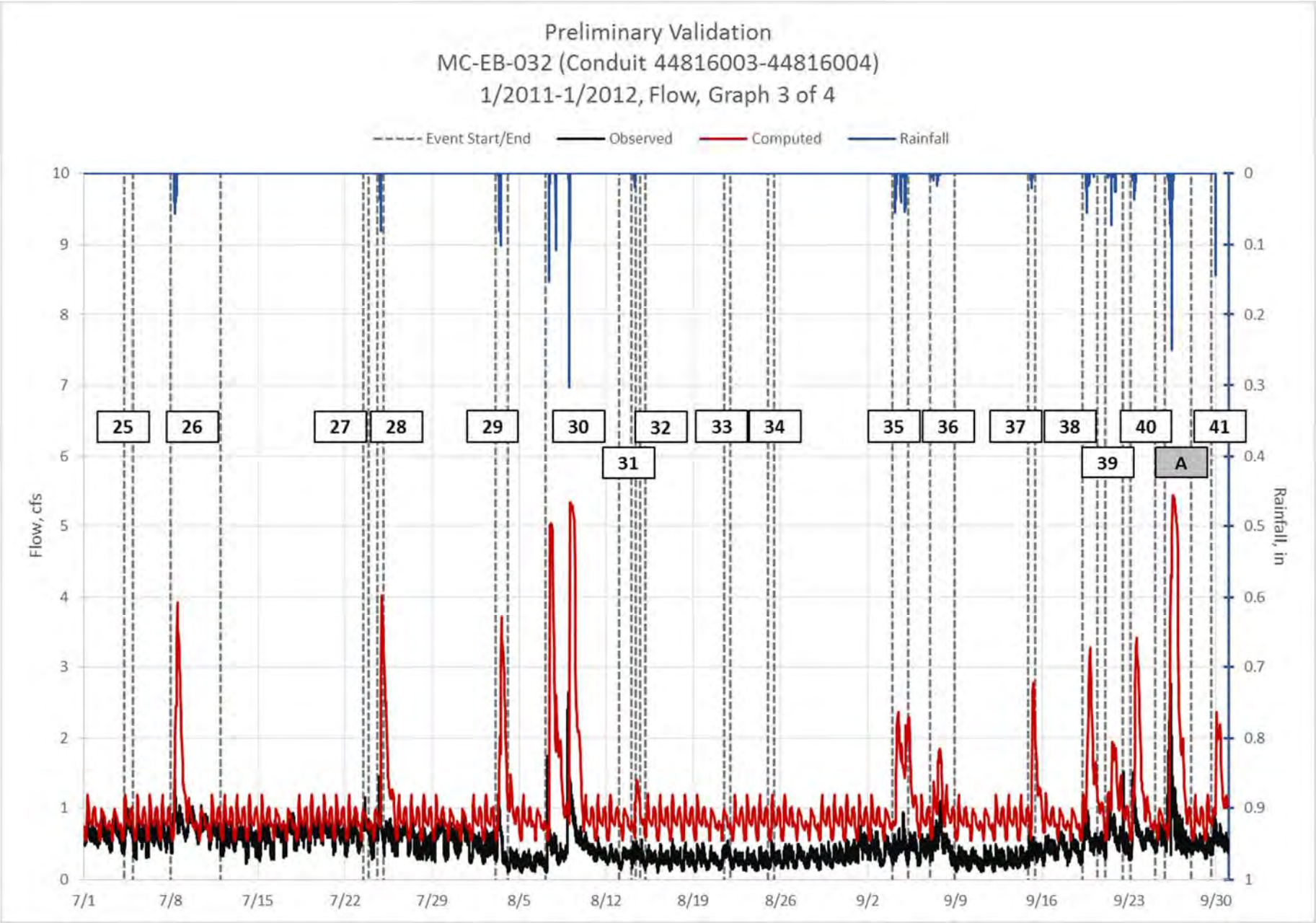

Preliminary Validation
MC-EB-031 (Pipe 48111008-48111019)
2007, Depth, Graph 2 of 4
Event Start/End
Observed
Computed
Rainfall
Depth, ft
Rainfall, in
2.5
2
1.5
1
0.5
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
7
8
9
10
11
12
13
14
4/1
4/8
4/15
4/22
4/29
5/6
5/13
5/20
5/27
6/3
6/10
6/17
6/24
7/1

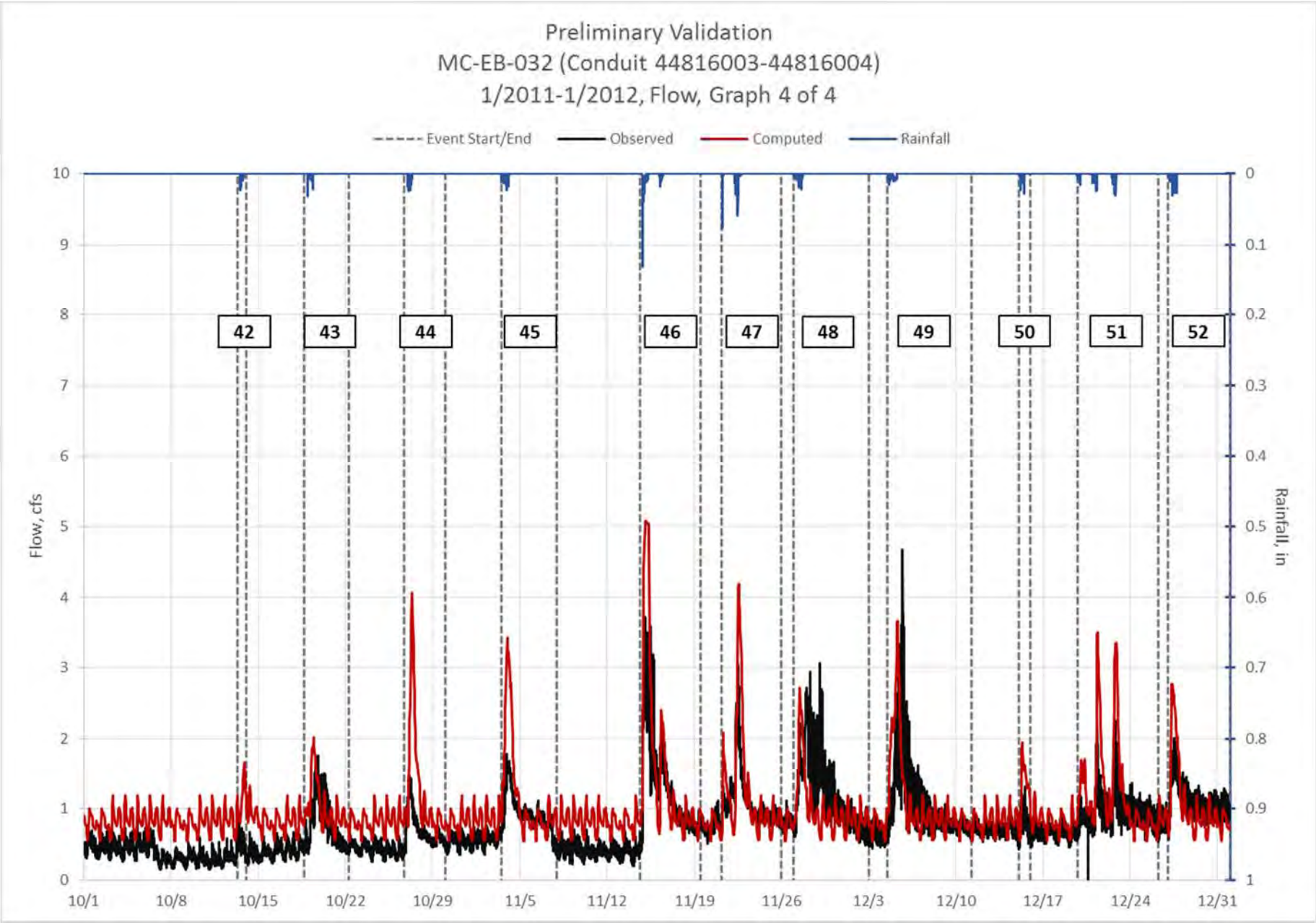

Preliminary Validation
MC-EB-031 (Pipe 48111008-48111019)
2007, Depth, Graph 3 of 4
Event Start/End
Observed
Computed
Rainfall
Depth, ft
Rainfall, in
15
16
17
18
19
20
21
22
23
2.5
2
1.5
1
0.5
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
7/1
7/8
7/15
7/22
7/29
8/5
8/12
8/19
8/26
9/2
9/9
9/16
9/23
9/30

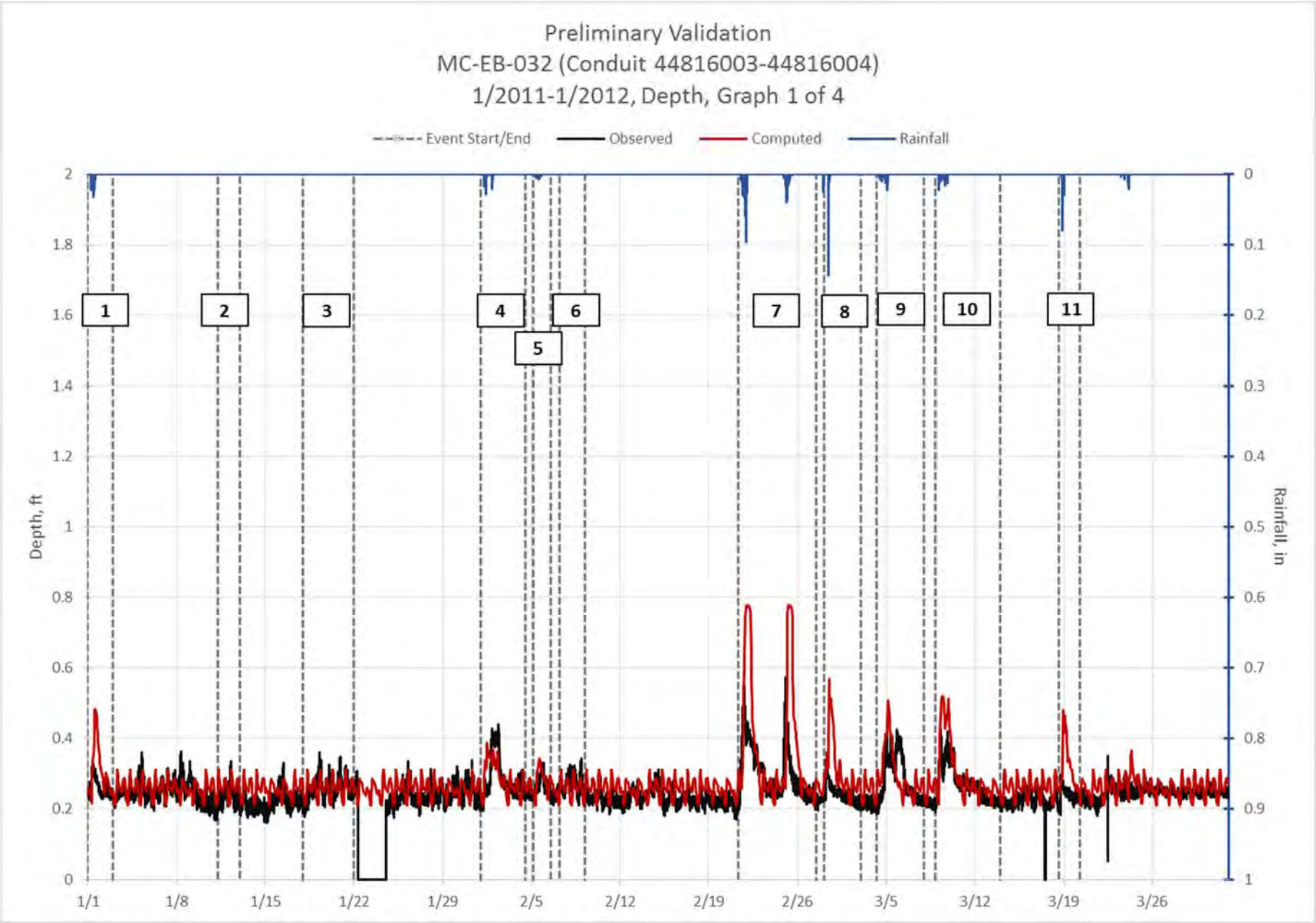

Preliminary Validation
MC-EB-031 (Pipe 48111008-48111019)
2007, Depth, Graph 4 of 4
Event Start/End
Observed
Computed
Rainfall
Depth, ft
Rainfall, in
24
25
26
27
28
29
30
2.5
2
1.5
1
0.5
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
10/1
10/8
10/15
10/22
10/29
11/5
11/12
11/19
11/26
12/3
12/10
12/17
12/24
12/31

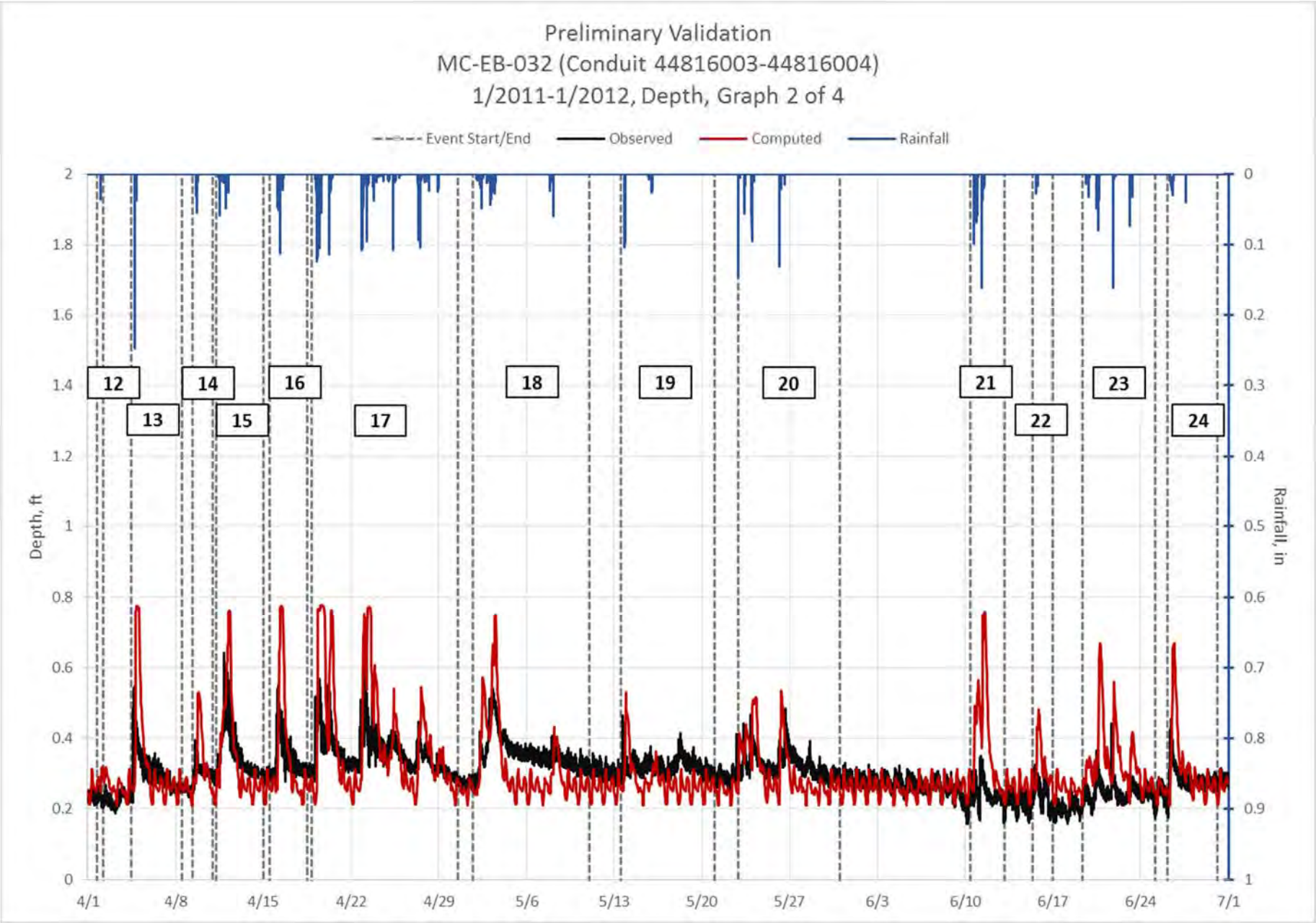

Preliminary Validation
MC-EB-032 (Conduit 44816003-44816004)
1/2011-1/2012, Flow, Graph 1 of 4
Event Start/End
Observed
Computed
Rainfall
Flow, cfs
Rainfall, in
1
2
3
4
5
6
7
8
9
10
11
1/1
1/8
1/15
1/22
1/29
2/5
2/12
2/19
2/26
3/5
3/12
3/19
3/26

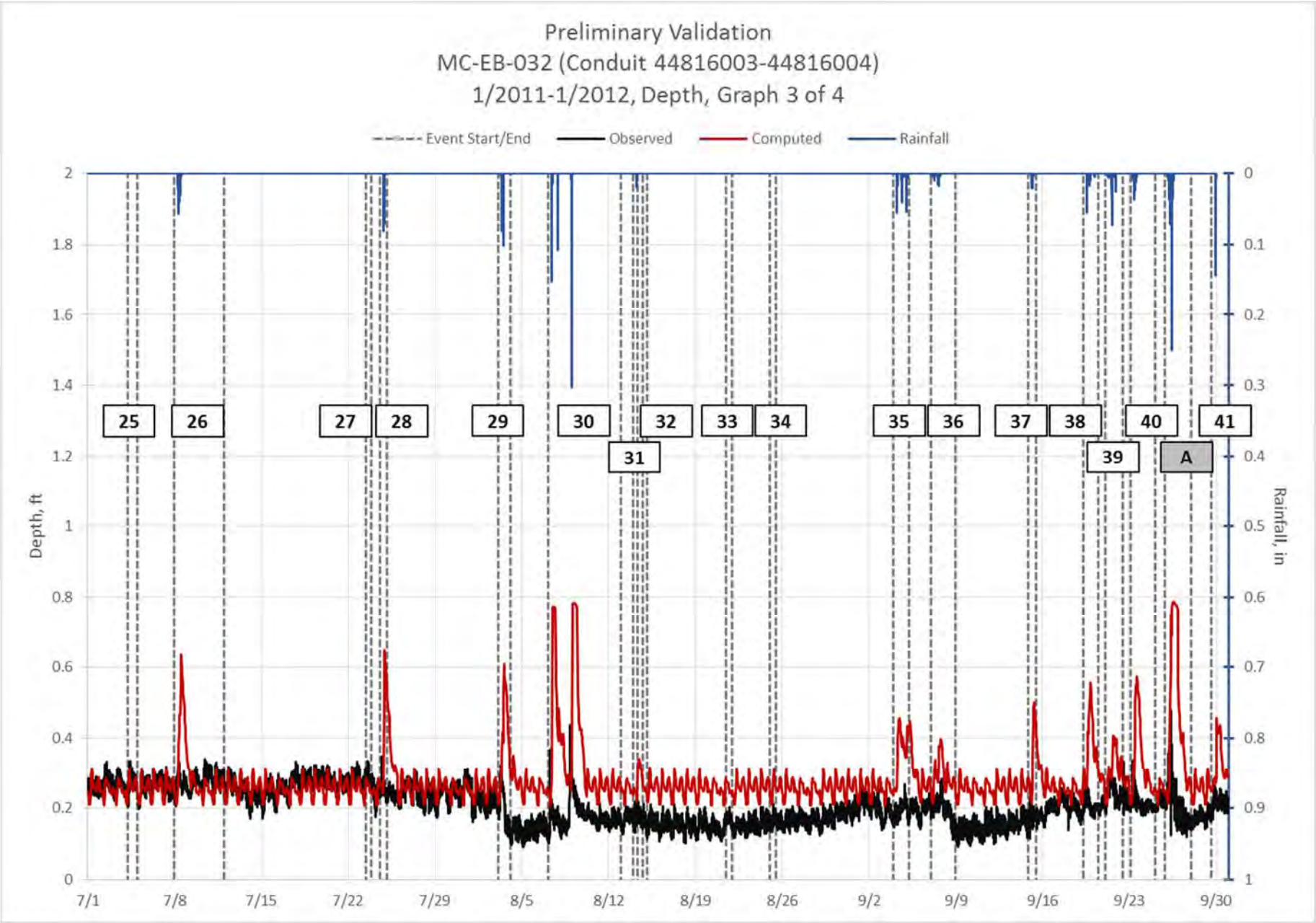

Preliminary Validation
MC-EB-032 (Conduit 44816003-44816004)
1/2011-1/2012, Flow, Graph 2 of 4
Event Start/End
Observed
Computed
Rainfall
Flow, cfs
Rainfall, in
12
13
14
15
16
17
18
19
20
21
22
23
24
4/1
4/8
4/15
4/22
4/29
5/6
5/13
5/20
5/27
6/3
6/10
6/17
6/24
7/1

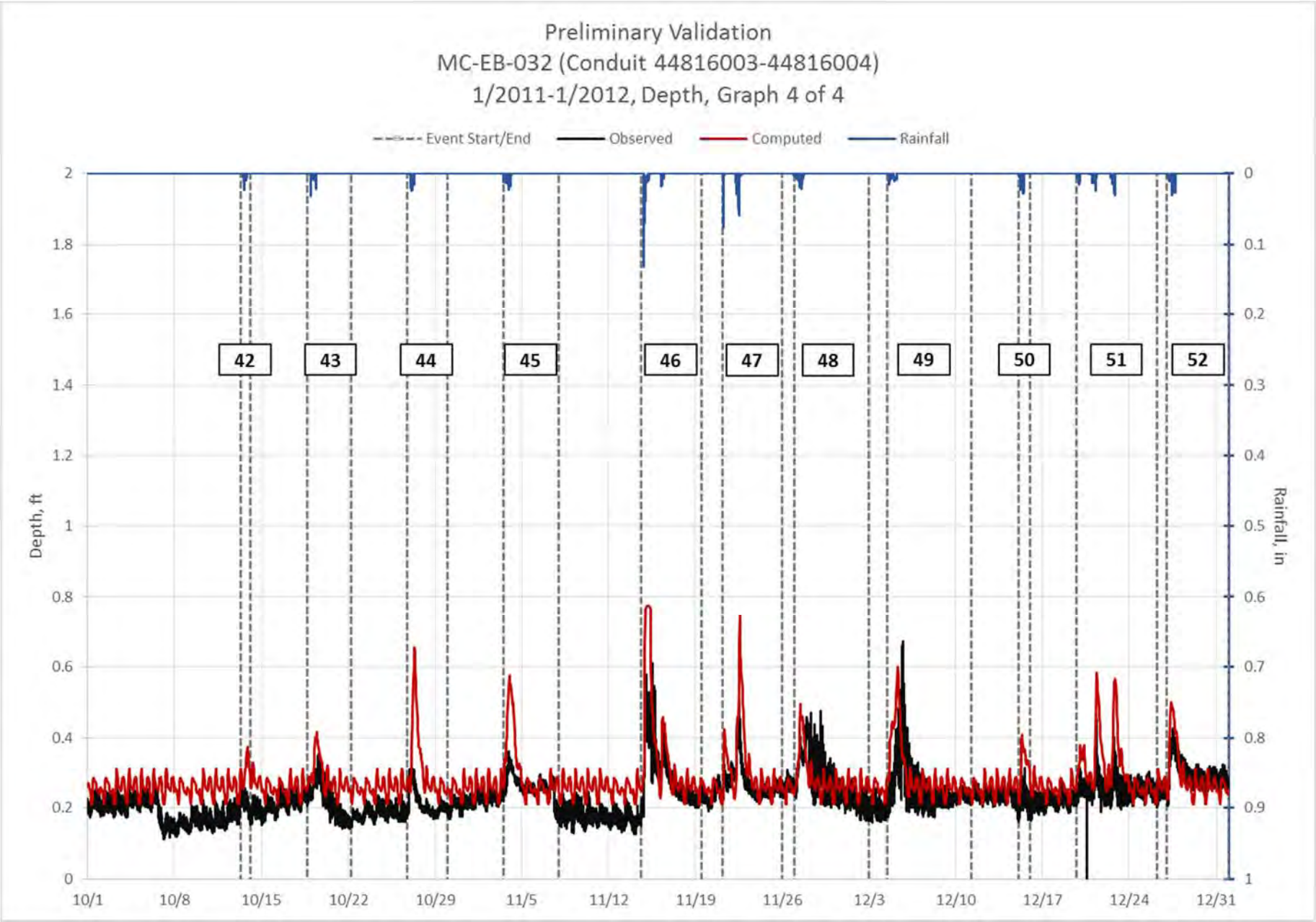

Preliminary Validation
MC-EB-032 (Conduit 44816003-44816004)
1/2011-1/2012, Flow, Graph 3 of 4
Event Start/End
Observed
Computed
Rainfall
Flow, cfs
Rainfall, in
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
A
41
7/1
7/8
7/15
7/22
7/29
8/5
8/12
8/19
8/26
9/2
9/9
9/16
9/23
9/30

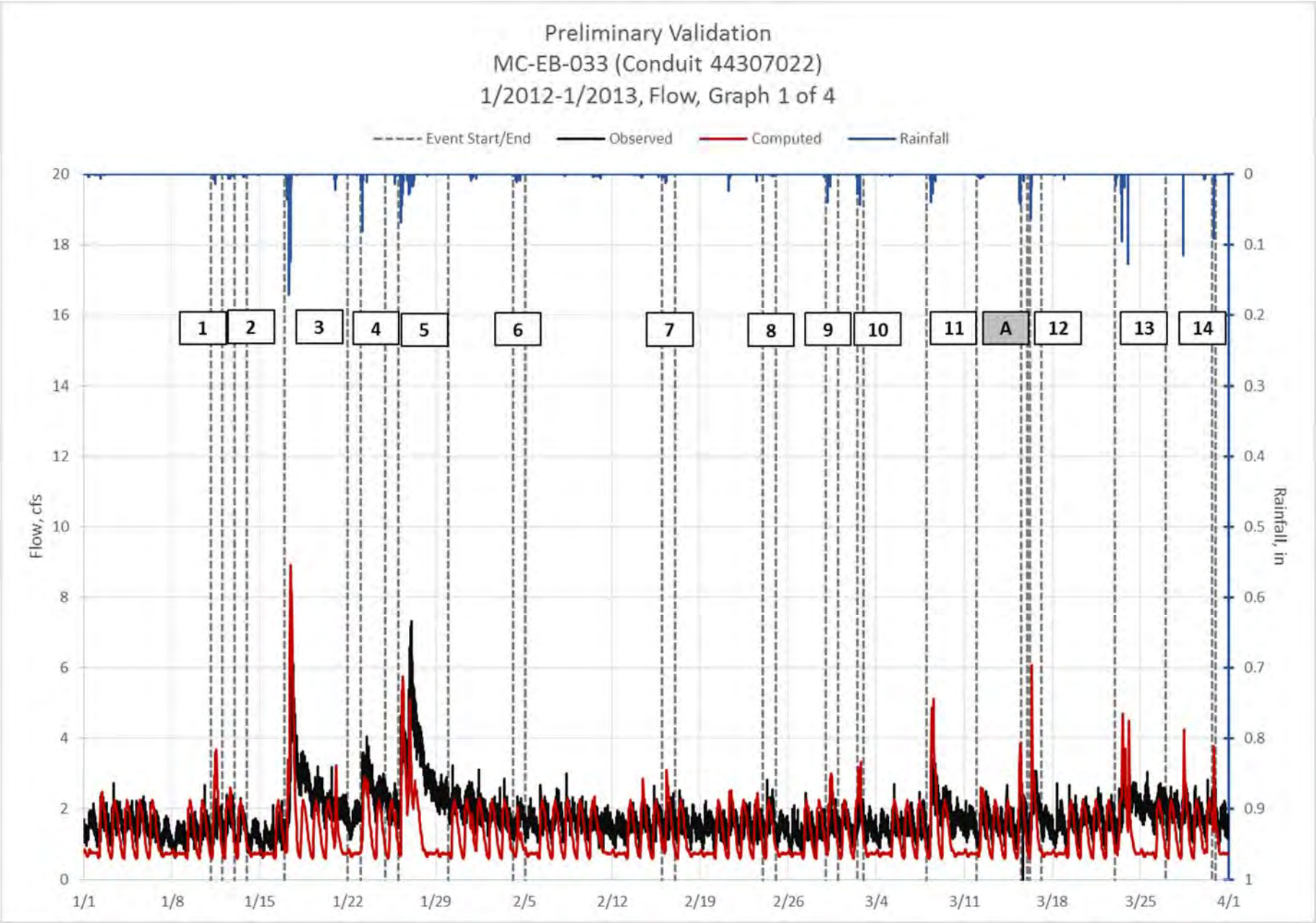

Preliminary Validation
MC-EB-032 (Conduit 44816003-44816004)
1/2011-1/2012, Flow, Graph 4 of 4
Event Start/End
Observed
Computed
Rainfall
Flow, cfs
Rainfall, in
42
43
44
45
46
47
48
49
50
51
52
10/1
10/8
10/15
10/22
10/29
11/5
11/12
11/19
11/26
12/3
12/10
12/17
12/24
12/31

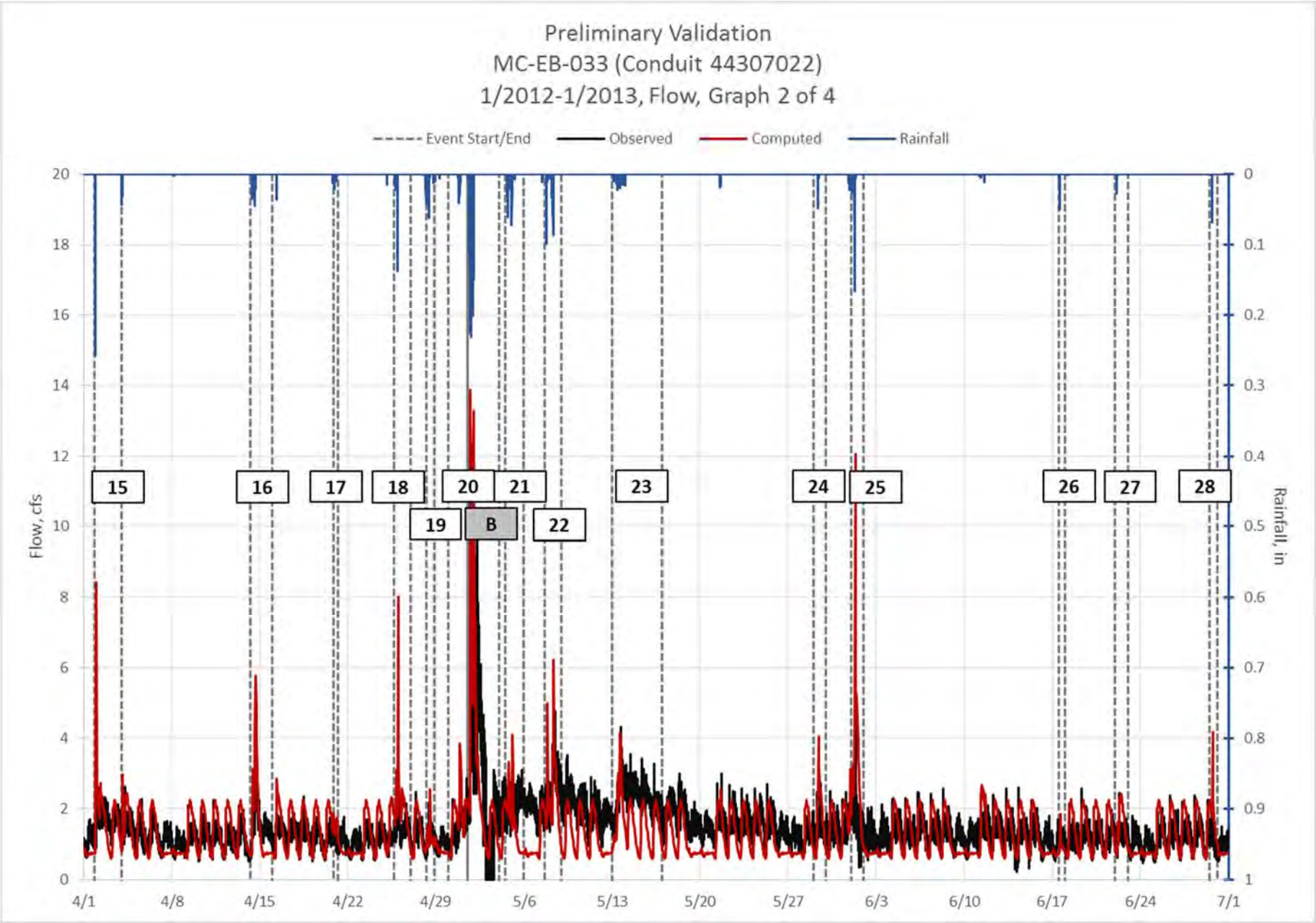

Preliminary Validation
MC-EB-032 (Conduit 44816003-44816004)
1/2011-1/2012, Depth, Graph 1 of 4
Event Start/End
Observed
Computed
Rainfall
Depth, ft
Rainfall, in
1
2
3
4
5
6
7
8
9
10
11
1/1
1/8
1/15
1/22
1/29
2/5
2/12
2/19
2/26
3/5
3/12
3/19
3/26

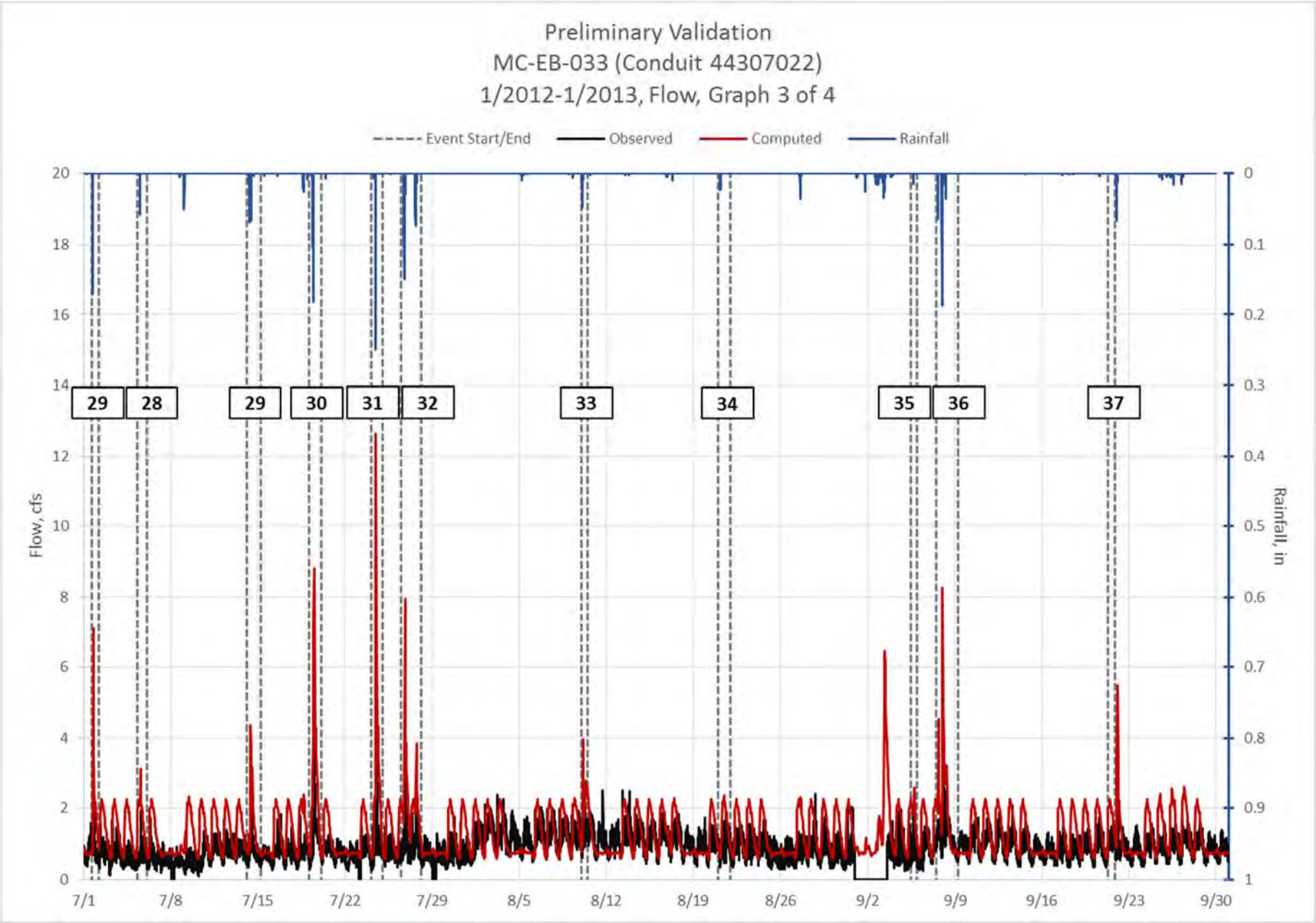

Preliminary Validation
MC-EB-032 (Conduit 44816003-44816004)
1/2011-1/2012, Depth, Graph 2 of 4
Event Start/End
Observed
Computed
Rainfall
Depth, ft
Rainfall, in
12
13
14
15
16
17
18
19
20
21
22
23
24
4/1
4/8
4/15
4/22
4/29
5/6
5/13
5/20
5/27
6/3
6/10
6/17
6/24
7/1

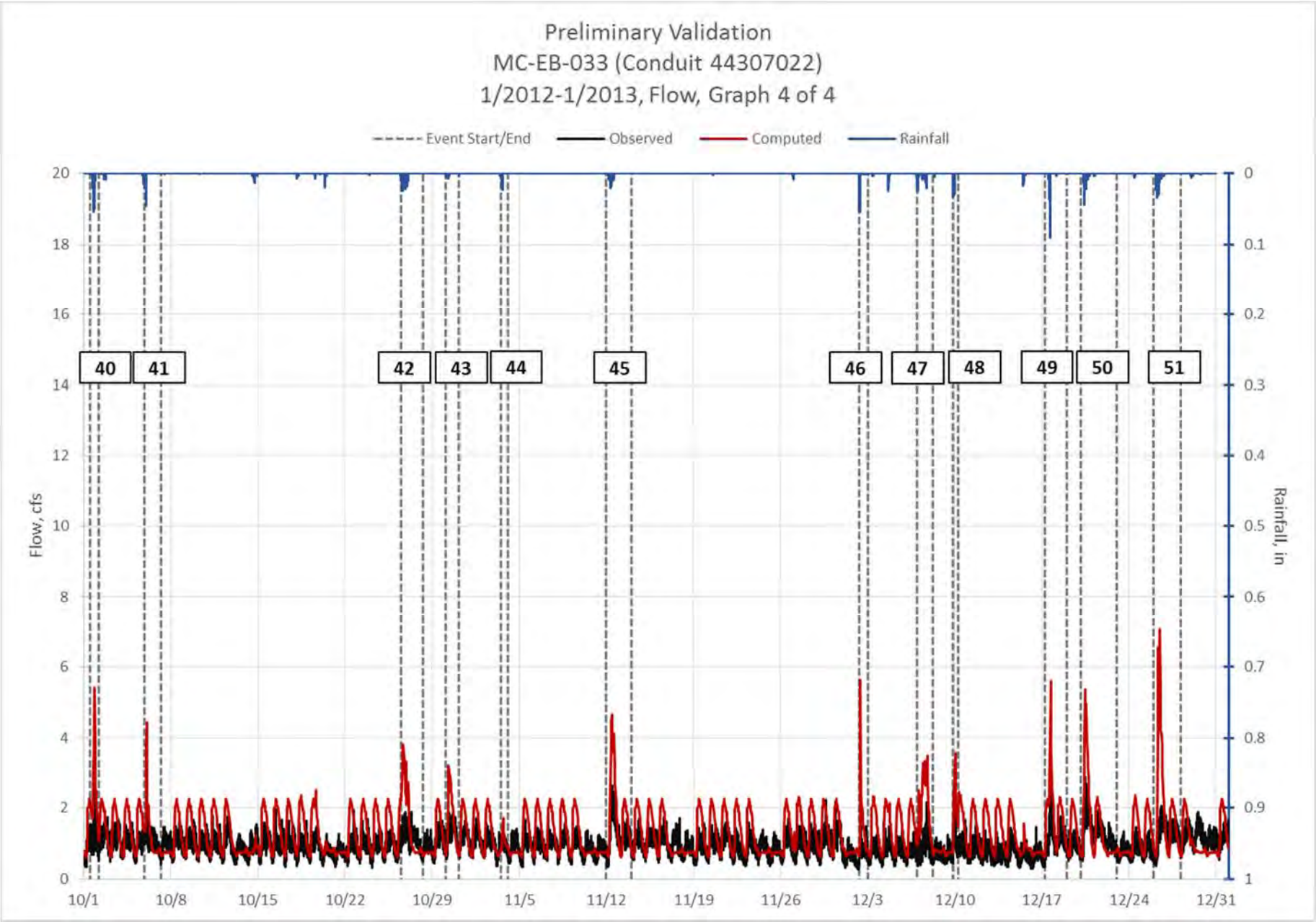

Preliminary Validation
MC-EB-032 (Conduit 44816003-44816004)
1/2011-1/2012, Depth, Graph 3 of 4
Event Start/End
Observed
Computed
Rainfall
Depth, ft
Rainfall, in
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
A
7/1
7/8
7/15
7/22
7/29
8/5
8/12
8/19
8/26
9/2
9/9
9/16
9/23
9/30

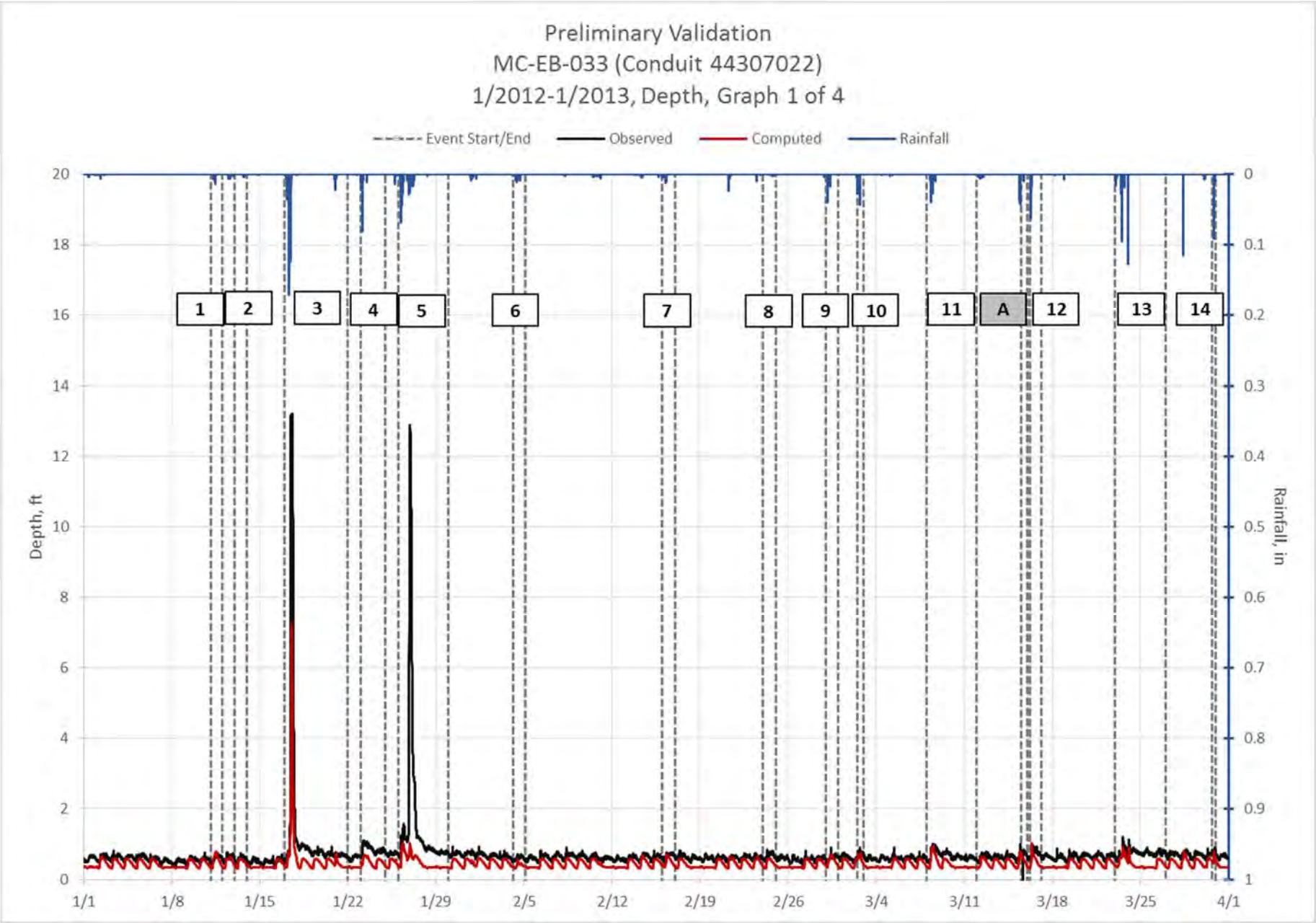

Preliminary Validation
MC-EB-032 (Conduit 44816003-44816004)
1/2011-1/2012, Depth, Graph 4 of 4
Event Start/End
Observed
Computed
Rainfall
Depth, ft
Rainfall, in
42
43
44
45
46
47
48
49
50
51
52
10/1
10/8
10/15
10/22
10/29
11/5
11/12
11/19
11/26
12/3
12/10
12/17
12/24
12/31

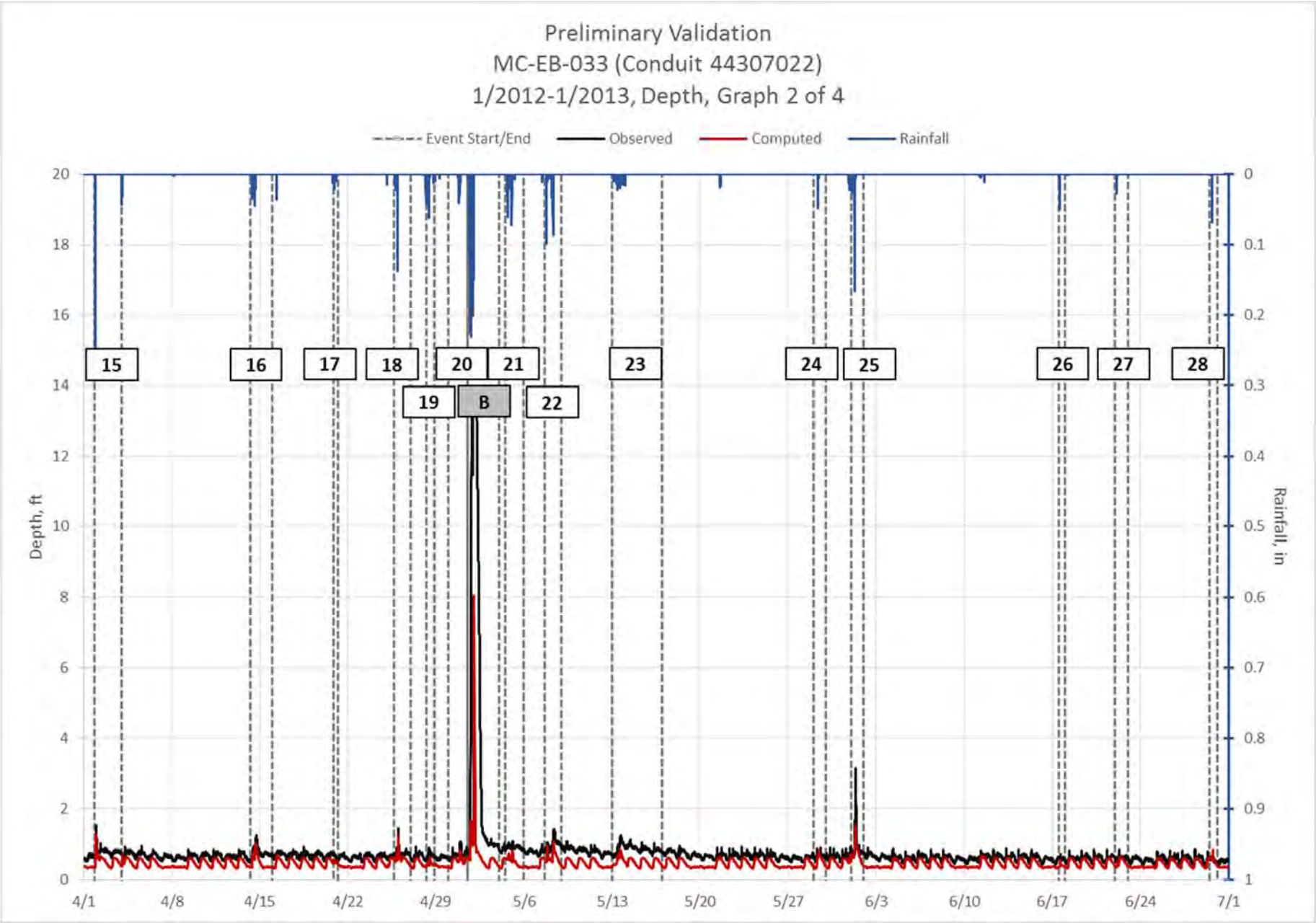

Preliminary Validation
MC-EB-033 (Conduit 44307022)
1/2012-1/2013, Flow, Graph 1 of 4
Event Start/End
Observed
Computed
Rainfall
Flow, cfs
Rainfall, in
1
2
3
4
5
6
7
8
9
10
11
A
12
13
14
1/1
1/8
1/15
1/22
1/29
2/5
2/12
2/19
2/26
3/4
3/11
3/18
3/25
4/1

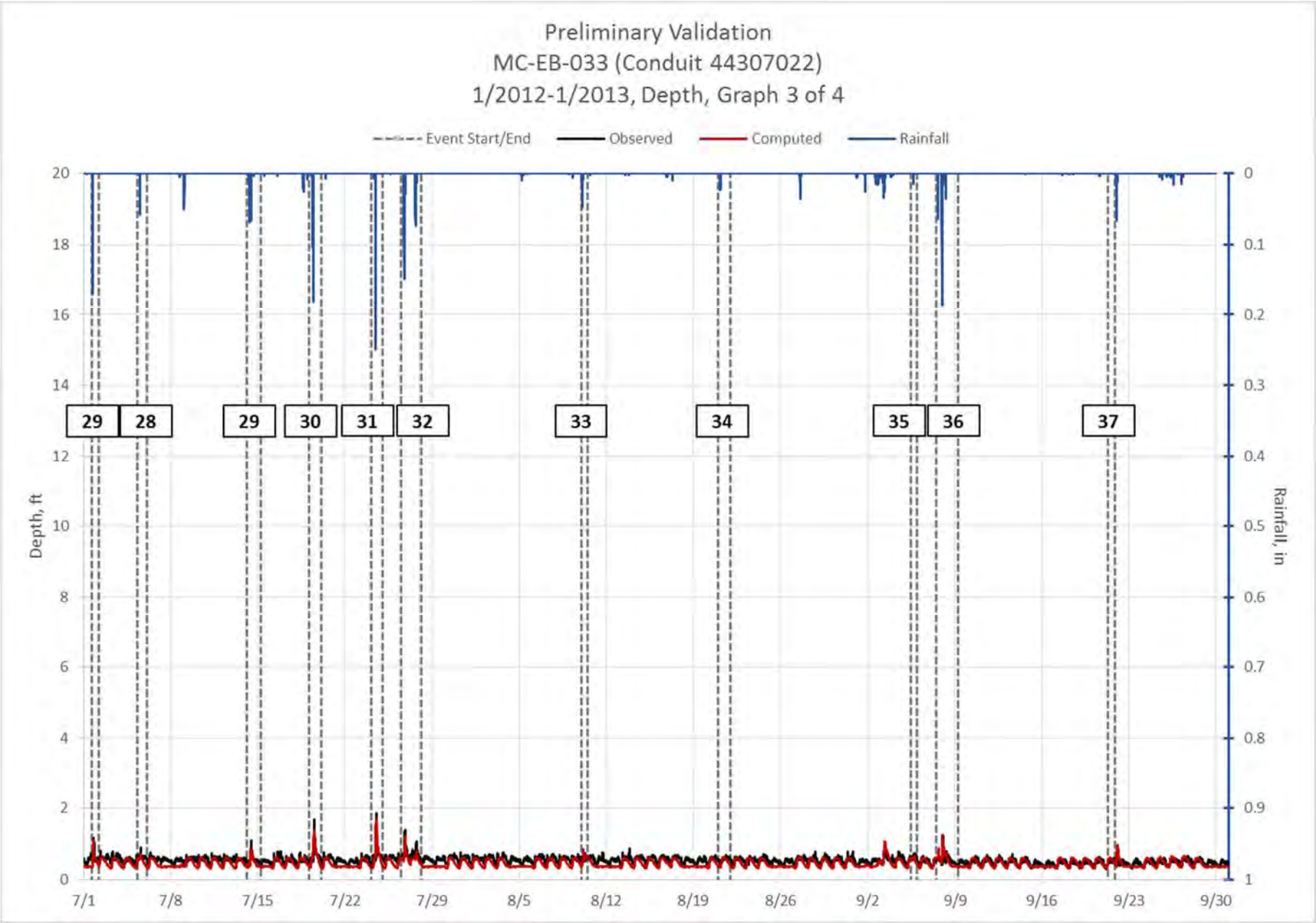

Preliminary Validation
MC-EB-033 (Conduit 44307022)
1/2012-1/2013, Flow, Graph 2 of 4
Event Start/End
Observed
Computed
Rainfall
Flow, cfs
Rainfall, in
15
16
17
18
19
20
B
21
22
23
24
25
26
27
28
4/1
4/8
4/15
4/22
4/29
5/6
5/13
5/20
5/27
6/3
6/10
6/17
6/24
7/1

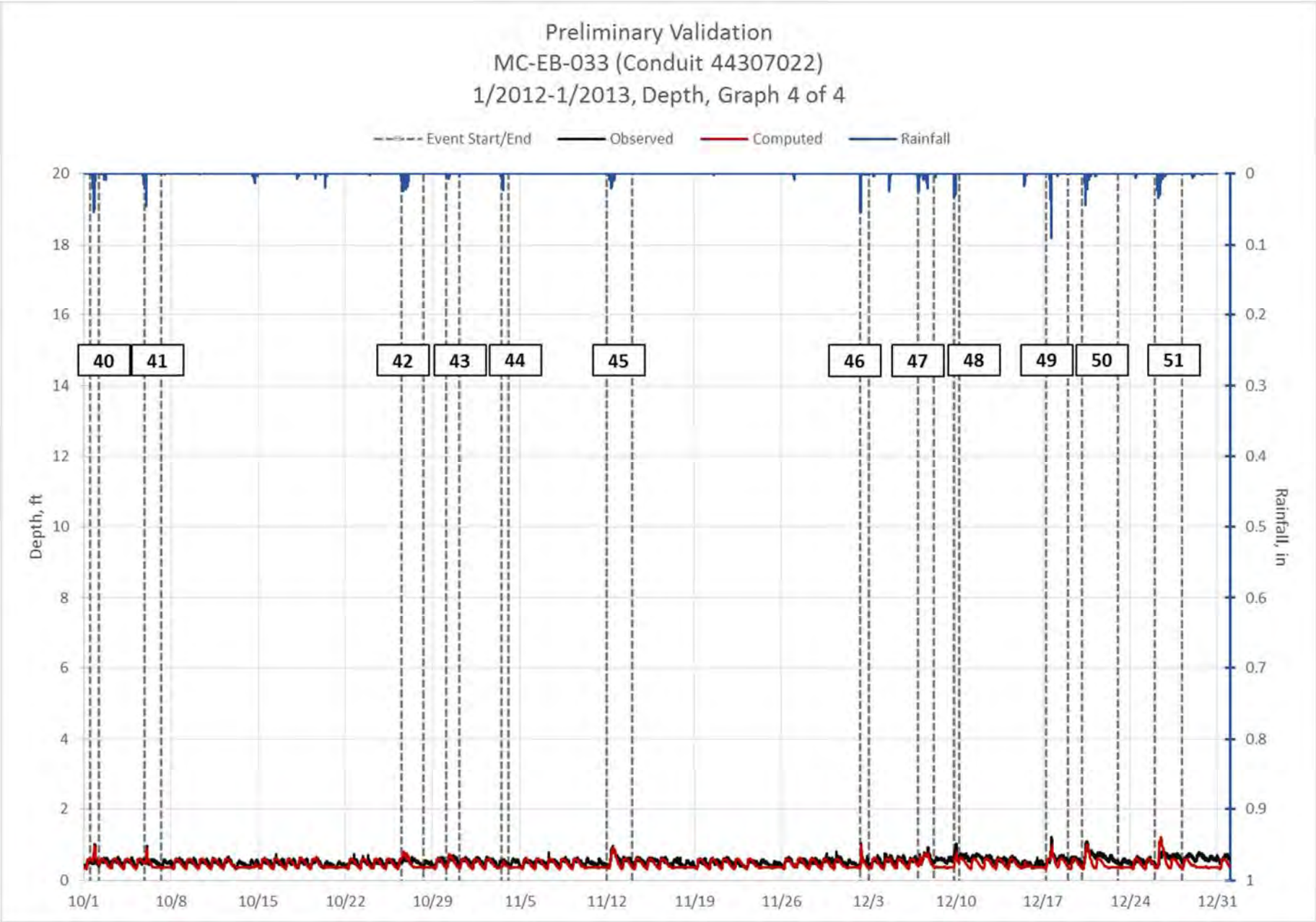

Preliminary Validation
MC-EB-033 (Conduit 44307022)
1/2012-1/2013, Flow, Graph 3 of 4
Event Start/End
Observed
Computed
Rainfall
Flow, cfs
Rainfall, in
29
28
29
30
31
32
33
34
35
36
37
7/1
7/8
7/15
7/22
7/29
8/5
8/12
8/19
8/26
9/2
9/9
9/16
9/23
9/30

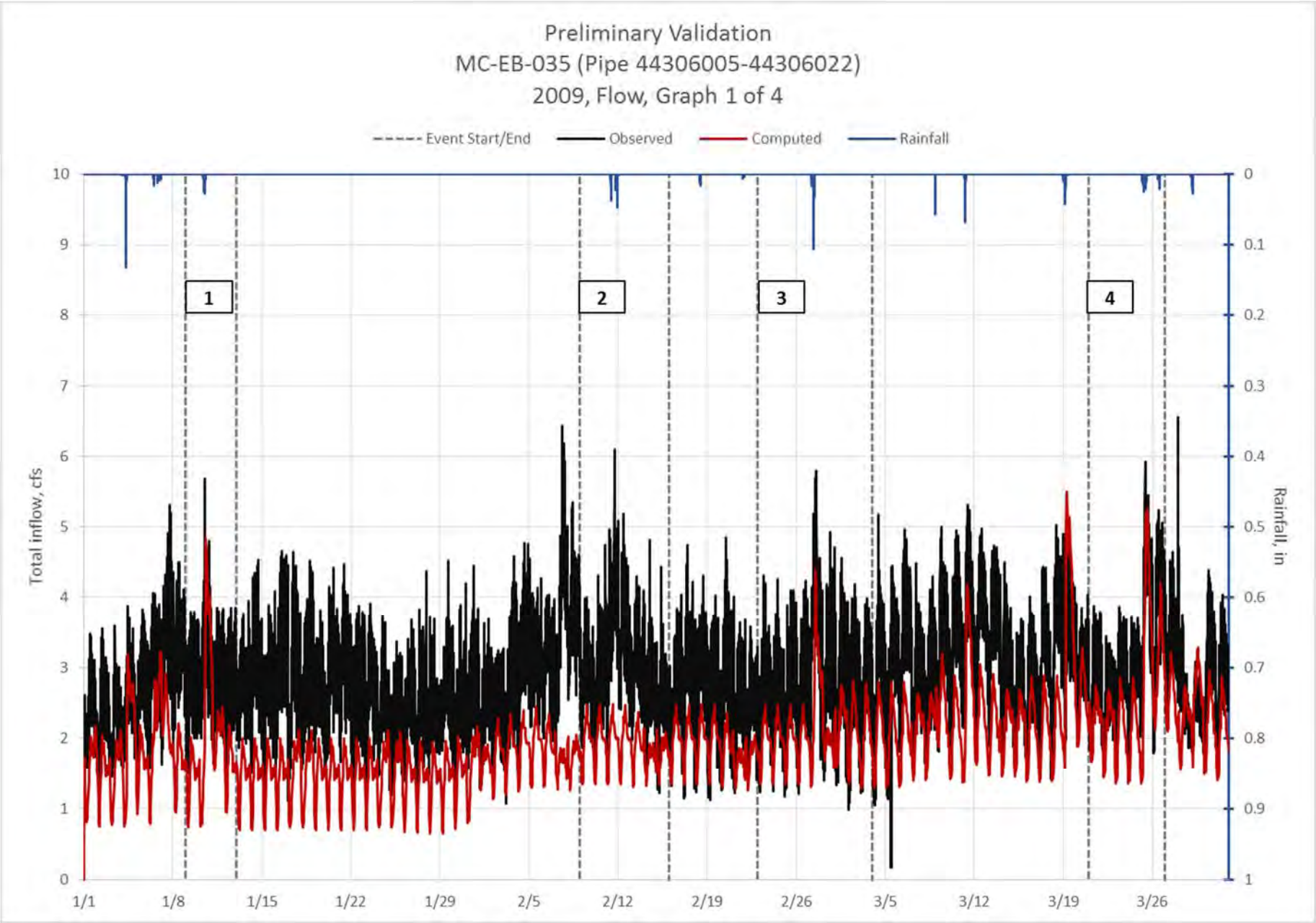

Preliminary Validation
MC-EB-033 (Conduit 44307022)
1/2012-1/2013, Flow, Graph 4 of 4
Event Start/End
Observed
Computed
Rainfall
Flow, cfs
Rainfall, in
40
41
42
43
44
45
46
47
48
49
50
51
10/1
10/8
10/15
10/22
10/29
11/5
11/12
11/19
11/26
12/3
12/10
12/17
12/24
12/31

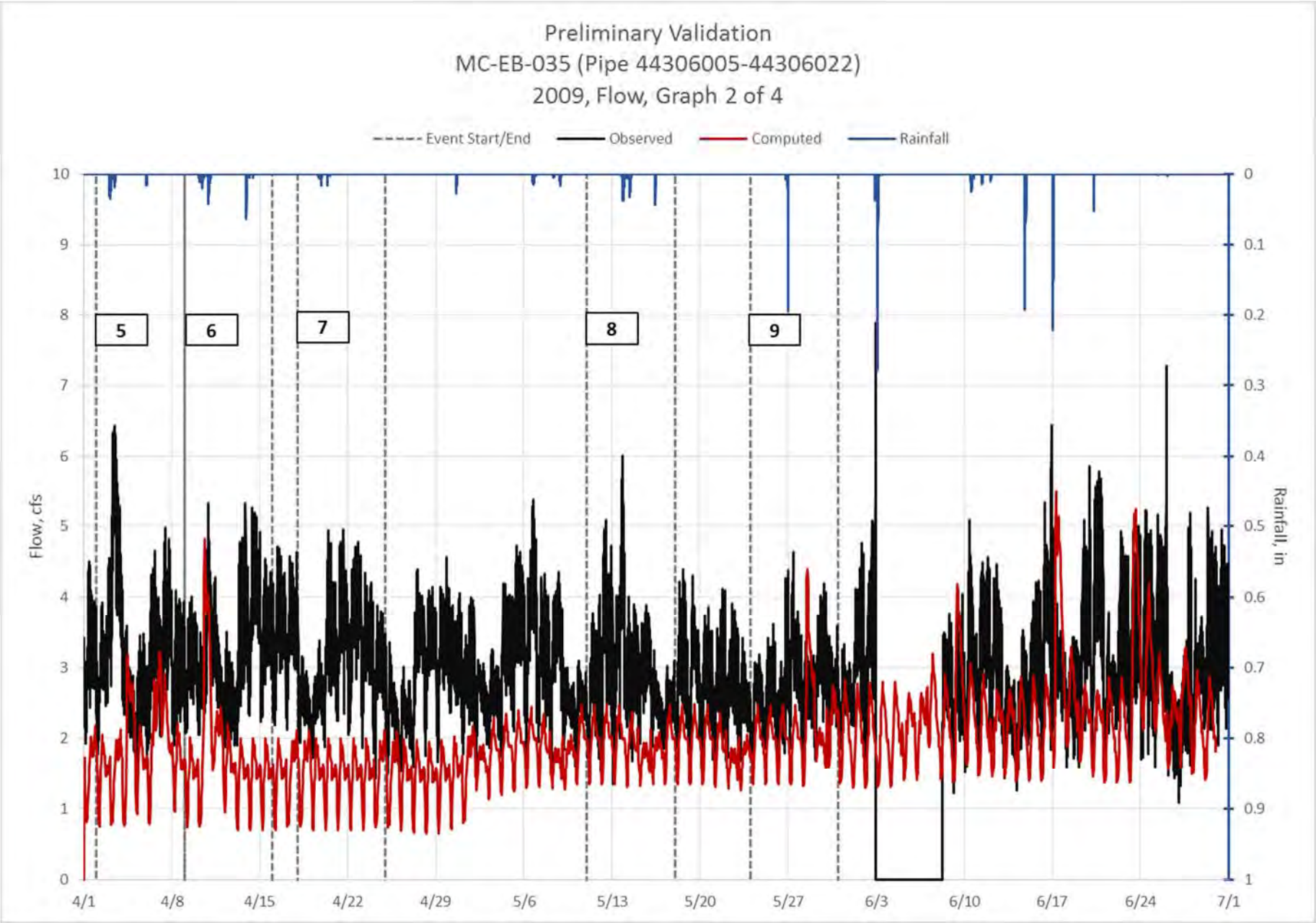

Preliminary Validation
MC-EB-033 (Conduit 44307022)
1/2012-1/2013, Depth, Graph 1 of 4
Event Start/End
Observed
Computed
Rainfall
Depth, ft
Rainfall, in
1
2
3
4
5
6
7
8
9
10
11
A
12
13
14
1/1
1/8
1/15
1/22
1/29
2/5
2/12
2/19
2/26
3/4
3/11
3/18
3/25
4/1

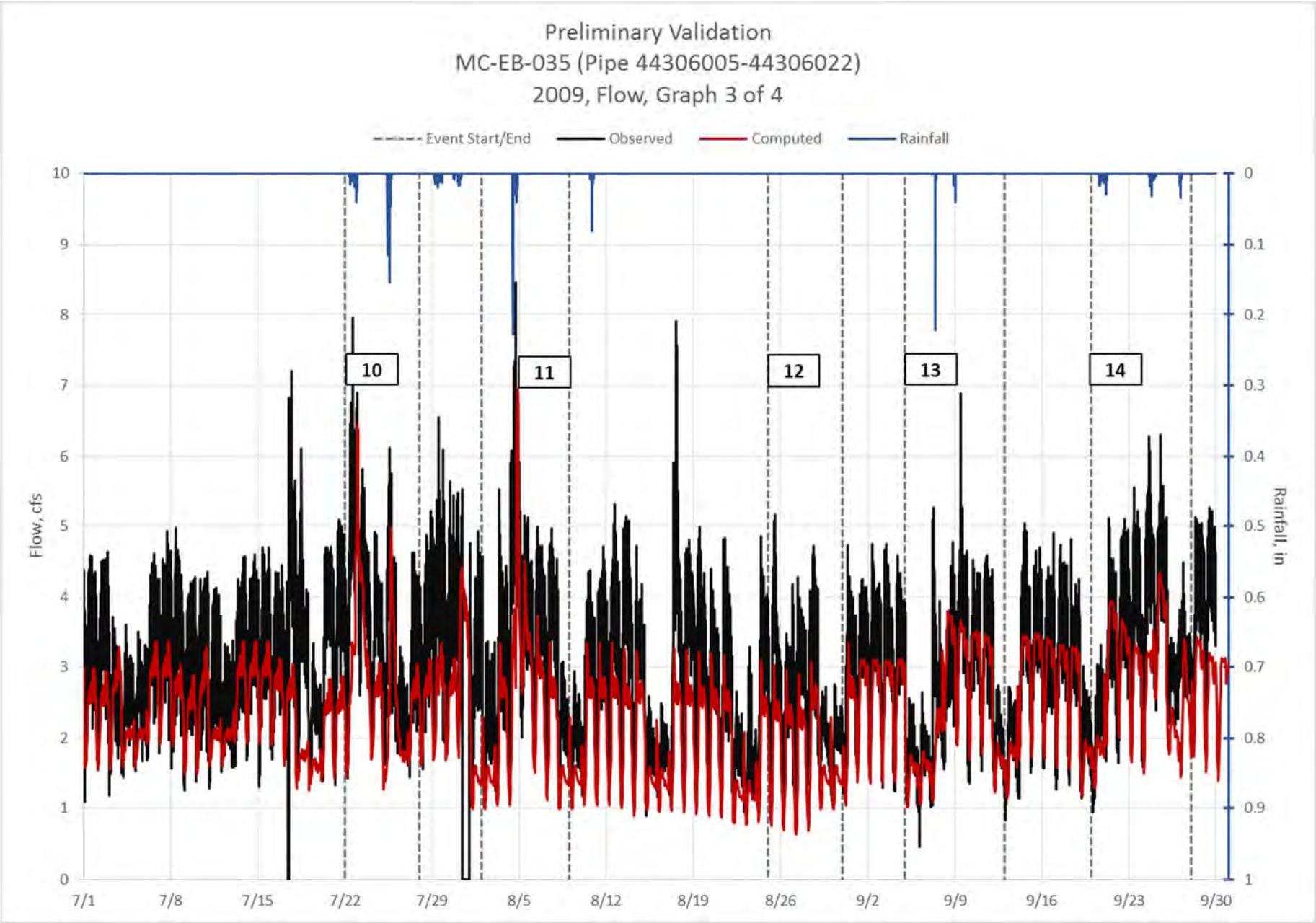

Preliminary Validation
MC-EB-033 (Conduit 44307022)
1/2012-1/2013, Depth, Graph 2 of 4
Event Start/End
Observed
Computed
Rainfall
Depth, ft
Rainfall, in
15
16
17
18
19
20
B
21
22
23
24
25
26
27
28
4/1
4/8
4/15
4/22
4/29
5/6
5/13
5/20
5/27
6/3
6/10
6/17
6/24
7/1

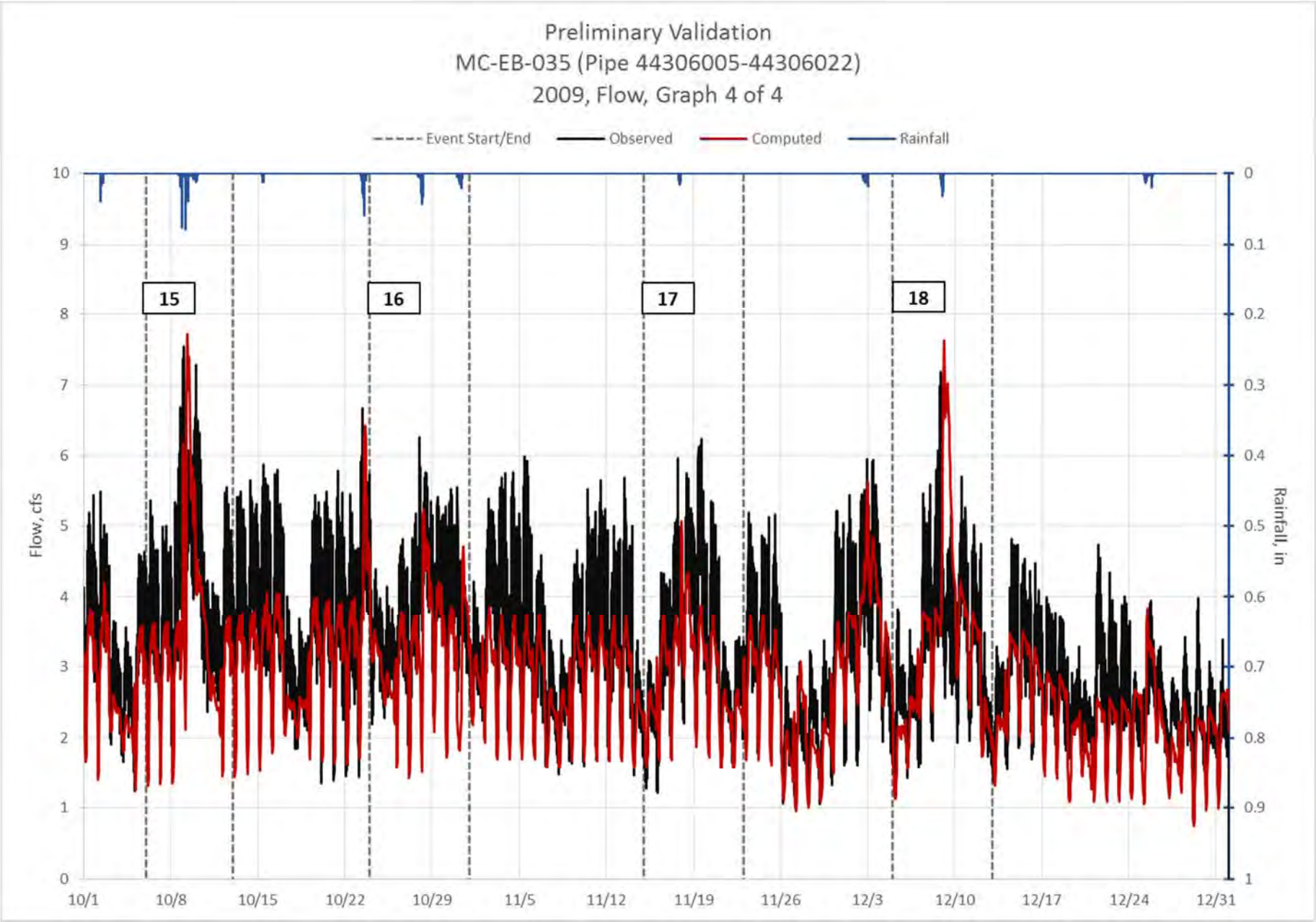

Preliminary Validation
MC-EB-033 (Conduit 44307022)
1/2012-1/2013, Depth, Graph 3 of 4
Event Start/End
Observed
Computed
Rainfall
Depth, ft
Rainfall, in
29
28
29
30
31
32
33
34
35
36
37
7/1
7/8
7/15
7/22
7/29
8/5
8/12
8/19
8/26
9/2
9/9
9/16
9/23
9/30

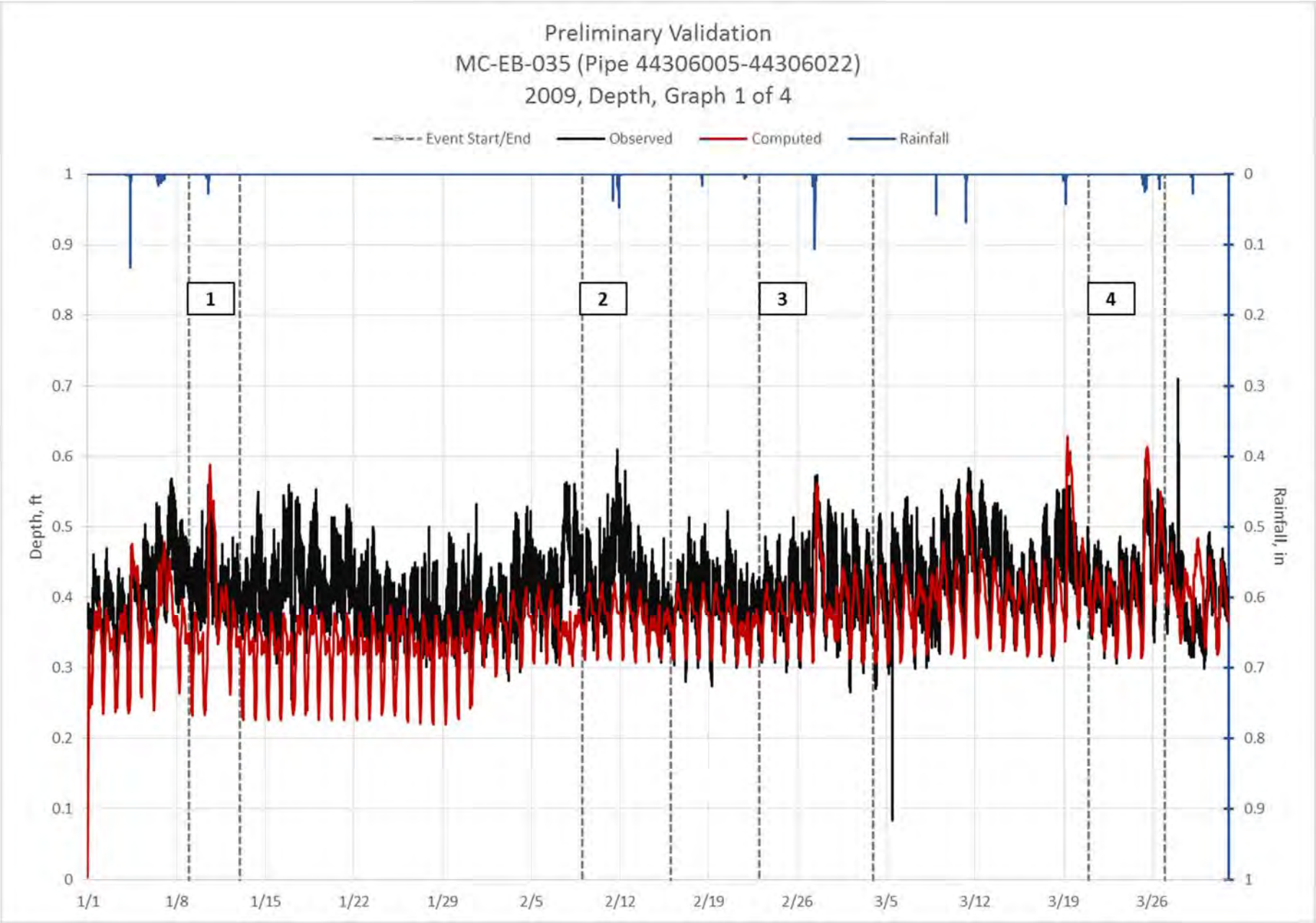

Preliminary Validation
MC-EB-033 (Conduit 44307022)
1/2012-1/2013, Depth, Graph 4 of 4
Event Start/End
Observed
Computed
Rainfall
Depth, ft
Rainfall, in
40
41
42
43
44
45
46
47
48
49
50
51
10/1
10/8
10/15
10/22
10/29
11/5
11/12
11/19
11/26
12/3
12/10
12/17
12/24
12/31

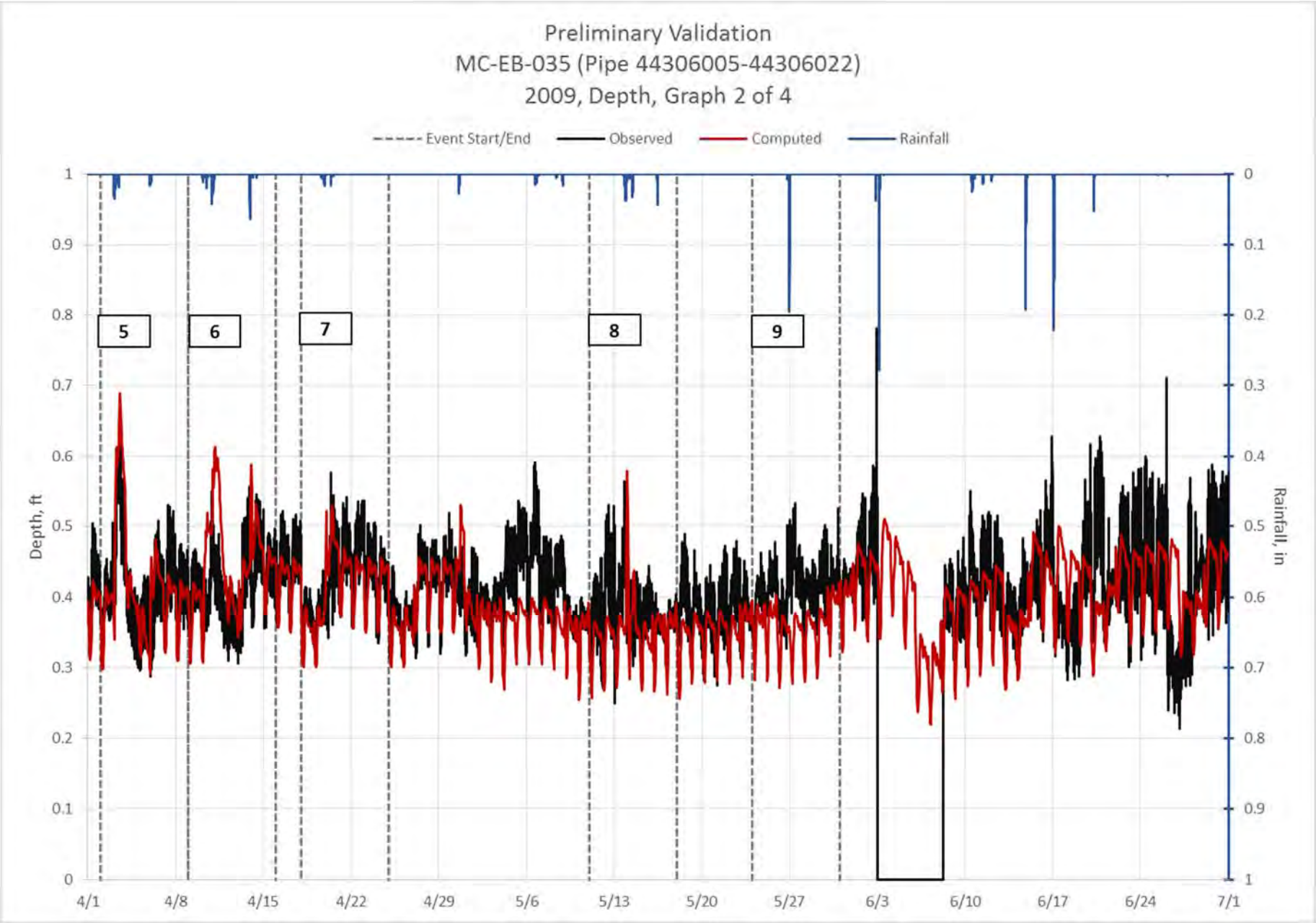

Preliminary Validation
MC-EB-035 (Pipe 44306005-44306022)
2009, Flow, Graph 1 of 4
Event Start/End
Observed
Computed
Rainfall
Total inflow, cfs
Rainfall, in
1
2
3
4
0
1
2
3
4
5
6
7
8
9
10
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1/1
1/8
1/15
1/22
1/29
2/5
2/12
2/19
2/26
3/5
3/12
3/19
3/26

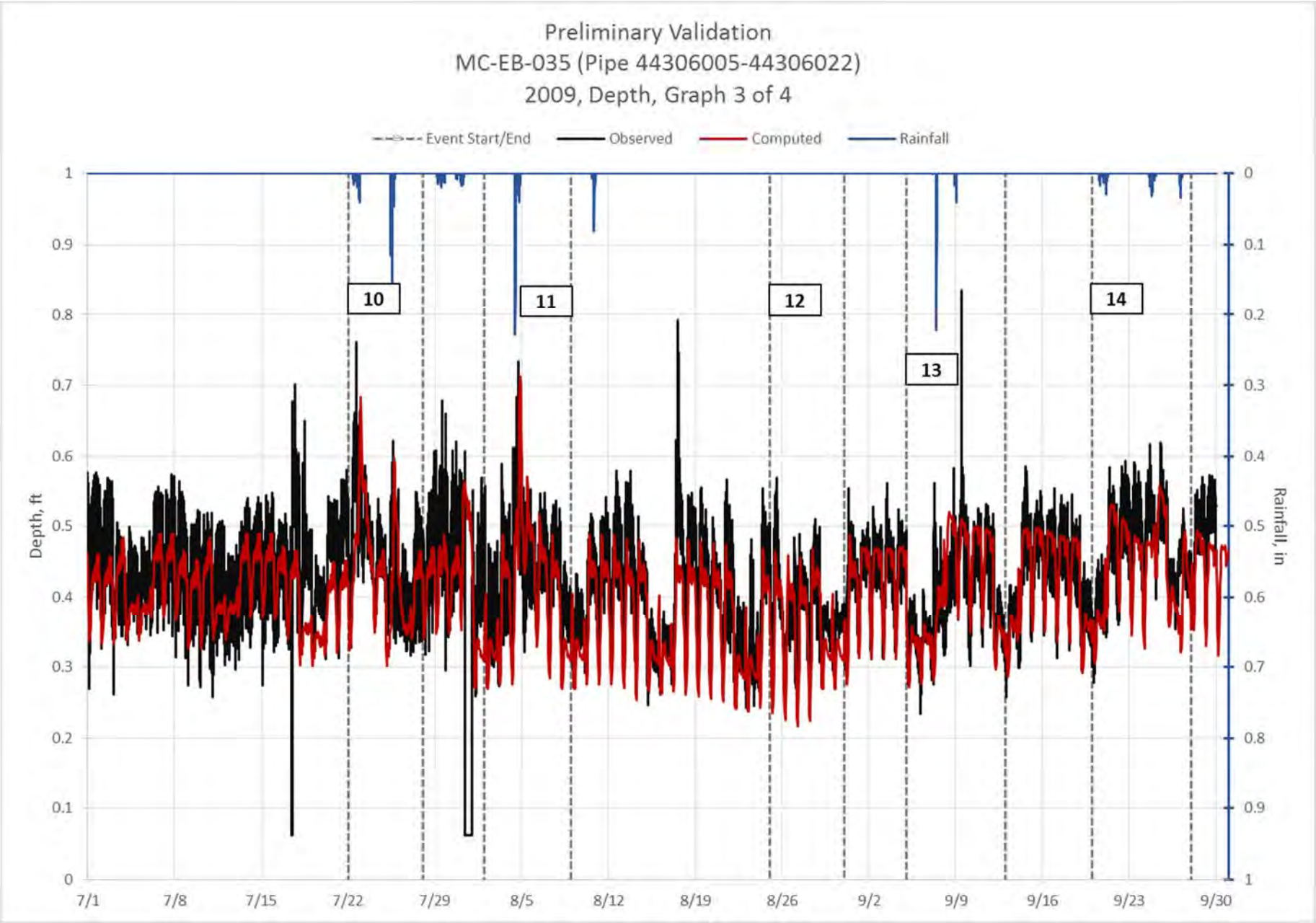

Preliminary Validation
MC-EB-035 (Pipe 44306005-44306022)
2009, Flow, Graph 2 of 4
Event Start/End
Observed
Computed
Rainfall
Flow, cfs
Rainfall, in
5
6
7
8
9
4/1
4/8
4/15
4/22
4/29
5/6
5/13
5/20
5/27
6/3
6/10
6/17
6/24
7/1

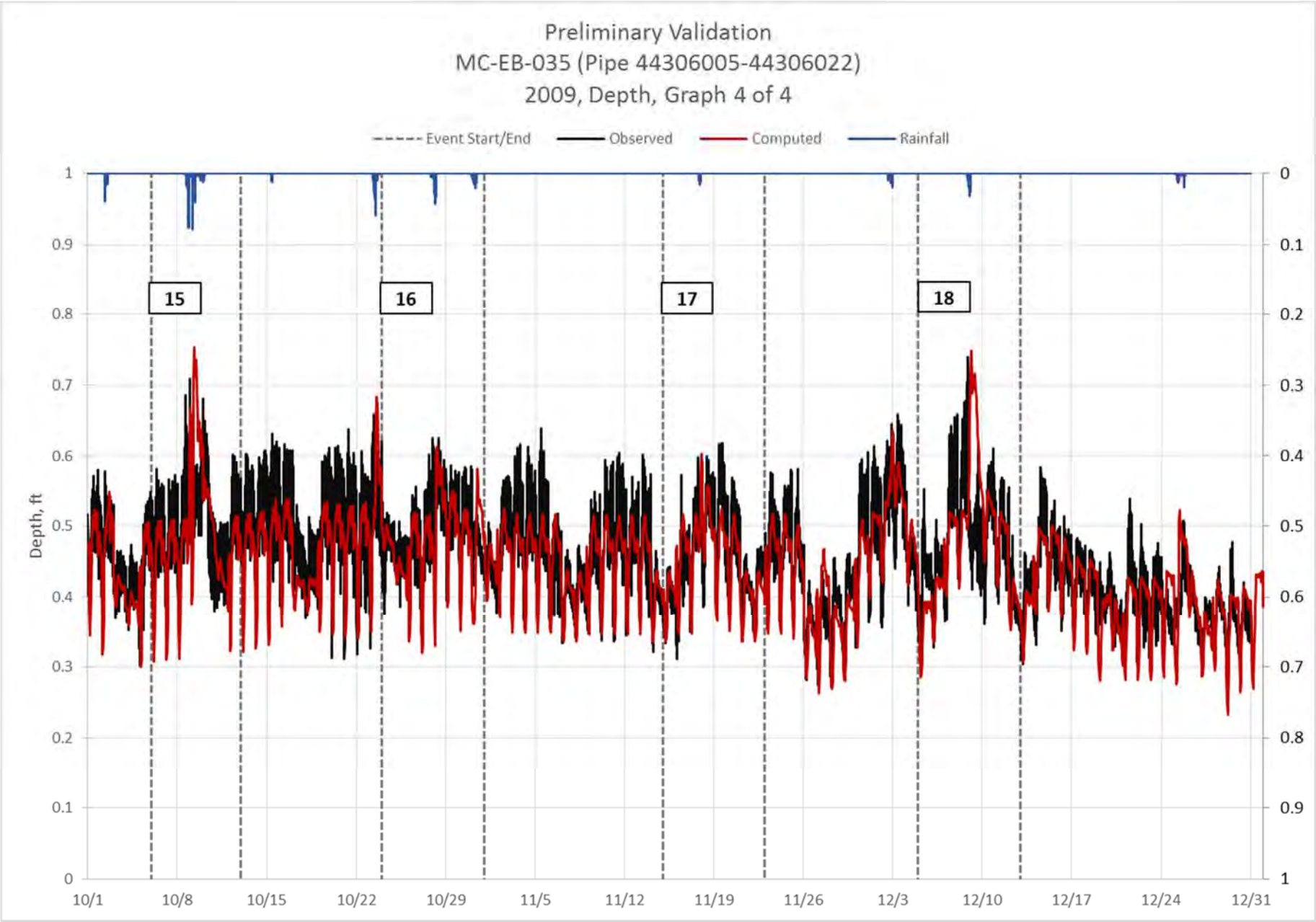

Preliminary Validation
MC-EB-035 (Pipe 44306005-44306022)
2009, Flow, Graph 3 of 4
Event Start/End
Observed
Computed
Rainfall
Flow, cfs
Rainfall, in
10
11
12
13
14
7/1
7/8
7/15
7/22
7/29
8/5
8/12
8/19
8/26
9/2
9/9
9/16
9/23
9/30

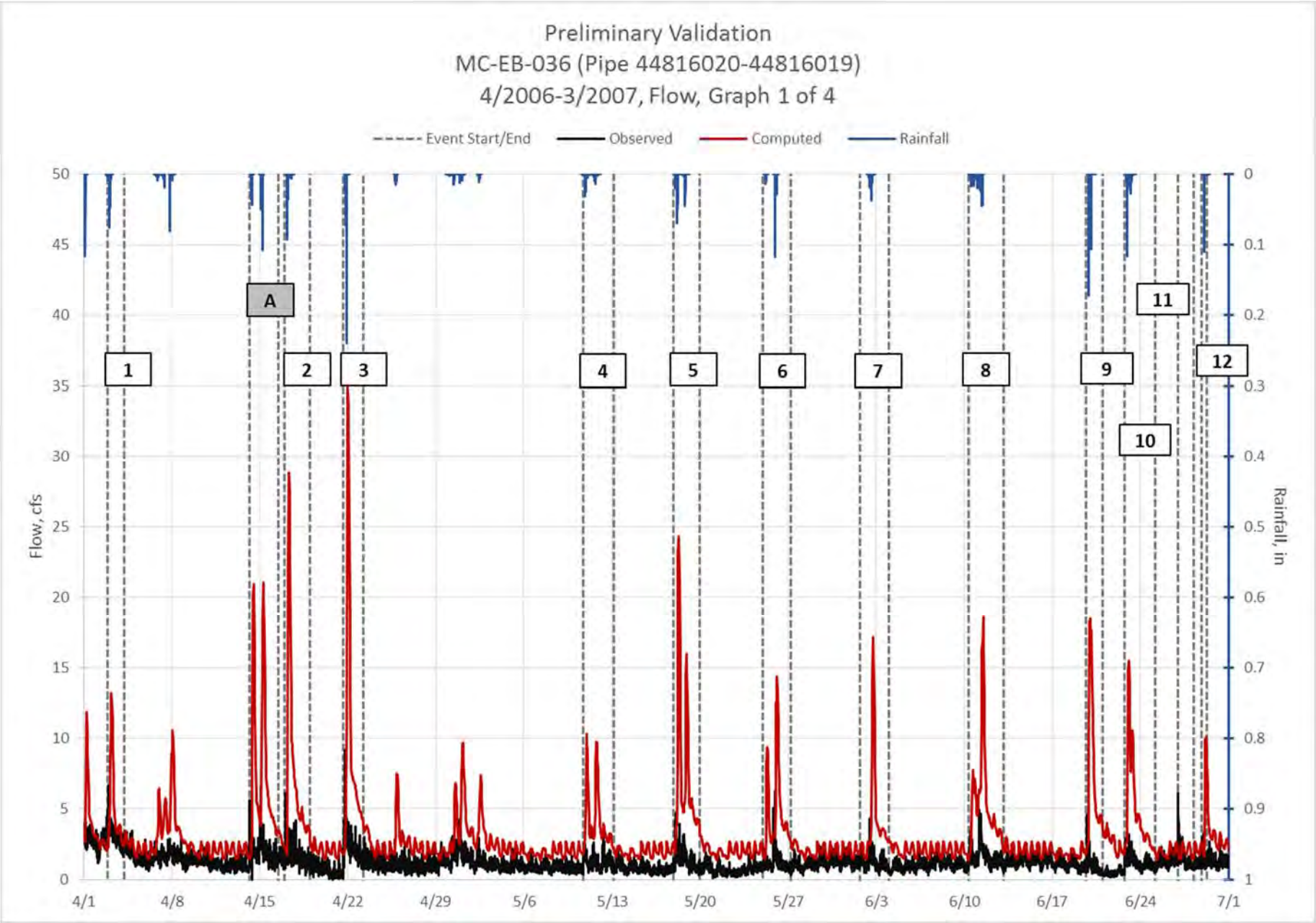

Preliminary Validation
MC-EB-035 (Pipe 44306005-44306022)
2009, Flow, Graph 4 of 4
Event Start/End
Observed
Computed
Rainfall
15
16
17
18
Flow, cfs
Rainfall, in
10/1
10/8
10/15
10/22
10/29
11/5
11/12
11/19
11/26
12/3
12/10
12/17
12/24
12/31

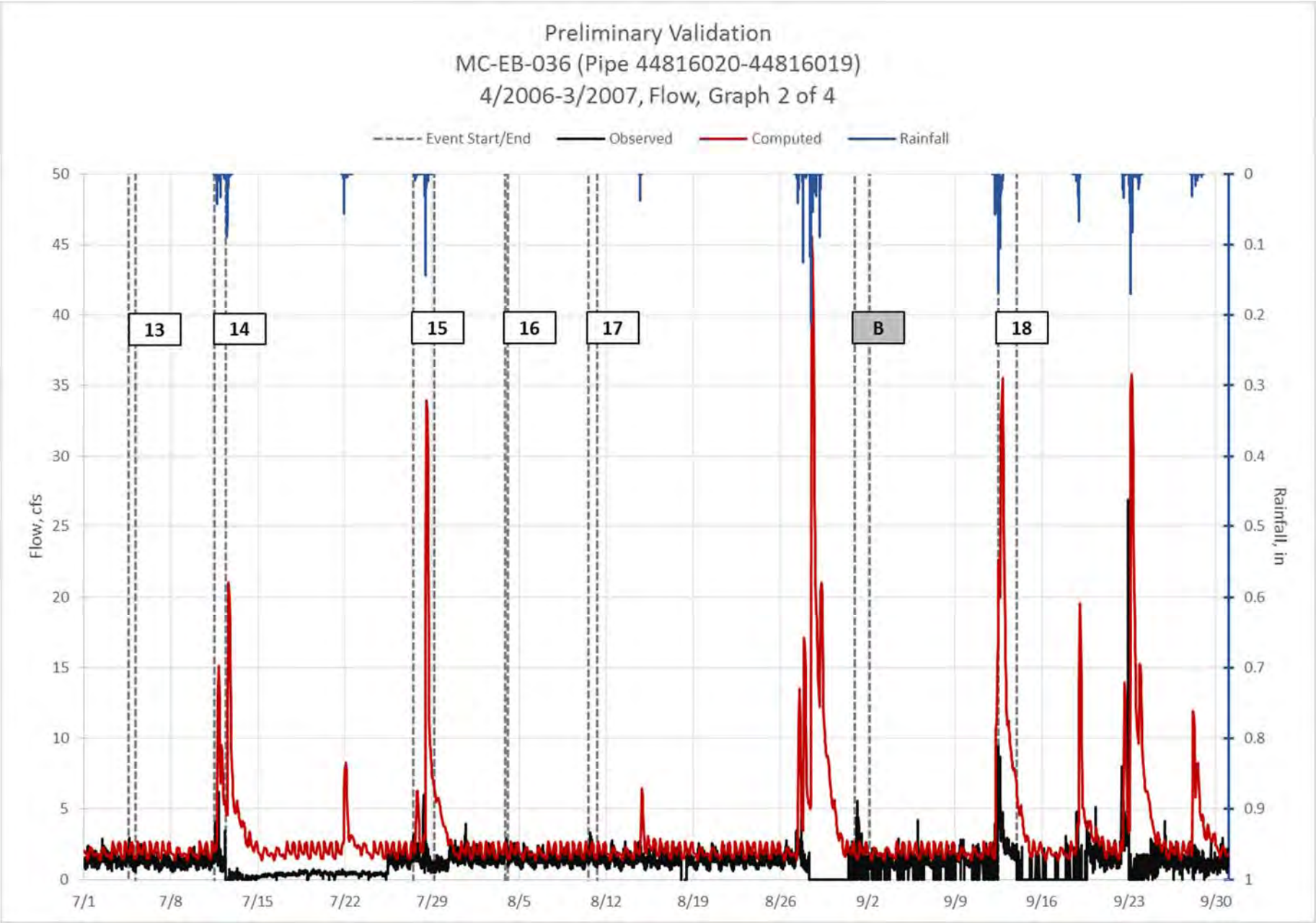

Preliminary Validation
MC-EB-035 (Pipe 44306005-44306022)
2009, Depth, Graph 1 of 4
Event Start/End
Observed
Computed
Rainfall
Depth, ft
Rainfall, in
1
2
3
4
1/1
1/8
1/15
1/22
1/29
2/5
2/12
2/19
2/26
3/5
3/12
3/19
3/26

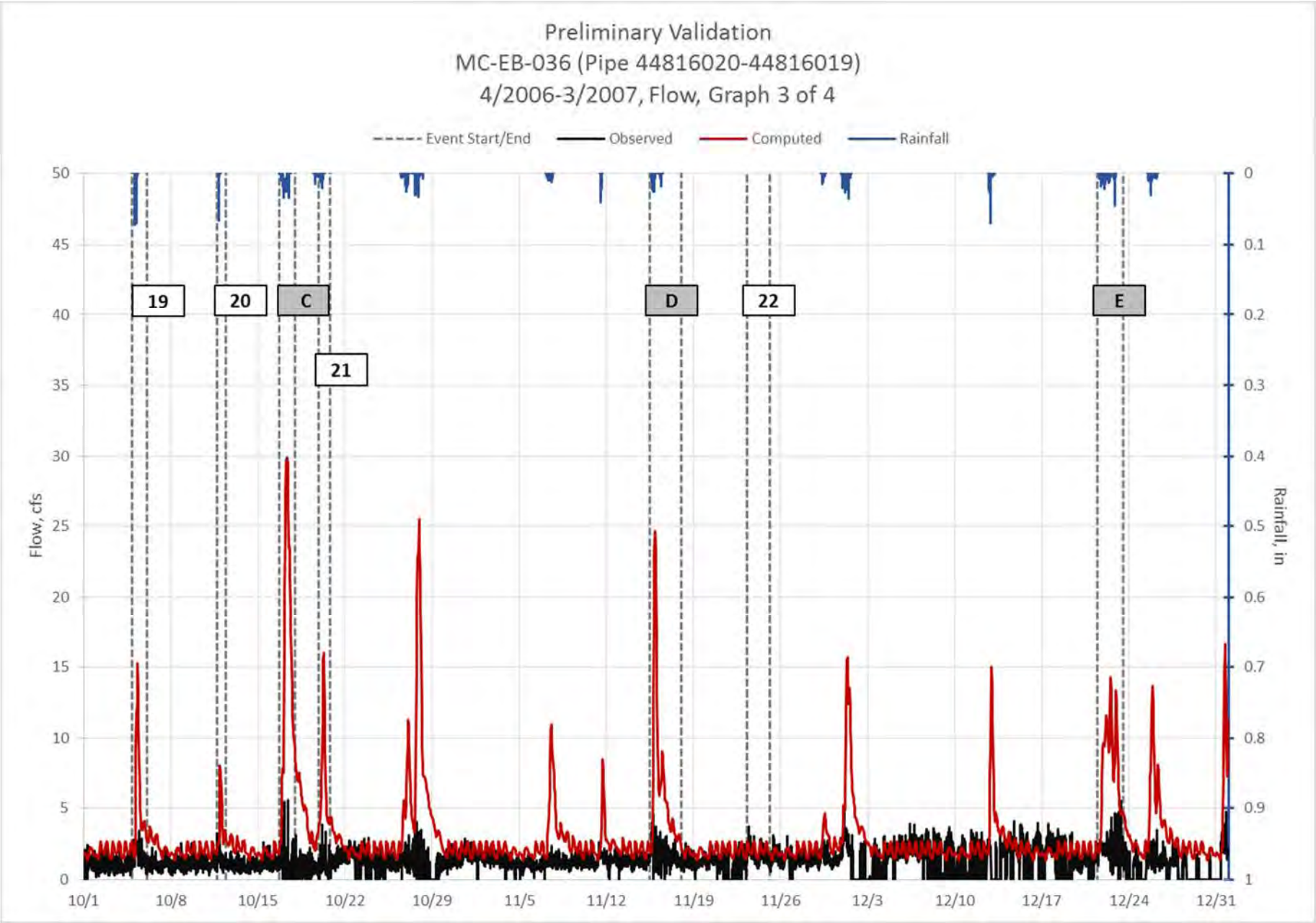

Preliminary Validation
MC-EB-035 (Pipe 44306005-44306022)
2009, Depth, Graph 2 of 4
Event Start/End
Observed
Computed
Rainfall
Depth, ft
Rainfall, in
5
6
7
8
9
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
4/1
4/8
4/15
4/22
4/29
5/6
5/13
5/20
5/27
6/3
6/10
6/17
6/24
7/1

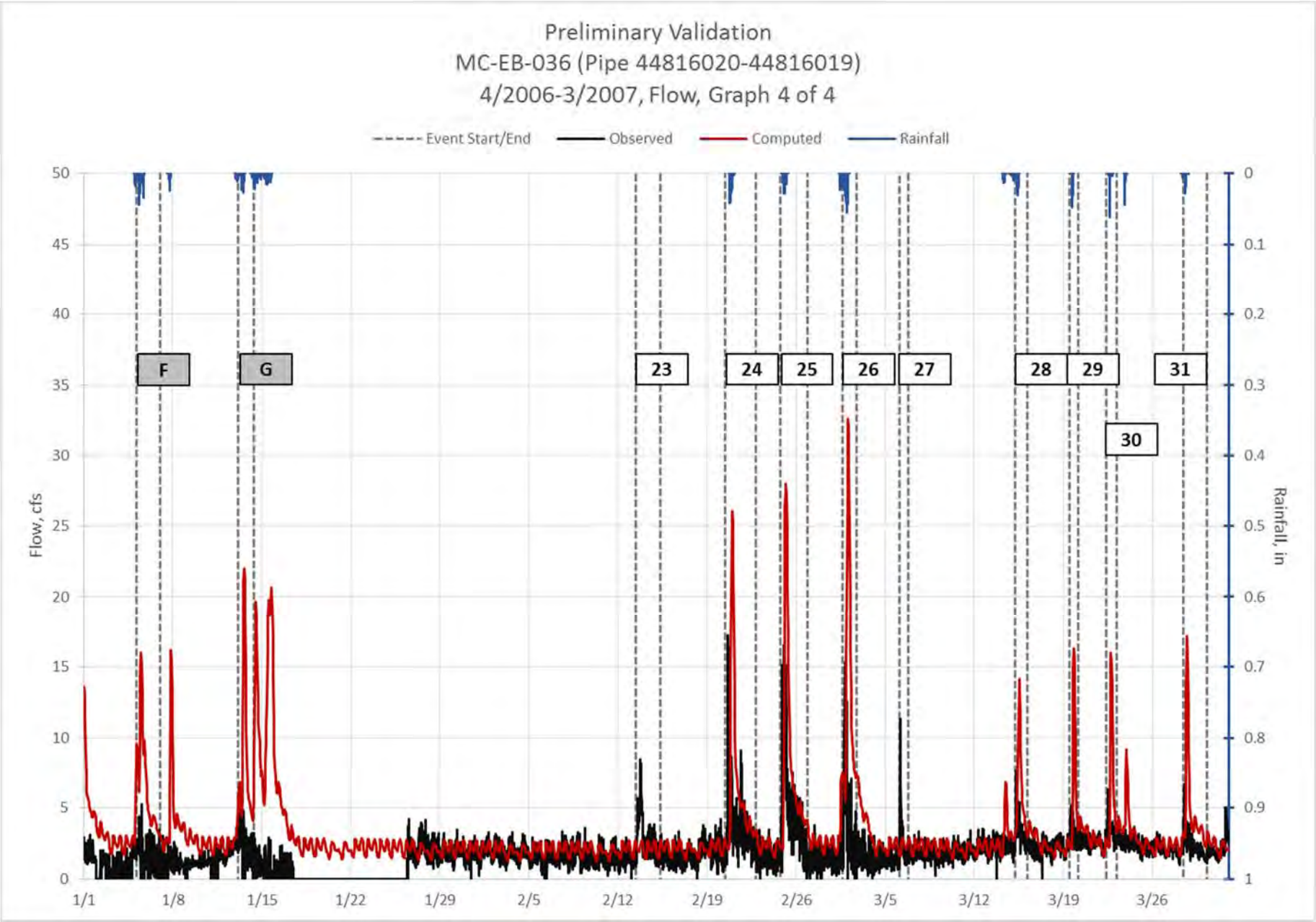

Preliminary Validation
MC-EB-035 (Pipe 44306005-44306022)
2009, Depth, Graph 3 of 4
Event Start/End
Observed
Computed
Rainfall
10
11
12
13
14
Depth, ft
Rainfall, in
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
7/1
7/8
7/15
7/22
7/29
8/5
8/12
8/19
8/26
9/2
9/9
9/16
9/23
9/30

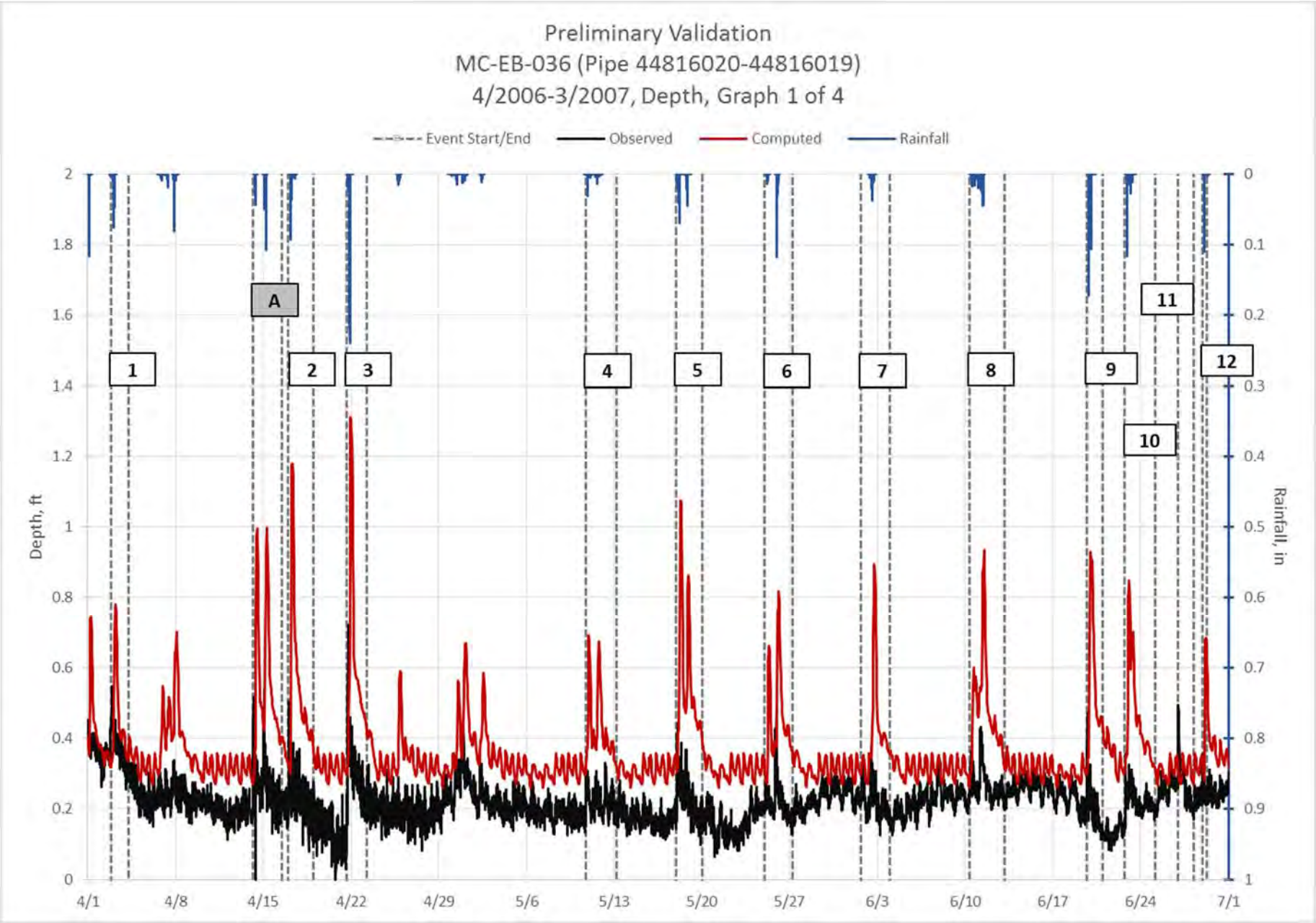

Preliminary Validation
MC-EB-035 (Pipe 44306005-44306022)
2009, Depth, Graph 4 of 4
Event Start/End
Observed
Computed
Rainfall
Depth, ft
15
16
17
18
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
10/1
10/8
10/15
10/22
10/29
11/5
11/12
11/19
11/26
12/3
12/10
12/17
12/24
12/31

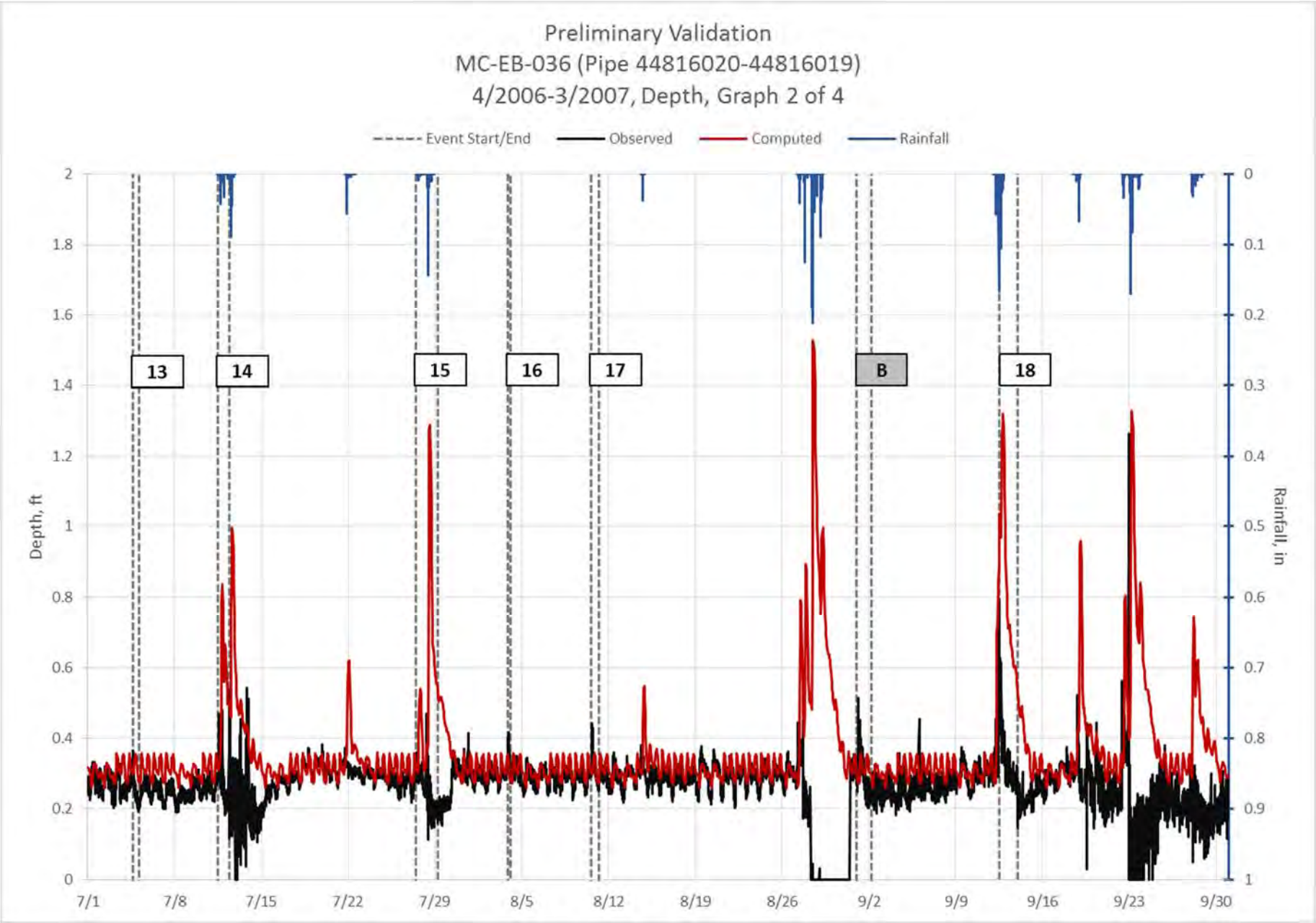

Preliminary Validation
MC-EB-036 (Pipe 44816020-44816019)
4/2006-3/2007, Flow, Graph 1 of 4
Event Start/End
Observed
Computed
Rainfall
Flow, cfs
Rainfall, in
A
1
2
3
4
5
6
7
8
9
10
11
12
4/1
4/8
4/15
4/22
4/29
5/6
5/13
5/20
5/27
6/3
6/10
6/17
6/24
7/1

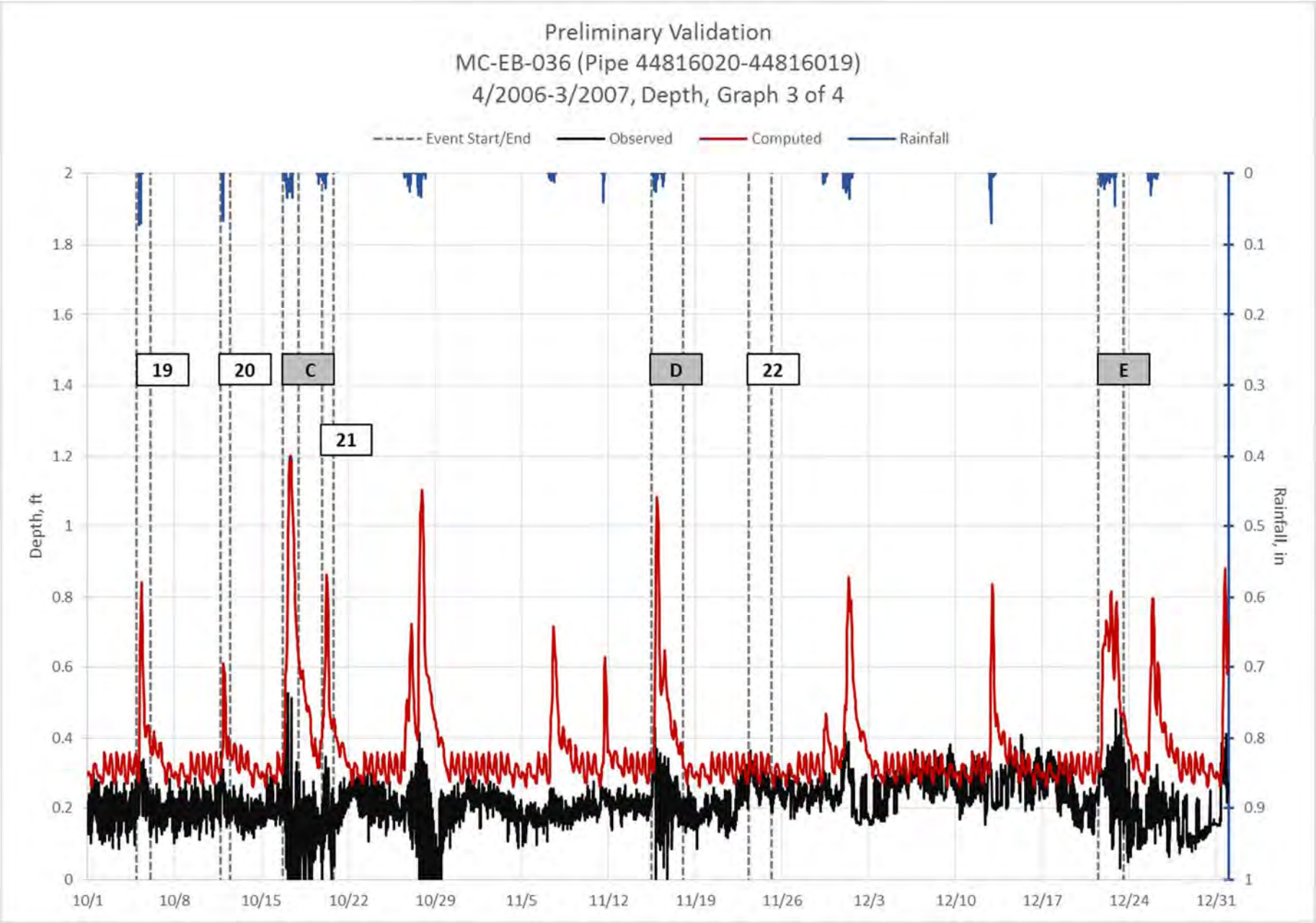

Preliminary Validation
MC-EB-036 (Pipe 44816020-44816019)
4/2006-3/2007, Flow, Graph 2 of 4
Event Start/End
Observed
Computed
Rainfall
13
14
15
16
17
B
18
Flow, cfs
Rainfall, in
50
45
40
35
30
25
20
15
10
5
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
7/1
7/8
7/15
7/22
7/29
8/5
8/12
8/19
8/26
9/2
9/9
9/16
9/23
9/30


Preliminary Validation
MC-EB-036 (Pipe 44816020-44816019)
4/2006-3/2007, Flow, Graph 3 of 4
Event Start/End
Observed
Computed
Rainfall
19
20
C
21
D
22
E
Flow, cfs
Rainfall, in
50
45
40
35
30
25
20
15
10
5
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
10/1
10/8
10/15
10/22
10/29
11/5
11/12
11/19
11/26
12/3
12/10
12/17
12/24
12/31


Preliminary Validation
MC-EB-036 (Pipe 44816020-44816019)
4/2006-3/2007, Flow, Graph 4 of 4
Event Start/End
Observed
Computed
Rainfall
Flow, cfs
Rainfall, in
F
G
23
24
25
26
27
28
29
30
31
1/1
1/8
1/15
1/22
1/29
2/5
2/12
2/19
2/26
3/5
3/12
3/19
3/26


Preliminary Validation
MC-EB-036 (Pipe 44816020-44816019)
4/2006-3/2007, Depth, Graph 1 of 4
Event Start/End
Observed
Computed
Rainfall
Depth, ft
Rainfall, in
A
1
2
3
4
5
6
7
8
9
10
11
12
4/1
4/8
4/15
4/22
4/29
5/6
5/13
5/20
5/27
6/3
6/10
6/17
6/24
7/1


Preliminary Validation
MC-EB-036 (Pipe 44816020-44816019)
4/2006-3/2007, Depth, Graph 2 of 4
Event Start/End
Observed
Computed
Rainfall
13
14
15
16
17
B
18
Depth, ft
Rainfall, in
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
7/1
7/8
7/15
7/22
7/29
8/5
8/12
8/19
8/26
9/2
9/9
9/16
9/23
9/30


Preliminary Validation
MC-EB-036 (Pipe 44816020-44816019)
4/2006-3/2007, Depth, Graph 3 of 4
Event Start/End
Observed
Computed
Rainfall
Depth, ft
Rainfall, in
19
20
C
21
D
22
E
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
10/1
10/8
10/15
10/22
10/29
11/5
11/12
11/19
11/26
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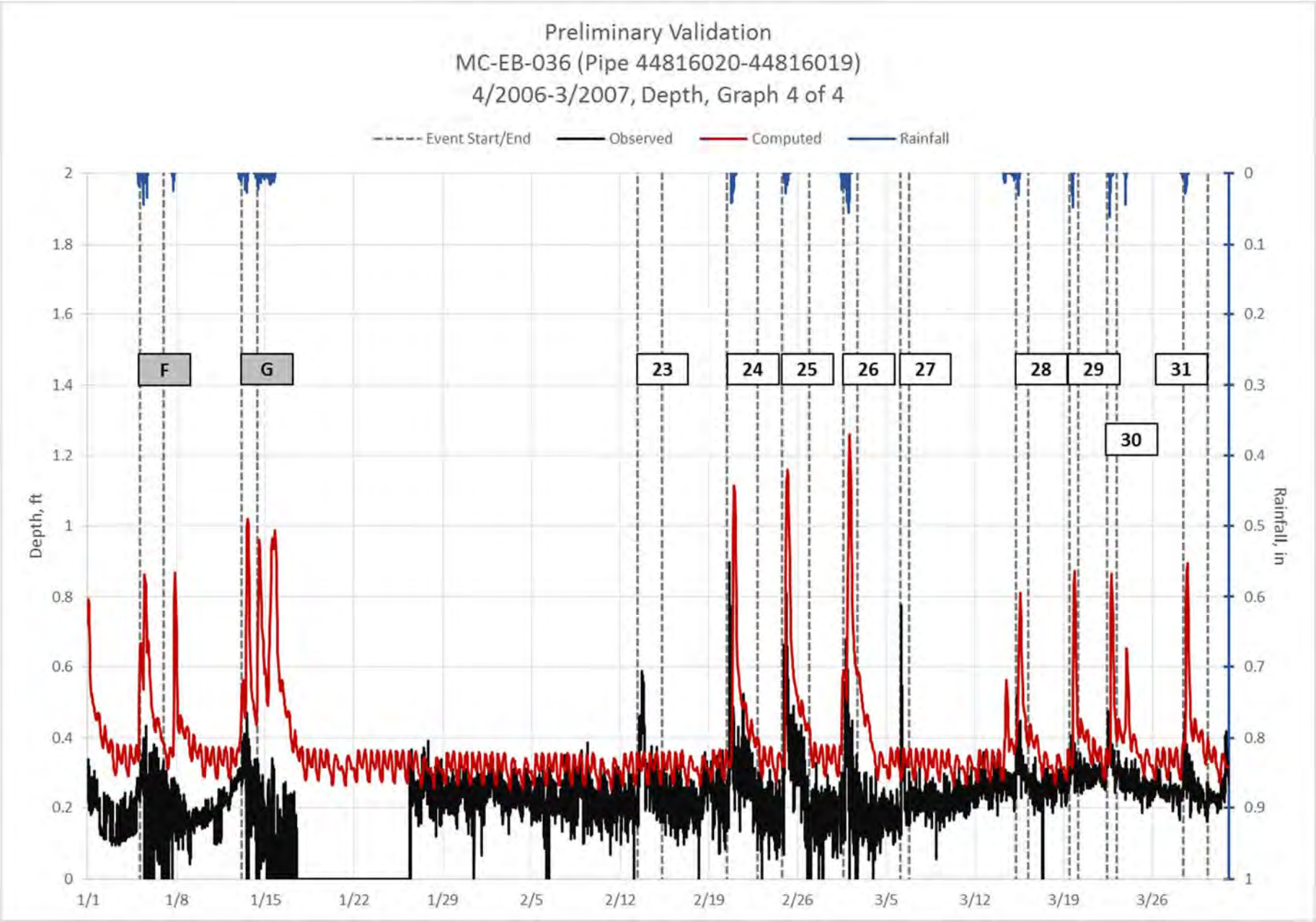
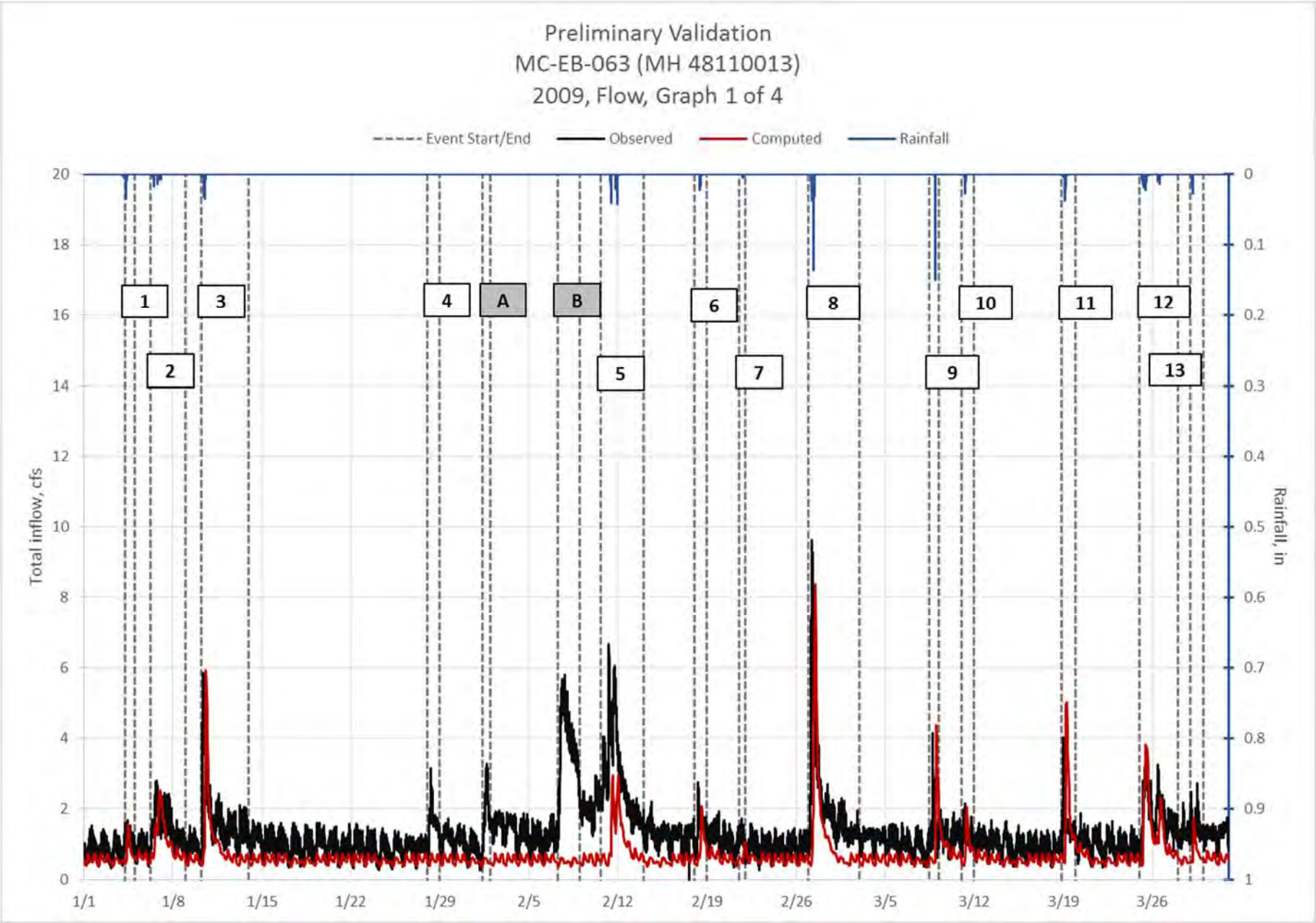
12/10
12/17
12/24
12/31


Preliminary Validation
MC-EB-036 (Pipe 44816020-44816019)
4/2006-3/2007, Depth, Graph 4 of 4
Event Start/End
Observed
Computed
Rainfall
Depth, ft
Rainfall, in
F
G
23
24
25
26
27
28
29
30
31
1/1
1/8
1/15
1/22
1/29
2/5
2/12
2/19
2/26
3/5
3/12
3/19
3/26


Preliminary Validation
MC-EB-063 (MH 48110013)
2009, Flow, Graph 1 of 4
Event Start/End
Observed
Computed
Rainfall
Total inflow, cfs
Rainfall, in
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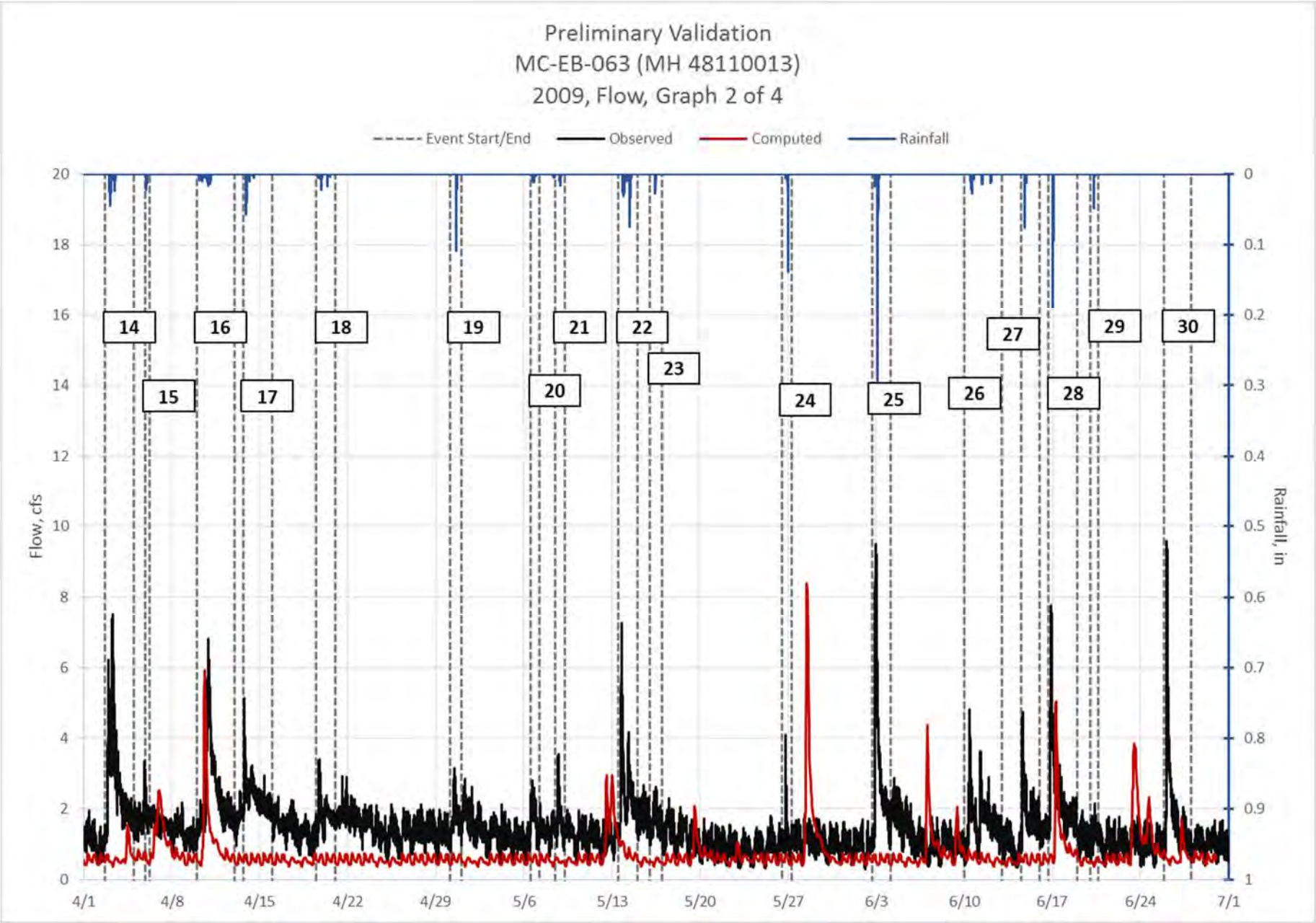
Preliminary Validation
MC-EB-063 (MH 48110013)
2009, Flow, Graph 2 of 4
Event Start/End
Observed
Computed
Rainfall
Flow, cfs
Rainfall, in
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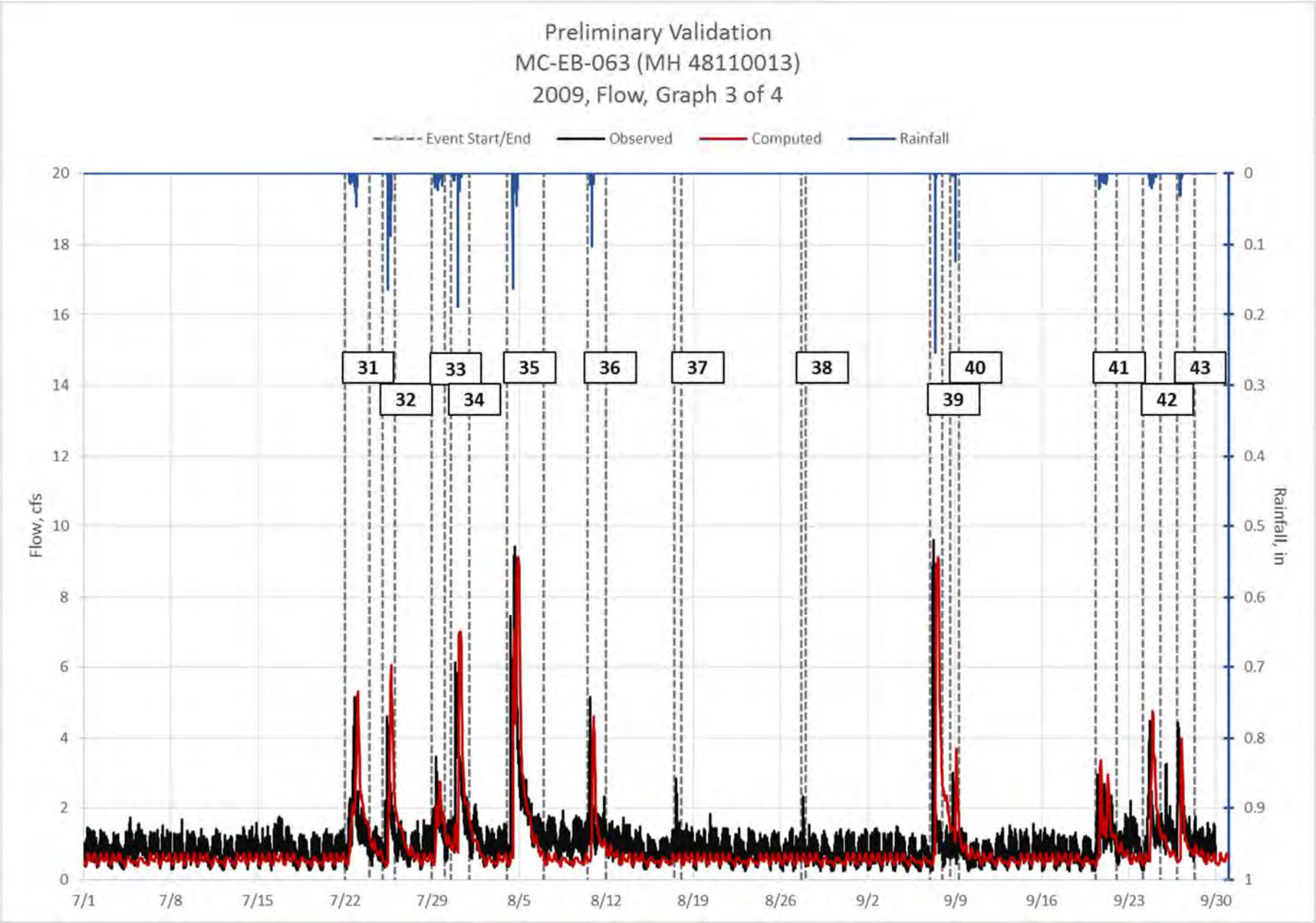
Preliminary Validation
MC-EB-063 (MH 48110013)
2009, Flow, Graph 3 of 4
Event Start/End
Observed
Computed
Rainfall
Flow, cfs
Rainfall, in
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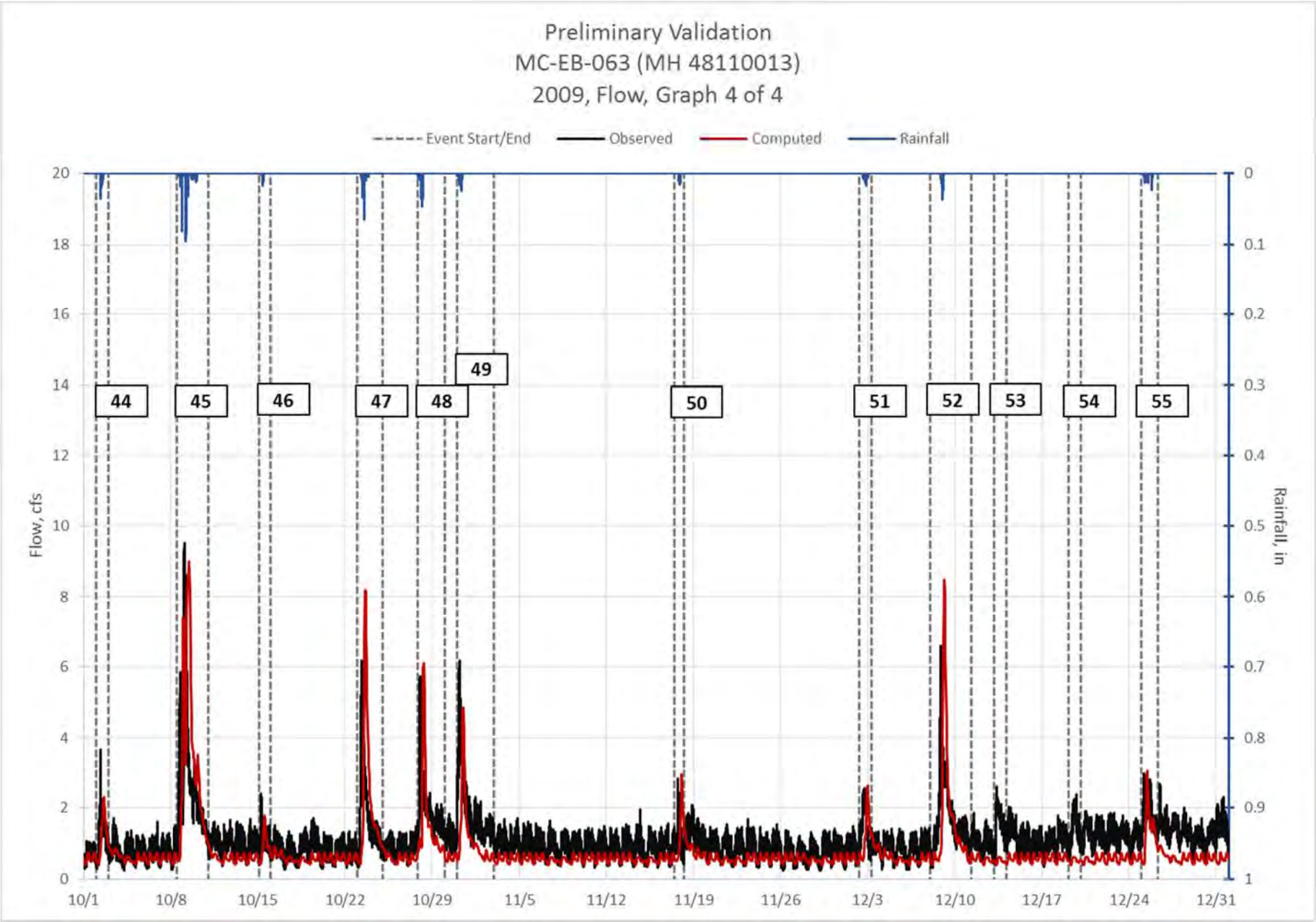
Preliminary Validation
MC-EB-063 (MH 48110013)
2009, Flow, Graph 4 of 4
Event Start/End
Observed
Computed
Rainfall
Flow, cfs
Rainfall, in
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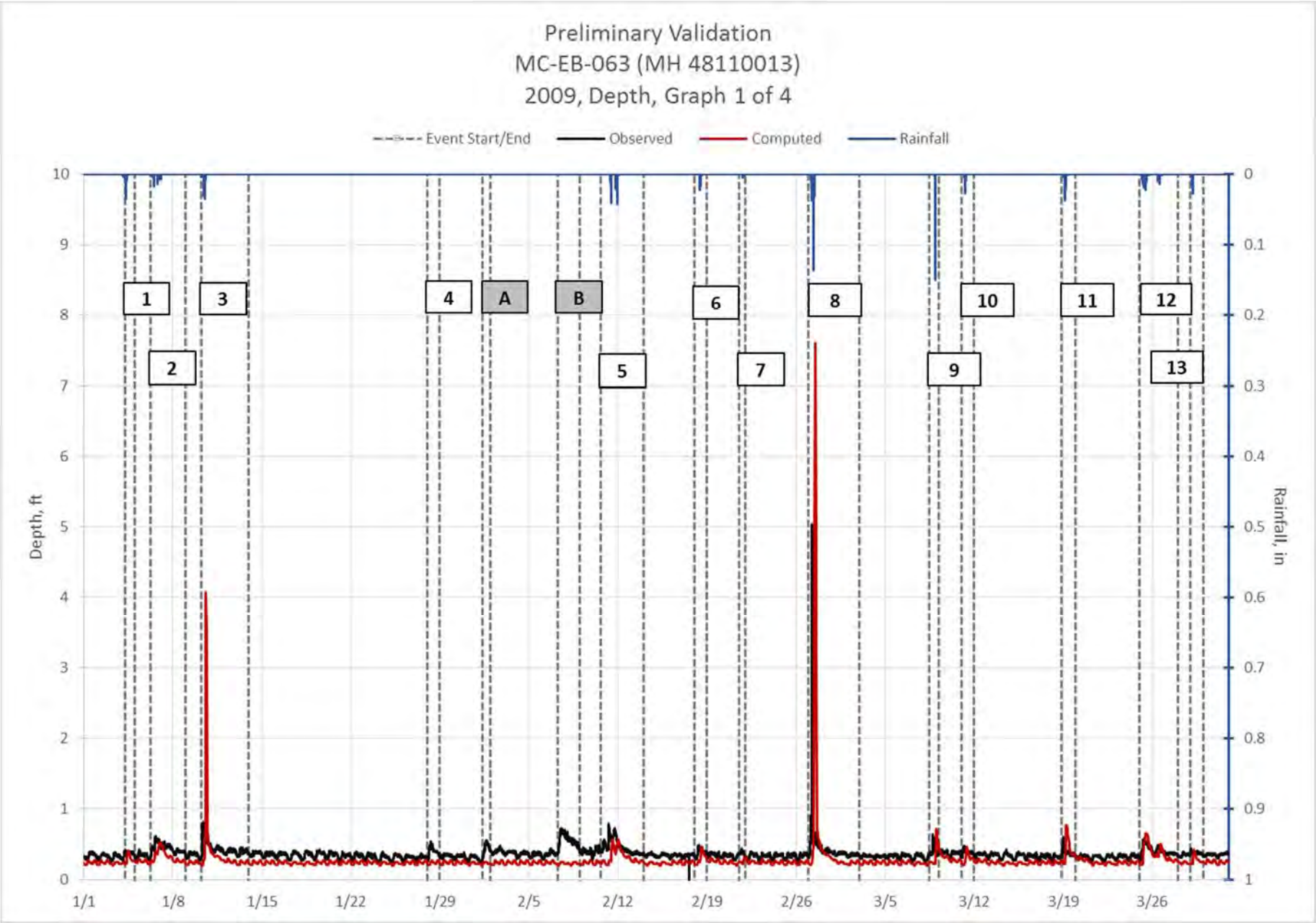
Preliminary Validation
MC-EB-063 (MH 48110013)
2009, Depth, Graph 1 of 4
Event Start/End
Observed
Computed
Rainfall
Depth, ft
Rainfall, in
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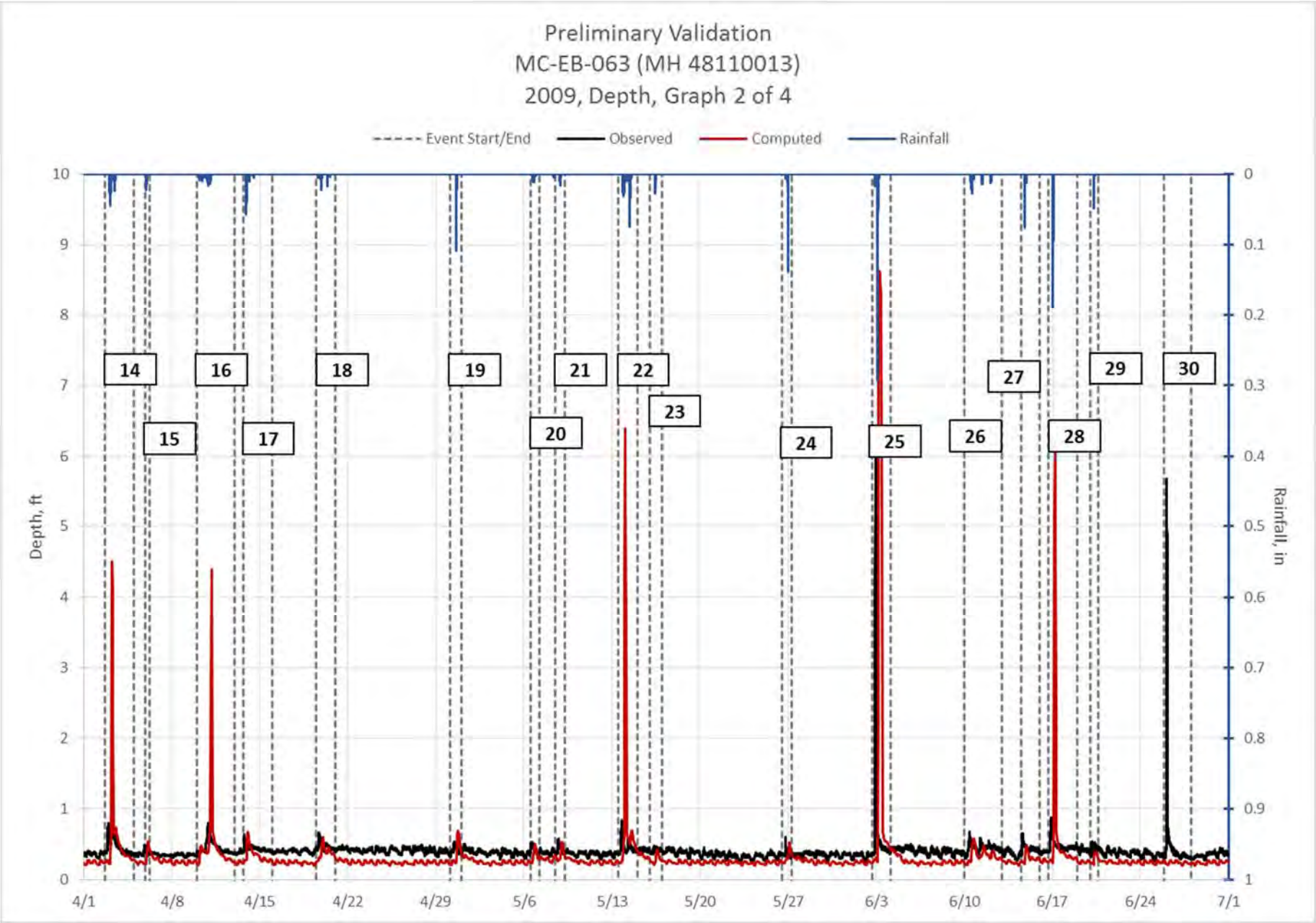
Preliminary Validation
MC-EB-063 (MH 48110013)
2009, Depth, Graph 2 of 4
Event Start/End
Observed
Computed
Rainfall
Depth, ft
Rainfall, in
14
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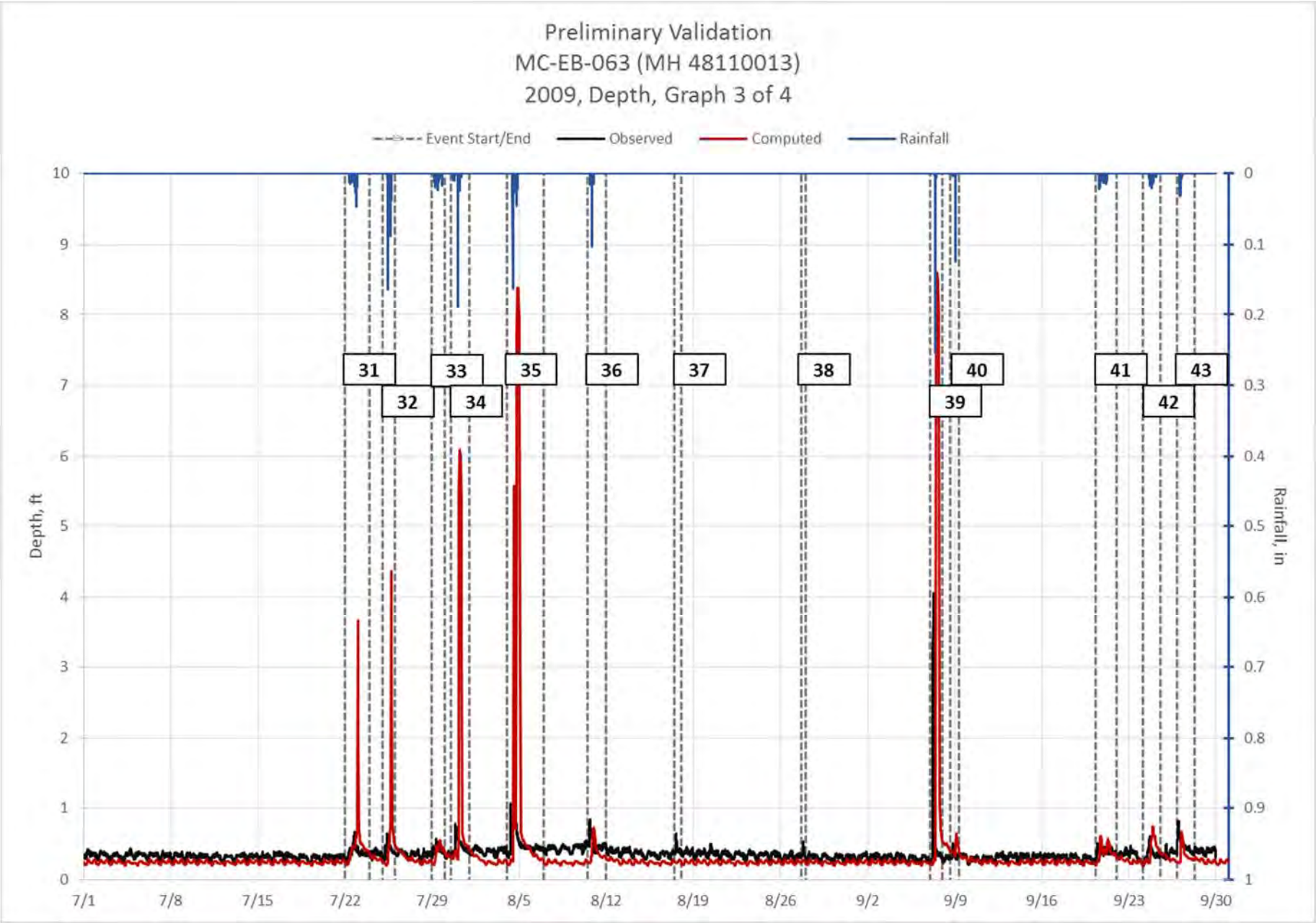
Preliminary Validation
MC-EB-063 (MH 48110013)
2009, Depth, Graph 3 of 4
Event Start/End
Observed
Computed
Rainfall
Depth, ft
Rainfall, in
31
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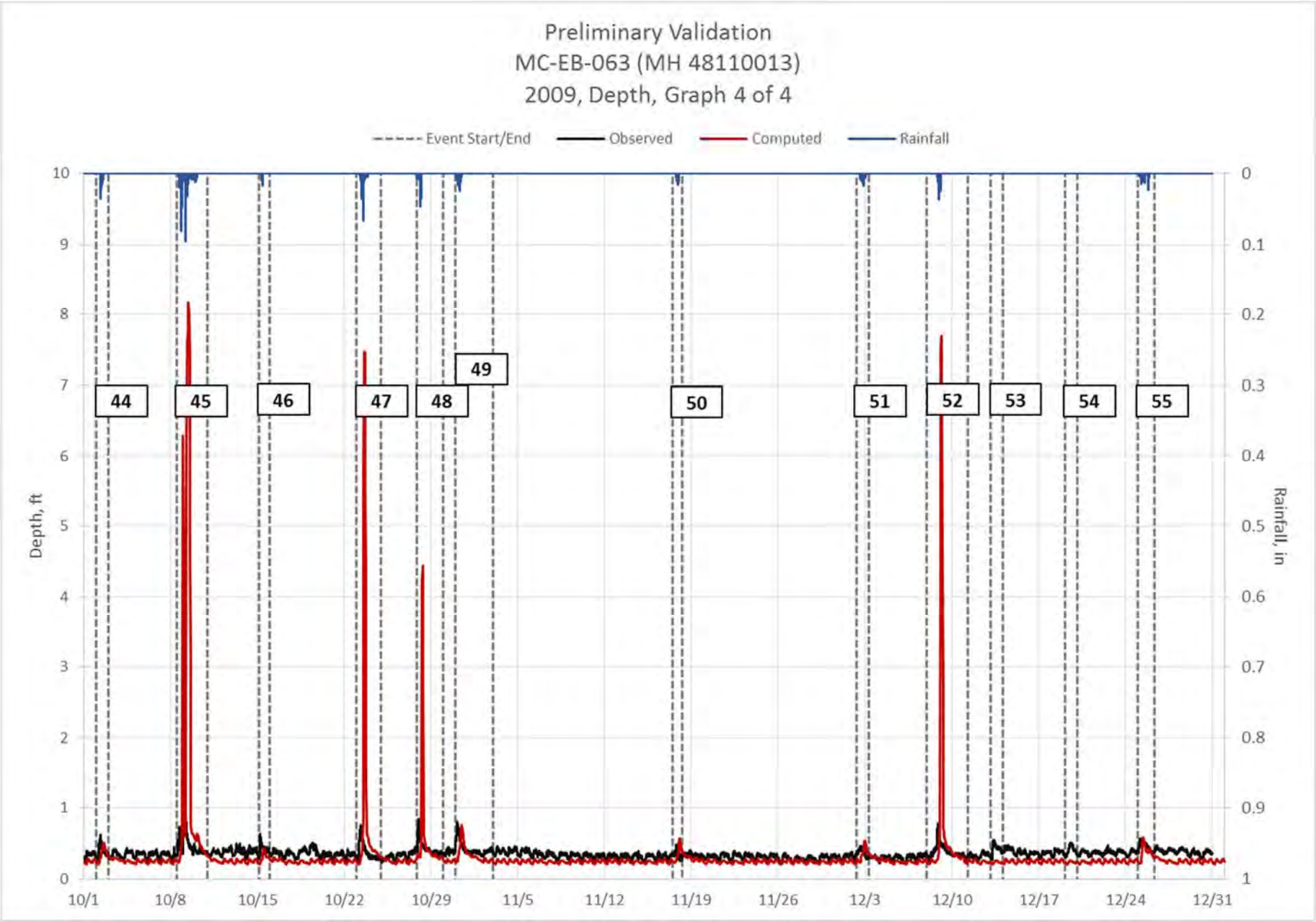
Preliminary Validation
MC-EB-063 (MH 48110013)
2009, Depth, Graph 4 of 4
Event Start/End
Observed
Computed
Rainfall
Depth, ft
Rainfall, in
44
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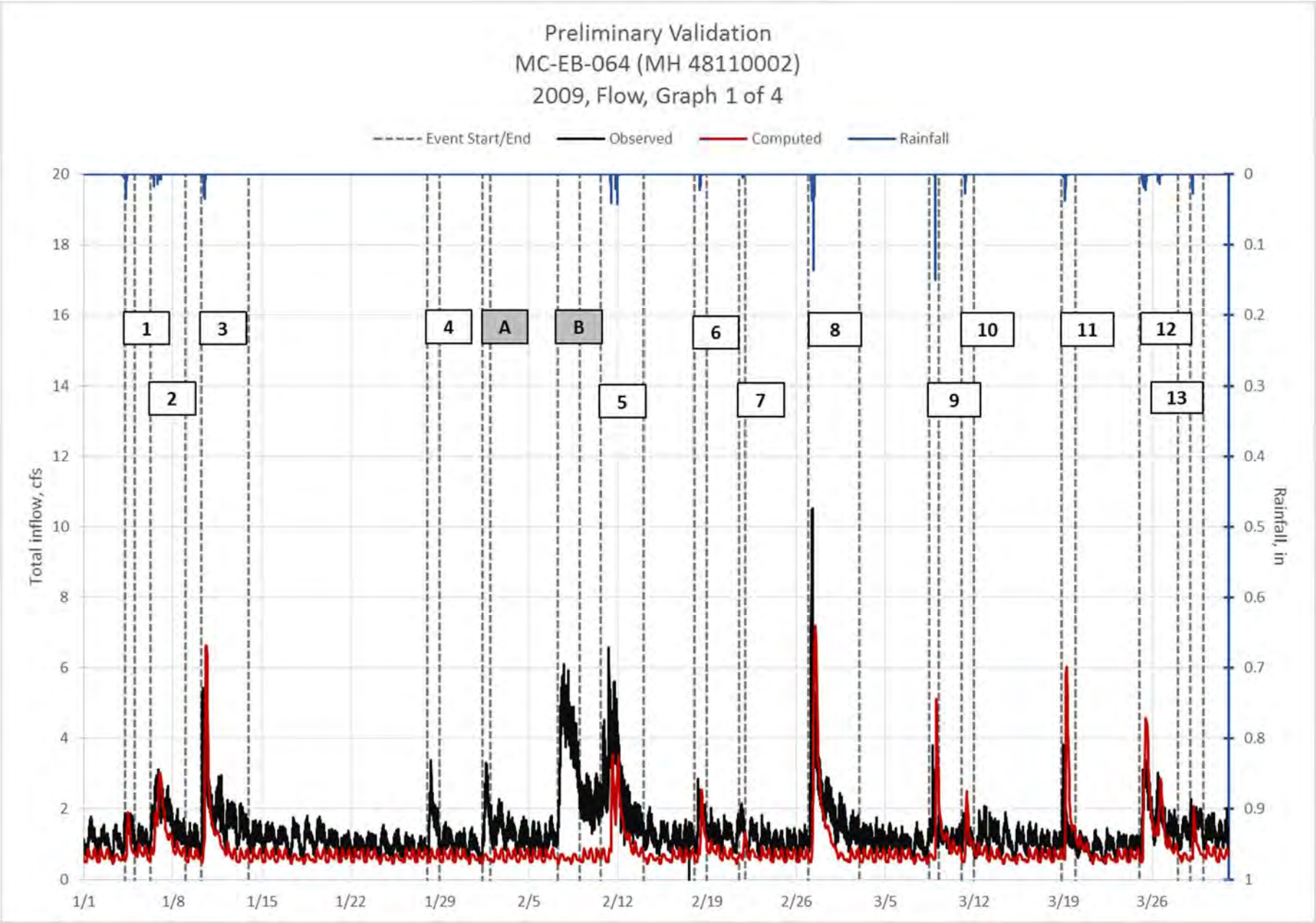
12/31


Preliminary Validation
MC-EB-064 (MH 48110002)
2009, Flow, Graph 1 of 4
Event Start/End
Observed
Computed
Rainfall
Total inflow, cfs
Rainfall, in
1
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1/29
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2/26
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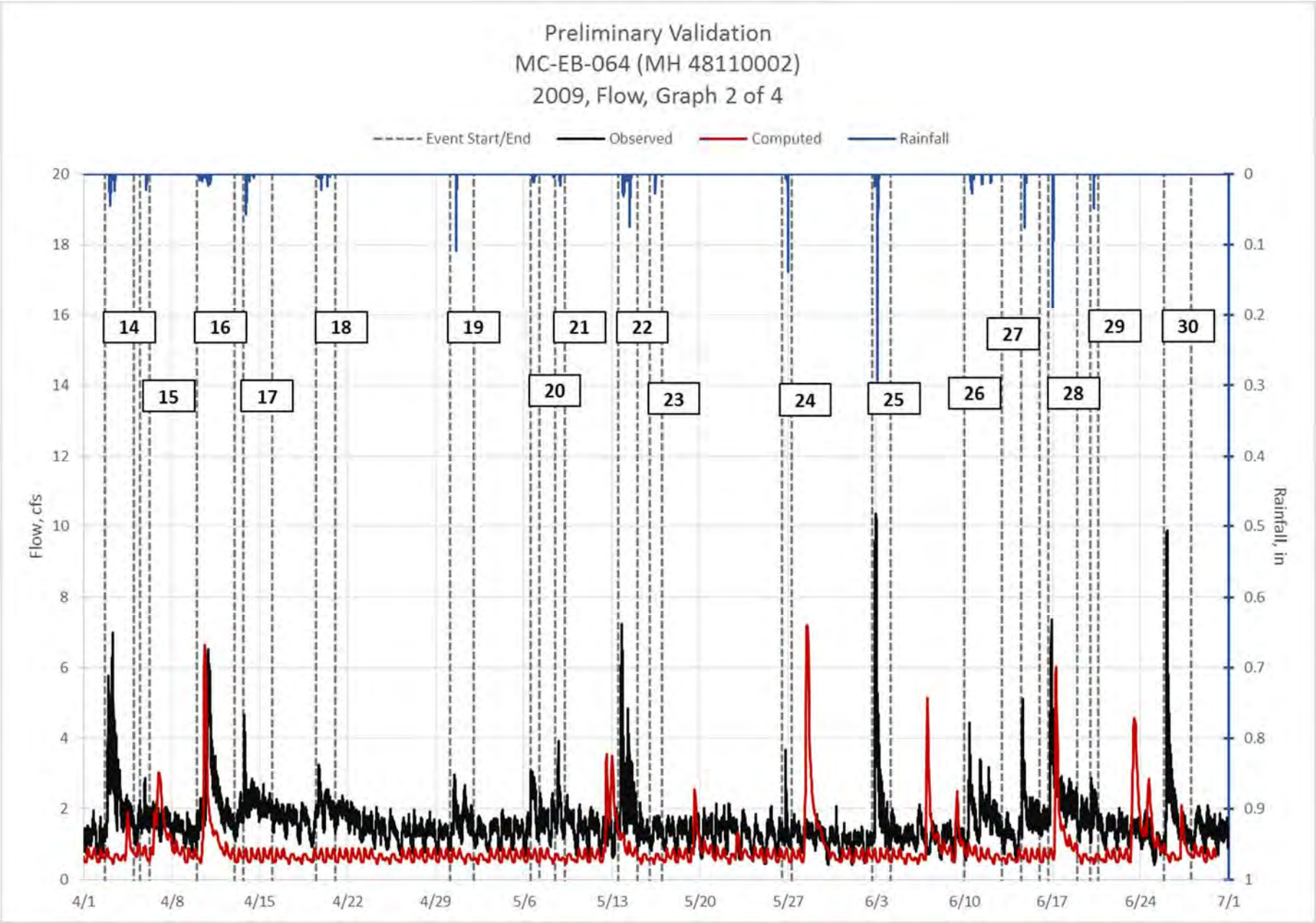
Preliminary Validation
MC-EB-064 (MH 48110002)
2009, Flow, Graph 2 of 4
Event Start/End
Observed
Computed
Rainfall
Flow, cfs
Rainfall, in
14
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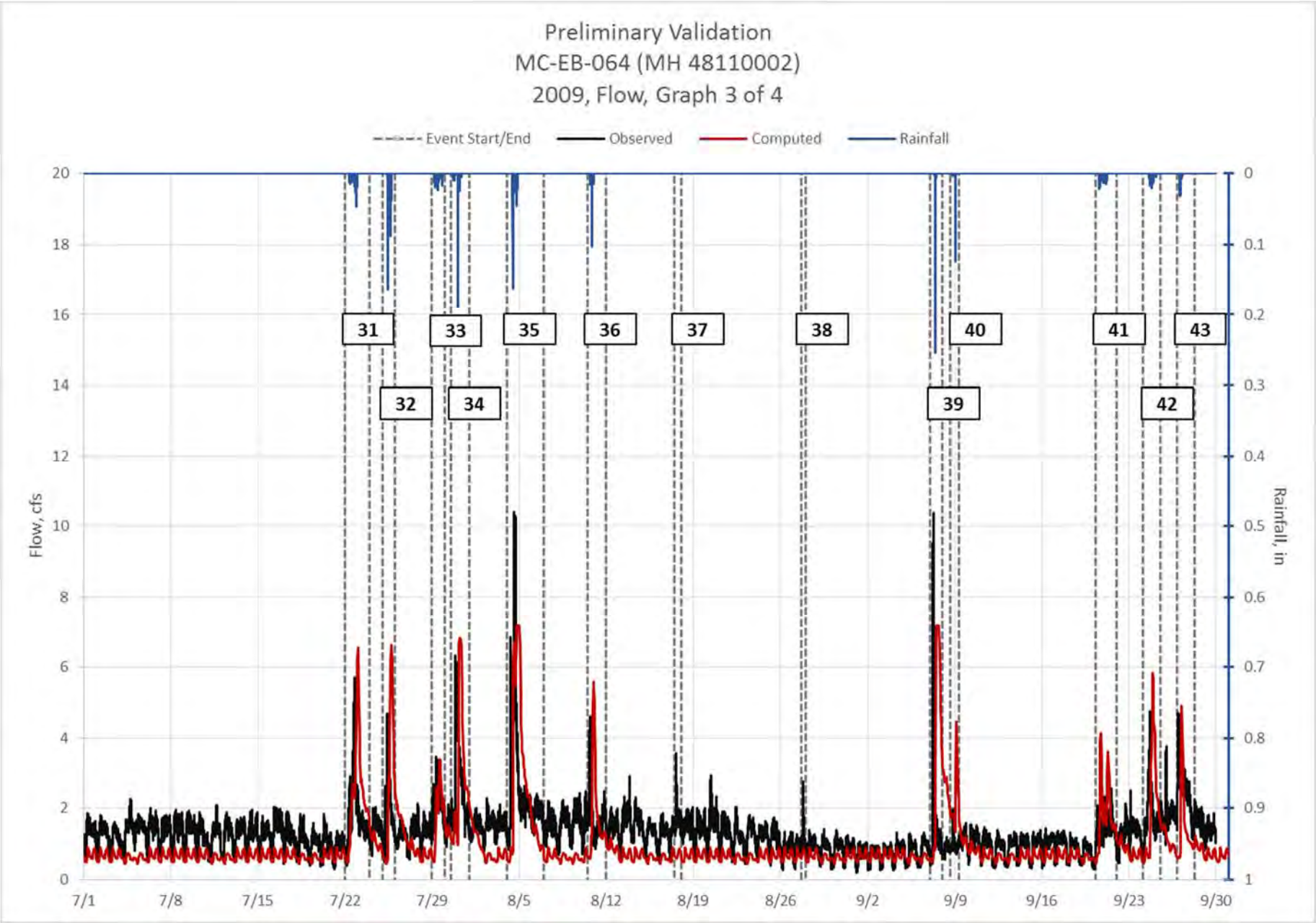
Preliminary Validation
MC-EB-064 (MH 48110002)
2009, Flow, Graph 3 of 4
Event Start/End
Observed
Computed
Rainfall
Flow, cfs
Rainfall, in
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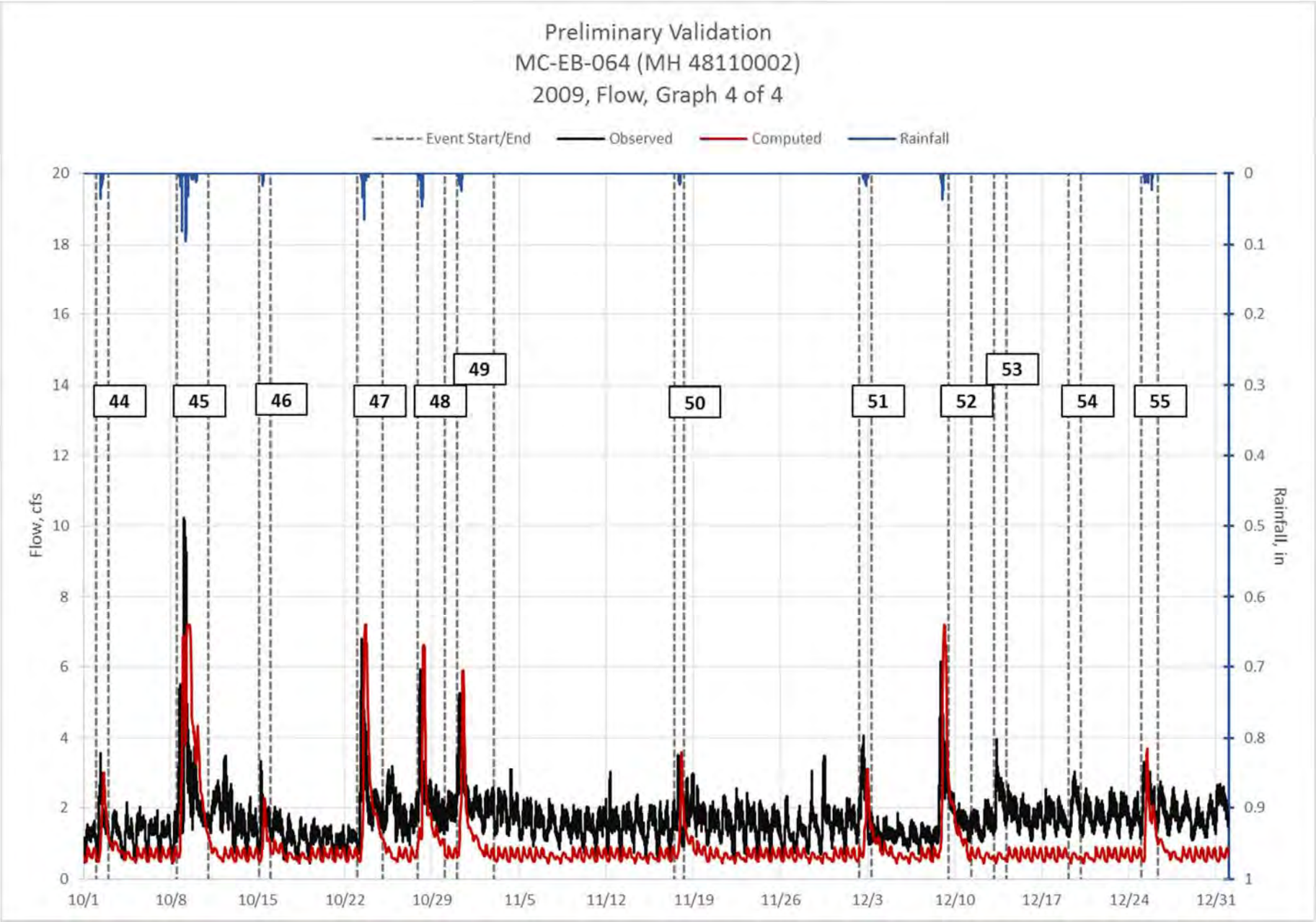
Preliminary Validation
MC-EB-064 (MH 48110002)
2009, Flow, Graph 4 of 4
Event Start/End
Observed
Computed
Rainfall
Flow, cfs
Rainfall, in
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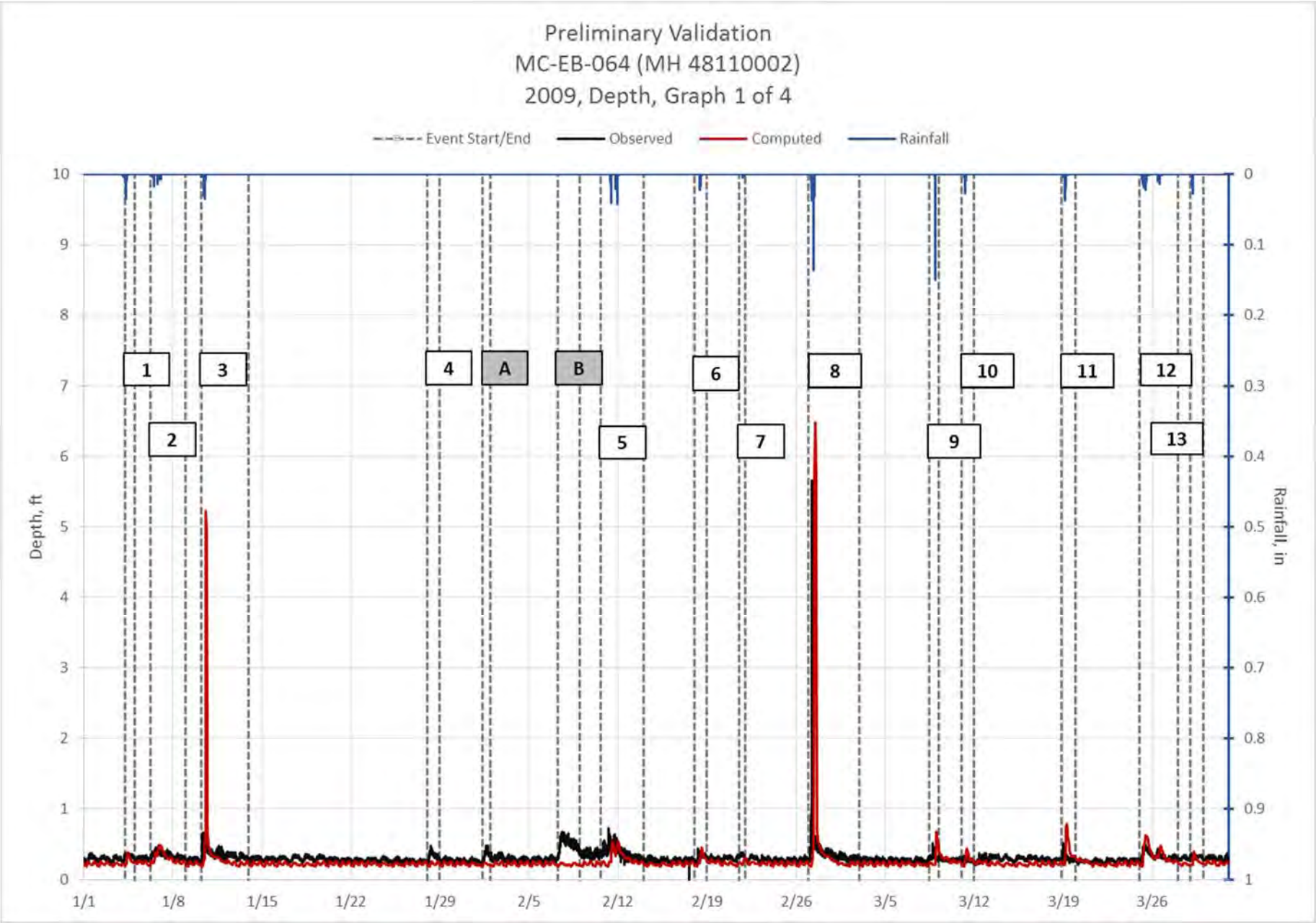
12/31


Preliminary Validation
MC-EB-064 (MH 48110002)
2009, Depth, Graph 1 of 4
Event Start/End
Observed
Computed
Rainfall
Depth, ft
Rainfall, in
1
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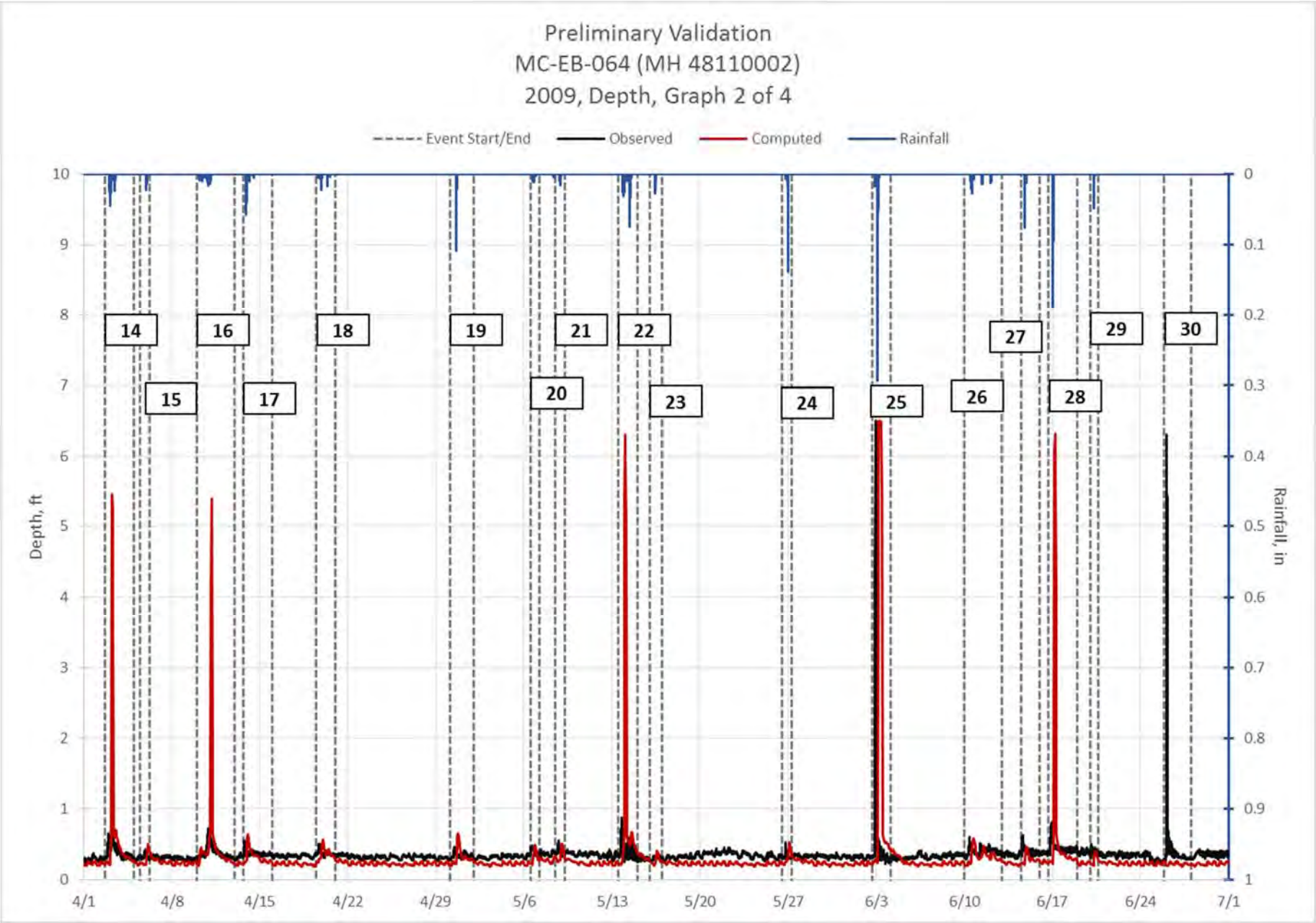
Preliminary Validation
MC-EB-064 (MH 48110002)
2009, Depth, Graph 2 of 4
Event Start/End
Observed
Computed
Rainfall
Depth, ft
Rainfall, in
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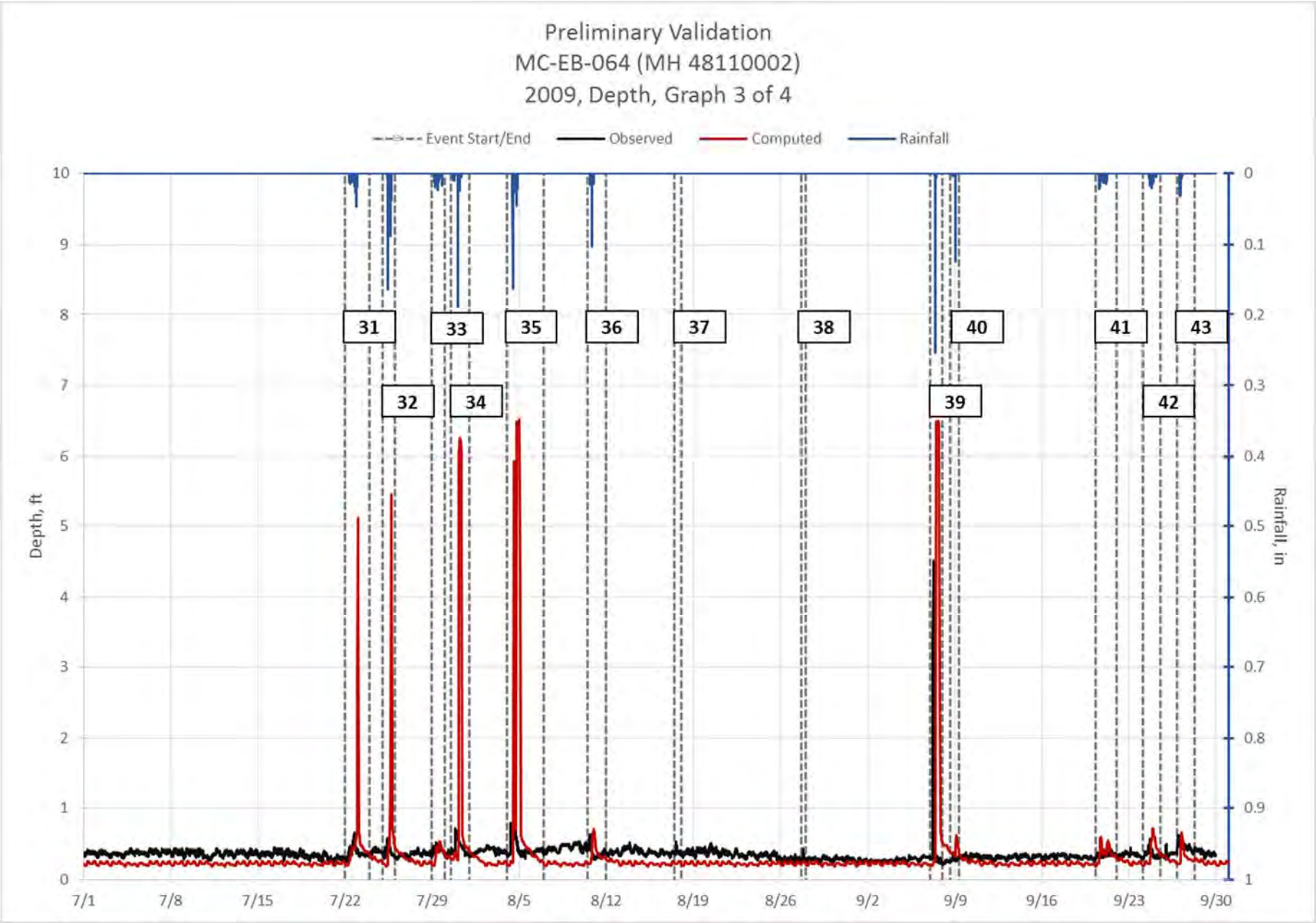
Preliminary Validation
MC-EB-064 (MH 48110002)
2009, Depth, Graph 3 of 4
Event Start/End
Observed
Computed
Rainfall
Depth, ft
Rainfall, in
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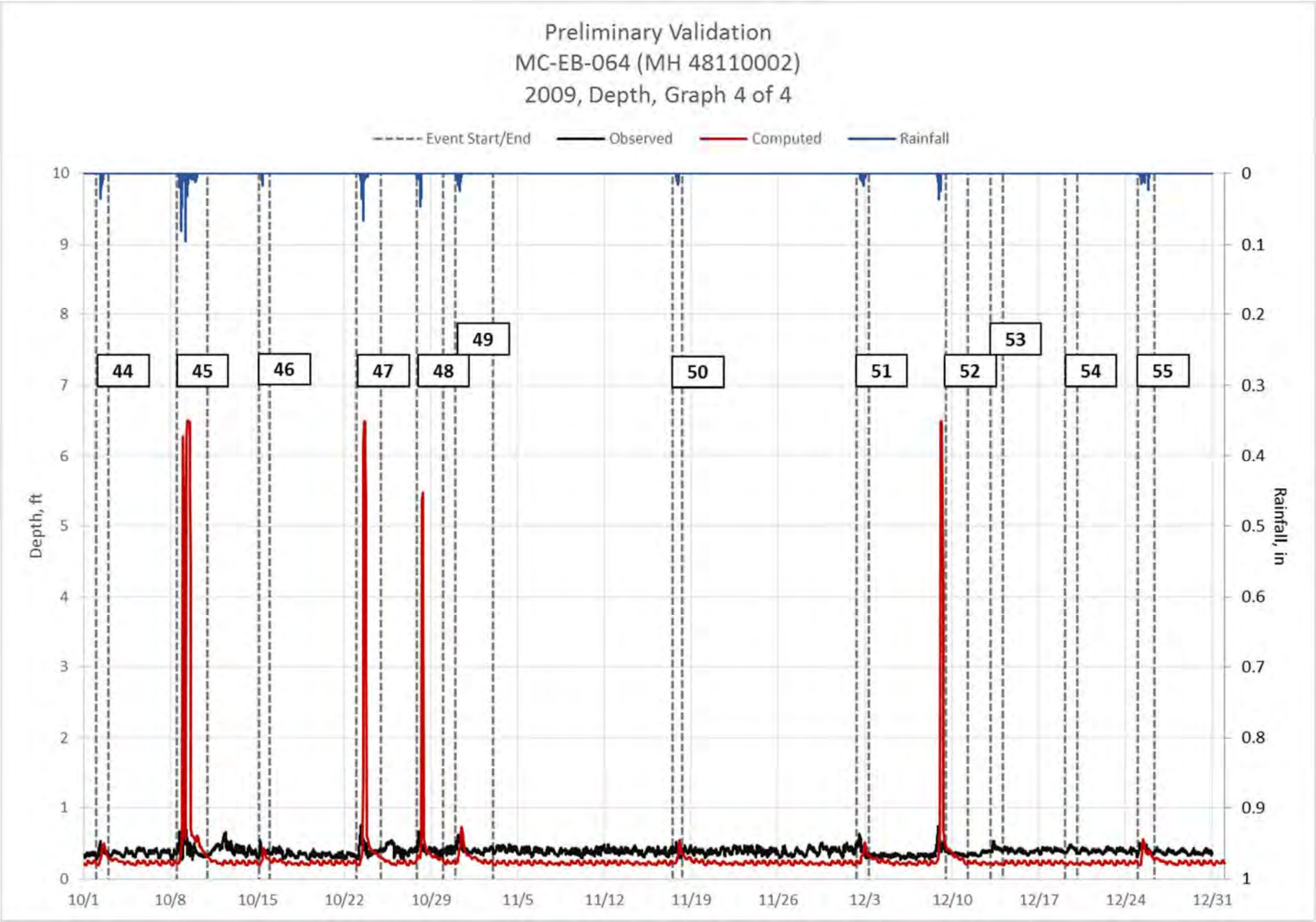
Preliminary Validation
MC-EB-064 (MH 48110002)
2009, Depth, Graph 4 of 4
Event Start/End
Observed
Computed
Rainfall
Depth, ft
Rainfall, in
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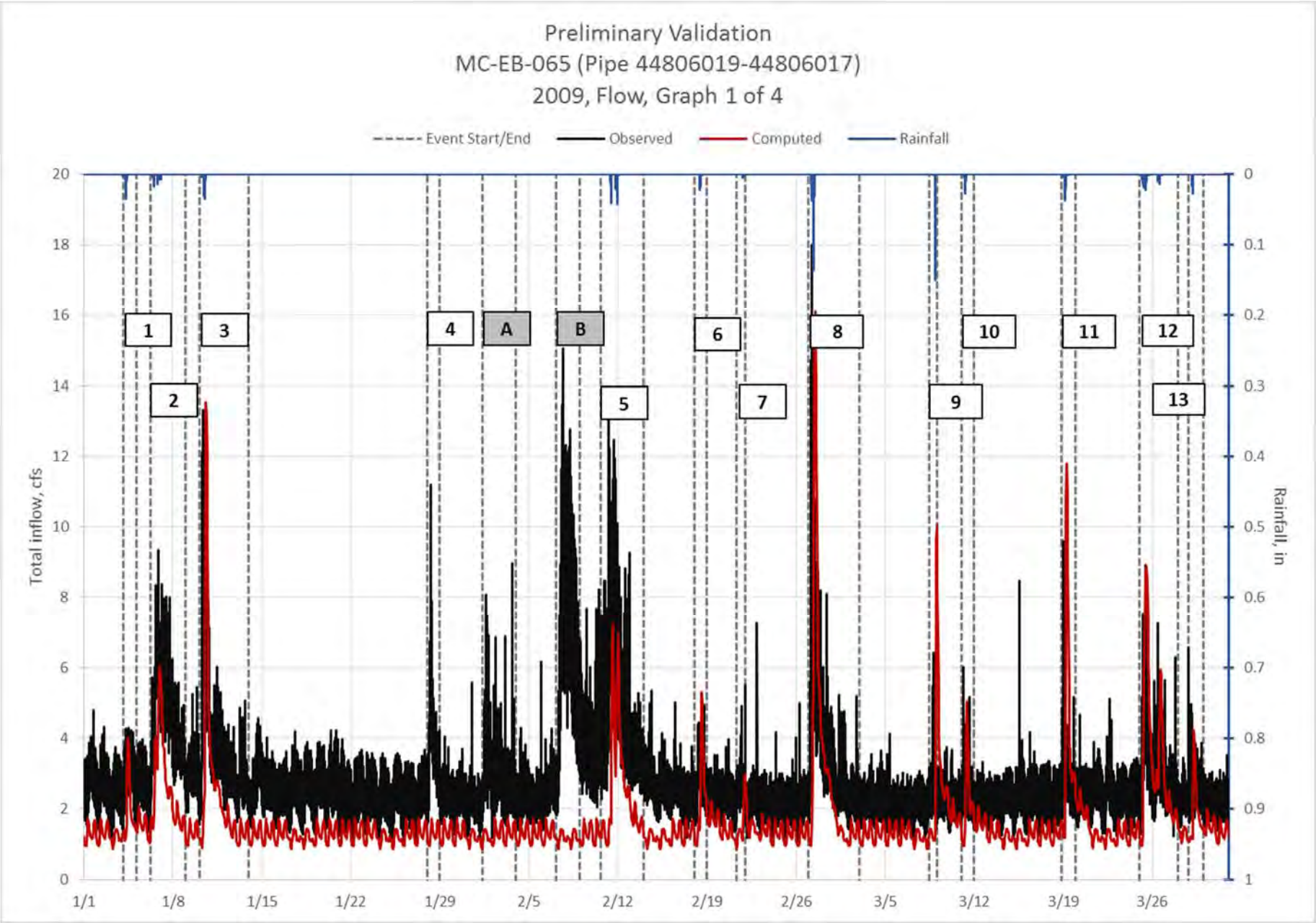
12/31


Preliminary Validation
MC-EB-065 (Pipe 44806019-44806017)
2009, Flow, Graph 1 of 4
Event Start/End
Observed
Computed
Rainfall
Total inflow, cfs
Rainfall, in
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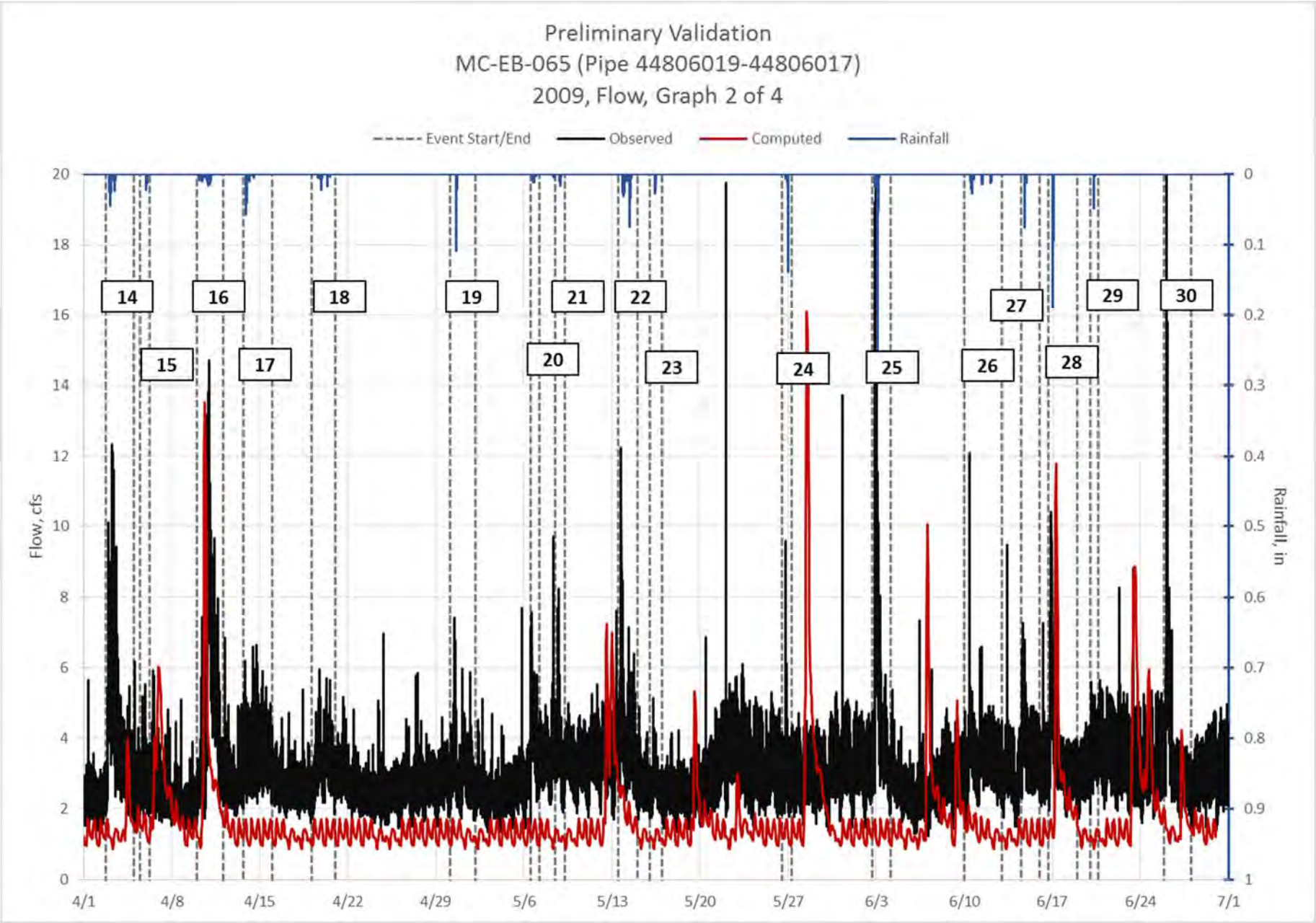
Preliminary Validation
MC-EB-065 (Pipe 44806019-44806017)
2009, Flow, Graph 2 of 4
Event Start/End
Observed
Computed
Rainfall
Flow, cfs
Rainfall, in
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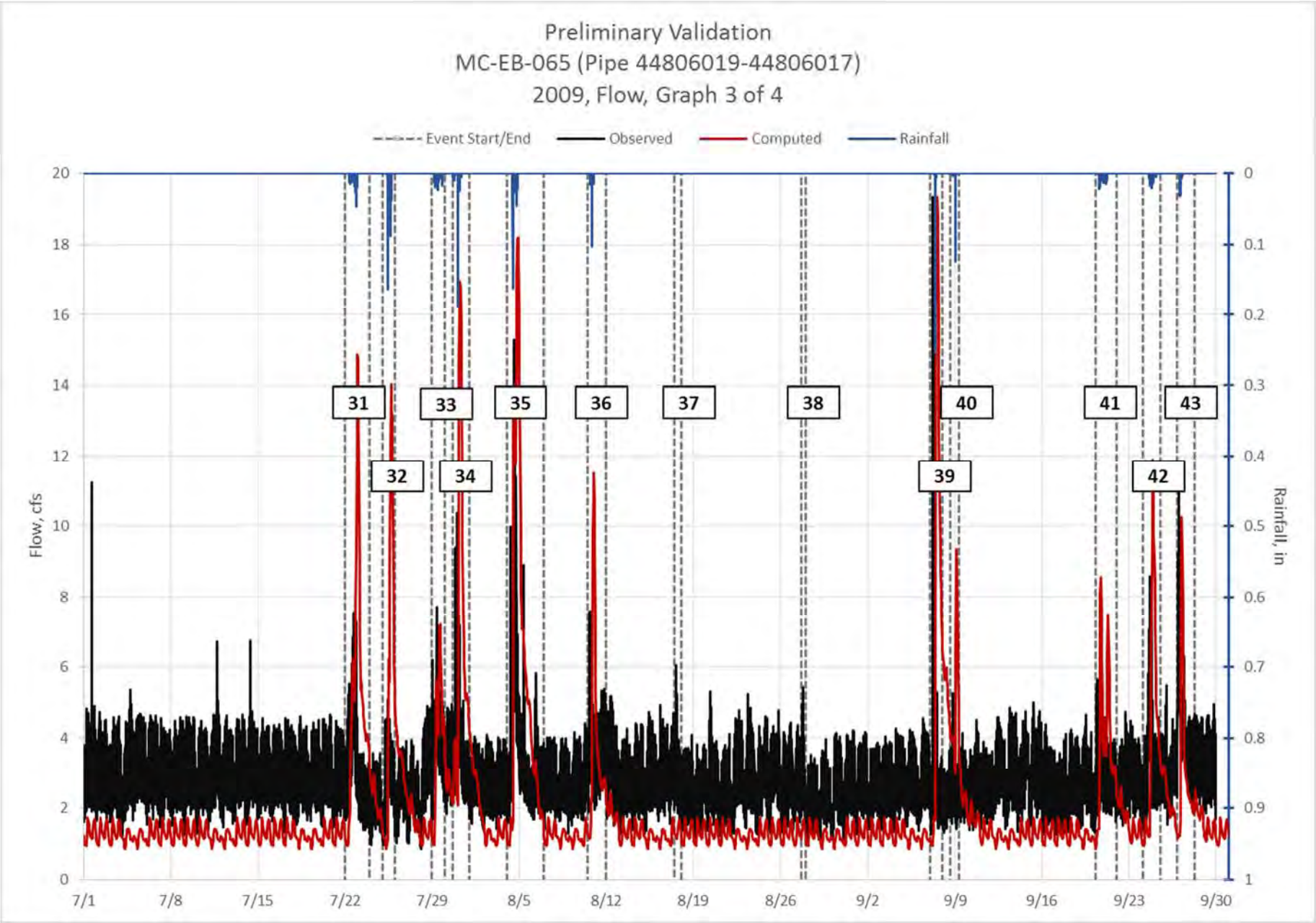
Preliminary Validation
MC-EB-065 (Pipe 44806019-44806017)
2009, Flow, Graph 3 of 4
Event Start/End
Observed
Computed
Rainfall
Flow, cfs
Rainfall, in
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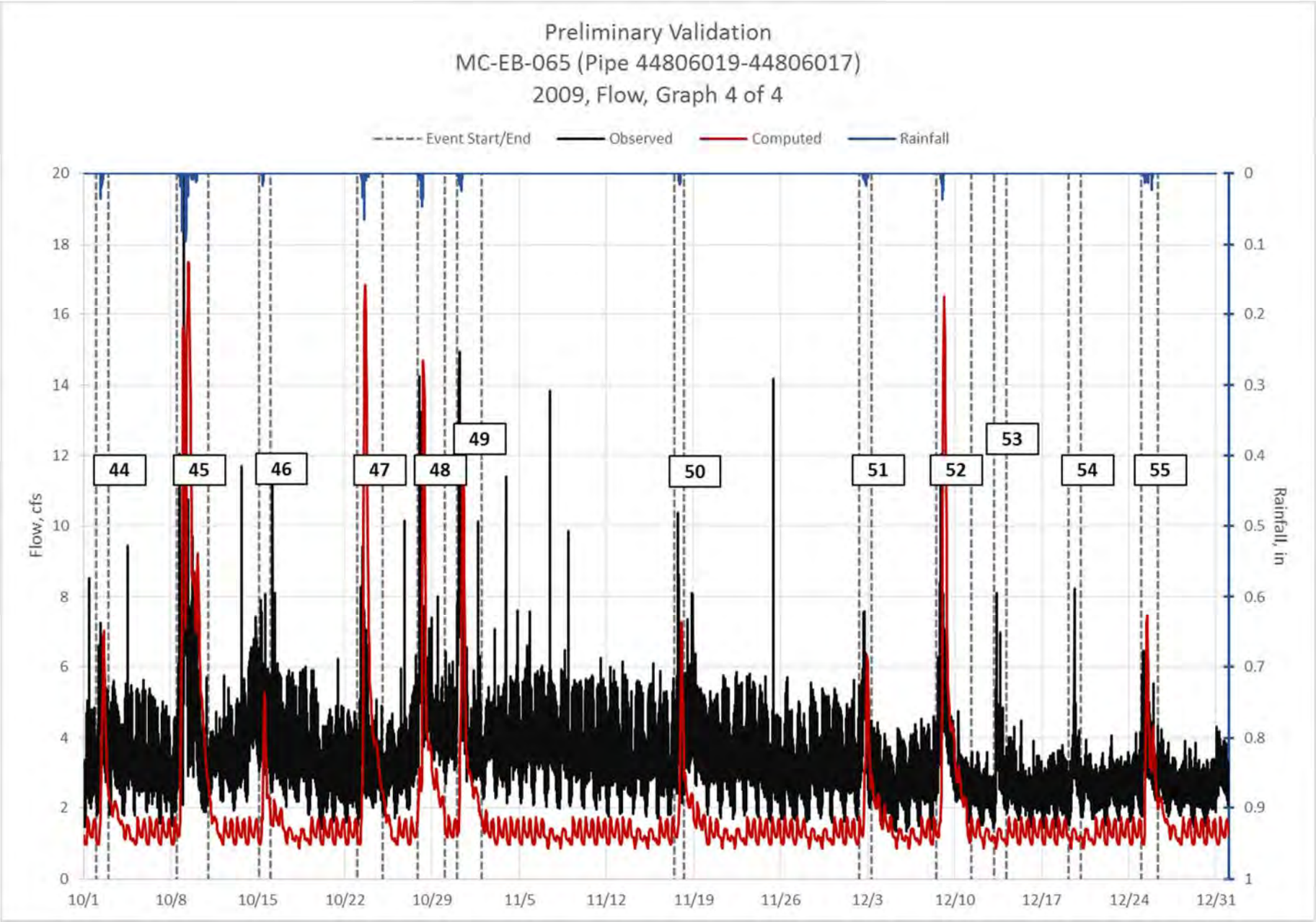
Preliminary Validation
MC-EB-065 (Pipe 44806019-44806017)
2009, Flow, Graph 4 of 4
Event Start/End
Observed
Computed
Rainfall
Flow, cfs
Rainfall, in
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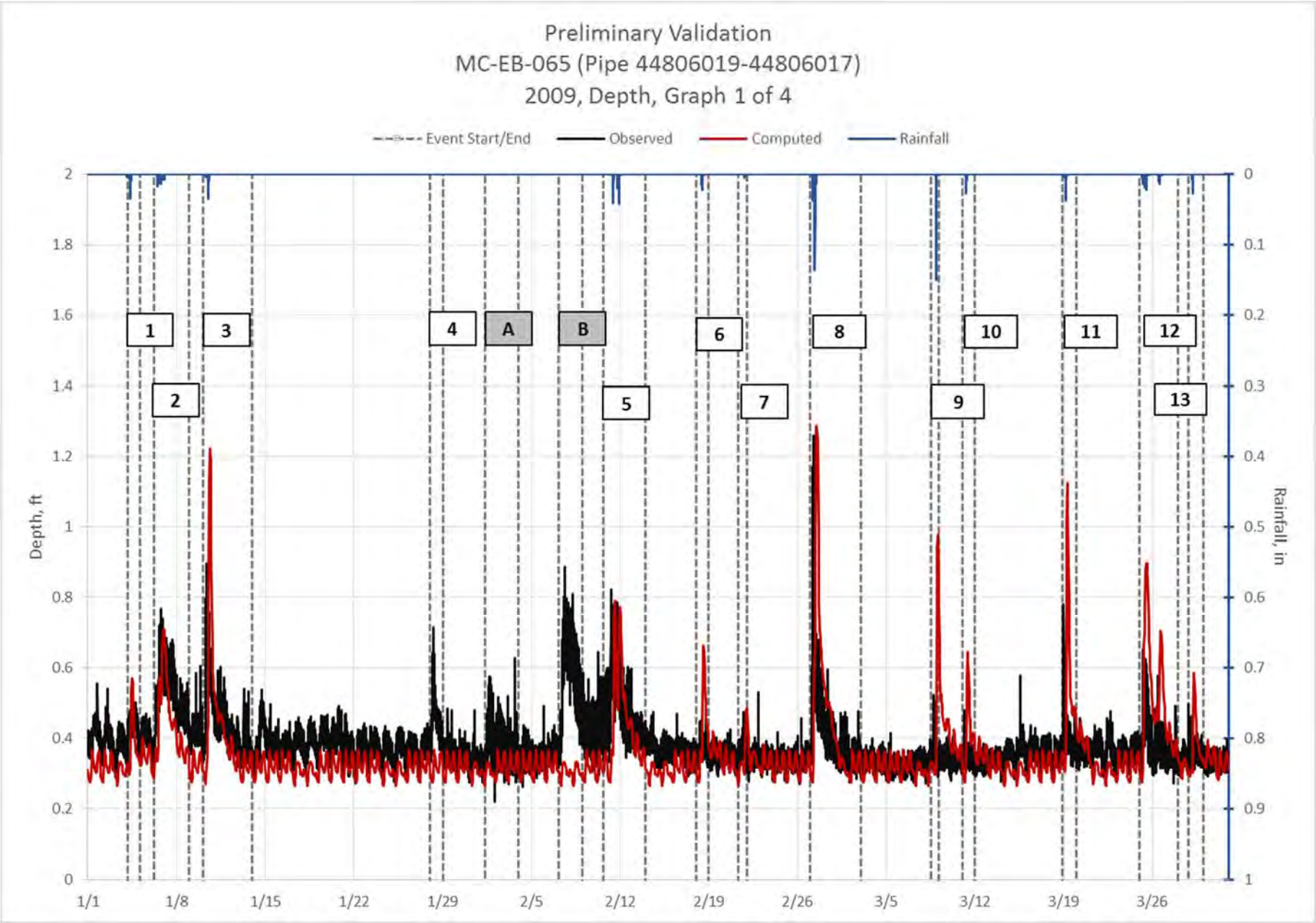
Preliminary Validation
MC-EB-065 (Pipe 44806019-44806017)
2009, Depth, Graph 1 of 4
Event Start/End
Observed
Computed
Rainfall
Depth, ft
Rainfall, in
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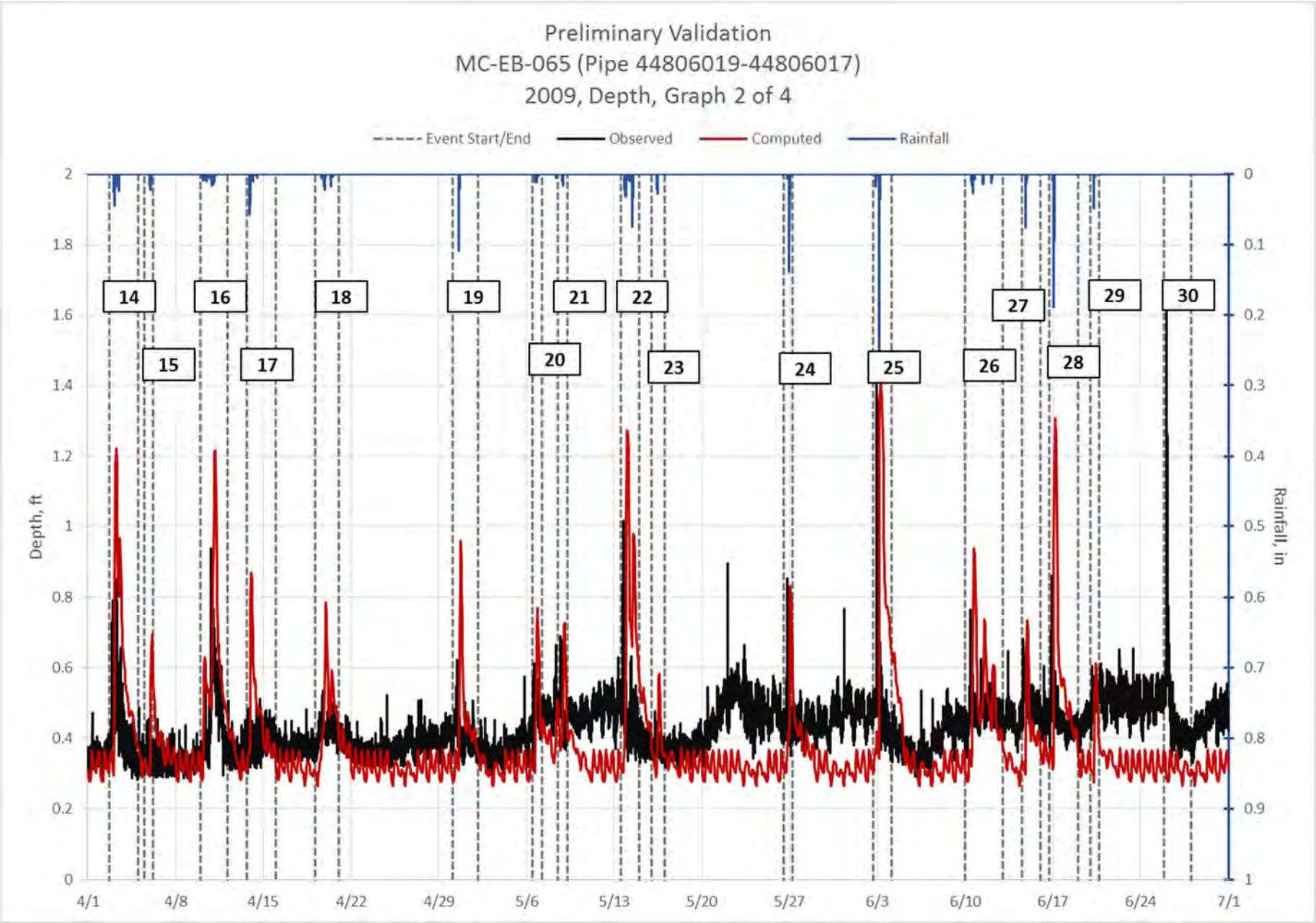
Preliminary Validation
MC-EB-065 (Pipe 44806019-44806017)
2009, Depth, Graph 2 of 4
Event Start/End
Observed
Computed
Rainfall
Depth, ft
Rainfall, in
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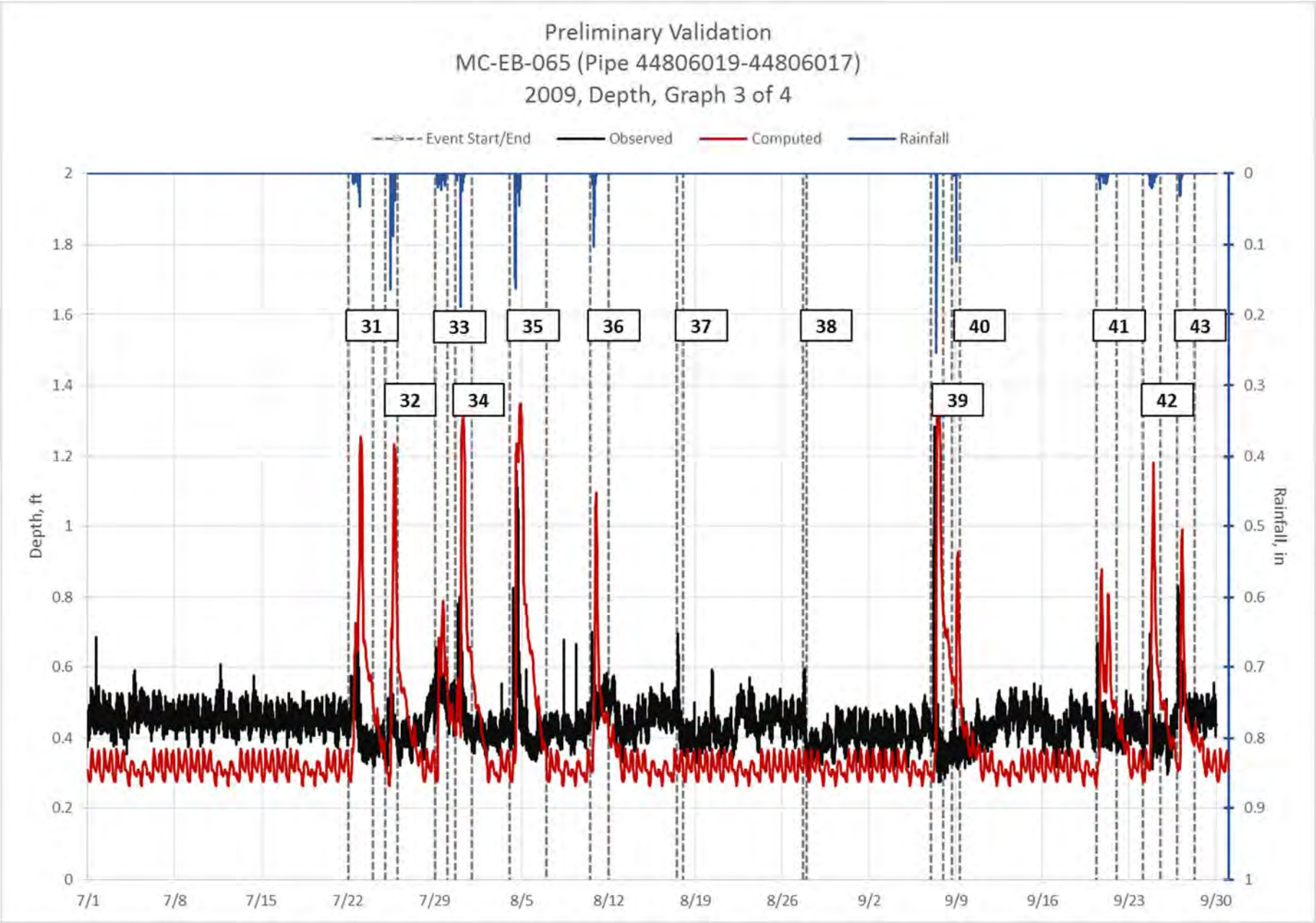
Preliminary Validation
MC-EB-065 (Pipe 44806019-44806017)
2009, Depth, Graph 3 of 4
Event Start/End
Observed
Computed
Rainfall
Depth, ft
Rainfall, in
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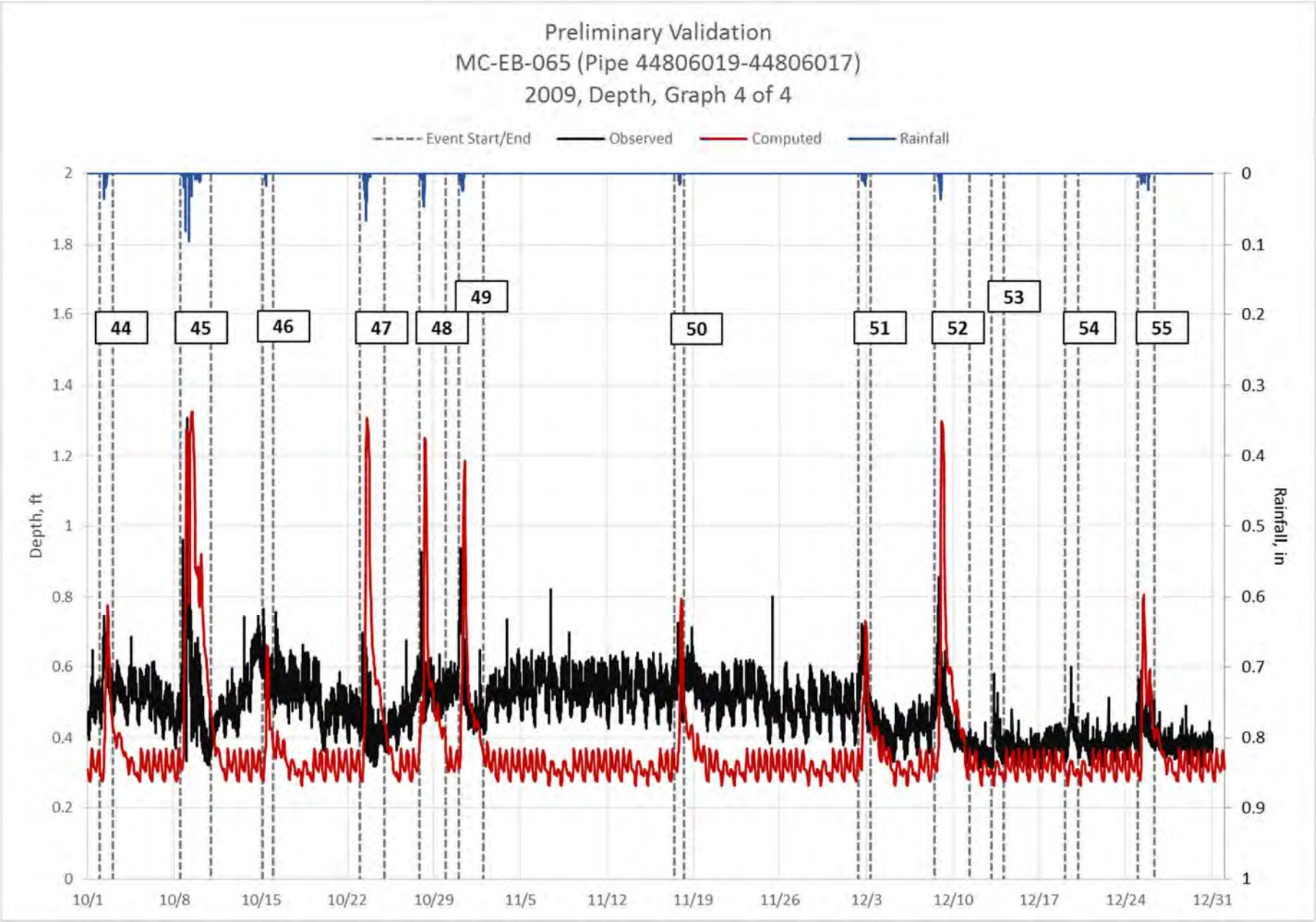
Preliminary Validation
MC-EB-065 (Pipe 44806019-44806017)
2009, Depth, Graph 4 of 4
Event Start/End
Observed
Computed
Rainfall
Depth, ft
Rainfall, in
44
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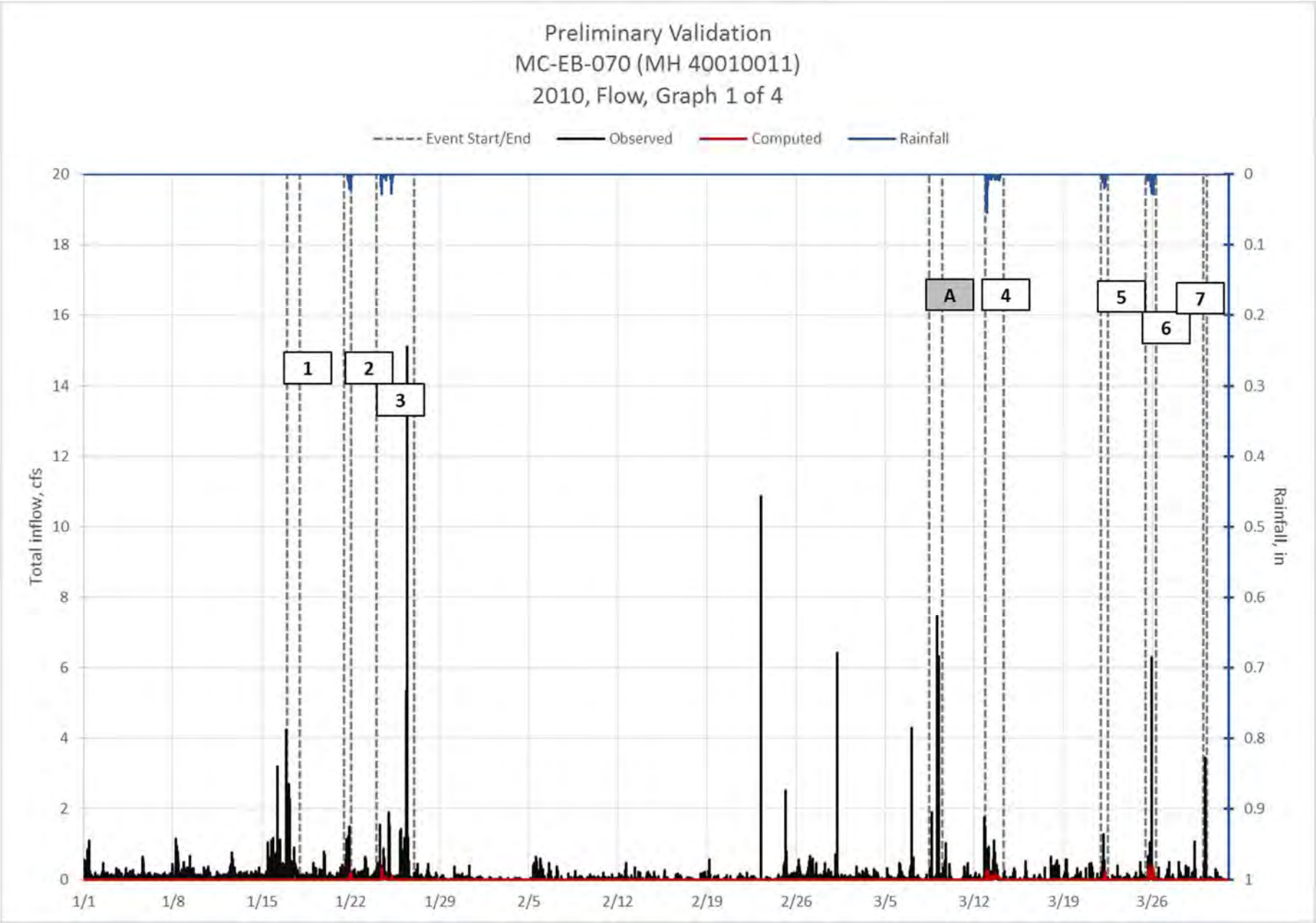
Preliminary Validation
MC-EB-070 (MH 40010011)
2010, Flow, Graph 1 of 4
Event Start/End
Observed
Computed
Rainfall
Total inflow, cfs
Rainfall, in
1
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A
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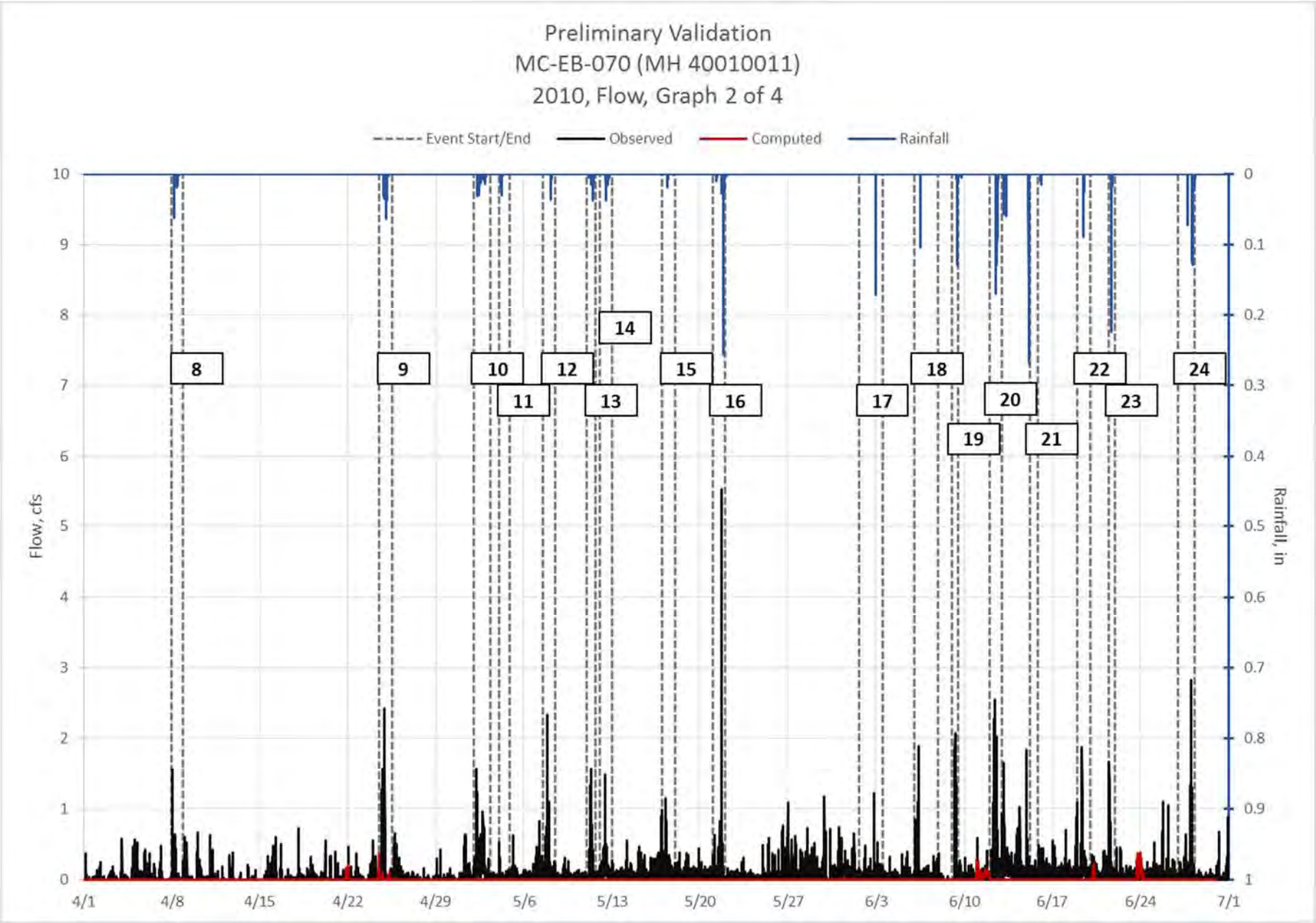
Preliminary Validation
MC-EB-070 (MH 40010011)
2010, Flow, Graph 2 of 4
Event Start/End
Observed
Computed
Rainfall
Flow, cfs
Rainfall, in
8
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23
24
4/1
4/8
4/15
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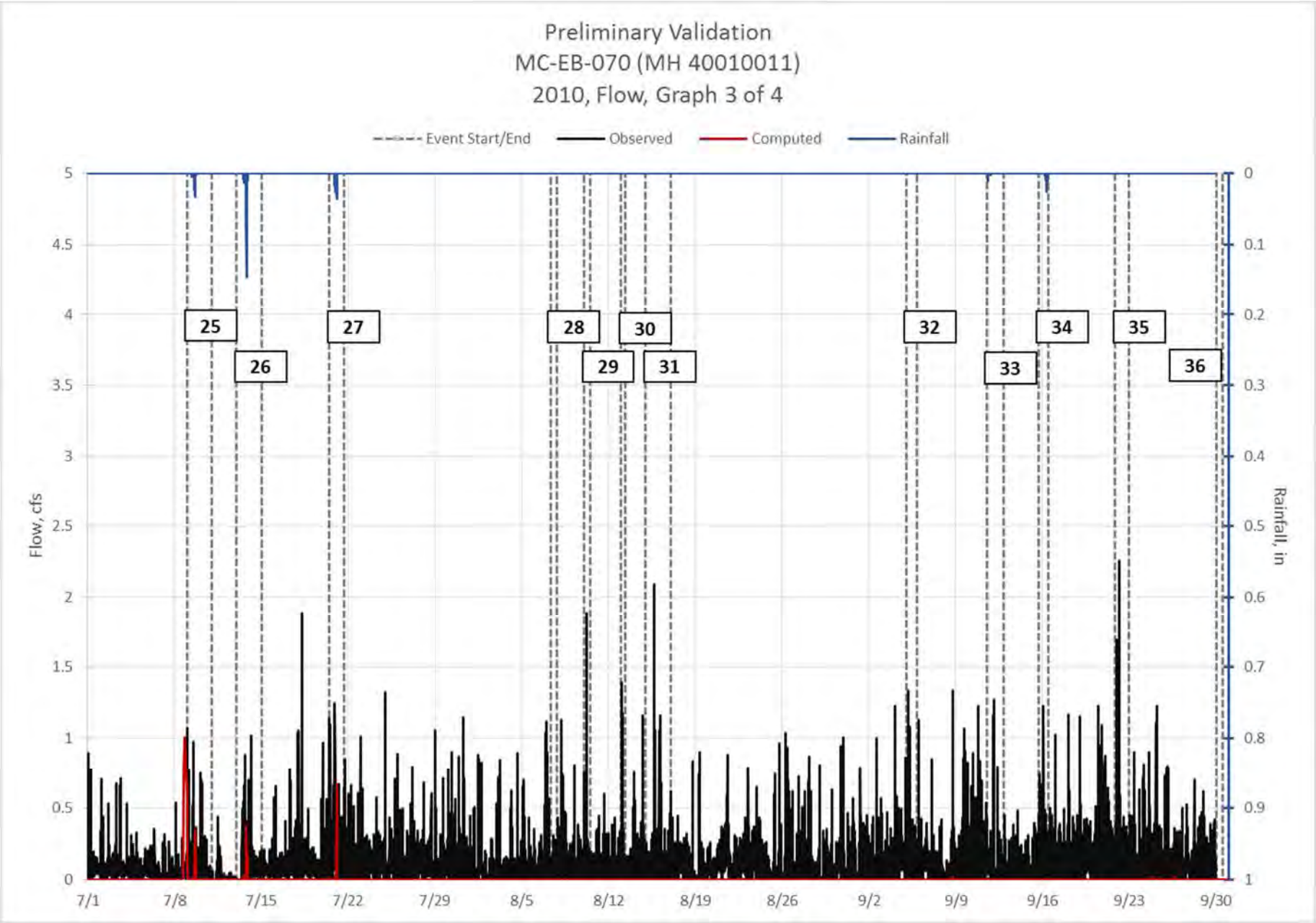
6/24
7/1


Preliminary Validation
MC-EB-070 (MH 40010011)
2010, Flow, Graph 3 of 4
Event Start/End
Observed
Computed
Rainfall
Flow, cfs
Rainfall, in
25
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9/23
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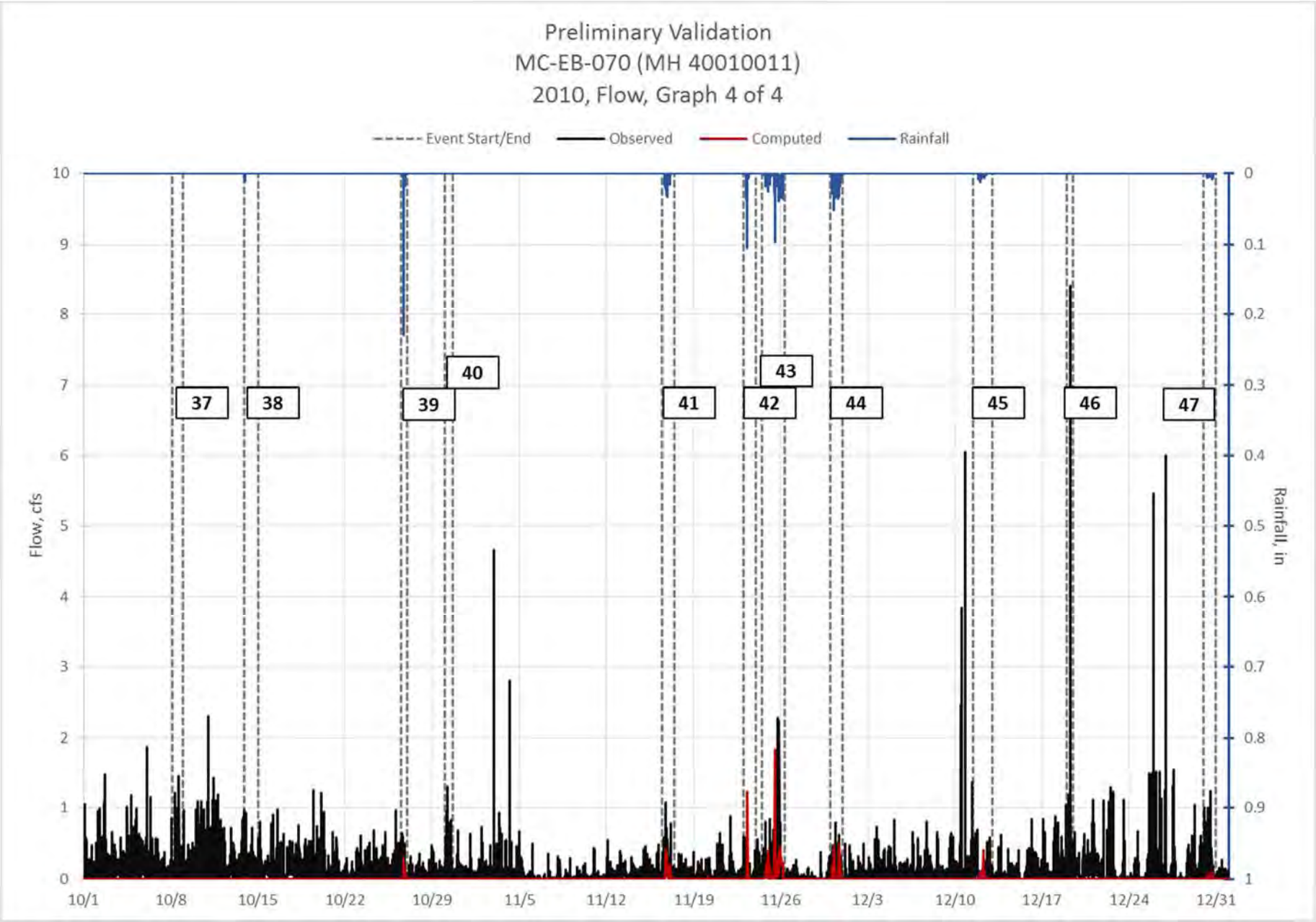
Preliminary Validation
MC-EB-070 (MH 40010011)
2010, Flow, Graph 4 of 4
Event Start/End
Observed
Computed
Rainfall
Flow, cfs
Rainfall, in
37
38
39
40
41
42
43
44
45
46
47
10/1
10/8
10/15
10/22
10/29
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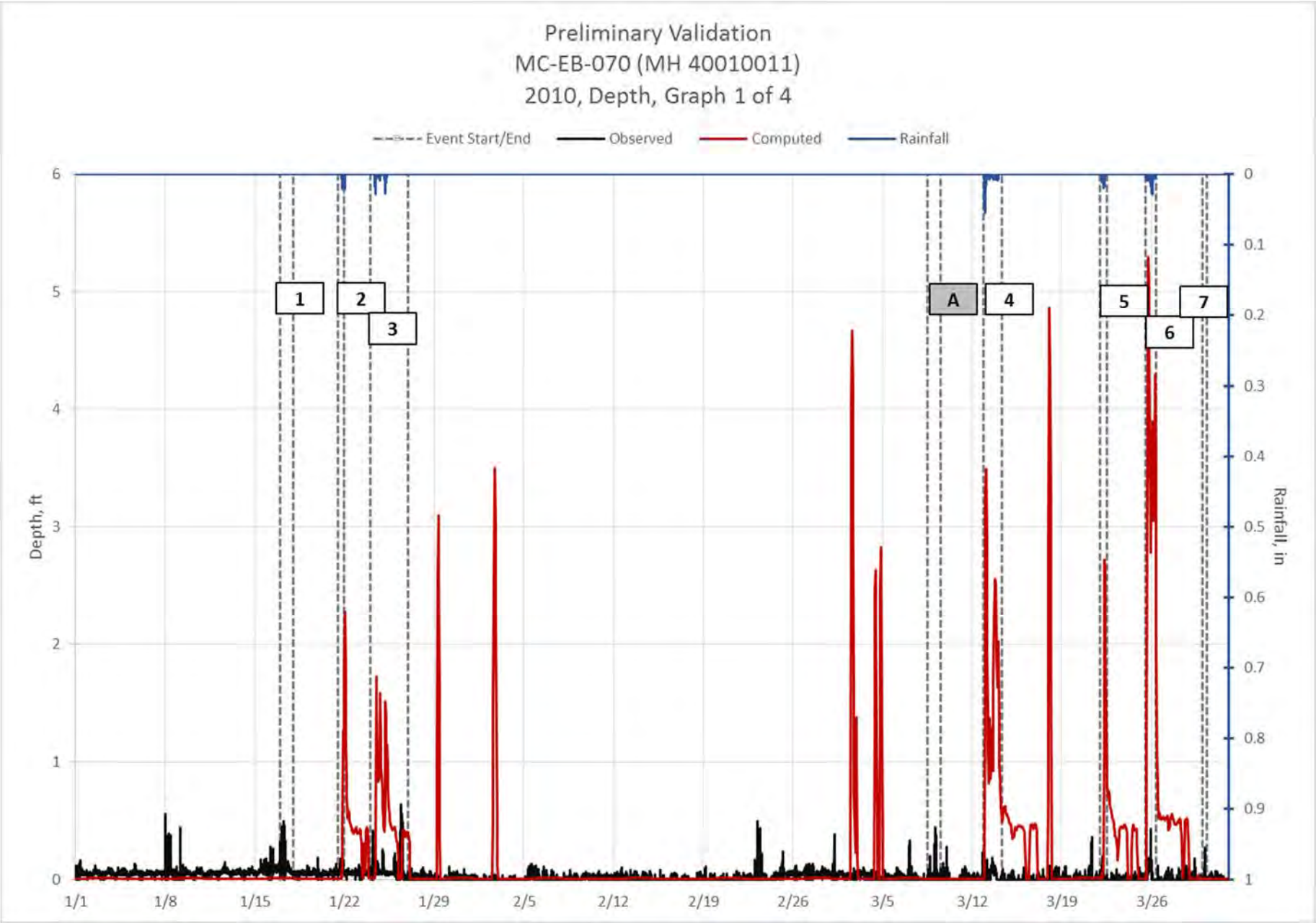
11/12
11/19
11/26
12/3
12/10
12/17
12/24
12/31


Preliminary Validation
MC-EB-070 (MH 40010011)
2010, Depth, Graph 1 of 4
Event Start/End
Observed
Computed
Rainfall
Depth, ft
Rainfall, in
1
2
3
A
4
5
6
7
0
1
2
3
4
5
6
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1/1
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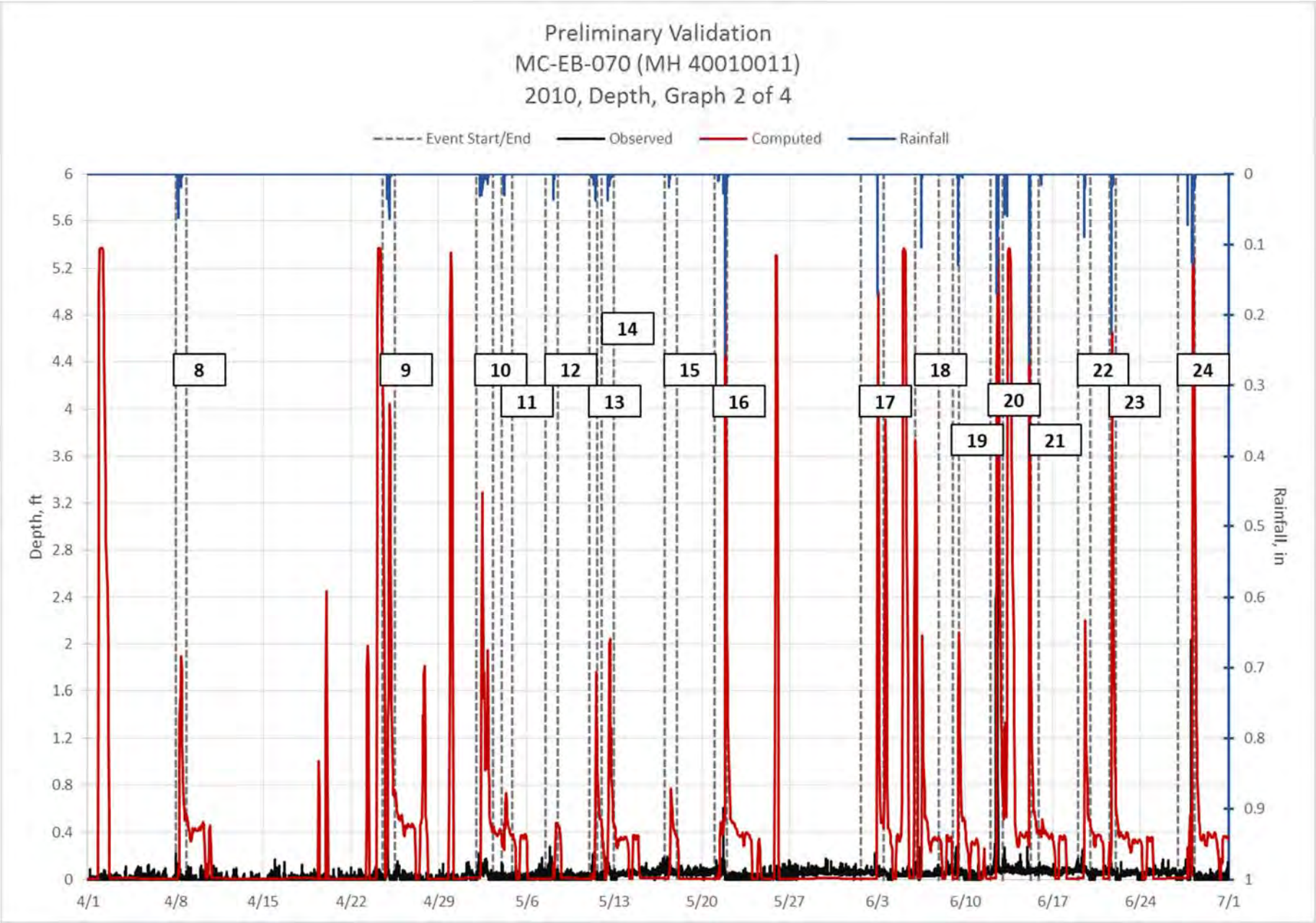
2/19
2/26
3/5
3/12
3/19
3/26


Preliminary Validation
MC-EB-070 (MH 40010011)
2010, Depth, Graph 2 of 4
Event Start/End
Observed
Computed
Rainfall
Depth, ft
Rainfall, in
8
9
10
11
12
13
14
15
16
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21
22
23
24
4/1
4/8
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4/29
5/6
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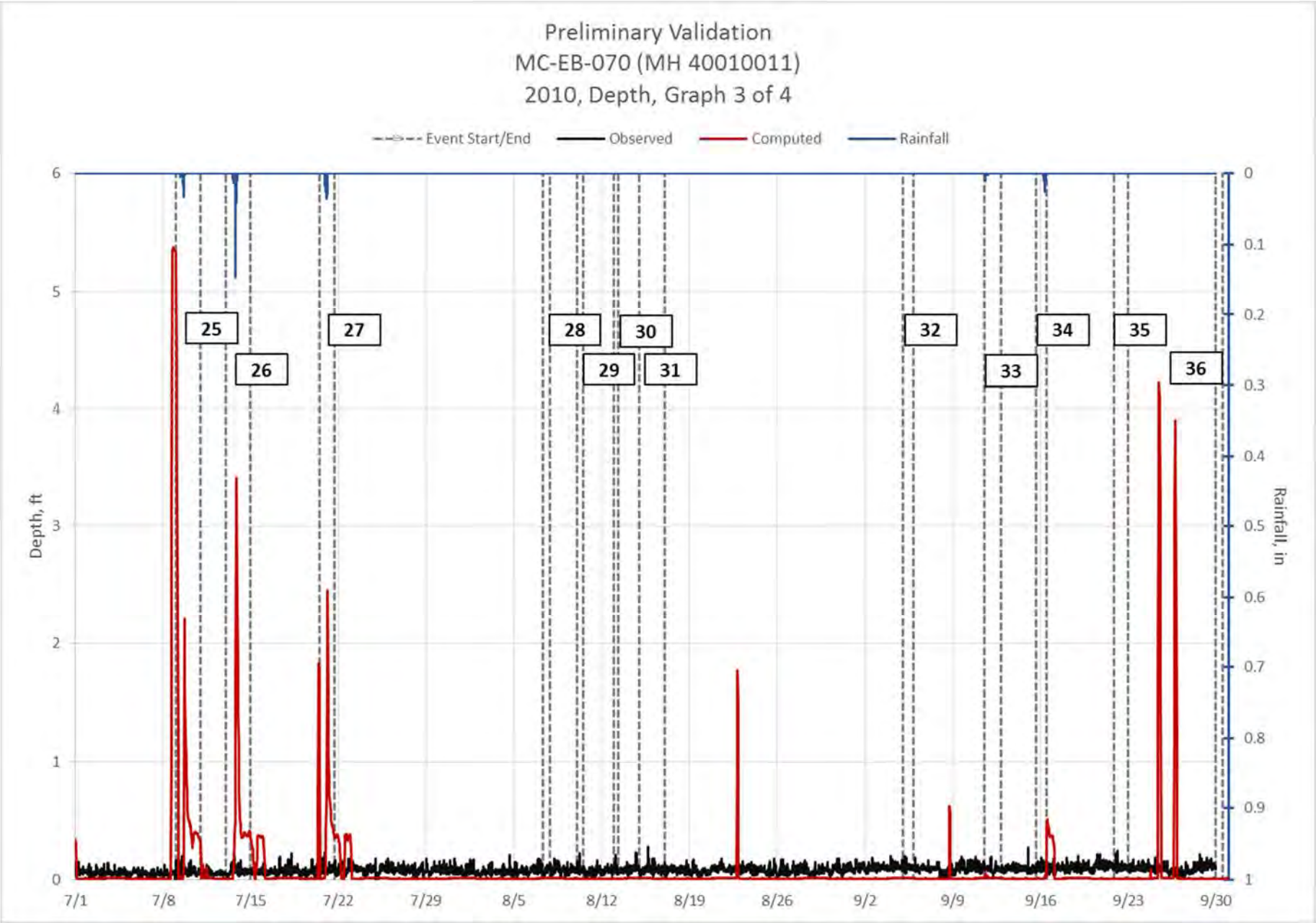
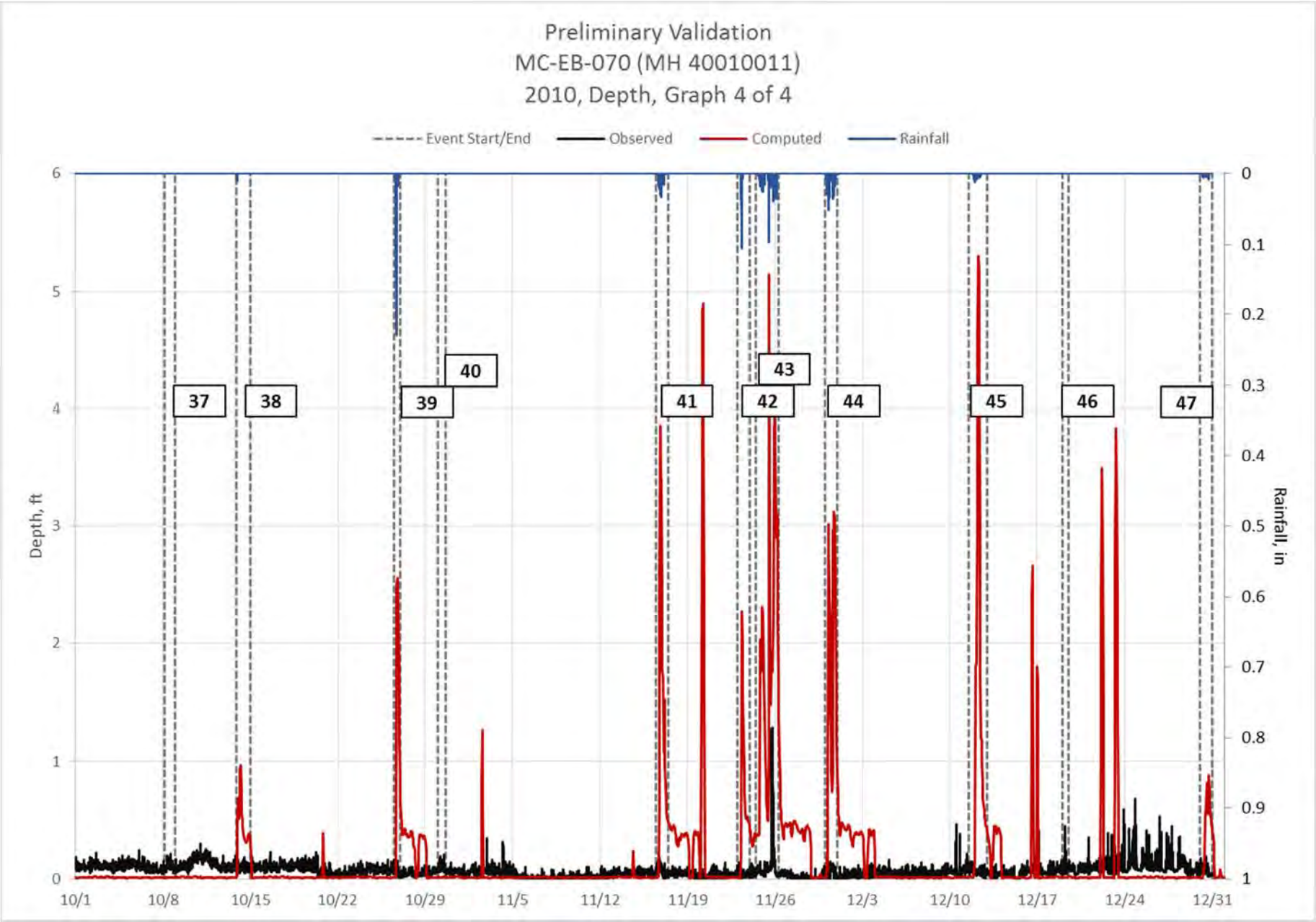
5/20
5/27
6/3
6/10
6/17
6/24
7/1


Preliminary Validation
MC-EB-070 (MH 40010011)
2010, Depth, Graph 3 of 4
Event Start/End
Observed
Computed
Rainfall
Depth, ft
Rainfall, in
25
26
27
28
29
30
31
32
33
34
35
36
7/1
7/8
7/15
7/22
7/29
8/5
8/12
8/19
8/26
9/2
9/9
9/16
9/23
9/30


Preliminary Validation
MC-EB-070 (MH 40010011)
2010, Depth, Graph 4 of 4
Event Start/End
Observed
Computed
Rainfall
Depth, ft
Rainfall, in
37
38
39
40
41
42
43
44
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46
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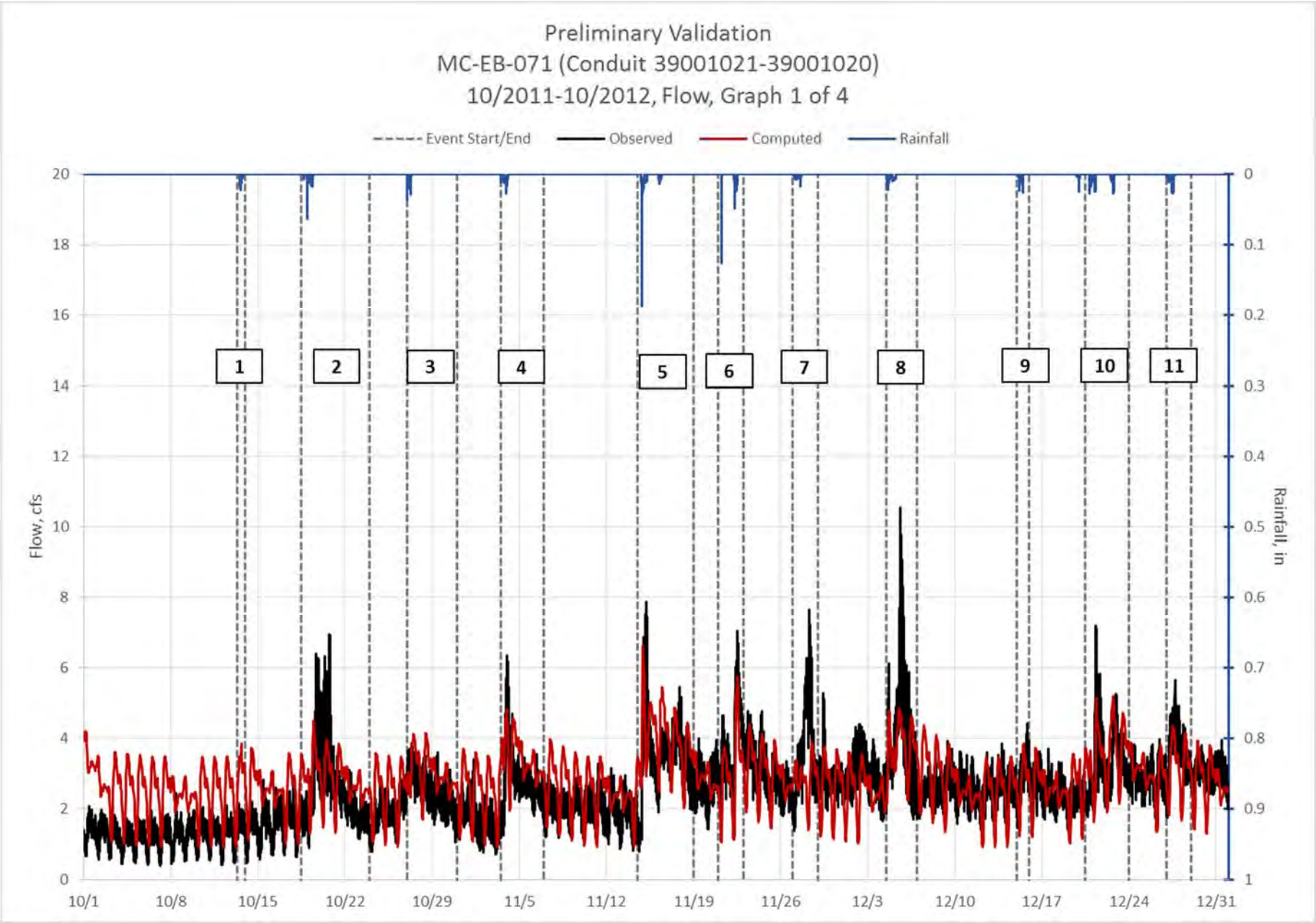
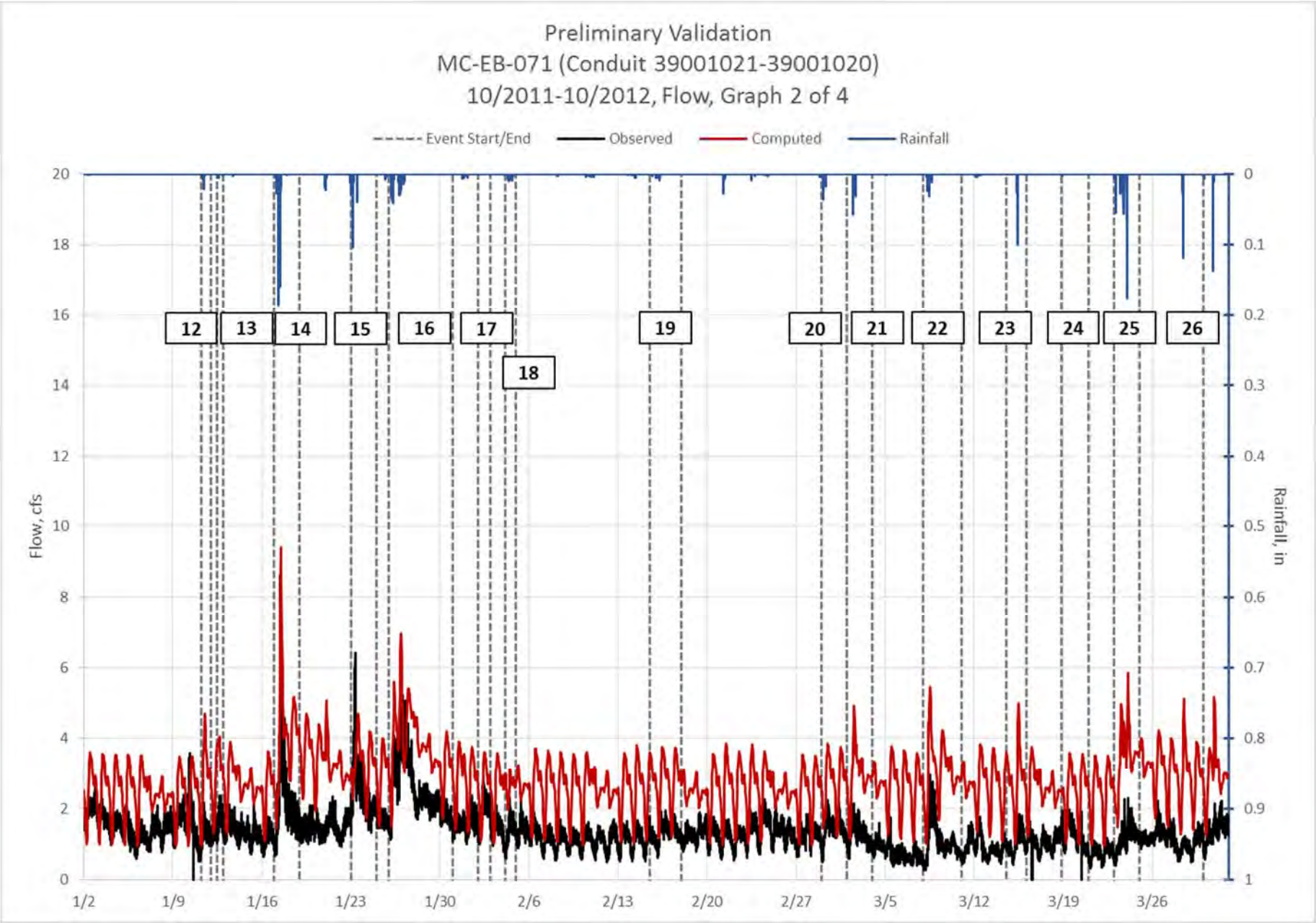
10/1
10/8
10/15
10/22
10/29
11/5
11/12
11/19
11/26
12/3
12/10
12/17
12/24
12/31


Preliminary Validation
MC-EB-071 (Conduit 39001021-39001020)
10/2011-10/2012, Flow, Graph 1 of 4
Event Start/End
Observed
Computed
Rainfall
Flow, cfs
Rainfall, in
1
2
3
4
5
6
7
8
9
10
11
10/1
10/8
10/15
10/22
10/29
11/5
11/12
11/19
11/26
12/3
12/10
12/17
12/24
12/31


Preliminary Validation
MC-EB-071 (Conduit 39001021-39001020)
10/2011-10/2012, Flow, Graph 2 of 4
Event Start/End
Observed
Computed
Rainfall
Flow, cfs
Rainfall, in
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
1/2
1/9
1/16
1/23
1/30
2/6
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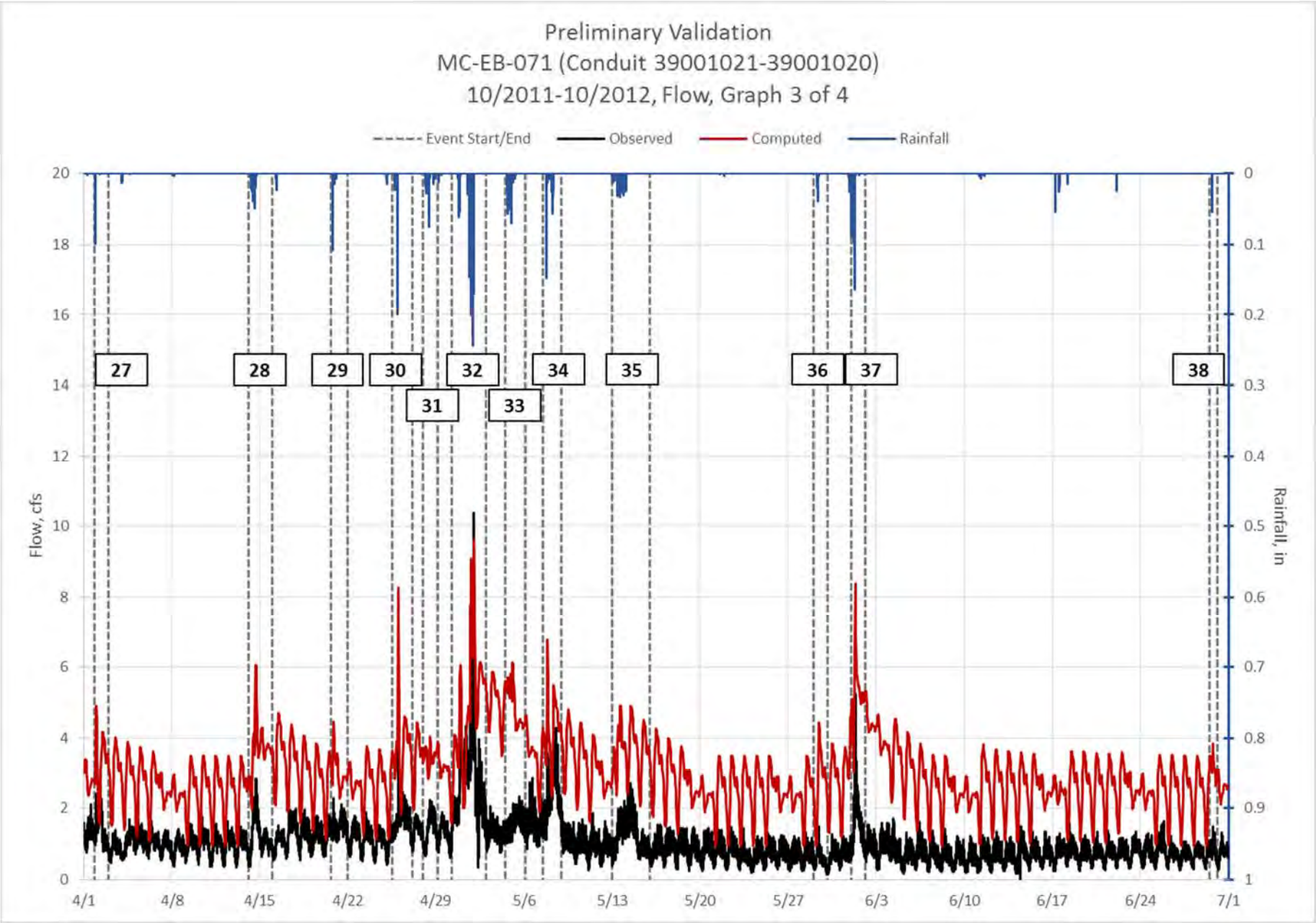
2/20
2/27
3/5
3/12
3/19
3/26


Preliminary Validation
MC-EB-071 (Conduit 39001021-39001020)
10/2011-10/2012, Flow, Graph 3 of 4
Event Start/End
Observed
Computed
Rainfall
Flow, cfs
Rainfall, in
27
28
29
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4/1
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4/29
5/6
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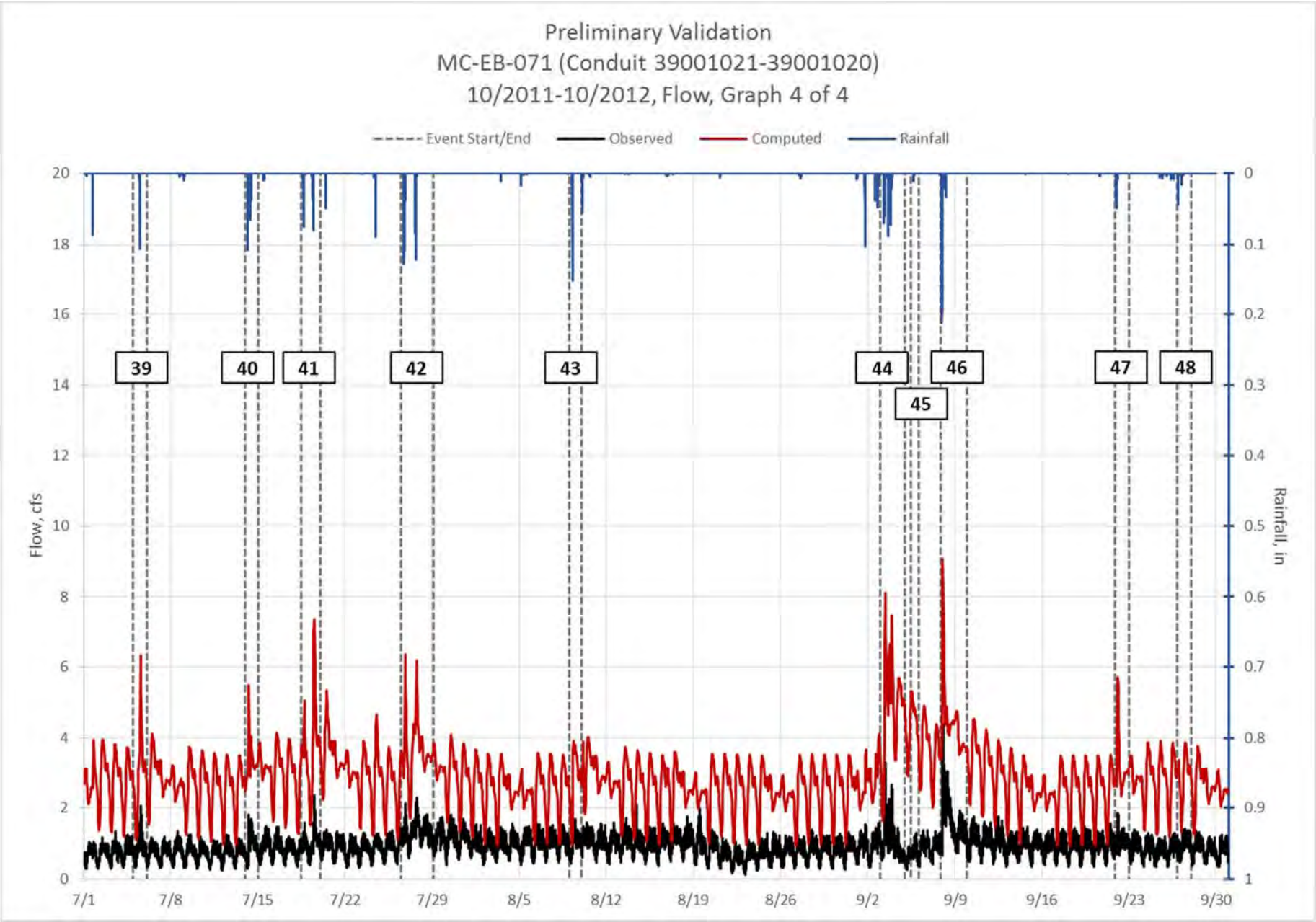
5/27
6/3
6/10
6/17
6/24
7/1


Preliminary Validation
MC-EB-071 (Conduit 39001021-39001020)
10/2011-10/2012, Flow, Graph 4 of 4
Event Start/End
Observed
Computed
Rainfall
Flow, cfs
Rainfall, in
39
40
41
42
43
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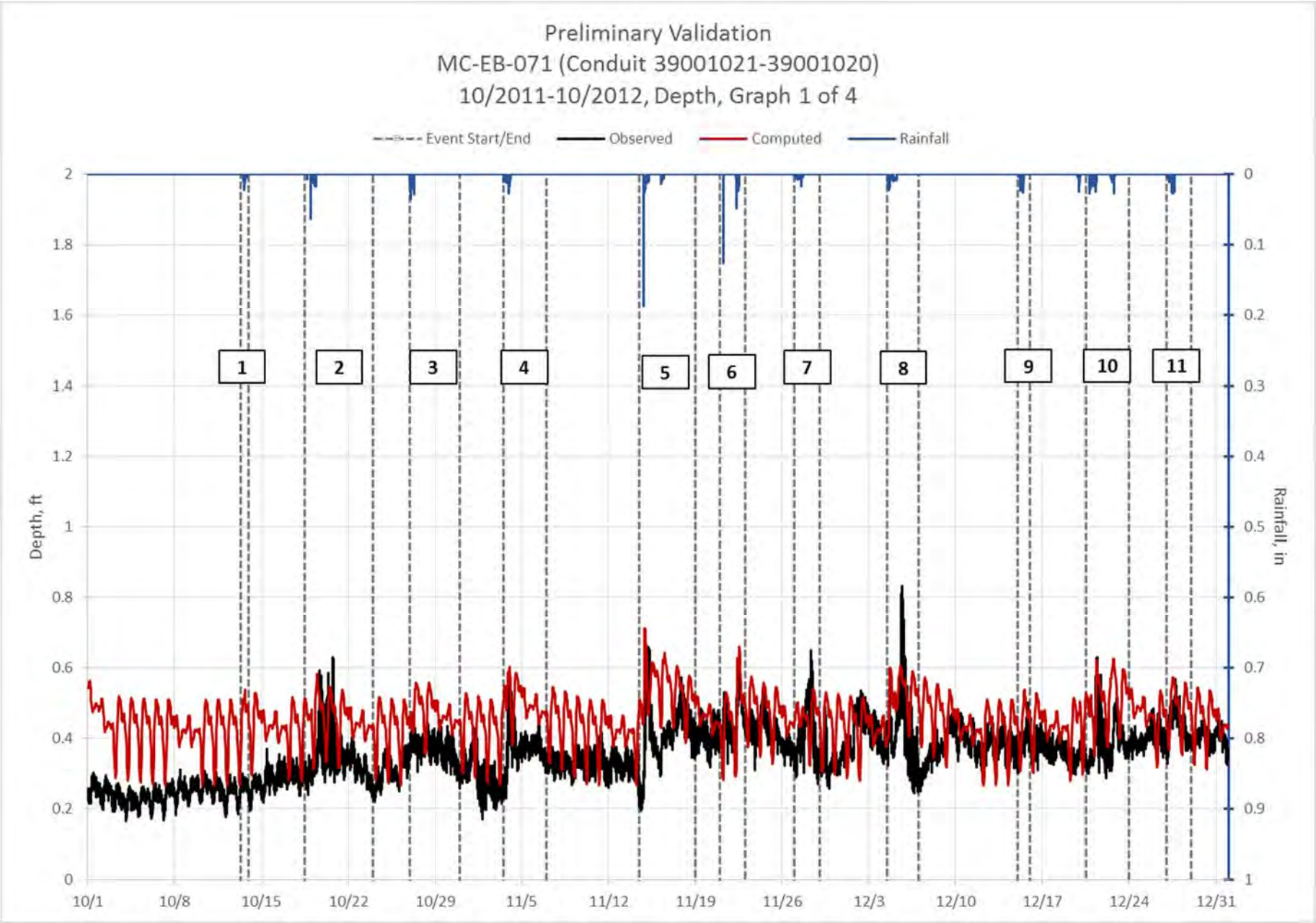
46
47
48
7/1
7/8
7/15
7/22
7/29
8/5
8/12
8/19
8/26
9/2
9/9
9/16
9/23
9/30


Preliminary Validation
MC-EB-071 (Conduit 39001021-39001020)
10/2011-10/2012, Depth, Graph 1 of 4
Event Start/End
Observed
Computed
Rainfall
Depth, ft
Rainfall, in
1
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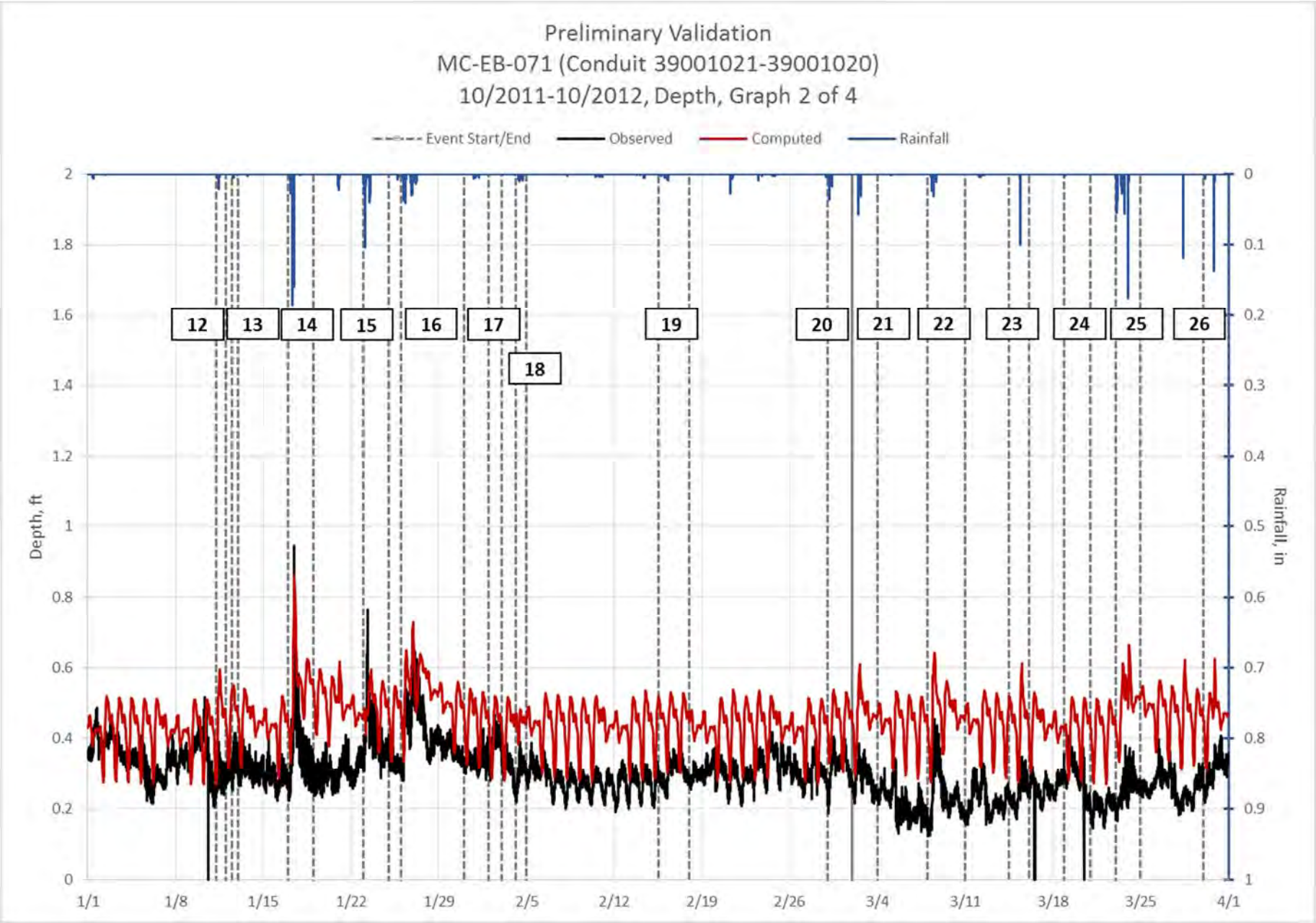
11
10/1
10/8
10/15
10/22
10/29
11/5
11/12
11/19
11/26
12/3
12/10
12/17
12/24
12/31


Preliminary Validation
MC-EB-071 (Conduit 39001021-39001020)
10/2011-10/2012, Depth, Graph 2 of 4
Event Start/End
Observed
Computed
Rainfall
Depth, ft
Rainfall, in
12
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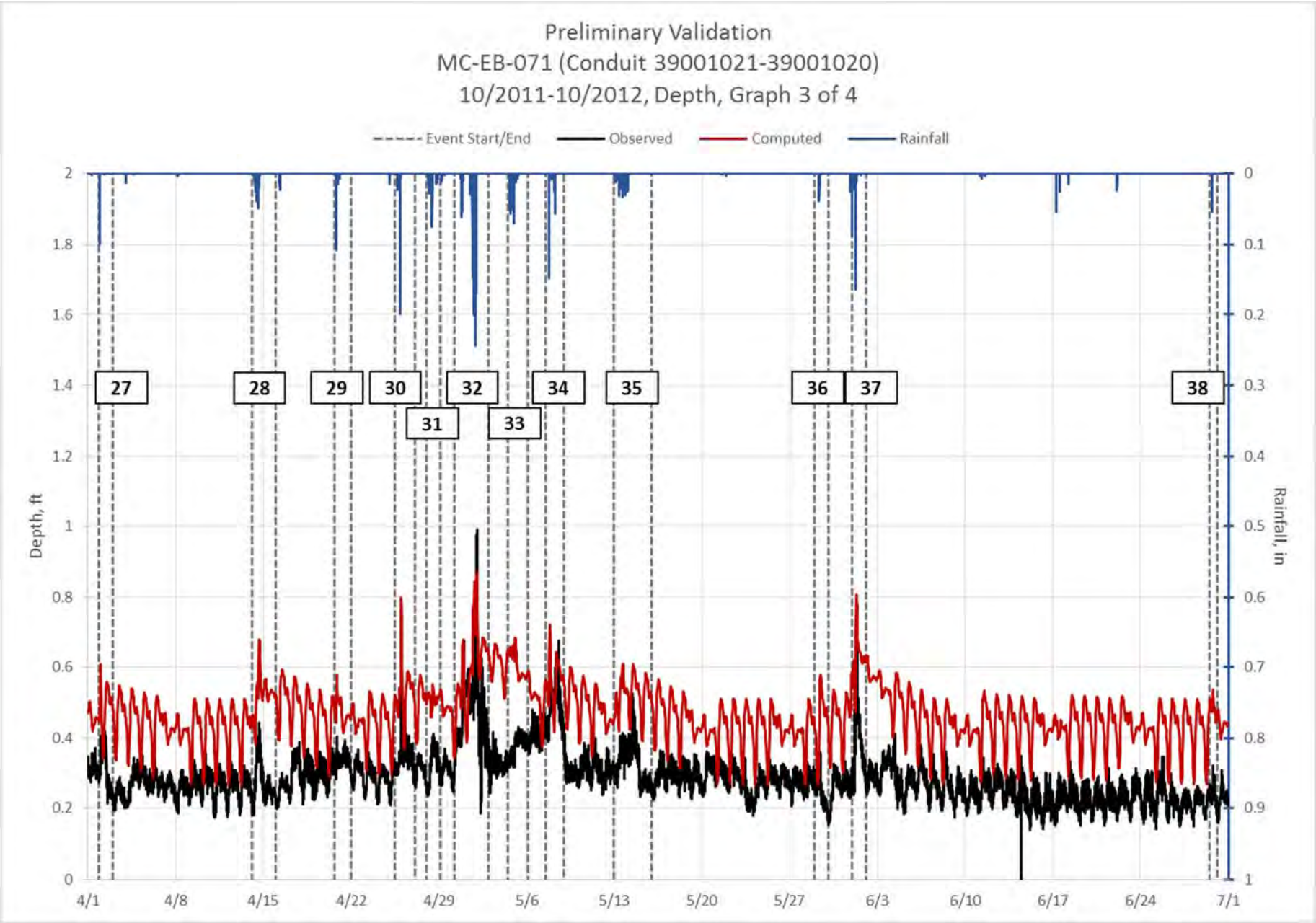
16
17
18
19
20
21
22
23
24
25
26
1/1
1/8
1/15
1/22
1/29
2/5
2/12
2/19
2/26
3/4
3/11
3/18
3/25
4/1


Preliminary Validation
MC-EB-071 (Conduit 39001021-39001020)
10/2011-10/2012, Depth, Graph 3 of 4
Event Start/End
Observed
Computed
Rainfall
Depth, ft
Rainfall, in
27
28
29
30
31
32
33
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36
37
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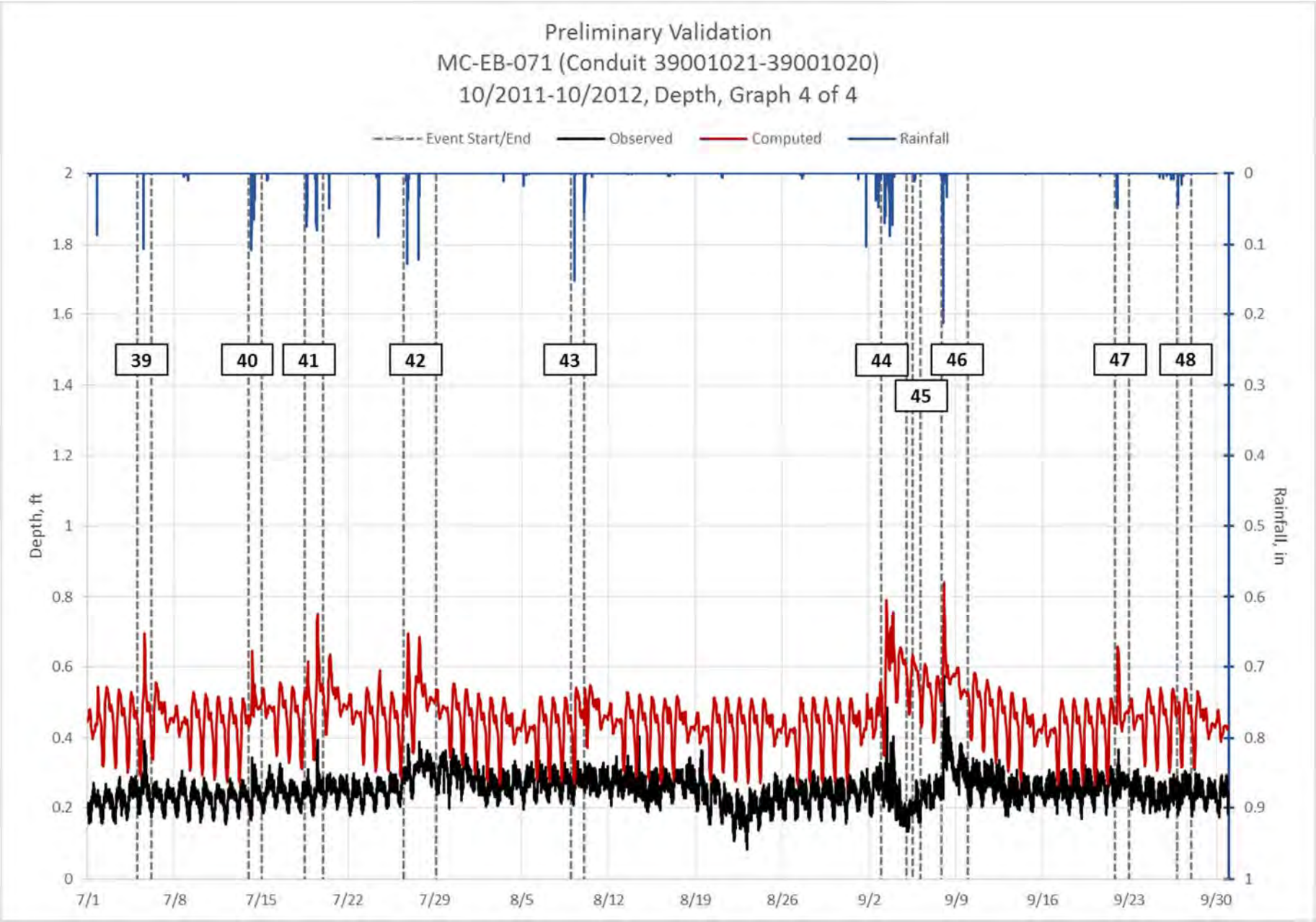
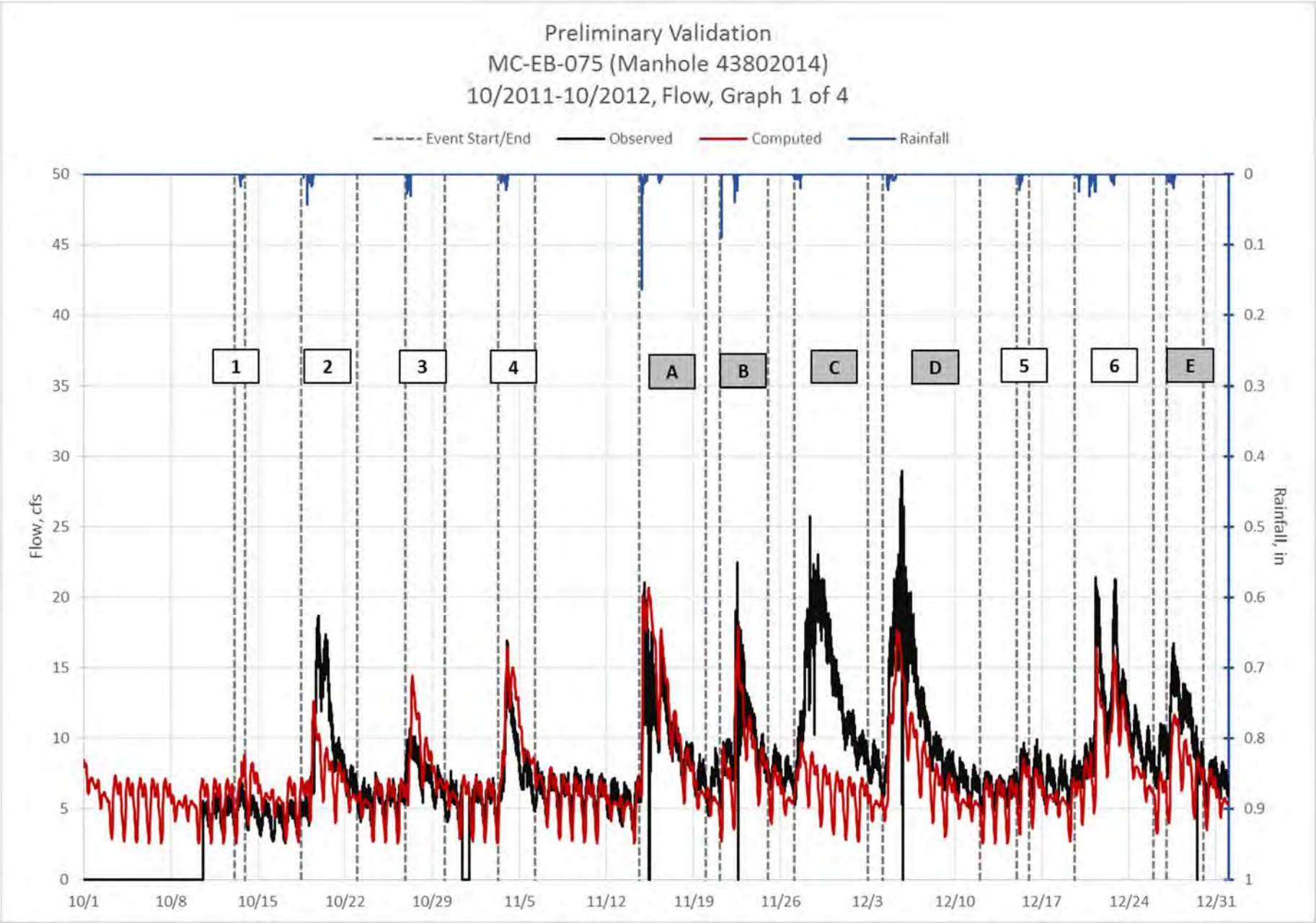
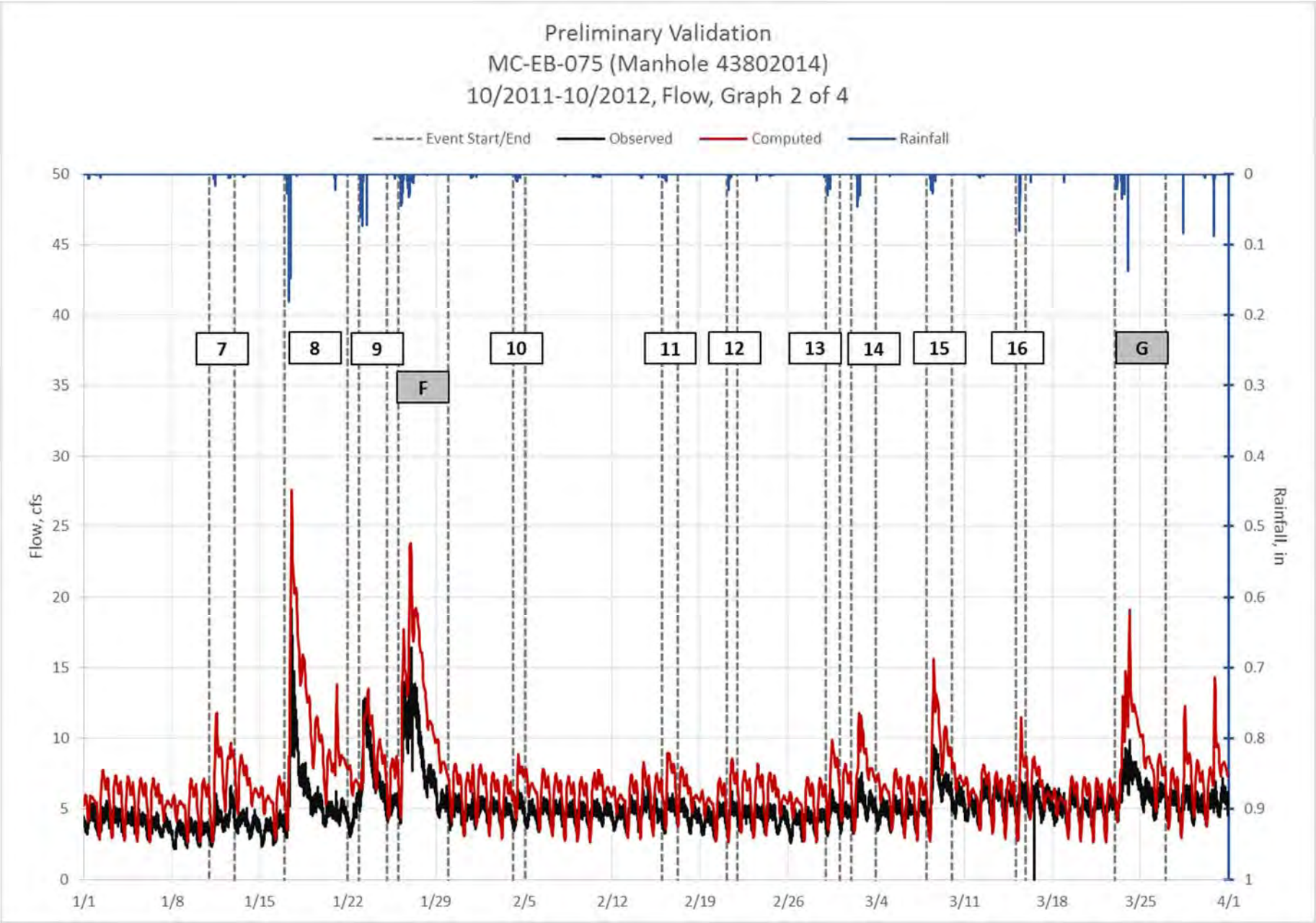
4/1
4/8
4/15
4/22
4/29
5/6
5/13
5/20
5/27
6/3
6/10
6/17
6/24
7/1


Preliminary Validation
MC-EB-071 (Conduit 39001021-39001020)
10/2011-10/2012, Depth, Graph 4 of 4
Event Start/End
Observed
Computed
Rainfall
Depth, ft
Rainfall, in
39
40
41
42
43
44
45
46
47
48
7/1
7/8
7/15
7/22
7/29
8/5
8/12
8/19
8/26
9/2
9/9
9/16
9/23
9/30


Preliminary Validation
MC-EB-075 (Manhole 43802014)
10/2011-10/2012, Flow, Graph 1 of 4
Event Start/End
Observed
Computed
Rainfall
Flow, cfs
Rainfall, in
1
2
3
4
A
B
C
D
5
6
E
10/1
10/8
10/15
10/22
10/29
11/5
11/12
11/19
11/26
12/3
12/10
12/17
12/24
12/31


Preliminary Validation
MC-EB-075 (Manhole 43802014)
10/2011-10/2012, Flow, Graph 2 of 4
Event Start/End
Observed
Computed
Rainfall
Flow, cfs
Rainfall, in
7
8
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F
10
11
12
13
14
15
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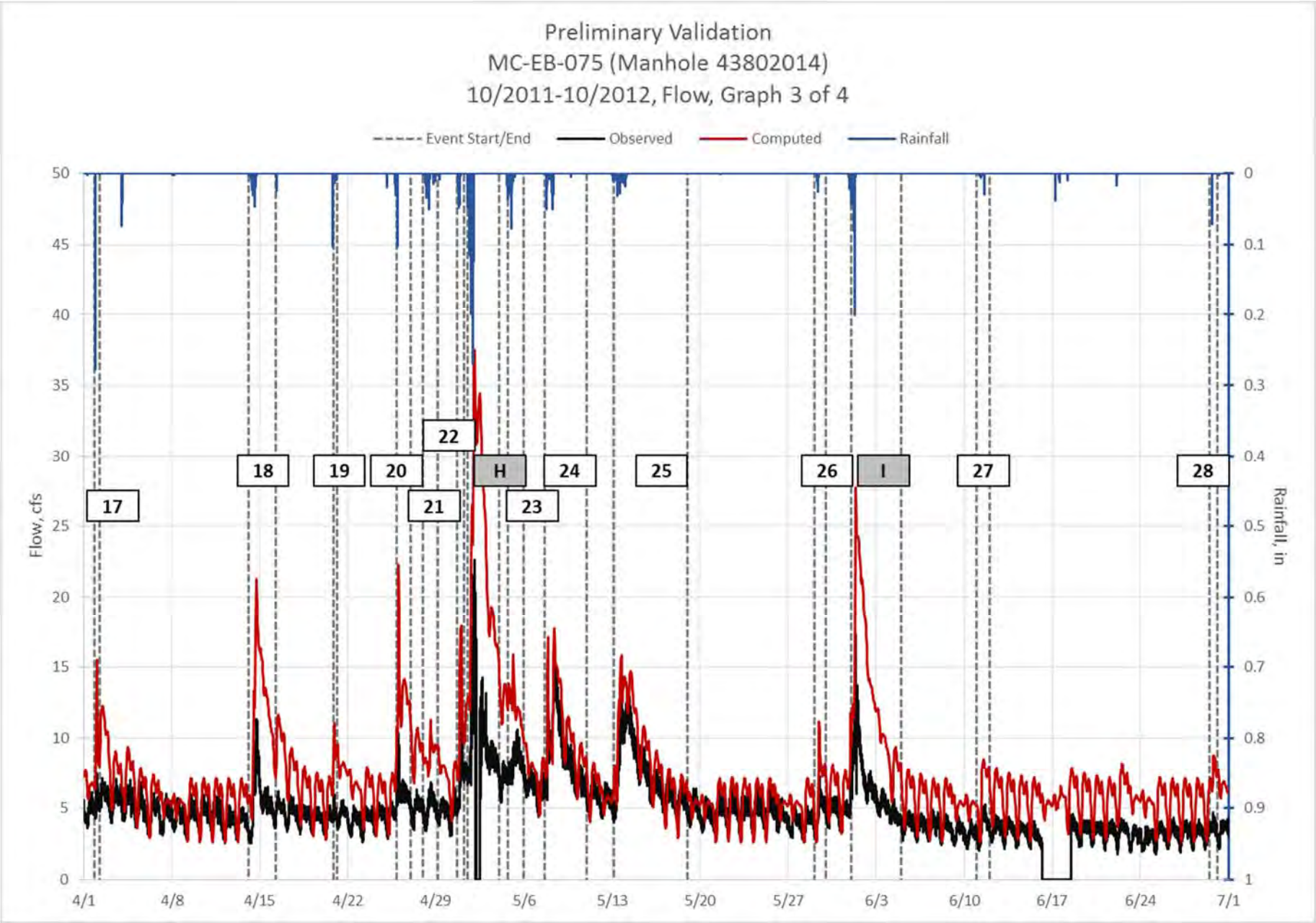
G
1/1
1/8
1/15
1/22
1/29
2/5
2/12
2/19
2/26
3/4
3/11
3/18
3/25
4/1


Preliminary Validation
MC-EB-075 (Manhole 43802014)
10/2011-10/2012, Flow, Graph 3 of 4
Event Start/End
Observed
Computed
Rainfall
Flow, cfs
Rainfall, in
17
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19
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21
22
H
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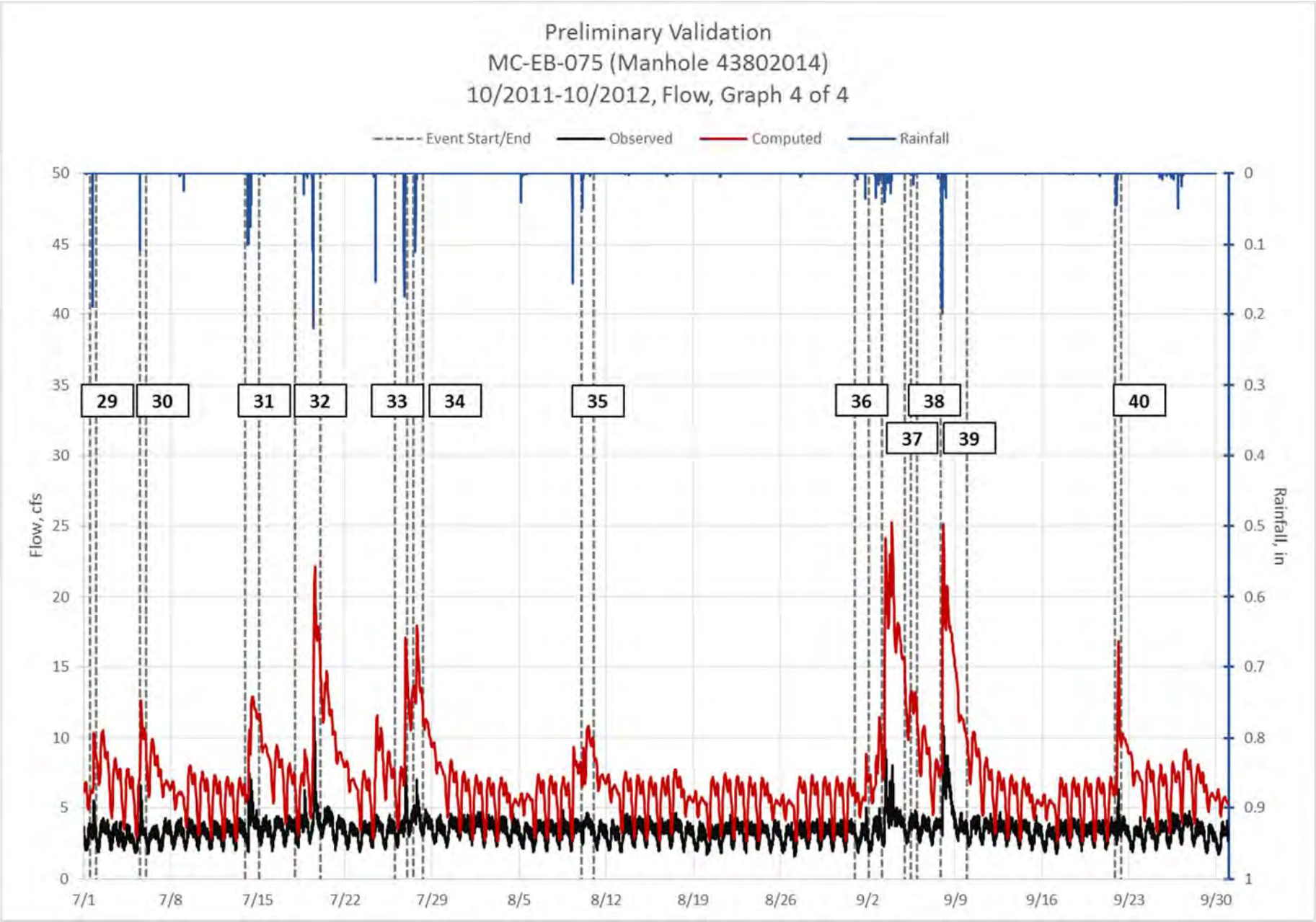
4/8
4/15
4/22
4/29
5/6
5/13
5/20
5/27
6/3
6/10
6/17
6/24
7/1


Preliminary Validation
MC-EB-075 (Manhole 43802014)
10/2011-10/2012, Flow, Graph 4 of 4
Event Start/End
Observed
Computed
Rainfall
Flow, cfs
Rainfall, in
29
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32
33
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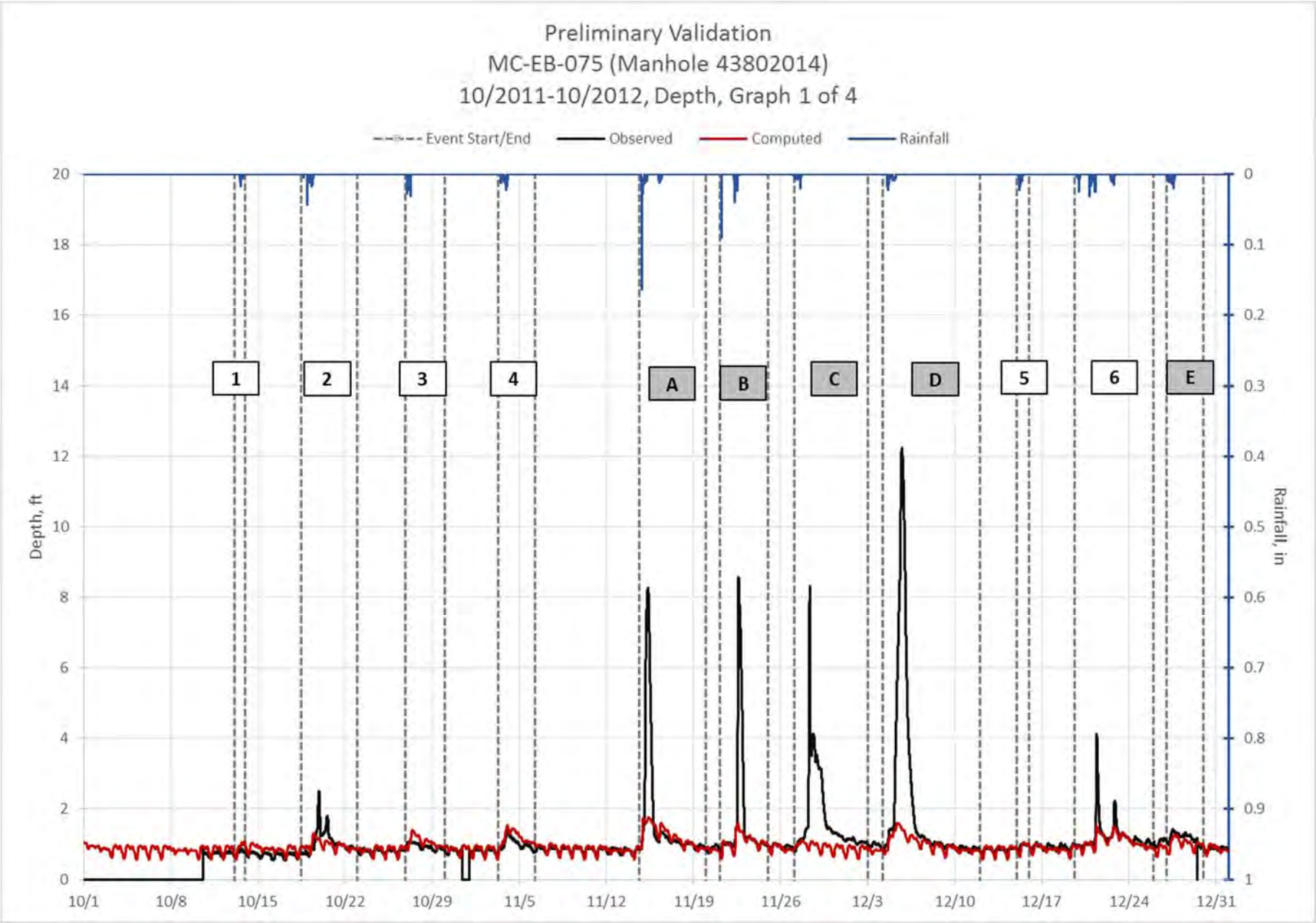
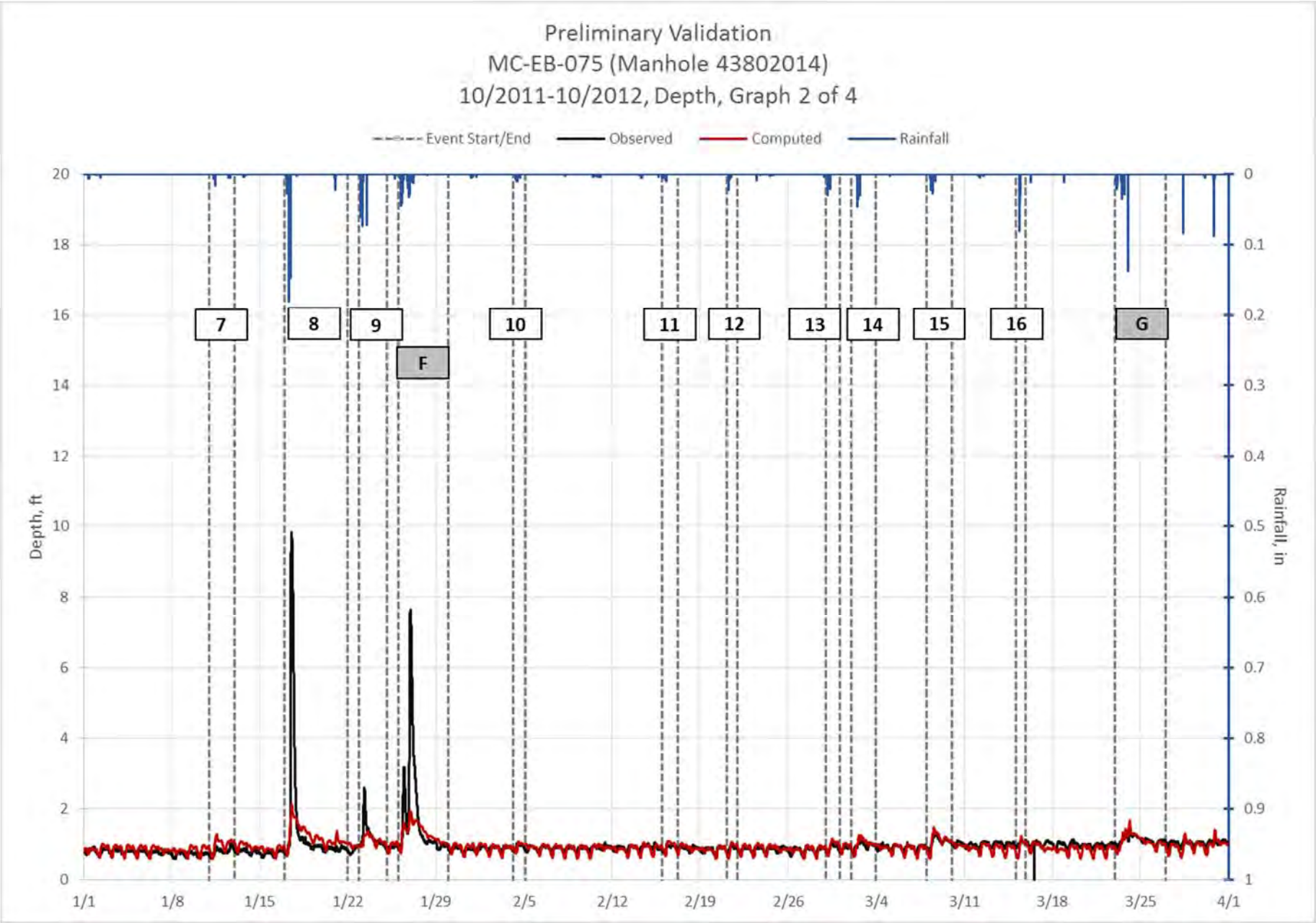
7/1
7/8
7/15
7/22
7/29
8/5
8/12
8/19
8/26
9/2
9/9
9/16
9/23
9/30


Preliminary Validation
MC-EB-075 (Manhole 43802014)
10/2011-10/2012, Depth, Graph 1 of 4
Event Start/End
Observed
Computed
Rainfall
Depth, ft
Rainfall, in
1
2
3
4
A
B
C
D
5
6
E
10/1
10/8
10/15
10/22
10/29
11/5
11/12
11/19
11/26
12/3
12/10
12/17
12/24
12/31


Preliminary Validation
MC-EB-075 (Manhole 43802014)
10/2011-10/2012, Depth, Graph 2 of 4
Event Start/End
Observed
Computed
Rainfall
Depth, ft
Rainfall, in
7
8
9
F
10
11
12
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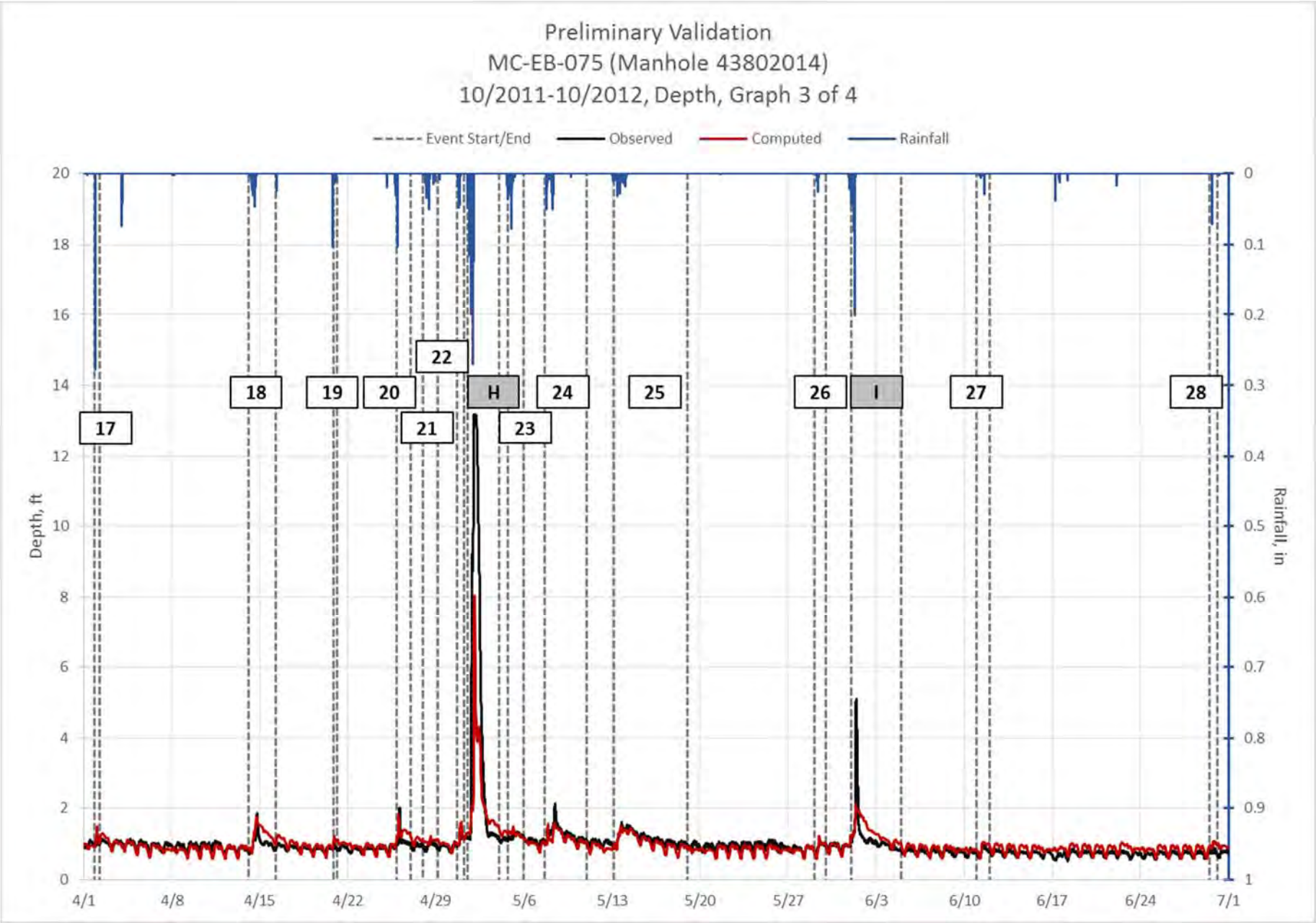
14
15
16
G
1/1
1/8
1/15
1/22
1/29
2/5
2/12
2/19
2/26
3/4
3/11
3/18
3/25
4/1


Preliminary Validation
MC-EB-075 (Manhole 43802014)
10/2011-10/2012, Depth, Graph 3 of 4
Event Start/End
Observed
Computed
Rainfall
Depth, ft
Rainfall, in
17
18
19
20
21
22
H
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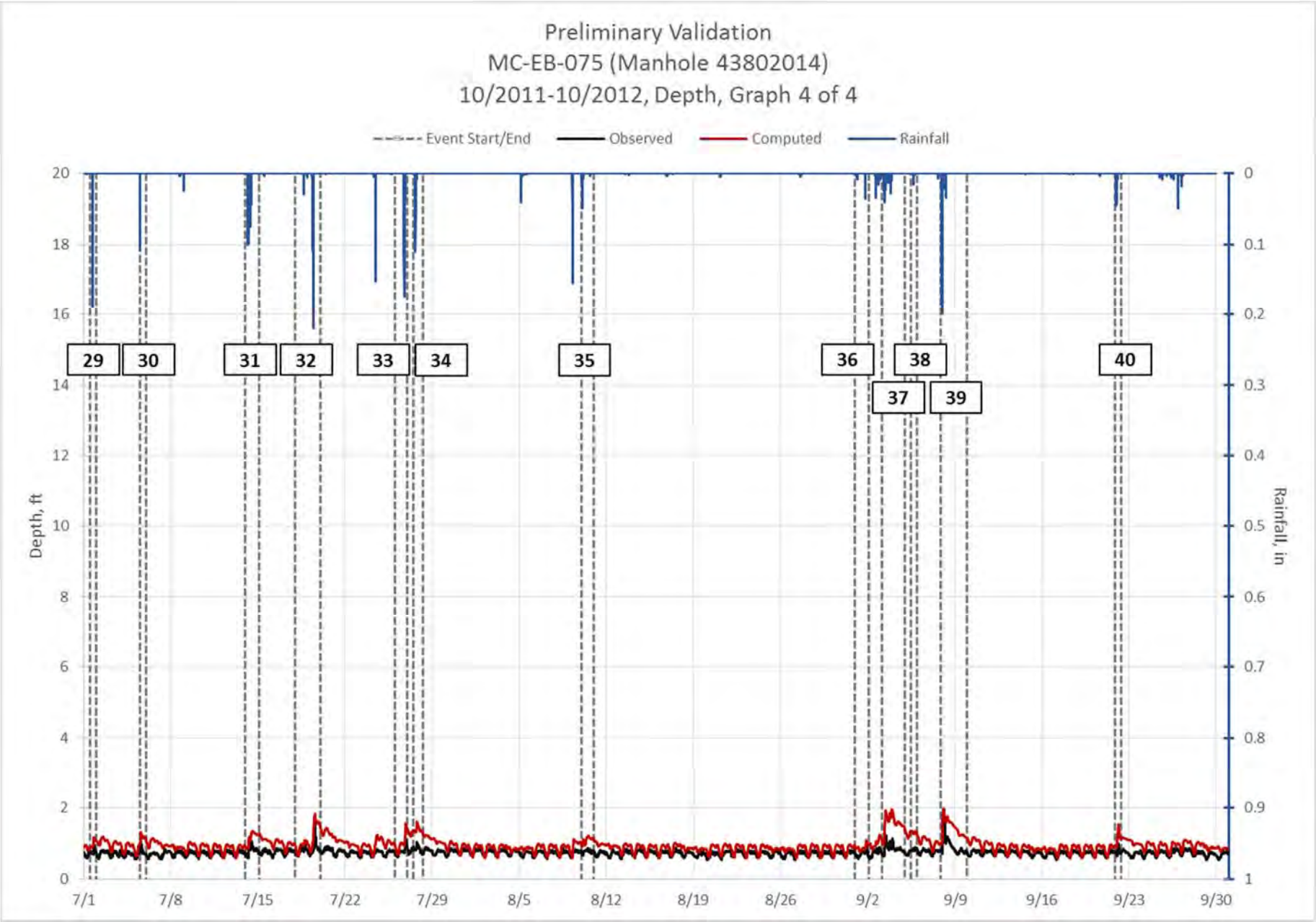
4/1
4/8
4/15
4/22
4/29
5/6
5/13
5/20
5/27
6/3
6/10
6/17
6/24
7/1


Preliminary Validation
MC-EB-075 (Manhole 43802014)
10/2011-10/2012, Depth, Graph 4 of 4
Event Start/End
Observed
Computed
Rainfall
Depth, ft
Rainfall, in
29
30
31
32
33
34
35
36
37
38
39
40
7/1
7/8
7/15
7/22
7/29
8/5
8/12
8/19
8/26
9/2
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9/23
9/30

Appendix C - SSO Summary Tables

TABLE C-1
SSO 587 Recorded and Modeled Discharges

Month-Year	Recorded Discharges	Estimated Discharge Date(s)	Modeled Discharges	Modeled Overflow Volume (MG)	Modeled Discharge Start Date(s)
Apr-06	1		0	0	
May-06	0		0	0	
Jun-06	0		0	0	
Jul-06	0		0	0	
Aug-06	1		1	1.59	28
Sep-06	0		0	0	
Oct-06	0		0	0	
Nov-06	0		0	0	
Dec-06	0		0	0	
Jan-07	1	Jan 13, 14, 15	0	0	
Feb-07	1	Feb 23, 25,	0	0	
Mar-07	1	Mar 1,	0	0	
Apr-07	0		0	0	
May-07	0		0	0	
Jun-07	0		0	0	
Jul-07	0		0	0	
Aug-07	0		0	0	
Sep-07	0		0	0	
Oct-07	1	Oct 22, 23,	1	1.46	23
Nov-07	0		0	0	
Dec-07	0		0	0	
Jan-08	0		0	0	
Feb-08	1	Feb 6,	0	0	
Mar-08	2	Mar 3, 4, 19 (pos discharge 4th)	1	0.39	19
Apr-08	0		0	0	
May-08	2	May 14, 15, 18, 19, 20	0	0	
Jun-08	0		1	0.06	4
Jul-08	0		0	0	
Aug-08	0		0	0	
Sep-08	0		0	0	
Oct-08	0		0	0	
Nov-08	0		0	0	
Dec-08	0		0	0	
Jan-09	0		0	0	
Feb-09	0		0	0	
Mar-09	0		0	0	
Apr-09	2	Apr 13, 14, 28	0	0	
May-09	1	May 13, 14, 15 (pos)	0	0	
Jun-09	0		0	0	
Jul-09	0		0	0	
Aug-09	0		0	0	
Sep-09	0		0	0	
Oct-09	0		0	0	
Nov-09	0		0	0	
Dec-09	0		0	0	
Jan-10	0		0	0	
Feb-10	0		0	0	
Mar-10	0		0	0	

Month-Year	Recorded Discharges	Estimated Discharge Date(s)	Modeled Discharges	Modeled Overflow Volume (MG)	Modeled Discharge Start Date(s)
Apr-10	0		0	0	
May-10	?	Summary spreadsheet indicates 1 discharge event but monthly report does not	0	0	
Jun-10	3	Jun 12, 13, 14, 15, 19, 21, 22, 27, 28	0	0	
Jul-10	0		0	0	
Aug-10	0		0	0	
Sep-10	0		0	0	
Oct-10	0		0	0	
Nov-10	0		1	0.33	25
Dec-10	0		0	0	
Jan-11	0		0	0	
Feb-11	2	Feb 20, 21, 22, 24, 25	0	0	
Mar-11	2	Mar 5, 8, 9, 10	0	0	
Apr-11	3	Apr 9, 11, 12 (pos), 16, 18, 19 (pos), 30	2	1.26	19, 23
May-11	1	May 1, 2, 3 (pos)	0	0	
Jun-11	0		0	0	
Jul-11	0		0	0	
Aug-11	0		0	0	
Sep-11	0		1	1.77	26
Oct-11	0		0	0	
Nov-11	1	Nov 14, 15 (pos)	0	0	
Dec-11	1	Dec 4, 5, 6 (pos)	0	0	
Jan-12	2	Jan 17, 25, 26, 27 (pos)	0	0	
Feb-12	0		0	0	
Mar-12	0		0	0	
Apr-12	0		0	0	
May-12	1	May 1, 2, (all pos)	1	1.11	1
Jun-12	0		0	0	
Jul-12	0		0	0	
Aug-12	0		0	0	
Sep-12	0		1	0.07	3
Oct-12	0		0	0	
Nov-12	0		0	0	
Dec-12	0		0	0	

TABLE C-2
SSO 603 Recorded and Modeled Discharges

Month-Year	Recorded Discharges	Estimated Discharge Date(s)	Modeled Discharges	Modeled Overflow Volume (MG)	Modeled Discharge Start Date(s)
Apr-06	1		2	0.58	17, 21
May-06	0		0	0	
Jun-06	0		0	0	
Jul-06	0		1	0.27	28
Aug-06	1		1	0.67	28
Sep-06	2		2	1.08	12, 23
Oct-06	0		2	0.81	17, 27
Nov-06	0		1	0.09	15
Dec-06	0		0	0	

Month-Year	Recorded Discharges	Estimated Discharge Date(s)	Modeled Discharges	Modeled Overflow Volume (MG)	Modeled Discharge Start Date(s)
Jan-07	1	Jan 12, 13, 14, 15 (pos discharge 15th)	1	0.06	15
Feb-07	2	Feb 20, 24, 25	2	0.51	20, 25
Mar-07	1	Mar 3,	1	0.38	2
Apr-07	0		2	0.28	4, 12
May-07	0		0	0	
Jun-07	0		2	0.37	5, 22
Jul-07	0		0	0	
Aug-07	0		0	0	
Sep-07	0		1	0.3	27
Oct-07	1	Oct 23, 24,	3	2.46	16, 19, 22
Nov-07	0		1	0.47	26
Dec-07	1	Dec 7, 8, 9,	2	0.53	2, 15
Jan-08	1	Jan 13,	1	0.19	11
Feb-08	1	Feb 5, 6,	1	0.52	5
Mar-08	2	Mar 4, 5, 18, 19	3	1.95	4, 18, 27
Apr-08	1	Apr 4,	1	0.34	4
May-08	2	May 2, 3, 5, 18, 19, 20	3	1.41	11, 15, 20
Jun-08	1	Jun 13, 15, 16	1	0.47	4
Jul-08	0		0	0	
Aug-08	0		1	0.16	5
Sep-08	0		0	0	
Oct-08	0		0	0	
Nov-08	0		0	0	
Dec-08	0		2	0.77	19, 24
Jan-09	0		0	0	
Feb-09	0		1	0.19	27
Mar-09	0		0	0	
Apr-09	0		0	0	
May-09	1	May 1, 3, 4,	1	0.11	14
Jun-09	2	Jun 2, 3, 4, 26	2	0.53	3, 17
Jul-09	0		1	0.23	31
Aug-09	2	Aug 4, 11,	1	0.48	4
Sep-09	0		1	0.45	7
Oct-09	0		2	0.81	9, 23
Nov-09	0		0	0	
Dec-09	0		1	0.24	9
Jan-10	0		0	0	
Feb-10	0		0	0	
Mar-10	0		2	0.3	13, 26
Apr-10	0		1	0.14	25
May-10	0		0	0	
Jun-10	3	Jun 12, 13, 14, 22, 23, 27, 28	3	1.34	12, 21, 28
Jul-10	1	Jul 13,	1	0.45	13
Aug-10	0		0	0	
Sep-10	0		0	0	
Oct-10	0		1	0.31	26
Nov-10	1	Nov 23, 24, 25, 26, 29	3	1.57	16, 25, 30
Dec-10	0		0	0	
Jan-11	0		0	0	
Feb-11	2	Feb 20, 21, 25, 27, 28	2	1.18	21, 25
Mar-11	2	Mar 4, 5, 8, 9, 10	0	0	
Apr-11	5	Apr 5, 12, 15, 16, 18, 19, 20, 22, 23, 24, 25	6	3.25	4, 9, 12, 16, 19, 22
May-11	2	May 3, 4, 13, 14, 15	2	0.42	2, 24

Month-Year	Recorded Discharges	Estimated Discharge Date(s)	Modeled Discharges	Modeled Overflow Volume (MG)	Modeled Discharge Start Date(s)
Jun-11	1	Jul 22, 23, 24	1	0.11	11
Jul-11	0		1	0.19	24
Aug-11	0		3	0.83	3, 7, 9
Sep-11	1	Sep 23, 24, 25, 26 (pos)	1	0.74	26
Oct-11	0		0	0	
Nov-11	2	Nov 15, 16, 22, 27, 28	2	0.81	14, 22
Dec-11	2	Dec 4, 5 (pos), 27	1	0.05	21
Jan-12	2	Jan 13, 17 (pos), 25, 26 (pos)	2	1.04	17, 26
Feb-12	0		0	0	
Mar-12	1	Mar 23, 24,	1	0.07	23
Apr-12	0		4	1.67	2, 14, 26, 30
May-12	2	May 1, 2, 13	2	0.51	13, 21
Jun-12	1	Jun 1,	1	0.36	1
Jul-12	0		1	0.1	24
Aug-12	1	Aug 5,	0	0	
Sep-12	0		3	1.1	3, 5, 8
Oct-12	0		0	0	
Nov-12	0		0	0	
Dec-12	1	Dec 10 (pos)	3	0.78	9, 20, 26

TABLE C-3
SSO 607 Recorded and Modeled Discharges

Month-Year	Recorded Discharges	Estimated Discharge Date(s)	Modeled Discharges	Modeled Overflow Volume (MG)	Modeled Discharge Start Date(s)
Apr-06	0		0	0	
May-06	0		0	0	
Jun-06	0		0	0	
Jul-06	0		0	0	
Aug-06	1		0	0	
Sep-06	1		0	0	
Oct-06	0		0	0	
Nov-06	0		0	0	
Dec-06	0		0	0	
Jan-07	0		0	0	
Feb-07	0		0	0	
Mar-07	0		0	0	
Apr-07	0		0	0	
May-07	0		0	0	
Jun-07	0		0	0	
Jul-07	0		0	0	
Aug-07	0		0	0	
Sep-07	0		0	0	
Oct-07	1	Oct 23, 24,	0	0	
Nov-07	0		0	0	

Month-Year	Recorded Discharges	Estimated Discharge Date(s)	Modeled Discharges	Modeled Overflow Volume (MG)	Modeled Discharge Start Date(s)
Dec-07	0		0	0	
Jan-08	0		0	0	
Feb-08	0		0	0	
Mar-08	1	Mar 18, 19,	0	0	
Apr-08	0		0	0	
May-08	1	May 18, 19, 20	0	0	
Jun-08	0		0	0	
Jul-08	0		0	0	
Aug-08	0		0	0	
Sep-08	0		0	0	
Oct-08	0		0	0	
Nov-08	0		0	0	
Dec-08	0		0	0	
Jan-09	0		0	0	
Feb-09	0		0	0	
Mar-09	0		0	0	
Apr-09	0		0	0	
May-09	0		0	0	
Jun-09	0		0	0	
Jul-09	0		0	0	
Aug-09	0		0	0	
Sep-09	0		0	0	
Oct-09	0		0	0	
Nov-09	0		0	0	
Dec-09	0		0	0	
Jan-10	0		0	0	
Feb-10	0		0	0	
Mar-10	0		0	0	
Apr-10	0		0	0	
May-10	0		0	0	
Jun-10	2	Jun 12, 13, 14, 27, 28	0	0	
Jul-10	0		0	0	
Aug-10	0		0	0	
Sep-10	0		0	0	
Oct-10	0		0	0	
Nov-10	0		0	0	
Dec-10	0		0	0	
Jan-11	0		0	0	
Feb-11	2	Feb 20, 21, 25, 27, 28	0	0	
Mar-11	0		0	0	

Month-Year	Recorded Discharges	Estimated Discharge Date(s)	Modeled Discharges	Modeled Overflow Volume (MG)	Modeled Discharge Start Date(s)
Apr-11	2	Apr 19, 20, 22, 23, 24, 25	0	0	
May-11	0		0	0	
Jun-11	1	Jun 18, 19, 20	0	0	
Jul-11	0		0	0	
Aug-11	2	Aug 6, 7, 8, 9	0	0	
Sep-11	1	Sep 23, 24, 25, 26 (pos)	0	0	
Oct-11	0		0	0	
Nov-11	0		0	0	
Dec-11	0		0	0	
Jan-12	0		0	0	
Feb-12	0		0	0	
Mar-12	0		0	0	
Apr-12	0		0	0	
May-12	0		0	0	
Jun-12	0		0	0	
Jul-12	0		0	0	
Aug-12	1	Aug 27 (pos)	0	0	
Sep-12	1	Sep 8 (pos)	0	0	
Oct-12	0		0	0	
Nov-12	0		0	0	
Dec-12	0		0	0	

TABLE C-4
SSO 681 Recorded and Modeled Discharges

Month-Year	Recorded Discharges	Estimated Discharge Date(s)	Modeled Discharges	Modeled Overflow Volume (MG)	Modeled Discharge Start Date(s)
Apr-06	0		0	0	
May-06	0		0	0	
Jun-06	0		0	0	
Jul-06	0		0	0	
Aug-06	0		1	0.12	28
Sep-06	0		0	0	
Oct-06	1		0	0	
Nov-06	0		0	0	
Dec-06	0		0	0	
Jan-07	0		0	0	
Feb-07	0		0	0	
Mar-07	1	Mar 3, 4,	0	0	
Apr-07	0		0	0	

Month-Year	Recorded Discharges	Estimated Discharge Date(s)	Modeled Discharges	Modeled Overflow Volume (MG)	Modeled Discharge Start Date(s)
May-07	0		0	0	
Jun-07	0		0	0	
Jul-07	0		0	0	
Aug-07	0		0	0	
Sep-07	0		0	0	
Oct-07	1	Oct 23, 24,	1	0.27	23
Nov-07	0		0	0	
Dec-07	0		0	0	
Jan-08	0		0	0	
Feb-08	1	Feb 1, 5, 6, 11,	0	0	
Mar-08	1	Mar 18, 19,	0	0	
Apr-08	0		0	0	
May-08	0		1	0.06	16
Jun-08	1	Jun 13, 15, 16	0	0	
Jul-08	0		0	0	
Aug-08	0		0	0	
Sep-08	0		0	0	
Oct-08	0		0	0	
Nov-08	0		0	0	
Dec-08	0		0	0	
Jan-09	0		0	0	
Feb-09	0		0	0	
Mar-09	0		0	0	
Apr-09	0		0	0	
May-09	0		0	0	
Jun-09	0		0	0	
Jul-09	0		0	0	
Aug-09	0		0	0	
Sep-09	0		0	0	
Oct-09	0		0	0	
Nov-09	0		0	0	
Dec-09	0		0	0	
Jan-10	0		0	0	
Feb-10	0		0	0	
Mar-10	0		0	0	
Apr-10	0		0	0	
May-10	0		0	0	
Jun-10	3	Jun 12, 13, 14, 22, 23, 27, 28	0	0	
Jul-10	0		0	0	
Aug-10	0		0	0	

Month-Year	Recorded Discharges	Estimated Discharge Date(s)	Modeled Discharges	Modeled Overflow Volume (MG)	Modeled Discharge Start Date(s)
Sep-10	0		0	0	
Oct-10	0		0	0	
Nov-10	0		0	0	
Dec-10	0		0	0	
Jan-11	0		0	0	
Feb-11	1	Feb 20, 21, 22	0	0	
Mar-11	0		0	0	
Apr-11	2	Apr 19, 20, 22, 23, 24, 25	0	0	
May-11	0		0	0	
Jun-11	0		0	0	
Jul-11	0		0	0	
Aug-11	0		1	0.17	9
Sep-11	0		1	0.22	26
Oct-11	0		0	0	
Nov-11	0		0	0	
Dec-11	0		0	0	
Jan-12	1	Jan 13, 17 (pos)	0	0	
Feb-12	0		0	0	
Mar-12	0		0	0	
Apr-12	0		0	0	
May-12	1	May 1, 2 (all pos)	0	0	
Jun-12	0		0	0	
Jul-12	0		0	0	
Aug-12	0		0	0	
Sep-12	0		0	0	
Oct-12	0		0	0	
Nov-12	0		0	0	
Dec-12	0		0	0	

TABLE C-5
SSO 682 Recorded and Modeled Discharges

Month-Year	Recorded Discharges	Estimated Discharge Date(s)	Modeled Discharges	Modeled Overflow Volume (MG)	Modeled Discharge Start Date(s)
Apr-06	0		0	0	
May-06	0		0	0	
Jun-06	0		0	0	
Jul-06	0		0	0	
Aug-06	0		0	0	
Sep-06	0		0	0	

Month-Year	Recorded Discharges	Estimated Discharge Date(s)	Modeled Discharges	Modeled Overflow Volume (MG)	Modeled Discharge Start Date(s)
Oct-06	0		0	0	
Nov-06	0		0	0	
Dec-06	0		0	0	
Jan-07	0		0	0	
Feb-07	0		0	0	
Mar-07	1	Mar 3, 4,	0	0	
Apr-07	0		0	0	
May-07	0		0	0	
Jun-07	0		0	0	
Jul-07	0		0	0	
Aug-07	0		0	0	
Sep-07	0		0	0	
Oct-07	0		0	0	
Nov-07	0		0	0	
Dec-07	0		0	0	
Jan-08	0		0	0	
Feb-08	0		0	0	
Mar-08	1	Mar 2, 4, 7, 8, 14, 15, 18, 19	0	0	
Apr-08	0		0	0	
May-08	0		0	0	
Jun-08	1	Jun 13, 15, 16	0	0	
Jul-08	0		0	0	
Aug-08	0		0	0	
Sep-08	0		0	0	
Oct-08	0		0	0	
Nov-08	0		0	0	
Dec-08	0		0	0	
Jan-09	0		0	0	
Feb-09	0		0	0	
Mar-09	0		0	0	
Apr-09	0		0	0	
May-09	0		0	0	
Jun-09	0		0	0	
Jul-09	0		0	0	
Aug-09	0		0	0	
Sep-09	0		0	0	
Oct-09	0		0	0	
Nov-09	0		0	0	
Dec-09	0		0	0	
Jan-10	0		0	0	

Month-Year	Recorded Discharges	Estimated Discharge Date(s)	Modeled Discharges	Modeled Overflow Volume (MG)	Modeled Discharge Start Date(s)
Feb-10	0		0	0	
Mar-10	0		0	0	
Apr-10	0		0	0	
May-10	0		0	0	
Jun-10	1	Jun 27-28	0	0	
Jul-10	0		0	0	
Aug-10	0		0	0	
Sep-10	0		0	0	
Oct-10	0		0	0	
Nov-10	0		0	0	
Dec-10	0		0	0	
Jan-11	0		0	0	
Feb-11	2	Feb 20, 21, 22, 25, 27, 28	0	0	
Mar-11	0		0	0	
Apr-11	1	Apr 22, 23, 24, 25	0	0	
May-11	1	May 17, 18,	0	0	
Jun-11	0		0	0	
Jul-11	0		0	0	
Aug-11	1	Aug 9,	0	0	
Sep-11	1	Sep 23, 24, 25, 26	0	0	
Oct-11	0		0	0	
Nov-11	0		0	0	
Dec-11	1	Dec 6,	0	0	
Jan-12	1	Jan 13, 17 (pos)	0	0	
Feb-12	0		0	0	
Mar-12	0		0	0	
Apr-12	0		0	0	
May-12	1	May 1, 2 (all pos)	0	0	
Jun-12	0		0	0	
Jul-12	0		0	0	
Aug-12	0		0	0	
Sep-12	0		0	0	
Oct-12	0		0	0	
Nov-12	0		0	0	
Dec-12	0		0	0	

TABLE C-6
SSO 700 Recorded and Modeled Discharges

Month-Year	Recorded Discharges	Estimated Discharge Date(s)	Modeled Discharges	Modeled Overflow Volume (MG)	Modeled Discharge Start Date(s)
Apr-06	6		0	0	
May-06	2		0	0	
Jun-06	4		0	0	
Jul-06	2		0	0	
Aug-06	0		0	0	
Sep-06	0		0	0	
Oct-06	0		0	0	
Nov-06	0		0	0	
Dec-06	0		0	0	
Jan-07	1	Jan 13, 14, 15 (pos surcharge 15th)	0	0	
Feb-07	0		0	0	
Mar-07	0		0	0	
Apr-07	0		0	0	
May-07	0		0	0	
Jun-07	0		0	0	
Jul-07	0		0	0	
Aug-07	0		0	0	
Sep-07	0		0	0	
Oct-07	1	Oct 23 (pos discharge 23rd)	0	0	
Nov-07	0		0	0	
Dec-07	1	Dec 2,	0	0	
Jan-08	0		0	0	
Feb-08	0		0	0	
Mar-08	6	Mar 4 (pos), 15, 17, 18 (pos), 19, 20 (pos), 23, 26, 27 (pos)	0	0	
Apr-08	1	Apr 4 (pos)	0	0	
May-08	3	May 11, 12, 16 (pos), 20	0	0	
Jun-08	1	Jun 15, 16,	0	0	
Jul-08	1	Jul 9,	0	0	
Aug-08	0		0	0	
Sep-08	0		0	0	
Oct-08	0		0	0	
Nov-08	0		0	0	
Dec-08	0		0	0	
Jan-09	0		0	0	
Feb-09	1	Feb 11, 12 (pos)	0	0	
Mar-09	1	Mar 18, 19,	0	0	
Apr-09	1	Apr 5, 6,	0	0	
May-09	0		0	0	

Month-Year	Recorded Discharges	Estimated Discharge Date(s)	Modeled Discharges	Modeled Overflow Volume (MG)	Modeled Discharge Start Date(s)
Jun-09	0		0	0	
Jul-09	0		0	0	
Aug-09	0		0	0	
Sep-09	0		0	0	
Oct-09	1	Oct 9 (pos)	0	0	
Nov-09	0		0	0	
Dec-09	0		0	0	
Jan-10	1	Jan 24, 25, 26	0	0	
Feb-10	?	Summary spreadsheet indicates 1 discharge event but monthly report does not	0	0	
Mar-10	2	Mar 13, 14, 26	0	0	
Apr-10	0		0	0	
May-10	1	May 8, 10, 11	0	0	
Jun-10	2	Jun 12, 13, 14, 27, 28	0	0	
Jul-10	0		0	0	
Aug-10	0		0	0	
Sep-10	0		0	0	
Oct-10	0		0	0	
Nov-10	1	Nov 24, 25, 26, 29, 30 (pos)	0	0	
Dec-10	0		0	0	
Jan-11	0		0	0	
Feb-11	4	Feb 2, 20, 21, 25 (pos), 27, 28	0	0	
Mar-11	2	Mar 5, 9, 10	0	0	
Apr-11	6	Apr 4, 11, 12, 16, 19, 20, 21, 23, 24, 25, 27 (all pos)	0	0	
May-11	1	May 3 (pos)	0	0	
Jun-11	0		0	0	
Jul-11	0		0	0	
Aug-11	1	Aug 8 (pos)	0	0	
Sep-11	1	Sep 26 (pos)	0	0	
Oct-11	0		0	0	
Nov-11	3	Nov 15, 22, 28 (all pos)	0	0	
Dec-11	1	Dec 5 (pos)	0	0	
Jan-12	3	Jan 17, 26, 27 (all pos)	0	0	
Feb-12	2	Feb 15, 16 (all pos)	0	0	
Mar-12	0		0	0	
Apr-12	0		0	0	
May-12	1	May 1, 2 (all pos)	0	0	
Jun-12	1	Jun 1 (pos)	0	0	
Jul-12	3	Jul 19, 24, 26 (all pos)	0	0	
Aug-12	0		0	0	

Month-Year	Recorded Discharges	Estimated Discharge Date(s)	Modeled Discharges	Modeled Overflow Volume (MG)	Modeled Discharge Start Date(s)
Sep-12	3	Sep 3, 5, 7, 8, 9 (all pos)	0	0	
Oct-12	0		0	0	
Nov-12	1	Nov 12 (pos)	0	0	
Dec-12	2	Dec 9, 10, 17, 18 (all pos)	0	0	

TABLE C-7
SSO 704 Recorded and Modeled Discharges

Month-Year	Recorded Discharges	Estimated Discharge Date(s)	Modeled Discharges	Modeled Overflow Volume (MG)	Modeled Discharge Start Date(s)
Apr-06	0		1	0.08	22
May-06	0		0	0	
Jun-06	0		0	0	
Jul-06	0		0	0	
Aug-06	1		1	0.75	28
Sep-06	2		2	0.76	12, 23
Oct-06	0		1	0.1	17
Nov-06	0		0	0	
Dec-06	0		0	0	
Jan-07	1	Jan 12, 13, 14, 15 (pos discharge 15th)	0	0	
Feb-07	2	Feb 20, 24, 25	0	0	
Mar-07	0		1	0.09	2
Apr-07	0		0	0	
May-07	0		0	0	
Jun-07	0		0	0	
Jul-07	0		0	0	
Aug-07	0		0	0	
Sep-07	1	Sept 11,	0	0	
Oct-07	1	Oct 23, 24,	1	1.59	23
Nov-07	0		1	0.08	26
Dec-07	1	Dec 2,	1	0.06	3
Jan-08	1	Jan 13,	0	0	
Feb-08	1	Feb 5, 6,	0	0	
Mar-08	2	Mar 4, 5, 18, 19	1	0.7	18
Apr-08	1	Apr 4,	0	0	
May-08	1	May 18, 19, 20	2	1.05	16, 20
Jun-08	0		1	0.05	4
Jul-08	0		0	0	
Aug-08	0		0	0	

Month-Year	Recorded Discharges	Estimated Discharge Date(s)	Modeled Discharges	Modeled Overflow Volume (MG)	Modeled Discharge Start Date(s)
Sep-08	0		0	0	
Oct-08	0		0	0	
Nov-08	0		0	0	
Dec-08	0		0	0	
Jan-09	0		0	0	
Feb-09	0		0	0	
Mar-09	0		0	0	
Apr-09	0		0	0	
May-09	0		0	0	
Jun-09	2	Jun 2, 3, 4, 26	1	0.26	3
Jul-09	0		0	0	
Aug-09	1	Aug 4,	1	0.1	4
Sep-09	1	Sep 7, 8,	1	0.37	7
Oct-09	1	Oct 9,	0	0	
Nov-09	0		0	0	
Dec-09	0		0	0	
Jan-10	0		0	0	
Feb-10	0		0	0	
Mar-10	1	Mar 26, 28, 29	0	0	
Apr-10	0		0	0	
May-10	0		0	0	
Jun-10	3	Jun 212, 13, 14, 22, 23, 27, 28	2	1.14	12, 28
Jul-10	2	46947	1	0.21	13
Aug-10	0		0	0	
Sep-10	0		0	0	
Oct-10	0		0	0	
Nov-10	1	Nov 23, 24, 25, 26, 29	1	0.69	26
Dec-10	0		0	0	
Jan-11	0		0	0	
Feb-11	2	Feb 20, 21, 22, 25, 27, 28	2	0.84	21, 25
Mar-11	2	Mar 4, 5, 8, 9, 10	0	0	
Apr-11	5	Apr 5, 12, 15, 16, 18, 19, 20, 22, 23, 24, 25	4	0.72	4, 16, 19, 23
May-11	0		0	0	
Jun-11	1	Jun 24, 26, 27	0	0	
Jul-11	0		0	0	
Aug-11	3	Aug 6, 7, 8, 9, 21	1	0.72	9
Sep-11	1	Sep 23, 24, 25, 26 (pos)	1	0.79	26
Oct-11	0		0	0	
Nov-11	3	Nov 4, 15, 16, 29	1	0.2	15
Dec-11	2	Dec 5, 6 (pos), 27	0	0	

Month-Year	Recorded Discharges	Estimated Discharge Date(s)	Modeled Discharges	Modeled Overflow Volume (MG)	Modeled Discharge Start Date(s)
Jan-12	3	Jan 13, 17, 25, 26, 27, 28	1	0.4	17
Feb-12	0		0	0	
Mar-12	1	Mar 23, 24,	0	0	
Apr-12	0		1	0.07	14
May-12	1	May 1, 2 (all pos)	1	0.53	1
Jun-12	1	Jun 1 (pos)	1	0.1	1
Jul-12	1	Jul 24 (pos)	0	0	
Aug-12	0		0	0	
Sep-12	0		1	0.26	3
Oct-12	0		0	0	
Nov-12	0		0	0	
Dec-12	1	Dec 10 (pos)	0	0	

TABLE C-8
SSO 1001 Recorded and Modeled Discharges

Month-Year	Recorded Discharges	Estimated Discharge Date(s)	Modeled Discharges	Modeled Overflow Volume (MG)	Modeled Discharge Start Date(s)
Apr-06	0		0	0	
May-06	0		0	0	
Jun-06	0		0	0	
Jul-06	0		0	0	
Aug-06	1		0	0	
Sep-06	1		0	0	
Oct-06	0		0	0	
Nov-06	0		0	0	
Dec-06	0		0	0	
Jan-07	0		0	0	
Feb-07	0		0	0	
Mar-07	1	Mar 3, 4,	0	0	
Apr-07	0		0	0	
May-07	0		0	0	
Jun-07	0		0	0	
Jul-07	0		0	0	
Aug-07	0		0	0	
Sep-07	0		0	0	
Oct-07	1	Oct 23, 24,	0	0	
Nov-07	0		0	0	
Dec-07	0		0	0	
Jan-08	0		0	0	

Month-Year	Recorded Discharges	Estimated Discharge Date(s)	Modeled Discharges	Modeled Overflow Volume (MG)	Modeled Discharge Start Date(s)
Feb-08	0		0	0	
Mar-08	2	Mar 14, 15, 18, 19	0	0	
Apr-08	0		0	0	
May-08	1	May 18, 19, 20	0	0	
Jun-08	0		0	0	
Jul-08	0		0	0	
Aug-08	0		0	0	
Sep-08	0		0	0	
Oct-08	0		0	0	
Nov-08	0		0	0	
Dec-08	0		0	0	
Jan-09	0		0	0	
Feb-09	0		0	0	
Mar-09	0		0	0	
Apr-09	0		0	0	
May-09	0		0	0	
Jun-09	1	Jun 2, 3, 4	0	0	
Jul-09	0		0	0	
Aug-09	0		0	0	
Sep-09	1	Sep 7, 8,	0	0	
Oct-09	0		0	0	
Nov-09	0		0	0	
Dec-09	0		0	0	
Jan-10	0		0	0	
Feb-10	0		0	0	
Mar-10	0		0	0	
Apr-10	0		0	0	
May-10	0		0	0	
Jun-10	3	Jun 12, 13, 14, 15, 22, 23, 27, 28	0	0	
Jul-10	0		0	0	
Aug-10	0		0	0	
Sep-10	0		0	0	
Oct-10	0		0	0	
Nov-10	1	Nov 23, 24, 25, 26, 29	0	0	
Dec-10	0		0	0	
Jan-11	0		0	0	
Feb-11	2	Feb 20, 21, 27, 28	0	0	
Mar-11	2	Mar 4, 5, 8, 9, 10	0	0	
Apr-11	7	Apr, 5, 8, 9, 11, 12, 15, 16, 18, 19, 20, 22, 23, 24, 25, 26, 27, 28	0	0	
May-11	1	May 13, 14, 15	0	0	

Month-Year	Recorded Discharges	Estimated Discharge Date(s)	Modeled Discharges	Modeled Overflow Volume (MG)	Modeled Discharge Start Date(s)
Jun-11	2	Jun 18, 19, 20, 21, 22, 23	0	0	
Jul-11	2	Jul 16, 22, 23, 24	0	0	
Aug-11	4	Aug 3, 6, 7, 8, 9, 25	0	0	
Sep-11	3	Sep 4, 20, 21, 22 (pos), 23, 24, 25, 26	0	0	
Oct-11	0		0	0	
Nov-11	1	Nov 22, 26, 27, 28	0	0	
Dec-11	1	Dec 6,	0	0	
Jan-12	1	Jan 13, 17 (pos)	0	0	
Feb-12	0		0	0	
Mar-12	1	Mar 12	0	0	
Apr-12	0		0	0	
May-12	1	May 1, 2	0	0	
Jun-12	1	Jun 1,	0	0	
Jul-12	0		0	0	
Aug-12	0		0	0	
Sep-12	0		0	0	
Oct-12	0		0	0	
Nov-12	0		0	0	
Dec-12	0		0	0	

TABLE C-9
SSO 1020 Recorded and Modeled Discharges

Month-Year	Recorded Discharges	Estimated Discharge Date(s)	Modeled Discharges	Modeled Overflow Volume (MG)	Modeled Discharge Start Date(s)
Apr-06	0		0	0	
May-06	0		0	0	
Jun-06	0		0	0	
Jul-06	0		0	0	
Aug-06	0		0	0	
Sep-06	1		0	0	
Oct-06	0		0	0	
Nov-06	0		0	0	
Dec-06	0		0	0	
Jan-07	0		0	0	
Feb-07	0		0	0	
Mar-07	1	Mar 3, 4,	0	0	
Apr-07	0		0	0	
May-07	0		0	0	

Month-Year	Recorded Discharges	Estimated Discharge Date(s)	Modeled Discharges	Modeled Overflow Volume (MG)	Modeled Discharge Start Date(s)
Jun-07	0		0	0	
Jul-07	0		0	0	
Aug-07	0		0	0	
Sep-07	0		0	0	
Oct-07	1	Oct 23, 24,	0	0	
Nov-07	0		0	0	
Dec-07	0		0	0	
Jan-08	0		0	0	
Feb-08	0		0	0	
Mar-08	2	Mar 18, 19, 26, 27	0	0	
Apr-08	0		0	0	
May-08	1	May 18, 19, 20	0	0	
Jun-08	0		0	0	
Jul-08	0		0	0	
Aug-08	0		0	0	
Sep-08	0		0	0	
Oct-08	0		0	0	
Nov-08	0		0	0	
Dec-08	0		0	0	
Jan-09	0		0	0	
Feb-09	0		0	0	
Mar-09	0		0	0	
Apr-09	0		0	0	
May-09	0		0	0	
Jun-09	1	Jun 2, 3, 4	0	0	
Jul-09	0		0	0	
Aug-09	0		0	0	
Sep-09	0		1	0.06	7
Oct-09	0		0	0	
Nov-09	0		0	0	
Dec-09	0		0	0	
Jan-10	0		0	0	
Feb-10	0		0	0	
Mar-10	0		0	0	
Apr-10	0		0	0	
May-10	0		0	0	
Jun-10	2	Jun 22, 23, 27, 28	0	0	
Jul-10	0		0	0	
Aug-10	0		0	0	
Sep-10	0		0	0	

Month-Year	Recorded Discharges	Estimated Discharge Date(s)	Modeled Discharges	Modeled Overflow Volume (MG)	Modeled Discharge Start Date(s)
Oct-10	0		0	0	
Nov-10	0		0	0	
Dec-10	0		0	0	
Jan-11	0		0	0	
Feb-11	2	Feb 20, 21, 25, 27, 28	0	0	
Mar-11	0		0	0	
Apr-11	4	Apr 8, 9, 11, 15, 16, 18, 19, 20, 22, 23, 24, 25	0	0	
May-11	0		0	0	
Jun-11	0		0	0	
Jul-11	0		0	0	
Aug-11	1	Aug 9,	0	0	
Sep-11	1	Sep 23, 24, 25, 26	1	0.06	26
Oct-11	0		0	0	
Nov-11	1	Nov 22, 26, 27, 28	0	0	
Dec-11	1	Dec 6,	0	0	
Jan-12	2	Jan 13, 17 (pos), 27, 28	0	0	
Feb-12	0		0	0	
Mar-12	0		0	0	
Apr-12	0		0	0	
May-12	1	May 1, 2,	0	0	
Jun-12	0		0	0	
Jul-12	0		0	0	
Aug-12	0		0	0	
Sep-12	0		0	0	
Oct-12	0		0	0	
Nov-12	0		0	0	
Dec-12	0		0	0	

TABLE C-10
SSO 1047 Recorded and Modeled Discharges

Month-Year	Recorded Discharges	Estimated Discharge Date(s)	Modeled Discharges	Modeled Overflow Volume (MG)	Modeled Discharge Start Date(s)
Apr-06	0		0	0	
May-06	0		0	0	
Jun-06	0		0	0	
Jul-06	0		0	0	
Aug-06	0		0	0	
Sep-06	0		0	0	

Month-Year	Recorded Discharges	Estimated Discharge Date(s)	Modeled Discharges	Modeled Overflow Volume (MG)	Modeled Discharge Start Date(s)
Oct-06	0		0	0	
Nov-06	0		0	0	
Dec-06	0		0	0	
Jan-07	0		0	0	
Feb-07	0		0	0	
Mar-07	0		0	0	
Apr-07	0		0	0	
May-07	0		0	0	
Jun-07	0		0	0	
Jul-07	0		0	0	
Aug-07	0		0	0	
Sep-07	0		0	0	
Oct-07	0		0	0	
Nov-07	0		0	0	
Dec-07	0		0	0	
Jan-08	0		0	0	
Feb-08	0		0	0	
Mar-08	1	Mar 19,	0	0	
Apr-08	?	Summary spreadsheet indicates 1 discharge event but monthly report does not	0	0	
May-08	1	May 14, 15,	0	0	
Jun-08	0		0	0	
Jul-08	0		0	0	
Aug-08	0		0	0	
Sep-08	0		0	0	
Oct-08	0		0	0	
Nov-08	0		0	0	
Dec-08	0		0	0	
Jan-09	0		0	0	
Feb-09	0		0	0	
Mar-09	0		0	0	
Apr-09	0		0	0	
May-09	0		0	0	
Jun-09	0		0	0	
Jul-09	0		0	0	
Aug-09	0		0	0	
Sep-09	0		0	0	
Oct-09	0		0	0	
Nov-09	0		0	0	
Dec-09	0		0	0	

Month-Year	Recorded Discharges	Estimated Discharge Date(s)	Modeled Discharges	Modeled Overflow Volume (MG)	Modeled Discharge Start Date(s)
Jan-10	0		0	0	
Feb-10	0		0	0	
Mar-10	0		0	0	
Apr-10	0		0	0	
May-10	0		0	0	
Jun-10	1	Jun 12, 13, 14, 15	0	0	
Jul-10	0		0	0	
Aug-10	0		0	0	
Sep-10	0		0	0	
Oct-10	0		0	0	
Nov-10	0		0	0	
Dec-10	0		0	0	
Jan-11	0		0	0	
Feb-11	1	Feb 20, 21, 22	0	0	
Mar-11	0		0	0	
Apr-11	2	Apr 16, 18, 19 (pos), 30	0	0	
May-11	1	May 1, 2, 3 (pos)	0	0	
Jun-11	0		0	0	
Jul-11	1	Jul 23, 24,	0	0	
Aug-11	0		0	0	
Sep-11	1	Sep 24, 25, 26	0	0	
Oct-11	0		0	0	
Nov-11	0		0	0	
Dec-11	0		0	0	
Jan-12	0		0	0	
Feb-12	0		0	0	
Mar-12	0		0	0	
Apr-12	0		0	0	
May-12	1	May 1, 2, 3	0	0	
Jun-12	0		0	0	
Jul-12	0		0	0	
Aug-12	0		0	0	
Sep-12	0		0	0	
Oct-12	0		0	0	
Nov-12	0		0	0	
Dec-12	0		0	0	

TABLE C-11
SSO 1048 Recorded and Modeled Discharges

Month-Year	Recorded Discharges	Estimated Discharge Date(s)	Modeled Discharges	Modeled Overflow Volume (MG)	Modeled Discharge Start Date(s)
Apr-06	1		2	0.2	7, 17
May-06	0		0	0	
Jun-06	0		0	0	
Jul-06	0		0	0	
Aug-06	1		1	1.16	28
Sep-06	1		1	0.33	12
Oct-06	0		1	0.21	17
Nov-06	0		0	0	
Dec-06	1		0	0	
Jan-07	2	Jan 1, 13, 14, 15	0	0	
Feb-07	1	Feb 24, 25,	0	0	
Mar-07	1	Mar 1,	0	0	
Apr-07	0		0	0	
May-07	0		0	0	
Jun-07	0		0	0	
Jul-07	0		0	0	
Aug-07	0		0	0	
Sep-07	0		0	0	
Oct-07	1	Oct 22, 23 (pos discharge 23)	1	1.39	22
Nov-07	1	Nov 25, 26,	1	0.06	26
Dec-07	0		0	0	
Jan-08	0		0	0	
Feb-08	1	Feb 6,	1	0.14	5
Mar-08	3	Mar 3, 4, 15, 17, 18, 26, 27, 28 (pos discharge 4th & 18th)	2	1.27	4, 18
Apr-08	1	Apr 3, 4 (pos)	0	0	
May-08	2	May 14, 15, 17, 18, 19, 20	1	0.27	16
Jun-08	0		0	0	
Jul-08	0		0	0	
Aug-08	0		0	0	
Sep-08	0		0	0	
Oct-08	0		0	0	
Nov-08	0		0	0	
Dec-08	0		0	0	
Jan-09	0		0	0	
Feb-09	0		0	0	
Mar-09	0		0	0	
Apr-09	0		0	0	
May-09	0		0	0	

Month-Year	Recorded Discharges	Estimated Discharge Date(s)	Modeled Discharges	Modeled Overflow Volume (MG)	Modeled Discharge Start Date(s)
Jun-09	0		0	0	
Jul-09	0		0	0	
Aug-09	?	Summary spreadsheet indicates 1 discharge event but monthly report does not	1	0.09	4
Sep-09	0		1	0.14	7
Oct-09	0		1	0.21	9
Nov-09	0		0	0	
Dec-09	0		0	0	
Jan-10	0		0	0	
Feb-10	0		0	0	
Mar-10	2	Mar 13, 14, 28, 29	0	0	
Apr-10	0		0	0	
May-10	?	Summary spreadsheet indicates 1 discharge event but monthly report does not	1	0.05	21
Jun-10	2	Jun 12, 13, 14, 15, 19, 21, 22	3	0.52	12, 21, 28
Jul-10	0		0	0	
Aug-10	0		0	0	
Sep-10	0		0	0	
Oct-10	0		0	0	
Nov-10	0		1	0.44	25
Dec-10	0		0	0	
Jan-11	0		0	0	
Feb-11	1	Feb 20, 21, 22	2	0.77	21, 25
Mar-11	0		0	0	
Apr-11	4	Apr 9, 11, 12 (pos), 16, 18, 19 (pos), 23, 24, 25, 26, 30	3	0.9	4, 19, 25
May-11	1	May 1, 2, 3 (pos)	0	0	
Jun-11	1	Jun 11,	0	0	
Jul-11	0		0	0	
Aug-11	0		0	0	
Sep-11	1	Sep 24, 25, 26	1	1.27	26
Oct-11	0		0	0	
Nov-11	2	Nov 14, 15 (pos), 27, 28, 29	1	0.08	14
Dec-11	0		0	0	
Jan-12	1	Jan 17,	2	0.25	17, 26
Feb-12	0		0	0	
Mar-12	0		0	0	
Apr-12	1	Apr 4,	1	0.07	14
May-12	2	May 1, 2, 3, 29	1	0.69	2
Jun-12	0		1	0.17	1

Month-Year	Recorded Discharges	Estimated Discharge Date(s)	Modeled Discharges	Modeled Overflow Volume (MG)	Modeled Discharge Start Date(s)
Jul-12	0		0	0	
Aug-12	0		0	0	
Sep-12	0		2	0.4	3, 8
Oct-12	0		0	0	
Nov-12	0		0	0	
Dec-12	0		0	0	

Appendix D- CSO Summary Tables

TABLE D-1

CSO 507 Recorded and Modeled Discharges

Month-Year	# of Recorded Discharges	Total Recorded Overflow Volume (MG)	Estimated Recorded Discharge Date(s)	Total Recorded Discharge Duration (hours)	# of Modeled Discharges	Total Modeled Overflow Volume* (MG)	Model Event Start Date(s)
Apr-06					3	3.22	14, 17, 21
May-06	4	0.974		10.9	2	1.24	18, 25
Jun-06					4	1.09	2, 10, 19, 22
Jul-06	5	1.703		9.6	3	1.38	11, 21, 28
Aug-06					1	5.44	27
Sep-06	6	7.062		21.6	3	5.43	12, 18, 22
Oct-06					4	2.4	5, 17, 20, 26
Nov-06	3	1.137		11.6	1	0.51	15
Dec-06					5	0.87	1, 12, 21, 25, 31
Jan-07	3	7.907		24.6	3	1.18	5, 7, 13
Feb-07					2	1.55	20, 25
Mar-07	6	3.999		17.7	3	2.01	1, 22, 28
Apr-07					5	1.77	3, 11, 14, 24, 26
May-07	1	0.104		3.4	1	0.11	16
Jun-07					3	1.63	4, 22, 27
Jul-07					3	0.52	4, 15, 19
Aug-07					1	0.16	21
Sep-07					2	1.16	11, 26
Oct-07					3	7.4	16, 18, 22
Nov-07	4	2.052		14.7	3	1.24	11, 21, 26
Dec-07					4	2	2, 9, 12, 15
Jan-08	2	0.701		9	3	0.68	9, 10, 29
Feb-08					1	1.74	5
Mar-08	5	8.716		32.5	4	5.17	4, 14, 18, 27
Apr-08					1	0.86	4
May-08	5	7.024		31.7	6	4.73	2, 8, 11, 14, 15, 19
Jun-08					4	5.98	3, 13, 27, 28
Jul-08	3	0.717		5.6	2	0.38	13, 22
Aug-08					1	0.6	5

Month-Year	# of Recorded Discharges	Total Recorded Overflow Volume (MG)	Estimated Recorded Discharge Date(s)	Total Recorded Discharge Duration (hours)	# of Modeled Discharges	Total Modeled Overflow Volume* (MG)	Model Event Start Date(s)
Sep-08	3	0.081		2.4	0	0	
Oct-08					2	0.59	8, 24
Nov-08	2	0.74		9.2	2	0.27	15, 24
Dec-08					3	2.12	9, 19, 24
Jan-09	4	0.898		21.6	1	0.28	10
Feb-09					2	1.13	11, 27
Mar-09	4	0.906		13.2	2	0.26	19, 25
Apr-09	---		---		2	0.68	3, 10
May-09	---		---		1	0.55	13
Jun-09	---		---		3	7.06	2, 10, 17
Jul-09	---		---		3	1.33	22, 25, 31
Aug-09	---		---		2	2.38	4, 10
Sep-09	---		---		5	5.58	7, 9, 20, 24, 27
Oct-09	---		---		4	2.74	8, 23, 28, 31
Nov-09					0	0	
Dec-09					1	0.68	8
Jan-10	2	1.995	21, 24		2	0.41	21, 24
Feb-10	4	0.654	5, 21, 22, 23		0	0	
Mar-10	4	7.684	12, 22, 25, 29		3	1.73	13, 22, 25
Apr-10	3	0.662	8, 16, 24		2	0.84	8, 24
May-10	8	1.886	1, 2, 4, 8, 11, 12, 17, 21		3	0.99	2, 12, 21
Jun-10	10	11.375	2, 6, 9, 12, 13, 14, 15, 19, 21, 27		8	9.04	3, 6, 9, 12, 15, 19, 21, 27
Jul-10	5	1.488	9, 13, 17, 19, 20		3	0.74	9, 13, 21
Aug-10	4	0.364	4, 11, 14, 15		0	0	
Sep-10	3	0.027	7, 16, 24		0	0	
Oct-10	2	0.542	13, 26		1	1.32	26
Nov-10	6	6.579	16, 23, 24, 25, 29, 30		4	4.5	16, 23, 24, 30
Dec-10	3	0.04	11, 12, 30		0	0	
Jan-11	3	0.513	1, 18, 30		1	0.2	1
Feb-11	4	11.081	1, 5, 21, 24		4	4.66	1, 21, 25, 28
Mar-11	5	6.242	4, 8, 15, 18, 23		3	0.48	4, 9, 18
Apr-11	16	26.681	1, 4, 9, 10, 11, 15, 17, 19, 20, 22, 23, 24, 25, 26, 27, 28		7	11.66	4, 9, 11, 16, 19, 22, 27
May-11	10	8.852	1, 2, 7, 13, 15, 17, 18, 22, 23, 26		4	2.6	2, 13, 22, 26

Month-Year	# of Recorded Discharges	Total Recorded Overflow Volume (MG)	Estimated Recorded Discharge Date(s)	Total Recorded Discharge Duration (hours)	# of Modeled Discharges	Total Modeled Overflow Volume* (MG)	Model Event Start Date(s)
Jun-11	15	3.771	6, 10, 11, 14, 15, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27		6	3.37	10, 15, 19, 21, 23, 26
Jul-11	4	1.734	4, 8, 23, 24		2	2.33	8, 24
Aug-11	6	3.483	3, 7, 8, 9, 14, 21		3	4.7	3, 7, 9
Sep-11	9	4.689	1, 4, 7, 14, 19, 21, 23, 26, 29		6	7.38	4, 15, 19, 23, 26, 30
Oct-11	7	2.485	13, 18, 19, 20, 24, 26, 27		1	0.26	27
Nov-11	10	22.696	3, 14, 16, 20, 21, 22, 24, 25, 26, 27		5	2.87	3, 14, 16, 22, 27
Dec-11	6	11.974	4, 15, 19, 21, 22, 27		4	1.11	4, 21, 22, 27
Jan-12	9	5.637	11, 12, 17, 20, 23, 24, 26, 27, 31		5	5	11, 17, 21, 23, 26
Feb-12	4	1.032	1, 4, 16, 29		0	0	
Mar-12	8	2.173	2, 8, 9, 12, 15, 23, 24, 30		5	1.19	2, 8, 15, 23, 30
Apr-12	14	3.734	1, 4, 5, 6, 14, 18, 19, 21, 25, 26, 27, 28, 29, 30		5	9.97	1, 14, 25, 28, 30
May-12	11	9.896	1, 4, 5, 7, 8, 9, 10, 11, 13, 29, 31		5	3.46	4, 7, 13, 29, 31
Jun-12	6	1.528	1, 11, 17, 18, 22, 29		1	0.15	29
Jul-12	6	0.681	14, 18, 19, 24, 26, 27		3	0.78	14, 18, 26
Aug-12	2	0.13	10, 27		1	0.13	10
Sep-12	9	2.387	1, 2, 3, 5, 8, 18, 22, 26, 27		4	4.16	2, 5, 8, 22
Oct-12	8	1.665	1, 5, 14, 18, 19, 20, 26, 30		3	0.86	1, 6, 26
Nov-12	2	1.296	3, 12		1	0.29	12
Dec-12	9	5.671	2, 4, 7, 8, 9, 17, 20, 24, 26		7	4.43	2, 4, 7, 9, 17, 20, 26

TABLE D-2

CSO 508 Recorded and Modeled Discharges

Month-Year	# of Recorded Discharges	Total Recorded Overflow Volume (MG)	Estimated Recorded Discharge Date(s)	Total Recorded Discharge Duration (hours)	Recorded Data Notes	# of Modeled Discharges	Total Modeled Overflow Volume* (MG)	Model Event Start Date(s)
Apr-06						0	0	
May-06	7	0.2		15.5		0	0	
Jun-06	5	0.001		5.2		0	0	
Jul-06	5	0.151		33.3		0	0	
Aug-06	2	1.24		27.6		1	0.14	28

Month-Year	# of Recorded Discharges	Total Recorded Overflow Volume (MG)	Estimated Recorded Discharge Date(s)	Total Recorded Discharge Duration (hours)	Recorded Data Notes	# of Modeled Discharges	Total Modeled Overflow Volume* (MG)	Model Event Start Date(s)
Sep-06	8	0.637		15.5		1	0.1	23
Oct-06	3	0.273		28		0	0	
Nov-06	3	0.018		32.6		0	0	
Dec-06	5	0.163		27.9		0	0	
Jan-07	3	0		3.1		0	0	
Feb-07	3	0.78		14.3		0	0	
Mar-07	3	0.46		7.8		0	0	
Apr-07	5	0		8.6		0	0	
May-07	0	0		0		0	0	
Jun-07	3	0.01		2.3		0	0	
Jul-07	1	0		0.5	Overflow activity may not be accurate due to missing or erroneous data	0	0	
Aug-07	1	0		0.5	Overflow activity may not be accurate due to missing or erroneous data	0	0	
Sep-07	0	0		0		0	0	
Oct-07	0	0		0	Overflow activity may not be accurate due to missing or erroneous data	0	0	
Nov-07	3	0.393		27		0	0	
Dec-07	1	0.01		4.8		0	0	
Jan-08	2	0.003		10.3		0	0	
Feb-08	6	0.096		20.2		0	0	
Mar-08	7	3.735		63.7	Overflow activity may not be accurate due to missing or erroneous data	0	0	
Apr-08	2	0.002		2	Overflow activity may not be accurate due to missing or erroneous data	0	0	
May-08	3	1.321		16.6		0	0	
Jun-08	3	0		4.3	Overflow activity may not be accurate due to missing or erroneous data	1	0.12	4
Jul-08	1	0.103		2		0	0	
Aug-08						0	0	

Month-Year	# of Recorded Discharges	Total Recorded Overflow Volume (MG)	Estimated Recorded Discharge Date(s)	Total Recorded Discharge Duration (hours)	Recorded Data Notes	# of Modeled Discharges	Total Modeled Overflow Volume* (MG)	Model Event Start Date(s)
Sep-08	2	0.105		1.3		0	0	
Oct-08						0	0	
Nov-08	3	0.27		10.9		0	0	
Dec-08						0	0	
Jan-09	6	0.716		40.4		0	0	
Feb-09						0	0	
Mar-09	4	0.435		13.2		0	0	
Apr-09	---		---			0	0	
May-09	---		---			0	0	
Jun-09	---		---			1	0.27	3
Jul-09	---		---			0	0	
Aug-09	---		---			0	0	
Sep-09	---		---			1	0.39	7
Oct-09	---		---			0	0	
Nov-09						0	0	
Dec-09						0	0	
Jan-10	4	0.011	17, 21, 24, 25			0	0	
Feb-10	5	0.006	5, 6, 15, 16, 22			0	0	
Mar-10	7	0.009	8, 11, 12, 13, 14, 22, 25			0	0	
Apr-10	3	0.003	24, 25, 28			0	0	
May-10	4	0.019	11, 12, 17, 21			0	0	
Jun-10	6	0.006	2, 6, 7, 9, 10, 12			2	0.31	12, 15
Jul-10	3	0.003	13, 17, 20			0	0	
Aug-10	2	0.002	4, 14			0	0	
Sep-10	0	0				0	0	
Oct-10	1	0.001	13			0	0	
Nov-10	0	0				0	0	
Dec-10	0	0				0	0	
Jan-11	0	0				0	0	
Feb-11	0	0				0	0	
Mar-11	0	0				0	0	
Apr-11	0	0				1	0.13	23
May-11	0	0				0	0	
Jun-11	9	0.086	10, 18, 19, 20, 21, 22, 23, 26, 27			0	0	

Month-Year	# of Recorded Discharges	Total Recorded Overflow Volume (MG)	Estimated Recorded Discharge Date(s)	Total Recorded Discharge Duration (hours)	Recorded Data Notes	# of Modeled Discharges	Total Modeled Overflow Volume* (MG)	Model Event Start Date(s)
Jul-11	0	0.028				0	0	
Aug-11	9	0.014	1, 2, 3, 13, 14, 21, 22, 27, 28			1	0.12	9
Sep-11	13	0.095	1, 4, 7, 14, 15, 19, 20, 21, 23, 26, 28, 29, 30			1	0.19	26
Oct-11	9	0.093	18, 19, 20, 24, 26, 27, 28, 29, 30			0	0	
Nov-11	10	0.055	3, 7, 8, 9, 10, 14, 16, 20, 21, 22			0	0	
Dec-11	7	0.045	5, 15, 19, 21, 22, 27, 30			0	0	
Jan-12	7	0.035	11, 12, 17, 20, 23, 26, 31			0	0	
Feb-12	2	0.004	4, 16			0	0	
Mar-12	2	0.002	15, 24			0	0	
Apr-12	3	0.003	2, 14, 30			0	0	
May-12	2	0.002	5, 13			1	0.4	1
Jun-12	0	0				0	0	
Jul-12	1	0.001	14			0	0	
Aug-12	0	0				0	0	
Sep-12	3	0.003	2, 3, 8			0	0	
Oct-12	0	0				0	0	
Nov-12	0	0				0	0	
Dec-12	1	0.001	20			0	0	

TABLE D-3
CSO 509 Recorded and Modeled Discharges

Month-Year	# of Recorded Discharges	Total Recorded Overflow Volume (MG)	Estimated Recorded Discharge Date(s)	# of Modeled Discharges	Total Modeled Overflow Volume (MG)	Model Event Start Date(s)
Jan-10	5	0.09	21, 24, 25, 27, 28	0	0	
Feb-10	1	0.003	19	0	0	
Mar-10	3	0.039	8, 13, 25	0	0	
Apr-10	2	0.002	7, 8	2	0.31	1, 24
May-10	0	0		0	0	
Jun-10	2	0.007	12, 27	3	0.37	5, 12, 15
Jul-10	0	0		1	0.16	8

Month-Year	# of Recorded Discharges	Total Recorded Overflow Volume (MG)	Estimated Recorded Discharge Date(s)	# of Modeled Discharges	Total Modeled Overflow Volume (MG)	Model Event Start Date(s)
Aug-10	0	0		0	0	
Sep-10	0	0		0	0	
Oct-10	0	0		0	0	
Nov-10	1	0.009	25	0	0	
Dec-10	0	0		0	0	
Jan-11	0	0		0	0	
Feb-11	1	0.023	21	0	0	
Mar-11	3	0.047	4, 5, 9	0	0	
Apr-11	0	0		2	0.6	1, 23
May-11	1	0.001	3	0	0	
Jun-11	0	0		2	0.15	5, 13
Jul-11	0	0		1	0.17	8
Aug-11	1	0.001	8	1	0.08	9
Sep-11	0	0		1	0.2	25
Oct-11	0	0		0	0	
Nov-11	0	0		0	0	
Dec-11	0	0		0	0	
Jan-12	0	0		0	0	
Feb-12	0	0		0	0	
Mar-12	0	0		0	0	
Apr-12	0	0		1	0.28	1
May-12	0	0		1	0.2	1
Jun-12	0	0		1	0.07	13
Jul-12	0	0		1	0.14	8
Aug-12	0	0		0	0	
Sep-12	1	0.001	8	0	0	
Oct-12	0	0		0	0	
Nov-12	0	0		0	0	
Dec-12	0	0		0	0	

TABLE D-4

CSO 510 Recorded and Modeled Discharges

Month-Year	# of Recorded Discharges	Total Recorded Overflow Volume (MG)	Estimated Recorded Discharge Date(s)	# of Modeled Discharges	Total Modeled Overflow Volume (MG)	Model Event Start Date(s)
Jan-10	0	0		0	0	
Feb-10	0	0		0	0	
Mar-10	1	0.013	25	0	0	
Apr-10	0	0		0	0	
May-10	3	0.051	21, 30, 31	0	0	
Jun-10	10	0.449	2, 6, 9, 12, 14, 18, 19, 21, 23, 27	1	0.06	12
Jul-10	3	0.014	9, 13, 20	0	0	
Aug-10	2	0.002	4, 11	0	0	
Sep-10	0	0		0	0	
Oct-10	3	0.004	12, 13, 26	0	0	
Nov-10	4	0.265	16, 23, 25, 30	0	0	
Dec-10	0	0		0	0	
Jan-11	0	0		0	0	
Feb-11	3	1.671	1, 14, 21	0	0	
Mar-11	2	0.914	9, 18	0	0	
Apr-11	12	2.165	4, 9, 10, 11, 12, 16, 19, 20, 22, 23, 24, 27	0	0	
May-11	9	0.506	2, 3, 4, 12, 14, 19, 22, 23, 26	0	0	
Jun-11	5	0.005	11, 20, 21, 22, 26	0	0	
Jul-11	3	0.006	8, 23, 24	0	0	
Aug-11	7	0.149	3, 7, 8, 9, 21, 27, 31	0	0	
Sep-11	3	0.606	1, 4, 26	1	0.13	26
Oct-11	0	0		0	0	
Nov-11	4	0.004	4, 14, 15, 22	0	0	
Dec-11	1	1.388	5	0	0	
Jan-12	3	0.517	17, 28, 29	0	0	
Feb-12	0	0		0	0	
Mar-12	4	0.005	15, 21, 22, 26	0	0	
Apr-12	1	0.001	25	0	0	
May-12	1	0.001	5	0	0	
Jun-12	1	0.02	1	0	0	
Jul-12	2	0.002	14, 18	0	0	
Aug-12	0	0		0	0	

Month-Year	# of Recorded Discharges	Total Recorded Overflow Volume (MG)	Estimated Recorded Discharge Date(s)	# of Modeled Discharges	Total Modeled Overflow Volume (MG)	Model Event Start Date(s)
Sep-12	2	0.002	3, 8	0	0	
Oct-12	0	0		0	0	
Nov-12	0	0		0	0	
Dec-12	1	0.001	9	0	0	

TABLE D-5

CSO 511 Recorded and Modeled Discharges

Month-Year	# of Recorded Discharges	Total Recorded Overflow Volume (MG)	Estimated Recorded Discharge Date(s)	# of Modeled Discharges	Total Modeled Overflow Volume (MG)	Model Event Start Date(s)
Jan-10	2	0.006	21, 24	0	0	
Feb-10	0	0		0	0	
Mar-10	5	0.013	12, 13, 22, 25, 28	0	0	
Apr-10	3	0.01	8, 16, 24	0	0	
May-10	5	0.009	1, 2, 11, 12, 21	0	0	
Jun-10	8	0.037	2, 6, 9, 12, 14, 19, 21, 27	0	0	
Jul-10	3	0.017	9, 13, 20	0	0	
Aug-10	3	0.012	11, 14, 15	0	0	
Sep-10	0	0		0	0	
Oct-10	2	0.01	12, 26	0	0	
Nov-10	5	0.057	16, 23, 24, 25, 30	0	0	
Dec-10	0	0		0	0	
Jan-11	2	0.003	1, 18	0	0	
Feb-11	5	0.068	1, 21, 24, 27, 28	0	0	
Mar-11	6	0.021	4, 5, 9, 10, 15, 18	0	0	
Apr-11	12	0.187	4, 9, 11, 12, 16, 19, 20, 22, 23, 25, 27, 28	0	0	
May-11	10	0.035	2, 3, 7, 13, 15, 18, 22, 23, 24, 26	0	0	
Jun-11	10	0.029	10, 11, 15, 19, 20, 21, 22, 23, 26, 27	0	0	
Jul-11	4	0.031	4, 8, 23, 24	0	0	
Aug-11	6	0.051	3, 7, 8, 9, 14, 21	0	0	
Sep-11	6	0.101	4, 7, 19, 23, 26, 29	0	0	
Oct-11	2	0.011	19, 26	0	0	

Month-Year	# of Recorded Discharges	Total Recorded Overflow Volume (MG)	Estimated Recorded Discharge Date(s)	# of Modeled Discharges	Total Modeled Overflow Volume (MG)	Model Event Start Date(s)
Nov-11	8	0.036	4, 14, 15, 16, 21, 22, 27, 28	0	0	
Dec-11	5	0.155	5, 15, 21, 22, 27	0	0	
Jan-12	5	0.07	11, 17, 21, 23, 26	0	0	
Feb-12	1	0.002	29	0	0	
Mar-12	6	0.031	2, 8, 15, 23, 24, 30	0	0	
Apr-12	5	0.037	1, 14, 25, 28, 30	0	0	
May-12	8	0.054	1, 4, 5, 7, 8, 13, 29, 31	0	0	
Jun-12	2	0.014	1, 29	0	0	
Jul-12	6	0.023	14, 18, 19, 24, 26, 27	0	0	
Aug-12	1	0.001	27	0	0	
Sep-12	4	0.041	2, 3, 8, 22	0	0	
Oct-12	3	0.006	1, 6, 30	0	0	
Nov-12	2	0.004	9, 12	0	0	
Dec-12	8	0.035	2, 4, 7, 9, 10, 17, 20, 26	0	0	

TABLE D-6

CSO 512 Recorded and Modeled Discharges

Month-Year	# of Recorded Discharges	Total Recorded Overflow Volume (MG)	Estimated Recorded Discharge Date(s)	# of Modeled Discharges	Total Modeled Overflow Volume (MG)	Model Event Start Date(s)
Jan-10	2	0.003	21, 24	0	0	
Feb-10	0	0		0	0	
Mar-10	5	0.014	12, 13, 22, 25, 29	0	0	
Apr-10	0	0		0	0	
May-10	8	0.037	1, 2, 4, 8, 11, 12, 17, 21	0	0	
Jun-10	10	0.261	2, 6, 9, 12, 14, 17, 19, 21, 22, 27	1	0.06	12
Jul-10	5	0.012	9, 13, 17, 20, 22	0	0	
Aug-10	5	0.009	4, 5, 11, 14, 15	0	0	
Sep-10	3	0.003	15, 18, 20	0	0	
Oct-10	2	0.015	13, 26	0	0	
Nov-10	6	0.08	16, 23, 24, 25, 29, 30	0	0	
Dec-10	1	0.001	11	0	0	

Month-Year	# of Recorded Discharges	Total Recorded Overflow Volume (MG)	Estimated Recorded Discharge Date(s)	# of Modeled Discharges	Total Modeled Overflow Volume (MG)	Model Event Start Date(s)
Jan-11	1	0.001	1	0	0	
Feb-11	5	0.294	1, 21, 24, 27, 28	0	0	
Mar-11	7	0.096	4, 5, 8, 9, 15, 18, 23	0	0	
Apr-11	15	0.144	1, 4, 5, 9, 11, 12, 15, 16, 19, 20, 22, 23, 24, 27, 28	0	0	
May-11	9	0.064	2, 3, 7, 13, 15, 22, 23, 24, 26	0	0	
Jun-11	10	0.024	10, 11, 15, 19, 20, 21, 22, 23, 26, 27	0	0	
Jul-11	4	0.022	4, 8, 23, 24	0	0	
Aug-11	6	0.033	3, 7, 8, 9, 14, 21	1	0.09	9
Sep-11	9	0.017	1, 4, 7, 9, 15, 19, 21, 23, 29	1	0.18	26
Oct-11	5	0.012	13, 19, 24, 26, 27	0	0	
Nov-11	9	0.027	3, 14, 16, 19, 21, 22, 27, 28, 29	0	0	
Dec-11	5	0.01	4, 15, 21, 22, 27	0	0	
Jan-12	6	0.053	11, 17, 20, 23, 26, 31	0	0	
Feb-12	2	0.002	16, 29	0	0	
Mar-12	6	0.016	2, 8, 15, 23, 24, 30	0	0	
Apr-12	6	0.028	1, 4, 14, 25, 28, 30	0	0	
May-12	7	0.012	4, 5, 7, 8, 13, 29, 31	1	0.31	1
Jun-12	3	0.036	1, 17, 29	0	0	
Jul-12	6	0.014	14, 18, 19, 24, 26, 27	0	0	
Aug-12	2	0.002	10, 27	0	0	
Sep-12	8	0.032	1, 2, 3, 5, 8, 22, 26, 27	0	0	
Oct-12	4	0.01	1, 5, 26, 30	0	0	
Nov-12	2	0.003	3, 12	0	0	
Dec-12	7	0.029	2, 4, 7, 9, 17, 20, 26	0	0	

TABLE D-7

CSO 513 Recorded and Modeled Discharges

Month-Year	# of Recorded Discharges	Total Recorded Overflow Volume (MG)	Estimated Recorded Discharge Date(s)	# of Modeled Discharges	Total Modeled Overflow Volume* (MG)	Model Event Start Date(s)
Jan-10	2	0.026	21, 24	2	0.27	21, 24
Feb-10	0	0		0	0	

Month-Year	# of Recorded Discharges	Total Recorded Overflow Volume (MG)	Estimated Recorded Discharge Date(s)	# of Modeled Discharges	Total Modeled Overflow Volume* (MG)	Model Event Start Date(s)
Mar-10	4	0.095	12, 13, 22, 25	3	1.07	13, 22, 25
Apr-10	4	0.065	8, 16, 24, 25	1	0.47	24
May-10	6	0.099	1, 2, 8, 11, 12, 21	2	1.14	2, 21
Jun-10	8	0.177	2, 6, 9, 12, 14, 19, 21, 27	6	6.07	3, 12, 15, 19, 21, 28
Jul-10	3	0.024	9, 13, 20	1	0.32	13
Aug-10	4	0.007	4, 11, 14, 15	0	0	
Sep-10	2	0.003	8, 16	0	0	
Oct-10	1	0.043	26	1	0.61	26
Nov-10	8	0.556	16, 23, 24, 25, 27, 28, 29, 30	4	3.43	16, 23, 24, 30
Dec-10	1	0.001	11	0	0	
Jan-11	1	0.017	1	1	0.16	1
Feb-11	2	2.532	1, 21	3	3.35	21, 25, 28
Mar-11	4	0.201	4, 5, 9, 15	2	0.13	9, 18
Apr-11	10	2.844	4, 9, 11, 12, 16, 19, 20, 22, 23, 27	7	7.89	4, 9, 11, 16, 19, 22, 27
May-11	8	1.012	2, 3, 8, 13, 15, 22, 23, 26	4	2.18	2, 13, 22, 26
Jun-11	9	0.168	10, 11, 15, 19, 20, 21, 22, 26, 27	5	1.94	10, 20, 21, 23, 26
Jul-11	4	0.127	8, 23, 24, 31	2	1.27	8, 24
Aug-11	3	0.111	3, 7, 8	3	2.26	3, 7, 9
Sep-11	8	0.425	1, 3, 4, 7, 23, 26, 28, 29	6	3.77	4, 15, 19, 23, 26, 30
Oct-11	4	0.217	19, 20, 26, 27	1	0.12	27
Nov-11	8	0.313	3, 14, 16, 19, 21, 22, 27, 28	5	1.85	3, 14, 16, 22, 27
Dec-11	6	0.686	4, 5, 15, 21, 22, 27	3	0.54	4, 21, 22
Jan-12	5	1.718	17, 21, 23, 25, 26	5	3.24	11, 17, 21, 23, 26
Feb-12	1	0.005	29	0	0	
Mar-12	6	0.07	2, 8, 15, 23, 24, 30	5	0.91	2, 8, 15, 23, 30
Apr-12	5	0.198	1, 14, 25, 28, 30	5	4.36	1, 14, 25, 28, 30
May-12	4	2.946	1, 13, 29, 31	4	2.01	5, 7, 13, 31
Jun-12	3	0.069	1, 22, 29	1	0.07	29
Jul-12	7	0.073	14, 15, 18, 19, 24, 26, 27	3	0.28	14, 18, 26
Aug-12	0	0		1	0.07	10
Sep-12	2	0.099	8, 22	4	2.67	2, 5, 8, 22
Oct-12	5	0.07	1, 5, 6, 26, 30	2	0.35	1, 6
Nov-12	2	0.026	3, 12	1	0.15	12
Dec-12	8	0.21	2, 4, 7, 9, 14, 17, 20, 26	7	2.61	2, 4, 7, 9, 17, 20, 26

TABLE D-8

CSO 514 Recorded and Modeled Discharges

Month-Year	# of Recorded Discharges	Total Recorded Overflow Volume (MG)	Estimated Recorded Discharge Date(s)	Total Recorded Discharge Duration (hours)	Recorded Data Notes	# of Modeled Discharges	Total Modeled Overflow Volume (MG)	Model Event Start Date(s)
Apr-06	10	6.907		156.8		0	0	
May-06	3	0.46		14.3		0	0	
Jun-06	5	0.78		18.1		0	0	
Jul-06	5	1.03	B	19.8	Overflow activity may not be accurate due to missing or erroneous data	0	0	
Aug-06	3	1.32		13.3		1	0.11	28
Sep-06	8	3.92		67.5		0	0	
Oct-06	3	2.41	B	44.6	Overflow activity may not be accurate due to missing or erroneous data	0	0	
Nov-06	5	0.044		21.9		0	0	
Dec-06	5	0.802	B	78.5	Overflow activity may not be accurate due to missing or erroneous data	0	0	
Jan-07	7	1.558		85.4		0	0	
Feb-07	1	0.01	B	9.3	Overflow activity may not be accurate due to missing or erroneous data	0	0	
Mar-07	11	0.083		27.4		0	0	
Apr-07	9	0.746		37.4		0	0	
May-07	3	0.003		16.6		0	0	
Jun-07	8	0.592		25.9		0	0	
Jul-07	5	0.23		9.8		0	0	
Aug-07	0	0	B	0	Overflow activity may not be accurate due to missing or erroneous data	0	0	
Sep-07	3	1.06		5.8		0	0	
Oct-07						0	0	
Nov-07	3	1.954		13.5		0	0	
Dec-07						0	0	
Jan-08	1	0.409		3.5		0	0	

Month-Year	# of Recorded Discharges	Total Recorded Overflow Volume (MG)	Estimated Recorded Discharge Date(s)	Total Recorded Discharge Duration (hours)	Recorded Data Notes	# of Modeled Discharges	Total Modeled Overflow Volume (MG)	Model Event Start Date(s)
Feb-08						0	0	
Mar-08	5	8.508		35		0	0	
Apr-08						0	0	
May-08	5	8.094	B	31.7	Overflow activity may not be accurate due to missing or erroneous data	0	0	
Jun-08						0	0	
Jul-08	2	0.446	B	2.7	Overflow activity may not be accurate due to missing or erroneous data	0	0	
Aug-08						0	0	
Sep-08	0	0	B	0	Overflow activity may not be accurate due to missing or erroneous data	0	0	
Oct-08						0	0	
Nov-08	1	0.069		5.2		0	0	
Dec-08						0	0	
Jan-09	0	0	B	0	Overflow activity may not be accurate due to missing or erroneous data	0	0	
Feb-09						0	0	
Mar-09	2	0.074	B	5.6	Overflow activity may not be accurate due to missing or erroneous data	0	0	
Apr-09	5			0.076		0	0	
May-09	8			0.188		0	0	
Jun-09	6			0.396		1	0.17	3
Jul-09	5			0.516		0	0	
Aug-09	3			0.218		0	0	
Sep-09	4			0.283		1	0.24	7
Oct-09	4			0.467		0	0	
Nov-09						0	0	
Dec-09						0	0	
Jan-10	2	0.131	21, 24			0	0	
Feb-10	1	0.11	22			0	0	
Mar-10	4	1.724	12, 22, 25, 29			0	0	

Month-Year	# of Recorded Discharges	Total Recorded Overflow Volume (MG)	Estimated Recorded Discharge Date(s)	Total Recorded Discharge Duration (hours)	Recorded Data Notes	# of Modeled Discharges	Total Modeled Overflow Volume (MG)	Model Event Start Date(s)
Apr-10	2	0.064	8, 24			0	0	
May-10	3	0.453	2, 12, 21			0	0	
Jun-10	9	5.544	6, 9, 12, 13, 14, 19, 21, 22, 27			1	0.05	12
Jul-10	3	0.095	9, 13, 20			0	0	
Aug-10	4	0.02	4, 11, 14, 15			0	0	
Sep-10	0	0				0	0	
Oct-10	1	0.001	26			0	0	
Nov-10	5	2.662	16, 23, 24, 25, 30			0	0	
Dec-10	0	0.013				0	0	
Jan-11	1	0.014	1			0	0	
Feb-11	5	6.972	1, 21, 24, 27, 28			0	0	
Mar-11	4	5.189	4, 8, 15, 18			0	0	
Apr-11	10	10.905	4, 5, 9, 11, 15, 19, 22, 27, 29, 30			0	0	
May-11	9	3.298	1, 2, 7, 13, 15, 22, 23, 26, 27			0	0	
Jun-11	10	0.287	10, 11, 15, 19, 20, 21, 22, 23, 26, 27			0	0	
Jul-11	3	0.243	8, 23, 24			0	0	
Aug-11	4	0.432	3, 7, 8, 14			0	0	
Sep-11	4	0.066	1, 4, 7, 19			1	0.13	26
Oct-11	2	0.599	19, 26			0	0	
Nov-11	6	4.478	3, 14, 16, 21, 22, 27			0	0	
Dec-11	5	3.707	4, 15, 21, 22, 27			0	0	
Jan-12	7	2.555	11, 12, 17, 20, 23, 26, 31			0	0	
Feb-12	3	0.026	4, 16, 29			0	0	
Mar-12	5	0.265	2, 8, 15, 23, 24			0	0	
Apr-12	5	0.423	1, 14, 25, 28, 30			0	0	
May-12	7	0.912	4, 5, 7, 8, 13, 29, 31			1	0.21	1
Jun-12	1	0.781	1			0	0	
Jul-12	6	0.143	14, 18, 19, 24, 26, 27			0	0	
Aug-12	1	0.001	10			0	0	
Sep-12	4	0.465	3, 5, 8, 22			0	0	
Oct-12	2	0.094	1, 5			0	0	
Nov-12	1	0.028	12			0	0	
Dec-12	5	0.262	2, 7, 9, 17, 20			0	0	

TABLE D-9

CSO 670 Recorded and Modeled Discharges

Month-Year	# of Recorded Discharges	Total Recorded Overflow Volume (MG)	Estimated Recorded Discharge Date(s)	# of Modeled Discharges	Total Modeled Overflow Volume* (MG)	Model Event Start Date(s)
Jan-10	0	0		0	0	
Feb-10	0	0		0	0	
Mar-10	0	0		0	0	
Apr-10	0	0		0	0	
May-10	0	0		0	0	
Jun-10	4	0.497	12, 14, 21, 27	0	0	
Jul-10	0	0		0	0	
Aug-10	0	0		0	0	
Sep-10	0	0		0	0	
Oct-10	1	0.003	26	0	0	
Nov-10	0	0		0	0	
Dec-10	0	0		0	0	
Jan-11	0	0		0	0	
Feb-11	0	0		0	0	
Mar-11	0	0		0	0	
Apr-11	6	0.435	4, 16, 19, 22, 23, 27	0	0	
May-11	1	0.001	13	0	0	
Jun-11	1	0.001	21	0	0	
Jul-11	0	0		0	0	
Aug-11	2	0.163	7, 8	0	0	
Sep-11	1	0.125	26	0	0	
Oct-11	0	0		0	0	
Nov-11	0	0		0	0	
Dec-11	1	0.003	5	0	0	
Jan-12	1	0.134	17	0	0	
Feb-12	0	0		0	0	
Mar-12	0	0		0	0	
Apr-12	0	0		0	0	
May-12	2	0.696	1, 5	0	0	
Jun-12	1	0.03	1	0	0	
Jul-12	0	0		0	0	
Aug-12	0	0		0	0	

Month-Year	# of Recorded Discharges	Total Recorded Overflow Volume (MG)	Estimated Recorded Discharge Date(s)	# of Modeled Discharges	Total Modeled Overflow Volume* (MG)	Model Event Start Date(s)
Sep-12	1	0.004	8	0	0	
Oct-12	0	0		0	0	
Nov-12	0	0		0	0	
Dec-12	1	0.036	9	0	0	

Appendix E- SSO 700 Storage & Treatment Facility Summary Table

TABLE E-1
SSO 700 STF Recorded and Modeled Discharges

Month_Year	Recorded Volume (MG)	Modeled Volume (MG)	Difference (MG)	% Difference
April_2009	16.9	24.66186401	7.8	46%
May_2009	8.9	13.2784259	4.4	49%
June_2009	35.8	34.45256341	-1.4	-4%
July_2009	20.9	34.69917495	13.8	66%
August_2009	17.7	21.67921848	4.0	22%
September_2009	10.3	41.21018829	30.9	300%
October_2009	48.8	55.7902351	7.0	14%
November_2009	0.0	1.921397719	1.9	-
December_2009	14.3	14.02390653	-0.3	-2%
January_2010	17.7	12.71038262	-5.0	-28%
February_2010	9.9	0	-9.9	-100%
March_2010	33.5	45.79992442	12.3	37%
April_2010	0.0	19.4079766	19.4	-
May_2010	23.9	34.2278757	10.3	43%
June_2010	44.3	87.12109846	42.8	97%
July_2010	0.0	14.48417433	14.5	-
August_2010	0.0	0	0.0	-
September_2010	0.0	0	0.0	-
October_2010	0.0	10.91046275	10.9	-
November_2010	28.9	75.81146889	46.9	162%
December_2010	0.0	14.25788594	14.3	-
January_2011	0.0	3.633385151	3.6	-
February_2011	68.9	51.75604665	-17.2	-25%
March_2011	47.1	24.67271835	-22.4	-48%
July_2011	0.0	24.78185233	24.8	-
August_2011	10.7	33.3092899	22.6	211%
September_2011	19.9	54.76785946	34.9	175%
October_2011	17.5	9.420816784	-8.1	-46%
November_2011	103.5	56.15760565	-47.3	-46%
December_2011	69.7	43.94206623	-25.8	-37%
January_2012	52.3	54.28094971	2.0	4%
February_2012	0.0	1.207487588	1.2	-
March_2012	19.1	37.11804735	18.0	94%
April_2012	52.2	48.22579508	-4.0	-8%
May_2012	37.0	75.05552077	38.1	103%
June_2012	0.0	20.88757387	20.9	-

Month_Year	Recorded Volume (MG)	Modeled Volume (MG)	Difference (MG)	% Difference
July_2012	0.0	33.38993687	33.4	-
August_2012	0.0	3.009208236	3.0	-
September_2012	15.8	56.9452339	41.1	260%
October_2012	0.0	23.76390688	23.8	-
November_2012	0.0	8.076434723	8.1	-
December_2012	26.9	61.34946184	34.5	128%

Appendix F- Overflowing Manhole Summary Table

TABLE F-1
Flooding Manholes in Model, 2006-2012 Summary

Manhole	2006 Flooding, Apr. through Dec. (mg)	2007 Flooding (mg)	2008 Flooding (mg)	2009 Flooding (mg)	2010 Flooding (mg)	2011 Flooding (mg)	2012 Flooding (mg)	2006-2012 Cumulative Flooding (mg)
35213017	0	0	0	0	0	0.144	0	0.144
35213018	0	0	0	0	0	0.076	0	0.076
35503003	0	0	0	0	0	0.19	0	0.19
35503006	0	0	0	0	0	0.117	0	0.117
35506005	0.241	0.142	0.085	0	0	0.806	0.217	1.491
35509001	0	0	0	0	0	0.114	0	0.114
35509021	0.128	0.081	0	0	0	0.406	0.114	0.729
35512001	0.163	0.107	0.117	0	0	0.426	0.132	0.945
35513007	0	0	0	0	0	0.057	0	0.057
35610006	0.098	0	0	0	0.053	0.227	0.072	0.45
39404003	0.05	0	0	0	0	0.077	0	0.127
39405006	0.181	0	0	0.078	0.071	0.288	0.153	0.771
39405007	0.676	0.794	0.786	0.699	0.766	1.855	1.161	6.737
39406004	0	0	0	0	0	0.055	0	0.055
39412010	0	0	0	0	0	0.052	0	0.052
39513001	0	0	0	0	0	0.056	0	0.056
39513005	0.417	0.49	0.525	0.435	0.506	1.094	0.705	4.172
39513006	0.068	0	0	0	0	0.113	0.056	0.237
39711002	0	0	0	0.064	0	0.132	0.09	0.286
39711003	0.499	0.482	0.436	0.467	0.548	1.162	0.714	4.308
39714008	0.073	0	0	0.148	0	0.263	0.087	0.571
39805001	22.965	26.259	31.187	19.033	26.359	49.081	28.356	203.24
39902019	0	0.06	0	0.145	0.107	0.221	0.058	0.591
39902022	0.23	0.762	0.779	0.366	0.442	1.366	0.812	4.757
39905020	0.148	0.206	0.142	0.263	0.314	0.52	0.217	1.81
39913006	1.049	0.417	0.432	2.442	2.282	2.834	1.621	11.077
40003005	0	0	0	0.158	0.072	0.093	0.058	0.381
43216015	0	0	0	0.068	0	0	0	0.068
43308020	22.802	29.85	20.443	21.299	20.997	33.486	33.714	182.591
43308021	10.569	11.324	11.076	13.42	7.801	13.313	16.444	83.947
43309002*	1.87	2.879	1.416	2.833	3.699	4.555	1.295	18.547
43309007*	0	0	0	0.078	0.206	0.399	0	0.683

Manhole	2006 Flooding, Apr. through Dec. (mg)	2007 Flooding (mg)	2008 Flooding (mg)	2009 Flooding (mg)	2010 Flooding (mg)	2011 Flooding (mg)	2012 Flooding (mg)	2006-2012 Cumulative Flooding (mg)
43405008	0.228	0.564	0.331	0	0.431	0.612	0.307	2.473
43412007	0.901	0.733	0.928	0.423	1.179	1.621	0.688	6.473
43412009	0.817	0.496	0.861	0.602	0.84	1.413	0.766	5.795
43412016	2.466	1.636	3.242	2.141	2.677	4.819	2.673	19.654
43412017	0.962	1.034	1.228	0.448	1.325	2.073	0.894	7.964
43503007	138.799	162.982	193.558	103.205	160.521	334.461	211.959	1305.485
43709003	0	0	0	0	0	0.165	0.111	0.276
43710003	0	0	0	0	0	0.099	0	0.099
44201004	0.388	0.354	0.343	0.186	0.258	0.785	0.489	2.803
44502009	0.17	2.388	0.735	0	0.654	0.954	0.932	5.833
44509001	0.212	1.307	0.707	0	0.608	0.9	0.719	4.453
44509011	0	0.787	0.115	0	0	0	0.243	1.145
44510017	0	0.264	0	0	0	0	0	0.264
44602009	0	0	0	0.065	0	0.065	0	0.13
44706013	0.081	0	0	0.106	0.165	0.125	0.16	0.637
44707011	1.231	1.473	1.546	1.184	1.694	2.475	2.079	11.682
44801003	0	0.093	0	0	0.055	0.094	0	0.242
44805005	0.945	0.966	0.787	0.647	1.512	1.669	0.677	7.203
44805010	0.455	0.647	0.304	0.413	1.063	1.139	0.132	4.153
44805027	0.133	0.131	0.133	0.092	0.216	0.199	0.11	1.014
44808002	0.663	0.848	0.708	0.56	0.742	1.269	0.56	5.35
44907003	0	0	0	0	0	0.078	0	0.078
44916001	0.383	0.664	0.371	0.354	0.516	0.802	0.218	3.308
48009011	0.065	0	0	0.056	0.1	0.126	0	0.347
48009013	0	0	0	0	0	0.058	0	0.058
48010011	0.253	0.18	0	0.192	0.345	0.411	0.206	1.587
48011022	2.671	3.793	3.713	2.355	3.139	5.54	3.511	24.722
48013009	0.161	0.24	0.122	0.136	0.371	0.384	0	1.414
48106005	0	0.071	0	0	0.106	0.188	0	0.365
48108012	0.15	0.138	0.128	0.083	0.172	0.212	0.141	1.024
48109007	0.075	0.092	0.059	0.061	0.154	0.159	0	0.6
48110001	0.972	1.206	1.357	0.696	1.068	1.834	1.336	8.469
48110003	1.633	1.845	2.023	0.993	1.749	2.942	1.851	13.036
48110017	0.219	0.258	0.199	0.147	0.391	0.432	0.132	1.778
48513010	0	0	0	0	0	0.057	0	0.057
48514001	0	0.17	0.302	0	0.091	0.871	0.265	1.699

***** These manholes are currently being monitored by MSDGC as potential SSOs.

Appendix G - Post-Validation Model Analysis

During model validation, the model predicted two large overflowing nodes (junction chamber 43503007 and manhole 39805001), shown in Figure G-1, that were not evidenced in the flow monitoring data. A site visit was performed after the model validation was completed to locate the junction chamber and manhole in the field and to verify if they could overflow.

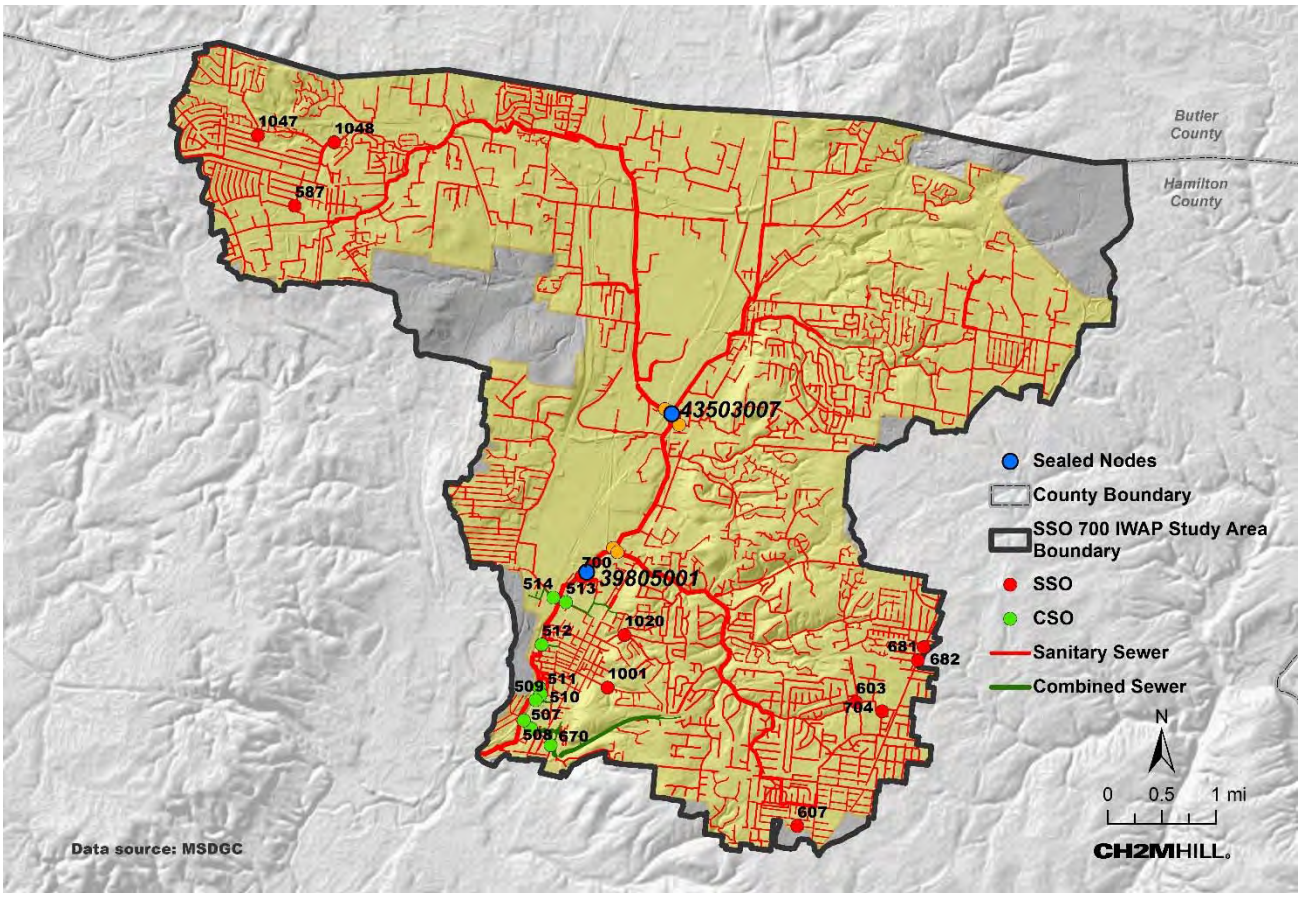

FIGURE G-1
Field Verified Non-overflowing Manholes

The site visit showed that the overflowing junction chamber 43503007, at the confluence of the east and west branch, is a blind junction, thus overflow cannot occur. Additionally, manhole 39805001 could not be located. The area where the manhole should be located was covered with gravel and showed no evidence of overflow.

Both of these nodes are located along the interceptor, so it is expected that the depths at locations along the interceptor would be impacted by the loss of flow in the model. Three of the model validation flow monitors located along the interceptor (MC-EB-005, MC-EB-019, and MC-EB-016) were evaluated for the year 2011, so an additional model analysis was performed to identify the impacts of sealing the two model nodes on the peak flow, volume, and depth of flow at these three flow monitoring locations.

The following sections provide updated model results for the three flow monitors evaluated in this additional analysis.

Monitor MC-EB-005

Thirty-six (36) total events were identified during the validation period, and 31 are considered to have good data. With the sealed manholes, of the 31 events with good data, 29% (9 events) met MSDGC's current C&V guidelines and standards for depth. (Only percent difference in depth was compared for this validation. The calibration standard using absolute depth may be used during the model calibration task.) Table G-1 summarizes the events and the updated C&V results for each. The events highlighted in green are within the model C&V standards. Figures G-3 through G-6 show the first quarter 2011, second quarter 2011, third quarter 2011, and fourth quarter 2011 depth hydrographs, respectively.

TABLE G-1
Events and Updated Simulation Results, MC-EB-005

Event	Date	Duration (h)	Difference in Depth (%)	Original Result	Updated Result
1	1/1/2011 1:00	51	-3.56	Within Standards	Within Standards
2	1/18/2011 10:30	12	-31.15	Not Within Standards	Not Within Standards
A	2/1/2011 5:00	187			
3	2/21/2011 8:00	250	-24.87	Not Within Standards	Not Within Standards
4	3/4/2011 12:00	234	-34.80	Not Within Standards	Not Within Standards
5	3/15/2011 6:00	42	-44.27	Not Within Standards	Not Within Standards
6	3/18/2011 16:00	38	1.26	Within Standards	Within Standards
B	3/21/2011 16:00	14			
7	3/23/2011 21:00	8	58.75	Not Within Standards	Not Within Standards
8	4/4/2011 13:00	107	-2.05	Not Within Standards	Within Standards
9	4/9/2011 12:00	756	-27.27	Not Within Standards	Not Within Standards
10	5/13/2011 15:00	12	6.49	Within Standards	Within Standards
11	5/14/2011 9:00	9	37.09	Not Within Standards	Not Within Standards
12	5/15/2011 18:00	6	-21.83	Not Within Standards	Not Within Standards
C	5/18/2011 0:00	24			
13	5/22/2011 17:00	175	-16.18	Not Within Standards	Not Within Standards
14	6/11/2011 3:00	15	18.64	Within Standards	Not Within Standards
15	6/15/2011 11:00	13	43.89	Not Within Standards	Not Within Standards
16	6/19/2011 15:00	39	16.92	Within Standards	Not Within Standards
17	6/21/2011 12:00	66	1.58	Within Standards	Within Standards
18	6/26/2011 0:00	54	11.58	Within Standards	Within Standards
19	7/8/2011 0:00	30	52.83	Not Within Standards	Not Within Standards
20	7/24/2011 12:00	24	105.36	Not Within Standards	Not Within Standards
21	8/3/2011 4:00	26	31.76	Not Within Standards	Not Within Standards
22	8/7/2011 4:00	119	27.68	Within Standards	Not Within Standards
23	9/6/2011 18:00	63	32.07	Not Within Standards	Not Within Standards
D	9/19/2011 9:00	45			
24	9/23/2011 0:00	146	-11.18	Not Within Standards	Within Standards
25	9/29/2011 18:00	24	9.42	Within Standards	Within Standards
26	10/19/2011 0:00	144	-5.93	Within Standards	Within Standards
27	10/26/2011 18:00	87	25.59	Not Within Standards	Not Within Standards
28	11/4/2011 12:00	66	24.23	Not Within Standards	Not Within Standards

Event	Date	Duration (h)	Difference in Depth (%)	Original Result	Updated Result
29	11/14/2011 18:00	278	49.90	Within Standards	Not Within Standards
E	12/15/2011 3:00	75	-17.79	Not Within Standards	Not Within Standards
30	12/19/2011 18:00	156	-33.35	Not Within Standards	Not Within Standards
31	12/27/2011 0:00	105	-25.32	Not Within Standards	Not Within Standards

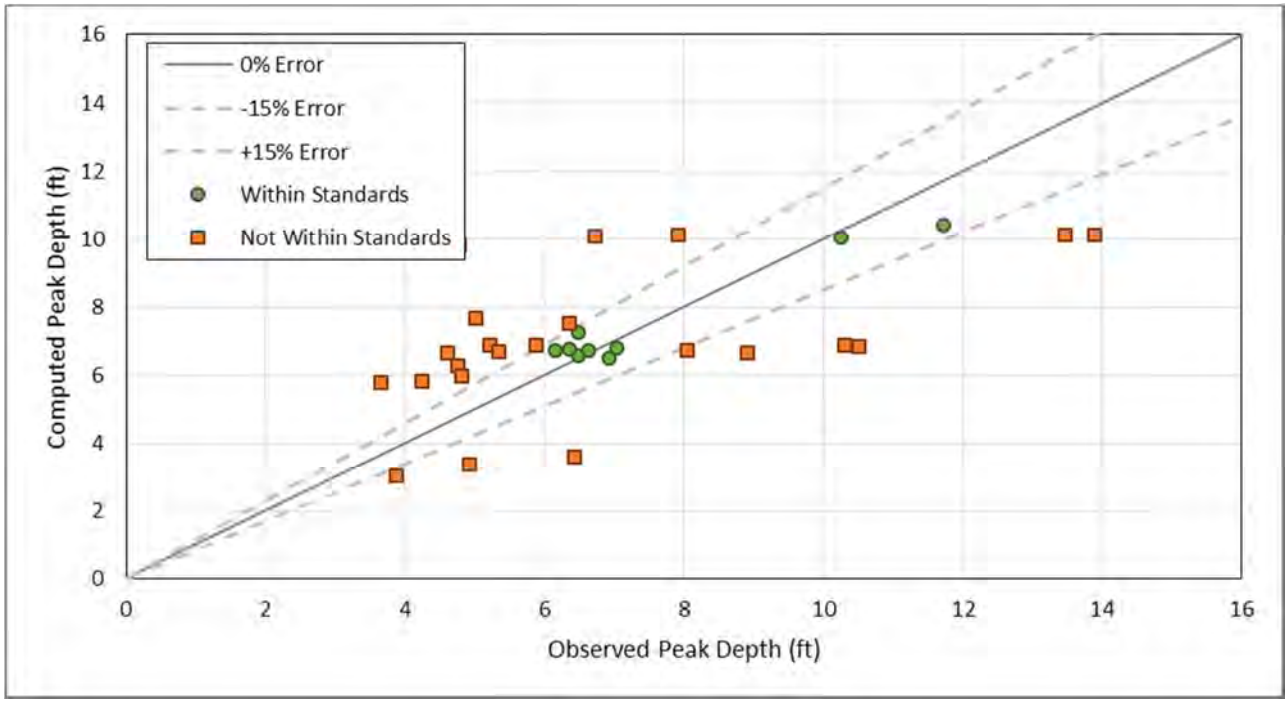

FIGURE G-2
Updated Scattergraph of Peak Depth, MC-EB-005

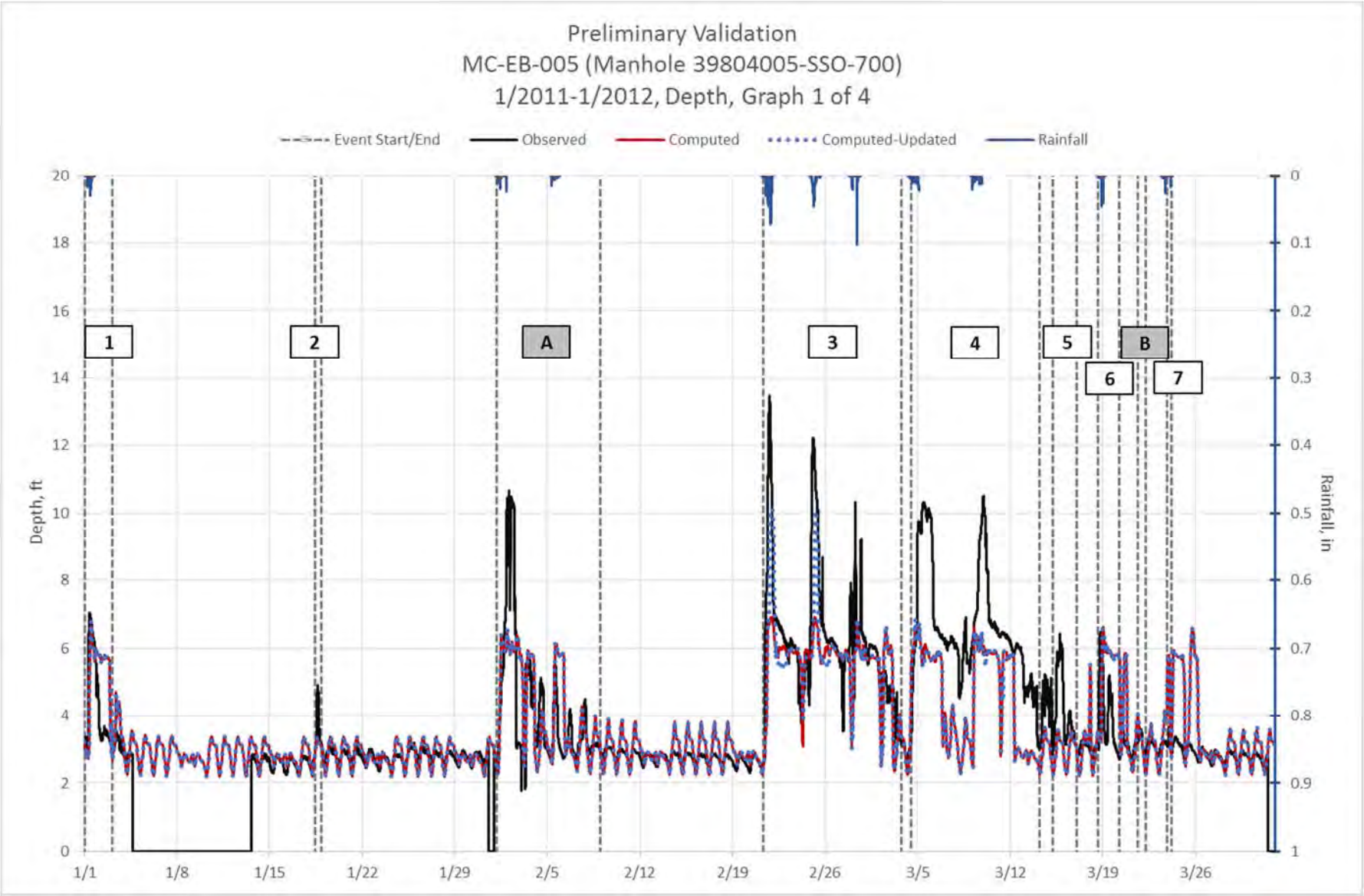

FIGURE G-3
First Quarter 2011 Depth Hydrograph, MC-EB-005

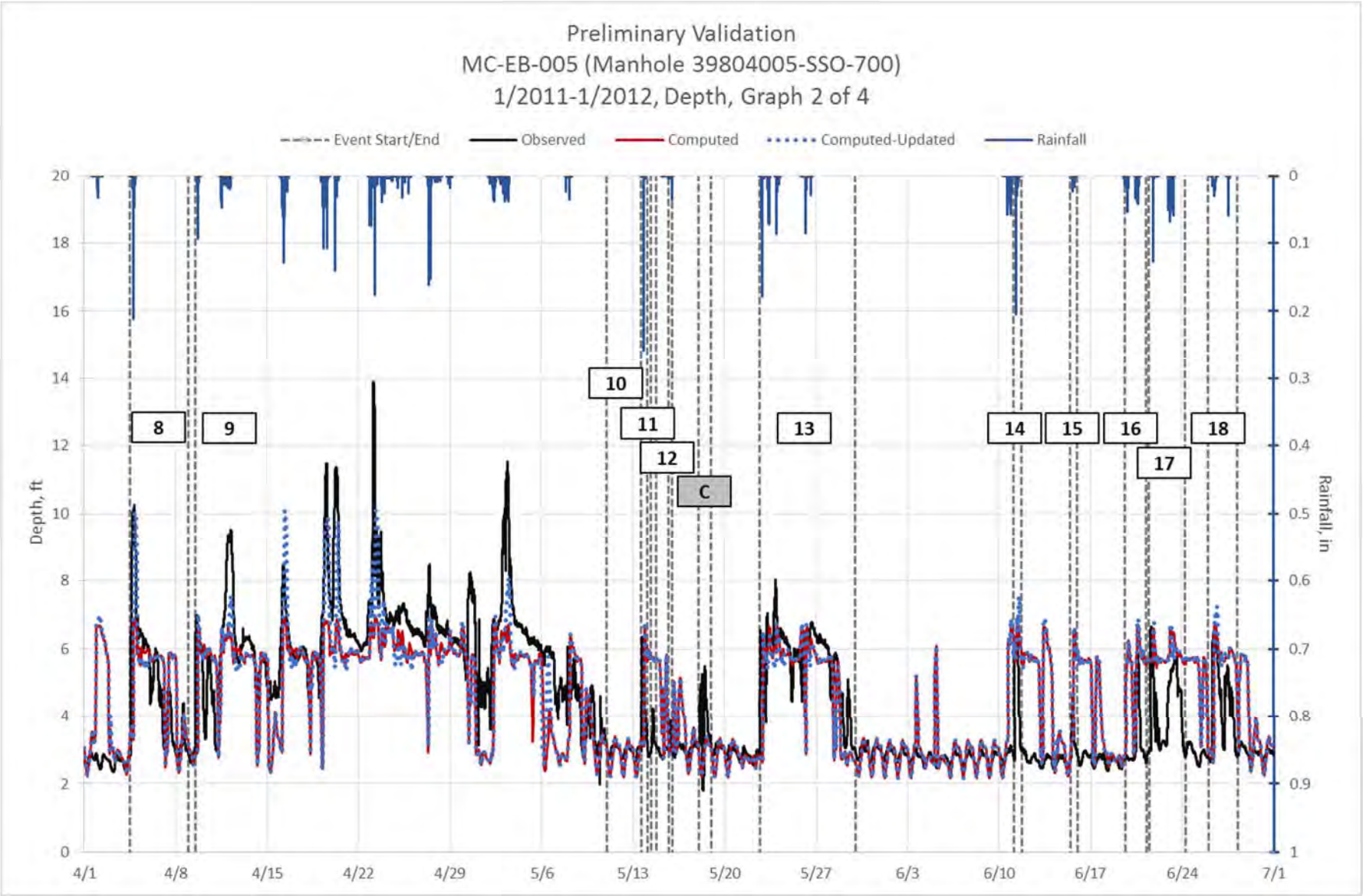

FIGURE G-4
Second Quarter 2011 Depth Hydrograph, MC-EB-005

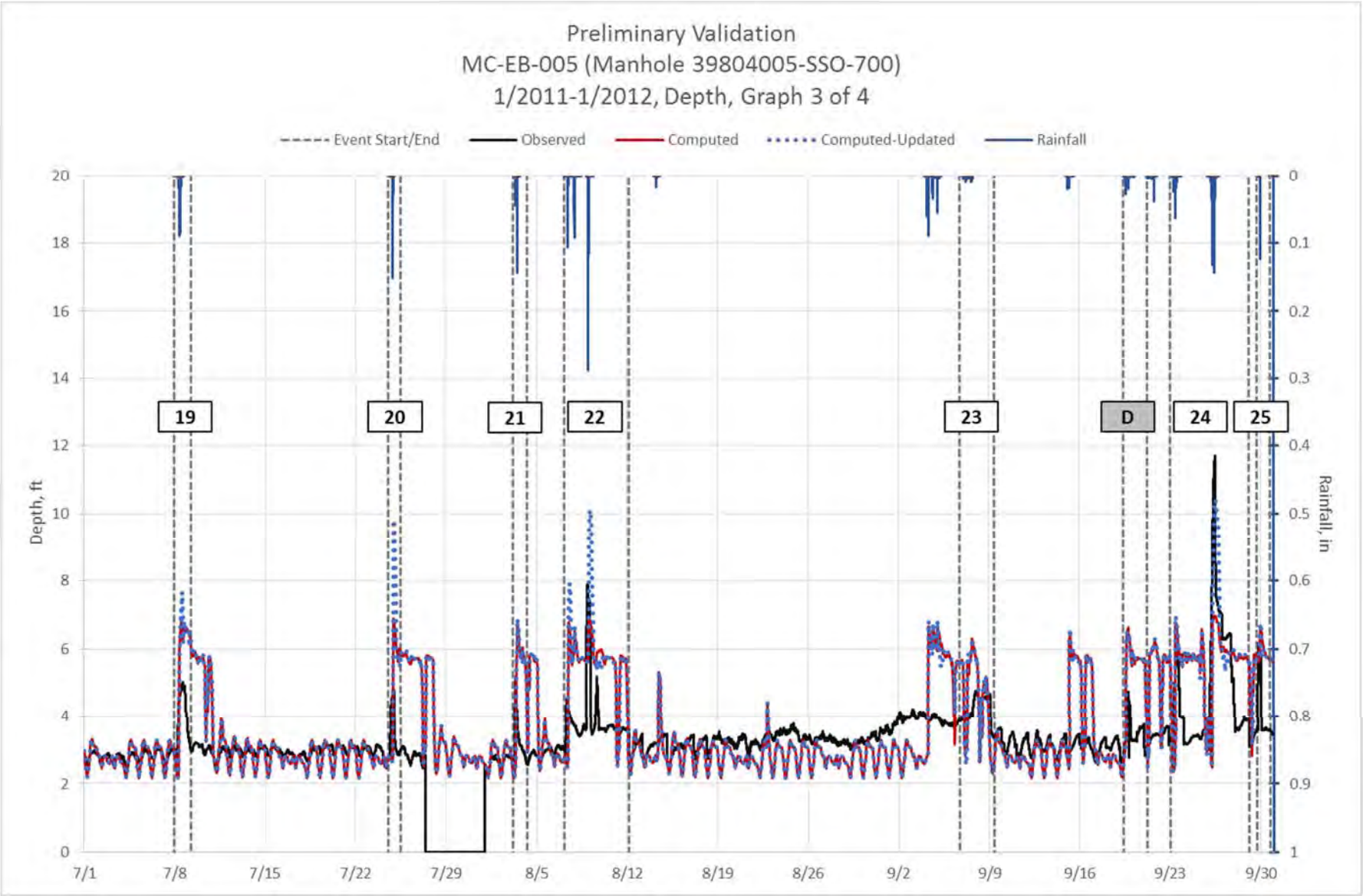

FIGURE G-5
Third Quarter 2011 Depth Hydrograph, MC-EB-005

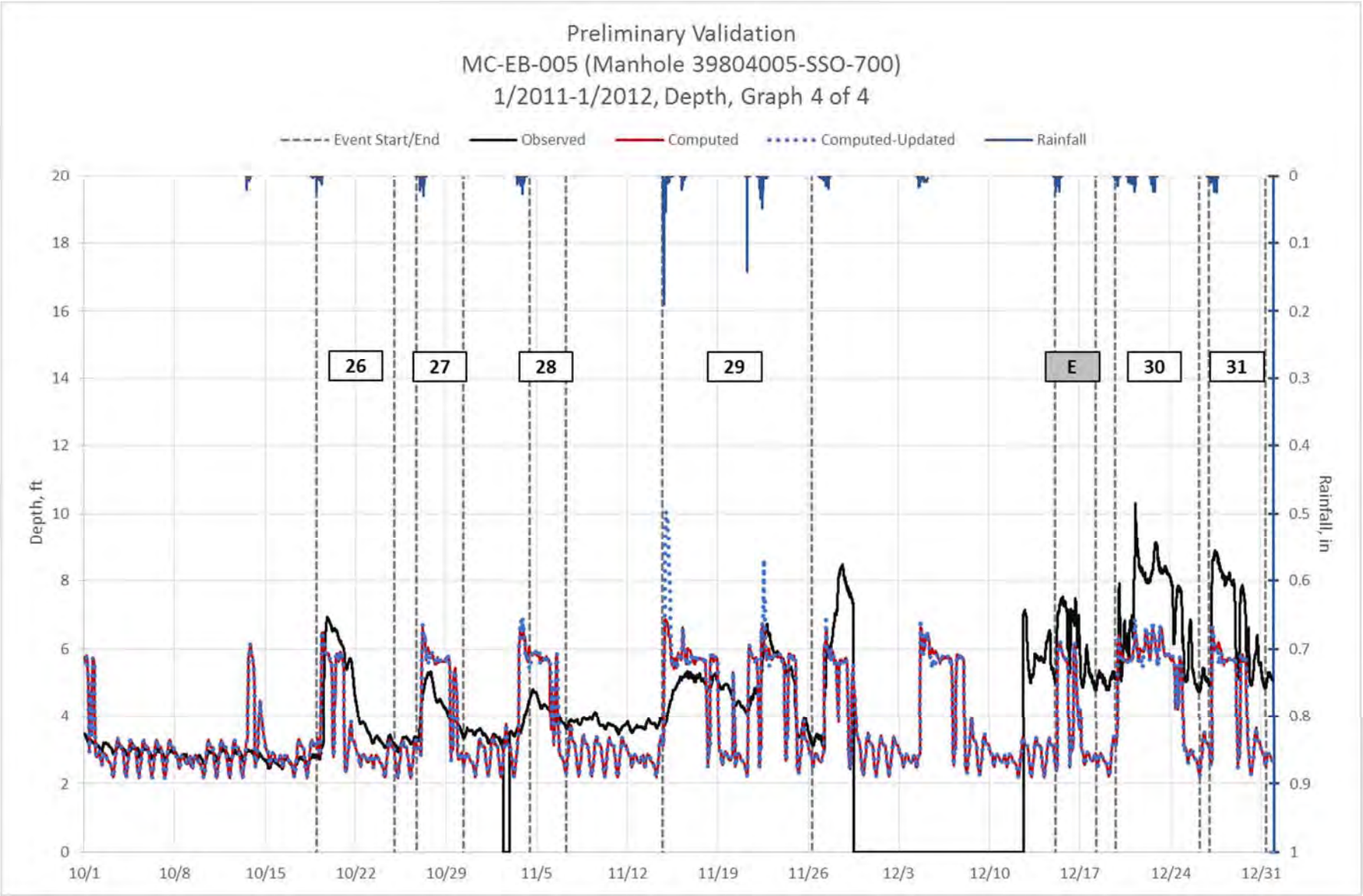

FIGURE G-6
Fourth Quarter 2011 Depth Hydrograph, MC-EB-005

Monitor MC-EB-016

Forty (40) total events were identified during the validation period, and 39 are considered to have good data. With the sealed manholes, of the 39 events with good data, 13% (5 events) met MSDGC's C&V guidelines and standards for peak flow, volume, and depth. Table G-2 summarizes the events and the updated C&V results for each. The events highlighted in green are within the model C&V guidelines, and the events highlighted in yellow are within the model guidelines for peak flow and volume. Figures G-10 through G-13 show the first quarter 2011, second quarter 2011, third quarter 2011, and fourth quarter 2011 depth hydrographs, respectively. Figures G-14 through G-17 show the first quarter 2011, second quarter 2011, third quarter 2011, and fourth quarter 2011 flow hydrographs, respectively.

TABLE G-2
Events and Updated Simulation Results, MC-EB-016

Event	Date	Duration (h)	Difference in Peak Flow (%)	Difference in Volume (%)	Difference in Depth (%)	Original Results	Updated Result
1	1/1/2011 0:00	48	6.70	-2.16	-8.13	Within Standards	Within Standards
2	1/11/2011 3:00	96	-6.90	-2.47	-19.11	Within Flow and Volume Standards	Within Flow and Volume Standards
3	1/18/2011 0:00	144	-13.58	-8.47	-21.02	Within Flow and Volume Standards	Within Flow and Volume Standards
4	2/1/2011 18:00	12	-43.10	-36.97	-84.26	Not Within Standards	Not Within Standards
5	2/21/2011 0:00	72	-2.75	7.95	-35.66	Within Flow and Volume Standards	Within Flow and Volume Standards
6	2/23/2011 18:00	78	-14.87	-15.98	-44.95	Not Within Standards	Not Within Standards
7	3/4/2011 0:00	96	-44.24	-37.41	-86.15	Not Within Standards	Not Within Standards
8	3/8/2011 18:00	108	-37.38	-31.44	-58.89	Not Within Standards	Not Within Standards
9	3/18/2011 12:00	20	18.94	17.15	-3.63	Within Standards	Within Standards
10	4/4/2011 8:00	40	25.03	29.00	-18.98	Not Within Standards	Not Within Standards
11	4/9/2011 0:00	120	-28.47	-12.94	-57.14	Not Within Standards	Not Within Standards
12	4/15/2011 21:00	54	1.66	-13.52	-38.45	Not Within Standards	Not Within Standards
13	4/19/2011 0:00	72	-2.25	-17.63	-36.13	Not Within Standards	Not Within Standards
14	4/22/2011 12:00	186	-5.07	-24.82	-38.70	Not Within Standards	Not Within Standards
15	5/2/2011 0:00	120	-30.93	-30.69	-55.33	Not Within Standards	Not Within Standards
16	5/13/2011 12:00	15	16.40	18.06	-22.82	Within Flow and Volume Standards	Within Flow and Volume Standards
17	5/22/2011 12:00	180	-16.47	-21.47	-3.65	Not Within Standards	Not Within Standards
18	6/11/2011 0:00	27	19.39	3.95	193.90	Within Standards	Within Flow and Volume Standards

Event	Date	Duration (h)	Difference in Peak Flow (%)	Difference in Volume (%)	Difference in Depth (%)	Original Results	Updated Result
19	6/15/2011 6:00	24	11.13	10.98	-11.31	Within Standards	Within Standards
20	6/20/2011 6:00	18	3.54	19.22	-11.17	Within Standards	Within Standards
21	6/22/2011 16:00	56	-16.51	-4.71	160.77	Not Within Standards	Not Within Standards
22	6/26/2011 0:00	27	-28.07	-20.74	147.31	Not Within Standards	Not Within Standards
23	7/4/2011 3:00	21	20.71	31.64	0.29	Not Within Standards	Not Within Standards
24	7/8/2011 0:00	24	37.13	14.49	298.53	Not Within Standards	Not Within Standards
25	7/24/2011 12:00	15	30.32	28.08	225.29	Not Within Standards	Not Within Standards
26	8/8/2011 18:00	12	15.75	18.88	171.39	Within Flow and Volume Standards	Within Flow and Volume Standards
27	9/3/2011 22:00	29	-7.26	15.45	16.23	Within Standards	Within Flow and Volume Standards
28	9/7/2011 3:00	45	-11.63	4.09	-16.22	Within Flow and Volume Standards	Within Flow and Volume Standards
29	9/23/2011 0:00	24	1.60	5.45	222.43	Within Standards	Within Flow and Volume Standards
30	9/25/2011 0:00	96	12.03	17.03	-20.71	Not Within Standards	Within Flow and Volume Standards
31	10/14/2011 3:00	24	14.07	17.82	3.79	Within Standards	Within Standards
32	10/19/2011 0:00	96	-22.24	-20.39	-76.70	Not Within Standards	Not Within Standards
33	10/26/2011 16:00	32	16.81	1.43	277.17	Within Standards	Within Flow and Volume Standards
34	11/3/2011 8:00	304	4.99	14.34	-37.60	Within Flow and Volume Standards	Within Flow and Volume Standards
35	11/14/2011 21:00	123	4.99	-12.00	-37.60	Not Within Standards	Not Within Standards

Event	Date	Duration (h)	Difference in Peak Flow (%)	Difference in Volume (%)	Difference in Depth (%)	Original Results	Updated Result
36	11/22/2011 0:00	96	-5.48	-16.51	-43.29	Not Within Standards	Not Within Standards
37	11/27/2011 16:00	104	-50.22	-44.71	-90.46	Not Within Standards	Not Within Standards
A	12/4/2011 12:00	156					
38	12/21/2011 0:00	72	-14.45	-8.44	-26.67	Within Flow and Volume Standards	Within Flow and Volume Standards
39	12/27/2011 0:00	48	7.58	-3.64	60.68	Within Flow and Volume Standards	Within Flow and Volume Standards

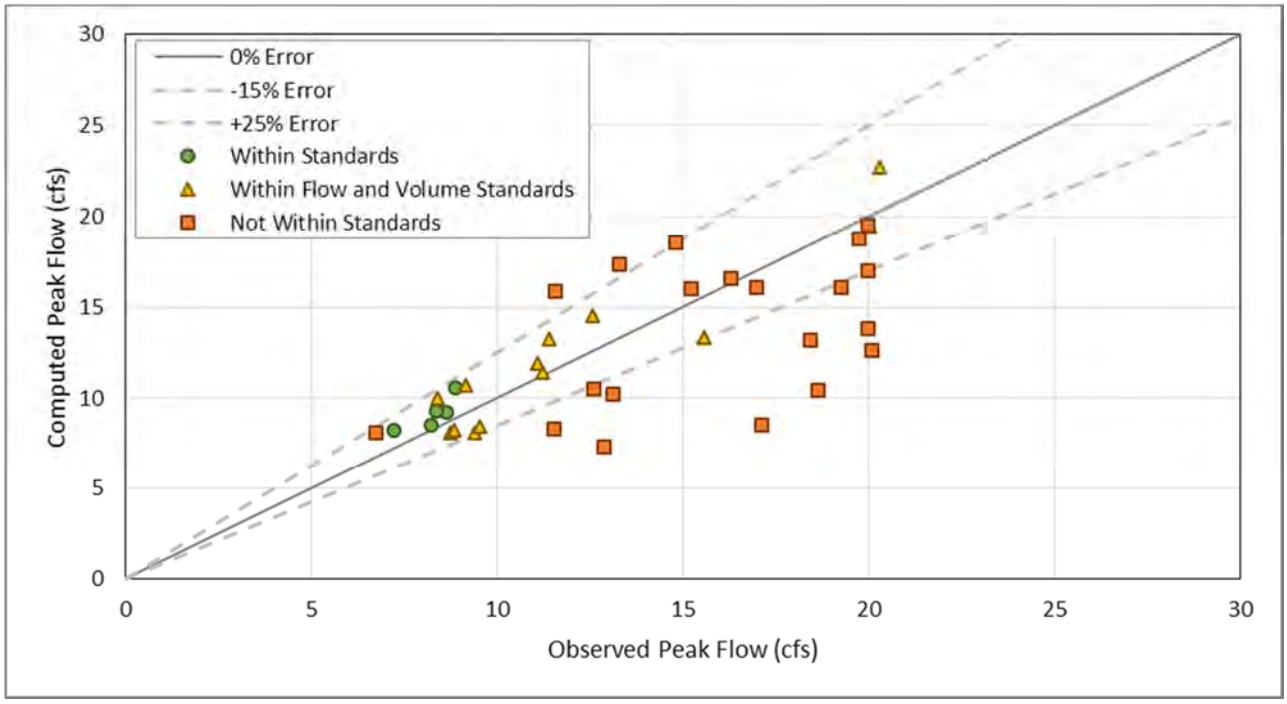

FIGURE G-7
Updated Scattergraph of Peak Flow, MC-EB-016

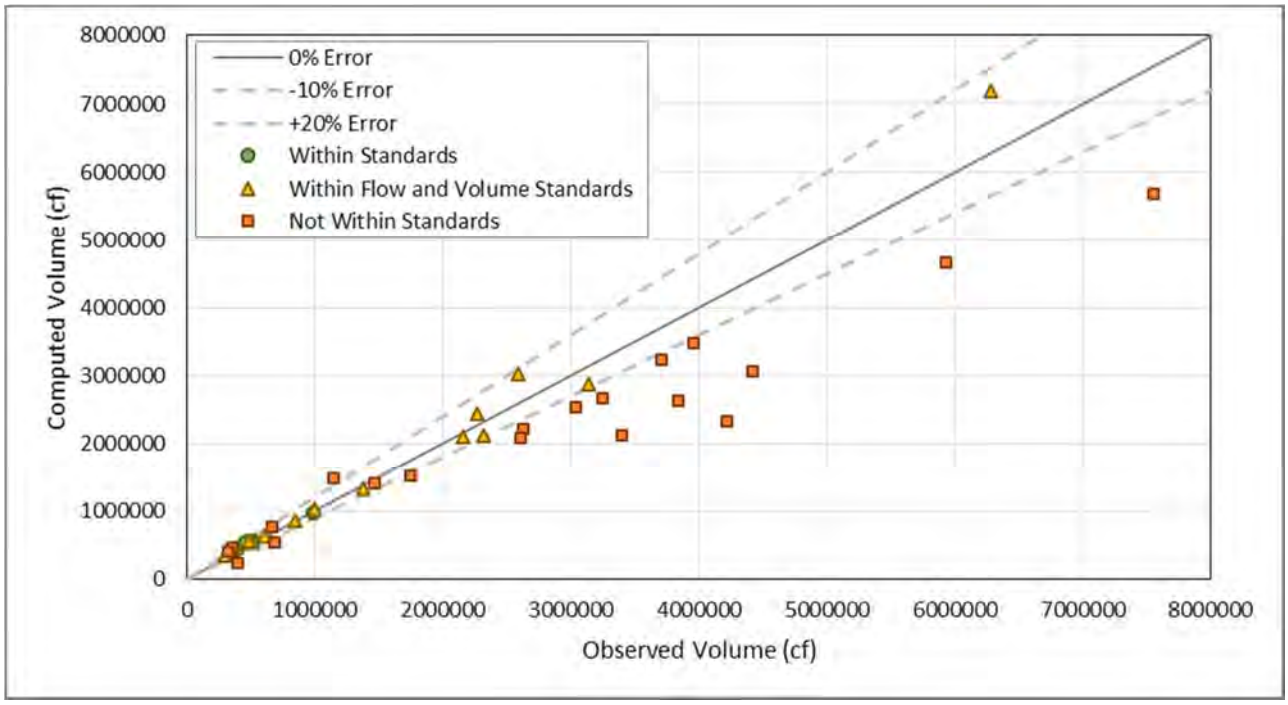

FIGURE G-8
Updated Scattergraph of Volume, MC-EB-016

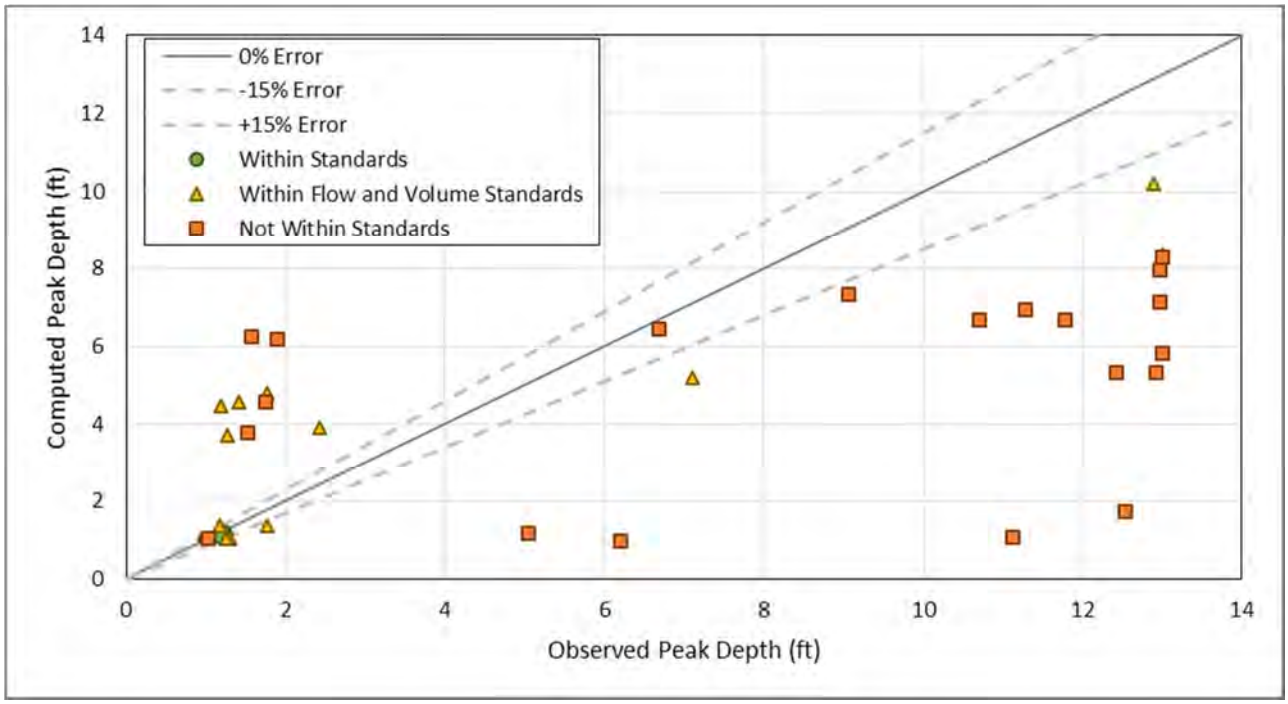

FIGURE G-9
Updated Scattergraph of Peak Depth, MC-EB-016

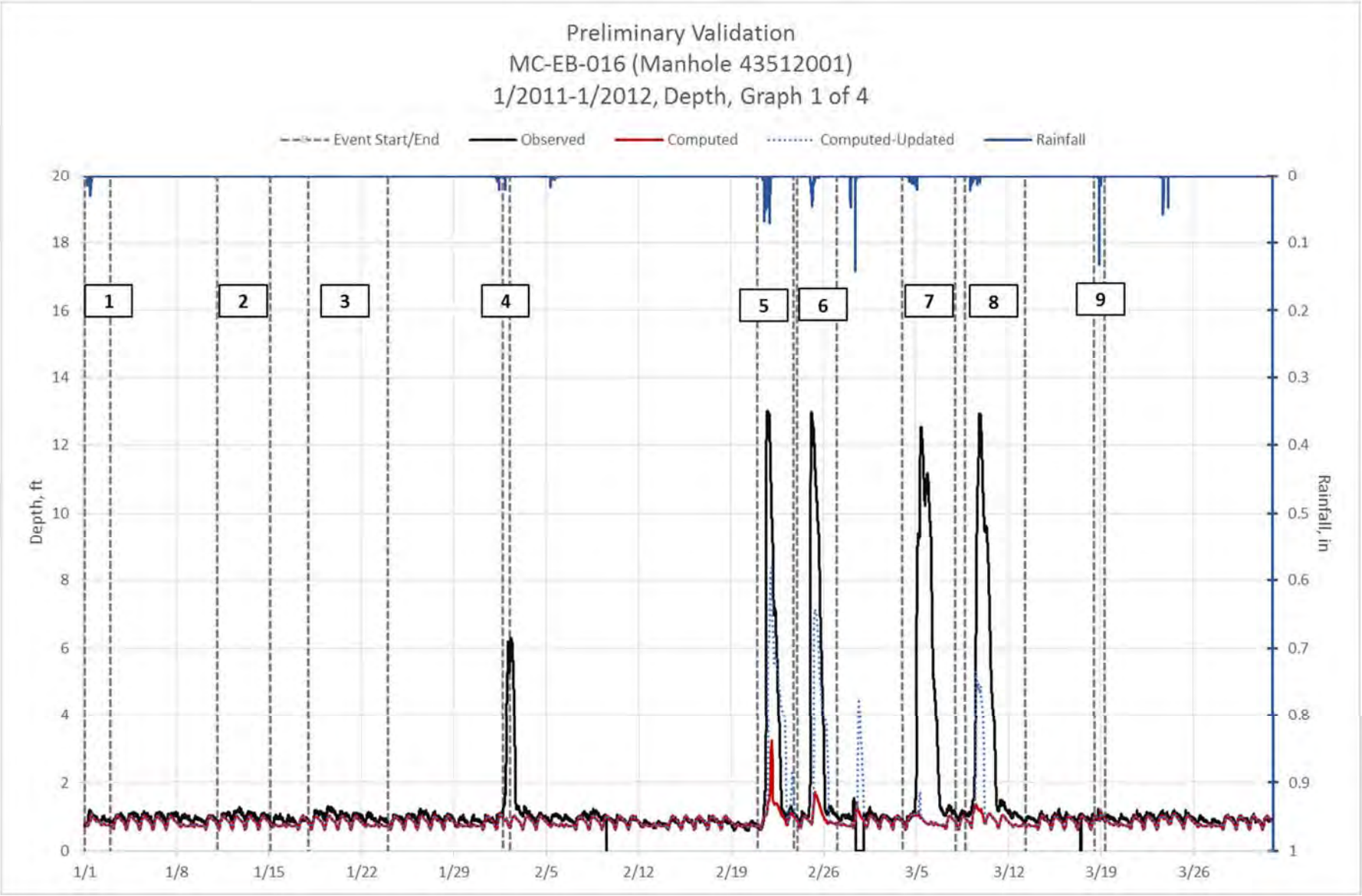

FIGURE G-10
First Quarter 2011 Depth Hydrograph, MC-EB-016

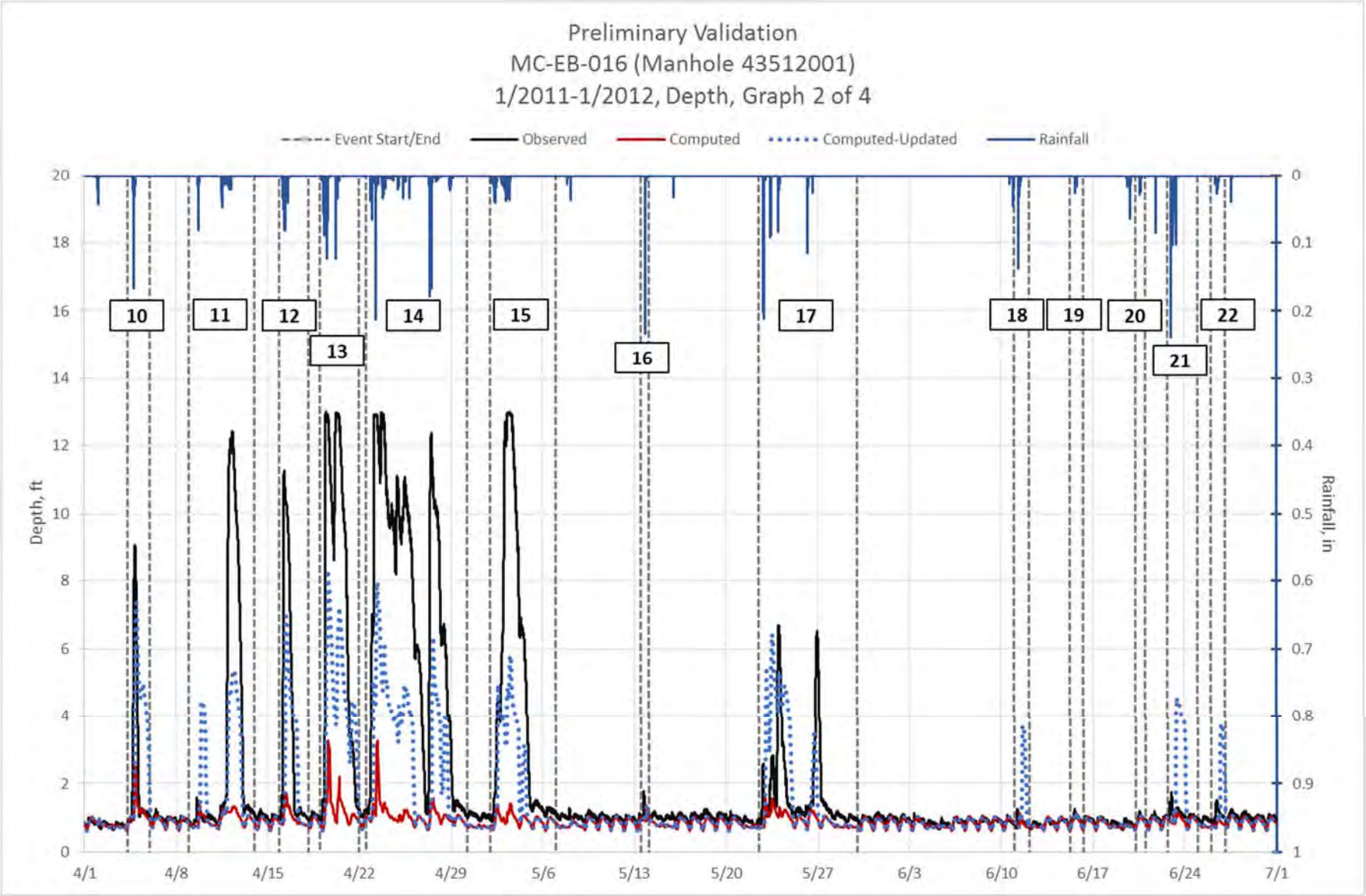
Preliminary Validation
MC-EB-016 (Manhole 43512001)
1/2011-1/2012, Depth, Graph 2 of 4
Event Start/End
Observed
Computed
Computed-Updated
Rainfall
Depth, ft
Rainfall, in
10
11
12
13
14
15
16
17
18
19
20
21
22
4/1
4/8
4/15
4/22
4/29
5/6
5/13
5/20
5/27
6/3
6/10
6/17
6/24
7/1

FIGURE G-11

Second Quarter 2011 Depth Hydrograph, MC-EB-016

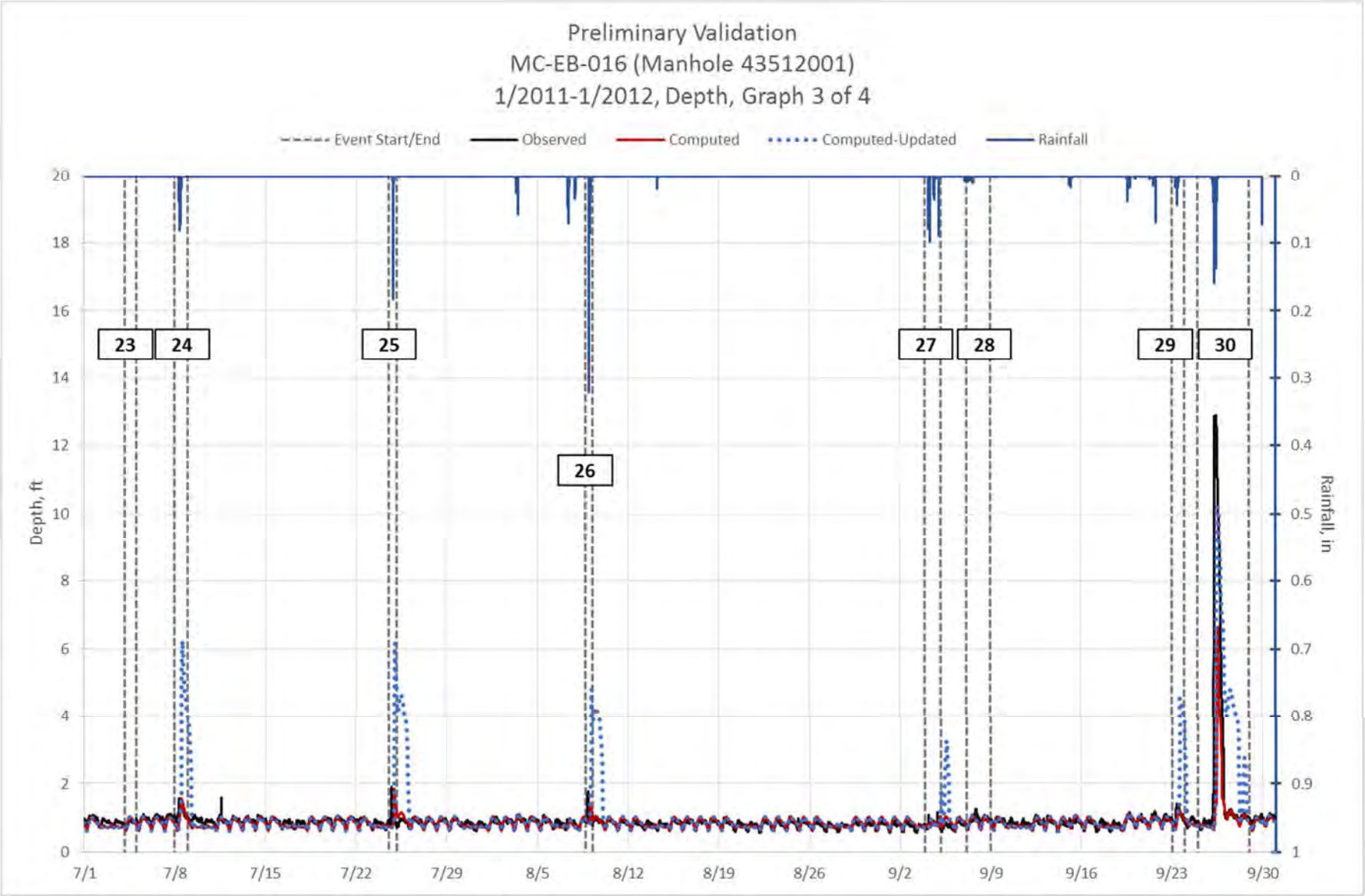

FIGURE G-12
Third Quarter 2011 Depth Hydrograph, MC-EB-016

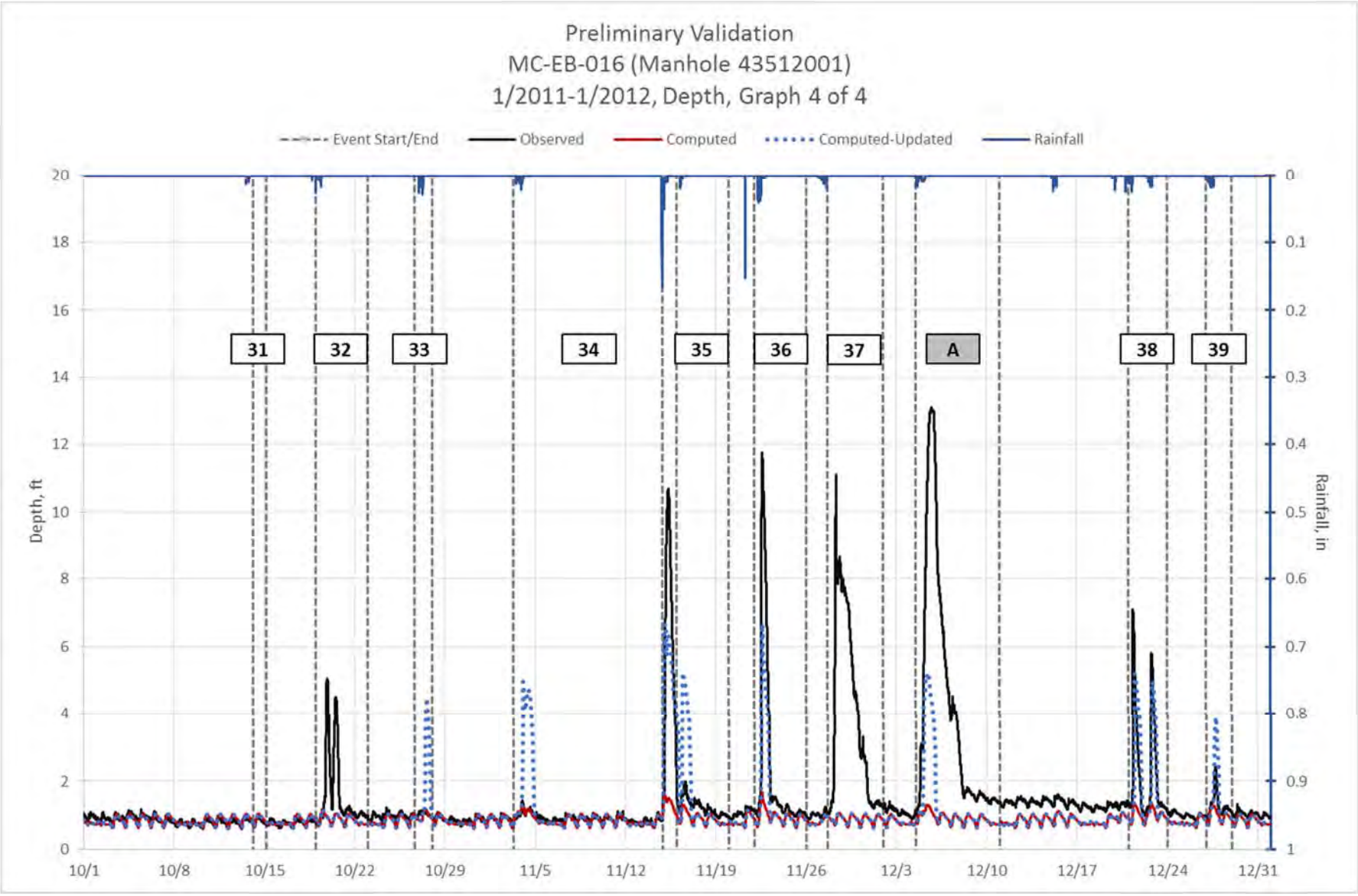

FIGURE G-13
Fourth Quarter 2011 Depth Hydrograph, MC-EB-016

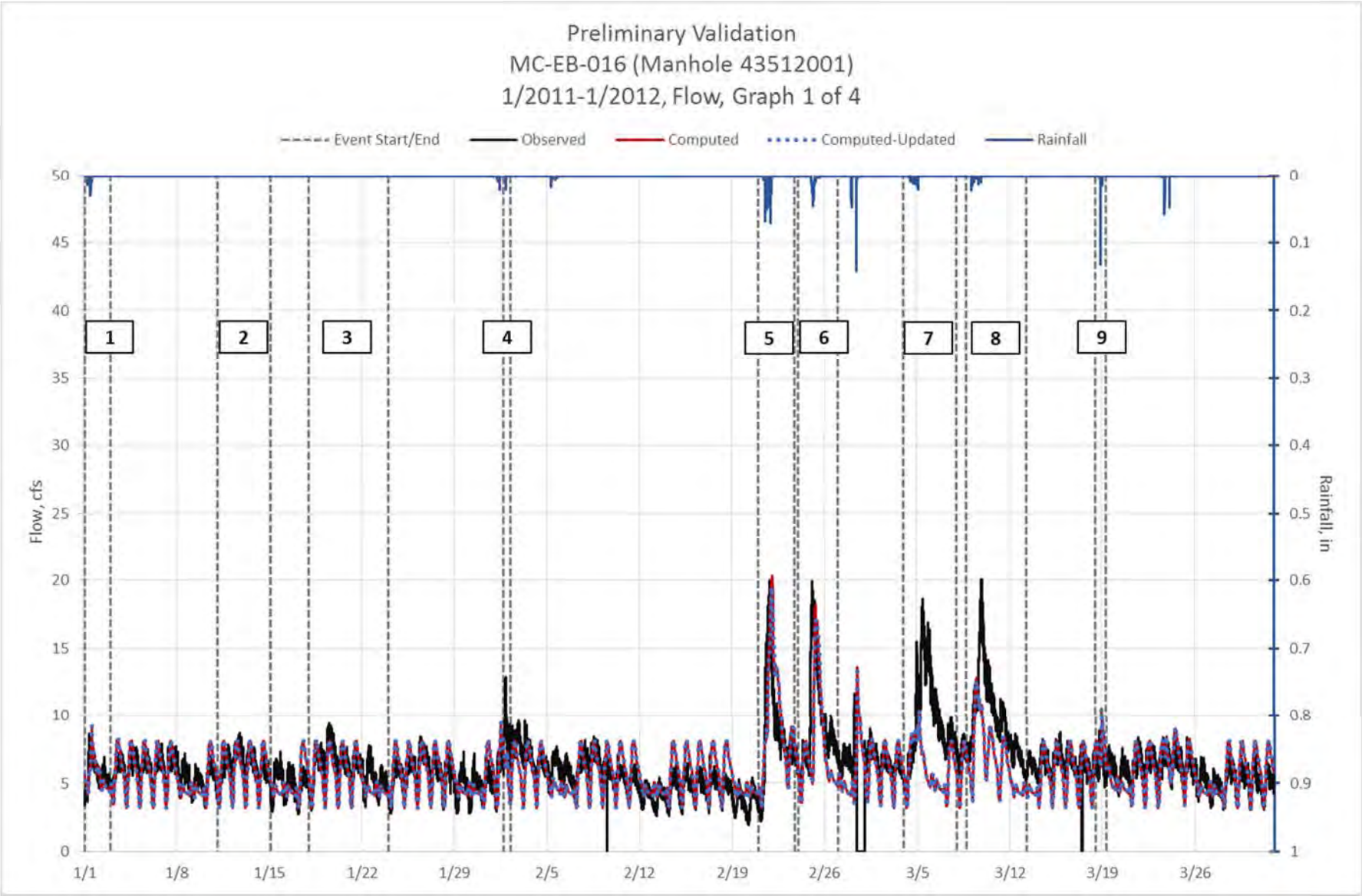

FIGURE G-14

First Quarter 2011 Flow Hydrograph, MC-EB-016

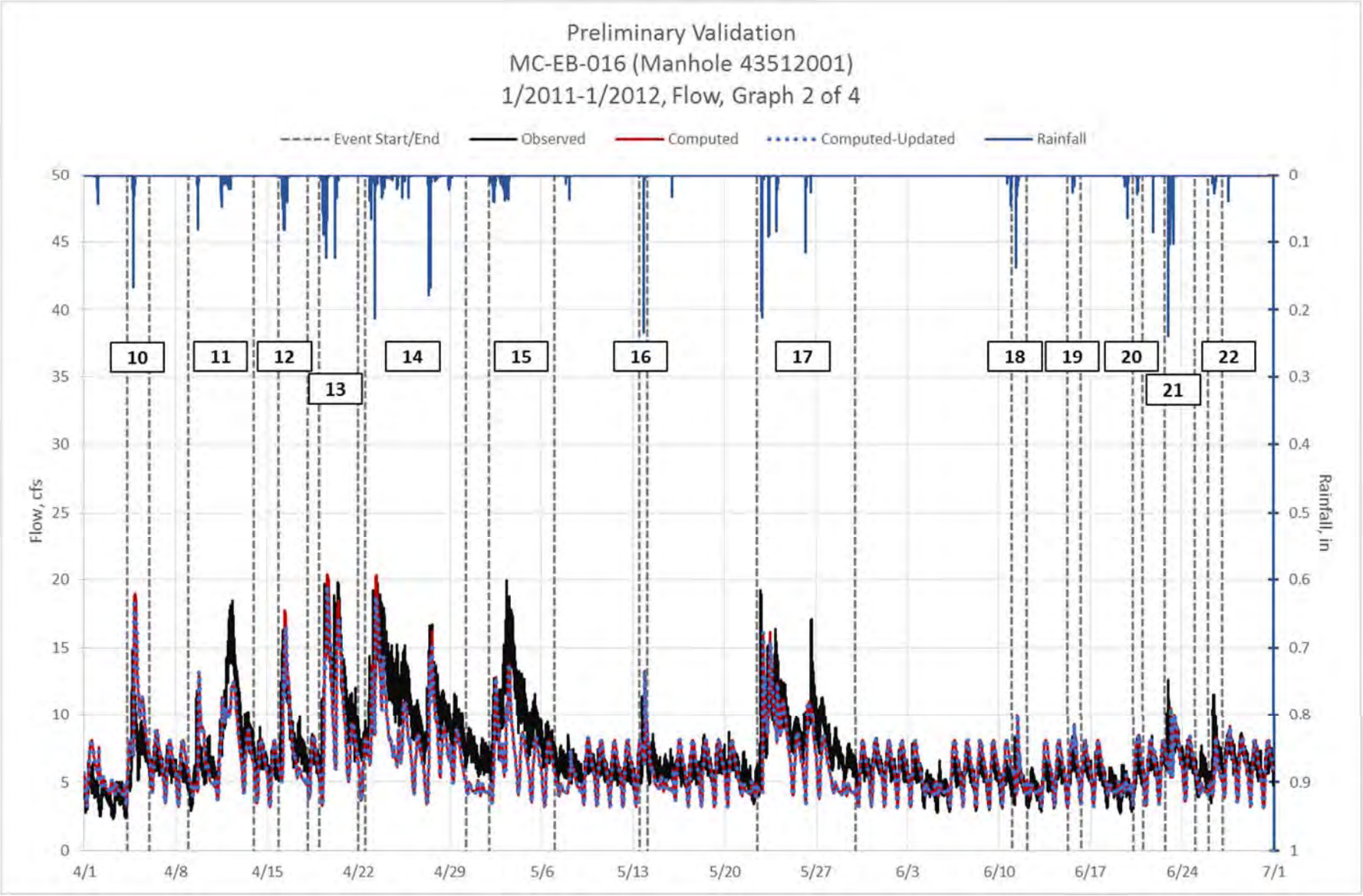

FIGURE G-15
Second Quarter 2011 Flow Hydrograph, MC-EB-016

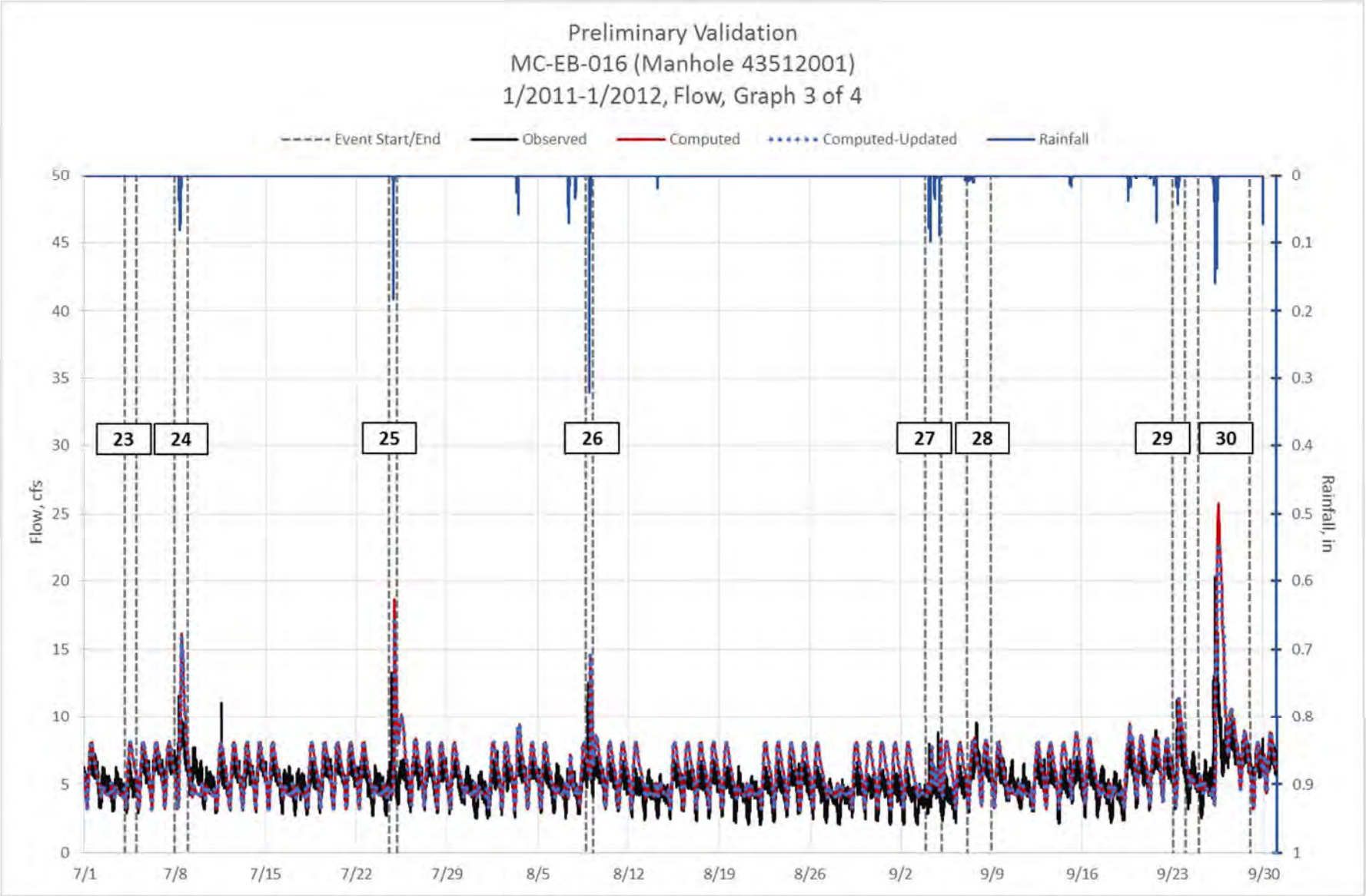

FIGURE G-16
Third Quarter 2011 Flow Hydrograph, MC-EB-016

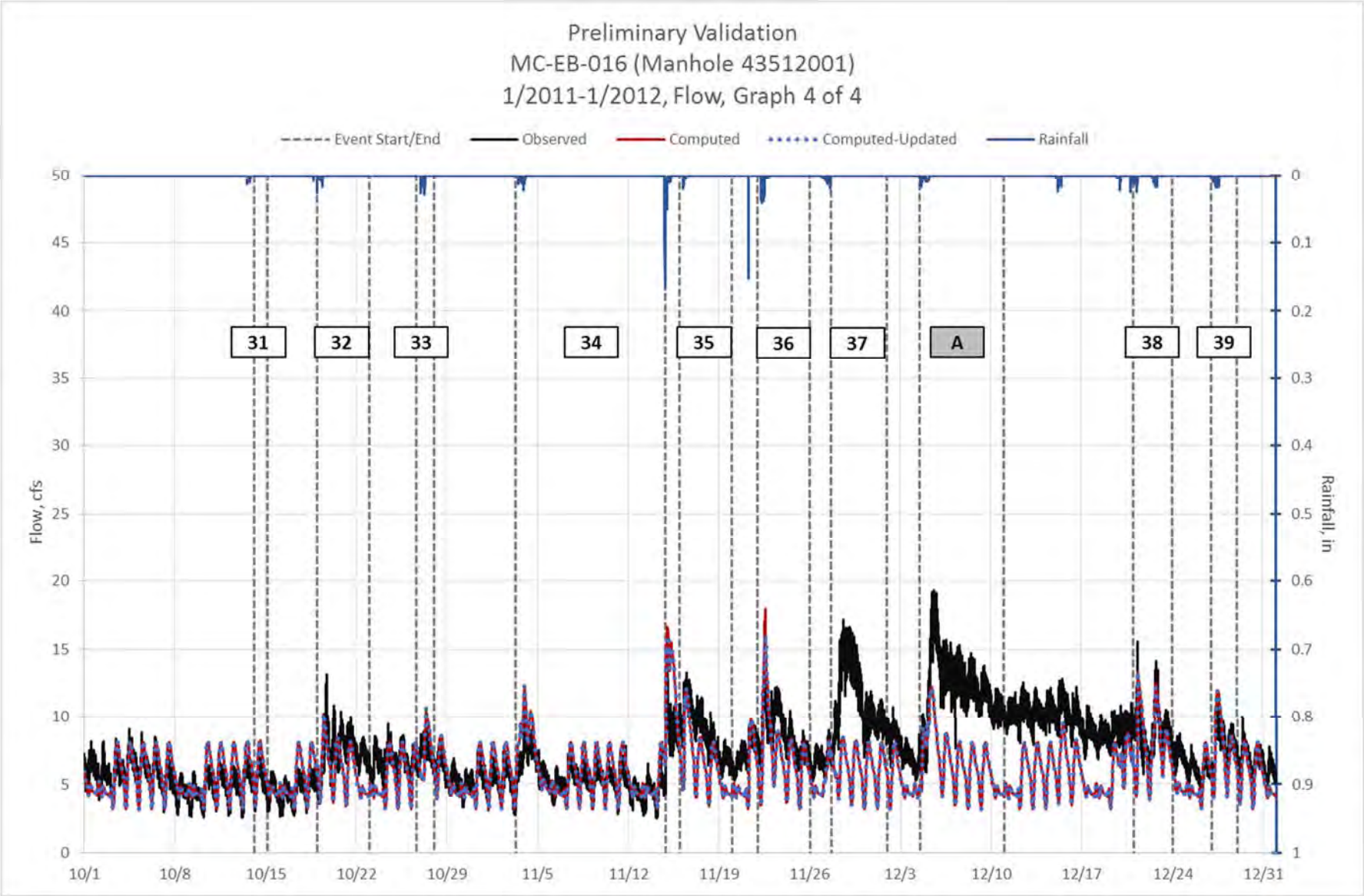

FIGURE G-17
Fourth Quarter 2011 Flow Hydrograph, MC-EB-016

Monitor MC-EB-019

Forty (40) total events were identified during the validation period, and 35 are considered to have good data. With the sealed manholes, of the 35 events with good data, 14% (5 events) met MSDGC's C&V guidelines and standards for peak flow, volume, and depth. Prior to sealing the model manholes in the model, none of the events met the calibration guidelines for peak flow, volume, and depth. Table G-3 summarizes the events and the updated C&V results for each. The events highlighted in green are within the model C&V guidelines and the events highlighted in yellow are within the model guidelines for peak flow and volume. Figures G-18 through G-20 show the peak flow, volume, and peak depth scattergraphs, respectively. Figures G-21 through G-24 show the first quarter 2011, second quarter 2011, third quarter 2011, and fourth quarter 2011 depth hydrographs, respectively. Figures G-25 through G-28 show the first quarter 2011, second quarter 2011, third quarter 2011, and fourth quarter 2011 flow hydrographs, respectively.

TABLE G-3
Events and Updated Simulation Results, MC-EB-019

Event	Date	Duration (h)	Difference in Peak Flow (%)	Difference in Volume (%)	Difference in Depth (%)	Original Results	Updated Result
1	1/1/2011 7:00	47	9.64	34.15	57.35	Not Within Standards	Not Within Standards
2	1/18/2011 10:00	33	-0.20	4.39	15.32	Within Flow and Volume Standards	Within Flow and Volume Standards
3	2/1/2011 7:00	116	-22.28	-2.64	-57.00	Not Within Standards	Not Within Standards
A	2/21/2011 11:00	67					
B	2/24/2011 21:00	58					
C	2/28/2011 6:30	65.5					
4	3/24/2011 7:00	66	14.36	10.61	152.14	Within Flow and Volume Standards	Within Flow and Volume Standards
5	4/4/2011 12:00	67	-9.31	24.13	-0.31	Not Within Standards	Not Within Standards
6	4/9/2011 12:00	36	14.11	29.76	70.98	Within Flow and Volume Standards	Not Within Standards
7	4/11/2011 8:00	63	-21.48	1.92	-4.87	Not Within Standards	Not Within Standards
8	4/15/2011 23:00	48	-19.17	5.64	-1.96	Not Within Standards	Not Within Standards
9	4/19/2011 4:00	74	-18.64	-1.07	-3.15	Not Within Standards	Not Within Standards
10	4/22/2011 19:00	173	-25.63	-5.65	-2.55	Not Within Standards	Not Within Standards
11	5/2/2011 3:00	115	-19.18	-7.42	-5.54	Not Within Standards	Not Within Standards
12	5/13/2011 15:30	8	-2.74	-1.77	54.43	Within Flow and Volume Standards	Within Flow and Volume Standards
13	5/22/2011 16:00	56	-12.18	7.67	14.09	Not Within Standards	Within Standards
14	5/26/2011 6:00	42	-15.96	-11.87	-7.74	Not Within Standards	Not Within Standards
15	6/11/2011 8:00	11	58.31	46.77	383.87	Not Within Standards	Not Within Standards

Event	Date	Duration (h)	Difference in Peak Flow (%)	Difference in Volume (%)	Difference in Depth (%)	Original Results	Updated Result
16	6/15/2011 12:00	12	28.75	26.31	247.42	Not Within Standards	Not Within Standards
17	6/20/2011 11:00	10	23.30	48.29	136.79	Not Within Standards	Not Within Standards
D	6/22/2011 18:30	51					
18	6/26/2011 8:00	16.5	13.82	23.30	95.64	Within Flow and Volume Standards	Not Within Standards
19	7/8/2011 5:00	25	8.94	36.55	115.05	Within Flow and Volume Standards	Not Within Standards
20	7/24/2011 16:00	9.5	-13.99	-15.05	83.04	Not Within Standards	Not Within Standards
21	8/3/2011 9:00	13	40.50	47.86	362.90	Not Within Standards	Not Within Standards
E	8/8/2011 19:00	39					
22	8/25/2011 0:00	6	21.94	23.18	26.06	Not Within Standards	Not Within Standards
23	9/4/2011 3:00	24	68.19	91.32	383.94	Not Within Standards	Not Within Standards
24	9/7/2011 11:00	64	-5.66	30.98	25.40	Not Within Standards	Not Within Standards
25	9/19/2011 11:30	9.5	-18.73	21.48	158.86	Not Within Standards	Not Within Standards
26	9/23/2011 6:00	10	25.41	13.46	127.28	Within Flow and Volume Standards	Not Within Standards
27	9/26/2011 1:00	49.5	-5.77	22.64	-2.75	Not Within Standards	Not Within Standards
28	10/19/2011 8:00	93	-21.96	-10.36	-35.46	Not Within Standards	Not Within Standards
29	10/26/2011 21:00	75	27.59	28.17	109.88	Not Within Standards	Not Within Standards
30	11/3/2011 21:00	33	11.25	46.74	81.80	Not Within Standards	Not Within Standards
31	11/14/2011 21:00	129	-11.58	10.29	-2.99	Not Within Standards	Within Standards
32	11/22/2011 7:00	95	-11.88	0.30	-2.74	Not Within Standards	Within Standards
33	12/21/2011 6:00	27	-15.90	4.77	-15.04	Not Within Standards	Not Within Standards

Event	Date	Duration (h)	Difference in Peak Flow (%)	Difference in Volume (%)	Difference in Depth (%)	Original Results	Updated Result
34	12/22/2011 21:00	27	-9.58	10.85	12.24	Not Within Standards	Within Standards
35	12/27/2011 9:00	42	-11.11	11.67	13.96	Not Within Standards	Within Standards

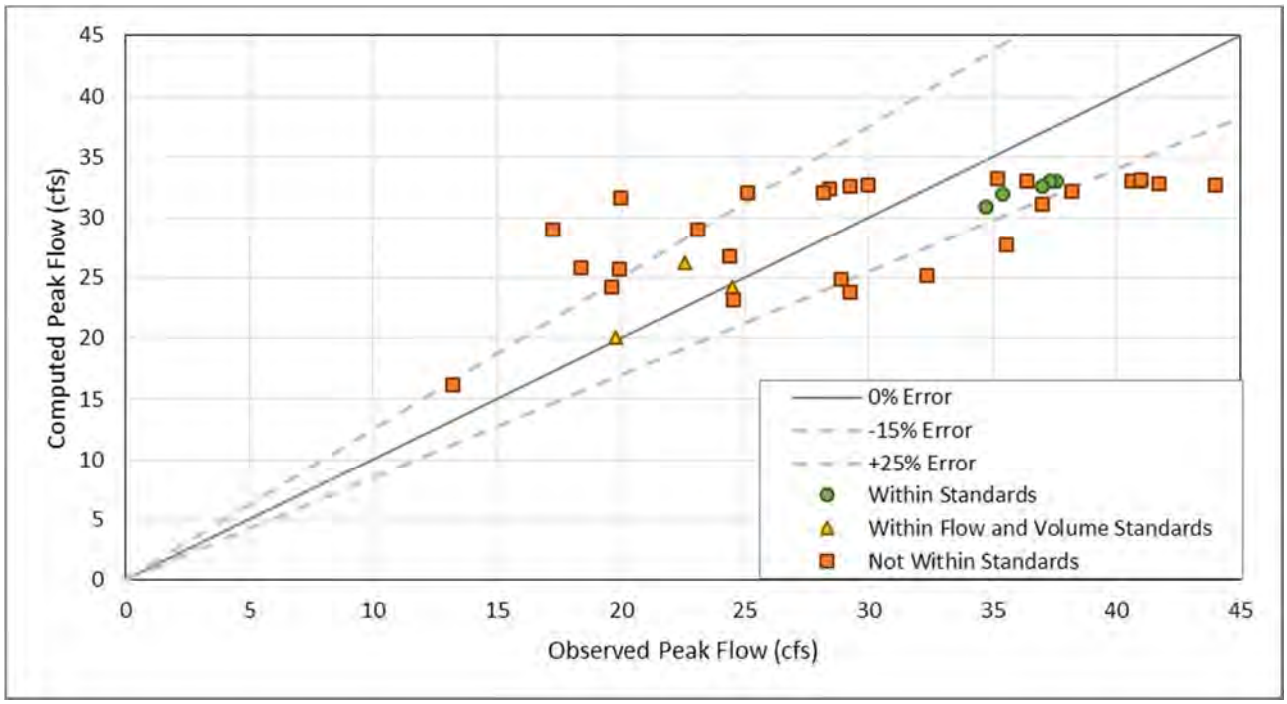

FIGURE G-18
Updated Scattergraph of Peak Flow, MC-EB-019

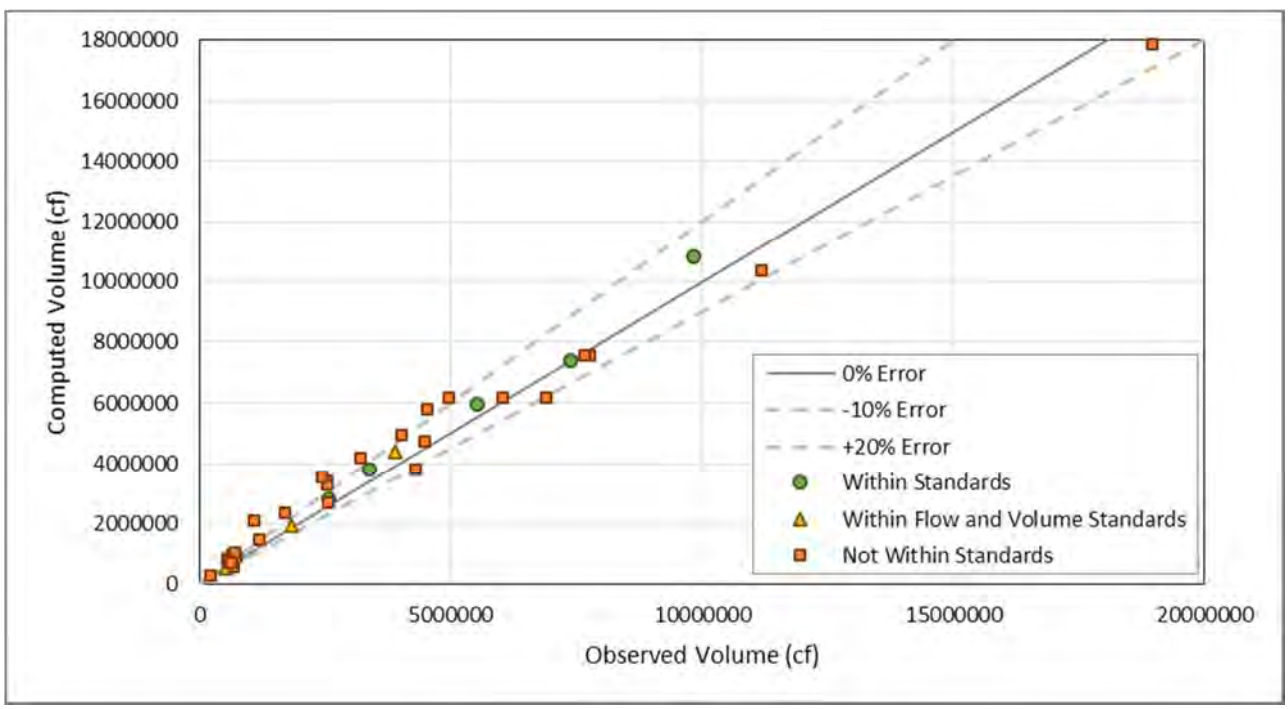

FIGURE G-19
Updated Scattergraph of Volume, MC-EB-019

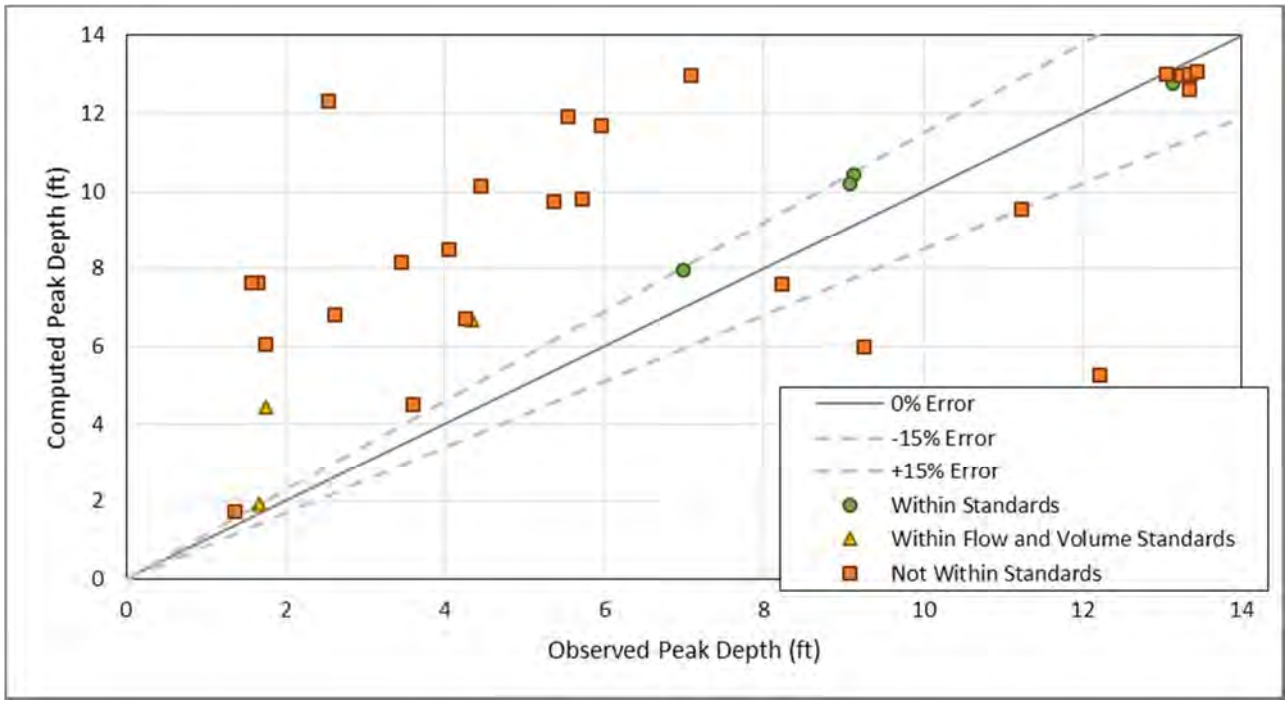

FIGURE G-20
Updated Scattergraph of Peak Depth, MC-EB-019

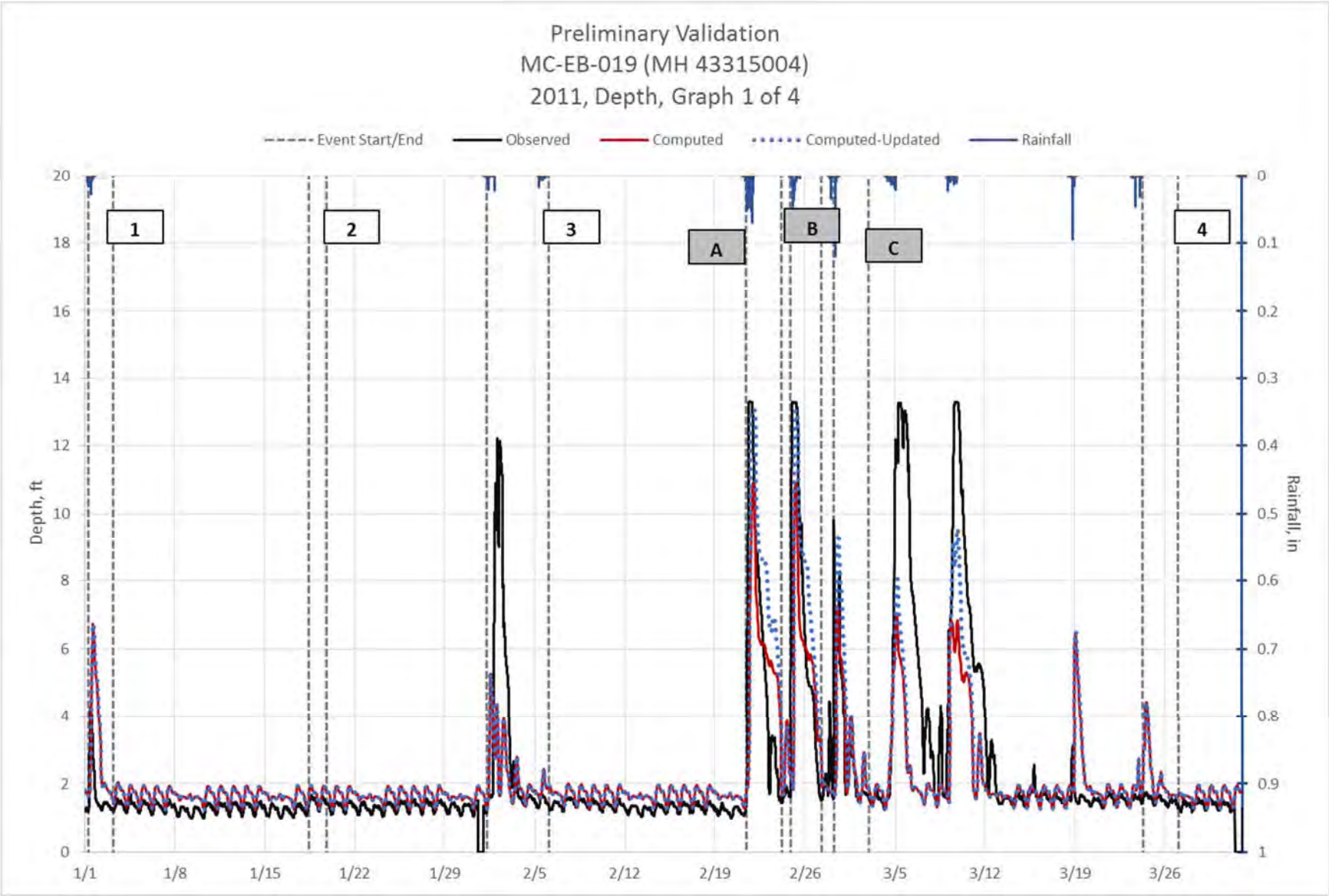

FIGURE G-21
First Quarter 2011 Depth Hydrograph, MC-EB-019

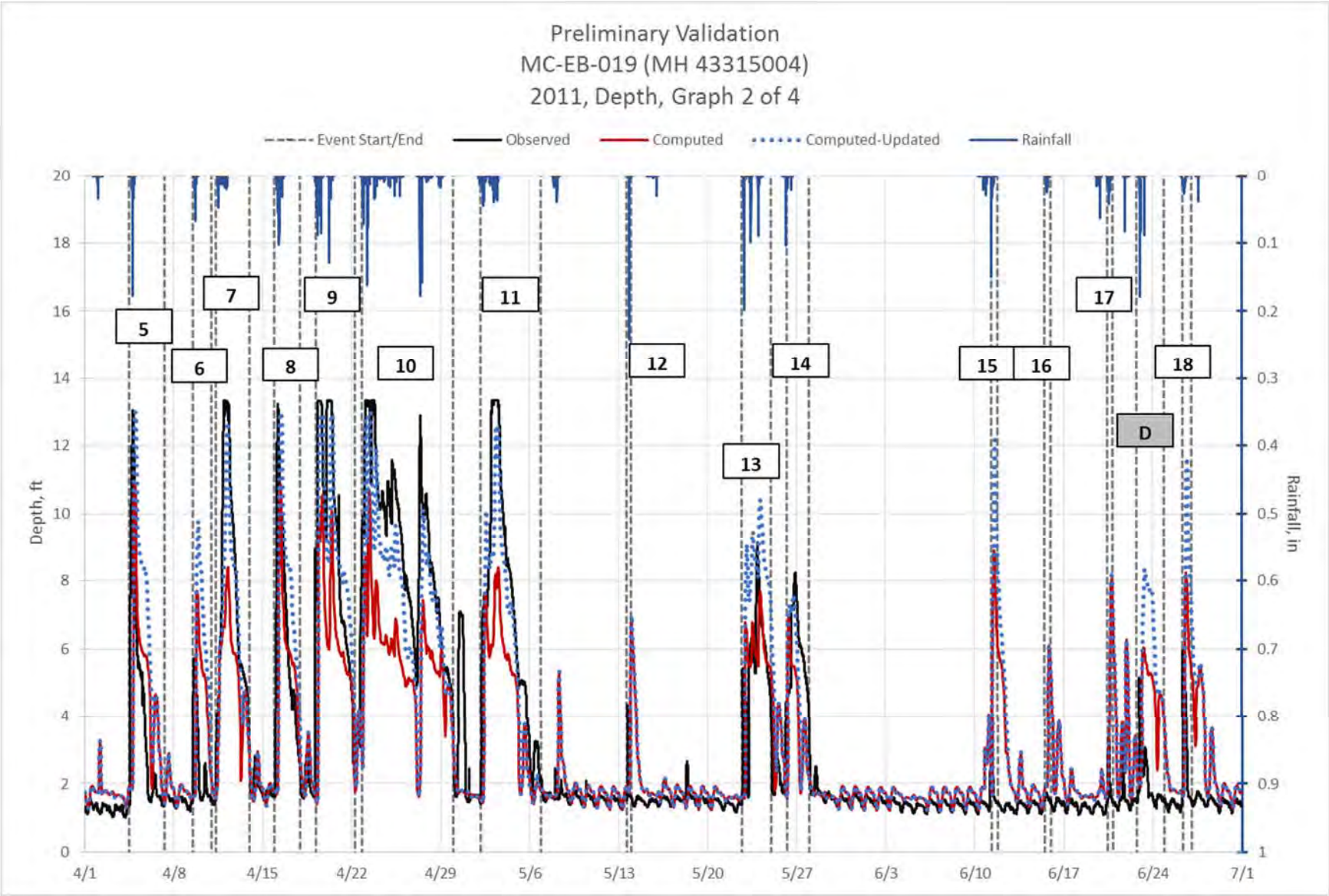

FIGURE G-22
Second Quarter 2011 Depth Hydrograph, MC-EB-019

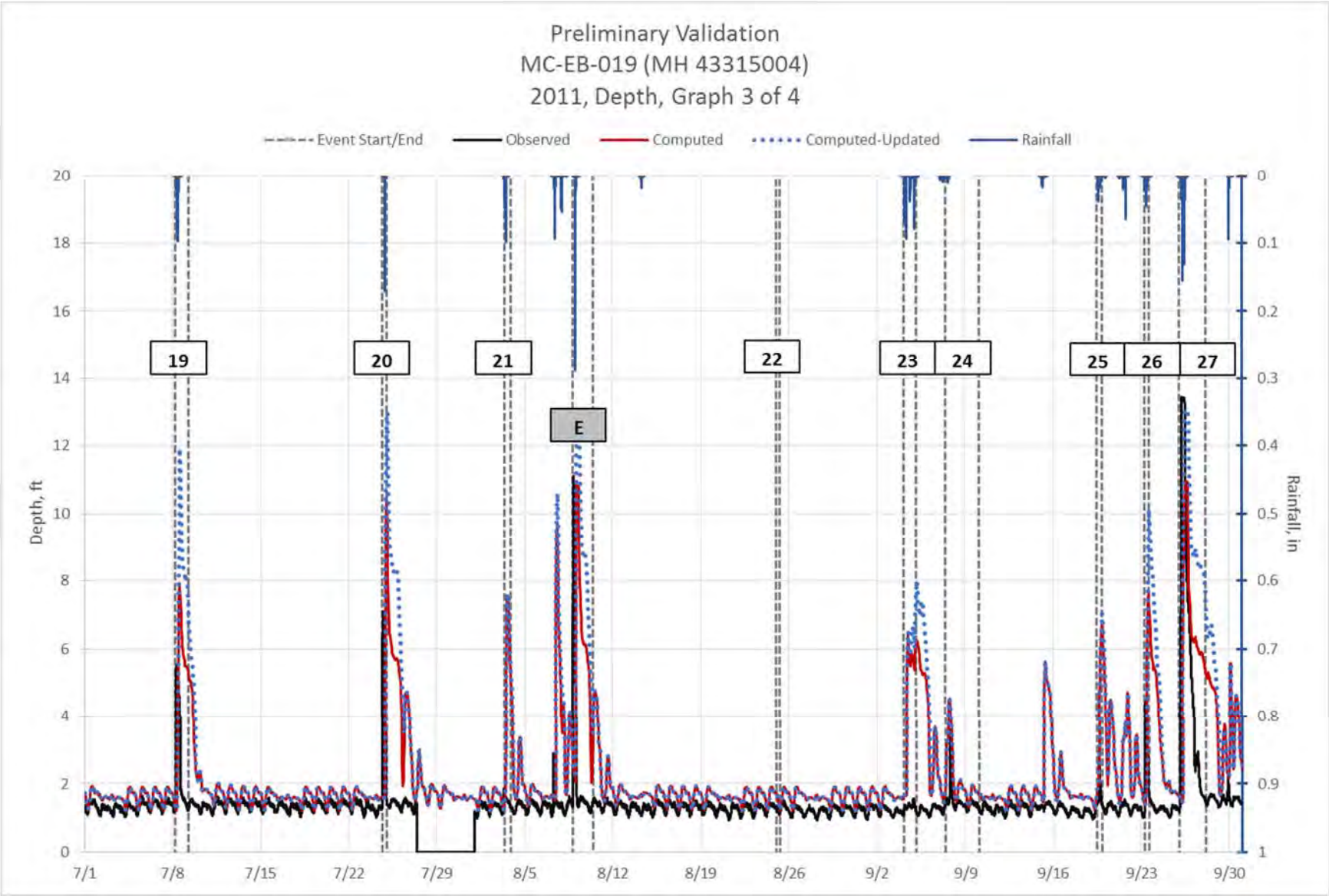

FIGURE G-23
Third Quarter 2011 Depth Hydrograph, MC-EB-019

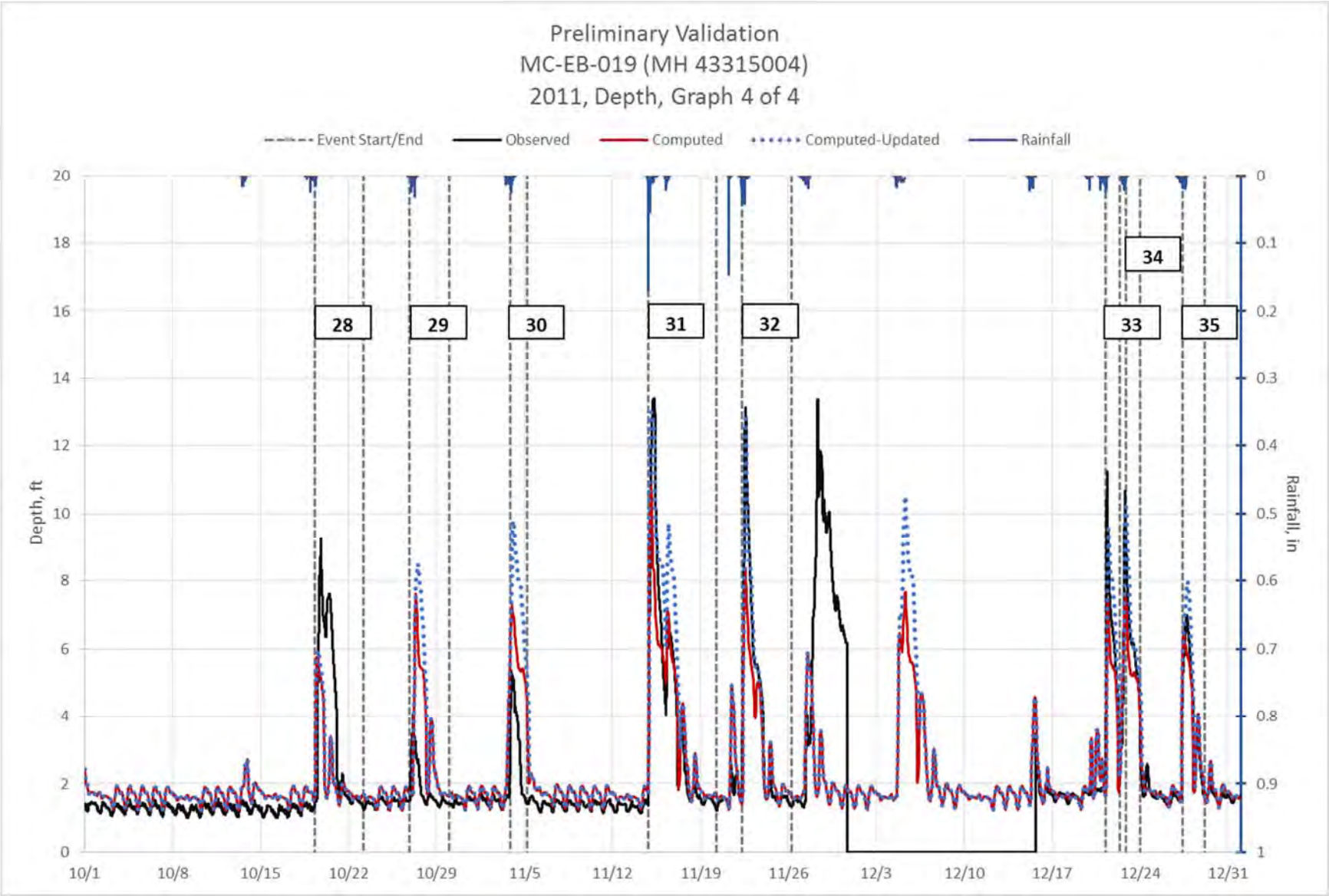

FIGURE G-24
Fourth Quarter 2011 Depth Hydrograph, MC-EB-019

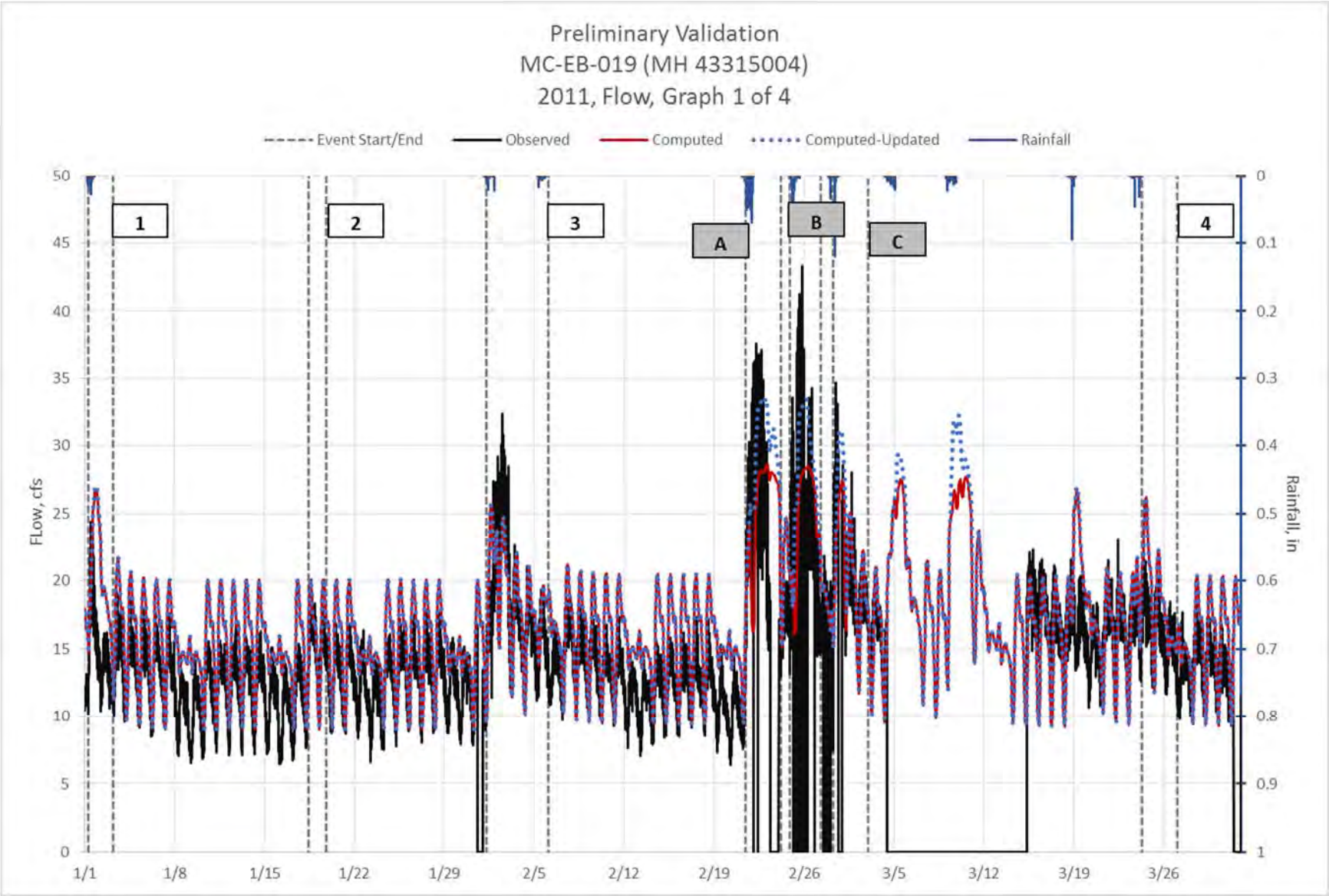

FIGURE G-25
First Quarter 2011 Flow Hydrograph, MC-EB-019

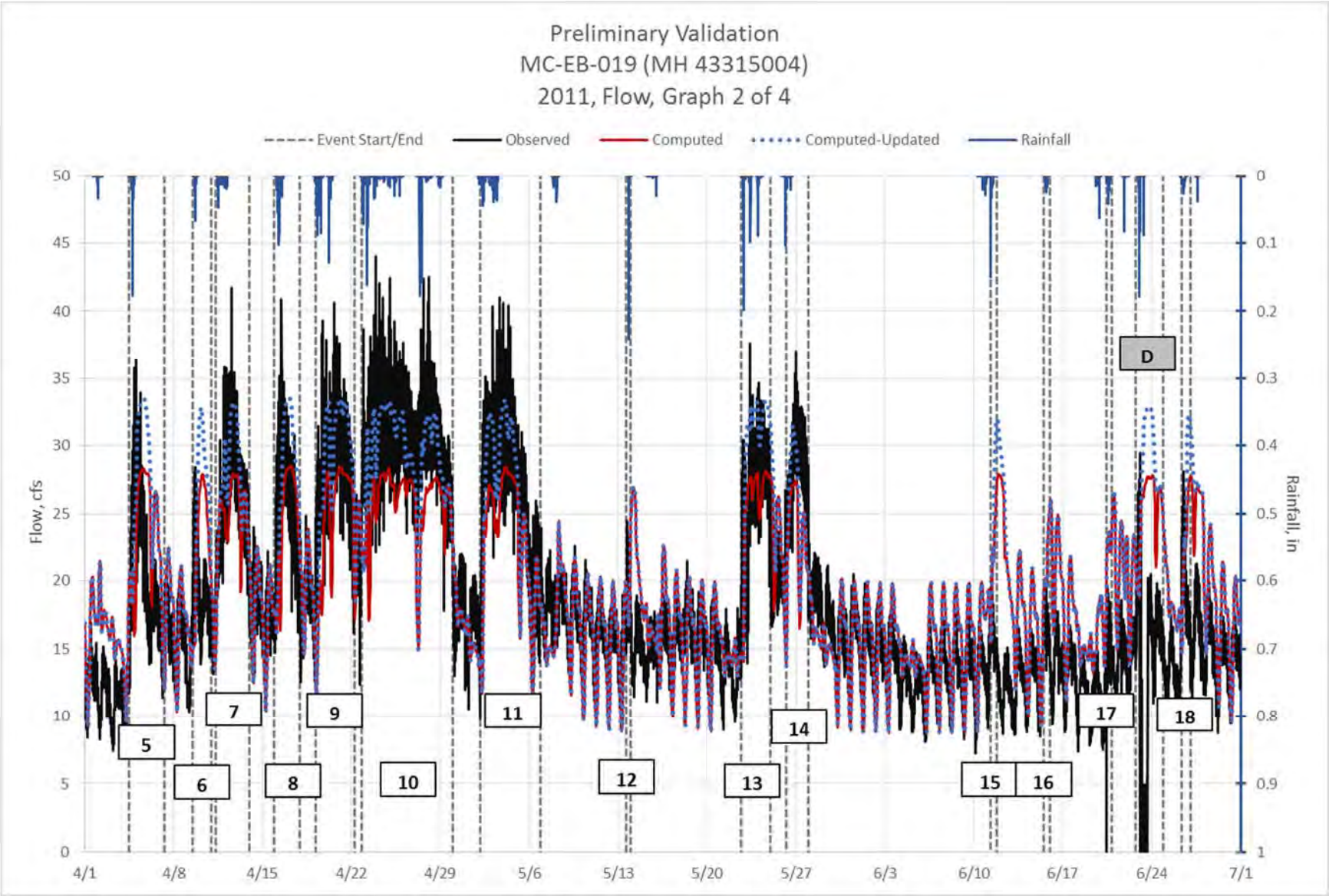

FIGURE G-26
Second Quarter 2011 Flow Hydrograph, MC-EB-019

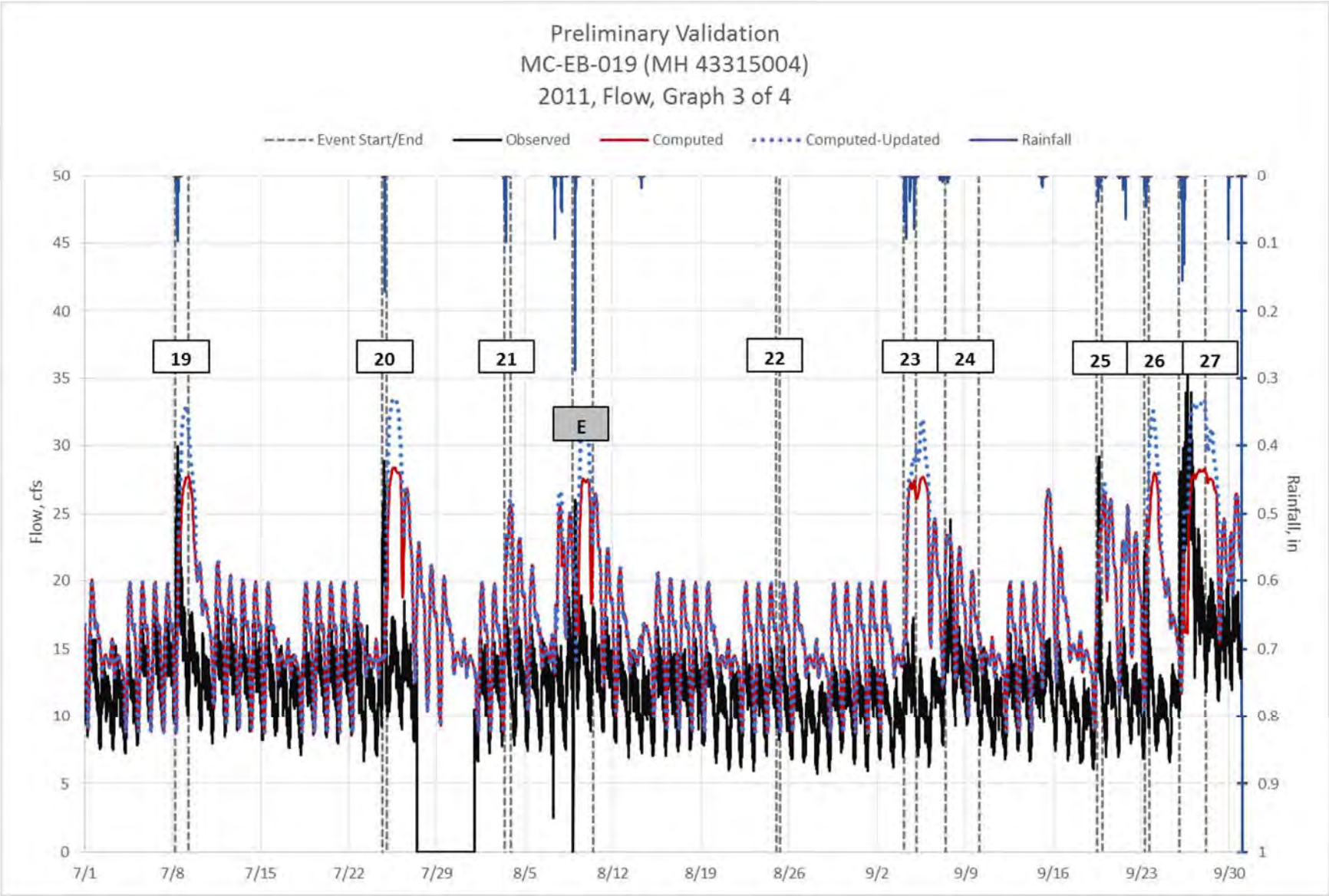

FIGURE G-27
Third Quarter 2011 Flow Hydrograph, MC-EB-019

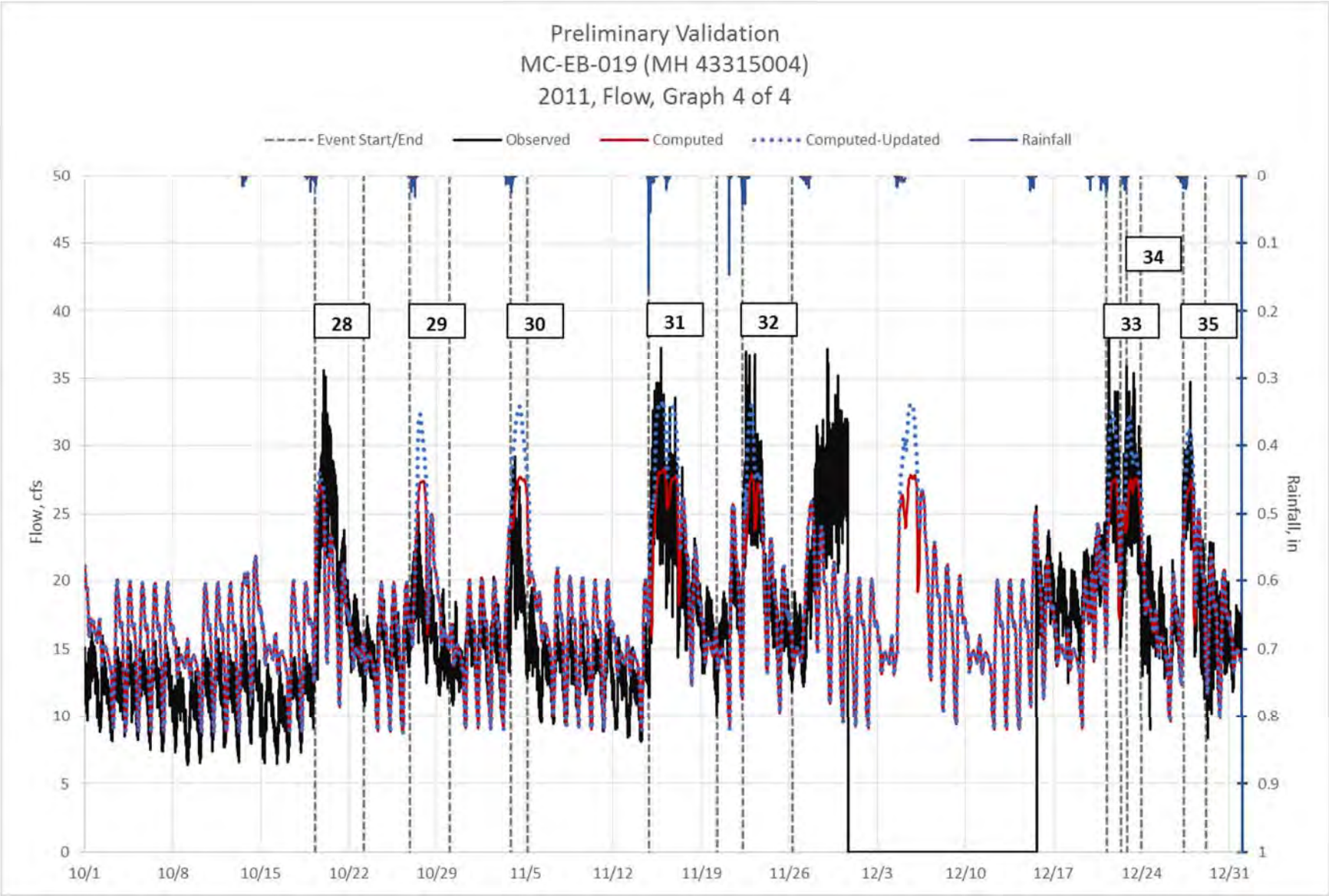

FIGURE G-28
Fourth Quarter 2011 Flow Hydrograph, MC-EB-019

Summary

Overall, sealing the manholes (1) improved the modeled depths at MC-EB-019, (2) improved the depth for some events at MC-EB-005 while also causing over predictions in depth for other events, and (3) generally caused over predictions in depth at MC-EB-016. The depth along the interceptor is also greatly impacted by the operations at SSO 700 STF, which have been shown to be not representative of actual operations during the model validation period. This will be addressed during model recalibration.