Handbook: NWC Visualization Services

Version 1.5

Updated: April 16, 2021
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Introduction

This handbook describes a suite of visualization services developed by the NOAA/NWS Office of Water Prediction (OWP) at the National Water Center (NWC). These dynamic services leverage forecasts from the NWS River Forecast Centers (RFCs) and the National Water Model (NWM). Included in the handbook is a brief description of the service and a summary of the methodology used to derive each visualization service; an Appendix is included to further describe methods for estimating inundation extent using the Height Above Nearest Drainage (HAND) method. Updates to existing services are documented in tables at the onset of each section.

Services leverage GIS technology and are made available through the NWC’s Enterprise GIS.
General Release Updates

For this release, the following general updates have been implemented:

1) A transition to using National Water Model v2.1 forecasts for all services.

2) Addition of services for the Puerto Rico / U.S. Virgin Islands domain.

Specific updates for individual services can be found in the summary tables at the beginning of each configuration section.
## Reference Services

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<th>Release Updates</th>
</tr>
</thead>
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<td>Depicts the boundaries of the National Weather Service (NWS) Regions.</td>
<td>● None</td>
</tr>
<tr>
<td>RFC Regions</td>
<td>Depicts the boundaries of the NWS River Forecast Centers.</td>
<td>● None</td>
</tr>
<tr>
<td>RFC Basins</td>
<td>Depicts the boundaries of the River Forecast Center basins.</td>
<td>● New</td>
</tr>
<tr>
<td>WFO Domains</td>
<td>Depicts the domains of the NWS Weather Forecast Offices.</td>
<td>● Updated to reflect the latest domain changes.</td>
</tr>
<tr>
<td>NWM Flowlines</td>
<td>Depicts the flowlines in the NWM (v2.1).</td>
<td>● Updated to reflect new NWM v2.1 reaches.</td>
</tr>
<tr>
<td>NWM Flowlines - Hawaii</td>
<td>Depicts the flowlines in the NWM (v2.1) for the state of Hawaii.</td>
<td>● None</td>
</tr>
<tr>
<td>NWM Flowlines - PR/VI</td>
<td>Depicts the flowlines in the NWM (v2.1) for Puerto Rico and U.S. Virgin Islands.</td>
<td>● New</td>
</tr>
<tr>
<td>NWM Waterbodies</td>
<td>Depicts the waterbodies in the NWM (v2.1).</td>
<td>● Updated to reflect new NWM v2.1 waterbodies.</td>
</tr>
<tr>
<td>U.S. Cities</td>
<td>Depicts U.S. cities.</td>
<td>● None</td>
</tr>
<tr>
<td>U.S. County Boundaries</td>
<td>Depicts the boundaries of U.S. counties.</td>
<td>● None</td>
</tr>
<tr>
<td>U.S. State Boundaries</td>
<td>Depicts the boundaries of U.S. states and territories.</td>
<td>● None</td>
</tr>
<tr>
<td>U.S. Urban Areas</td>
<td>Depicts the extent of U.S. urban areas.</td>
<td>● None</td>
</tr>
<tr>
<td>RFC Replace &amp; Route FIM Catchment Boundaries</td>
<td>Depicts catchment boundaries for FIM v2.X main stem (MS) configuration applied to R&amp;R streamflow forecasts.</td>
<td>● None</td>
</tr>
<tr>
<td>NOHRSC Flight Lines</td>
<td>Depicts the flight lines for NOAA’s Airborne Snow Survey Program.</td>
<td>• New</td>
</tr>
</tbody>
</table>
NWS Regions

Description
Depicts the boundaries of the National Weather Service regions.

Update Frequency
Static

Methodology
Source of data: https://www.weather.gov/gis/AWIPSShapefiles
RFC Regions

Description
Depicts the boundaries of the NWS River Forecast Centers.

Update Frequency
Static

Methodology
Source of data: https://www.weather.gov/gis/AWIPSShapefiles
RFC Basins

**Description**
Depicts the boundaries of the River Forecast Center basins.

**Update Frequency**
Static

**Methodology**
Source of data: [https://www.nohrsc.noaa.gov/gisdatasets/](https://www.nohrsc.noaa.gov/gisdatasets/)
**WFO Domains**

*Description*
Depicts the boundaries of the NWS Weather Forecast Office domains.

*Update Frequency*
Static

*Methodology*
Source of data: [https://www.weather.gov/gis/AWIPSShapefiles](https://www.weather.gov/gis/AWIPSShapefiles)
**Description**
Depicts the flowlines in the National Water Model (v2.1).

**Update Frequency**
Static

**Methodology**

Source of data: https://water.noaa.gov
**Description**
Depicts the flowlines in the National Water Model (v2.1) for the state of Hawaii.

**Update Frequency**
Static

**Methodology**

Source of data: [https://water.noaa.gov](https://water.noaa.gov)
Description
Depicts the flowlines in the National Water Model (v2.1) for Puerto Rico and the U.S. Virgin Islands.

Update Frequency
Static

Methodology
Source of data: https://water.noaa.gov
**Description**  
Depicts the waterbodies in the National Water Model (v2.1).

**Update Frequency**  
Static

**Methodology**

Source of data: [https://water.noaa.gov](https://water.noaa.gov)
Description
Depicts U.S. cities.

Update Frequency
Static

Methodology
Source of data: 
https://tigerweb.geo.census.gov/tigerwebmain/TIGERweb_restmapservicest.html
U.S. Counties

Description
Depicts the boundaries of U.S. counties.

Update Frequency
Static

Methodology
Source of data:
https://tigerweb.geo.census.gov/tigerwebmain/TIGERweb_restmapservice.html
Description
Depicts the boundaries of U.S. states and territories.

Update Frequency
Static

Methodology
Source of data:
https://tigerweb.geo.census.gov/tigerwebmain/TIGERweb_restmapservicex.html
U.S. Urban Areas

**Description**
Depicts the extent of U.S. urban areas.

**Update Frequency**
Static

**Methodology**
Source of data: [https://tigerweb.geo.census.gov/tigerwebmain/TIGERweb_restmapservicetml](https://tigerweb.geo.census.gov/tigerwebmain/TIGERweb_restmapsservice.html)
RFC Replace & Route FIM Catchment Boundaries

**URL**
https://gis.nwc.nws.noaa.gov/server/rest/services/reference/rnr_catchment_boundary/MapServer

**Description**
Catchments for the main stem FIM v2.X based on v1.3 Height Above the Nearest Drainage (HAND) grids.

**Update Frequency**
Static

**Methodology**
N/A
**Description**  
Depicts the flight lines for collecting snow water equivalent and soil moisture measurements for NOAA’s Airborne Snow Survey Program.

**Update Frequency**  
Static

**Methodology**  
Source of data: [https://www.nohrsc.noaa.gov/gisdatasets/](https://www.nohrsc.noaa.gov/gisdatasets/)
# AHPS and RFC Visualization Services

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<thead>
<tr>
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<th>Description</th>
<th>Release Updates</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AHPS Max Stage Forecast</strong></td>
<td>Depicts AHPS gauges with forecasts at or above &quot;action&quot; stage.</td>
<td>• Implemented a fix for gauges with datum issues.</td>
</tr>
<tr>
<td><strong>RFC Replace &amp; Route 5-Day Max Streamflow Forecast</strong></td>
<td>Depicts maximum streamflow over the next 5 days derived from the official RFC forecasts routed through the NWM (v2.1) stream network downstream of AHPS gauges (Replace &amp; Route).</td>
<td>• Symbology updated to reflect AHPS forecasts status at AHPS locations and downstream until a new AHPS location is reached. • Changed sublayer name to &quot;Maximum Streamflow (cfs)&quot;.</td>
</tr>
<tr>
<td><strong>RFC Replace &amp; Route 5-Day Max Inundation Extent Forecast</strong></td>
<td>Depicts expected maximum inundation extent derived from the official RFC forecasts routed through the NWM (v2.1) stream network downstream of AHPS gauges (Replace &amp; Route). Shown are areas expected to be inundated at some point over the next 5 days.</td>
<td>• &quot;Possible Omission of Coastal Flooding&quot; sublayer set to the county scale.</td>
</tr>
</tbody>
</table>
**Description**
Depicts AHPS gauges with forecasts at or above "action" stage. Circles represent gauges where stages are changing by less than +/- 5% over the entire forecast period. Upward-pointing triangles represent gauges where a greater than 5% increase in stage is expected sometime during the forecast. If stage increases greater than 5% are not expected, downward-pointing triangles represent gauges where a greater than 5% decrease in stage is expected sometime during the forecast. Gauges are colored by their maximum forecast flood category.

**Update Frequency**
Every 15 minutes.

**Methodology**
HML products transmitted through the SBN are ingested into a database and then queried through an API. Forecast time series are then analyzed to detect changes in flood stage.
**Description**
Depicts maximum streamflow over the next 5 days derived from the official RFC forecasts routed through the NWM (v2.1) stream network downstream of AHPS gauges (Replace & Route). Maximum streamflows are available downstream of AHPS gauges whose forecasts reach action status or greater.

**Update Frequency**
Hourly

**Methodology**
HML products transmitted through the SBN are ingested into a database and then queried. Forecast streamflow time series are assimilated into the NWM (v2.1) channel routing module and then routed through river segments.
downstream (Replace & Route). The NWM Analysis and Assimilation configuration provides the initial streamflow conditions for Replace & Route.
**Description**
Depicts expected maximum inundation extent derived from the official RFC forecasts routed through the NWM (v2.1) stream network downstream of AHPS gauges (Replace & Route). Shown are areas expected to be inundated at some point over the next 5 days. Inundation extents are derived using the Height Above the Nearest Drainage method; stage heights are interpolated from routed discharges using synthetic rating curves, interpolated stage heights are rounded up to the nearest foot, and corresponding pre-computed inundation extent polygons are displayed.

**Update Frequency**
Hourly

**Methodology**
HML products transmitted through the SBN are ingested into a database and then queried. Forecast streamflow time series are assimilated into the NWM (v2.1) channel routing module and then routed through river segments downstream (Replace & Route). The NWM (v2.1) Analysis and Assimilation configuration provides the initial streamflow conditions for Replace & Route.

Forecast streamflows from Replace & Route are converted to forecast stages using synthetic rating curves derived from reach-averaged channel properties. Reach-averaged channel properties are derived from 10-meter elevation data. Forecast stages are then converted to forecast inundation extents using a 10-meter relative elevation grid derived using the HAND method.
NWM Visualization Services

This section outlines the suite of visualization services driven by the National Water Model (NWM). The NWM provides estimates of current and forecast hydrologic conditions (including streamflow) across the U.S. via several model configurations: Analysis and Assimilation (current conditions), Short-Range Forecast (18-hours), Medium-Range Forecast (10-days) and Long-Range Forecast (30-days); see Figure 1 below. For more information about the NWM, visit https://water.noaa.gov.

Figure 1: NWM configurations.
## Current Conditions (Analysis and Assimilation Configuration)

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<th>Description</th>
<th>Release Updates</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NWM Streamflow Analysis - Hawaii</strong></td>
<td>Depicts the streamflow output from the operational NWM (v2.1) analysis and assimilation for the state of Hawaii.</td>
<td>● None</td>
</tr>
<tr>
<td><strong>NWM Streamflow Anomaly Analysis</strong></td>
<td>Depicts current seasonal streamflow anomalies derived from the latest operational NWM (v2.1) output.</td>
<td>● New</td>
</tr>
<tr>
<td><strong>NWM Low Flow Analysis</strong></td>
<td>Depicts low flow anomalies derived from the operational NWM (v2.1) analysis and assimilation.</td>
<td>● Updated the symbology categories to better match the USGS WaterWatch.</td>
</tr>
<tr>
<td><strong>NWM High Flow Magnitude Analysis</strong></td>
<td>Depicts high flow magnitudes derived from the operational NWM (v2.1) analysis and assimilation.</td>
<td>● None</td>
</tr>
<tr>
<td><strong>NWM High Flow Magnitude Analysis - Hawaii</strong></td>
<td>Depicts high flow magnitudes derived from the operational NWM (v2.1) analysis and assimilation for the state of Hawaii.</td>
<td>● None</td>
</tr>
<tr>
<td><strong>NWM High Flow Magnitude Analysis - PR/VI</strong></td>
<td>Depicts high flow magnitudes derived from the operational NWM (v2.1) analysis and assimilation for Puerto Rico and Virgin Islands.</td>
<td>● New</td>
</tr>
<tr>
<td><strong>NWM Low Soil Moisture Anomaly Analysis</strong></td>
<td>Depicts low soil moisture anomalies derived from the operational NWM (v2.1) analysis and assimilation.</td>
<td>● None</td>
</tr>
<tr>
<td><strong>NWM Soil Moisture Ice Content Analysis</strong></td>
<td>Depicts the soil moisture ice content output from the operational National Water Model (v2.1) analysis and assimilation.</td>
<td>● New</td>
</tr>
<tr>
<td><strong>NWM Low Soil Temperature Analysis</strong></td>
<td>Depicts the low soil temperature output from the operational National Water Model (v2.1) analysis and assimilation.</td>
<td>● New</td>
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<tr>
<td>Analysis Type</td>
<td>Description</td>
<td>Notes</td>
</tr>
<tr>
<td>---------------</td>
<td>-------------</td>
<td>-------</td>
</tr>
<tr>
<td>NWM Snow Depth Analysis</td>
<td>Depicts the snow depth output from the operational NWM (v2.1) analysis and assimilation.</td>
<td>None</td>
</tr>
<tr>
<td>NWM Snow Water Equivalent Analysis</td>
<td>Depicts the snow water equivalent output from the operational NWM (v2.1) analysis and assimilation.</td>
<td>None</td>
</tr>
<tr>
<td>NWM Past 72-Hour Snow Water Equivalent Change Analysis</td>
<td>Depicts snow water equivalent changes over the past 24, 48, and 72 hours derived from the operational NWM (v2.1) analysis and assimilation.</td>
<td>None</td>
</tr>
<tr>
<td>NWM Past 24-Hour Snow Melt Analysis</td>
<td>Depicts snow melt over the past 24 hours derived from the operational NWM (v2.1) analysis and assimilation.</td>
<td>None</td>
</tr>
<tr>
<td>NWM Inundation Extent Analysis</td>
<td>Depicts inundation extent derived from the operational NWM (v2.1) analysis and assimilation.</td>
<td>None</td>
</tr>
<tr>
<td>Note: Inundation extent is only viewable to users on the NWC Portal, and only available over the Texas/WGRFC, SERFC, MARFC and NERFC domains.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MRMS Past 72-Hour Accumulated Precipitation Analysis</td>
<td>Depicts accumulated precipitation totals over the past 72 hours derived from the MRMS forcing for the operational NWM (v2.1) analysis and assimilation.</td>
<td>None</td>
</tr>
<tr>
<td>NAM-Nest with MRMS Past 72-Hour Accumulated Precipitation Analysis - Hawaii</td>
<td>Depicts accumulated precipitation totals over the past 72 hours derived from the NAM-Nest with MRMS forcing for the operational NWM (v2.1) analysis and assimilation for the state of Hawaii.</td>
<td>New</td>
</tr>
</tbody>
</table>
Description
Depicts the streamflow output from the operational NWM (v2.1) analysis and assimilation for the state of Hawaii.

Update Frequency
Hourly

Methodology
Raw NWM (v2.1) output is displayed.
NWM Streamflow Anomaly Analysis (New)

**Description**
Depicts current seasonal streamflow anomalies derived from the latest operational NWM (v2.1) output. Anomalies are based on 7-day average streamflow percentiles for each reach for the current calendar day. For example, reaches shown in purple, the High category, have a 7-day streamflow average at or above their 95th streamflow percentile for this time of year. Streamflow percentiles were derived from 7-day streamflow averages for each reach for each calendar day using a 25-year retrospective analysis of the NWM (v2.0).

**Update Frequency**
Daily

**Methodology**
Streamflow percentiles were derived using a 25-year retrospective analysis of the NWM (v2.0). NWM streamflow values are compared to these percentiles and classified accordingly.
NWM Low Flow Analysis

Description
Depicts low flow anomalies derived from the operational NWM (v2.1) analysis and assimilation. Anomalies are based on 28-day average streamflow percentiles for each reach for the current calendar day. Streamflow percentiles were derived from 28-day streamflow averages for each reach for each calendar day using a 25-year retrospective analysis of the NWM (v2.0).

Update Frequency
Daily

Methodology
Low flows are based on 28-day average streamflow percentiles for each reach for the current calendar day. For example, reaches shown in red, the Drought (< 2nd) category, have a 28-day streamflow average below their 2nd streamflow percentile for this time of year. Streamflow percentiles were derived from 28-day streamflow averages for each reach for each calendar day using a 25-year retrospective analysis of the NWM (v2.0).
NWM High Flow Magnitude Analysis

Description
Depicts high flow magnitudes derived from the operational NWM (v2.1) analysis and assimilation. Shown are reaches with flow at or above bankfull. Reaches are colored by the annual exceedance probability (AEP) of their current flow. Bankfull flows and AEPs were derived using a 25-year retrospective analysis of the NWM (v2.0).

Update Frequency
Hourly

Methodology
AEPs were derived from a multi-decade reanalysis of the NWM (v2.0). NWM streamflow values are compared to these AEPS and classified accordingly. “Bankfull” conditions are approximated by the 67% AEP. A training video is available for this service.
Description
Depicts high flow magnitudes derived from the operational NWM (v2.1) analysis and assimilation for the state of Hawaii. Shown are reaches with flow at or above bankfull. Reaches are colored by the annual exceedance probability (AEP) of their current flow. Bankfull flows and AEPs were derived from USGS regression equations found at https://pubs.usgs.gov/sir/2010/5035/sir2010-5035_text.pdf.

Update Frequency
Hourly

Methodology
Bankfull flows and AEPs were derived from USGS regression equations found at [https://pubs.usgs.gov/sir/2010/5035/sir2010-5035_text.pdf](https://pubs.usgs.gov/sir/2010/5035/sir2010-5035_text.pdf). Streamflow values are then compared to AEPs and classified accordingly. “Bankfull” conditions are approximated by the 67% AEP.
Description
Depicts high flow magnitudes derived from the operational NWM (v2.1) analysis and assimilation for Puerto Rico and Virgin Islands. Shown are reaches with flow at or above bankfull. Reaches are colored by the annual exceedance probability (AEP) of their current flow. Bankfull flows and AEPs were derived from USGS regression equations found at https://pubs.usgs.gov/wri/wri994142/pdf/wri99-4142.pdf.

Update Frequency
Hourly

Methodology
Bankfull flows and AEPs were derived from USGS regression equations found at https://pubs.usgs.gov/wri/wri994142/pdf/wri99-4142.pdf. Streamflow values are then compared to AEPs and classified accordingly. “Bankfull” conditions are approximated by the 67% AEP.
**Description**
Depicts low soil moisture anomalies derived from the operational NWM (v2.1) analysis and assimilation. Values represent soil saturation anomalies for the 0 - 100cm soil layer. Anomalies are based on 15-day average soil saturation percentiles for each reach centered around the current calendar day. Percentiles were derived from 15-day soil saturation averages for each reach for each calendar day using a 25-year retrospective analysis of the NWM (v2.0).

**Update Frequency**
Daily

**Methodology**
Soil moisture percentiles were created at a 1km-resolution from a 15-day average centered around the day of the year using a 25-year retrospective analysis of the NWM (v2.0).
**Description**
Depicts the soil moisture ice content output from the operational NWM (v2.1) analysis and assimilation. Values represent ice content for the 0 - 2m soil layer.

**Update Frequency**
Hourly

**Methodology**
Raw NWM (v2.1) output is displayed.
Description
Depicts the low soil temperature output from the operational National Water Model (v2.1) analysis and assimilation. Values represent temperatures for the 0 - 10cm soil layer.

Update Frequency
Hourly

Methodology
Raw NWM (v2.1) output is displayed.
NWM Snow Depth Analysis

Description
Depicts the snow depth output from the operational NWM (v2.1) analysis and assimilation.

Update Frequency
Hourly

Methodology
Raw NWM (v2.1) output is displayed.
NWM Snow Water Equivalent Analysis

**Description**
Depicts the snow water equivalent output from the operational NWM (v2.1) analysis and assimilation.

**Update Frequency**
Hourly

**Methodology**
Raw NWM (v2.1) output is displayed.
**NWM Past 72-Hour Snow Water Equivalent Change Analysis**

*Description*

Depicts snow water equivalent changes over the past 24, 48, and 72 hours derived from the operational NWM (v2.1) analysis and assimilation. Data for each interval can be seen by using a filter to select the name of the desired layer.

*Update Frequency*

Hourly

*Methodology*
Compares current snow water equivalent values to snow water equivalent values from 24, 48, and 72 hours in the past.
Description
Depicts snow melt over the past 24 hours derived from the operational NWM (v2.1) analysis and assimilation.

Update Frequency
Daily

Methodology
Compares snow water equivalent values from 24 hours in the past to current conditions. A decrease in snow water equivalent directly corresponds to an equal amount of snow melt in the past 24 hours.
**Description**
Depicts inundation extent derived from the operational NWM (v2.1) analysis and assimilation. Inundation extents are derived using the Height Above the Nearest Drainage method; stage heights are interpolated from NWM (v2.1) discharges using synthetic rating curves, interpolated stage heights are rounded up to the nearest foot, and corresponding pre-computed inundation extent polygons are displayed. Inundation extent is currently only available for the Texas/WGRFC, NERFC, MARFC, and SERFC regions.

**Update Frequency**
Hourly

**Methodology**
NWM streamflows are converted to stages using synthetic rating curves derived from reach-averaged channel properties. Reach-averaged channel properties are derived from 10-meter elevation data. Stages are then converted to inundation extents using a 10-meter relative elevation grid derived using the HAND method. “Bankfull” conditions are approximated by the 67% annual exceedance probability (AEP). AEPs were derived from a multi-decade reanalysis of the NWM (v2.0). For more information on HAND and synthetic rating curves, see the references listed in Appendix A. A training video is available for this service.
**Description**  
Depicts accumulated precipitation totals over the past 72 hours derived from the MRMS forcing for the operational NWM (v2.1) analysis and assimilation. Data for each interval can be seen by using a filter to select the name of the desired layer.

**Update Frequency**  
Hourly

**Methodology**  
Hourly precipitation from the NWM (v2.1) analysis and assimilation configuration is accumulated over past intervals: 1 hour, 3 hours, 6 hours,
12 hours, 24 hours, 48 hours, and 72 hours. NWM (v2.1) analysis and assimilation precipitation is derived from a HRRR/RAP/MRMS/MPE blend.
**Description**
Depicts accumulated precipitation totals over the past 72 hours derived from the NAM-Nest with MRMS forcing for the operational NWM (v2.1) analysis and assimilation for the state of Hawaii. Data for each interval can be seen by using a filter to select the name of the desired layer.

**Update Frequency**
Hourly

**Methodology**
Hourly precipitation from the NWM (v2.1) analysis and assimilation configuration is accumulated over past intervals: 1 hour, 3 hours, 6 hours, 12 hours, 24 hours, 48 hours, and 72 hours. NWM (v2.1) analysis and assimilation precipitation is derived from the NAM-Nest with MRMS blend.
## Short-Range Forecast

<table>
<thead>
<tr>
<th>Service</th>
<th>Description</th>
<th>Release Updates</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NWM 18-Hour Streamflow Rate of Change Forecast</strong></td>
<td>Depicts expected change in discharge derived from the operational NWM (v2.1) short-range forecast.</td>
<td>• None</td>
</tr>
<tr>
<td><strong>NWM 18-Hour Max High Flow Magnitude Forecast</strong></td>
<td>Depicts expected high flow magnitudes derived from the operational NWM (v2.1) short-range forecast.</td>
<td>• None</td>
</tr>
</tbody>
</table>
| **NWM 48-Hour High Flow Magnitude Forecast - Hawaii** | Depicts expected high flow magnitudes derived from the operational NWM (v2.1) short-range forecast for the state of Hawaii. | • Forecast length reduced from 60 hours to 48 hours.  
• 6z and 18z updates eliminated, resulting in a new forecast frequency of 12 hours. |
| **NWM 48-Hour High Flow Magnitude Forecast - PR/VI** | Depicts expected high flow magnitudes derived from the operational NWM (v2.1) short-range forecast for Puerto Rico/Virgin Islands. | • New                                                                          |
| **NWM 18-Hour Bankfull Arrival Time Forecast** | Depicts expected bankfull arrival times derived from the operational NWM (v2.1) short-range forecast. | • None                                                                          |
| **NWM 48-Hour Bankfull Arrival Time Forecast - Hawaii** | Depicts expected bankfull arrival times derived from the operational National Water Model (NWM) (v2.1) short-range forecast for the state of Hawaii. | • New                                                                          |
| **NWM 18-Hour Peak Flow Arrival Time Forecast** | Depicts expected peak flow arrival times derived from the operational NWM (v2.1) short-range forecast. | • None                                                                          |
| **NWM 12-Hour Bankfull Probability Forecast** | Depicts above-bankfull probabilities derived from a time-lag of the operational NWM (v2.1) short-range forecast. | • Methodology updated - probabilities are computed as the % agreement          |
| **NWM 18-Hour Rapid Onset Flooding Forecast** | Depicts the potential for rapid onset flooding derived from the operational NWM (v2.1) short-range forecast. | • Filtered to show only stream orders 4 and below.  
• Summary sublayer is now based on percentage of waterway length with rapid onset flooding.  
• Removed the 0 - 10% legend category from the summary sublayer. |
| **NWM 18-Hour Max Inundation Extent Forecast** | Depicts expected maximum inundation extent derived from the operational NWM (v2.1) short-range forecast.  

*Note: Inundation extent is only viewable to users on the NWC Portal, and only available over the Texas/WGRFC, SERFC, MARFC and NERFC domains.* | • None |
| **HRRR 18-Hour Accumulated Precipitation Forecast** | Depicts expected accumulated precipitation totals over the next 18 hours derived from the HRRR forcing for the operational NWM (v2.1) short-range forecast. | • None |
| **NAM-Nest with HIRESW WRF-ARW 48-Hour Accumulated Precipitation Forecast - Hawaii** | Depicts expected accumulated precipitation totals over the next 48 hours derived from the NAM-Nest with HIRESW WRF-ARW forcing for the operational NWM (v2.1) short-range forecast for Hawaii. | • Forecast length reduced from 60 hours to 48 hours.  
• 6z and 18z updates eliminated, resulting in a new forecast frequency of 12 hours. |
<p>| <strong>NAM-Nest with HIRESW WRF-ARW</strong> | Depicts expected accumulated precipitation totals over the next 48 hours derived from | • New |</p>
<table>
<thead>
<tr>
<th><strong>48-Hour Accumulated Precipitation Forecast - PR/VI</strong></th>
<th>the NAM-Nest with HIRESW WRF-ARW forcing for the operational NWMI (v2.1) short-range forecast for Puerto Rico/Virgin Islands.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NWM Short-Range Forecast Water Management</strong></td>
<td>Depicts the source of reservoir forecasts from outputs of the operational NWM (v2.1) short-range forecast.</td>
</tr>
<tr>
<td></td>
<td>● New</td>
</tr>
</tbody>
</table>
**Description**
Depicts expected change in discharge derived from the operational NWM (v2.1) short-range forecast. Change is computed between the current streamflow and that expected over the next 18 hours at 3-hourly intervals, and is only displayed for reaches that are expected to have flow at or above bankfull over the next 18 hours. Bankfull flows were derived using a 25-year retrospective analysis of the NWM (v2.0).

**Update Frequency**
Hourly
**Methodology**

Change is computed between the current streamflow and that expected in 3, 6, 9, 12, 15, and 18 hours, and is only displayed for reaches that are expected to have flow at or above “bankfull” at any time within the next 18 hours. “Bankfull” conditions are approximated by the 67% annual exceedance probability (AEP). AEPs were derived from a multi-decade reanalysis of the NWM (v2.0).
**Description**
Depicts expected high flow magnitudes derived from the operational NWM (v2.1) short-range forecast. Shown are reaches that are expected to have flow at or above bankfull over the next 18 hours. Reaches are colored by the annual exceedance probability (AEP) of their maximum forecast flow over the next 18 hours. Bankfull flows and AEPs were derived using a 25-year retrospective analysis of the NWM (v2.0).

**Update Frequency**
Hourly

**Methodology**
AEPs were derived from a multi-decade reanalysis of the NWM (v2.0). Maximum streamflow values are compared to these AEPs and classified accordingly. “Bankfull” conditions are approximated by the 67% AEP. A training video is available for this service.
**Description**
Depicts expected high flow magnitudes derived from the operational NWM (v2.1) short-range forecast for the state of Hawaii. Shown are reaches that are expected to have flow at or above bankfull over the next 48 hours. Reaches are colored by the annual exceedance probability (AEP) of their maximum forecast flow over the next 48 hours. Bankfull flows and AEPs were derived from USGS regression equations found at [https://pubs.usgs.gov/sir/2010/5035/sir2010-5035_text.pdf](https://pubs.usgs.gov/sir/2010/5035/sir2010-5035_text.pdf).

**Update Frequency**
Every 12 hours.

**Methodology**
Bankfull flows and AEPs were derived from USGS regression equations found at https://pubs.usgs.gov/sir/2010/5035/sir2010-5035_text.pdf. Streamflow values are compared to these AEPs and classified accordingly. “Bankfull” conditions are approximated by the 67% AEP.
Description
Depicts expected high flow magnitudes derived from the operational NWM (v2.1) short-range forecast for Puerto Rico/Virgin Islands. Shown are reaches that are expected to have flow at or above bankfull over the next 48 hours. Reaches are colored by the annual exceedance probability (AEP) of their maximum forecast flow over the next 48 hours. Bankfull flows and AEPs were derived from USGS regression equations found at https://pubs.usgs.gov/wri/wri994142/pdf/wri99-4142.pdf.

Update Frequency
Every 12 hours.
Methodology
Bankfull flows and AEPs were derived from USGS regression equations found at https://pubs.usgs.gov/sir/2010/5035/sir2010-5035_text.pdf. Streamflow values are compared to these AEPs and classified accordingly. “Bankfull” conditions are approximated by the 67% AEP.
Description
Depicts expected bankfull arrival times derived from the operational NWM (v2.1) short-range forecast. Shown are reaches that are expected to have flow at or above bankfull over the next 18 hours. Reaches are colored by the time at which they are expected to reach bankfull. Bankfull flows were derived using a 25-year retrospective analysis of the NWM (v2.0).

Update Frequency
Hourly

Methodology
The arrival time is calculated by comparing the forecast streamflow for each lead time to the estimated “bankfull” condition. The time at which forecast streamflow first exceeds the “bankfull” condition is considered the arrival time. “Bankfull” conditions are approximated by the 67% annual exceedance probability (AEP). AEPs were derived from a multi-decade reanalysis of the NWM (v2.0). A training video is available for this service.
NWM 48-Hour Bankfull Arrival Time Forecast - Hawaii

**Description**
Depicts expected bankfull arrival times derived from the operational NWM (v2.1) short-range forecast for the state of Hawaii. Shown are reaches that are expected to have flow at or above bankfull over the next 48 hours. Reaches are colored by the time at which they are expected to reach bankfull. Bankfull flows and annual exceedance probabilities were derived from USGS regression equations found at https://pubs.usgs.gov/sir/2010/5035/sir2010-5035_text.pdf.

**Update Frequency**
Every 12 hours.

**Methodology**
The arrival time is calculated by comparing the forecast streamflow for each lead time to the estimated “bankfull” condition. The time at which forecast streamflow first exceeds the “bankfull” condition is considered the arrival time. “Bankfull” conditions are approximated by the 67% annual exceedance probability (AEP). AEPs were derived from a multi-decade reanalysis of the NWM (v2.0).
**Description**

Depicts expected peak flow arrival times derived from the operational NWM (v2.1) short-range forecast. Shown are reaches that are expected to have flow at or above bankfull over the next 18 hours. Reaches are colored by the time at which they are expected to be at their maximum flow within the forecast period. Bankfull flows were derived using a 25-year retrospective analysis of the NWM (v2.0).

**Update Frequency**

Hourly

**Methodology**
Shown are reaches that are expected to have forecast streamflow at or above “bankfull” conditions within the next 18 hours. “Bankfull” conditions are approximated by the 67% annual exceedance probability (AEP). AEPs were derived from a multi-decade reanalysis of the NWM (v2.0). Reaches are colored by the time at which they are expected to be at their maximum streamflow within the forecast period, even if it is not the first peak to occur. A training video is available for this service.
NWM 12-Hour Bankfull Probability Forecast

Description
Depicts above-bankfull probabilities derived from a time-lag of the operational NWM (v2.1) short-range forecast. Shown are reaches that are expected to have flow at or above bankfull within the next 12 hours, using the last 7 NWM (v2.1) short-range forecasts. Reaches are colored by the probability that they will meet or exceed bankfull within the next 12 hours. Probabilities are derived from the streamflow values for each reach over the past 7 NWM (v2.1) short-range forecasts, equally weighted. Bankfull flows were derived using a 25-year retrospective analysis of the NWM (v2.0).

Update Frequency
Hourly

Methodology
Shown are reaches that are expected to have forecast streamflow at or above “bankfull” conditions within the next 12 hours. “Bankfull” conditions are approximated by the 67% annual exceedance probability (AEP). AEPs were derived from a multi-decade reanalysis of the NWM (v2.0). Probabilities are computed as the % agreement across 7 “ensemble members”, in this case represented by the last 7 NWM (v2.1) short-range forecasts, that a given reach will be at or above bankfull at some point during the forecast period. A training video is available for this service.
Description
Depicts the potential for rapid onset flooding derived from the operational NWM (v2.1) short-range forecast. Shown are reaches (stream order 4 and below) with a forecast flow increase of 100% or greater in an hour, and which are expected to be at or above bankfull within 6 hours of that increase. Also shown are USGS HUC10 polygons symbolized by the percentage of NWM waterway length in each that are expected to meet the previously mentioned criteria. Bankfull flows were derived using a 25-year retrospective analysis of the NWM (v2.0).

Update Frequency
Hourly
**Methodology**

Shown are reaches that are expected to have a forecast flow increase of 100% or greater in an hour, and which are expected to be at above bankfull within 6 hours of that increase. “Bankfull” conditions are approximated by the 67% annual exceedance probability (AEP). AEPs were derived from a multi-decade reanalysis of the NWM (v2.0). Reaches are colored in two ways. One sublayer colors reaches by the time at which they are expected to reach “bankfull” conditions. Another sublayer colors reaches by the length of time between when the streamflow increases above bankfull and the streamflow decreases below bankfull. If the streamflow never decreases below bankfull within the forecast period, the length will be “ongoing”. HUC10s are also shown and colored based on the percentage of NWM waterway length within that HUC that meets the rapid onset flooding criteria.
Description
Depicts expected maximum inundation extent derived from the operational NWM (v2.1) short-range forecast. Inundation extents are derived using the Height Above the Nearest Drainage method; stage heights are interpolated from NWM (v2.1) discharges using synthetic rating curves, interpolated stage heights are rounded up to the nearest foot, and corresponding pre-computed inundation extent polygons are displayed. Maximum inundation extent is currently only available for the Texas/WGRFC, NERFC, MARFC, and SERFC regions.

Update Frequency
Hourly

Methodology
NWM streamflows are converted to stages using synthetic rating curves derived from reach-averaged channel properties. Reach-averaged channel properties are derived from 10-meter elevation data. Stages are then converted to inundation extents using a 10-meter relative elevation grid derived using the HAND method. “Bankfull” conditions are approximated by the 67% annual exceedance probability (AEP). AEPs were derived from a multi-decade reanalysis of the NWM (v2.0). For more information on HAND and synthetic rating curves, see the references listed in Appendix A. A training video is available for this service.
**Description**
Depicts expected accumulated precipitation totals over the next 18 hours derived from the HRRR forcing for the operational NWM (v2.1) short-range forecast. Data for each interval can be seen by using a filter to select the name of the desired layer.

**Update Frequency**
Hourly

**Methodology**
Hourly forecast precipitation from the NWM (v2.1) short-range forecast configuration is accumulated over future intervals: hour 1, hour 2, hour 3, hours 4-6, hours 7-9, hours 10-12, hours 13-15, hours 16-18, and hours 1-
18. NWM (v2.1) short-range forecast precipitation is derived from a HRRR/RAP blend.
**Description**
Depicts expected accumulated precipitation totals over the next 48 hours derived from the NAM-Nest with HIRESW WRF-ARW forcing for the operational NWM (v2.1) short-range forecast for Hawaii. Data for each interval can be seen by using a filter to select the name of the desired layer.

**Update Frequency**
Every 12 hours.

**Methodology**
Hourly forecast precipitation from the NWM (v2.1) short-range forecast configuration is accumulated over future intervals: hours 1-3, hours 4-6, hours 7-9, hours 10-12, hours 13-24, hours 25-48, and hours 1-48. NWM (v2.1) short-range forecast precipitation is derived from the NAM-Nest with HIRESW WRF-ARW blend.
**Description**

Depicts expected accumulated precipitation totals over the next 48 hours derived from the NAM-Nest with HIRESW WRF-ARW forcing for the operational NWM (v2.1) short-range forecast for Puerto Rico/Virgin Islands. Data for each interval can be seen by using a filter to select the name of the desired layer.

**Update Frequency**

Every 12 hours.

**Methodology**
Hourly forecast precipitation from the NWM (v2.1) short-range forecast configuration is accumulated over future intervals: hours 1-3, hours 4-6, hours 7-9, hours 10-12, hours 13-24, hours 25-48, and hours 1-48. NWM (v2.1) short-range forecast precipitation is derived from the NAM-Nest with HIRESW WRF-ARW blend.
NWM Short-Range Forecast Water Management (New)

Description
Depicts the source of reservoir forecasts from outputs of the operational NWM (v2.1) short-range forecast. Reservoirs can have forecasts obtained from 1 of 4 sources: Level-pool, USGS-Persistence, USACE-Persistence, or RFC forecasts. Sites that have USGS, USACE, or RFC forecasts use those in the NWM run when available; otherwise, the run will default to using the level-pool method.

Update Frequency
Hourly

Methodology
Hourly reservoir forecasts include a flag to denote 1 of 4 methods from which they were derived. When a site has a RFC-issued forecast or streamflow persisting from a USGS or USACE site available, the NWM will use those values as the output streamflow for the reservoir. Otherwise, it will default to the level-pool method. This service visualizes those flag values.
## Medium-Range Forecast

<table>
<thead>
<tr>
<th>Service</th>
<th>Description</th>
<th>Release Updates</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NWM 7-Day Average Low Flow Forecast</strong></td>
<td>Depicts expected low flow anomalies derived from the operational National Water Model (NWM) (v2.1) medium-range forecast.</td>
<td>• New</td>
</tr>
<tr>
<td><strong>NWM 10-Day Max High Flow Magnitude Forecast</strong></td>
<td>Depicts expected high flow magnitudes derived from the operational NWM (v2.1) medium-range forecast.</td>
<td>• None</td>
</tr>
<tr>
<td><strong>NWM 10-Day Bankfull Arrival Time Forecast</strong></td>
<td>Depicts expected bankfull arrival times derived from the operational NWM (v2.1) medium-range forecast.</td>
<td>• None</td>
</tr>
<tr>
<td><strong>NWM 10-Day Peak Flow Arrival Time Forecast</strong></td>
<td>Depicts expected peak flow arrival times derived from the operational NWM (v2.1) medium-range forecast.</td>
<td>• None</td>
</tr>
</tbody>
</table>
| **NWM 5-Day Bankfull Probability Forecast**  | Depicts bankfull probabilities derived from the operational NWM (v2.1) medium-range forecast. | • Adjusted the legend categories and colors.  
• Probabilities now represent the percent agreement between the 7 members of the NWM medium-range forecast. |
| NWM 10-Day Rapid Onset Flooding Forecast     | Depicts the potential for rapid onset flooding derived from the operational National Water Model (NWM) (v2.1) medium-range forecast. | • New                                     |
| **NWM 10-Day Snow Water Equivalent Change Forecast** | Depicts expected snow water equivalent changes over the next 1, 3, 5, 7, and 10 days derived from the operational NWM (v2.1) medium-range forecast. | • None                                    |
| **NWM 10-Day Max Inundation Extent Forecast** | Depicts expected maximum inundation extent derived from the operational NWM (v2.1) medium-range forecast. | • None                                    |

*Note: Inundation extent is only available to users on NWC Portal, and only available*
over the Texas/WGRFC, SERFC, MARFC and NERFC domains.

| **GFS 10-Day Accumulated Precipitation Forecast** | Depicts expected accumulated precipitation totals over the next 10 days derived from the GFS forcing for the operational NWM (v2.1) medium-range forecast. | ● None |
| **NWM Medium-Range Forecast Water Management** | Depicts the source of reservoir forecasts from outputs of the operational NWM (v2.1) medium-range forecast. | ● New |
**Description**
Depicts expected low flow anomalies derived from the operational National Water Model (NWM) (v2.1) medium-range forecast. Anomalies are based on 7-day average streamflow percentiles for each reach for the current calendar day. Streamflow percentiles were derived from 7-day streamflow averages for each reach for each calendar day using a 25-year retrospective analysis of the NWM (v2.0).

**Update Frequency**
Every 6 hours.

**Methodology**
Low flows are based on 7-day average streamflow percentiles for each reach for the current calendar day. For example, reaches shown in red, the Extreme (\(\leq 2\text{nd}\)) category, have a 7-day streamflow average below their 2nd streamflow percentile for this time of year. Streamflow percentiles were derived from 7-day streamflow averages for each reach for each calendar day using a 25-year retrospective analysis of the NWM (v2.0).
**NWM 10-Day Max High Flow Magnitude Forecast**

[Map Image]

**Description**
Depicts expected high flow magnitudes derived from the operational NWM (v2.1) medium-range forecast. Shown are reaches that are expected to have flow at or above bankfull over the next 3, 5, and 10 days. Reaches are colored by the annual exceedance probability (AEP) of their maximum forecast flow over the next 3, 5, and 10 days. Bankfull flows and AEPs were derived using a 25-year retrospective analysis of the NWM (v2.0).

**Update Frequency**
Every 6 hours.

**Methodology**
AEPs were derived from a multi-decade reanalysis of the NWM (v2.0). Maximum streamflow values over the forecast period are compared to these AEPs and classified accordingly. “Bankfull” conditions are approximated by the 67% AEP.
**Description**

Depicts expected bankfull arrival times derived from the operational NWM (v2.1) medium-range forecast. Shown are reaches that are expected to have flow at or above bankfull over the next 10 days. Reaches are colored by the time at which they are expected to reach bankfull. Bankfull flows were derived using a 25-year retrospective analysis of the NWM (v2.0).

**Update Frequency**

Every 6 hours.

**Methodology**
The arrival time is calculated by comparing the forecast streamflow for each lead time to the estimated “bankfull” condition. The time at which forecast streamflow first exceeds the “bankfull” condition is considered the arrival time. “Bankfull” conditions are approximated by the 67% annual exceedance probability (AEP). AEPs were derived from a multi-decade reanalysis of the NWM (v2.0).
**Description**
Depicts expected peak flow arrival times derived from the operational NWM (v2.1) medium-range forecast. Shown are reaches that are expected to have flow at or above bankfull over the next 10 days. Reaches are colored by the time at which they are expected to be at their maximum flow within the forecast period. Bankfull flows were derived using a 25-year retrospective analysis of the NWM (v2.0).

**Update Frequency**
Every 6 hours.

**Methodology**
Shown are reaches that are expected to have forecast streamflow at or above “bankfull” conditions within the next 10 days. “Bankfull” conditions are approximated by the 67% annual exceedance probability (AEP). AEPs were derived from a multi-decade reanalysis of the NWM (v2.0). Reaches are colored by the time at which they are expected to be at their maximum streamflow within the forecast period, even if it is not the first peak to occur.
**Description**
Depicts bankfull probabilities derived from the operational NWM (v2.1) medium-range forecast. Shown are reaches that are expected to have flow at or above bankfull on Day 1, Day 2, Day 3, and Days 4-5, using the 7 members of the NWM (v2.1) medium-range forecast. Reaches are colored by the probability that they will meet or exceed bankfull on Day 1, Day 2, Day 3, and Days 4-5. Probabilities are computed as the % agreement across the 7 ensemble members that a given reach will be at or above bankfull at some point during the time period of interest, based on the NWM (v2.1) medium-range forecast. Bankfull flows were derived using a 25-year retrospective analysis of the NWM (v2.0).

**Update Frequency**
Every 6 hours.

**Methodology**

Shown are reaches that are expected to have forecast streamflow at or above “bankfull” conditions on Day 1, Day 2, Day 3, and Days 4-5. “Bankfull” conditions are approximated by the 67% annual exceedance probability (AEP). AEPs were derived from a multi-decade reanalysis of the NWM (v2.0). Probabilities are computed for Day 1, Day 2, Day 3, and Days 4-5 valid time ranges from the latest NWM (v2.1) medium-range forecast reference time. For a particular reach, all forecast streamflow values from the 7 members of the latest NWM (v2.1) medium-range forecast for the valid time ranges of interest are obtained and considered of equal weight. From these values, the number of times a reach was forecast to be at or above “bankfull” during each of the valid time ranges is used to compute bankfull probabilities.
NWM 10-Day Rapid Onset Flooding Forecast

Description
Depicts the potential for rapid onset flooding derived from the operational NWM (v2.1) medium-range forecast. Shown are reaches (stream order 4 and below) with a forecast flow increase of 100% or greater in 3 hours, and which are expected to be at or above bankfull within 6 hours of that increase. Also shown are USGS HUC10 polygons symbolized by the percentage of NWM waterway length in each that are expected to meet the previously mentioned criteria. Bankfull flows were derived using a 25-year retrospective analysis of the NWM (v2.0).

Update Frequency
Every 6 hours.

Methodology
Shown are reaches that are expected to have a forecast flow increase of 100% or greater in 3 hours, and which are expected to be at above bankfull within 6 hours of that increase. “Bankfull” conditions are approximated by the 67% annual exceedance probability (AEP). AEPs were derived from a multi-decade reanalysis of the NWM (v2.0). Reaches are colored in two ways. One sublayer colors reaches by the time at which they are expected to reach “bankfull” conditions. Another sublayer colors reaches by the length of time between when the streamflow increases above bankfull and the streamflow decreases below bankfull. If the streamflow never decreases below bankfull within the forecast period, the length will be “ongoing”. HUC10s are also shown and colored based on the percentage of NWM waterway length within that HUC that meets the rapid onset flooding criteria.
**Description**
Depicts expected snow water equivalent changes over the next 1, 3, 5, 7, and 10 days derived from the operational NWM (v2.1) medium-range forecast. Data for each interval can be seen by using a filter to select the name of the desired layer.

**Update Frequency**
Every 6 hours.

**Methodology**
Compares current snow water equivalent values to snow water equivalent values from the 1, 3, 5, 7, and 10 day lead times of the medium-range forecast.
**NWM 10-Day Max Inundation Extent Forecast**

**Description**

Depicts expected maximum inundation extent derived from the operational NWM (v2.1) medium-range forecast. Shown are areas that are expected to be inundated sometime over the next 3, 5, and 10 days. Inundation extents are derived using the Height Above the Nearest Drainage method; stage heights are interpolated from NWM (v2.1) discharges using synthetic rating curves, interpolated stage heights are rounded up to the nearest foot, and corresponding pre-computed inundation extent polygons are displayed. Maximum inundation extent is currently only available for the Texas/WGRFC, NERFC, MARFC, and SERFC regions.

**Update Frequency**
Every 6 hours.

**Methodology**
NWM streamflows are converted to stages using synthetic rating curves derived from reach-averaged channel properties. Reach-averaged channel properties are derived from 10-meter elevation data. Stages are then converted to inundation extents using a 10-meter relative elevation grid derived using the HAND method. “Bankfull” conditions are approximated by the 67% annual exceedance probability (AEP). AEPs were derived from a multi-decade reanalysis of the NWM (v2.0). For more information on HAND and synthetic rating curves, see the references listed in Appendix A.
Description
Depicts expected accumulated precipitation totals over the next 10 days derived from the GFS forcing for the operational NWM (v2.1) medium-range forecast. Data for each interval can be seen by using a filter to select the name of the desired layer.

Update Frequency
Every 6 hours.

Methodology
Hourly forecast precipitation from the NWM (v2.1) medium-range forecast configuration is accumulated over future intervals: Hours 1-6, Hours 7-12, Hours 13-18, Hours 19-24, Day 1, Day 2, Day 3, Days 4-5, Days 6-7, Days
8-10, and Days 1-10. NWM (v2.1) medium-range forecast precipitation is derived from the GFS.
**Description**
Depicts the source of reservoir forecasts from outputs of the operational NWM (v2.1) medium-range forecast. Reservoirs can have forecasts obtained from 1 of 4 sources: Level-pool, USGS-Persistence, USACE-Persistence, or RFC forecasts. Sites that have USGS, USACE, or RFC forecasts use those in the NWM run when available; otherwise, the run will default to using the level-pool method.

**Update Frequency**
Every 6 hours.

**Methodology**
Medium-range reservoir forecasts include a flag to denote 1 of 4 methods from which they were derived. When a site has a RFC-issued forecast or streamflow persisting from a USGS or USACE site available, the NWM will use those values as the output streamflow for the reservoir. Otherwise, it will default to the level-pool method. This service visualizes the 1st ensemble member’s flag values.
Appendix A: HAND and Synthetic Rating Curve References

For more information on the Height Above the Nearest Drainage (HAND) method of inundation mapping and derivation of synthetic rating curves, please refer to the following publications:
