

# Guide to District Hydrologic Data

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An inventory of data types collected and maintained by the Hydrologic Data Section of the Data Collection Bureau, including availability, format, update frequency, data access, and contact information.



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## Introduction

The purpose of this document is to provide an inventory of current and legacy time series data types collected and maintained by the Hydrologic Data Section of the Data Collection Bureau (DCB) of the Southwest Florida Water Management District (SWFWMD or District). These data include rainfall, water level, discharge, and evaporation data. For general information about the Hydrologic Data Section and its activities, please review the Section Work Plan (<https://www.swfwmd.state.fl.us/resources/data-maps/hydrologic-data>). For water quality data products, please see resources offered by the Water Quality Section (<https://www.swfwmd.state.fl.us/resources/data-maps/water-quality-data>).

This document provides a description of each hydrologic data type, along with a summary of availability, format, data start and end date (approximate), update frequency, data access, special instructions for interpreting and using the data appropriately, and contact information. Additionally, information is provided about select counterpart datasets available from other agencies. Please note that the exact beginning and ending dates for each data type are approximate and may vary by station and parameter. General assistance with locating and obtaining hydrologic data is available by contacting [Data.Maps@WaterMatters.org](mailto:Data.Maps@WaterMatters.org).

This guide assumes that the user is familiar with the District's Environmental Data Portal (EDP) and its associated data retrieval apps. Briefly, the EDP allows users to view stations via a map interface, through which data also can be selected, displayed, and downloaded. Through EDP, users can search by station name or station ID (SID), as well as filter stations by resource type, station type, status, primary hydrostratigraphy for wells, project number, and parameter. A user's manual for EDP is available ([https://edp.swfwmd.state.fl.us/EDP\\_User\\_Guide.pdf](https://edp.swfwmd.state.fl.us/EDP_User_Guide.pdf)). Additionally, metadata and time series data can be obtained by using advanced search apps (available via the "Advanced Search" button in the top menu of the EDP), with options to search by station name (partial or full) or SID for one or more stations; for users that know the name or ID of stations of interest, the apps are faster for data retrieval compared to EDP. Finally, the appendices of this document contain information on obtaining data and metadata via API calls, which are useful for complex metadata queries and retrieving data via scripting. Users may request assistance with EDP or data access by contacting [Data.Maps@WaterMatters.org](mailto:Data.Maps@WaterMatters.org)

## Rainfall Data

### District rainfall gauge data

Available for download through EDP, rainfall gauge data are stored in 15-minute, hourly, daily, and event-based (rainfall amount was recorded when accumulation reached 0.10-inch, or at least every 12 hours if less) frequencies depending on the station and time period. Periods of record range from the 1960s to present, but much of the earliest data was collected by unknown sources, likely volunteer observers. Currently, approximately 170 stations are active, all instrumented with 15-minute recorders, which report on an hourly basis (near-real-time) through the District's near-real-time telemetry management software, LoggerNet. Stations that are not on the SCADA system are visited once per month and the data downloaded from the station recorder for subsequent upload to EDP. Update generally occurs hourly for stations on SCADA and monthly for download stations.

<b>General access:</b>	EDP; see also Time Series Data Retrieval app through EDP Advanced Search
<b>Date range:</b>	1962 – present (varies by station)
<b>Update frequency:</b>	Ongoing
<b>Internal availability:</b>	No restrictions
<b>External availability:</b>	Daily values through EDP; 15-minute data upon request (see email below)
<b>Special instructions:</b>	As noted above, some values are accumulations that can represent multi-day periods. Accumulated values are indicated by a quality code of 80 (see appendix).
<b>Contact for questions:</b>	<a href="mailto:Data.Maps@WaterMatters.org">Data.Maps@WaterMatters.org</a>

### District regional rainfall summaries

Available from the District's public website (see link below), area-weighted rainfall summaries are produced for several geographic regions (District planning regions, counties, and USGS primary drainage basins, for portions within SWFWMD). Summaries provide total monthly, calendar-year, water-year, wet-season, and dry-season rainfall by year from 1915 to present. The data are available as "tabbed" Excel file worksheets with each month's data from 1915-present on a separate "tab") and in a single worksheet (as a matrix of year-months with associated rainfall values). The methodology used to produce these summary values is available in the appendix of this document.

<b>General access:</b>	<a href="https://www.swfwmd.state.fl.us/resources/data-maps/rainfall-summary-data-region">https://www.swfwmd.state.fl.us/resources/data-maps/rainfall-summary-data-region</a>
<b>Date range:</b>	1915 – present
<b>Update frequency:</b>	Monthly
<b>Internal availability:</b>	No restrictions
<b>External availability:</b>	No restrictions
<b>Special instructions:</b>	None
<b>Contact for questions:</b>	<a href="mailto:Data.Maps@WaterMatters.org">Data.Maps@WaterMatters.org</a>

### NEXRAD radar rainfall estimates

Radar rainfall estimates are available in text format via FTP in 15-minute, hourly, daily, monthly, and annual aggregations for 17,450 2 km-by-2 km grid cells within the District plus a 30-mile landward buffer. A shapefile of the grid is available for visualizing and summarizing the data geospatially (see the "Geospatial Data and Maps" section later in this document). This data is generated by a vendor, contracted in cooperation with other water management districts. Rainfall

totals are calculating for each grid cell using information from the National Weather Service's NEXRAD radar, calibrated against rainfall gauge data. There are known issues with 2004 data due to problems with that year's radar.

**General access:** [ftp://ftp.swfwmd.state.fl.us/pub/radar\\_rainfall](ftp://ftp.swfwmd.state.fl.us/pub/radar_rainfall)  
Use *anonymous* as your username and your full e-mail address as password.

**Date range:** 1995 – present

**Update frequency:** Monthly

**Internal availability:** No restrictions; see also app through the EDP Advanced Search

**External availability:** No restrictions

**Special instructions:** FTP software is required to access this data from the FTP site (see "Access" above for login information). Select the desired aggregation level by folder name in main directory, then download compressed file(s) by year(s) within the aggregation subfolder. Due to processing and quality control and assurance, data availability typically lags by two months (e.g., January data becomes available in March).

**Contact for questions:** [Data.Maps@WaterMatters.org](mailto:Data.Maps@WaterMatters.org)

## NOAA/NWS and other rainfall gauge data

Daily rainfall totals are available for internal users for approximately 60 stations within and near the District boundaries, updated each month from National Weather Service (NWS) and National Atmospheric and Oceanic Administration (NOAA) Global Historical Climatology Network-Daily (GHCND) records. The National Centers for Environmental Information (formerly the National Climatic Data Center, NCDC) have additional data in various formats, levels of resolution, and for many more stations across the United States. Additionally, rainfall gauge data collected by other external agencies for select stations (many of them discontinued) is available for internal users.

**General access:** EDP; source agency

**Date range:** 1891 – present (varies by station)

**Update frequency:** Semi-annual

**Internal availability:** No restrictions; see also Time Series Data Retrieval app through EDP Advanced Search

**External availability:** <https://www.ncdc.noaa.gov/cdo-web/search?datasetid=GHCND>

**Special instructions:** None

**Contact for questions:** [Data.Maps@WaterMatters.org](mailto:Data.Maps@WaterMatters.org) (internal) or [ncei.orders@noaa.gov](mailto:ncei.orders@noaa.gov) (external)

## Consultant rainfall infill data

In collaboration with the South Florida Water Management District, the District retained INTERA to fill gaps in NWS rainfall records using geostatistical interpolation methods. There are two parameters for each NWS rainfall station included in the study: estimated daily rainfall and estimated daily rainfall error. These data can be used in conjunction with daily NWS rainfall values to form a temporally complete dataset. For more information, see the project report, "An Assessment of Interpolation Methods for Estimating Missing Daily Precipitation Records for Rain Gauges in Central and South Florida," available in the District's Technical Library or from Hydrologic Data Section staff (see email below).

**General access:** Available upon request (see email below)

**Date range:** 1901 – 2006 (varies by station)

**Update frequency:** Not updated

**Internal availability:** Available upon request (see email below)

**External availability:** Available upon request (see email below)  
**Special instructions:** These data can be used with NOAA daily rainfall data to infill missing values. For stations included in the study, the infill data are available in WIKSI via the “Eprecip” and “Error” time series.  
**Contact for questions:** [Data.Maps@WaterMatters.org](mailto:Data.Maps@WaterMatters.org)

### List of rainfall stations available in EDP

This link returns a table of rainfall gauge stations stored in EDP (for radar rainfall, see the FTP site), including active stations and inactive/closed stations. Use the EDP user interface or the EDP Advanced Search Time Series Data Retrieval app to see data availability and to obtain data. Note that the EDP for external users does not provide access to sub-daily resolutions or to data collected by external agencies; email [Data.Maps@WaterMatters.org](mailto:Data.Maps@WaterMatters.org) for assistance with obtaining sub-daily data (where available) or locating external agencies’ data. To select only active stations, add `Station_Status:Active;` to the end of the URL. To download the file as a CSV, add `&format=csv&csvdiv=,` to the end of the URL.

[https://edp.swfwmd.state.fl.us/KiWIS/KiWIS?datasource=1&service=kisters&type=queryServices&request=getStationList&returnfields=station\\_no,station\\_name,station\\_latitude,station\\_longitude,ca\\_sta&ca\\_sta\\_returnfields=County,Station\\_Characteristic,station\\_status,Station\\_Type,Instrumentation,Equipment\\_Owner&custattrfilter=Station\\_Type:Rainfall;](https://edp.swfwmd.state.fl.us/KiWIS/KiWIS?datasource=1&service=kisters&type=queryServices&request=getStationList&returnfields=station_no,station_name,station_latitude,station_longitude,ca_sta&ca_sta_returnfields=County,Station_Characteristic,station_status,Station_Type,Instrumentation,Equipment_Owner&custattrfilter=Station_Type:Rainfall;)

## Evapotranspiration and Other Atmospheric Data

### Air temperature and ET data

Atmospheric data are collected by the District on an hourly basis for two special-purpose stations, DV-1 Dover (SID 18298) and Saddle Creek at P-11 (SID 838153). Parameters available for these stations include air temperature, relative humidity, and evapotranspiration. Additionally, wind speed, wind direction, and solar radiation are available for SID 838153.

<b>Access:</b>	EDP; see also Time Series Data Retrieval app through EDP Advanced Search
<b>Date range:</b>	2010 – present (varies by parameter)
<b>Update frequency:</b>	Daily, for two stations noted above only
<b>Internal availability:</b>	No restrictions
<b>External availability:</b>	Daily values through EDP; hourly upon request
<b>Special instructions:</b>	Users may find atmospheric data for other stations using external sources such as NOAA ( <a href="https://www.ncdc.noaa.gov/cdo-web/search?datasetid=GHCND">https://www.ncdc.noaa.gov/cdo-web/search?datasetid=GHCND</a> ), FAWN ( <a href="https://fawn.ifas.ufl.edu/data">https://fawn.ifas.ufl.edu/data</a> ), the Florida Climate Center ( <a href="https://climatecenter.fsu.edu/products-services/data">https://climatecenter.fsu.edu/products-services/data</a> ), and the USGS ( <a href="https://waterdata.usgs.gov/nwis/inventory">https://waterdata.usgs.gov/nwis/inventory</a> ).
<b>Contact for questions:</b>	<a href="mailto:Data.Maps@WaterMatters.org">Data.Maps@WaterMatters.org</a>

### Grid-based ET estimates

Potential (PET) and reference (RET) evapotranspiration estimates are generated using solar radiation obtained from Geostationary Operational Environmental Satellites (GOES). The data are cooperatively funded by the District, produced by University of New Hampshire and University of Alabama-Huntsville researchers, and are distributed by the US Geological Survey. Data from 1995 to 2018 are provided in tab-delimited text format; beginning in 2019, data are provided in NetCDF format. The dataset also includes daily solar radiation (insolation in MJ/m<sup>2</sup>), minimum and maximum daily humidity (%), minimum and maximum daily temperatures, and daily wind speed (m/s).

<b>Access:</b>	<a href="https://www.usgs.gov/centers/cfwsc/science/reference-and-potential-evapotranspiration">https://www.usgs.gov/centers/cfwsc/science/reference-and-potential-evapotranspiration</a>
<b>Date range:</b>	1995 – 2020
<b>Update frequency:</b>	Ongoing (annual)
<b>Internal availability:</b>	USGS (see link above)
<b>External availability:</b>	USGS (see link above)
<b>Special instructions:</b>	Starting in 2019, data are provided in NetCDF format. Each year of data has its own quality code file, which should be downloaded and used to interpret the parameter values for each year. The complete project report (provided on the USGS webpage) provides detailed information about how the data were generated; please review prior to using the data.
<b>Contact for questions:</b>	<a href="mailto:jbellino@usgs.gov">jbellino@usgs.gov</a> or <a href="mailto:bshoemak@usgs.gov">bshoemak@usgs.gov</a>

### List of evapotranspiration and other atmospheric data stations available in EDP

This link returns a table of weather stations stored in EDP, including active stations and inactive/closed stations. Use the EDP user interface or the EDP Advanced Search Time Series Data Retrieval app to see data availability and to obtain data. Note that the EDP for external users does not provide access to sub-daily resolutions or to data collected by external agencies; email

[Data.Maps@WaterMatters.org](mailto:Data.Maps@WaterMatters.org) for assistance with obtaining sub-daily data (where available) or locating external agencies' data. To select only active stations, add `Station_Status:Active;` to the end of the URL. To download the file as a CSV, add `&format=csv&csvdiv=,` to the end of the URL.

[https://edp.swfwmd.state.fl.us/KiWIS/KiWIS?datasource=1&service=kisters&type=queryServices&request=getStationList&returnfields=station\\_no,station\\_name,station\\_latitude,station\\_longitude,ca\\_sta&ca\\_sta\\_returnfields=County,Station\\_Characteristic,station\\_status,Station\\_Type,Instrumentation,Equipment\\_Owner&custattrfilter=Station\\_Type:Weather%20Station;Station\\_Status:Active;](https://edp.swfwmd.state.fl.us/KiWIS/KiWIS?datasource=1&service=kisters&type=queryServices&request=getStationList&returnfields=station_no,station_name,station_latitude,station_longitude,ca_sta&ca_sta_returnfields=County,Station_Characteristic,station_status,Station_Type,Instrumentation,Equipment_Owner&custattrfilter=Station_Type:Weather%20Station;Station_Status:Active;)



## Surface-Water Level and Flow Data

### District surface-water level and flow (discharge) data

The District currently collects water levels at approximately 800 active surface-water stations. Water levels are available as elevation, which is reported as feet relative to the NAVD88 vertical datum. Additionally, the District reports elevations in feet relative to the NGVD29 vertical datum, by converting measured NAVD88 values. More information about the vertical elevation datum is available at <https://www.swfwmd.state.fl.us/resources/data-maps/vertical-datum-upgrade>.

<b>Access:</b>	EDP; see also Time Series Data Retrieval app through EDP Advanced Search
<b>Date range:</b>	c. 1962 – present (varies by station)
<b>Update frequency:</b>	Daily to monthly, depending on station
<b>Internal availability:</b>	No restrictions
<b>External availability:</b>	Daily (or less frequently) through EDP; hourly upon request
<b>Special instructions:</b>	Daily values are calculated means of top-of-the-hour readings on recorder stations. Hourly values (internal only) are top-of-the-hour values. All manual values are instantaneous, point-in-time readings. Some lakes have supplemental low-water (LWG) or high-water (HWG) gauges used when the main lake gauge is either out of water or submerged; data from these gauges are important to obtain the full range of water level measurements. See the “Water Level Data Structure” appendix of this document.
<b>Contact for questions:</b>	<a href="mailto:Data.Maps@WaterMatters.org">Data.Maps@WaterMatters.org</a>

### USGS surface-water data

The USGS is contracted by the District as part of an annual cooperative data collection program to collect water level and/or discharge data at approximately 150 surface-water stations. Water levels are available as gauge heights and/or elevations (feet NAVD29 and/or feet NAVD88), depending on station. Discharge data are available in cubic feet per second (cfs) only.

<b>Access:</b>	USGS; EDP
<b>Date range:</b>	1928 – present (District-sponsored data begins 1961)
<b>Update frequency:</b>	Daily to semi-annually, depending on station
<b>Internal availability:</b>	EDP; see also Time Series Data Retrieval app through EDP Advanced Search
<b>External availability:</b>	<a href="https://dashboard.waterdata.usgs.gov/app/nwd/?region=lower48&amp;aoi=state-fl">https://dashboard.waterdata.usgs.gov/app/nwd/?region=lower48&amp;aoi=state-fl</a>
<b>Special instructions:</b>	Values are daily mean values, unless otherwise noted in the parameter description.
<b>Contact for questions:</b>	<a href="mailto:Data.Maps@WaterMatters.org">Data.Maps@WaterMatters.org</a> (internal) or <a href="https://answers.usgs.gov">https://answers.usgs.gov</a> (external)

### List of surface-water data stations available in EDP

This link returns a table of surface-water stations stored in EDP, including active stations and inactive/closed stations. Use the EDP user interface or the EDP Advanced Search Time Series Data Retrieval app to see data availability and to obtain data. Note that the EDP for external users does not provide access to sub-daily resolutions or to data collected by external agencies; email [Data.Maps@WaterMatters.org](mailto:Data.Maps@WaterMatters.org) for assistance with obtaining sub-daily data (where available) or locating external agencies’ data. To select only active stations, add `Station_Status:Active`; to the end of the URL. To download the file as a CSV, add `&format=csv&csvdiv=,` to the end of the URL.

<https://edp.swfwmd.state.fl.us/KiWIS/KiWIS?datasource=1&service=kisters&type=queryServices&request=getStationList&returnfields=station no,station name,station latitude,station longitude,ca sta&ca sta returnfields=County,Station Characteristic,station status,Station Type,Instrumentation,Equipment Owner&cust attrfilter=Station Characteristic:Surface%20Water;>

## Groundwater Level Data

### District groundwater level data

The District has an extensive long-term groundwater monitoring network, collecting 15-minute (generally only for special/time-limited projects), hourly, daily, or monthly water levels at over 1,500 wells currently. Many of these wells are also sampled for water-quality data. Water levels are available as elevation, which is reported as feet relative to the NAVD88 vertical datum. Additionally, the District reports elevations in feet relative to the NGVD29 vertical datum, by converting measured NAVD88 values. More information about the vertical elevation datum is available at <https://www.swfwmd.state.fl.us/resources/data-maps/vertical-datum-upgrade>.

<b>Access:</b>	EDP; see also Time Series Data Retrieval app through EDP Advanced Search
<b>Date range:</b>	1962 – present (varies by station)
<b>Update frequency:</b>	Daily
<b>Internal availability:</b>	No restrictions
<b>External availability:</b>	Daily maximum values through EDP; hourly upon request (see email below)
<b>Special instructions:</b>	Daily values are calculated maxima of top-of-the-hour readings on recorder stations. Hourly values are top-of-the-hour values. All manual values are instantaneous, point-in-time readings.
<b>Contact for questions:</b>	<a href="mailto:Data.Maps@WaterMatters.org">Data.Maps@WaterMatters.org</a>

### USGS groundwater level data

The USGS is contracted by the District to collect continuous and monthly levels at approximately 15 ground-water stations through the District’s annual Cooperative Data-Collection Program. USGS data from program stations (and additional non-program stations, upon request) are loaded to EDP for the convenience of District users but are not available to the outside public through the District’s external EDP portal, at the request of the source agency. However, the data are available directly from the USGS. Some periodic or field measurements may not be available from EDP at this time; please contact the Hydrologic Data Section for more assistance on obtaining these data.

<b>Access:</b>	EDP; USGS
<b>Date range:</b>	1946 – present (varies by station)
<b>Update frequency:</b>	Daily
<b>Internal availability:</b>	EDP; in some cases, higher-frequency data may be available from USGS
<b>External availability:</b>	<a href="https://dashboard.waterdata.usgs.gov/app/nwd/?region=lower48&amp;aoi=state-fl">https://dashboard.waterdata.usgs.gov/app/nwd/?region=lower48&amp;aoi=state-fl</a>
<b>Special instructions:</b>	Values are daily maximum values, unless otherwise noted in the parameter description.
<b>Contact for questions:</b>	<a href="mailto:Data.Maps@WaterMatters.org">Data.Maps@WaterMatters.org</a> (internal) or <a href="https://answers.usgs.gov">https://answers.usgs.gov</a> (external)

### List of groundwater data stations available in EDP

This link returns a table of ground-water stations stored in EDP, including active stations and inactive/closed stations. Use the EDP user interface or the EDP Advanced Search Time Series Data Retrieval app to see data availability and to obtain data. Note that the EDP for external users does not provide access to sub-daily resolutions or to data collected by external agencies; email [Data.Maps@WaterMatters.org](mailto:Data.Maps@WaterMatters.org) for assistance with obtaining sub-daily data (where available) or locating external agencies’ data. To select only active stations, add `Station_Status:Active;` to the end of the URL. To download the file as a CSV, add `&format=csv&csvdiv=,` to the end of the URL.

[https://edp.swfwmd.state.fl.us/KiWIS/KiWIS?datasource=1&service=kisters&type=queryServices&request=getStationList&returnfields=station\\_no,station\\_name,station\\_latitude,station\\_longitude,ca\\_sta&ca\\_sta\\_returnfields=County,Station\\_Characteristic,station\\_status,Station\\_Type,Instrumentation,Equipment\\_Owner&custattrfilter=Station\\_Characteristic:Groundwater;](https://edp.swfwmd.state.fl.us/KiWIS/KiWIS?datasource=1&service=kisters&type=queryServices&request=getStationList&returnfields=station_no,station_name,station_latitude,station_longitude,ca_sta&ca_sta_returnfields=County,Station_Characteristic,station_status,Station_Type,Instrumentation,Equipment_Owner&custattrfilter=Station_Characteristic:Groundwater;)

## Reports and Web Content

The Hydrologic Data Section produces or contributes to several reports and map products on an ongoing basis. Some of the most widely used are listed here.

### Hydrologic Conditions Report

<b>Access:</b>	<a href="https://www.swfwmd.state.fl.us/resources/weather-hydrology/hydrologic-conditions-reports">https://www.swfwmd.state.fl.us/resources/weather-hydrology/hydrologic-conditions-reports</a> (see contact below for earlier print versions)
<b>Date range:</b>	2009 – present
<b>Update frequency:</b>	Monthly
<b>Internal availability:</b>	District website (see link above)
<b>External availability:</b>	District website (see link above)
<b>Special instructions:</b>	None
<b>Contact for questions:</b>	<a href="mailto:Data.Maps@WaterMatters.org">Data.Maps@WaterMatters.org</a>

### Aquifer Resource Index

These weekly updates, published by the District’s Public Affairs Bureau, are generated from data provided by the Hydrologic Data Section. Percentile rankings of current regional aquifer conditions with respect to historical conditions are presented for the District’s northern, central, and southern regions.

<b>Access:</b>	<a href="https://www.swfwmd.state.fl.us/about/newsroom">https://www.swfwmd.state.fl.us/about/newsroom</a>
<b>Date range:</b>	January 2005 – present
<b>Update frequency:</b>	Weekly
<b>Internal availability:</b>	District website (see link above)
<b>External availability:</b>	District website (see link above)
<b>Special instructions:</b>	None
<b>Contact for questions:</b>	<a href="mailto:Data.Maps@WaterMatters.org">Data.Maps@WaterMatters.org</a>

### Daily Hydrologic Conditions Report

A daily hydrologic conditions report, generated each morning, is shared on the District’s website. The report summarizes daily and month-to-date rainfall, USGS river flow, and surface-water elevations at key monitoring stations throughout the District. The rainfall and river flow webpages, available from the same link, show location maps and additional graphs for these data. The report covers the most recent data, but prior days’ reports may be available by contacting [Data.Maps@WaterMatters.org](mailto:Data.Maps@WaterMatters.org).

<b>Access:</b>	<a href="https://www.swfwmd.state.fl.us/resources/data-maps/daily-hydrologic-data">https://www.swfwmd.state.fl.us/resources/data-maps/daily-hydrologic-data</a>
<b>Date range:</b>	Current data only
<b>Update frequency:</b>	Daily
<b>Internal availability:</b>	District website (see link above)
<b>External availability:</b>	District website (see link above)
<b>Special instructions:</b>	None
<b>Contact for questions:</b>	<a href="mailto:Data.Maps@WaterMatters.org">Data.Maps@WaterMatters.org</a>

## Daily Structure Operations Report

The Daily Structure Operations Report is generated daily and provides a summary of gate status and water levels for select water control structures.

<b>Access:</b>	<a href="https://www.swfwmd.state.fl.us/projects/structure-operational-guidelines">https://www.swfwmd.state.fl.us/projects/structure-operational-guidelines</a>
<b>Date range:</b>	Current data only
<b>Update frequency:</b>	Daily
<b>Internal availability:</b>	District website (see link above)
<b>External availability:</b>	District website (see link above)
<b>Special instructions:</b>	None
<b>Contact for questions:</b>	<a href="mailto:Data.Maps@WaterMatters.org">Data.Maps@WaterMatters.org</a>

## Geospatial Data and Maps

Designed for use with GIS software, the Hydrologic Data Section maintains several geospatial data products for mapping and analyzing hydrologic data.

### Data collection station shapefiles

There are several shapefiles available showing the locations of resource monitoring stations throughout the District. These layers include all historical and current hydrologic, water-quality, and geohydrologic monitors, organized by station type (groundwater, surface water, atmospheric). Internal users also have access to a layer showing currently active stations (external users can filter collection shapefiles using the DCS\_SITE\_STATUS\_DESC metadata field in the shapefile to view only active stations).

<b>Access:</b>	SWFWMD Spatial Data Library (see link below)
<b>Date range:</b>	Current
<b>Update frequency:</b>	Ongoing
<b>Internal availability:</b>	For ArcMap, use the SWFWMD Feature Selector; for ArcGIS Pro, add from LayerFiles/Data_Collection folder
<b>External availability:</b>	<a href="https://data-swfwmd.opendata.arcgis.com/">https://data-swfwmd.opendata.arcgis.com/</a>
<b>Special instructions:</b>	External users will need to subset layer(s) based on value of DCS_STATION_STATUS_DESC to view stations by current data collection status.
<b>Contact for questions:</b>	<a href="mailto:Data.Maps@WaterMatters.org">Data.Maps@WaterMatters.org</a>

### Upper Floridan potentiometric surface maps

Interpretations of the potentiometric surface of the Upper Floridan aquifer in Florida are available in PDF and shapefile formats for various years, compiled and distributed by various source agencies, including SWFWMD, FDEP, and the USGS. PDF editions and SWFWMD shapefiles cover the areal extent of the SWFWMD. USGS and FDEP shapefiles cover the areal extent of Florida. Please visit all three source agencies' websites to select the best available data for your purposes.

<b>a. Source agency:</b>	SWFWMD, USGS, and FGS
<b>Access:</b>	Shapefiles and PDF (see links below)
<b>Date range:</b>	Predevelopment to present (varies by source agency)
<b>Update frequency:</b>	Annual
<b>Internal availability:</b>	For ArcMap, use the SWFWMD Feature Selector; for ArcGIS Pro, add from LayerFiles/Potentiometric_Surfaces_YYYYs folders
<b>External availability:</b>	a. Shapefiles: i. SWFWMD: <a href="https://data-swfwmd.opendata.arcgis.com/search?groupIds=da7085d62405427ca49321873adf87a6&amp;q=potentiometric&amp;sort=name">https://data-swfwmd.opendata.arcgis.com/search?groupIds=da7085d62405427ca49321873adf87a6&amp;q=potentiometric&amp;sort=name</a> ii. FDEP: <a href="https://geodata.dep.state.fl.us/datasets/FDEP::upper-floridan-aquifer-potentiometric-surface/about">https://geodata.dep.state.fl.us/datasets/FDEP::upper-floridan-aquifer-potentiometric-surface/about</a> iii. USGS: <a href="https://pubs.usgs.gov/ds/584/">https://pubs.usgs.gov/ds/584/</a> b. PDF maps: <a href="https://www.swfwmd.state.fl.us/sites/default/files/medias/documents/PotSurfMapBook.pdf">https://www.swfwmd.state.fl.us/sites/default/files/medias/documents/PotSurfMapBook.pdf</a> <a href="http://www.swfwmd.state.fl.us/data/gis/layer_library/category/potmaps">http://www.swfwmd.state.fl.us/data/gis/layer_library/category/potmaps</a>
<b>Special instructions:</b>	None
<b>Contact for questions:</b>	<a href="mailto:Data.Maps@WaterMatters.org">Data.Maps@WaterMatters.org</a> (SWFWMD), <a href="mailto:GIS.Librarian@dep.state.fl.us">GIS.Librarian@dep.state.fl.us</a> (FDEP), or <a href="mailto:dc_fl@usgs.gov">dc_fl@usgs.gov</a> (USGS)

## Gauge-adjusted NEXRAD radar rainfall shapefile

This shapefile contains 17,450 2 km–by–2 km grid cells (contiguous polygons) within the District plus 30 miles beyond the District interior boundary. Each cell has a unique PIXEL (cell number) that links the radar rainfall time series data to the shapefile features. The same shapefile is used to visualize both data sets in GIS.

<b>Access:</b>	a. Internal: For ArcMap, use the SWFWMD Feature Selector; for ArcGIS Pro, add from LayerFiles/Radar_Rainfall folder b. External: <a href="ftp://ftp.swfwmd.state.fl.us/pub/radar_rainfall/gisdata/">ftp://ftp.swfwmd.state.fl.us/pub/radar_rainfall/gisdata/</a> (use <i>anonymous</i> as your username and your full e-mail address as password)
<b>Date range:</b>	Current
<b>Update frequency:</b>	Not applicable
<b>Internal availability:</b>	No restrictions
<b>External availability:</b>	No restrictions
<b>Special instructions:</b>	FTP software is required to access this data from the FTP site (see “Access” above for login information). See the “Rainfall Data” section earlier in this document for information on time series data associated with this shapefile.
<b>Contact for questions:</b>	<a href="mailto:Data.Maps@WaterMatters.org">Data.Maps@WaterMatters.org</a>

(End of catalog)



## Appendix: Quality Codes

When downloading hydrologic time series data from EDP, quality codes provide information about the data, such as circumstances that affected data collection. Quality codes and associated meanings are shown in the table below. Quality codes can also be retrieved in JSON format (<https://edp.swfwmd.state.fl.us/KiWIS/KiWIS?datasource=1&service=kisters&type=queryServices&request=getQualityCodes>).

For additional information about quality codes, please email [Data.Maps@WaterMatters.org](mailto:Data.Maps@WaterMatters.org).

Quality Code	Description
1	Good Quality Data
2	Good Quality Edited Data
4	Irregular Time Rate Data
26	Good Daily Read Records
79	Fewer Than 24 Values in Daily Aggregate
80	Accumulated
83	Verification Value
95	Estimated
96	Override
97	Surveyed
99	Unverifiable
140	Data Unchecked
149	Trace*
153	Above Staff Gauge* ‡
154	Less Than* †
155	Greater Than* †
156	Below Gauge or Sensor* ‡
-1 or 255	Could Not Locate Site*
	Site Destroyed*
	Weeds Too High to Read Gauge*
	No Access to Site*
	Gauge Missing*
	Data Missing*
	Out of Service*
Missing/Presumed Zero*	

\*Data not used in aggregated time series †Used for wetlands and wells ‡Used for lakes

## **Appendix: Methodology for Calculation of Rainfall Summary Statistics**

To aid the management of water resources in the Southwest Florida Water Management District (District), a number of reports are produced at daily, weekly, monthly, and annual intervals that characterize present-day rainfall over the District in relation to historical rainfall amounts. District staff has drawn upon all of the available data to develop estimates of historical rainfall occurring within the counties encompassed by the District. For the period between 1915 and 1970, most rainfall data were from observer stations and data recorder stations, operated and/or maintained by the National Oceanic and Atmospheric Administration (NOAA). After 1970, the District also became active in its rainfall data collection efforts, greatly increasing the number of monitored rainfall stations within the 16-county region. The District's SCADA system for near-real-time electronic data collection also became an important tool for collecting rainfall data beginning in 1989. Thus, the number of rainfall stations used for the calculation of rainfall summary statistics between 1915 and 2000 varied greatly from year to year throughout the Start date, depending upon the number of available stations with complete data in a given year.

To estimate rainfall totals for the District's counties, data were screened to ensure that they were complete for each year of the Start date. Any years with fewer than 365 days of data were not included in the data set. Selected data were then used to construct Thiessen polygons, a method in which polygons are constructed around each rainfall station, such that the area within the polygon is closer to the central rainfall station than to any other rainfall station. Rainfall anywhere within the polygon area is assumed to be the same as the rainfall at the station central to the polygon. Using a geographical information system (GIS), the polygons were intersected with counties so that each county contained only the area of each polygon that fell within the basin. The sum of the polygon area and rainfall products for all of the polygons within the county, divided by the county total area, yielded an area-weighted estimate of rainfall within the county. Thiessen polygons were recalculated for each year based on the number of stations with complete data that were available. Thus, the final estimates of annual rainfall were always based upon the best available data for each subject year.

Since December 1999, the county rainfall totals have been calculated from data acquired from OneRain, Inc. (through October 2007) and Vieux, Inc. (from September 2007 to present). Digital rainfall data were acquired from the NEXRAD weather radar. By comparing these rainfall data with District supplied SCADA rainfall data, the radar data are calibrated to estimate rainfall amounts over the SWFWMD. Daily rainfall estimates derived from the calibrated radar data are provided to the District in a 2-kilometer square grid resolution. Each grid cell is then associated with a county, and the rainfall totals are calculated.

When the data from these two sources are combined, they provide a complete record for the period from 1915 to the present. These data are used primarily for comparisons, so the statistics used are typically the means, medians, interquartile ranges, period-of-record minima and maxima, and percentiles. Using the same methods described, rainfall totals and statistics are also calculated by USGS primary drainage basin, by District region, and by county boundary.

## Appendix: Water Level Data Structure

This appendix provides information to help users identify and obtain all available hydrologic data that may exist for a station within the Environmental Data Portal (EDP). For information about usage of the EDP, see the EDP user's manual ([https://edp.swfwmd.state.fl.us/EDP\\_User\\_Guide.pdf](https://edp.swfwmd.state.fl.us/EDP_User_Guide.pdf)). Users may request assistance with EDP or data access by contacting [Data.Maps@WaterMatters.org](mailto:Data.Maps@WaterMatters.org).

### Overview

Water level data in the EDP are organized by *data source*, *data frequency*, and *datum*, indicated in the time series name. After locating and clicking a station of interest in the EDP, you will see time series names for the water level (WL) parameter type, as shown in the example below.

Time Series Name	From	To
District Daily Mean NAVD 88	10/07/2002 12:00:00 AM	05/10/2022 12:00:00 AM
District Daily Mean NGVD 29	10/07/2002 12:00:00 AM	05/10/2022 12:00:00 AM

Accordingly, each water level time series is named by 1) collecting agency (e.g., District, USGS), 2) data collection frequency (e.g., Daily Mean), and 3) vertical datum (e.g., NGVD29, NAVD88, gauge height [GH]). Additionally, EDP will display the beginning and ending dates of data collection, but data may not be continuous between the starting and ending dates (i.e., there may be gaps) for any time series.

Any time series with a specific data frequency interval (i.e., daily, hourly, 15-minute) in its name is equidistant. An equidistant time series is one in which the difference between two consecutive timestamps is always equal. If data are not available for a timestamp, a null value is returned for that timestamp.

For any waterbody or site, the complete period-of-record dataset may be comprised of data of varying frequency (e.g., manual, daily, hourly, 15-minute) and data source (e.g., District, USGS). At some stations, District data collection frequency has changed with time; in these cases, internal users have access to an "All" time series that combines these time series. Additionally, at some stations, data was collected by the USGS during one or more periods and by the District at other periods, in which case, both USGS and District data should be downloaded to obtain the complete record (taking care to select the same vertical datum).

EDP only allows display and download of up to five time series for a single station at a time. For simultaneous download of multiple time series for one or more stations, the Advanced Time Series Data Retrieval app (available via the "Advanced Search" button in the top menu of the EDP) can be used, with options to search by station ID or name.

For external users, the EDP does not return sub-daily data or data collected by an agency other than the District; external users should contact [Data.Maps@WaterMatters.org](mailto:Data.Maps@WaterMatters.org) for assistance obtaining these data (where available).

## Source and Frequency

Water level data in the EDP fall within four main groups based on data frequency and data source.

First, District and USGS *manual data* measurements are collected from monitoring stations (for waterbodies that do not have recorders, representing the majority of waterbodies) and to verify recorder data (for waterbodies with recorders).

Second, District *high-frequency data* (15-minute or hourly values, depending on the station) are collected from recorders. For external users, the EDP does not return sub-daily (e.g., hourly) data; external users should contact [Data.Maps@WaterMatters.org](mailto:Data.Maps@WaterMatters.org) for assistance on obtaining these data, where available.

Third, District and USGS *daily summary data* are calculated from sub-daily (e.g., hourly) data; the calculation statistic depends on the data type. Specifically, groundwater data are always daily maxima. Surface water data are always daily means.

Fourth, water level data from *external agencies* exist for selected stations and should be used to create a complete dataset for the station and parameter. The District contracts with consultants to collect data in support of Hydrologic Data Section efforts, other District sections' efforts, and as part of some of the District's cooperatively-funded projects; these consultant-collected data are labeled as "WAR", "consultant" or a similar descriptor in the time series name. Additionally, the District imports some data collected by the Mosaic Company, Manatee County, Tampa Bay Water, and St. Johns Water Management District for selected stations, but these data are not subjected to District quality assurance and control procedures and are provided as-is. For external users, the EDP does not typically return data collected by an agency other than the District; external users should contact the source agency or [Data.Maps@WaterMatters.org](mailto:Data.Maps@WaterMatters.org) for assistance obtaining these data.

## Lakes with Multiple Stations

Some lakes have water level data split between several stations, which should be concatenated to create a complete dataset. To find all water level data available for a given lake, use mapping functions available in EDP or GIS to locate lake stations within and around the lake, or search by lake or site name (there may be one or more monitoring stations per site) to find all available stations and their periods of record.

A lake (or other waterbody) can have multiple stations for several reasons, including 1) when new stations *replace* discontinued stations, 2) when a waterbody needs *more detailed spatial monitoring* due to special conditions (such as having structural operations or multiple lobes that behave differently), or 3) when the waterbody regularly experiences a large range of fluctuation that necessitates a *low-water gauge* (LWG) for when the main staff gauge is stranded (on dry land) or *high-water gauge* (HWG) for when the main staff gauge is underwater.

Most lake water level stations are on private property, and development or changes in property ownership can necessitate removal of a station, at which point that station's record ends.

Usually, a replacement station is installed to resume the record, but in some cases, a suitable replacement location cannot be found, and the record ends.

EDP only allows display and download of up to five time series for a single station at a time. For simultaneous download of multiple time series for one or more stations, the Advanced Time Series Data Retrieval app (available via the “Advanced Search” button in the top menu of the EDP) can be used, with options to search by station ID or name.

## **Wetland Staff Gauges and Wells**

In addition to staff gauges, which measure the elevation of surface water in the wetland, many wetlands also have one or more surficial wells, which can be used to measure the elevation of the water table near the wetland. Surficial wells associated with wetlands will include “Wetland Surf” or “Upland Surf” in the station names. These wells help to characterize wetland subsurface hydrology and are especially valuable when dry readings occur at the staff gauge.

Note that older wetland staff gauge data at some wetlands may include subsurface water level readings, typically measured from hand-dug wells used to extend the range of the staff gauge below ground. These hand-dug wells often filled with debris over time, resulting in upward migration of data minima, sometimes followed by sudden drops in minima when wells were cleared of debris. These practices were discontinued by the early 2000s. Today, surface and subsurface water elevations are measured with different devices and reported in different time series, with all wells professionally installed. However, this history is important to know when comparing older (i.e., before the early 2000s) to modern staff gauge data at some wetlands, as the range of the older data may appear larger than the modern due the older “staff gauge” data including subsurface readings. For these wetlands, incorporating surficial well data (if available) into the water level time series will result in time series more comparable to the older data.

## **Dry and Inundated Readings**

Dry (i.e., when no water is present in the waterbody at the location of gauge or sensor) and inundated readings (i.e., when the surface of the water is above the gauge or sensor) are handled differently by waterbody type.

Dry readings will be marked as “Less than” (quality code 154) for wetlands and wells, while lakes will be marked as “Below gauge or sensor” (quality code 156), and the reported elevation will correspond to the lowest measurement available on the measuring device (e.g., bottom of well or staff gauge).

Inundated readings will be marked as “Greater than” (quality code 153) for wetlands and wells, while lakes will be marked as “Above staff gauge” (quality code 155), and the reported elevation will correspond to the highest measurement available on the measuring device (e.g., top of staff gauge or well measuring point).

When a value cannot be read from a staff gauge, staff may be able to survey a water level elevation, in which case these values will be marked as “Surveyed” (quality code 97).

## Vertical Datum (NAVD88 and NGVD29)

Water level data are reported as elevations with respect to the NAVD88 vertical datum (preferred due to increased accuracy) or the NGVD29 vertical datum.

For District time series, data are available in both NGVD29 *and* NAVD88 for the full period of record. *The NAVD88 dataset is significantly better* than the NGVD29 dataset. Large regions of the District had erroneous NGVD29 benchmarks used to establish station elevations at District (and USGS) monitoring stations, resulting in measured datum shifts (errors) at these stations of 1.5 to over 8 feet, which could not be corrected. By comparison, the District NAVD88 dataset is internally consistent and highly accurate for the full period of record (this includes NGVD29 data which was developed by converting NAVD88 into NGVD29).

USGS data are largely available in either NGVD29 or NAVD88, depending on date, although some USGS data are reported as gauge height (GH), which is the height of the water above a reference point. Where available, dates of first NAVD88 data vary for USGS time series. USGS data before the USGS' migration to NAVD88 for a station are only available in NGVD29 datum; after the migration, only NAVD88 data are available. The USGS does not plan to convert historical NGVD29 water level data into the NAVD88 datum. However, for USGS stations that were part of the District's cooperative data collection program, datum conversion values are available.

## Appendix: Accessing Data via API

In addition to the EDP and EDP Advanced Search apps, time series data and metadata can be retrieved using KiWIS API calls. API calls are useful for scripting, automation, and for refined control over queries.

This provides an overview and examples of common API calls for accessing the District's time series data and metadata. Note that URLs in this appendix refer to the server for external users. These URLs will also work for internal users, with the caveat that sub-daily time series resolutions will not be returned (contact [Data.Maps@WaterMatters.org](mailto:Data.Maps@WaterMatters.org) to request information on modifying the URLs for internal use).

Kisters' documentation on KiWIS API requests, including information on commands not covered in this appendix, can be found at the following link.

<https://edp.swfwmd.state.fl.us/KiWIS/KiWIS?datasource=1&service=kisters&type=queryServices&request=getrequestinfo>

For assistance with API calls, please email [Data.Maps@WaterMatters.org](mailto:Data.Maps@WaterMatters.org).

### File format and name

The example URLs throughout this appendix are set up to return data in CSV format with a default filename. The default filename depends on the request (tslist.csv for time series lists, tsvalues.csv for time series data, and stationlist.csv for metadata). The filename can be customized by adding `&downloadfilename=xyz` to the end of the URL, replacing `xyz` with your desired filename (do not include the file extension; this is determined by the `format` parameter). You can change the delimiter by replacing the comma in `&csvdiv=,` with another character. You can change the file format by removing `&csvdiv=,` and replacing `csv` in `&format=csv` with another file format. Supported formats include `ascii`, `csv`, `html` (default if `format` is not specified), and `xlsx` for most requests; see the Kisters documentation link above for a full list of formats supported for each request type.

To view data in the browser without downloading it, remove `&format=csv&csvdiv=,` from the example URL and paste the final URL in a browser address bar.

### Time series data

Downloading time series data using API calls requires querying time series paths for data of interest. An API call can be used to retrieve time series paths available for a station, including information on parameters (e.g., water levels) and period of record (examples 1 through 4). With the time series path, an API call can be used to download data, for the period of record (example 5) or a specified time period (example 6), as-is or aggregated (example 7).

Note that a station can have multiple time series paths, corresponding to different parameters, aggregations, and source agencies. For example, a station might have manual, hourly, daily (aggregated), and all (combined) District water level time series, with each time series available in units of NAVD88 or NGVD29, plus a USGS time series, for a total of nine time series at this hypothetical station.

## Retrieve available time series parameters and paths for specified stations (getTimeseriesList)

1. To retrieve time series paths for a single SID, replace **NNN** in this URL with the target SID.

```
https://edp.swfwmd.state.fl.us/KiWIS/KiWIS?datasource=1&service=kisters&type=queryServices
&request=getTimeseriesList&returnfields=station_no,station_name,ts_name,ts_path,parametert
ype_name,stationparameter_longname,ts_clientvalue1,coverage&station_no=NNN&format=csv
&csvdiv=,
```

2. To retrieve time series paths for multiple SIDs, use commas to separate SIDs. In the example URL below, **NNN, XXX, YYYY** would correspond to three different SIDs.

```
https://edp.swfwmd.state.fl.us/KiWIS/KiWIS?datasource=1&service=kisters&type=queryServices
&request=getTimeseriesList&returnfields=station_no,station_name,ts_name,ts_path,parametert
ype_name,stationparameter_longname,ts_clientvalue1,coverage&station_no=NNN,XXX,YYY&for
mat=csv&csvdiv=,
```

3. To retrieve time series paths searching by name, replace **NAME** in this URL with the target station name. The search is not case-sensitive. In the URL, the asterisks on either side of **NAME** are wildcard characters, so that the full station name is not required. Specifically, the wildcards allow a partial search (e.g., **\*alice\*** will return stations “Lake Alice Fldn” and “Lake Alice 2”, among others). Note that all space characters ( ) must be converted into HTML character codes (%20) for the call to work (e.g., a search value of “Lake Alice” must be sent as **Lake%20Alice**). Most browsers will automatically convert the spaces if the URL is pasted in the address bar, but when scripting, code should be included to convert spaces prior to the API call. Space characters can be avoided in some instances by using wildcard characters (e.g., using **\*alice\*** instead of **Lake%20Alice**).

```
https://edp.swfwmd.state.fl.us/KiWIS/KiWIS?datasource=1&service=kisters&type=queryServices
&request=getTimeseriesList&returnfields=station_no,station_name,ts_name,ts_path,parametert
ype_name,stationparameter_longname,ts_clientvalue1,coverage&station_name=*NAME*&met
adata=TRUE&md_returnfields=station_no,station_name &format=csv&csvdiv=,
```

4. Search by multiple names by separating names by commas, as in this example. See the previous example URL for advice on searching by name.

```
https://edp.swfwmd.state.fl.us/KiWIS/KiWIS?datasource=1&service=kisters&type=queryServices
&request=getTimeseriesList&returnfields=station_no,station_name,ts_name,ts_path,parametert
ype_name,stationparameter_longname,ts_clientvalue1,coverage&station_name=*NAME1*,*NA
ME2*,*NAME3*&metadata=TRUE&md_returnfields=station_no,station_name&format=csv&csv
div=,
```

## Retrieve time series data using time series paths (getTimeseriesValues)

5. To retrieve period-of-record data, replace **TSPATH** in this URL with the target station’s time series path. Note that **TSPATH** will have a format of **A/B/C/D**, where **A**, **B**, and **C** are integers, and **D** is a text string (**B** is the SID and **D** provides information about the parameter).

```
https://edp.swfwmd.state.fl.us/KiWIS/KiWIS?datasource=1&service=kisters&type=queryServices
&request=getTimeseriesValues&ts_path=TSPATH&returnfields=Timestamp,Value,Quality%20Co
```



de,Quality%20Code%20Description&period=complete&metadata=TRUE&md\_returnfields=station\_no,station\_name,ts\_clientvalue1,stationparameter\_longname&timezone=GMT-5&format=csv&csvdiv=,

6. To retrieve data from a specified time period, replace **TSPATH** in this URL with the target station's time series path, as well as **YYYY-MM-DD** with the desired start date and **YYYY-MM-DD** with the desired end date. If no end period is specified, today's date is used. If no period is specified, only the most recent value is returned.

[https://edp.swfwmd.state.fl.us/KiWIS/KiWIS?datasource=1&service=kisters&type=queryServices&request=getTimeseriesValues&ts\\_path=TSPATH&returnfields=Timestamp,Value,Quality%20Code,Quality%20Code%20Description&timezone=GMT-5&from=YYYY-MM-DD&to=YYYY-MM-DD&metadata=TRUE&md\\_returnfields=station\\_no,station\\_name,ts\\_clientvalue1,stationparameter\\_longname&format=csv&csvdiv=,](https://edp.swfwmd.state.fl.us/KiWIS/KiWIS?datasource=1&service=kisters&type=queryServices&request=getTimeseriesValues&ts_path=TSPATH&returnfields=Timestamp,Value,Quality%20Code,Quality%20Code%20Description&timezone=GMT-5&from=YYYY-MM-DD&to=YYYY-MM-DD&metadata=TRUE&md_returnfields=station_no,station_name,ts_clientvalue1,stationparameter_longname&format=csv&csvdiv=)

7. To retrieve an amount of data relative to today's date, replace **TSPATH** in this URL with the target station's time series path. Additionally, for the **period** parameter, replace **U** with the time unit desired (**Y** for year, **M** for month, and **D** for day) and **n** with the integer number of time units to count backwards from the start date, which defaults to the system date. If you wish to use a starting date other than today, add the **from** parameter (see example 6).

[https://edp.swfwmd.state.fl.us/KiWIS/KiWIS?datasource=1&service=kisters&type=queryServices&request=getTimeseriesValues&ts\\_path=TSPATH&returnfields=Timestamp,Value,Quality%20Code,Quality%20Code%20Description&period=PnU&metadata=TRUE&md\\_returnfields=station\\_no,station\\_name,ts\\_clientvalue1,stationparameter\\_longname&timezone=GMT-5&format=csv&csvdiv=,](https://edp.swfwmd.state.fl.us/KiWIS/KiWIS?datasource=1&service=kisters&type=queryServices&request=getTimeseriesValues&ts_path=TSPATH&returnfields=Timestamp,Value,Quality%20Code,Quality%20Code%20Description&period=PnU&metadata=TRUE&md_returnfields=station_no,station_name,ts_clientvalue1,stationparameter_longname&timezone=GMT-5&format=csv&csvdiv=)

8. To aggregate period-of-record data, replace **TSPATH** in this URL with the target station's time series path. Additionally, replace **interval** with one of *yearly*, *monthly*, *daily*, or *hourly* and **statistic** with one of *average*, *total*, *max*, *min*, or, for nonexceedance percentiles, *perc-#*, replacing # with the desired percentile. *The total aggregation statistic should only be used for rainfall; all other parameter types will result in erroneous values with the total aggregation.* Aggregation is performed on a calendar basis. More than one statistic can be requested by adding additional **%7Cstatistic** terms immediately after **interval**, but only a single **interval** value can be specified (note that **%7C** is the HTML code for the pipe character |, but the pipe character itself will result in errors; the tilde character ~ or its HTML code **o%7E** can be used instead of **%7C**). Note that while the server will attempt to aggregate to the specified interval, the aggregation is, of course, limited to the original resolution of the data (e.g., there is limited value in aggregated monthly manual data into hourly data). However, a convenient aspect of the aggregation function is that the time series will be returned at an equidistant step, with null values inserted for time steps for which data are not available. The **%7Ccounts** term in the URLs after the statistics terms returns a "Count" column that reports the number of values incorporated into each time step for the aggregation. When aggregating a time series to a finer resolution than its original resolution, the value will be null and the count zero for most rows. The time period requested can be modified by replacing **period=complete** (see examples 6 and 7); the aggregation will only apply to the specified period and will return no data if the period is insufficient to characterize the interval (for example, a yearly aggregation requested for a period of 100 days will return no data, but the same request for 500 days would return two values). Additional transformation functions, such

as moving averages, are available and can be found in Kisters' documentation (see the `queryServices` URL at the beginning of this appendix).

```
https://edp.swfwmd.state.fl.us/KiWIS/KiWIS?datasource=1&service=kisters&type=queryServices
&request=getTimeseriesValues&ts_path=TSPATH;aggregate(interval%7Cstatistic%7Ccounts)&ret
urnfields=Timestamp,Value,Quality%20Code,Quality%20Code%20Description&timezone=GMT-
5&metadata=TRUE&md_returnfields=station_no,station_name,ts_clientvalue1,stationparameter
_longname&period=complete&format=csv&csvdiv=,
```

9. For multiple time series paths, use commas to separate time series paths. Note that the different time series will be concatenated, separated by header values. The time period for the request can be modified by replacing `period=complete` (see examples 6 and 7). Each time series path can be aggregated individually by adding the `aggregate(interval%7Cstatistic%7Ccounts)` term (see example 8) after each time series path for which aggregation is desired; the time series are aggregated separately of one another.

```
https://edp.swfwmd.state.fl.us/KiWIS/KiWIS?datasource=1&service=kisters&type=queryServices
&request=getTimeseriesValues&ts_path=TSPATH,TSPATH2,TSPATH3&returnfields=Timestamp,V
alue&metadata=TRUE&md_returnfields=station_no,station_name,ts_clientvalue1,stationparam
eter_longname&timezone=GMT-5&period=complete&format=csv&csvdiv=,
```

## Metadata

Metadata API calls can be used to retrieve information about a specified station or to identify stations meeting certain criteria. Due to the high number of attributes possible, these calls can be very complex. Additionally, attributes are queried differently based on whether they belong to the "default" or "custom" attribute type. The "Metadata Attributes Table" appendix at the end of this document lists common metadata attributes that can be used in calls, along with their types (default or custom) and valid value examples. This section provides an overview of metadata API calls, including examples, so that users can craft custom API calls for metadata.

### General tips for metadata API calls (`getStationList`)

1. **Query order:** Conveniently, the order of query parameters does not matter. Query parameters provide the server with information about the type of data being requesting. They are appended to the root URL (`https://edp.swfwmd.state.fl.us/KiWIS/KiWIS?datasource=1`). The start of each parameter is signaled by `&`. For example, in the URLs provided below, rearranging so that `&service=kisters` came after `&type=queryServices` would not affect the call.
2. **Attribute types:** As seen in the "Metadata Attributes Table" appendix, metadata include default and custom attribute types, which are handled separately in API calls: both when returning attributes and when filtering by attributes. The appendix notes the attribute type, while the following sections will provide examples of how the two types are passed into calls.
3. **Empty metadata:** Not all stations have metadata available for all attribute fields, and all stations have some attributes that will return blank or null values. In the "Metadata Attributes Table" appendix, rows highlighted in green are only available for surface-water stations, while rows highlighted in blue are only available for groundwater stations. Attributes *can* be requested for a mismatched station, but a null value will be returned.

4. Invalid attributes: If an API call is set up to return a default attribute that does not exist, an error will be returned. If the call filters by a default attribute that does not exist, all records will be returned. If the call is set up to return a custom attribute that does not exist, the call will still complete successfully, but all values for that attribute will be not. If the call filters by a custom attribute that does not exist, no records will be returned.
5. Attribute field name casing: Some attribute field names are case sensitive, so best practice is to use the casing shown in the “Metadata Attributes Table” appendix. For example, if a call requests `county` (incorrect casing, per the appendix) instead of `County` (correct casing, per the appendix), a column of null values will be returned for `county`.
6. Attribute value casing and wildcard matching: Attribute values are not sensitive to case when used to filter stations in via API call. Flanking the search value with the asterisk wildcard character (\*) will return all stations that contain the substring (for the specified attribute) anywhere in the value. For example, searching for `*alice*` in `station_name` will return stations “Lake Alice” and “Lake Alice Fldn” (among others).
7. Space characters: Note that all space characters ( ) must be converted into HTML character codes (%20) for the call to work (e.g., a search value of “Lake Alice” must be sent as `Lake%20Alice`). Most browsers will automatically convert the spaces if the URL is pasted in the address bar, but when scripting, code should be included to convert spaces prior to the API call. Space characters can also be avoided in some instances by using wildcard characters (e.g., using `*alice*` instead of `Lake%20Alice`). Trailing and leading spaces are ignored.
8. Searching by multiple values and attributes: Default attributes support comparison against multiple search values via comma-separation, which returns any station that meets any search value (Boolean OR). Custom attributes only support comparison against a single value. When filtering using multiple attributes (e.g. `County` and `Station_Status`), only stations meeting ALL of the criteria to be returned (Boolean AND). Generally, due to the nature of the default attributes (which tend to identify specific stations), it is not useful to search using both default and custom attributes. It is, however, frequently useful to search by multiple custom attributes; see the last group of examples below.

### **Returning and filtering stations by default attributes (returnfields, station\_no, station\_name)**

The simplest metadata call only returns default attributes, filtered by a single default attribute. The `returnfields` parameter in the term indicates which default attributes are requested and is followed by a comma-separated list of the desired default attributes. Filtering by a default attribute is performed by querying the attribute, that is, by adding `&default_attribute=value` to the call, replacing `default_attribute` with the desired attribute (typically `station_no` or `station_name`) set equal to the desired value. Comparison against multiple values is possible by passing a comma-separated list of values, as shown in the examples. If no filter is included (or the value is left blank), all stations are returned. Here are examples of metadata API calls that use only default attributes.

#### Filtering by one SID, returning default attributes:

[https://edp.swfwmd.state.fl.us/KiWIS/KiWIS?datasource=1&service=kisters&type=queryServices&request=getStationList&returnfields=station\\_no,station\\_name,station\\_latitude,station\\_longitude&station\\_no=20524&format=csv&csvdiv=,](https://edp.swfwmd.state.fl.us/KiWIS/KiWIS?datasource=1&service=kisters&type=queryServices&request=getStationList&returnfields=station_no,station_name,station_latitude,station_longitude&station_no=20524&format=csv&csvdiv=)

Filtering by three SIDs, returning default attributes:

[https://edp.swfwmd.state.fl.us/KiWIS/KiWIS?datasource=1&service=kisters&type=queryServices&request=getStationList&returnfields=station\\_no,station\\_name,station\\_latitude,station\\_longitude&station\\_no=20524,20525,21203&format=csv&csvdiv=,](https://edp.swfwmd.state.fl.us/KiWIS/KiWIS?datasource=1&service=kisters&type=queryServices&request=getStationList&returnfields=station_no,station_name,station_latitude,station_longitude&station_no=20524,20525,21203&format=csv&csvdiv=)

Filtering by one station name (using wildcards) returning default attributes:

[https://edp.swfwmd.state.fl.us/KiWIS/KiWIS?datasource=1&service=kisters&type=queryServices&request=getStationList&returnfields=station\\_no,station\\_name,station\\_latitude,station\\_longitude&station\\_name=\\*alice\\*&format=csv&csvdiv=,](https://edp.swfwmd.state.fl.us/KiWIS/KiWIS?datasource=1&service=kisters&type=queryServices&request=getStationList&returnfields=station_no,station_name,station_latitude,station_longitude&station_name=*alice*&format=csv&csvdiv=)

Filtering by two station names (using wildcards) returning default attributes:

[https://edp.swfwmd.state.fl.us/KiWIS/KiWIS?datasource=1&service=kisters&type=queryServices&request=getStationList&returnfields=station\\_no,station\\_name,station\\_latitude,station\\_longitude&station\\_name=\\*alice\\*,\\*tarpon\\*&format=csv&csvdiv=,](https://edp.swfwmd.state.fl.us/KiWIS/KiWIS?datasource=1&service=kisters&type=queryServices&request=getStationList&returnfields=station_no,station_name,station_latitude,station_longitude&station_name=*alice*,*tarpon*&format=csv&csvdiv=)

### Returning custom attributes (ca\_sta and ca\_sta\_returnfields)

Metadata calls can be made more complex and versatile by including custom attributes. First, `ca_sta` must be requested in the `returnfields` parameter, which notifies the server that custom attributes should be returned. Then, to specify which custom attributes to return, the `ca_sta_returnfields` parameter is added. A single custom attribute can be requested, or multiple custom attributes can be requested by entering a comma-separated list, as shown in the following examples.

Returning custom attributes for a single station specified by SID:

[https://edp.swfwmd.state.fl.us/KiWIS/KiWIS?datasource=1&service=kisters&type=queryServices&request=getStationList&returnfields=station\\_no,station\\_name,station\\_latitude,station\\_longitude,ca\\_sta&ca\\_sta\\_returnfields=GW\\_Primary\\_Geology,GW\\_Total\\_Cased\\_Depth,GW\\_Total\\_Depth\\_Hole,GW\\_Primary\\_Casing\\_Diameter&station\\_no=19808&format=csv&csvdiv=,](https://edp.swfwmd.state.fl.us/KiWIS/KiWIS?datasource=1&service=kisters&type=queryServices&request=getStationList&returnfields=station_no,station_name,station_latitude,station_longitude,ca_sta&ca_sta_returnfields=GW_Primary_Geology,GW_Total_Cased_Depth,GW_Total_Depth_Hole,GW_Primary_Casing_Diameter&station_no=19808&format=csv&csvdiv=)

Returning custom attributes for three stations specified by SIDs:

[https://edp.swfwmd.state.fl.us/KiWIS/KiWIS?datasource=1&service=kisters&type=queryServices&request=getStationList&returnfields=station\\_no,station\\_name,station\\_latitude,station\\_longitude,ca\\_sta&ca\\_sta\\_returnfields=Station\\_Characteristic,Station\\_Type,station\\_status,County,station\\_elevation,Instrumentation&station\\_no=20524,20525,21203&format=csv&csvdiv=,](https://edp.swfwmd.state.fl.us/KiWIS/KiWIS?datasource=1&service=kisters&type=queryServices&request=getStationList&returnfields=station_no,station_name,station_latitude,station_longitude,ca_sta&ca_sta_returnfields=Station_Characteristic,Station_Type,station_status,County,station_elevation,Instrumentation&station_no=20524,20525,21203&format=csv&csvdiv=)

Returning custom attributes based on one search term for station name (using wildcards):

[https://edp.swfwmd.state.fl.us/KiWIS/KiWIS?datasource=1&service=kisters&type=queryServices&request=getStationList&returnfields=station\\_no,station\\_name,station\\_latitude,station\\_longitude,ca\\_sta&ca\\_sta\\_returnfields=County,MFL\\_Rule,Waterbody\\_Name,station\\_Characteristic,Station\\_Type,station\\_status,County,Guidance\\_Levels&station\\_name=\\*alice\\*&format=csv&csvdiv=,](https://edp.swfwmd.state.fl.us/KiWIS/KiWIS?datasource=1&service=kisters&type=queryServices&request=getStationList&returnfields=station_no,station_name,station_latitude,station_longitude,ca_sta&ca_sta_returnfields=County,MFL_Rule,Waterbody_Name,station_Characteristic,Station_Type,station_status,County,Guidance_Levels&station_name=*alice*&format=csv&csvdiv=)

Returning custom attributes based on two search terms for station name (using wildcards):

[https://edp.swfwmd.state.fl.us/KiWIS/KiWIS?datasource=1&service=kisters&type=queryServices&request=getStationList&returnfields=station\\_no,station\\_name,station\\_latitude,station\\_longitude,ca\\_sta&ca\\_sta\\_returnfields=Station\\_Characteristic,Station\\_Type,station\\_status,County,station\\_elevation,Instrumentation&station\\_name=\\*alice\\*,\\*tarpon\\*&format=csv&csvdiv=,](https://edp.swfwmd.state.fl.us/KiWIS/KiWIS?datasource=1&service=kisters&type=queryServices&request=getStationList&returnfields=station_no,station_name,station_latitude,station_longitude,ca_sta&ca_sta_returnfields=Station_Characteristic,Station_Type,station_status,County,station_elevation,Instrumentation&station_name=*alice*,*tarpon*&format=csv&csvdiv=)

### Filtering stations by custom attributes (custattrfilter)

Instead of using SID or station name to select stations of interest, stations can also be selected based on the values of custom attributes, such as finding stations where `County` is `Pasco`. To filter by custom

attribute, add the `custattrfilter` parameter. Each custom attribute is separated its single search value using a colon (:). Multiple custom attributes can be added to the filter via separation of custom attribute key-value pairs by semicolons (;). When filtering with multiple attributes, only stations meeting ALL of the criteria are returned. Note that attributes specified in `custattrfilter` do not have to be included in `ca_sta_returnfields`, and vice versa. Therefore, the `ca_sta` parameter could be omitted in calls that include the `ca_sta_returnfields` parameter, if desired. Wildcard characters ARE allowed in search values. Here are examples of metadata API calls that select stations based on one or more custom attributes.

Selecting stations based on one custom attribute (using wildcards):

```
https://edp.swfwmd.state.fl.us/KiWIS/KiWIS?datasource=1&service=kisters&type=queryServices&request=getStationList&returnfields=station_no,station_name,station_latitude,station_longitude,ca_sta&ca_sta_returnfields=Equipment_Owner,Station_Characteristic,Station_Type,station_status,County&custattrfilter=Equipment_Owner:*Geo*;&format=csv&csvdiv=,
```

Selecting stations based on one custom attribute:

```
https://edp.swfwmd.state.fl.us/KiWIS/KiWIS?datasource=1&service=kisters&type=queryServices&request=getStationList&returnfields=station_no,station_name,station_latitude,station_longitude,ca_sta&ca_sta_returnfields=GW_Primary_Geology,GW_Total_Cased_Depth,GW_Total_Depth_Hole,GW_Well_Condition,station_status,County&custattrfilter=GW_Primary_Geology:Arcadia%20Formation;&format=csv&csvdiv=,
```

Selecting stations based on two custom attributes:

```
https://edp.swfwmd.state.fl.us/KiWIS/KiWIS?datasource=1&service=kisters&type=queryServices&request=getStationList&returnfields=station_no,station_name,station_latitude,station_longitude,ca_sta&ca_sta_returnfields=GW_Primary_Geology,GW_Total_Cased_Depth,GW_Total_Depth_Hole,GW_Well_Condition,station_status,County&custattrfilter=GW_Primary_Geology:Arcadia%20Formation;County:Pasco;&format=csv&csvdiv=,
```

Selecting stations based on three custom attributes:

```
https://edp.swfwmd.state.fl.us/KiWIS/KiWIS?datasource=1&service=kisters&type=queryServices&request=getStationList&returnfields=station_no,station_name,station_latitude,station_longitude,ca_sta&ca_sta_returnfields=County,Station_Type,CFWI&custattrfilter=station_status:Active;Instrumentation:Near-real-time;Station_Characteristic:Atmospheric;&format=csv&csvdiv=,
```

Selecting stations based on four custom attributes:

```
https://edp.swfwmd.state.fl.us/KiWIS/KiWIS?datasource=1&service=kisters&type=queryServices&request=getStationList&returnfields=station_no,station_name,station_latitude,station_longitude,ca_sta&ca_sta_returnfields=County,Station_Type,CFWI&custattrfilter=station_status:Active;Instrumentation:Near-real-time;Station_Characteristic:Atmospheric;CFWI:yes;&format=csv&csvdiv=,
```

## Appendix: Metadata Attributes Table

These metadata fields can be queried in API calls (see the “Accessing Data via API” appendix). Not all stations have metadata available for all attribute fields. Rows highlighted in green are only available for surface-water stations, while rows highlighted in blue are only available for groundwater stations. (You can request these attributes for a mismatched station, but a null value will be returned.) In API calls, some attribute field names are case sensitive, so best practice is to use the casing shown below; however, attribute *values* are not sensitive to case when used to select stations, and wildcard symbols (\*) are supported in most filters.

For questions about metadata, please email [Data.Maps@WaterMatters.org](mailto:Data.Maps@WaterMatters.org).

KiWIS API Call Term (Field Name)	Type	Example Valid Values
site_no	default	integer of station ID (e.g., 19874)
site_name	default	text string (e.g., Lake Alice)
station_latitude	default	numeric, in decimal degrees (e.g., -82.60533)
station_longitude	default	numeric, in decimal degrees (e.g., 28.13639)
Station_Characteristic	custom	Atmospheric, Groundwater, Surface Water
Station_Type	custom	Bay/Harbor, Borrow Pit, Canal, Estuary, Lake, Lake Inflow, Lake Outflow, Mine/Mine Discharge, Ocean, Pond, Rainfall, Reservoir, Retention Pond, River/Stream, Sinkhole, Spring at Vent, Spring not in Vent, Storm Sewer, Surface Water Facility, Weather Station, Well, Wetland
station_status	custom	Active, Closed, General, Inactive, Planned, Under construction, Unknown
County	custom	Alachua, Charlotte, Citrus, Collier, DeSoto, Dixie, Gilchrist, Glades, Hardee, Hendry, Hernando, Highlands, Hillsborough, Lake, Lee, Levy, Manatee, Marion, Okeechobee, Orange, Osceola, Pasco, Pinellas, Polk, Putnam, Sarasota, Seminole, Sumter
station_elevation	custom	numeric, in feet NAVD88 (e.g. 35.55)
Instrumentation	custom	Continuous Recorder, Flowmeter, Near-real-time, Staff Gauge, Tape, Unknown
Equipment_Owner	custom	Southwest Florida Water Management District, Contractor, US Geological Survey
FDEP_ID	custom	integer (e.g. 280753082361601)
FGS_ID	custom	integer (e.g., W-12640)
USGS_ID_Number	custom	integer (e.g., 02307328)
USGS_Station_Name	custom	text string (e.g., LAKE ALICE NEAR ODESSA FL)
region_township	custom	Heartland Planning Region, Northern Planning Region, Southern Planning Region, Tampa Bay Planning Region

MFL_Rule	custom	yes, no
Guidance_Levels	custom	yes, no
DMIT	custom	yes, no
CFWI	custom	yes, no
GARR_Cell_ID	custom	integer, of radar rainfall pixel ID (e.g., 102690)
Datum_Shift_Value	custom	numeric, in feet; added to NGVD29 to convert to NAVD88 equivalent elevation (e.g., -0.84)
Gauge_Datum_Description	custom	Direct-Reading, Gauge Add-On, Unknown
Waterbody_Name	custom	text string (e.g., Lake Alice)
GW_Datum_Shift_Value	custom	numeric, in feet; added to NGVD29 to convert to NAVD88 equivalent elevation (e.g., -0.84)
GW_Measuring_Point_Elevation_NAVD88	custom	numeric, in feet NAVD88 (e.g., 49.07)
GW_Primary_Casing_Bottom	custom	numeric, in feet below land surface (e.g., 94.0)
GW_Total_Cased_Depth	custom	numeric, in feet below land surface (e.g., 94.0)
GW_Total_Depth_Hole	custom	numeric, in feet below land surface (e.g., 137.0)
GW_Primary_Casing_Diameter	custom	numeric, in inches (e.g., 6)
GW_Primary_Casing_Material	custom	ABS, Fiberglass, Fiberglass Plastic, Galvanized Iron, Other Material, PVC Glued, PVC or Plastic, PVC Threaded, Stainless Steel, Steel, Steel-Galvanized, Steel Carbon, Unknown, Wrought Iron
GW_Primary_Geology	custom	Arcadia Formation, Avon Park Formation, Caloosahatchee Formation, Cedar Keys Formation, Cypresshead Formation, Hawthorn Group, Nocatee Member, Ocala Limestone, Oldsmar Formation, Peace River Formation, Suwannee Limestone, Tamiami Formation, Tampa Member, Undifferentiated sand and clay, Undifferentiated sand clay and shells, Unknown
GW_Primary_Hydrogeology	custom	Avon Park high-permeability zone, Confining unit, Floridan aquifer system, Hawthorn aquifer system (former Intermediate), Lower Arcadia aquifer (former zone 3), Lower Floridan aquifer below middle confining unit I, Lower Floridan aquifer below middle confining unit II, Lower Floridan aquifer below middle confining unit VIII, Middle confining unit II, Ocala low-permeability zone, Peace River aquifer (former zone 1), Surficial aquifer, Unknown, Upper Arcadia aquifer (former zone 2), Upper Floridan aquifer

GW_Secondary_Hydrogeology	custom	Avon Park high-permeability zone, Hawthorn aquifer system (former Intermediate), Lower Arcadia aquifer (former zone 3), Lower Floridan aquifer below middle confining unit II, Lower Floridan aquifer below middle confining unit VIII, Middle confining unit I, Middle confining unit II, Ocala low-permeability zone, Unknown, Upper Arcadia aquifer (former zone 2), Upper Floridan aquifer
GW_Spring_Name	custom	Buckhorn Spring, Catfish Spring, Chassahowitzka Springs, Dobes Hole, Golfview Boathouse Spring, Health Spring, House Spring, Hudson Spring, Hunters Spring, Otter Creek Spring, Ruth Spring, Ryle Creek Spring, Salt Spring (Hernando), Salt Spring (Pasco), Tarpon Hole, Trotter Spring, Weeki Wachee Springs, Wilderness Spring, Wilson Spring
GW_Well_Condition	custom	Abandoned, Capped, Destroyed, Functional, Inactive, Plugged, Unknown
GW_Well_Construction_Permit1	custom	integer (e.g., 667289)
GW_Well_Construction_Permit2	custom	integer (e.g., 435472)
GW_Well_Construction_Permit3	custom	Integer (e.g., 736997)
GW_Well_WCP_Type1	custom	Backplugged, Domestic, Domestic (new construction), Industrial, Irrigation, Irrigation - agricultural, Irrigation - landscape, Irrigation - recreation area, Irrigation commercial, Livestock, Monitor, Monitor (or piezometer), Plugged, Plugging, Public supply, Public supply - community or non-community/DEP, Public water supply, Remediation - air sparging, Remediation - recovery, Repair irrigation, Repair or deepen (use not specified), Test
GW_Well_WCP_Type2	custom	Backplugged, Monitor, Plugged, Plugging, Repair Domestic, Repair irrigation, Repair or deepen (use not specified)
GW_Well_WCP_Type3	custom	Monitor, Plugged, Repair irrigation
GW_Well_Finish	custom	Open End, Open Hole, Perforated or Slotted, Sand Point, Sand/Gravel Pack w/Screen, Screen, Unknown
GW_Well_Screen_Material	custom	ABS, Brass or Bronze, Not Applicable, PVC, PVC Glued, PVC Threaded, Stainless Steel, Steel, Steel-Galvanized, Unknown
GW_Well_Type	custom	Agricultural supply well, Aquifer test, Corehole, Exploratory, Industrial supply well, Irrigation well, Monitor, Other well, Private drinking water well, Public drinking water well, Recharge well, Unknown