Package 'dataRetrieval'

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Type Package

Title Retrieval Functions for USGS and EPA Hydrologic and Water
Quality Data

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Description Collection of functions to help retrieve U.S. Geological Survey
(USGS) and U.S. Environmental Protection Agency (EPA) water quality and
hydrology data from web services. USGS web services are discovered from
National Water Information System (NWIS) tools. Both EPA and USGS water
quality data are obtained from the Water Quality Portal <https://www.waterqualitydata.us/>.

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materials that originally came from the United States
Geological Survey, an agency of the United States Department of
Interior.

Depends R (>= 3.0)

Imports httr (>= 1.0.0), curl, reshape2, lubridate (>= 1.5.0), stats,
utils, dplyr, xml2, readr (>= 1.0.0)

Suggests xtable, knitr, testthat

VignetteBuilder knitr

BuildVignettes true

BugReports https://github.com/USGS-R/dataRetrieval/issues

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NeedsCompilation no

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R **topics documented:**

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dataRetrieval-package   *Retrieval functions for USGS and EPA data*

Description

Package:	dataRetrieval
Type:	Package
License:	Unlimited for this package, dependencies have more restrictive licensing.
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LazyLoad:	yes

Details

Retrieval functions for USGS and EPA hydrologic and water quality data.

Please see <http://pubs.usgs.gov/tm/04/a10/> for more information.

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constructNWISURL   *Construct NWIS url for data retrieval*

Description

Imports data from NWIS web service. This function gets the data from here: http://nwis.waterdata.usgs.gov/nwis/qwdata A list of parameter codes can be found here: http://nwis.waterdata.usgs.gov/nwis/pmcodes/ A list of statistic codes can be found here: http://nwis.waterdata.usgs.gov/nwis/help/?read_file=stat&format=table

Usage

```
constructNWISURL(siteNumber, parameterCd = "00060", startDate = "",
  endDate = "", service, statCd = "00003", format = "xml",
  expanded = TRUE, ratingType = "base", statReportType = "daily",
  statType = "mean")
```

Arguments

siteNumber	string or vector of strings USGS site number. This is usually an 8 digit number
parameterCd	string or vector of USGS parameter code. This is usually an 5 digit number.
startDate	character starting date for data retrieval in the form YYYY-MM-DD. Default is "" which indicates retrieval for the earliest possible record.
endDate	character ending date for data retrieval in the form YYYY-MM-DD. Default is "" which indicates retrieval for the latest possible record.
service	string USGS service to call. Possible values are "dv" (daily values), "uv" (unit/instantaneous values), "qw" (water quality data), "gwlevels" (groundwater),and "rating" (rating curve), "peak", "meas" (discrete streamflow measurements), "stat" (statistics web service BETA).
statCd	string or vector USGS statistic code only used for daily value service. This is usually 5 digits. Daily mean (00003) is the default.
format	string, can be "tsv" or "xml", and is only applicable for daily and unit value requests. "tsv" returns results faster, but there is a possiblitiy that an incomplete file is returned without warning. XML is slower, but will offer a warning if the file was incomplete (for example, if there was a momentary problem with the internet connection). It is possible to safely use the "tsv" option, but the user must carefully check the results to see if the data returns matches what is expected. The default is therefore "xml".
expanded	logical defaults to TRUE. If TRUE, retrieves additional information, only applicable for qw data.
ratingType	can be "base", "corr", or "exsa". Only applies to rating curve data.
statReportType	character Only used for statistics service requests. Time division for statistics: daily, monthly, or annual. Default is daily. Note that daily provides statistics for each calendar day over the specified range of water years, i.e. no more than 366 data points will be returned for each site/parameter. Use readNWISdata or readNWISdv for daily averages. Also note that 'annual' returns statistics for the calendar year. Use readNWISdata for water years. Monthly and yearly provide statistics for each month and year within the range individually.
statType	character Only used for statistics service requests. Type(s) of statistics to output for daily values. Default is mean, which is the only option for monthly and yearly report types. See the statistics service documentation at http://waterservices.usgs.gov/rest/Statistics-Service.html#statType for a full list of codes.

Value

url string

Examples

```
siteNumber <- '01594440'
startDate <- '1985-01-01'
endDate <- ''
pCode <- c("00060","00010")
```

```
url_daily <- constructNWISURL(siteNumber,pCode,
          startDate,endDate,'dv',statCd=c("00003","00001"))
url_unit <- constructNWISURL(siteNumber,pCode,"2012-06-28","2012-06-30",'iv')

url_qw_single <- constructNWISURL(siteNumber,"01075",startDate,endDate,'qw')
url_qw <- constructNWISURL(siteNumber,c('01075','00029','00453'),
          startDate,endDate,'qw')
url_daily_tsv <- constructNWISURL(siteNumber,pCode,startDate,endDate,'dv',
          statCd=c("00003","00001"),format="tsv")
url_rating <- constructNWISURL(siteNumber,service="rating",ratingType="base")
url_peak <- constructNWISURL(siteNumber, service="peak")
url_meas <- constructNWISURL(siteNumber, service="meas")
urlQW <- constructNWISURL("450456092225801","70300",startDate="",endDate="","qw",expanded=TRUE)
```

---

constructUseURL   *Construct URL for NWIS water use data service*

Description

Reconstructs URLs to retrieve data from here: <http://waterdata.usgs.gov/nwis/wu>

Usage

```
constructUseURL(years, stateCd, countyCd, categories)
```

Arguments

years	integer Years for data retrieval. Must be years ending in 0 or 5, or "ALL", which retrieves all available years.
stateCd	could be character (full name, abbreviation, id), or numeric (id)
countyCd	could be numeric (County IDs from countyCdLookup) or character ("ALL")
categories	character Two-letter cateogory abbreviation(s)

Value

url string

Examples

```
url <- constructUseURL(years=c(1990,1995),stateCd="Ohio",countyCd = c(1,3), categories = "ALL")
```

---

constructWQPURL *Construct WQP url for data retrieval*

Description

Imports data from WQP web service. This function gets the data from here: [http://nwis. waterdata.usgs.gov/nwis/qwdata](http://nwis.waterdata.usgs.gov/nwis/qwdata) A list of parameter codes can be found here: [http://nwis. waterdata.usgs.gov/nwis/pmcodes/](http://nwis.waterdata.usgs.gov/nwis/pmcodes/) A list of statistic codes can be found here: [http://nwis. waterdata.usgs.gov/nwis/help/?read_file=stat&format=table](http://nwis.waterdata.usgs.gov/nwis/help/?read_file=stat&format=table)

Usage

```
constructWQPURL(siteNumber, parameterCd, startDate, endDate, zip = FALSE)
```

Arguments

siteNumber	string or vector of strings USGS site number. This is usually an 8 digit number
parameterCd	string or vector of USGS parameter code. This is usually an 5 digit number.
startDate	character starting date for data retrieval in the form YYYY-MM-DD. Default is "" which indicates retrieval for the earliest possible record.
endDate	character ending date for data retrieval in the form YYYY-MM-DD. Default is "" which indicates retrieval for the latest possible record.
zip	logical to request data via downloading zip file. Default set to FALSE.

Value

url string

Examples

```
siteNumber <- '01594440'
startDate <- '1985-01-01'
endDate <- ''
pCode <- c("00060","00010")
url_wqp <- constructWQPURL(paste("USGS",siteNumber,sep="-"),
          c('01075','00029','00453'),
          startDate,endDate)
```

---

countyCd   *US County Code Lookup Table*

Description

Data pulled from http://www2.census.gov/geo/docs/reference/codes/files/national_county.txt on April 1, 2015.

Value

countyCd data frame.

Name	Type	Description
STUSAB	character	State abbreviation
STATE	character	two-digit ANSI code
COUNTY	character	three-digit county code
COUNTY_NAME	character	County full name
COUNTY_ID	character	County id

Examples

```
head(countyCd)
```

---

countyCdLookup   *County code look up*

Description

Function to simplify finding county and county code definitions. Used in `readNWISdata` and `readNWISuse`.

Usage

```
countyCdLookup(state, county, outputType = "id")
```

Arguments

state	could be character (full name, abbreviation, id), or numeric (id)
county	could be character (name, with or without "County") or numeric (id)
outputType	character can be "fullName","tableIndex", "id", or "fullEntry".

Examples

```
id <- countyCdLookup(state = "WI", county = "Dane")
name <- countyCdLookup(state = "OH", county = 13, output = "fullName")
index <- countyCdLookup(state = "Pennsylvania", county = "ALLEGHENY COUNTY", output = "tableIndex")
fromIDs <- countyCdLookup(state = 13, county = 5, output = "fullName")
```

---

getQuerySummary   *getting header information from a WQP query*

Description

getting header information from a WQP query

Usage

```
getQuerySummary(url)
```

Arguments

url   the query url

---

getWebServiceData   *Function to return data from web services*

Description

This function accepts a url parameter, and returns the raw data. The function enhances GET with more informative error messages.

Usage

```
getWebServiceData(obs_url, ...)
```

Arguments

obs_url   character containing the url for the retrieval

...   information to pass to header request

Value

raw data from web services

Examples

```
siteNumber <- "02177000"
startDate <- "2012-09-01"
endDate <- "2012-10-01"
offering <- '00003'
property <- '00060'
obs_url <- constructNWISURL(siteNumber,property,startDate,endDate,'dv')
## Not run:
rawData <- getWebServiceData(obs_url)

## End(Not run)
```

---

importRDB1   *Function to return data from the NWIS RDB 1.0 format*

Description

This function accepts a url parameter that already contains the desired NWIS site, parameter code, statistic, startdate and enddate. It is not recommended to use the RDB format for importing multi-site data.

Usage

```
importRDB1(obs_url, asDateTime = TRUE, convertType = TRUE, tz = "")
```

Arguments

obs_url	character containing the url for the retrieval or a file path to the data file.
asDateTime	logical, if TRUE returns date and time as POSIXct, if FALSE, Date
convertType	logical, defaults to TRUE. If TRUE, the function will convert the data to dates, datetimes, numerics based on a standard algorithm. If false, everything is returned as a character
tz	character to set timezone attribute of datetime. Default is an empty quote, which converts the datetimes to UTC (properly accounting for daylight savings times based on the data's provided tz_cd column). Possible values to provide are "America/New_York","America/Chicago", "America/Denver","America/Los_Angeles", "America/Anchorage","America/Honolulu","America/Jamaica","America/Managua","America/Phoenix", and "America/Metlakatla"

Value

A data frame with the following columns:

Name	Type	Description
agency_cd	character	The NWIS code for the agency reporting the data
site_no	character	The USGS site number
datetime	POSIXct	The date and time of the value converted to UTC (if asDateTime = TRUE

	character	or raw character string (if asDateTime = FALSE)
tz_cd	character	The time zone code for datetime
code	character	Any codes that qualify the corresponding value
value	numeric	The numeric value for the parameter
tz_cd_reported	The originally reported time zone	

Note that code and value are repeated for the parameters requested. The names are of the form XD_P_S, where X is literal, D is an option description of the parameter, P is the parameter code, and S is the statistic code (if applicable). If a date/time (dt) column contained incomplete date and times, a new column of dates and time was inserted. This could happen when older data was reported as dates, and newer data was reported as a date/time.

There are also several useful attributes attached to the data frame:

Name	Type	Description
url	character	The url used to generate the data
queryTime	POSIXct	The time the data was returned
comment	character	Header comments from the RDB file

Examples

```
siteNumber <- "02177000"
startDate <- "2012-09-01"
endDate <- "2012-10-01"
offering <- "00003"
property <- "00060"

obs_url <- constructNWISURL(siteNumber,property,
        startDate,endDate,"dv",format="tsv")
## Not run:
data <- importRDB1(obs_url)

urlMultiPcodes <- constructNWISURL("04085427",c("00060","00010"),
        startDate,endDate,"dv",statCd=c("00003","00001"),"tsv")
multiData <- importRDB1(urlMultiPcodes)
unitDataURL <- constructNWISURL(siteNumber,property,
        "2013-11-03","2013-11-03","uv",format="tsv") #includes timezone switch
unitData <- importRDB1(unitDataURL, asDateTime=TRUE)
qwURL <- constructNWISURL(c('04024430','04024000'),
        c('34247','30234','32104','34220'),
        "2010-11-03","","qw",format="rdb")
qwData <- importRDB1(qwURL, asDateTime=TRUE, tz="America/Chicago")
iceSite <- '04024000'
start <- "2015-11-09"
end <- "2015-11-24"
urlIce <- constructNWISURL(iceSite,"00060",start, end,"uv",format="tsv")
ice <- importRDB1(urlIce, asDateTime=TRUE)
iceNoConvert <- importRDB1(urlIce, convertType=FALSE)
```

```
## End(Not run)
# User file:
filePath <- system.file("extdata", package="dataRetrieval")
fileName <- "RDB1Example.txt"
fullPath <- file.path(filePath, fileName)
importUserRDB <- importRDB1(fullPath)
```

---

importWaterML1   *Function to return data from the NWISWeb WaterML1.1 service*

Description

This function accepts a url parameter that already contains the desired NWIS site, parameter code, statistic, startdate and enddate.

Usage

```
importWaterML1(obs_url, asDateTime = FALSE, tz = "")
```

Arguments

obs_url   character or raw, containing the url for the retrieval or a file path to the data file, or raw XML.

asDateTime   logical, if TRUE returns date and time as POSIXct, if FALSE, Date

tz   character to set timezone attribute of . Default is an empty quote, which converts the s to UTC (properly accounting for daylight savings times based on the data's provided tz_cd column). Possible values to provide are "America/New_York","America/Chicago", "America/Denver","America/Los_Angeles", "America/Anchorage","America/Honolulu","America/Jama and "America/Metlakatla"

Value

A data frame with the following columns:

Name	Type	Description
agency_cd	character	The NWIS code for the agency reporting the data
site_no	character	The USGS site number
	POSIXct	The date and time of the value converted to UTC (if asDateTime = TRUE),
	character	or raw character string (if asDateTime = FALSE)
tz_cd	character	The time zone code for
code	character	Any codes that qualify the corresponding value
value	numeric	The numeric value for the parameter

Note that code and value are repeated for the parameters requested. The names are of the form X_D_P_S, where X is literal, D is an option description of the parameter, P is the parameter code,

and S is the statistic code (if applicable).

There are also several useful attributes attached to the data frame:

Name	Type	Description
url	character	The url used to generate the data
siteInfo	data.frame	A data frame containing information on the requested sites
variableInfo	data.frame	A data frame containing information on the requested parameters
statisticInfo	data.frame	A data frame containing information on the requested statistics on the data
queryTime	POSIXct	The time the data was returned

See Also

renameNWISColumns

Examples

```
siteNumber <- "02177000"
startDate <- "2012-09-01"
endDate <- "2012-10-01"
offering <- '00003'
property <- '00060'
obs_url <- constructNWISURL(siteNumber,property,startDate,endDate,'dv')
## Not run:
data <- importWaterML1(obs_url, asDateTime=TRUE)

groundWaterSite <- "431049071324301"
startGW <- "2013-10-01"
endGW <- "2014-06-30"
groundwaterExampleURL <- constructNWISURL(groundWaterSite, NA,
          startGW,endGW, service="gwlevels")
groundWater <- importWaterML1(groundwaterExampleURL)
groundWater2 <- importWaterML1(groundwaterExampleURL, asDateTime=TRUE)

unitDataURL <- constructNWISURL(siteNumber,property,
        "2013-11-03","2013-11-03",'uv')
unitData <- importWaterML1(unitDataURL,TRUE)

# Two sites, two pcodes, one site has two data descriptors:
siteNumber <- c('01480015',"04085427")
obs_url <- constructNWISURL(siteNumber,c("00060","00010"),startDate,endDate,'dv')
data <- importWaterML1(obs_url)
data$dateTime <- as.Date(data$dateTime)
data <- renameNWISColumns(data)
names(attributes(data))
attr(data, "url")
attr(data, "disclaimer")

inactiveSite <- "05212700"
inactiveSite <- constructNWISURL(inactiveSite, "00060", "2014-01-01", "2014-01-10",'dv')
inactiveSite <- importWaterML1(inactiveSite)
```

```
inactiveAndAcitive <- c("07334200","05212700")
inactiveAndAcitive <- constructNWISURL(inactiveAndAcitive, "00060", "2014-01-01", "2014-01-10",'dv')
inactiveAndAcitive <- importWaterML1(inactiveAndAcitive)

Timezone change with specified local timezone:
tzURL <- constructNWISURL("04027000", c("00300","63680"), "2011-11-05", "2011-11-07","uv")
tzIssue <- importWaterML1(tzURL, TRUE, "America/Chicago")

#raw XML
url <- constructNWISURL(service = 'dv', siteNumber = '02319300', parameterCd = "00060",
                        startDate = "2014-01-01", endDate = "2014-01-01")
raw <- content(GET(url), as = 'raw')
rawParsed <- importWaterML1(raw)

## End(Not run)
filePath <- system.file("extdata", package="dataRetrieval")
fileName <- "WaterML1Example.xml"
fullPath <- file.path(filePath, fileName)
importFile <- importWaterML1(fullPath,TRUE)
```

---

importWaterML2   *Function to return data from the WaterML2 data*

Description

This function accepts a url parameter for a WaterML2 getObservation. This function is still under
development, but the general functionality is correct.

Usage

```
importWaterML2(obs_url, asDateTime = FALSE, tz = "")
```

Arguments

obs_url   character or raw, containing the url for the retrieval or a path to the data file, or
             raw XML.

asDateTime   logical, if TRUE returns date and time as POSIXct, if FALSE, character

tz   character to set timezone attribute of datetime. Default is an empty quote, which
             converts the datetimes to UTC (properly accounting for daylight savings times
             based on the data's provided tz_cd column). Possible values to provide are
             "America/New_York","America/Chicago", "America/Denver","America/Los_Angeles",
             "America/Anchorage","America/Honolulu","America/Jamaica","America/Managua","America/Phoenix"
             and "America/Metlakatla"

Value

mergedDF a data frame time, value, description, qualifier, and identifier

Examples

```
baseURL <- "http://waterservices.usgs.gov/nwis/dv/?format=waterml,2.0"
URL <- paste(baseURL, "sites=01646500",
     "startDT=2014-09-01",
     "endDT=2014-09-08",
     "statCd=00003",
     "parameterCd=00060",sep="&")
URL2 <- paste("http://cida.usgs.gov/noreast-sos/simple?request=GetObservation",
     "featureID=MD-BC-BC-05",
     "offering=RAW",
     "observedProperty=WATER",sep="&")
## Not run:
dataReturned1 <- importWaterML2(URL)
dataReturn2 <- importWaterML2(URL2, TRUE)
URLmulti <-  paste(baseURL,
  "sites=04024430,04024000",
  "startDT=2014-09-01",
  "endDT=2014-09-08",
  "statCd=00003",
  "parameterCd=00060",sep="&")
dataReturnMulti <- importWaterML2(URLmulti)

## End(Not run)
filePath <- system.file("extdata", package="dataRetrieval")
fileName <- "WaterML2Example.xml"
fullPath <- file.path(filePath, fileName)
UserData <- importWaterML2(fullPath)
```

---

importWQP   *Basic Water Quality Portal Data parser*

Description

Imports data from the Water Quality Portal based on a specified url.

Usage

```
importWQP(obs_url, zip = FALSE, tz = "")
```

Arguments

obs_url	character URL to Water Quality Portal#' @keywords data import USGS web service
zip	logical to request data via downloading zip file. Default set to FALSE.
tz	character to set timezone attribute of datetime. Default is an empty quote, which converts the datetimes to UTC (properly accounting for daylight savings times based on the data's provided tz_cd column). Possible values to provide are

"America/New_York","America/Chicago", "America/Denver","America/Los_Angeles",
"America/Anchorage","America/Honolulu","America/Jamaica","America/Managua","America/Phoenix"
and "America/Metlakatla"

Value

retval dataframe raw data returned from the Water Quality Portal. Additionally, a POSIXct dateTime
column is supplied for start and end times, and converted to UTC. See http://www.waterqualitydata.us/portal_userguide/ for more information.

See Also

readWQPdata, readWQPqw, whatWQPsites

Examples

```
# These examples require an internet connection to run

## Examples take longer than 5 seconds:
## Not run:
rawSampleURL <- constructWQPURL('USGS-01594440','01075', '', '')

rawSample <- importWQP(rawSampleURL)

rawSampleURL_Zip <- constructWQPURL('USGS-01594440','01075', '', '', TRUE)
rawSample2 <- importWQP(rawSampleURL_Zip, zip=TRUE)

STORETex <- constructWQPURL('WIDNR_WQX-10032762','Specific conductance', '', '')
STORETdata <- importWQP(STORETex)

## End(Not run)
```

---

readNWISdata	*General Data Import from NWIS*

Description

Returns data from the NWIS web service. Arguments to the function should be based on http://waterservices.usgs.gov service calls. See examples below for ideas of constructing queries.

Usage

```
readNWISdata(service = "dv", ..., asDateTime = TRUE, convertType = TRUE)
```

Arguments

service	character. Possible values are "iv" (for instantaneous), "dv" (for daily values), "gwlevels" (for groundwater levels), "site" (for site service), "qw" (water-quality),"measurement", and "stat" (for statistics service). Note: "qw" and "measurement" calls go to: http://nwis.waterdata.usgs.gov/usa/nwis for data requests, and use different call requests schemes. The statistics service has a limited selection of arguments (see http://waterservices.usgs.gov/rest/Statistics-Service-Test-Tool.html).
asDateTime	logical, if TRUE returns date and time as POSIXct, if FALSE, Date
convertType	logical, defaults to TRUE. If TRUE, the function will convert the data to dates, datetimes, numerics based on a standard algorithm. If false, everything is returned as a character
...	see http://waterservices.usgs.gov/rest/Site-Service.html#Service for a complete list of options

Value

A data frame with the following columns:

Name	Type	Description
agency	character	The NWIS code for the agency reporting the data
site	character	The USGS site number
dateTime	POSIXct	The date and time (if applicable) of the measurement, converted to UTC for unit value data. R only al
tz_cd	character	The time zone code for dateTime column
code	character	Any codes that qualify the corresponding value
value	numeric	The numeric value for the parameter

Note that code and value are repeated for the parameters requested. The names are of the form X_D_P_S, where X is literal, D is an option description of the parameter, P is the parameter code, and S is the statistic code (if applicable).

There are also several useful attributes attached to the data frame:

Name	Type	Description
url	character	The url used to generate the data
siteInfo	data.frame	A data frame containing information on the requested sites
variableInfo	data.frame	A data frame containing information on the requested parameters
statisticInfo	data.frame	A data frame containing information on the requested statistics on the data
queryTime	POSIXct	The time the data was returned

See Also

renameNWISColumns, importWaterML1, importRDB1

Examples

```
## Not run:
# Examples not run for time considerations
dataTemp <- readNWISdata(stateCd="OH",parameterCd="00010", service="dv")
instFlow <- readNWISdata(sites="05114000", service="iv",
                  parameterCd="00060",
                  startDate="2014-05-01T00:00Z",endDate="2014-05-01T12:00Z")

instFlowCDT <- readNWISdata(sites="05114000", service="iv",
                  parameterCd="00060",
                  startDate="2014-05-01T00:00",endDate="2014-05-01T12:00",
                  tz="America/Chicago")

#Empty:
multiSite <- readNWISdata(sites=c("04025000","04072150"), service="iv",
                            parameterCd="00010")
#Not empty:
multiSite <- readNWISdata(sites=c("04025500","040263491"),
                            service="iv", parameterCd="00060")
bBoxEx <- readNWISdata(bBox=c(-83,36.5,-81,38.5), parameterCd="00010")

startDate <- as.Date("2013-10-01")
endDate <- as.Date("2014-09-30")
waterYear <- readNWISdata(bBox=c(-83,36.5,-81,38.5), parameterCd="00010",
                  service="dv", startDate=startDate, endDate=endDate)
siteInfo <- readNWISdata(stateCd="WI", parameterCd="00010",
                  hasDataTypeCd="iv", service="site")
qwData <- readNWISdata(bBox=c(-82.5,41.52,-81,41),startDate=as.Date("2000-01-01"),
                  drain_area_va_min=50, qw_count_nu=50,qw_attributes="expanded",
                qw_sample_wide="wide",list_of_search_criteria=c("lat_long_bounding_box",
                  "drain_area_va","obs_count_nu"),service="qw")
temp <- readNWISdata(bBox=c(-83,36.5,-81,38.5), parameterCd="00010", service="site",
                  seriesCatalogOutput=TRUE)
wiGWL <- readNWISdata(stateCd="WI",service="gwlevels")
meas <- readNWISdata(state_cd="WI",service="measurements",format="rdb_expanded")

waterYearStat <- readNWISdata(site=c("03112500"),service="stat",statReportType="annual",
                  statYearType="water", missingData="on")
monthlyStat <- readNWISdata(site=c("03112500","03111520"),
                            service="stat",
                            statReportType="monthly")
dailyStat <- readNWISdata(site=c("03112500","03111520"),
                            service="stat",
                            statReportType="daily",
                            statType=c("p25","p50","p75","min","max"),
                            parameterCd="00065")
allDailyStats <- readNWISdata(site=c("03111548"),
                            service="stat",
                            statReportType="daily")
                            service="stat",statReportType="daily",
                            statType=c("p25","p50","p75","min","max"),
                            parameterCd="00065")
```

```
dailyWV <- readNWISdata(stateCd = "West Virginia", parameterCd = "00060")

## End(Not run)
```

---

readNWISdv   *Daily Value USGS NWIS Data Retrieval*

Description

Imports data from NWIS web service. This function gets the data from here: http://waterservices.usgs.gov/

Usage

```
readNWISdv(siteNumber, parameterCd, startDate = "", endDate = "",
  statCd = "00003")
```

Arguments

siteNumber	character USGS site number. This is usually an 8 digit number. Multiple sites can be requested with a character vector.
parameterCd	character of USGS parameter code(s). This is usually an 5 digit number.
startDate	character starting date for data retrieval in the form YYYY-MM-DD. Default is "" which indicates retrieval for the earliest possible record. Date arguments are always specified in local time.
endDate	character ending date for data retrieval in the form YYYY-MM-DD. Default is "" which indicates retrieval for the latest possible record. Date arguments are always specified in local time.
statCd	character USGS statistic code. This is usually 5 digits. Daily mean (00003) is the default.

Value

A data frame with the following columns:

Name	Type	Description
agency	character	The NWIS code for the agency reporting the data
site	character	The USGS site number
Date	Date	The date of the value
code	character	Any codes that qualify the corresponding value
value	numeric	The numeric value for the parameter

Note that code and value are repeated for the parameters requested. The names are of the form X_D_P_S, where X is literal, D is an option description of the parameter, P is the parameter code,

and S is the statistic code (if applicable).

There are also several useful attributes attached to the data frame:

Name	Type	Description
url	character	The url used to generate the data
siteInfo	data.frame	A data frame containing information on the requested sites
variableInfo	data.frame	A data frame containing information on the requested parameters
statisticInfo	data.frame	A data frame containing information on the requested statistics on the data
queryTime	POSIXct	The time the data was returned

See Also

[renameNWISColumns](#), [importWaterML1](#)

Examples

```
siteNumber <- '04085427'
startDate <- '2012-01-01'
endDate <- '2012-06-30'
pCode <- '00060'
## Not run:
rawDailyQ <- readNWISdv(siteNumber,pCode, startDate, endDate)
rawDailyQAndTempMeanMax <- readNWISdv(siteNumber,c('00010','00060'),
        startDate, endDate, statCd=c('00001','00003'))
rawDailyQAndTempMeanMax <- renameNWISColumns(rawDailyQAndTempMeanMax)
rawDailyMultiSites<- readNWISdv(c("01491000","01645000"),c('00010','00060'),
        startDate, endDate, statCd=c('00001','00003'))
# Site with no data:
x <- readNWISdv("10258500","00060", "2014-09-08", "2014-09-14")
names(attributes(x))
attr(x, "siteInfo")
attr(x, "variableInfo")

site <- "05212700"
notActive <- readNWISdv(site, "00060", "2014-01-01","2014-01-07")

## End(Not run)
```

---

readNWISgwl   *Groundwater level measurements retrieval from USGS (NWIS)*

Description

Reads groundwater level measurements from NWISweb. Mixed date/times come back from the service depending on the year that the data was collected. See http://waterdata.usgs.gov/usa/nwis/gw for details about groundwater. By default the returned dates are converted to date objects, unless convertType is specified as FALSE. Sites with non-standard date formats (i.e. lacking a day) can be affected (see examples). See http://waterservices.usgs.gov/rest/GW-Levels-Service.html for more information.

Usage

```
readNWISgwl(siteNumbers, startDate = "", endDate = "", convertType = TRUE,
  tz = "")
```

Arguments

siteNumbers   character USGS site number (or multiple sites). This is usually an 8 digit number

startDate   character starting date for data retrieval in the form YYYY-MM-DD. Default is "" which indicates retrieval for the earliest possible record.

endDate   character ending date for data retrieval in the form YYYY-MM-DD. Default is "" which indicates retrieval for the latest possible record.

convertType   logical, defaults to TRUE. If TRUE, the function will convert the data to dates, datetimes, numerics based on a standard algorithm. If false, everything is returned as a character

tz   character to set timezone attribute of dateTime. Default is an empty quote, which converts the dateTimes to UTC (properly accounting for daylight savings times based on the data's provided tz_cd column). Possible values to provide are "America/New_York","America/Chicago", "America/Denver","America/Los_Angeles", "America/Anchorage","America/Honolulu","America/Jamaica","America/Managua","America/Phoenix' and "America/Metlakatla"

Value

A data frame with the following columns:

Name	Type	Description
agency_cd	character	The NWIS code for the agency reporting the data
site_no	character	The USGS site number
site_tp_cd	character	Site type code
lev_dt	Date	Date level measured
lev_tm	character	Time level measured
lev_tz_cd	character	Time datum
lev_va	numeric	Water level value in feet below land surface
sl_lev_va	numeric	Water level value in feet above specific vertical datum
lev_status_cd	character	The status of the site at the time the water level was measured
lev_agency_cd	character	The agency code of the person measuring the water level

There are also several useful attributes attached to the data frame:

Name	Type	Description
url	character	The url used to generate the data
queryTime	POSIXct	The time the data was returned
comment	character	Header comments from the RDB file
siteInfo	data.frame	A data frame containing information on the requested sites

See Also

constructNWISURL, importRDB1

Examples

```
siteNumber <- "434400121275801"
## Not run:
data <- readNWISgwl(siteNumber, '','')
sites <- c("434400121275801", "375907091432201")
data2 <- readNWISgwl(sites, '','')
data3 <- readNWISgwl("420125073193001", '','')
#handling of data where date has no day
data4 <- readNWISgwl("425957088141001", startDate = "1980-01-01")

## End(Not run)
```

---

readNWISmeas *Surface-water measurement data retrieval from USGS (NWIS)*

Description

Reads surface-water measurement data from NWISweb. Data is retrieved from http://waterdata.usgs.gov/nwis. See http://waterdata.usgs.gov/usa/nwis/sw for details about surface water.

Usage

```
readNWISmeas(siteNumbers, startDate = "", endDate = "", tz = "",
  expanded = FALSE, convertType = TRUE)
```

Arguments

siteNumbers	character USGS site number (or multiple sites). This is usually an 8 digit number
startDate	character starting date for data retrieval in the form YYYY-MM-DD. Default is "" which indicates retrieval for the earliest possible record.
endDate	character ending date for data retrieval in the form YYYY-MM-DD. Default is "" which indicates retrieval for the latest possible record.
tz	character to set timezone attribute of dateTime. Default is an empty quote, which converts the dateTimes to UTC (properly accounting for daylight savings times based on the data's provided tz_cd column). Possible values to provide are "America/New_York","America/Chicago", "America/Denver","America/Los_Angeles", "America/Anchorage","America/Honolulu","America/Jamaica","America/Managua","America/Phoenix", and "America/Metlakatla"
expanded	logical. Whether or not (TRUE or FALSE) to call the expanded data.
convertType	logical, defaults to TRUE. If TRUE, the function will convert the data to dates, datetimes, numerics based on a standard algorithm. If false, everything is returned as a character

Value

A data frame with at least the following columns:

Name	Type	Description
agency_cd	character	The NWIS code for the agency reporting the data
site_no	character	The USGS site number
measurement_dt	POSIXct	The date and time (in POSIXct) of the measurement. Unless specified with the tz parameter, th
tz_cd	character	The time zone code for the measurement_dt column

See <http://waterdata.usgs.gov/usa/nwis/sw> for details about surface water, and http://waterdata.usgs.gov/nwis/help?output_formats_help#streamflow_measurement_data for help on the columns and codes.

There are also several useful attributes attached to the data frame:

Name	Type	Description
url	character	The url used to generate the data
queryTime	POSIXct	The time the data was returned
comment	character	Header comments from the RDB file
siteInfo	data.frame	A data frame containing information on the requested sites
tz_cd_reported	The originally reported time zone	

See Also

constructNWISURL, importRDB1

Examples

```
siteNumbers <- c('01594440','040851325')
## Not run:
data <- readNWISmeas(siteNumbers)
Meas05316840 <- readNWISmeas("05316840")
Meas05316840.ex <- readNWISmeas("05316840",expanded=TRUE)
Meas07227500.ex <- readNWISmeas("07227500",expanded=TRUE)
Meas07227500.exRaw <- readNWISmeas("07227500",expanded=TRUE, convertType = FALSE)

## End(Not run)
```

---

readNWISpCode	*USGS Parameter Data Retrieval*

Description

Imports data from NWIS about meaured parameter based on user-supplied parameter code or codes. This function gets the data from here: <http://nwis.waterdata.usgs.gov/nwis/pmcodes>

Usage

```
readNWISpCode(parameterCd)
```

Arguments

parameterCd   character of USGS parameter codes (or multiple parameter codes). These are 5 digit number codes, more information can be found here: `http://help.waterdata.usgs.gov/`. To get a complete list of all current parameter codes in the USGS, use "all" as the input.

Value

parameterData data frame with the following information:

Name	Type	Description
parameter_cd	character	5-digit USGS parameter code
parameter_group_nm	character	USGS parameter group name
parameter_nm	character	USGS parameter name
casrn	character	Chemical Abstracts Service (CAS) Registry Number
srsname	character	Substance Registry Services Name
parameter_units	character	Parameter units

See Also

importRDB1

Examples

```
paramINFO <- readNWISpCode(c('01075','00060','00931'))
paramINFO <- readNWISpCode(c('01075','00060','00931', NA))
```

---

readNWISpeak   *Peak flow data from USGS (NWIS)*

Description

Reads peak flow from NWISweb. Data is retrieved from `http://waterdata.usgs.gov/nwis`. In some cases, the specific date of the peak data is not know. This function will default to converting the complete dates, dropping rows with incomplete dates. If those incomplete dates are needed, set the 'asDateTime' argument to FALSE. No rows will be removed, and no dates will be converted to R Date objects.

Usage

```
readNWISpeak(siteNumbers, startDate = "", endDate = "", asDateTime = TRUE,
  convertType = TRUE)
```

Arguments

siteNumbers	character USGS site number(or multiple sites). This is usually an 8 digit number.
startDate	character starting date for data retrieval in the form YYYY-MM-DD. Default is "" which indicates retrieval for the earliest possible record.
endDate	character ending date for data retrieval in the form YYYY-MM-DD. Default is "" which indicates retrieval for the latest possible record.
asDateTime	logical default to TRUE. When TRUE, the peak_dt column is converted to a Date object, and incomplete dates are removed. When FALSE, no columns are removed, but no dates are converted.
convertType	logical, defaults to TRUE. If TRUE, the function will convert the data to dates, datetimes, numerics based on a standard algorithm. If false, everything is returned as a character

Value

A data frame with the following columns:

Name	Type	Description
agency_cd	character	The NWIS code for the agency reporting the data
site_no	character	The USGS site number
peak_dt	Date	Date of peak streamflow
peak_tm	character	Time of peak streamflow as character
peak_va	numeric	Annual peak streamflow value in cfs
peak_cd	character	Peak Discharge-Qualification codes (see comment for more information)
gage_ht	numeric	Gage height for the associated peak streamflow in feet
gage_ht_cd	character	Gage height qualification codes
year_last_pk	numeric	Peak streamflow reported is the highest since this year
ag_dt	Date	Date of maximum gage-height for water year (if not concurrent with peak)
ag_tm	character	Time of maximum gage-height for water year (if not concurrent with peak)
ag_gage_ht	numeric	maximum Gage height for water year in feet (if not concurrent with peak)
ag_gage_ht_cd	character	maximum Gage height code

There are also several useful attributes attached to the data frame:

Name	Type	Description
url	character	The url used to generate the data
queryTime	POSIXct	The time the data was returned
comment	character	Header comments from the RDB file
siteInfo	data.frame	A data frame containing information on the requested sites

See Also

[constructNWISURL](), [importRDB1]()

Examples

```
siteNumbers <- c('01594440','040851325')
## Not run:
data <- readNWISpeak(siteNumbers)
data2 <- readNWISpeak(siteNumbers, asDateTime=FALSE)
stations<-c("06011000")
peakdata<-readNWISpeak(stations,convertType=FALSE)

## End(Not run)
```

---

readNWISqw   *Raw Data Import for USGS NWIS QW Data*

Description

Imports data from NWIS web service. This function gets the data from here: http://nwis.waterdata.usgs.gov/nwis/qwdata A list of parameter codes can be found here: http://nwis.waterdata.usgs.gov/nwis/pmcodes/ A list of statistic codes can be found here: http://nwis.waterdata.usgs.gov/nwis/help/?read_file=stat&format=table

Usage

```
readNWISqw(siteNumbers, parameterCd, startDate = "", endDate = "",
  expanded = TRUE, reshape = FALSE, tz = "")
```

Arguments

siteNumbers	character of USGS site numbers. This is usually an 8 digit number
parameterCd	character that contains the code for a parameter group, or a character vector of 5-digit parameter codes. See **Details**.
startDate	character starting date for data retrieval in the form YYYY-MM-DD. Default is "" which indicates retrieval for the earliest possible record. Date arguments are always specified in local time.
endDate	character ending date for data retrieval in the form YYYY-MM-DD. Default is "" which indicates retrieval for the latest possible record. Date arguments are always specified in local time.
expanded	logical defaults to TRUE. If TRUE, retrieves additional information. Expanded data includes remark_cd (remark code), result_va (result value), val_qual_tx (result value qualifier code), meth_cd (method code), dqi_cd (data-quality indicator code), rpt_lev_va (reporting level), and rpt_lev_cd (reporting level type). If FALSE, only returns remark_cd (remark code) and result_va (result value). Expanded = FALSE will not give sufficient information for unbiased statistical analysis.

reshape	logical, reshape the expanded data. If TRUE, then return a wide data frame with all water-quality in a single row for each sample. If FALSE (default), then return a long data frame with each water-quality result in a single row. This argument is only applicable to expanded data. Data requested using expanded=FALSE is always returned in the wide format.
tz	character to set timezone attribute of output columns: startDateTime and end-DateTime. Default is an empty quote, which converts the datetimes to UTC (properly accounting for daylight savings times). Possible values to provide are "America/New_York","America/Chicago", "America/Denver","America/Los_Angeles", "America/Anchorage","America/Honolulu","America/Jamaica","America/Managua","America/Phoenix" and "America/Metlakatla"

Details

Valid parameter code groups are "All," or group codes:

Code	Description
INF	Information
PHY	Physical
INM	Inorganics, Major, Metals (major cations)
INN	Inorganics, Major, Non-metals (major anions)
NUT	Nutrient
MBI	Microbiological
BIO	Biological
IMN	Inorganics, Minor, Non-metals
IMM	Inorganics, Minor, Metals
TOX	Toxicity
OPE	Organics, pesticide
OPC	Organics, PCBs
OOT	Organics, other
RAD	Radiochemical
SED	Sediment
POP	Population/community

If more than one parameter group is requested, only sites that data for all requested groups are returned.

Value

A data frame with at least the following columns:

Name	Type	Description
agency_cd	character	The NWIS code for the agency reporting the data
site_no	character	The USGS site number
sample_dt	Date	The date the sample was collected
sample_tm	character	The reported sample collection time
startDateTime	POSIXct	Combining sample_dt and sample_tm, a date/time column is created, and converted into UTC (u
endDateTime	POSIXct	If any sample_end_dt and sample_end_dt exist, this column is created similar to startDateTime

Further columns will be included depending on the requested output format (expanded = TRUE or FALSE).

There are also several useful attributes attached to the data frame:

Name	Type	Description
url	character	The url used to generate the data
queryTime	POSIXct	The time the data was returned
comment	character	Header comments from the RDB file
siteInfo	data frame	A data frame containing information on the requested sites
variableInfo	data frame	A data frame containing information on the requested parameters

See Also

[readWQPdata](), [whatWQPsites](), [readWQPqw](), [constructNWISURL]()

Examples

```
siteNumbers <- c('04024430','04024000')
startDate <- '2010-01-01'
endDate <- ''
parameterCd <- c('34247','30234','32104','34220')
## Not run:
rawNWISqwData <- readNWISqw(siteNumbers,parameterCd,startDate,endDate)
rawNWISqwDataReshaped <- readNWISqw(siteNumbers,parameterCd,
        startDate,endDate,reshape=TRUE)
parameterCd <- "all"
rawNWISall <- readNWISqw(siteNumbers,parameterCd,
        startDate,endDate)
pgroup <- c("NUT")
rawNWISNutrients <- readNWISqw(siteNumbers,pgroup,
        startDate,endDate)
groups <- c("NUT","OPE")
rawNWISNutOpe <- readNWISqw(siteNumbers,groups,
        startDate,endDate)
rawNWISOpe <- readNWISqw(siteNumbers,"OPE",
        startDate,endDate)

## End(Not run)
```

---

readNWISrating	*Rating table for an active USGS streamgage retrieval*

Description

Reads current rating table for an active USGS streamgage from NWISweb. Data is retrieved from <http://waterdata.usgs.gov/nwis>.

Usage

```
readNWISrating(siteNumber, type = "base", convertType = TRUE)
```

Arguments

siteNumber   character USGS site number. This is usually an 8 digit number

type   character can be "base", "corr", or "exsa"

convertType   logical, defaults to TRUE. If TRUE, the function will convert the data to dates,
                datetimes, numerics based on a standard algorithm. If false, everything is re-
                turned as a character

Value

A data frame. If `type` is "base," then the columns are INDEP, typically the gage height, in feet;
DEP, typically the streamflow, in cubic feet per second; and STOR, where "*" indicates that the
pair are a fixed point of the rating curve. If `type` is "exsa," then an additional column, SHIFT, is
included that indicates the current shift in the rating for that value of INDEP. If `type` is "corr," then
the columns are INDEP, typically the gage height, in feet; CORR, the correction for that value; and
CORRINDEP, the corrected value for CORR.

If `type` is "base," then the data frame has an attribute called "RATING" that describes the rating
curve is included.

There are also several useful attributes attached to the data frame:

Name	Type	Description
url	character	The url used to generate the data
queryTime	POSIXct	The time the data was returned
comment	character	Header comments from the RDB file
siteInfo	data.frame	A data frame containing information on the requested sites
RATING	character	Rating information

Note

Not all active USGS streamgages have traditional rating curves that relate flow to stage.

See Also

[constructNWISURL](), [importRDB1]()

Examples

```
siteNumber <- '01594440'
## Not run:
data <- readNWISrating(siteNumber, "base")
attr(data, "RATING")

## End(Not run)
```

---

readNWISsite   *USGS Site File Data Retrieval*

Description

Imports data from USGS site file site. This function gets data from here: http://waterservices.usgs.gov/

Usage

```
readNWISsite(siteNumbers)
```

Arguments

siteNumbers   character USGS site number (or multiple sites). This is usually an 8 digit number

Value

A data frame with at least the following columns:

Name	Type	Description
agency_cd	character	The NWIS code for the agency reporting the data
site_no	character	The USGS site number
station_nm	character	Site name
site_tp_cd	character	Site type
lat_va	numeric	DMS latitude
long_va	numeric	DMS longitude
dec_lat_va	numeric	Decimal latitude
dec_long_va	numeric	Decimal longitude
coord_meth_cd	character	Latitude-longitude method
coord_acy_cd	character	Latitude-longitude accuracy
coord_datum_cd	character	Latitude-longitude datum
dec_coord_datum_cd	character	Decimal Latitude-longitude datum
district_cd	character	District code
state_cd	character	State code
county_cd	character	County code
country_cd	character	Country code
land_net_ds	character	Land net location description
map_nm	character	Name of location map
map_scale_fc	character	Scale of location map
alt_va	numeric	Altitude of Gage/land surface
alt_meth_cd	character	Method altitude determined
alt_acy_va	numeric	Altitude accuracy
alt_datum_cd	character	Altitude datum
huc_cd	character	Hydrologic unit code
basin_cd	character	Drainage basin code
topo_cd	character	Topographic setting code

instruments_cd	character	Flags for instruments at site
construction_dt	character	Date of first construction
inventory_dt	character	Date site established or inventoried
drain_area_va	numeric	Drainage area
contrib_drain_area_va	numeric	Contributing drainage area
tz_cd	character	Time Zone abbreviation
local_time_fg	character	Site honors Daylight Savings Time
reliability_cd	character	Data reliability code
gw_file_cd	character	Data-other GW files
nat_aqfr_cd	character	National aquifer code
aqfr_cd	character	Local aquifer code
aqfr_type_cd	character	Local aquifer type code
well_depth_va	numeric	Well depth
hole_depth_va	numeric	Hole depth
depth_src_cd	character	Source of depth data
project_no	character	Project number

There are also several useful attributes attached to the data frame:

Name	Type	Description
url	character	The url used to generate the data
queryTime	POSIXct	The time the data was returned
comment	character	Header comments from the RDB file

Examples

```
## Not run:
siteINFO <- readNWISsite('05114000')
siteINFOMulti <- readNWISsite(c('05114000','09423350'))

## End(Not run)
```

| readNWISstat | *Site statistics retrieval from USGS (NWIS)* |

Description

Retrieves site statistics from the USGS Statistics Web Service beta. See http://waterservices.usgs.gov/rest/Statistics-Service.html for more information.

Usage

```
readNWISstat(siteNumbers, parameterCd, startDate = "", endDate = "",
  convertType = TRUE, statReportType = "daily", statType = "mean")
```

Arguments

siteNumbers	character USGS site number (or multiple sites). This is usually an 8 digit number.
parameterCd	character USGS parameter code. This is usually a 5 digit number.
startDate	character starting date for data retrieval in the form YYYY, YYYY-MM, or YYYY-MM-DD. Dates cannot be more specific than the statReportType, i.e. startDate for monthly statReportTypes cannot include days, and annual statReportTypes cannot include days or months. Months and days are optional for the daily statReportType. Default is "" which indicates retrieval for the earliest possible record. For daily data, this indicates the start of the period the statistics will be computed over.
endDate	character ending date for data retrieval in the form YYYY, YYYY-MM, or YYYY-MM-DD. Default is "" which indicates retrieval for the latest possible record. For daily data, this indicates the end of the period the statistics will be computed over. The same restrictions as startDate apply.
convertType	logical, defaults to TRUE. If TRUE, the function will convert the data to numerics based on a standard algorithm. Years, months, and days (if appliccable) are also returned as numerics in separate columns. If convertType is false, everything is returned as a character.
statReportType	character time division for statistics: daily, monthly, or annual. Default is daily. Note that daily provides statistics for each calendar day over the specified range of water years, i.e. no more than 366 data points will be returned for each site/parameter. Use readNWISdata or readNWISdv for daily averages. Also note that 'annual' returns statistics for the calendar year. Use readNWISdata for water years. Monthly and yearly provide statistics for each month and year within the range indivually.
statType	character type(s) of statistics to output for daily values. Default is mean, which is the only option for monthly and yearly report types. See the statistics service documentation at http://waterservices.usgs.gov/rest/Statistics-Service.html#statType for a full list of codes.

Value

A data frame with the following columns:

Name	Type	Description
agency_cd	character	The NWIS code for the agency repor
site_no	character	The USGS site number
parameter_cd	character	The USGS parameter code
Other columns will be present depending on statReportType and statType		

See Also

[constructNWISURL](), [importRDB1]()

Examples

```
## Not run:
x1 <- readNWISstat(siteNumbers=c("02319394"),
                   parameterCd=c("00060"),
                   statReportType="annual")

#all the annual mean discharge data for two sites
x2 <- readNWISstat(siteNumbers=c("02319394","02171500"),
                   parameterCd=c("00010","00060"),
                   statReportType="annual")

#Request p25, p75, and mean values for temperature and discharge for the 2000s
#Note that p25 and p75 were not available for temperature, and return NAs
x <- readNWISstat(siteNumbers=c("02171500"),
                  parameterCd=c("00010","00060"),
                  statReportType="daily",
                  statType=c("mean","median"),
                  startDate="2000",endDate="2010")

## End(Not run)
```

---

readNWISuse   *Water use data retrieval from USGS (NWIS)*

Description

Retrieves water use data from USGS Water Use Data for the Nation. See http://waterdata.usgs.gov/nwis/wu for more information. All available use categories for the supplied arguments are retrieved.

Usage

```
readNWISuse(stateCd, countyCd, years = "ALL", categories = "ALL",
  convertType = TRUE, transform = FALSE)
```

Arguments

stateCd	could be character (full name, abbreviation, id), or numeric (id). Only one is accepted per query.
countyCd	could be character (name, with or without "County", or "ALL"), numeric (id), or codeNULL, which will return state or national data depending on the stateCd argument. ALL may also be supplied, which will return data for every county in a state. Can be a vector of counties in the same state.
years	integer Years for data retrieval. Must be years ending in 0 or 5. Default is all available years.
categories	character categories of water use. Defaults to ALL. Specific categories must be supplied as two- letter abbreviations as seen in the URL when using the NWIS water use web interface.

convertType	logical defaults to TRUE. If TRUE, the function will convert the data to numerics based on a standard algorithm. Years, months, and days (if appliccable) are also returned as numerics in separate columns. If convertType is false, everything is returned as a character.
transform	logical only intended for use with national data. Defaults to FALSE, with data being returned as presented by the web service. If TRUE, data will be transformed and returned with column names, which will reformat national data to be similar to state data.

Value

A data frame with at least the year of record, and all available statistics for the given geographic parameters. County and state fields will be included as appropriate.

Examples

```
## Not run:
#All data for a county
allegheny <- readNWISuse(stateCd = "Pennsylvania",countyCd = "Allegheny")

#Data for an entire state for certain years
ohio <- readNWISuse(years=c(2000,2005,2010),stateCd = "OH", countyCd = NULL)

#Data for an entire state, county by county
pr <- readNWISuse(years=c(2000,2005,2010),stateCd = "PR",countyCd="ALL")

#All national-scale data, transforming data frame to named columns from named rows
national <- readNWISuse(stateCd = NULL, countyCd = NULL, transform = TRUE)

#Washington, DC data
dc <- readNWISuse(stateCd = "DC",countyCd = NULL)

#data for multiple counties, with different input formatting
paData <- readNWISuse(stateCd = "42",countyCd = c("Allegheny County", "BUTLER", 1, "031"))

#retrieving two specific categories for an entire state
ks <- readNWISuse(stateCd = "KS", countyCd = NULL, categories = c("IT","LI"))

## End(Not run)
```

---

readNWISuv	*Instantaneous value data retrieval from USGS (NWIS)*

Description

Imports data from NWIS web service. This function gets the data from here: http://waterservices.usgs.gov/ A list of parameter codes can be found here: http://nwis.waterdata.usgs.gov/nwis/pmcodes/ A list of statistic codes can be found here: http://nwis.waterdata.usgs.gov/nwis/help/?read_file=stat&format=table. More information on the web service can be found here: http://waterservices.usgs.gov/rest/IV-Service.html.

Usage

```
readNWISuv(siteNumbers, parameterCd, startDate = "", endDate = "",
  tz = "")
```

Arguments

siteNumbers	character USGS site number (or multiple sites). This is usually an 8 digit number
parameterCd	character USGS parameter code. This is usually an 5 digit number.
startDate	character starting date for data retrieval in the form YYYY-MM-DD. Default is "" which indicates retrieval for the earliest possible record. Simple date arguments are specified in local time. See more information here: http://waterservices.usgs.gov/rest/IV-Service.html#Specifying.
endDate	character ending date for data retrieval in the form YYYY-MM-DD. Default is "" which indicates retrieval for the latest possible record. Simple date arguments are specified in local time. See more information here: http://waterservices.usgs.gov/rest/IV-Service.html#Specifying.
tz	character to set timezone attribute of dateTime. Default is an empty quote, which converts the dateTimes to UTC (properly accounting for daylight savings times based on the data's provided tz_cd column). Possible values to provide are "America/New_York","America/Chicago", "America/Denver","America/Los_Angeles", "America/Anchorage","America/Honolulu","America/Jamaica","America/Managua","America/Phoenix", and "America/Metlakatla"

Value

A data frame with the following columns:

Name	Type	Description
agency_cd	character	The NWIS code for the agency reporting the data
site_no	character	The USGS site number
dateTime	POSIXct	The date and time of the value converted to UTC
tz_cd	character	The time zone code for dateTime
code	character	Any codes that qualify the corresponding value
value	numeric	The numeric value for the parameter

Note that code and value are repeated for the parameters requested. The names are of the form: X_D_P_S, where X is literal, D is an option description of the parameter, P is the parameter code, and S is the statistic code (if applicable).

There are also several useful attributes attached to the data frame:

Name	Type	Description
url	character	The url used to generate the data
siteInfo	data.frame	A data frame containing information on the requested sites
variableInfo	data.frame	A data frame containing information on the requested parameters
statisticInfo	data.frame	A data frame containing information on the requested statistics on the data
queryTime	POSIXct	The time the data was returned

See Also

renameNWISColumns, importWaterML1

Examples

```
siteNumber <- '05114000'
parameterCd <- '00060'
startDate <- "2014-10-10"
endDate <- "2014-10-10"
## Not run:
rawData <- readNWISuv(siteNumber,parameterCd,startDate,endDate)

timeZoneChange <- readNWISuv(c('04024430','04024000'),parameterCd,
          "2013-11-03","2013-11-03")

centralTime <- readNWISuv(siteNumber,parameterCd,
                          "2014-10-10T12:00", "2014-10-10T23:59",
                          tz="America/Chicago")

# Adding 'Z' to the time indicates to the web service to call the data with UTC time:
GMTdata <- readNWISuv(siteNumber,parameterCd,
                          "2014-10-10T00:00Z", "2014-10-10T23:59Z")

## End(Not run)
```

---

readWQPdata   *General Data Import from Water Quality Portal*

Description

Imports data from Water Quality Portal web service. This function gets the data from here: https://www.waterqualitydata.us. because it allows for other agencies rather than the USGS.

Usage

```
readWQPdata(..., zip = FALSE, querySummary = FALSE)
```

Arguments

zip	logical to request data via downloading zip file. Default set to FALSE.
querySummary	logical to ONLY return the number of records and unique sites that will be returned from this query.
...	see www.waterqualitydata.us/webservices_documentation.jsp for a complete list of options

Value

A data frame with at least the following columns:

Name	Type	Description
OrganizationIdentifier	character	A designator used to uniquely identify a unique busines
OrganizationFormalName	character	The legal designator (i.e. formal name) of an organizat
ActivityIdentifier	character	Designator that uniquely identifies an activity within an
ActivityTypeCode	character	The text describing the type of activity.
ActivityMediaName	character	Name or code indicating the environmental medium wh
ActivityMediaSubdivisionName	character	Name or code indicating the environmental matrix as a
ActivityStartDate	character	The calendar date on which the field activity is started.
ActivityStartTime/Time	character	The time of day that is reported when the field activity
ActivityStartTime/TimeZoneCode	character	The time zone for which the time of day is reported. An
ActivityEndDate	character	The calendar date when the field activity is completed.
ActivityEndTime/Time	character	The time of day that is reported when the field activity
ActivityEndTime/TimeZoneCode	character	The time zone for which the time of day is reported. An
ActivityDepthHeightMeasure/MeasureValue	character	A measurement of the vertical location (measured from
ActivityDepthHeightMeasure/MeasureUnitCode	character	The code that represents the unit for measuring the item
ActivityDepthAltitudeReferencePointText	character	The reference used to indicate the datum or reference u
ActivityTopDepthHeightMeasure/MeasureValue	character	A measurement of the upper vertical location of a verti
ActivityTopDepthHeightMeasure/MeasureUnitCode	character	The code that represents the unit for measuring the item
ActivityBottomDepthHeightMeasure/MeasureValue	character	A measurement of the lower vertical location of a verti
ActivityBottomDepthHeightMeasure/MeasureUnitCode	character	The code that represents the unit for measuring the item
ProjectIdentifier	character	A designator used to uniquely identify a data collection
ActivityConductingOrganizationText	character	A name of the Organization conducting an activity.
MonitoringLocationIdentifier	character	A designator used to describe the unique name, number
ActivityCommentText	character	General comments concerning the activity.
SampleAquifer *	character	A code that designates the aquifer associated with grou
HydrologicCondition *	character	Hydrologic condition is the hydrologic condition that is
HydrologicEvent *	character	A hydrologic event that is represented by the sample co
SampleCollectionMethod/MethodIdentifier	character	The identification number or code assigned by the meth
SampleCollectionMethod/MethodIdentifierContext	character	Identifies the source or data system that created or defin
SampleCollectionMethod/MethodName	character	The title that appears on the method from the method p
SampleCollectionEquipmentName	character	The name for the equipment used in collecting the sam
ResultDetectionConditionText	character	The textual descriptor of a result.
CharacteristicName	character	The object, property, or substance which is evaluated o
ResultSampleFractionText	character	The text name of the portion of the sample associated v
ResultMeasureValue	numeric	The reportable measure of the result for the chemical, r
MeasureQualifierCode	character	A code used to identify any qualifying issues that affec
ResultMeasure/MeasureUnitCode	character	The code that represents the unit for measuring the item
ResultStatusIdentifier	character	Indicates the acceptability of the result with respect to
StatisticalBaseCode	character	The code for the method used to calculate derived resu
ResultValueTypeName	character	A name that qualifies the process which was used in the
ResultWeightBasisText	character	The name that represents the form of the sample or por
ResultTimeBasisText	character	The period of time (in days) over which a measuremen
ResultTemperatureBasisText	character	The name that represents the controlled temperature at
ResultParticleSizeBasisText	character	User defined free text describing the particle size class
PrecisionValue	character	A measure of mutual agreement among individual mea

ResultCommentText	character	Free text with general comments concerning the result.
USGSPCode *	character	5-digit number used in the US Geological Survey comp
ResultDepthHeightMeasure/MeasureValue +	character	A measurement of the vertical location (measured from
ResultDepthHeightMeasure/MeasureUnitCode +	character	The code that represents the unit for measuring the iten
ResultDepthAltitudeReferencePointText +	character	The reference used to indicate the datum or reference u
SubjectTaxonomicName	character	The name of the organism from which a tissue sample
SampleTissueAnatomyName *	character	The name of the anatomy from which a tissue sample v
ResultAnalyticalMethod/MethodIdentifier	character	The identification number or code assigned by the meth
ResultAnalyticalMethod/MethodIdentifierContext	character	Identifies the source or data system that created or defi
ResultAnalyticalMethod/MethodName	character	The title that appears on the method from the method p
MethodDescriptionText *	character	A brief summary that provides general information abo
LaboratoryName	character	The name of Lab responsible for the result.
AnalysisStartDate	character	The calendar date on which the analysis began.
ResultLaboratoryCommentText	character	Remarks which further describe the laboratory procedu
DetectionQuantitationLimitTypeName	character	Text describing the type of detection or quantitation lev
DetectionQuantitationLimitMeasure/MeasureValue	numeric	Constituent concentration that, when processed throug
DetectionQuantitationLimitMeasure/MeasureUnitCode	character	The code that represents the unit for measuring the iten
PreparationStartDate	character	The calendar date when the preparation/extraction of th
ActivityStartDateTime	POSIXct	Activity start date and time converted to POSIXct UTC
ActivityEndDateTime	POSIXct	Activity end date and time converted to POSIXct UTC.

* = elements only in NWIS + = elements only in STORET

There are also several useful attributes attached to the data frame:

Name	Type	Description
url	character	The url used to generate the data
siteInfo	data.frame	A data frame containing information on the requested sites
variableInfo	data.frame	A data frame containing information on the requested parameters
queryTime	POSIXct	The time the data was returned

Examples

```
## Not run:
nameToUse <- "pH"
pHData <- readWQPdata(siteid="USGS-04024315",characteristicName=nameToUse)
pHData_summary <- readWQPdata(bBox=c(-90.10,42.67,-88.64,43.35),
     characteristicName=nameToUse, querySummary=TRUE)
startDate <- as.Date("2013-01-01")
nutrientDaneCounty <- readWQPdata(countycode="US:55:025",startDate=startDate,
                       characteristicType="Nutrient")


## End(Not run)
```

---

readWQPqw   *Raw Data Import for Water Quality Portal*

Description

Imports data from the Water Quality Portal. This function gets the data from here: https://www.waterqualitydata.us. There are four required input arguments: siteNumber, parameterCd, startDate, and endDate. parameterCd can either be a USGS 5-digit code, or a characteristic name. The sites can be either USGS, or other Water Quality Portal offered sites. It is required to use the 'full' site name, such as 'USGS-01234567'.

Usage

```
readWQPqw(siteNumbers, parameterCd, startDate = "", endDate = "", tz = "",
  querySummary = FALSE)
```

Arguments

siteNumbers   character site number. This needs to include the full agency code prefix.

parameterCd   vector of USGS 5-digit parameter code or characteristicNames. Leaving this blank will return all of the measured values during the specified time period.

startDate   character starting date for data retrieval in the form YYYY-MM-DD. Default is "" which indicates retrieval for the earliest possible record. Date arguments are always specified in local time.

endDate   character ending date for data retrieval in the form YYYY-MM-DD. Default is "" which indicates retrieval for the latest possible record. Date arguments are always specified in local time.

tz   character to set timezone attribute of datetime. Default is an empty quote, which converts the datetimes to UTC (properly accounting for daylight savings times based on the data's provided tz_cd column). Possible values to provide are "America/New_York","America/Chicago", "America/Denver","America/Los_Angeles", "America/Anchorage","America/Honolulu","America/Jamaica","America/Managua","America/Phoenix", and "America/Metlakatla" querySummary logical to look at number of records and unique sites that will be returned from this query.

querySummary   logical to look at number of records and unique sites that will be returned from this query.

Value

A data frame with at least the following columns:

Name	Type	Description
OrganizationIdentifier	character	A designator used to uniquely identify a unique busines
OrganizationFormalName	character	The legal designator (i.e. formal name) of an organizat
ActivityIdentifier	character	Designator that uniquely identifies an activity within an
ActivityTypeCode	character	The text describing the type of activity.

ActivityMediaName	character	Name or code indicating the environmental medium wh
ActivityMediaSubdivisionName	character	Name or code indicating the environmental matrix as a
ActivityStartDate	character	The calendar date on which the field activity is started.
ActivityStartTime/Time	character	The time of day that is reported when the field activity
ActivityStartTime/TimeZoneCode	character	The time zone for which the time of day is reported. A
ActivityEndDate	character	The calendar date when the field activity is completed.
ActivityEndTime/Time	character	The time of day that is reported when the field activity
ActivityEndTime/TimeZoneCode	character	The time zone for which the time of day is reported. A
ActivityDepthHeightMeasure/MeasureValue	character	A measurement of the vertical location (measured from
ActivityDepthHeightMeasure/MeasureUnitCode	character	The code that represents the unit for measuring the item
ActivityDepthAltitudeReferencePointText	character	The reference used to indicate the datum or reference u
ActivityTopDepthHeightMeasure/MeasureValue	character	A measurement of the upper vertical location of a verti
ActivityTopDepthHeightMeasure/MeasureUnitCode	character	The code that represents the unit for measuring the item
ActivityBottomDepthHeightMeasure/MeasureValue	character	A measurement of the lower vertical location of a verti
ActivityBottomDepthHeightMeasure/MeasureUnitCode	character	The code that represents the unit for measuring the item
ProjectIdentifier	character	A designator used to uniquely identify a data collection
ActivityConductingOrganizationText	character	A name of the Organization conducting an activity.
MonitoringLocationIdentifier	character	A designator used to describe the unique name, number
ActivityCommentText	character	General comments concerning the activity.
SampleAquifer *	character	A code that designates the aquifer associated with grou
HydrologicCondition *	character	Hydrologic condition is the hydrologic condition that is
HydrologicEvent *	character	A hydrologic event that is represented by the sample co
SampleCollectionMethod/MethodIdentifier	character	The identification number or code assigned by the meth
SampleCollectionMethod/MethodIdentifierContext	character	Identifies the source or data system that created or defi
SampleCollectionMethod/MethodName	character	The title that appears on the method from the method p
SampleCollectionEquipmentName	character	The name for the equipment used in collecting the sam
ResultDetectionConditionText	character	The textual descriptor of a result.
CharacteristicName	character	The object, property, or substance which is evaluated o
ResultSampleFractionText	character	The text name of the portion of the sample associated v
ResultMeasureValue	numeric	The reportable measure of the result for the chemical, r
MeasureQualifierCode	character	A code used to identify any qualifying issues that affec
ResultMeasure/MeasureUnitCode	character	The code that represents the unit for measuring the item
ResultStatusIdentifier	character	Indicates the acceptability of the result with respect to C
StatisticalBaseCode	character	The code for the method used to calculate derived resul
ResultValueTypeName	character	A name that qualifies the process which was used in the
ResultWeightBasisText	character	The name that represents the form of the sample or por
ResultTimeBasisText	character	The period of time (in days) over which a measurement
ResultTemperatureBasisText	character	The name that represents the controlled temperature at
ResultParticleSizeBasisText	character	User defined free text describing the particle size class
PrecisionValue	character	A measure of mutual agreement among individual mea
ResultCommentText	character	Free text with general comments concerning the result.
USGSPCode *	character	5-digit number used in the US Geological Survey comp
ResultDepthHeightMeasure/MeasureValue +	character	A measurement of the vertical location (measured from
ResultDepthHeightMeasure/MeasureUnitCode +	character	The code that represents the unit for measuring the item
ResultDepthAltitudeReferencePointText +	character	The reference used to indicate the datum or reference u
SubjectTaxonomicName	character	The name of the organism from which a tissue sample
SampleTissueAnatomyName *	character	The name of the anatomy from which a tissue sample v
ResultAnalyticalMethod/MethodIdentifier	character	The identification number or code assigned by the meth

ResultAnalyticalMethod/MethodIdentifierContext	character	Identifies the source or data system that created or defi...
ResultAnalyticalMethod/MethodName	character	The title that appears on the method from the method p...
MethodDescriptionText *	character	A brief summary that provides general information abo...
LaboratoryName	character	The name of Lab responsible for the result.
AnalysisStartDate	character	The calendar date on which the analysis began.
ResultLaboratoryCommentText	character	Remarks which further describe the laboratory procedu...
DetectionQuantitationLimitTypeName	character	Text describing the type of detection or quantitation lev...
DetectionQuantitationLimitMeasure/MeasureValue	numeric	Constituent concentration that, when processed through...
DetectionQuantitationLimitMeasure/MeasureUnitCode	character	The code that represents the unit for measuring the item...
PreparationStartDate	character	The calendar date when the preparation/extraction of th...
ActivityStartDateTime	POSIXct	Activity start date and time converted to POSIXct UTC...
ActivityEndDateTime	POSIXct	Activity end date and time converted to POSIXct UTC...

* = elements only in NWIS + = elements only in STORET

There are also several useful attributes attached to the data frame:

Name	Type	Description
url	character	The url used to generate the data
siteInfo	data.frame	A data frame containing information on the requested sites
variableInfo	data.frame	A data frame containing information on the requested parameters
queryTime	POSIXct	The time the data was returned

See Also

[readWQPdata](), [whatWQPsites](), [readNWISqw](), and [importWQP]()

Examples

```
## Not run:
rawPcode <- readWQPqw('USGS-01594440','01075', '', '')
rawCharacteristicName <- readWQPqw('WIDNR_WQX-10032762','Specific conductance', '', '')
rawPHsites <- readWQPqw(c('USGS-05406450', 'USGS-05427949','WIDNR_WQX-133040'), 'pH','','')
nwisEx <- readWQPqw('USGS-04024000',c('34247','30234','32104','34220'),'','2012-12-20')
nwisEx.summary <- readWQPqw('USGS-04024000',c('34247','30234','32104','34220'),
    '','2012-12-20', querySummary=TRUE)

## End(Not run)
```

---

renameNWISColumns *renameColumns*

Description

Rename columns coming back from NWIS data retrievals. Daily and unit value columns have names derived from their data descriptor, parameter, and statistic codes. This function reads information from the header and the arguments in the call to to rename those columns.

Usage

```
renameNWISColumns(rawData, p00010 = "Wtemp", p00045 = "Precip",
  p00060 = "Flow", p00065 = "GH", p00095 = "SpecCond", p00300 = "DO",
  p00400 = "pH", p62611 = "GWL", p63680 = "Turb", p72019 = "WLBLS", ...)
```

Arguments

rawData	the daily- or unit-values datset retrieved from NWISweb.
p00010	the base name for parameter code 00010.
p00045	the base name for parameter code 00045.
p00060	the base name for parameter code 00060.
p00065	the base name for parameter code 00065.
p00095	the base name for parameter code 00095.
p00300	the base name for parameter code 00300.
p00400	the base name for parameter code 00400.
p62611	the base name for parameter code 62611.
p63680	the base name for parameter code 63680.
p72019	the base name for parameter code 72019.
...	named arguments for the base name for any other parameter code. The form of the name must be like pXXXXX, where XXXXX is the parameter code.

Value

A dataset like data with selected columns renamed.

Note

The following statistics codes are converted by renameNWISColumns.

00000 Instantaneous Value, suffix: Inst

00001 Maximum value, suffix: Max

00002 Minimum value, suffix: Min

00003 Mean value, no suffix

00006 Sum of values, suffix: Sum

00007 Modal value, suffix: Mode

00008 Median value, suffix: Median

00012 Equivalent mean value, suffix: EqMean

00021 Tidal high-high value, suffix: HiHiTide

00022 Tidal low-high value, suffix: LoHiTide

00023 Tidal high-low value, suffix: HiLoTide

00024 Tidal low-low value, suffix: LoLoTide

See Also

[readNWISdv](#), [readNWISuv](#)

Examples

```
siteWithTwo <- '01480015'
startDate <- "2012-09-01"
endDate <- "2012-10-01"
## Not run:
url2 <- constructNWISURL(siteWithTwo, "00060",startDate,endDate,'dv')
twoResults <- importWaterML1(url2,TRUE)
twoResults <- renameNWISColumns(twoResults)
url2RDB <- constructNWISURL(siteWithTwo,"00060",
         startDate,endDate,"dv",format="tsv")
rdbResults <- importRDB1(url2RDB)
rdbResults <- renameNWISColumns(rdbResults)

## End(Not run)
```

---

setAccess   *Set data endpoint*

Description

access Indicate which dataRetrieval access code you want to use options: `c('public','internal')`

Usage

```
setAccess(access = "public")
```

Arguments

access   code for data access. Options are: "public","internal","cooperator", or "USGS".

- "internal" represents Access=3 ...for a single water science center
- "USGS" represents Access=2 ...for all water science centers
- "cooperator" represents Access=1
- "public" represents Access=0, public access

Author(s)

Luke Winslow, Jordan S Read

Examples

```
## Not run:
setAccess('internal')

setAccess('public')


## End(Not run)
```

---

stateCd   *US State Code Lookup Table*

Description

Data pulled from <http://www2.census.gov/geo/docs/reference/state.txt> on April 1, 2015.

Value

stateCd data frame.

Name	Type	Description
STATE	character	FIPS State Code
STUSAB	character	Official United States Postal Service (USPS) Code
STATE_NAME	character	State Name
STATENS	character	Geographic Names Information System Identifier (GNISID)

Examples

```
head(stateCd)
```

---

stateCdLookup   *State code look up*

Description

Function to simplify finding state and state code definitions. Used in `readNWISdata` and `readWQPdata`.

Usage

```
stateCdLookup(input, outputType = "postal")
```

Arguments

input	could be character (full name, abbreviation, id), or numeric (id)
outputType	character can be "postal","fullName","tableIndex", or "id".

Examples

```
fullName <- stateCdLookup("wi", "fullName")
abbriev <- stateCdLookup("Wisconsin", "postal")
id <- stateCdLookup("WI", "id")
name <- stateCdLookup(55, "fullName")
index <- stateCdLookup("WI", "tableIndex")
stateCd[index,]
stateCdLookup(c("West Virginia", "Wisconsin", 55, "MN"))
```

---

whatNWISdata   *USGS data availability*

Description

Imports a table of available parameters, period of record, and count. See http://waterservices.usgs.gov/rest/Site-Service.html for more information.

Usage

```
whatNWISdata(siteNumbers, service = "all", parameterCd = "all",
  statCd = "all")
```

Arguments

siteNumbers	character USGS site number or multiple sites.
service	character. Options are "all", or one or many of "dv"(daily values), "uv","rt", or "iv"(unit values), "qw"(water-quality),"sv"(sites visits),"pk"(peak measurements), "gw"(groundwater levels), "ad" (sites included in USGS Annual Water Data Reports External Link), "aw" (sites monitored by the USGS Active Groundwater Level Network External Link), "id" (historical instantaneous values)
parameterCd	character vector of valid parameter codes to return. Defaults to "all" which will not perform a filter.
statCd	character vector of all statistic codes to return. Defaults to "all" which will not perform a filter.

Value

A data frame with the following columns:

Name	Type	Description
agency_cd	character	The NWIS code for the agency reporting the data
site_no	character	The USGS site number
station_nm	character	Site name
site_tp_cd	character	Site type
dec_lat_va	numeric	Decimal latitude
dec_long_va	numeric	Decimal longitude
coord_acy_cd	character	Latitude-longitude accuracy
dec_coord_datum_cd	character	Decimal Latitude-longitude datum
alt_va	character	Altitude of Gage or land surface
alt_acy_va	character	Altitude accuracy
alt_datum_cd	character	Altitude datum
huc_cd	character	Hydrologic unit code
data_type_cd	character	Data type
parm_cd	character	Parameter code
stat_cd	character	Statistical code
dd_nu	character	Internal database key
loc_web_ds	character	Additional measurement description
medium_grp_cd	character	Medium group code
parm_grp_cd	character	Parameter group code
srs_id	character	SRS ID
access_cd	character	Access code
begin_date	Date	Begin date
end_date	Date	End date
count_nu	integer	Record count
parameter_group_nm	character	Parameter group name
parameter_nm	character	Parameter name
casrn	character	Chemical Abstracts Service (CAS) Registry Number
srsname	character	Substance Registry Services
parameter_units	character	Parameter units

There are also several useful attributes attached to the data frame:

Name	Type	Description
url	character	The url used to generate the data
comment	character	Header comments from the RDB file
queryTime	POSIXct	The time the data was returned

Examples

```
## Not run:
availableData <- whatNWISdata('05114000')
# To find just unit value ('instantaneous') data:
```

```
uvData <- whatNWISdata('05114000',service="uv")
uvDataMulti <- whatNWISdata(c('05114000','09423350'),service=c("uv","dv"))
siteNumbers <- c("01491000","01645000")
flowAndTemp <- whatNWISdata(siteNumbers, parameterCd=c("00060","00010"))

## End(Not run)
```

---

whatNWISsites   *Site Data Import from NWIS*

Description

Returns a list of sites from the NWIS web service. This function gets the data from: http://waterservices.usgs.gov/rest/Site-Test-Tool.html. Arguments to the function should be based on http://waterservices.usgs.gov/rest/Site-Service.html#Service Mapper format is used

Usage

```
whatNWISsites(...)
```

Arguments

```
...                see http://waterservices.usgs.gov/rest/Site-Service.html#Service for
                   a complete list of options
```

Value

A data frame with at least the following columns:

Name	Type	Description
agency_cd	character	The NWIS code for the agency reporting the data
site_no	character	The USGS site number
station_nm	character	Station name
site_tp_cd	character	Site type code
dec_lat_va	numeric	Decimal latitude
dec_long_va	numeric	Decimal longitude
queryTime	POSIXct	Query time

There are also several useful attributes attached to the data frame:

Name	Type	Description
url	character	The url used to generate the data
queryTime	POSIXct	The time the data was returned

Examples

```
## Not run:
siteListPhos <- whatNWISsites(stateCd="OH",parameterCd="00665")

## End(Not run)
```

---

whatWQPsites   *Site Data Import from Water Quality Portal*

Description

Returns a list of sites from the Water Quality Portal web service. This function gets the data from: <http://www.waterqualitydata.us>. Arguments to the function should be based on www.waterqualitydata.us/webservices_documentation.jsp

Usage

```
whatWQPsites(..., zip = FALSE)
```

Arguments

zip	logical to request data via downloading zip file. Default set to FALSE.
...	see www.waterqualitydata.us/webservices_documentation.jsp for a complete list of options

Value

A data frame with at least the following columns:

Name	Type	Description
OrganizationIdentifier	character	A designator used to uniquely identify a unique busines
OrganizationFormalName	character	The legal designator (i.e. formal name) of an organizat
MonitoringLocationIdentifier	character	A designator used to describe the unique name, numbe
MonitoringLocationName	character	The designator specified by the sampling organization
MonitoringLocationTypeName	character	The descriptive name for a type of monitoring location
MonitoringLocationDescriptionText	character	Text description of the monitoring location.
HUCEightDigitCode	character	The 8 digit federal code used to identify the hydrologic
DrainageAreaMeasure/MeasureValue *	character	The drainage basin of a lake, stream, wetland, or estuar
DrainageAreaMeasure/MeasureUnitCode *	character	The code that represents the unit for measuring the iten
ContributingDrainageAreaMeasure/MeasureValue *	character	The contributing drainage area of a lake, stream, wetlar
ContributingDrainageAreaMeasure/MeasureUnitCode *	character	The code that represents the unit for measuring the iten
LatitudeMeasure	numeric	The measure of the angular distance on a meridian nort
LongitudeMeasure	numeric	The measure of the angular distance on a meridian east
SourceMapScaleNumeric	character	The number that represents the proportional distance o
HorizontalAccuracyMeasure/MeasureValue *	character	The horizontal measure of the relative accuracy of the l
HorizontalAccuracyMeasure/MeasureUnitCode *	character	The code that represents the unit for measuring the iten
HorizontalCollectionMethodName	character	The name that identifies the method used to determine

HorizontalCoordinateReferenceSystemDatumName	character	The name that describes the reference datum used in d...
VerticalMeasure/MeasureValue	character	The measure of elevation (i.e., the altitude), above or b...
VerticalMeasure/MeasureUnitCode	character	The code that represents the unit for measuring the iten...
VerticalAccuracyMeasure/MeasureValue *	character	The vertical measure of the relative accuracy of the lati...
VerticalAccuracyMeasure/MeasureUnitCode *	character	The code that represents the unit for measuring the iten...
VerticalCollectionMethodName	character	The name that identifies the method used to collect the ...
VerticalCoordinateReferenceSystemDatumName	character	The name of the reference datum used to determine the ...
CountryCode	character	A code designator used to identify a primary geopolitic...
StateCode	character	A code designator used to identify a principal administ...
CountyCode	character	A code designator used to identify a U.S. county or cou...
AquiferName *	character	Name of the aquifer in which the well is completed.
FormationTypeText *	character	Name of the primary formation or soils unit, in which t...
AquiferTypeName *	character	The type of aquifer, such as confined or unconfined.
ConstructionDateText *	character	Date of construction when well was completed. May b...
WellDepthMeasure/MeasureValue *	character	Depth below land surface datum (LSD) to the bottom o...
WellDepthMeasure/MeasureUnitCode *	character	The code that represents the unit for measuring the iten...
WellHoleDepthMeasure/MeasureValue *	character	Depth below land surface datum (LSD) to the bottom o...
WellHoleDepthMeasure/MeasureUnitCode *	character	The code that represents the unit for measuring the iten...
queryTime	POSIXct	Query time

* element is only in NWIS

Examples

```
## Not run:
site1 <- whatWQPsites(siteid="USGS-01594440")

type <- "Stream"
sites <- whatWQPsites(countycode="US:55:025",siteType=type)
lakeSites <- whatWQPsites(siteType = "Lake, Reservoir, Impoundment", statecode = "US:55")

## End(Not run)
```

---

zeroPad   *Pad string with leading zeros*

Description

Function to pad a string with leading zeros. Useful for parameter codes and USGS site IDs.

Usage

```
zeroPad(x, padTo)
```

Arguments

| x | character |
| padTo | number Final desired length of the character |

Value

x character returned with leading zeros

Examples

```
pCode <- '10'
correctPCode <- zeroPad(pCode,5)
pCodes <- c('100','1000','0','12345','1565465465465465')
correctPCodes <- zeroPad(pCodes,5)
pCodeNA <- c(1,2,NA)
padPCodeNA <- zeroPad(pCodeNA,4)
```

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