

Package ‘inldata’

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Title Collection of Datasets for the USGS-INL Aquifer Monitoring Networks

Version 1.0.3

Description Contains data for the U.S. Geological Survey-Idaho National Laboratory (USGS-INL) aquifer monitoring networks administrated by the Idaho National Laboratory Project Office in cooperation with the U.S. Department of Energy.

Depends R (>= 3.5.0)

Imports sp, raster

Suggests dataRetrieval, inlmisc, knitr, maptools, rgdal, rgeos, stats, tools, utils

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R topics documented:

background	2
benchmarks	3
cities	4
counties	5
dl	6
esrp	7
facilities	7
gwl	8
idaho	9
inl	10
labels	11
lakes	12
mountains	12
parameters	13
projection	14
roads	14
samples	15
sites	17
streams	19
topo	20
Index	21

background	<i>Background Concentrations</i>
------------	----------------------------------

Description

Water-quality background concentrations for selected radionuclides, organic compounds, and chemical constituents analyzed for in water from the Eastern Snake River Plain aquifer at and near the Idaho National Laboratory (INL). Background concentrations are either naturally occurring or anthropogenic, and are not influenced by waste and wastewater disposal at the INL (Bartholomay and Hall, 2016, p. 3).

Usage

background

Format

A data frame with 73 records and 4 variables:

parm_cd U.S. Geological Survey 5-digit parameter code, see [parameters](#) dataset for details.
 bkgrd_min, bkgrd_max minimum and maximum limits of background concentration

reference source of background concentration limits. Reference citations are: "Bartholomay and Hall (2016)", "Knobel and others (1992)", "Michel (1989)", and "Orr and others (1991)".

Row names for the data frame indicate the Substance Registry Services (SRS) name and parameter units.

References

Bartholomay, R.C., and Hall, L.F., 2016, Evaluation of background concentrations of selected chemical and radiochemical constituents in groundwater in the eastern Snake River Plain aquifer at and near the Idaho National Laboratory, Idaho: U.S. Geological Survey Scientific Investigations Report 2016–5056, (DOE/ID–22237), 19 p., <https://doi.org/10.3133/sir20165056>.

Knobel, L.L., Orr, B.R., and Cecil, L.D., 1992, Summary of background concentrations of selected radiochemical and chemical constituents in groundwater from the Snake River Plain aquifer, Idaho: estimated from an analysis of previously published data: Journal of the Idaho Academy of Science, v. 28, no. 1, p. 48–61.

Michel, R.L., 1989, Tritium deposition in the continental United States, 1953–83: U.S. Geological Survey Water Resources Investigations Report 89–4072, 46 p., <https://doi.org/10.3133/wri894072>.

Orr, B.R., Cecil, L.D., and Knobel, L.L., 1991, Background concentrations of selected radionuclides, organic compounds, and chemical constituents in ground water in the vicinity of the Idaho National Engineering Laboratory: U.S. Geological Survey Water-Resources Investigations Report 91–4015 (DOE/ID–22094), 52 p., <https://doi.org/10.3133/wri914015>.

Examples

```
str(background)
rownames(background)
```

benchmarks

Benchmark Concentrations

Description

Water-quality benchmark concentrations of selected radionuclides, organic compounds, and chemical constituents. Benchmarks include: the U.S. Environmental Protection Agency (USEPA) Maximum Contaminant Levels (MCLs) and Human Health Benchmarks for Pesticides (HHBPs), and the U.S. Geological Survey (USGS) Health-Based Screening Levels (HBSLs).

Usage

```
benchmarks
```

Format

A data frame with 74 records and 9 variables:

parm_cd USGS 5-digit parameter code, see [parameters](#) dataset for details.
 mc1 USEPA MCLs.
 hhbp_noncancer USEPA Chronic Noncancer HHBPs
 hhbp_cancer_min USEPA Carcinogenic HHBPs for a one-in-one million cancer risk.
 hhbp_cancer_max USEPA Carcinogenic HHBPs for a one-in-ten thousand cancer risk.
 hbsl_noncancer USGS Noncancer HBSLs
 hbsl_cancer_min USGS Cancer HBSLs for a one-in-one million cancer risk.
 hbsl_cancer_max USGS Cancer HBSLs for a one-in-ten thousand cancer risk.
 remark comments

Row names for the data frame indicate the Substance Registry Services (**SRS**) name and parameter units.

Source

Many of the water-quality benchmarks were accessed from the U.S. Geological Survey Health-Based Screening Levels database, accessed on August 8, 2017, from <https://water.usgs.gov/water-resources/hbsl/>. Benchmarks for total Trihalomethanes, Tritium, and Strontium-90 were provided by the U.S. Environmental Protection Agency (2015). Note that MCL benchmark values reported in millirem per year were substituted with a 50 picocuries per liter screening level.

References

U.S. Environmental Protection Agency, 2015, Protection of environment—Code of Federal Regulations 40, Part 141, Subpart G, National Primary Drinking Water Regulations, Maximum Contaminant Levels and Maximum Residual Disinfectant Levels: Washington, D.C., Office of the Federal Register, National Archives and Records Administration.

Examples

```
str(benchmarks)
rownames(benchmarks)
```

cities

Cities and Towns

Description

Cities and towns (populated places) in the vicinity of Idaho National Laboratory, eastern Idaho.

Usage`cities`**Format**

A `SpatialPointsDataFrame` of the `sp` package with 24 records and 16 variables. See [projection](#) dataset for coordinate reference system information.

Source

U.S. Department of Commerce, U.S. Census Bureau, Geography Division/Cartographic Products Branch. Spatial extract from the Master Address File / Topologically Integrated Geographic Encoding and Referencing (**MAF/TIGER**) Database (MTDB), 2019 data collection, released April 2, 2020.

Examples

```
inlmisc::PlotMap(cities, dms.tick = TRUE)
sp::plot(cities, pch = 19, add = TRUE)
raster::text(cities, cities@data$NAME,
             pos = 1, cex = 0.6)
str(cities@data)
```

`counties`*County Boundaries*

Description

Boundaries of counties in the vicinity of Idaho National Laboratory, eastern Idaho, as of January 1, 2015.

Usage`counties`**Format**

A `SpatialLines` of the `sp` package with 45 features. See [projection](#) dataset for coordinate reference system information.

Source

U.S. Department of Commerce, U.S. Census Bureau, Geography Division/Cartographic Products Branch. Spatial extract from the Master Address File / Topologically Integrated Geographic Encoding and Referencing (**MAF/TIGER**) Database (MTDB), 2019 data collection, released April 2, 2020.

Examples

```
inlmisc::PlotMap(counties, dms.tick = TRUE)
sp::plot(counties, lty = 5, add = TRUE)
```

dl

Laboratory Detection Limits

Description

Analytical method detection limits of selected radionuclides, which are based on laboratory procedures.

Usage

dl

Format

A data frame with 8 records and 6 variables:

srsname Substance Registry Services (**SRS**) name.
 parm_cd U.S. Geological Survey 5-digit parameter code.
 parameter_units parameter units
 lab_det_lim_va laboratory detection limit concentration
 sdate date that the detection limit went into effect.
 reference source of detection limit.

Source

Detection limits reported by: Bartholomay and others (2003, table 9); Bartholomay and others (2014, table D1); and Bodnar and Percival (1982).

References

- Bartholomay, R.C., Knobel, L.L., and Rousseau, J.P., 2003, Field methods and quality-assurance plan for quality-of-water activities, U.S. Geological Survey, Idaho National Engineering and Environmental Laboratory, Idaho: U.S. Geological Survey Open-File Report 03–42 (DOE/ID–22182), 45 p. <https://doi.org/10.3133/ofr0342>.
- Bartholomay, R.C., Maimer, N.V., and Wehnke, A.J., 2014, Field methods and quality-assurance plan for water-quality activities and water-level measurements, U.S. Geological Survey, Idaho National Laboratory, Idaho: U.S. Geological Survey Open-File Report 2014–1146 (DOE/ID–22230), 64 p. <https://pubs.usgs.gov/of/2014/1146/>.
- Bodnar, L.Z., and Percival, D.R., eds., 1982, Analytical Chemistry Branch procedures manual—Radiological and Environmental Sciences Laboratory: U.S. Department of Energy Report IDO–12096 [variously paged].

Examples

```
str(dl)
```

esrp	<i>Eastern Snake River Plain Boundary</i>
------	---

Description

Boundary of the eastern Snake River Plain, Idaho.

Usage

```
esrp
```

Format

A `SpatialPolygonsDataFrame` of the `sp` package object with 1 feature and 1 variable. See [projection](#) dataset for coordinate reference system information.

Source

U.S. Geological Survey [Idaho National Laboratory Project Office](#)

Examples

```
inlmisc::PlotMap(esrp, dms.tick = TRUE)
sp::plot(esrp, col = "red", add = TRUE)
str(esrp@data)
```

facilities	<i>Idaho National Laboratory Facilities</i>
------------	---

Description

Federal research facilities at the Idaho National Laboratory ([INL](#)).

Usage

```
facilities
```

Format

A `SpatialPolygonsDataFrame` object with 7 features and 1 variable. See [projection](#) dataset for coordinate reference system information.

Source

U.S. Geological Survey [Idaho National Laboratory Project Office](#)

Examples

```
inlmisc::PlotMap(facilities, dms.tick = TRUE)
sp::plot(facilities, col = "red", add = TRUE)
raster::text(facilities, facilities@data$NAME,
             cex = 0.6, pos = 1)
str(facilities@data)
```

gwl

Groundwater Level Measurements

Description

Groundwater level measurements in wells in the U.S. Geological Survey (USGS) water-level aquifer monitoring network, Idaho National Laboratory and vicinity, Idaho. Data was obtained from the National Water Information System ([NWIS](#)) (U.S. Geological Survey, 2020).

Usage

gwl

Format

A data frame with 54,417 records and 5 variables:

site_no USGS site number

lev_dt date the water level was measured.

lev_va water level value, in feet below land surface. A water-level elevation may be calculated by subtracting the depth-to-water (lev_va) from the land-surface elevation (alt_va in the [sites](#) dataset).

lev_status_cd a code indicating the status of the site at the time the water level was measured. The codes and their meanings are: "A" water level was affected by atmospheric pressure, "D" the site was dry (no water level is recorded), "N" the measurement was discontinued, "O" an obstruction was encountered in the well (no water level was recorded), "P" the site was being pumped, "R" the site had been pumped recently, "S" a nearby site that taps the same aquifer was being pumped, and "X" the water level was affected by stage in nearby surface-water site.

date_time date and time the water level was measured. Missing values of time were substituted with "00:00" (12:00 midnight and start of day).

Source

Data obtained from the NWIS database (U.S. Geological Survey, 2020).

References

U.S. Geological Survey, 2020, National Water Information System—web services, accessed August 4, 2020, from <https://doi.org/10.5066/F7P55KJN>.

Examples

```
site_no <- "432700112470801" # well USGS 1
xlim <- as.Date(c("1989-01-01", "2019-01-01"))
d <- gwl[gwl$site_no == site_no, c("lev_dt", "lev_va")]
main <- sites@data[sites@data$site_no == site_no, "site_nm"]
ylab <- sprintf("Water level, in %s below land surface",
               c("feet", "meters"))
inlmisc::PlotGraph(d, ylab = ylab, main = main, xlim = xlim,
                  type = "p", pch = 19, seq.date.by = "year",
                  conversion.factor = 0.3048,
                  center.date.labels = TRUE)

str(gwl)

alt_va <- sites@data[sites@data$site_no == site_no, "alt_va"]
y <- alt_va - d$lev_va
ylab <- sprintf("Water level, in %s above sea level",
               c("feet", "meters"))
inlmisc::PlotGraph(d$lev_dt, y, ylab = ylab, main = main,
                  xlim = xlim, type = "p", pch = 19,
                  seq.date.by = "year",
                  conversion.factor = 0.3048,
                  center.date.labels = TRUE)
```

idaho

State of Idaho Boundary

Description

Simplified representation of the boundary of Idaho, a state in the northwestern region of the United States.

Usage

```
idaho
```

Format

A SpatialPolygons of the **sp** package with 1 feature. See [projection](#) dataset for coordinate reference system information.

Source

U.S. Department of Commerce, U.S. Census Bureau, Geography Division/Cartographic Products Branch. Spatial extract from the Master Address File / Topologically Integrated Geographic Encoding and Referencing (**MAF/TIGER**) Database (MTDB), 2019 data collection, released April 2, 2020.

Examples

```
inlmisc::PlotMap(idaho, dms.tick = TRUE)
sp::plot(idaho, col = "red", add = TRUE)
```

inl

Idaho National Laboratory Boundary

Description

Boundary of the Idaho National Laboratory (**INL**).

Usage

```
inl
```

Format

A `SpatialPolygonsDataFrame` of the `sp` package object with 1 feature and 4 variables. See [projection](#) dataset for coordinate reference system information.

Source

U.S. Geological Survey **Idaho National Laboratory Project Office**

Examples

```
inlmisc::PlotMap(inl, dms.tick = TRUE)
sp::plot(inl, col = "red", add = TRUE)
str(inl@data)
```

labels	<i>Map Labels</i>
--------	-------------------

Description

Map labels in the vicinity of Idaho National Laboratory, eastern Idaho.

Usage

```
labels
```

Format

A `SpatialPointsDataFrame` of the `sp` package with 50 features and 7 variables:

`labels` text to be written

`cex` character expansion factor

`col`, `font` color and font to be used, respectively.

`srt` string rotation in degrees.

`halo` if true, a "halo" is printed around text.

`map` map index

See [projection](#) dataset for coordinate reference system information.

Source

U.S. Geological Survey [Idaho National Laboratory Project Office](#)

Examples

```
inlmisc::PlotMap(labels, dms.tick = TRUE)
lab <- labels[labels$map == 1L, names(labels) != "map"]
for (i in seq_along(lab))
  do.call(raster::text, c(lab[i, ], as.list(lab@data[i, ])))
str(labels@data)
```

lakes	<i>Lakes and Ponds</i>
-------	------------------------

Description

Perennial lakes and ponds in the vicinity of Idaho National Laboratory, eastern Idaho.

Usage

lakes

Format

A SpatialPolygonsDataFrame of the **sp** package with 155 features of 12 variables. See [projection](#) dataset for coordinate reference system information.

Source

U.S. Geological Survey (USGS), National Geospatial Technical Operations Center, USGS National Hydrography Dataset (NHD) Medium Resolution for Idaho, released August 4, 2014.

Examples

```
inlmisc::PlotMap(lakes, dms.tick = TRUE,  
                 lakes = list(lakes, "lwd" = 1))  
str(lakes@data)
```

mountains	<i>Mountain Ranges and Buttes</i>
-----------	-----------------------------------

Description

Simplified representation of the mountain ranges and buttes in the vicinity of Idaho National Laboratory, eastern Idaho.

Usage

mountains

Format

A SpatialPolygonsDataFrame of the **sp** package with 17 features and 1 variable. See [projection](#) dataset for coordinate reference system information.

Source

U.S. Geological Survey [Idaho National Laboratory Project Office](#)

Examples

```
inlmisc::PlotMap(mountains, dms.tick = TRUE)
sp::plot(mountains, col = "gray", add = TRUE)
str(mountains@data)
```

parameters

Parameter Information for Analytes

Description

Parameter code information for selected chemical constituents, organic compounds, and radionuclides measured for in water samples collected from wells in the U.S. Geological Survey (USGS) water-quality aquifer monitoring network, Idaho National Laboratory and vicinity, Idaho.

Usage

```
parameters
```

Format

A data frame with 74 records and 7 variables:

`parm_cd` USGS 5-digit parameter code

`parameter_group_nm` parameter group name, such as "Radiochemical"

`parameter_nm` long parameter name, such as "Strontium-90,water,unfiltered,picocuries per liter"

`casrn` Chemical Abstracts Service (**CAS**) registry number, such as "10098-97-2" for Strontium-90

`srsname` Substance Registry Services (**SRS**) name, such as "Strontium-90"

`parameter_units` parameter units. Unit abbreviations and descriptions are: "mg/L" milligrams per liter, "mg/L as N" milligrams per liter as Nitrogen, "ug/L" microgram per liter, and "pCi/L" picocuries per liter.

`siunitx` parameter units formatted for LaTeX using the `siunitx` package notation.

Source

USGS water data acquired from the National Water Information System (U.S. Geological Survey, 2019). The **SRS** name (`srsname`) for "Trihalomethanes (four), total, from SDWA NPDWR" was shorten to its preferred acronym "TTHM4".

References

U.S. Geological Survey, 2019, National Water Information System—web services, accessed June 11, 2019, from <https://doi.org/10.5066/F7P55KJN>.

Examples

```
str(parameters)
```

projection	<i>Coordinate Reference System</i>
------------	------------------------------------

Description

PROJ.4 string defining a custom coordinate reference system (CRS) used by the U.S. Geological Survey Idaho National Laboratory Project Office. The CRS is based on the following attributes: Albers equal-area conic projection; latitude of first and second standard parallel is 42.83 and 44.16 decimal degrees, respectively; latitude and longitude of false origin is 41.5 and -113 decimal degrees, respectively; easting and northing of false origin is 200,000 and 0 meters, respectively; Clarke (1966) reference ellipsoid; North American Datum of 1983; and units of meters.

Usage

```
projection
```

Format

A character string describing the CRS in PROJ.4 format.

Examples

```
crs <- sp::CRS(projection) # convert to class "CRS"
print(crs)
```

roads	<i>Primary and Secondary Roads</i>
-------	------------------------------------

Description

Primary and secondary roads in the vicinity of Idaho National Laboratory, eastern Idaho.

Usage

```
roads
```

Format

A SpatialLinesDataFrame of the **sp** package with 1,616 features and 5 variables. See [projection](#) dataset for coordinate reference system information.

Source

U.S. Department of Commerce, U.S. Census Bureau, Geography Division/Cartographic Products Branch. Spatial extract from the Master Address File / Topologically Integrated Geographic Encoding and Referencing (**MAF/TIGER**) Database (MTDB), 2019 data collection, released April 2, 2020.

Examples

```
inlmisc::PlotMap(roads, dms.tick = TRUE,
                 roads = list(roads, "lwd" = 1))
sp::plot(roads[roads@data$PRISEC, ], col = "red", add = TRUE)
str(roads@data)
```

 samples

Water-Quality Data Records

Description

Water-quality data from laboratory analyses of groundwater samples collected from wells in the U.S. Geological Survey (USGS) water-quality monitoring network, Idaho National Laboratory and vicinity, Idaho. Data was obtained from the National Water Information System (U.S. Geological Survey, 2019).

Usage

samples

Format

A data frame with 159,554 records and 19 variables:

site_no USGS site identification number

sample_dt date sample was collected

medium_cd 3-digit medium code that identifies the material type and quality assurance type of the sample. The codes and their meanings are: "WG" water below land surface contained in the saturated zone (groundwater); and "WGQ" groundwater quality-control (QC) sample.

db_no 2-digit NWIS database number. The codes and their meanings are: "01" is the environmental database, and "10" is the quality-assurance (QA) database.

anl_ent_cd analyzing entity code of the organizational unit that performed the sample analysis used to obtain the result.

- `parm_cd` USGS 5-digit parameter code. For example, the parameter code for Tritium is "07000".
- `remark_cd` 1-digit remark code (result level) used to qualify the parameter value. The codes and their meanings are: "" quantified value. "<" actual value is known to be less than the value reported, that is, the measured concentration is below the reporting limit (RL) and represented as a censored (or nondetection) value. For censored values, the value reported is the RL. "E" value is estimated, that is, the actual value is greater than the minimum detection limit (MDL) and less than the laboratory reporting level (LRL). "R" nondetect, result less than sample-specific critical level. "U" material specifically analyzed for but not detected. "V" value affected by contamination.
- `result_va` parameter value; see `parameter_units` variable in the [parameters](#) dataset for the units of measurement.
- `lab_std_dev_va` laboratory standard deviation (SD). For radiochemical data, SD is determined from the counting error. Prior to January 1, 2018, counting error was reported as two SD, therefore, these values were divided by 2.
- `dqi_cd` 1-digit data quality indicator code that indicates the review status of a result. The codes and their meanings are: "A" historical data, "S" presumed satisfactory, and "R" reviewed and accepted.
- `rpt_lev_va` laboratory reporting limit in effect for the parameter and method at the time the measurement was made.
- `rpt_lev_cd` reporting level code that identifies the analytical reporting level appropriate for the analytical method. The codes and their meanings are: "DLBLK" detection limit by blank data; "DLDQC" detection limit by DQCALC, lowest concentration that with 90 percent confidence will be exceeded no more than 1 percent of the time when a blank sample is measured; "IRL" interim reporting level, a temporary reporting level; "LRL" laboratory reporting level, equal to twice the yearly-determined LT-MDL; "LT-MDL" long-term method detection limit, a detection level derived by determining the standard deviation of a minimum of 24 MDL spike sample measurements over an extended period of time; "MDL" method detection limit, minimum concentration of a substance that can be measured and reported with a 99 percent confidence that the analyte concentration is greater than zero; "PQL" practical quantitation limits; "MRL" minimum reporting level, smallest measured concentration that can be reliably measured using a given analytical method; "RLDQC" reporting limit by DQCALC, is greater than or equal to two times the DLDQC; "SSLC" sample-specific critical level, the calculated and reported value is below which the radiochemistry result is considered a non-detect; and "SSMDC" sample-specific minimum detectable concentration, a reporting level that varies for each sample and is primarily used in radiochemical analyses.
- `samp_type_cd` 1-digit sample type code that identifies the QA type of a sample. The codes and their meanings are: "H" samples collected over a period of time (composite); "2" samples prepared from a reference material where none of the analytes of interest are present in detectable quantities (blank); "6" reference material that provide the baseline analytical results for comparison with reference samples; "7" replicate samples; and "9" sample taken from the environment (regular).
- `meth_cd` method code, the codes are documented in the ["NWIS Method Code Dictionary"](#)
- `result_cm_tx` comment about the water quality result
- `date_time` date and time the sample was collected. Missing values of time were substituted with "00:00" (12:00 midnight and start of day).

sample_cd unique identifier for the water sample. The sample code is a concatenation of the date_time and site_no variables.

comments comments pertaining to changes applied after the records were obtained from NWIS.

rep_pair_no number used to identify replicate samples. Replicates are identified by matching a replicate sample (samp_type_cd equal to 7) with its corresponding environmental sample (samp_type_cd equal to 9).

Source

Data obtained from the NWIS-QWDATA database on June 11, 2019 using the QWDATA system (U.S. Geological Survey, 2019).

References

U.S. Geological Survey, 2019, National Water Information System—Water-Quality System (QW-DATA) data retrieval program.

Examples

```
site_no <- "433002113021701" # well RWMC PROD
parm_cd <- "32102"          # carbon tetrachloride
xlim <- as.Date(c("1989-01-01", "2019-01-01"))
d <- samples[samples$site_no == site_no & samples$parm_cd == parm_cd,
             c("sample_dt", "result_va")]
ylab <- parameters[parameters$parm_cd == parm_cd, "parameter_nm"]
main <- sites@data[sites@data$site_no == site_no, "site_nm"]
inlmisc::PlotGraph(d, ylab = ylab, main = main, xlim = xlim,
                  type = "p", pch = 19, seq.date.by = "year",
                  center.date.labels = TRUE)

str(samples)
```

sites

Descriptive Site Information

Description

Information for sampling sites in the U.S. Geological Survey (USGS) aquifer monitoring networks, Idaho National Laboratory and vicinity, Idaho.

Usage

sites

Format

A `SpatialPointsDataFrame` of the `sp` package with 182 records and 21 variables:

`site_no` USGS site number for monitoring well

`station_nm` USGS site name

`coord_meth_cd` latitude/longitude coordinate method code. The codes and their meanings are: "D" differentially corrected Global Positioning System (GPS), "G" mapping grade GPS unit (handheld accuracy range 3.7 to 12.2 meters), "L" long range navigation system, "M" interpolated from topographic map, and "S" transit, theodolite, or other surveying method.

`coord_acy_cd` accuracy code for latitude/longitude values. The codes and their meanings are: "H" accurate to ± 0.1 second, "5" accurate to ± 0.5 second, "S" accurate to ± 1 second, and "F" accurate to ± 5 seconds.

`alt_va` elevation of the land surface reference point, in feet above the North American Vertical Datum of 1988.

`alt_meth_cd` method code for measuring elevation. The codes and their meanings are: "D" differentially corrected global positioning system, "L" level or other surveyed method, and "M" interpolated from topographic map.

`alt_acy_va` accuracy of the elevation value (`alt_va`), does not account for vertical datum shift.

`construction_dt` date the well was completed.

`huc_cd` hydrologic unit code (HUC). Hydrologic units are geographic areas representing part or all of a surface drainage basin or distinct hydrologic feature and are delineated on the [Hydrologic Unit Map](#).

`reliability_cd` reliability code for data available for the site. The codes and their meanings are: "C" data have been checked by the reporting agency, and "U" unchecked data.

`nat_aqfr_cd` national aquifer codes

`aqfr_cd` aquifer codes defined by the catalog of aquifer names and geologic unit codes used by the Water Mission Area.

`aqfr_type_cd` aquifer type code. The codes and their meanings are: "C" confined single aquifer, "M" confined multiple aquifers, "U" unconfined single aquifer, and "X" mixed (confined and unconfined) multiple aquifers.

`well_depth_va` depth of the finished well, in feet below the land surface datum

`hole_depth_va` total depth of the borehole, in feet below the land surface datum

`depth_src_cd` source code for depth measurements. The codes and their meanings are: "A" reported by another government agency, "D" from driller's log or report, "G" private geologist-consultant or university associate, "L" interpreted from geophysical logs by personnel of source agency, "O" reported by owner of well, "R" reported by person other than the owner, driller, or another government agency, and "S" measured by personnel of reporting agency.

`site_nm` local site name

`completion_cd` borehole completion code. The codes and their meanings are: "O" open hole completion, "M" multilevel completion, and "P" open hole completion prior to multilevel completion.

`network` aquifer monitoring network, either "aquifer" or "perched".

`pos` a position specifier for site-labels on a map. Values of 1, 2, 3 and 4, respectively indicate positions below, to the left of, above and to the right of the site coordinates.

See [projection](#) dataset for coordinate reference system information.

Source

USGS site data acquired from the NWIS (U.S. Geological Survey, 2020).

References

U.S. Geological Survey, 2020, National Water Information System—web services, accessed August 4, 2020, from <https://doi.org/10.5066/F7P55KJN>.

Examples

```
inlmisc::PlotMap(sites, dms.tick = TRUE)
sp::plot(sites, add = TRUE)
str(sites@data)
```

streams

Rivers and Streams

Description

Stream segments in the vicinity of Idaho National Laboratory, eastern Idaho.

Usage

```
streams
```

Format

A SpatialLinesDataFrame of the **sp** package with 197 features of 14 variables. See [projection](#) dataset for coordinate reference system information.

Source

U.S. Geological Survey (USGS), National Geospatial Technical Operations Center, USGS National Hydrography Dataset (NHD) Medium Resolution for Idaho, released August 4, 2014.

Examples

```
inlmisc::PlotMap(streams, dms.tick = TRUE,
                  rivers = list(streams, "lwd" = 1))
str(streams@data)
```

topo

Land-Surface Topography

Description

Land-surface topography and shaded relief in the vicinity of Idaho National Laboratory, eastern Idaho.

Usage

topo

Format

A RasterStack of the **raster** package with 2 layers. Grid cells in the "elevation" layer represent land-surface elevations in meters above the North American Vertical Datum of 1988 (NAVD 88). Grid cells in the "hillshade" layer represent shaded relief calculated from the slope and aspect of land-surface elevations. The spatial grid is composed of 900 rows and 900 columns, and has cell sizes that are constant at 100 meters by 100 meters. See [projection](#) dataset for coordinate reference system information.

Source

The National Map (**TNM**) 1/3-arc-second DEM (Gesch, 2007; Gesch and others, 2002), accessed on August 4, 2020. This dataset can be downloaded in a Esri ArcGRID™ format using **TNM Download**. Elevation datasets are distributed in geographic coordinates in units of decimal degrees, and in conformance with the NAD 83. Elevation values are in meters above the NAVD 88. The west, east, south, and north bounding coordinates for this dataset are -114, -112, 43, and 45 decimal degrees, respectively.

References

Gesch, D.B., 2007, The National Elevation Dataset, in Maune, D., ed., Digital Elevation Model Technologies and Applications—The DEM Users Manual, 2nd ed.: Bethesda, Maryland, American Society for Photogrammetry and Remote Sensing, p. 99–118.

Gesch, D., Oimoen, M., Greenlee, S., Nelson, C., Steuck, M., and Tyler, D., 2002, The National Elevation Dataset: Photogrammetric Engineering and Remote Sensing, v. 68, no. 1, p. 5–11.

Examples

```
inlmisc::PlotMap(topo[["elevation"]], bg.image = topo[["hillshade"]],
  pal = inlmisc::GetColors(scheme = "dem3", alpha = 0.5),
  dms.tick = TRUE, useRaster = TRUE)
```

Index

* datasets

- background, 2
- benchmarks, 3
- cities, 4
- counties, 5
- dl, 6
- esrp, 7
- facilities, 7
- gwl, 8
- idaho, 9
- inl, 10
- labels, 11
- lakes, 12
- mountains, 12
- parameters, 13
- projection, 14
- roads, 14
- samples, 15
- sites, 17
- streams, 19
- topo, 20

- background, 2
- benchmarks, 3

- cities, 4
- counties, 5

- dl, 6

- esrp, 7

- facilities, 7

- gwl, 8

- idaho, 9

- inl, 10

- labels, 11

- lakes, 12

- mountains, 12

- parameters, 2, 4, 13, 16

- projection, 5, 7, 9–12, 14, 15, 18–20

- roads, 14

- samples, 15

- sites, 8, 17

- streams, 19

- topo, 20