



# Orphaned Wells Interactive Map

## DETAILS OF ANALYSIS AND DATA SOURCES

This National Parks Conservation Association (NPCA) interactive map provides users access to abandoned wells data based on our assessment of publicly available information collated to identify sites near all 423 national park service units. This dataset is conservative in its estimate of number of wells, is a snapshot in time (varying by state dataset), and is varying by state.

FracTracker Alliance and NPCA looked at state data on orphaned wells and discovered that there are 214,548 orphaned wells nationwide and 31,737 of them are within 30 miles of a national park site. An “orphaned” oil and gas well is a well that is not actively being used for authorized purposes, such as production, injection, or monitoring, and for which either no operator can be found, or the operator is unable to permanently plug the well and remediate and reclaim the well site. Federal, Tribal and state definitions vary for abandoned, idle and orphaned wells. Because there is not a uniformed way of tracking orphaned wells, estimates can range anywhere between thousands to millions of unidentified orphaned wells. FracTracker relied on information available at the state level to determine the number of orphaned wells using the best available data.

## Alaska

Regulator: Department of Commerce, Community, and Economic Development / Alaska Oil and Gas Conservation Commission

Download page: <https://www.commerce.alaska.gov/web/aogcc/Data.aspx>

Download date: 4/15/21

Direct link: <http://aogweb.state.ak.us/DataMiner3/Forms/WellList.aspx>

Definitions: <https://dog.dnr.alaska.gov/About/Definitions>

Notes: Statuses used: administratively abandoned (n=26) and surface plugged (n=1)

None of the 27 wells were within the 30 mile investigation zone, so there are no Alaska wells in the national file.

## Alabama

Regulator: Geological Survey of Alabama / Oil and Gas Board

Download page: <https://www.gsa.state.al.us/ogb/gisdata>

Download date:

Direct link: <https://www.gsa.state.al.us/img/ogb/gis/well.zip>

Definitions: <http://www.alabamaadministrativecode.state.al.us/docs/oil/1OIL4.htm>

Notes: Statuses used include AB - Abandoned; DA - Dry and Abandoned; and TA - Temporarily Abandoned

440 of 4,938 abandoned wells within 30-mile investigation zone.

## Arkansas

Regulator: Arkansas Dept. of Energy and Environment - Oil and Gas Commission

Download page: <https://gis.arkansas.gov/>

Download date: 4/21/2021

Direct link: <https://gis.arkansas.gov/product/arkansas-oil-and-gas-wells/>

Definitions:

Notes: Determined status code definitions by matching one of each type to <http://www.aogc.state.ar.us/welldata/wells/default.aspx> which provides them in English.

Statuses include: AOW - Abandoned / Orphaned Well; DA - Dry and Abandoned; and TA - Temporarily Abandoned. 7,571 results.

2,186 wells within investigation zone.

2,186 wells within investigation zone.

## Arizona

Regulator: Arizona Oil and Gas Conservation Commission

Download page: Requested via email

Download date: 4/15/2021

Direct link: Requested via email

Definitions:

Notes: "Well\_Status" entries are in English, not coded. 42 results.

4 results in the investigation zone.

## California

Regulator: CalGEM

Download page: <https://wellstar-public.conservacion.ca.gov/General/PublicDownloads/Index>

Download date: 4/21/2021

Direct link: <https://calgem-pid.conservacion.ca.gov/pid/2020CaliforniaOilAndGasWells.csv>

Definitions: <https://www.conservacion.ca.gov/calgem/maps/Documents/GIS-metadata-ReadMe.pdf>

Notes: Well statuses used are abeyance and idle, with 38,555 results. Other choices were active, cancelled, new, plugged, plugged only, and unknown. Original .csv didn't have lat/long values. Full OG dataset was hanging during lat/long calculations from shapefile, so I exported the subset and made calculations on the smaller file.

6,932 results in investigation area.

## Colorado

Regulator: Department of Natural Resources - Colorado Oil and Gas Conservation Commission

Download page: <https://cogcc.state.co.us/data2.html#/downloads>

Download date: 4/21/2021

Direct

link: [https://cogcc.state.co.us/documents/data/downloads/gis/COGCC\\_OWP\\_Sites\\_20190701\\_SHP.ZIP](https://cogcc.state.co.us/documents/data/downloads/gis/COGCC_OWP_Sites_20190701_SHP.ZIP)

Definitions:

Notes: Direct link for orphans dated 7/1/2019 with 422 locations. Checked broader dataset for wells in the other statuses that we are interested in. CO has tens of thousands of wells that are "dry and abandoned." I sent email to CO regulator asking for clarification on whether dry and abandoned wells were in fact permanently plugged, and if so how they differ from plugged and abandoned wells. Awaiting reply (never received).

131 wells in clip geometry.

## Florida

Regulator: Florida Department of Environmental Protection

Download page: <https://floridadep.gov/water/oil-gas/content/oil-and-gas-permit-database>

Download date: 4/22/2021

Direct link: [http://publicfiles.dep.state.fl.us/dworm/oil\\_gas/data/O\\_G\\_WELLS\\_WEBSITE.xlsx](http://publicfiles.dep.state.fl.us/dworm/oil_gas/data/O_G_WELLS_WEBSITE.xlsx)

Definitions:

Notes: Used Junked and TA statuses 25 results.

14 results in investigation area.

## Idaho

Regulator: Idaho Oil & Gas Conservation Commission

Download page: <https://ogcc.idaho.gov/data-explorer/>

Download date: 3/1/2021

Direct link:

Definitions:

Notes: ID has very few wells. There are 5 wells indicated as dry holes, however these all have plug dates and are therefore not included.

No wells in investigation area.

## **Illinois**

Regulator: Illinois DNR - Oil & Gas Resource Management

Download page: <https://clearinghouse.isgs.illinois.edu/data/geology/location-points-isgs-wells-and-borings-database>

Download date: 4/22/2021

Direct

link: [https://clearinghouse.isgs.illinois.edu/sites/clearinghouse.isgs/files/Clearinghouse/data/ISGS/Geology/zips/IL\\_WELLS\\_Borings\\_Location\\_Pt.zip](https://clearinghouse.isgs.illinois.edu/sites/clearinghouse.isgs/files/Clearinghouse/data/ISGS/Geology/zips/IL_WELLS_Borings_Location_Pt.zip)

Definitions: [https://isgs-oas.isgs.illinois.edu/geoprodDAD/image\\_get.xls?p\\_id=29](https://isgs-oas.isgs.illinois.edu/geoprodDAD/image_get.xls?p_id=29) (seems to have SSL certificate issue)

Notes: IL has 147 different well status codes. We looked at 18, although some of them had zero records. They are: ABLOC, DA, DAG, DAO, DAOG, DRY, JA, JAG, JAO, JAOG, LUST, METHV, SUS, SUSO, TA, TAG, TAO, TAOG. These total 19,871 wells out of 622,272 on file. Also, IL has numerous wells outside of the state boundary (many are probably legit offshore in Lake Michigan).

3,521 wells in investigation area.

## **Indiana**

Regulator: Indiana Department of Natural Resources

Download page: See below

Download date: 4/19/2021

Direct link:

Definitions:

Notes: Indiana's O&G data is supposedly freely available, but difficult to obtain. Notably, Indiana does not use well API numbers, favoring their own classification system. Well data was found at [https://gis.in.gov/arcgis/rest/services/DNR/OilGasWells\\_DNR\\_DOG\\_IN/MapServer](https://gis.in.gov/arcgis/rest/services/DNR/OilGasWells_DNR_DOG_IN/MapServer)

Location data converted from Universal Transverse Mercator Zone 16 North to decimal degree. Statuses used include: Inactive; Inadqtlly Plugged; Orphaned, TA. IN also has "Presumed plugged" but didn't include these.

1,254 records. 253 of those within investigation area.

## **Kansas**

Regulator: Kansas Corporation Commission

Download page: <http://www.kgs.ku.edu/PRS/petroDB.html>

Download date: 4/22/2021

Direct link: [http://www.kgs.ku.edu/PRS/Ora\\_Archive/OILGAS\\_WELLS\\_GEO27.zip](http://www.kgs.ku.edu/PRS/Ora_Archive/OILGAS_WELLS_GEO27.zip)

Definitions: <http://www.kgs.ku.edu/Magellan/Elog/status.html>

Notes: Zip file is comma delimited but saved as a text file. There are two status columns. I chose Status2 because some of our selected choices from Status were shown to be plugged in Status2. Choices are Approved for plugging - CP-1 received; Expired plugging application (CP-1); Inactive well; KCC Fee Fund Plugging. 31,454 wells total. 2,171 wells in investigation area.

## Kentucky

Regulator: Kentucky Division of Oil and Gas; Data through Kentucky Geologic Survey

Download page: <https://www.uky.edu/KGS/emsweb/data/kyogshape.html>

Download date: 4/23/2021

Direct link: [https://kgs.uky.edu/ogdata/kyog\\_dd.zip](https://kgs.uky.edu/ogdata/kyog_dd.zip) AND <https://eec.ky.gov/Natural-Resources/Oil-and-Gas/Documents/Abandoned%20Wells%20-%20January%202020.xls>

Definitions: [https://www.uky.edu/KGS/emsweb/data/kyog\\_dd.htm](https://www.uky.edu/KGS/emsweb/data/kyog_dd.htm)

Notes: Statuses are in the PLUG\_AFDVT field, and we selected AB - Well is known to be abandoned, manner of plugging not known; and IR - Abandonment attested to by an Inspector Report (record not generally available through KGS). However, the only status available in the dataset is PA - Standard plugging affidavit form specified by KRS 353. None of our selected statuses exist. I was able to locate a dataset of abandoned wells last updated on 1/3/2020. <https://eec.ky.gov/Natural-Resources/Oil-and-Gas/Programs/Pages/State-Bid-Well-Program.aspx> direct download <https://eec.ky.gov/Natural-Resources/Oil-and-Gas/Documents/Abandoned%20Wells%20-%20January%202020.xls> Matched with KGS Permit number - this yielded 8,543 matches out of 15,251 on the abandoned list. Matched with concatenated lease name and number - this yielded 12,650 matches, so this is the subset that we went with. 2,884 within investigation area.

## Louisiana

Regulator: Louisiana Department of Natural Resources

Download page: <https://sonris-www.dnr.state.la.us/gis/agsweb/IE/JSViewer/index.html?TemplateID=181>

Download date: 4/26/2021

Direct link:

Definitions: FracTracker Louisiana map has status code descriptions in the the Details section. <https://maps.fractracker.org/latest/?webmap=3718fd9ae3ef491cb66456407a8a127a>

Notes: Statuses included are: 18 - Temp. abandoned well; 19 - Inactive well, no responsible party; 20 - PA-35 Temp. inactive well to be omitted from the production report; 26 - Act 404 orphan well - injection and mining; 28 - Unable to locate well - no plugged and abandoned; 32 - Shut-in dry hole - no future utility; 34 - Shut-in productive - no future utility. 5,028 total wells. Surface Lat/Long values appear to be reversed. 939 wells in investigation area.

## **Maryland**

Regulator: Maryland Department of the Environment -

Download page:

Download date:

Direct link:

Definitions:

Notes: Maryland has very few wells but does not publish O&G data but I have requested updated data. Per Molly Michaelson, Program Manager of the state's mining program, "It is not online and I don't think we can get you a whole lot out of database. No API number or coordinates." Therefore, we cannot determine if there are abandoned wells in Maryland.

No wells in investigation area.

## **Michigan**

Regulator: Michigan Department of Environment, Great Lakes, and Energy

Download page: <https://gis-michigan.opendata.arcgis.com/datasets/egle::oil-gas-test-well-surface-hole-locations?geometry=-175.875%2C-38.921%2C42.270%2C18.859>

Download date: 4/27/2021; updated by site 2/21/2021

Direct link:

Definitions:

Notes: Michigan has a GIS Open Data page linked above. From shapefile, selected "Orphan", "Plugging Approved", "Suspended Operations", and "Temporarily Abandoned. This selected 63,807 of the state's total inventory of 91,116, which is obviously a huge percentage. Contacted department and left voicemail asking whether "Plugging Approved" wells were actually plugged. MI returned call, verifying that these wells are indeed plugged, so they were removed from the list. There is also a "Plugging Completed" option, and most of the "Plugging Approved" have a dummy plug date of 1/1/1970. Interestingly, Pennsylvania began using this exact dummy date for blank date fields earlier this year.

1,053 wells, 217 in investigation zone.

## **Missouri**

Regulator: Missouri Department of Natural Resources

Download page: <http://dnr.mo.gov/geology/geosrv/ogc/ogc-permits/>

Download date: 4/27/2021

Direct link: <http://dnr.mo.gov/geology/geosrv/docs/oil-gas-wells.xlsx>

Definitions:

Notes: Statuses used include: Abandoned; Abandoned, Known location and verified; Abandoned, No evidence of existence / unable to find; Abandoned, Unknown location; Inactive - Initial 30 day window; Orphaned; Temporarily Abandoned (Idle). 4,908 wells.

3,332 of wells are in investigation area.

## **Mississippi**

Regulator: Mississippi State Oil and Gas Board

Download page: <https://www.ogb.state.ms.us/welldata.php>

Download date: 4/27/2021

Direct link:

Definitions: On Details section of FracTracker map

<https://maps.fractracker.org/latest/?appid=a72d458485ae4880bc3f26ff98854df8>

Notes: Selected AA - Intent to abandon well; AU - Abandoned - Unapproved; AUS - Abandoned - Unapproved - Surveyor inspection; DA - Dry and abandoned; JA - Junked and abandoned; O - Orphaned well; PO - Potential orphaned well; TA - Temporarily abandoned. 820 total selected.

219 in investigation area.

## **Montana**

Regulator: Montana Board of Oil and Gas Conservation

Download page: <http://dnrc.mt.gov/divisions/board-of-oil-and-gas-conservation>

Download date: 4/29/2021

Direct link: <http://www.bogc.dnrc.mt.gov/gisdata/WellSurface/WellSurface.txt>

Definitions:

Notes: At first, Montana's data appears to be years out of date, as you have to pass through a folder with the date 5/22/2015. However, on the link above, the data is up to date.

823 abandoned wells, 45 of which are in the investigation area.

## North Dakota

Regulator: North Dakota Department of Natural Resources

Download page: <https://www.dmr.nd.gov/OaGIMS/viewer.htm>

Download date: 4/26/2021 (checked on 5/4 but this was still most recent upload)

Direct link: <https://www.dmr.nd.gov/output/ShapeFiles/Wells.zip>

Definitions: Codes are on FracTracker map page

<https://maps.fractracker.org/latest/?appid=de52b05f484a4c4fac08e94cc4d7048c&webmap=b27a81c0649c43438e834664613ff8f1>

Notes: Statuses used include AB - Abandoned (Shut-In >12 Months); DRY (not on list but presumably dry and abandoned); IA - Inactive (Shut-In  $\geq$  3 months and  $\leq$  12 months); IAW - Inactive Well Waiver; TA - Temporarily Abandoned; TAI - Temporarily Abandoned, SoD (Intermediate Casing Set); TAO - Temporarily Abandoned - Observation; TASC - Temporarily Abandoned, SoD (Surface Casing Set), TATD - Temporarily Abandoned, Drilled to Total Depth. Results in 9,080 of 38,845 total wells.

1,872 in investigation area.

## Nebraska

Regulator: Nebraska Oil and Gas Conservation Commission

Download page: <http://www.nogcc.ne.gov/NOGCCPublications.aspx>

Download date: 5/4/2021

Direct link: [http://www.nogcc.ne.gov/Publications/NE\\_WELLS.zip](http://www.nogcc.ne.gov/Publications/NE_WELLS.zip)

Definitions: [http://www.nogcc.ne.gov/Publications/NebraskaWellStatus\\_TypeCodes.pdf](http://www.nogcc.ne.gov/Publications/NebraskaWellStatus_TypeCodes.pdf)

Notes: Well status codes used include AL - Abandoned Location; AU - Abandoned - Unapproved; DA - Dry and Abandoned; IA - Inactive; JA - Junked and Abandoned; TA - Temporarily Abandoned. No entries for AU or IA, but the others account for 13,038 of total 22,399 total inventory, a large percentage. If this seems unreasonable, we could remove the DA wells, which account for most of them, but we are including these in other states. No plug data on dataset to check against.

2,057 wells in investigation area.

## New Mexico

Regulator: New Mexico Oil Conservation Division

Download page: <ftp://164.64.106.6/Public/OCD/OCD%20GIS%20Data/>



Download date: 3/25/2021

Direct

link: <https://wwwapps.emnrd.state.nm.us/ocd/ocdpermitting/Reporting/Compliance/InactiveWellList.aspx?production=15&ACO=Exclude&TA=Exclude> AND  
<ftp://164.64.106.6/Public/OCD/OCD%20GIS%20Data/>

Definitions:

Notes: New Mexico keeps a list of inactive wells, but they do not have location coordinates. Fortunately, these can be matched with the statewide download via the wells' API numbers. 2,269 records.

431 wells in investigation area.

## **Nevada**

Regulator: Nevada Bureau of Mines and Geology

Download page: <https://data-nbmg.opendata.arcgis.com/datasets/oil-and-gas-wells/data?geometry=-137.212%2C35.564%2C-95.399%2C41.571&orderBy=spuiddatetime&orderByAsc=false>

Download date: 3/25/2021

Direct link:

Definitions:

Notes: 96 wells from "Abandoned" and "Temporarily Abandoned". A few are missing location data. One has coordinates in Utah (not a part of our investigation).

29 wells in investigation area.

## **New York**

Regulator: New York Division of Mineral Resources

Download page: <https://www.dec.ny.gov/energy/1603.html>

Download date: 4/29/2021

Direct link: <ftp://ftp.dec.state.ny.us/dmn/zip/wellDOS.zip>

Definitions: Included in metadata for ftp download

Notes: Included statuses are: IN - Inactive; TA - Temporarily abandoned; UN - Unknown; UL - Unknown located; UM - Unknown not found. Since this dataset also includes plug dates, I have removed those records from the unknown status categories. 7,490 wells fit this criteria.

492 wells in investigation area.

## Ohio

Regulator: Ohio Department of Natural Resources

Download page: <https://gis.ohiodnr.gov/MapView/?config=oilgaswells> AND [https://apps.ohiodnr.gov/oilgas/rbdmsreports/Reports\\_Completions.aspx](https://apps.ohiodnr.gov/oilgas/rbdmsreports/Reports_Completions.aspx)

Download date: 5/7/2021

Direct link: <https://gis.ohiodnr.gov/MapView/download.ashx?18cc41d7-b93d-4603-bf63-53fdf3eda507>

Definitions:

Notes: Ohio has a statewide download. It has three columns similar to well status but not quite the same: "WL\_SYMBOL", "MAPSYMBOL\_", and "WELL\_TYP". However, it also has a page where you can download wells by status. I downloaded the following categories for this project: "Dry and Abandoned", "Location Unknown" (was unsure if it had any record of locations that couldn't be verified but it doesn't), "Lost Hole", "Orphaned Well - Pending", "Orphaned Well - Ready", "Temporarily Abandoned", plus specific downloads for temporarily abandoned wells in their 1st to 4th years. Two of the five TA well categories had no results, and others seemed buggy, apparently listing the same well dozens of times. For this reason, I pivoted the aggregated results of these categories to remove duplicates to list unique API numbers and the average of associated lat and long values. All of this resulted in just 383 usable locations, but there are probably actually tens of thousands of abandoned wells statewide.

37 abandoned wells are in the investigation area.

## Oklahoma

Regulator: Oklahoma Corporation Commission

Download page: <https://oklahoma.gov/occ/divisions/oil-gas/oil-gas-data.html>

Download date: 5/9/2021

Direct link: <https://oklahoma.gov/occ/divisions/oil-gas/oil-gas-data.html>

Definitions:

Notes: Oklahoma separates out the orphaned wells into a separate list, with 18,276 records. However, many of these do not have coordinates or have invalid coordinates, as Oklahoma's data is extremely messy. To find wells in the right ballpark, I checked for latitude values between 33 and 37 and longitude values between -96 and -103, basically a bounding box that is slightly oversized on the southern and eastern sides. This led to 12,489 valid locations. 12,486 of these had coordinates within the state of Oklahoma according to the GIS intersect tool.

176 within investigation area.

## **Oregon**

Regulator: Oregon Department of Geology and Mineral Industries

Download page: <https://www.oregongeology.org/mlrr/oilgas-report.htm>

Download date: 4/26/2021

Direct link: [https://www.oregongeology.org/mlrr/spreadsheets/OG\\_Permits\\_01-29-2021.xls](https://www.oregongeology.org/mlrr/spreadsheets/OG_Permits_01-29-2021.xls)

Definitions:

Notes: There are no wells categorized as abandoned or orphaned in Oregon. There is hardly any drilling in the state, with just eight producing wells and a handful more that are shut-in.

## **Pennsylvania**

Regulator: Pennsylvania Department of Environmental Protection

Download page:

<https://www.dep.pa.gov/DataandTools/Reports/Oil%20and%20Gas%20reports/Pages/default.aspx>

Download date: 4/26/2021

Direct

link: [http://cedatareporting.pa.gov/Reportserver/Pages/ReportViewer.aspx?/Public/DEP/OG/SSRS/Abandoned\\_Orphan\\_Web](http://cedatareporting.pa.gov/Reportserver/Pages/ReportViewer.aspx?/Public/DEP/OG/SSRS/Abandoned_Orphan_Web)

Definitions:

Notes: This is PA's official list of orphaned and abandoned wells. It is known to be far from complete. I have removed DEP plugged wells from this list leaving 8,786 wells. DEP estimates there could be as many as 560,000 of these wells statewide. See poster (large file size) [https://gsa.confex.com/gsa/2017NE/webprogram/Handout/Paper290348/DEP\\_Pennsylvania\\_Legacy\\_Well\\_Integrity\\_Emissions\\_Study\\_GSA2017.pdf](https://gsa.confex.com/gsa/2017NE/webprogram/Handout/Paper290348/DEP_Pennsylvania_Legacy_Well_Integrity_Emissions_Study_GSA2017.pdf)

64 wells in investigation area.

## **South Dakota**

Regulator: South Dakota Department of Agriculture and Natural Resources

Download page: [http://www.sdgs.usd.edu/sdoil/oilgas\\_databases.aspx](http://www.sdgs.usd.edu/sdoil/oilgas_databases.aspx)

Download date: 4/28/2021

Direct link: <http://www.sdgs.usd.edu/pubs/og/SDOILexport.zip>

Definitions:

Notes: Used "Abandoned - Not Regulated" and "Temporarily Abandoned" statuses, with 29 resulting wells.

1 well in investigation area.

## Tennessee

Regulator: Tennessee Department of Environmental Conservation

Download page: [https://environment-online.state.tn.us:8090/pls/enf\\_reports/f?p=9034:34300:0::NO](https://environment-online.state.tn.us:8090/pls/enf_reports/f?p=9034:34300:0::NO) or <https://tdeconline.tn.gov/oilgaswells/> (click arrow at bottom then can download the wells as .csv)

Download date: 5/9/2021

Direct link:

Definitions:

Notes: TN data lacks well status information, so this information was requested from the regulator, who provided it to us. This data lacked latitude and longitude values, but we were able to obtain the location by matching well API numbers to the general statewide download.

413 abandoned wells, 317 of which are in the investigation area.

## Texas

Regulator: Texas Railroad Commission

Download page: <https://mft.rrc.texas.gov/link/4e9023eb-e4ee-45b8-81b7-aec1494c1e8e> (all wells)

Download date: 5/8/2021

Direct link: <https://www.rrc.state.tx.us/media/obvd4xnu/orphanwells0321.zip> (orphans)

Definitions: <https://www.rrc.state.tx.us/media/kmld3uzj/digital-map-information-user-guide-2021.pdf> SYMNUM codes pages 17-19.

Notes: These are released by county, and Texas has a lot of counties. Each county folder has tophole locations, bottomhole locations, and most of them also have lines for deviated or horizontal wells. We just used tophole locations and merged the counties together. Initially missed county codes after 499 because they are on a second page but saw the holes in the state map and added them in, along with Terrell County, which was overlooked in the initial merge process, and wells in Federal waters that probably don't affect this project.

Despite the very large number of SYMNUM codes, the only one that could possibly apply is 3 - Dry Hole. Because of this, I searched elsewhere and found a separate listing of 6,702 orphaned wells. The data was downloaded on 5/9 but the file itself is given the date 3/21/2020, despite supposedly being updated monthly per <https://www.rrc.state.tx.us/oil-and-gas/research-and-statistics/well-information/orphan-wells-12-months/>. The linked page claims to have been updated on 4/15/2021, so it is possible that they either got the year wrong in the file name or have been overwriting the file for a year without updating the file name?

At any rate, the time spent processing the county shapefiles was not wasted, because the locations were then obtained by matching the well API numbers to the shapefile.

Due to Excel's problem with leading zeroes on .csv files, I converted the orphans to a .dbf using an online utility so that it could be matched to the shapefile (ArcGIS requires an extension to use Excel files). 6,369 of the 6,702 matched to the statewide dataset of 1.3 million+ wells.

907 wells in investigation area.

## Utah

Regulator: Utah Department of Natural Resources

Download page:

Download date:

Direct link:

Definitions: <https://oilgas.ogm.utah.gov/oilgasweb/live-data-search/lds-ref/ref-codes-lu.xhtml>

Notes: Selected statuses include TA - Temporarily-abandoned oil or gas well; and I - Inactive service well (well types: WI, WD, GI, GS, WS, TW) These codes are well types including injection, storage, and test wells. 1,398 matches.

1,383 wells in investigation area.

## Virginia

Regulator: Virginia Department of Mines, Minerals, and Energy

Download page: <https://dmme.virginia.gov/dgo inquiry/frmMain.aspx?ctl=7>

Download date: 5/7/2021

Direct link:

Definitions:

Notes: Specific statuses can be selected at the download page. We used "Abandoned conversion wh"; "Orphaned well"; and "Partial Plug" with 19 results. Locations are in North American Datum 1983 state plane, feet, Virginia South Zone (<https://www.dmme.virginia.gov/dgo inquiry/>) which I converted to lat/long.

10 of the wells are within the investigation area.

## Washington

Regulator: Washington State Department of Natural Resources

Download page: <https://www.dnr.wa.gov/programs-and-services/geology/energy-mining-and-minerals/oil-and-gas-resources#more-information>

Download date: 3/25/2021

Direct link: [https://www.dnr.wa.gov/publications/ger\\_ofr2012-02\\_oil\\_and\\_gas\\_wells.zip](https://www.dnr.wa.gov/publications/ger_ofr2012-02_oil_and_gas_wells.zip)

Definitions:

Notes: Washington has a small number of historical O&G wells, but none currently producing, and none in the categories that we are looking for. There are some wells that are given a status that seems inconsistent with this non-production, such as "Drilled" and "Completed", as opposed to "Plugged and Abandoned". However, the download page indicates that there are 45 gas storage wells that access a sizable storage reservoir. Note that on the download page, the "Oil and Gas Tabular Date" link has a date associated with it: 2012-02.

## **West Virginia**

Short Description: There are 13,118 wells in West Virginia described by West Virginia Department of Environmental Protection as "Wells other than active status" AND "Abandoned". This is a conservative estimate of total orphaned wells in the state.

Regulator: West Virginia Department of Environmental Protection

Download page: <https://data-wvdep.opendata.arcgis.com/datasets/wvdep-wells-other-than-active-status?geometry=-88.508%2C37.341%2C-72.501%2C40.336>

Download date: 5/7/2021

Direct link:

Definitions:

Notes: DL page is "Wells other than active status". Only status used is "Abandoned" with 14,276 results. Shapefile appears to have been entered in Universal Transverse Mercator Zone 17 North, but lat/long values in decimal degree were added. Only 13,118 of these wells were within WV's boundaries on the original shapefile, so the others were discarded. 1,156 wells apparently all have the same coordinates in Virginia.

1,617 wells in investigation area.

## **Wyoming**

Regulator: Wyoming Oil and Gas Conservation Commission

Download page: <http://pipeline.wyo.gov/legacywogcce.cfm>

Download date:

Direct link:

Definitions: Status codes on Details section of FracTracker Map

<https://maps.fractracker.org/latest/?appid=2571cd357d5a47f59e2f2929ad7fe102>

Notes: Statuses used include DH - Dry Hole; TA - Temporarily Abandoned; DR - Dormant; NI - Notice of Intent to Abandon; SR - Subsequent Report of Abandonment. There is a status of PA - Permanently Abandoned, but this is released separately from the other wells, and I believe it to mean "Plugged and abandoned" since this state does not have that status. 10,155 total wells.

289 wells in investigation area.