Task B.3.5 Loudoun County Wells and Groundwater Quantity

B.3.5 Wells and Groundwater Quantity (using data sets 1.1, 1.2, 1.3, 1.5, and 3.1)

Data Set 1.1
Loudoun County Groundwater, Well, and Pollution Sources

Well construction and groundwater information in database (MS Access) with locations in GIS maintained by B&D and Health Department. Source of most data from paper files generated during Health Department well permitting process (e.g., GW2 well construction form). Subset of WellPoll database, which includes well data and pollution sources data. Data on ~18,500 wells dating from 1930 to present, with information of varying quality and completeness including: location (VA state plane coordinates), surface elevation (62% complete), well depth (70%), casing depth (65%), static water level (53%) {but of suspect accuracy}, total yield (60%), depth of primary yield zone (60%), and transmissivity (~250 values).

Also includes groundwater quality data. Water quality data for a limited number of parameters are entered in the database for some wells (~2,100) constructed and tested prior to 2002. Water quality data provided digitally to B&D by National Testing Labs started in 2002 and is available for approximately 2,250 wells. These data are considered level A quality and typically consist of 100 physical/chemical water quality parameters per well for a total of more than 200,000 individual analyses. NTL data linked to the groundwater database by Health Department Permit No.

Also includes data on potential pollution sources – primarily on-site sewage disposal systems (e.g., drainfields) but also other sites such as cemeteries, landfills, chemical storage sites, etc. Currently approximately 15,000 records with site ID numbers and corresponding points in GIS. Data in some of the old records may be obsolete. Currently, data are obtained primarily from the Health Department sewage disposal system permitting process.

Data Set 1.2
USGS Groundwater Wells

The USGS operates three real-time water level measurement wells within Loudoun County or contributing watersheds. One well is located on the ridge of Short Hill north of Hillsboro (1963 to present), one is located east of Leesburg (1977 to present), and the third is in Prince William County, just south of the Loudoun County line in the Bull Run watershed (1968 to present). Data is added to B&D databases through automated web queries.

Data Set 1.3
County Hydrogeologic Studies
These reports are valuable sources of high-quality groundwater data, including level data, geologic logs and aquifer testing data. The reports are required for most large subdivisions, as well as other developments with anticipated usage greater than 10,000 gal/day. The County has ~ 165 reports on file. However, these reports are largely paper files only, and need to be compiled electronically. Tasks (subcontract and in-house) are now underway to compile these into a new “enhanced” Loudoun County well database. Activities are expected to be completed by May 2007. This will replace the draft data now in the database.

Data Set 1.5
WRMP Monitoring Wells
B&D started monitoring groundwater levels in the county in 2003 and, with two wells added in December 2006, currently monitors eight wells (with the goal of establishing 17-20 wells by 2009). Water levels recorded by automatic data loggers several times per day and manually downloaded. Records are incomplete for some wells. (Water quality sampling from many of these wells is slated to begin in 2007.)

Data Set 3.1
Geology – USGS/Loudoun County
Surficial and bedrock geology GIS layers and printed maps developed through mapping efforts by USGS with assistance from Loudoun County’s former Department of Natural Resources. Bedrock map data updated by USGS in 1999. Following minor corrections with data labeling after consulting with USGS, layers incorporated into Loudoun County GIS in 2003.

Task B.3.5 Wells and Groundwater Quantity

Section A) Statistical Comparisons and Summary Statistics of Wells from Hydrostudies and Wells from VDH.

1) Two sample comparison: Static Water Level from Hydrostudy wells to Static Water Level from VDH. Includes graphical comparison, summary statistics, comparison of means and comparison of medians.
2) Well Depth by year from VDH well data. This data set is used because it is more complete than the hydrostudy data.
3) Frequency diagram of Dry Holes (WWDH) by year. Issue is revisited below.
4) One way ANOVA of VDH static water level by Year Code. The years are grouped through 1999 to allow for larger sample sizes. The VDH data set is used instead of the Hydrostudy data set because it has a longer record. ANOVA shows which groups are stastically similar.
5) Two sample comparison: Hydrostudy well depth to VDH well depth.
6) Multiple variable analysis of Hydrostudy data; This analysis produces summary statistics for Well depth, bedrock depth, static water level, specific capacity, airlift yield, primary yield zone, secondary yield zone, median transmissivity and median storativity for all hydrostudy wells. Analysis includes, count, mean, median, standard deviation, minimum, maximum, range, upper and lower quartiles, interquartile range, standardized skewness and standardized kurtosis. The analysis also produced a correlation matrix for the above parameters.
7) Two sample comparison: VDH primary water zone and VDH secondary water zone.
8) Multiple Box and Whisker Plot of Specific Capacity vs Rock Class' Visual comparison of medians and distribution of specific capacity values by rock class.
9) Simple Regression: VDH base elevation vs BDH Well depth.
10) Simple Regression: VDH well depth vs Year.
11) Simple Regression: VDH static water level vs Year.
12) Simple Regression: VDH airlift yield vs year
13) Two Sample comparison: Hydrostudy Airlift Yield to VDH airlift yield.
14) Analysis of VDH static water level by year. Summary statistics of static water levels reported each year, beginning with 1975 to allow for larger sample populations.
15) Multiple sample comparison: Hydrostudy Well depth by Year.
16) Summary Statistic table for VDH static water level by Year.

Section B) Box and Whiskers plots for various comparisons. These plots allow visual inspections of distributions of data and comparisons of mean and median values. Other Box and Whiskers plots may be found within various analysis routines throughout this document, Plots provided include:

Hydrostudy Well Depth by Bedrock Class
Hydrostudy Airlift Yield by Bedrock Class
Hydrostudy Bedrock Depth by Bedrock Class
Hydrostudy Yield Zone Depth by Bedrock Class
Hydrostudy Airlift Yields by Year
Hydrostudy Well Depth by Year

Section C) Detailed statistical analysis of Hydrostudy data, including parameters calculated from pumping tests.

1) Analysis of Airlift Yield vs Year. Detailed analysis of airlift yield values dating back to 1985. Comparison of means and medians.
2) Comparison of Well Depth by major Watershed.
3) Comparison of Airlift Yield by major Watershed.
4) Comparison of Airlift Yield by Rock Class.
5) Comparison of Specific Capacity by Rock Class.
6) Comparison of Median Transmissivity by Rock Class.
7) Comparison of Median Storativity by Rock Class.
8) Comparison of Primary Yield Zone by Rock Class.
9) Summary Statistics table from Hydrostudy well data.
10) Correlation matrix produced for Hydrostudy parameters Well Depth, Bedrock Depth, Static Water Level, Specific Capacity, Airlift Yield, Primary Yield Zone, Secondary Yield Zone, Median Transmissivity, and Median Storativity.
11) Summary Statictics table for Hydrostudy well depths by Year.

Section D) Detailed analysis of VDH well data.

1) Analysis of VDH Casing depth by year (grouped).
2) Analysis of VDH Well depth by year (grouped).
3) Analysis of VDH Well Yield by year (grouped).
4) Analysis of VDH Static Water Level by year (grouped).
5) Summary statistics table for VDH Static Water Level by year (grouped).
6) Summary statistics table for VDH well parameters Well Depth, Bedrock Depth, Static Water Level, Airlift Yield, Primary Yield Zone and Secondary Yield Zone.

Section E) Analysis of dry hole data from VDH data set. Includes frequency histogram of reported dry holes by year, and frequency histogram of dry holes by year concurrent with total wells drilled by year. Also a table showing the number of dry holes for each rock class.

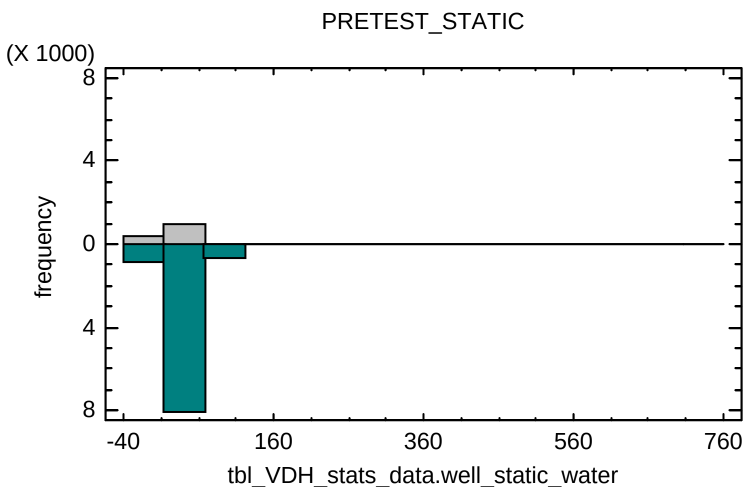
Section A) Statistical Comparisons and Summary Statistics of Wells from Hydrostudies and Wells from VDH.

1) Two-Sample Comparison – Static Water Level from Hydrostudy Data to VDH Static Water Level data

Sample 1: PRETEST_STATIC (hydrostudy)
Sample 2: tbl_VDH_stats_data.well_static_water

Sample 1: 1401 values ranging from 0.0 to 182.93
Sample 2: 9320 values ranging from 0.2 to 700.0

The StatAdvisor
This procedure is designed to compare two samples of data. It will calculate various statistics and graphs for each sample, and it will run several tests to determine whether there are statistically significant differences between the two samples.

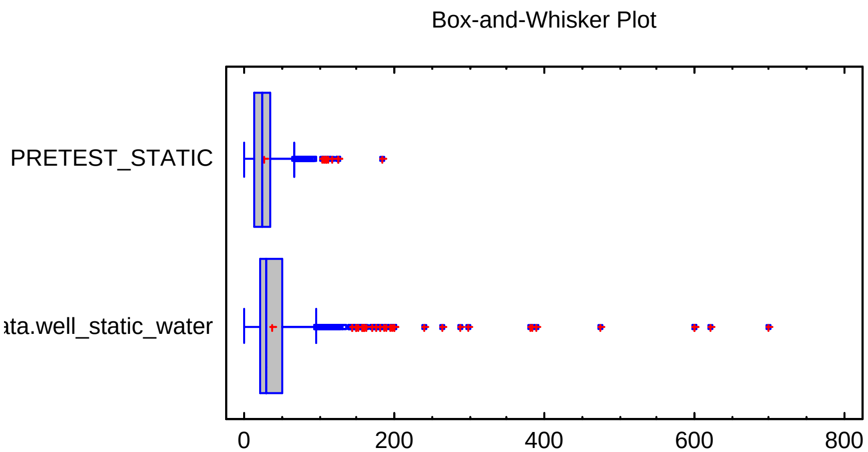


Summary Statistics

	PRETEST_STATIC (hydrostudies)	*tbl_VDH_stats_data.well_static_water*
Count	1401	9320
Average	25.6313	37.7393
Standard deviation	18.5542	26.0762
Coeff. of variation	72.3888%	69.0956%
Minimum	0.0	0.2
Maximum	182.93	700.0

Range	182.93	699.8
Stnd. skewness	26.4129	292.606
Stnd. kurtosis	51.6279	2754.27

The StatAdvisor
This table shows summary statistics for the two samples of data. Other tabular options within this analysis can be used to test whether differences between the statistics from the two samples are statistically significant. Of particular interest here are the standardized skewness and standardized kurtosis, which can be used to determine whether the samples come from normal distributions. Values of these statistics outside the range of -2 to +2 indicate significant departures from normality, which would tend to invalidate the tests which compare the standard deviations. **In this case, both samples have standardized skewness values outside the normal range. Both samples have standardized kurtosis values outside the normal range.**



Comparison of Means
95.0% confidence interval for mean of PRETEST_STATIC (hydrostudies): 25.6313 +/- 0.971563 [24.6597, 26.6028]
95.0% confidence interval for mean of tbl_VDH_stats_data.well_static_water: 37.7393 +/- 0.529402 [37.2099, 38.2687]
95.0% confidence interval for the difference between the means
assuming equal variances: -12.1081 +/- 1.41648 [-13.5246, -10.6916]

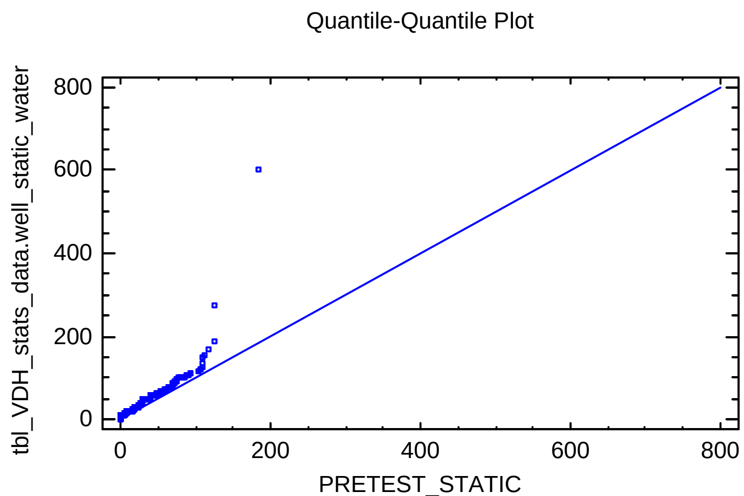
t test to compare means
Null hypothesis: mean1 = mean2
Alt. hypothesis: mean1 NE mean2
assuming equal variances: t = -16.7538 P-value = 0.0
Reject the null hypothesis for alpha = 0.05.

The StatAdvisor
This option runs a t-test to compare the means of the two samples. It also constructs confidence intervals or bounds for each mean and for the difference between the means. Of particular interest is

the confidence interval for the difference between the means, which extends from -13.5246 to -10.6916. Since the interval does not contain the value 0, **there is a statistically significant difference between the means of the two samples at the 95.0% confidence level.**

A t-test may also be used to test a specific hypothesis about the difference between the means of the populations from which the two samples come. In this case, the test has been constructed to determine whether the difference between the two means equals 0.0 versus the alternative hypothesis that the difference does not equal 0.0. Since the computed P-value is less than 0.05, we can reject the null hypothesis in favor of the alternative.

NOTE: these results assume that the variances of the two samples are equal. **In this case, that assumption is questionable since the results of an F-test to compare the standard deviations suggests that there may be a significant difference between them**. You can see the results of that test by selecting Comparison of Standard Deviations from the Tabular Options menu.



Comparison of Standard Deviations

	PRETEST_STATIC	*tbl_VDH_stats_data.well_static_water*
Standard deviation	18.5542	26.0762
Variance	344.257	679.969
Df	1400	9319

Ratio of Variances = 0.506283

95.0% Confidence Intervals
Standard deviation of PRETEST_STATIC (hydrostudies): [17.8917, 19.2679]
Standard deviation of tbl_VDH_stats_data.well_static_water: [25.7072, 26.4561]
Ratio of Variances: [0.470775, 0.545986]

F-test to Compare Standard Deviations
Null hypothesis: sigma1 = sigma2

Alt. hypothesis: sigma1 NE sigma2
F = 0.506283 P-value = 0.0
Reject the null hypothesis for alpha = 0.05.

The StatAdvisor
This option runs an F-test to compare the variances of the two samples. It also constructs confidence intervals or bounds for each standard deviation and for the ratio of the variances. Of particular interest is the confidence interval for the ratio of the variances, which extends from 0.470775 to 0.545986. Since the interval does not contain the value 1, there is a statistically significant difference between the standard deviations of the two samples at the 95.0% confidence level.

An F-test may also be used to test a specific hypothesis about the standard deviations of the populations from which the two samples come. In this case, the test has been constructed to determine whether the ratio of the standard deviations equals 1.0 versus the alternative hypothesis that the ratio does not equal 1.0**. Since the computed P-value is less than 0.05, we can reject the null hypothesis in favor of the alternative.**

IMPORTANT NOTE: <u>the F-tests and confidence intervals shown here depend on the samples having come from normal distributions.</u> To test this assumption, select Summary Statistics from the list of Tabular Options and check the standardized skewness and standardized kurtosis values**. (Summary Statistics shown above indicate non-normal distributions, therefore the F-test for comparison of variances is not adequate).**

<u>SINCE THE DATA IS NON-NORMALLY DISTRIBUTED, THE COMPARISON OF MEDIANS IS MORE APPROPRIATE FOR COMPARING CENTRAL TENDANCY.</u>

<u>Comparison of Medians</u>
Median of sample 1: 23.0
Median of sample 2: 30.0

Mann-Whitney (Wilcoxon) W test to compare medians
Null hypothesis: median1 = median2
Alt. hypothesis: median1 NE median2

Average rank of sample 1: 3723.8
Average rank of sample 2: 5607.11

W = 2.29371E6 P-value = 0.0
Reject the null hypothesis for alpha = 0.05. MEDIANS ARE NOT EQUAL, HYDROSTUDY STATIC WATER LEVELS SHOW SIGNIFICANT DIFFERENCE FROM VDH STATIC WATER LEVELS.

The StatAdvisor
This option runs a Mann-Whitney W test to compare the medians of the two samples. This test is constructed by combining the two samples, sorting the data from smallest to largest, and comparing the average ranks of the two samples in the combined data. **Since the P-value is less than 0.05, there is a statistically significant difference between the medians at the 95.0% confidence level.**

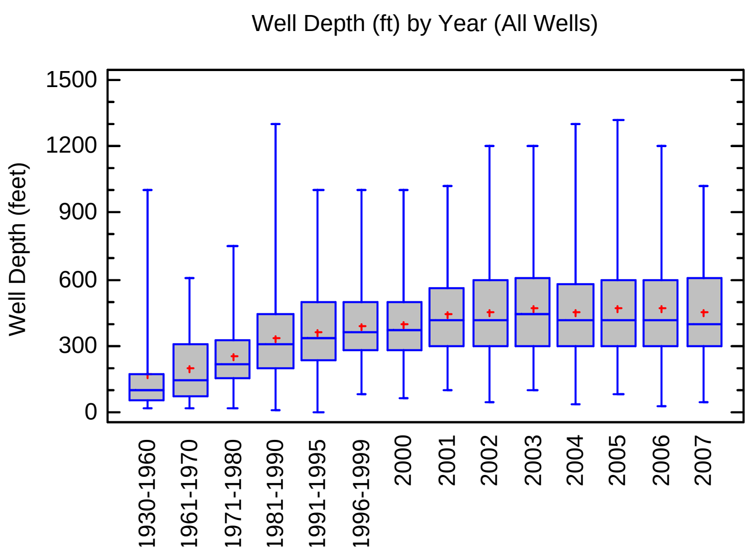
2) HEALTH DEPARTMENT WELL DATA: Well depth by Year

Multiple Box-and-Whisker Plot

Dependent variable: tbl_VDH_stats_data.well_depth
Factor: Year_Code

Number of observations: 12792
Number of levels: 14

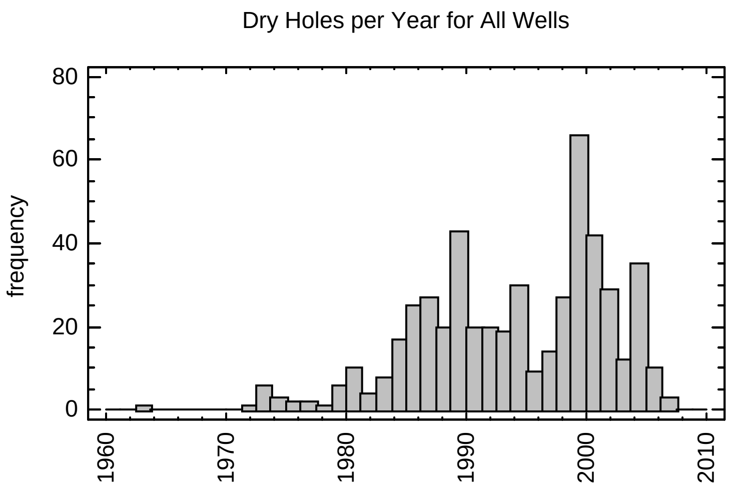
The StatAdvisor
This procedure constructs box-and-whisker plots to compare the 14 samples of tbl_VDH_stats_data.well_depth. For a detailed statistical analysis of this data, select Compare - Analysis of Variance - One-Way ANOVA from the main menu.



3) Frequency Histogram – Dry Holes (WWHD) from VDH by Year

Data variable: tbl_WWDH.WE_ID_YEAR
512 values ranging from 1963.0 to 2007.0

The StatAdvisor
This procedure displays a frequency histogram for a single column of data. You can create many other graphs and statistics for the data by selecting Describe - Numeric Data - One-Variable Analysis from the main menu.

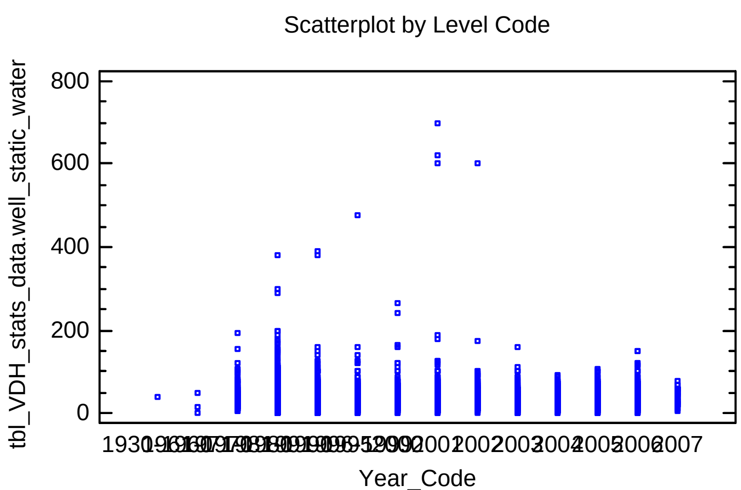


4) One-Way ANOVA – VDH static water level by Year_Code

Dependent variable: tbl_VDH_stats_data.well_static_water
Factor: Year_Code

Number of observations: 9320
Number of levels: 14

The StatAdvisor
This procedure performs a one-way analysis of variance for tbl_VDH_stats_data.well_static_water. It constructs various tests and graphs to compare the mean values of tbl_VDH_stats_data.well_static_water for the 14 different levels of Year_Code. **The F-test in the ANOVA table will test whether there are any significant differences amongst the means**. If there are, the Multiple Range Tests will tell you which means are significantly different from which others. **If you are worried about the presence of outliers, choose the Kruskal-Wallis Test which compares medians instead of means**. The various plots will help you judge the practical significance of the results, as well as allow you to look for possible violations of the assumptions underlying the analysis of variance.



ANOVA Table for tbl_VDH_stats_data.well_static_water by Year_Code

Source	*Sum of Squares*	*Df*	*Mean Square*	*F-Ratio*	*P-Value*
Between groups	79834.2	13	6141.09	9.13	0.0000
Within groups	6.2568E6	9306	672.34		
Total (Corr.)	6.33663E6	9319			

The StatAdvisor
The ANOVA table decomposes the variance of tbl_VDH_stats_data.well_static_water into two components: a between-group component and a within-group component. The F-ratio, which in this case equals 9.13391, is a ratio of the between-group estimate to the within-group estimate**. Since the P-value of the F-test is less than 0.05, there is a statistically significant difference between**

the mean tbl_VDH_stats_data.well_static_water from one level of Year_Code to another at the 95.0% confidence level. To determine which means are significantly different from which others, select Multiple Range Tests from the list of Tabular Options.

Multiple Range Tests for tbl_VDH_stats_data.well_static_water by Year_Code:

Method: 95.0 percent LSD

Year_Code	*Count*	*Mean*	*Homogeneous Groups*
1961-1970	3	21.6667	XXXXXX
2003	415	32.3687	X
2004	575	33.409	XX
2000	685	34.5902	XXX
2005	725	34.8428	XXX
1996-1999	1355	35.7791	XXX
2002	569	37.1511	XXX
2006	795	37.7434	XX
2001	677	39.4919	XX
1930-1960	1	40.0	XXXXXX
1981-1990	2178	40.2764	X
1971-1980	222	40.8626	XX
1991-1995	1024	41.5859	X
2007	96	44.6667	X

Contrast	*Sig.*	*Difference*	*+/- Limits*
1930-1960 - 1961-1970		18.3333	58.6831
1930-1960 - 1971-1980		-0.862613	50.9354
1930-1960 - 1981-1990		-0.2764	50.8327
1930-1960 - 1991-1995		-1.58594	50.8458
1930-1960 - 1996-1999		4.2209	50.8398
1930-1960 - 2000		5.40978	50.8581
1930-1960 - 2001		0.508124	50.8586
1930-1960 - 2002		2.84886	50.8657
1930-1960 - 2003		7.63133	50.8822
1930-1960 - 2004		6.59096	50.8652
1930-1960 - 2005		5.15724	50.8561
1930-1960 - 2006		2.2566	50.853
1930-1960 - 2007		-4.66667	51.085
1961-1970 - 1971-1980		-19.1959	29.5391
1961-1970 - 1981-1990		-18.6097	29.3617
1961-1970 - 1991-1995		-19.9193	29.3845
1961-1970 - 1996-1999		-14.1124	29.374
1961-1970 - 2000		-12.9236	29.4057
1961-1970 - 2001		-17.8252	29.4065
1961-1970 - 2002		-15.4845	29.4188

1961-1970 - 2003		-10.702	29.4474
1961-1970 - 2004		-11.7424	29.418
1961-1970 - 2005		-13.1761	29.4022
1961-1970 - 2006		-16.0767	29.3969
1961-1970 - 2007		-23.0	29.7965
1971-1980 - 1981-1990		0.586212	3.5805
1971-1980 - 1991-1995		-0.723325	3.7625
1971-1980 - 1996-1999	*	5.08351	3.67971
1971-1980 - 2000	*	6.27239	3.92487
1971-1980 - 2001		1.37074	3.93054
1971-1980 - 2002		3.71147	4.0216
1971-1980 - 2003	*	8.49394	4.22584
1971-1980 - 2004	*	7.45357	4.01571
1971-1980 - 2005	*	6.01985	3.89828
1971-1980 - 2006		3.11922	3.85784
1971-1980 - 2007		-3.80405	6.2079
1981-1990 - 1991-1995		-1.30954	1.92564
1981-1990 - 1996-1999	*	4.4973	1.7584
1981-1990 - 2000	*	5.68618	2.22628
1981-1990 - 2001		0.784524	2.23627
1981-1990 - 2002	*	3.12526	2.3927
1981-1990 - 2003	*	7.90773	2.72202
1981-1990 - 2004	*	6.86736	2.38278
1981-1990 - 2005	*	5.43364	2.17906
1981-1990 - 2006	*	2.533	2.10586
1981-1990 - 2007		-4.39027	5.29998
1991-1995 - 1996-1999	*	5.80684	2.10437
1991-1995 - 2000	*	6.99572	2.50853
1991-1995 - 2001		2.09406	2.5174
1991-1995 - 2002	*	4.4348	2.65733
1991-1995 - 2003	*	9.21726	2.95733
1991-1995 - 2004	*	8.17689	2.6484
1991-1995 - 2005	*	6.74318	2.46672
1991-1995 - 2006	*	3.84254	2.4023
1991-1995 - 2007		-3.08073	5.42459
1996-1999 - 2000		1.18888	2.38256
1996-1999 - 2001	*	-3.71278	2.39189
1996-1999 - 2002		-1.37204	2.53875
1996-1999 - 2003	*	3.41042	2.85126
1996-1999 - 2004		2.37006	2.52941
1996-1999 - 2005		0.936341	2.3385
1996-1999 - 2006		-1.9643	2.27044
1996-1999 - 2007	*	-8.88757	5.3675

2000 - 2001	*	-4.90166	2.75418
2000 - 2002		-2.56092	2.88264
2000 - 2003		2.22154	3.16134
2000 - 2004		1.18118	2.87442
2000 - 2005		-0.25254	2.70794
2000 - 2006	*	-3.15318	2.64939
2000 - 2007	*	-10.0764	5.53845
2001 - 2002		2.34073	2.89036
2001 - 2003	*	7.1232	3.16837
2001 - 2004	*	6.08283	2.88216
2001 - 2005	*	4.64912	2.71615
2001 - 2006		1.74848	2.65778
2001 - 2007		-5.17479	5.54247
2002 - 2003	*	4.78247	3.28066
2002 - 2004	*	3.7421	3.00515
2002 - 2005		2.30838	2.84633
2002 - 2006		-0.592254	2.79069
2002 - 2007	*	-7.51552	5.60741
2003 - 2004		-1.04037	3.27343
2003 - 2005		-2.47408	3.12826
2003 - 2006	*	-5.37472	3.07772
2003 - 2007	*	-12.298	5.75565
2004 - 2005		-1.43372	2.838
2004 - 2006	*	-4.33435	2.78219
2004 - 2007	*	-11.2576	5.60319
2005 - 2006	*	-2.90064	2.60983
2005 - 2007	*	-9.82391	5.51964
2006 - 2007	*	-6.92327	5.49115

* denotes a statistically significant difference.

The StatAdvisor
This table applies a multiple comparison procedure to determine which means are significantly different from which others. The bottom half of the output shows the estimated difference between each pair of means**. An asterisk has been placed next to 38 pairs, indicating that these pairs show statistically significant differences at the 95.0% confidence level. At the top of the page, 6 homogenous groups are identified using columns of X's**. Within each column, the levels containing X's form a group of means within which there are no statistically significant differences. The method currently being used to discriminate among the means is Fisher's least significant difference (LSD) procedure. With this method, there is a 5.0% risk of calling each pair of means significantly different when the actual difference equals 0.

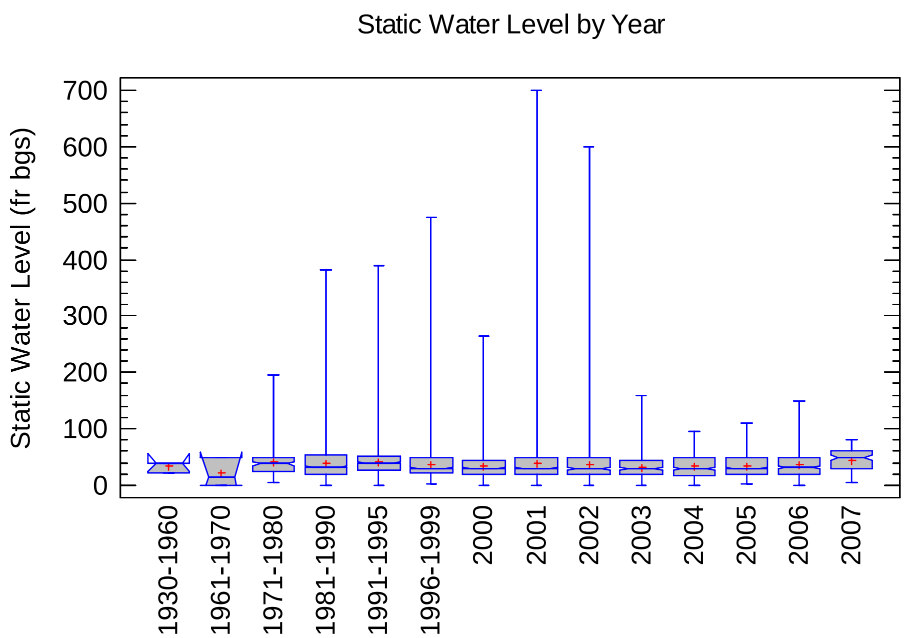
Kruskal-Wallis Test for tbl_VDH_stats_data.well_static_water by Year_Code

Year_Code	*Sample Size*	*Average Rank*
1930-1960	1	5559.0
1961-1970	3	2569.83
1971-1980	222	5105.67
1981-1990	2178	4863.09
1991-1995	1024	5222.64

1996-1999	1355	4547.38
2000	685	4253.54
2001	677	4589.77
2002	569	4571.98
2003	415	3989.26
2004	575	4186.2
2005	725	4328.04
2006	795	4774.27
2007	96	5929.59

Test statistic = 162.67   P-Value = 0.0

The StatAdvisor
The Kruskal-Wallis test tests the null hypothesis that the medians of tbl_VDH_stats_data.well_static_water within each of the 14 levels of Year_Code are the same. The data from all the levels is first combined and ranked from smallest to largest. The average rank is then computed for the data at each level. **Since the P-value is less than 0.05, there is a statistically significant difference amongst the medians at the 95.0% confidence level**. To determine which medians are significantly different from which others, select Box-and-Whisker Plot from the list of Graphical Options and select the median notch option.

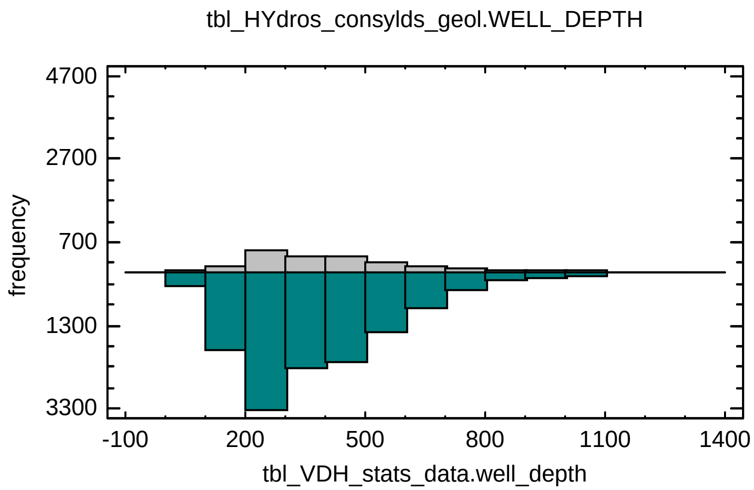


5) Two-Sample Comparison – Hydrostudies WELL_DEPTH & VDH well_depth

Sample 1: tbl_HYdros_consylds_geol.WELL_DEPTH (hydrostudies)
Sample 2: tbl_VDH_stats_data.well_depth (VDH)

Sample 1: 1817 values ranging from 50.0 to 1320.0
Sample 2: 12792 values ranging from 1.5 to 1320.0

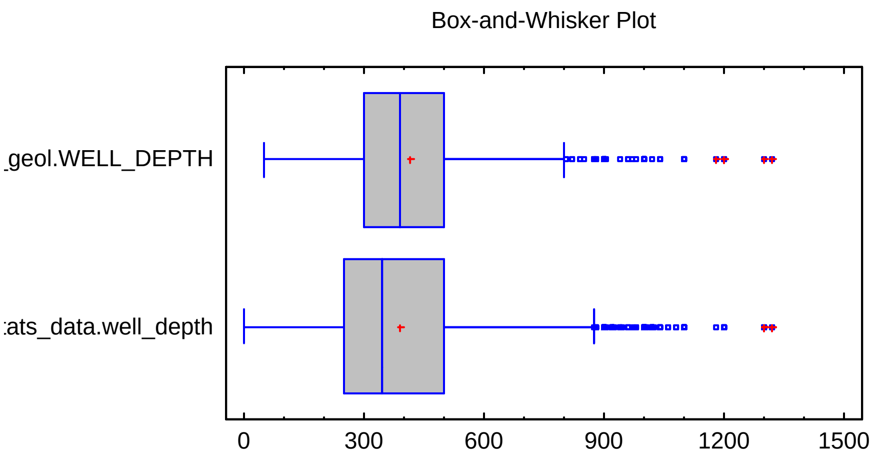
The StatAdvisor
This procedure is designed to compare two samples of data. It will calculate various statistics and graphs for each sample, and it will run several tests to determine whether there are statistically significant differences between the two samples.



Summary Statistics

	tbl_HYdros_consylds_geol.WELL_DEPTH	*tbl_VDH_stats_data.well_depth*
Count	1817	12792
Average	417.01	389.448
Standard deviation	182.455	191.342
Coeff. of variation	43.753%	49.1316%
Minimum	50.0	1.5
Maximum	1320.0	1320.0
Range	1270.0	1318.5
Stnd. skewness	18.8844	38.9927
Stnd. kurtosis	13.8639	17.7977

The StatAdvisor
This table shows summary statistics for the two samples of data. Other tabular options within this analysis can be used to test whether differences between the statistics from the two samples are statistically significant. Of particular interest here are the standardized skewness and standardized kurtosis, which can be used to determine whether the samples come from normal distributions. Values of these statistics outside the range of -2 to +2 indicate significant departures from normality, which would tend to invalidate the tests which compare the standard deviations. In this case, both samples have standardized skewness values outside the normal range. Both samples have standardized kurtosis values outside the normal range. **BOTH SAMPLES ARE NON-NORMALLY DISTRIBUTED. NON-PARAMETRIC TEST REQUIRED.**



Comparison of Standard Deviations

	tbl_HYdros_consylds_geol.WELL_DEPTH	*tbl_VDH_stats_data.well_depth*
Standard deviation	182.455	191.342
Variance	33289.7	36611.8
Df	1816	12791

Ratio of Variances = 0.909262
95.0% Confidence Intervals
Standard deviation of tbl_HYdros_consylds_geol.WELL_DEPTH: [176.709, 188.589]
Standard deviation of tbl_VDH_stats_data.well_depth: [189.026, 193.716]
Ratio of Variances: [0.852901, 0.971428]

F-test to Compare Standard Deviations
Null hypothesis: sigma1 = sigma2
Alt. hypothesis: sigma1 NE sigma2
F = 0.909262 P-value = 0.00825567
Reject the null hypothesis for alpha = 0.05. **STANDARD DEVIATIONS NOT EQUAL, SAMPLES SIGNIFICANTLY DIFFERENT**

The StatAdvisor
This option runs an F-test to compare the variances of the two samples. It also constructs confidence intervals or bounds for each standard deviation and for the ratio of the variances. Of particular interest is the confidence interval for the ratio of the variances, which extends from 0.852901 to 0.971428. Since the interval does not contain the value 1**, there is a statistically significant difference between the standard deviations of the two samples at the 95.0% confidence level**.
An F-test may also be used to test a specific hypothesis about the standard deviations of the populations from which the two samples come. In this case, the test has been constructed to determine whether the ratio of the standard deviations equals 1.0 versus the alternative hypothesis that the ratio does not equal 1.0. Since the computed P-value is less than 0.05, we can reject the null hypothesis in favor of the alternative.

IMPORTANT NOTE: the F-tests and confidence intervals shown here depend on the samples having come from normal distributions. To test this assumption, select Summary Statistics from the list of Tabular Options and check the standardized skewness and standardized kurtosis values. **Summary Statistics show that standard skewness and standard kurtosis are outside the limits of normally distributed data. Comparison of Medians (below) is a more appropriate comparison of central tendancy than comparison of means.**

Comparison of Medians
Median of sample 1: 390.0
Median of sample 2: 345.0

Mann-Whitney (Wilcoxon) W test to compare medians
Null hypothesis: median1 = median2
Alt. hypothesis: median1 NE median2

Average rank of sample 1: 7903.59
Average rank of sample 2: 7219.98

W = -1.08763E6 P-value = 9.70246E-11
Reject the null hypothesis for alpha = 0.05. **MEDIANS NOT EQUAL, SAMPLES SHOW STATISTICALLY SIGNIFICANT DIFFERENCE (NOTE THAT HYDROSTUDY WELL_DEPTH MEDIAN IS HIGHER.)**

The StatAdvisor
This option runs a Mann-Whitney W test to compare the medians of the two samples. This test is constructed by combining the two samples, sorting the data from smallest to largest, and comparing the average ranks of the two samples in the combined data. **Since the P-value is less than 0.05, there is a statistically significant difference between the medians at the 95.0% confidence level.**

6) Multiple-Variable Analysis HYDROSTUDY DATA

Data variables:
- tbl_HYdros_consylds_geol.WELL_DEPTH
- tbl_HYdros_consylds_geol.BEDROCK_DEPTH
- PRETEST_STATIC
- SPECIFIC_CAPACITY
- AIRLIFT_YIELD
- YIELD_ZONE
- SECONDARY_WATER
- Median_Trans
- Median_Stor

All available data will be used in each calculation.

The StatAdvisor

This procedure is designed to summarize several columns of quantitative data. It will calculate various statistics, including correlations, covariances, and partial correlations. Also included in the procedure are a number of multivariate graphs, which give interesting views into the data. Use the Tabular Options and Graphical Options buttons on the analysis toolbar to access these different procedures.

After this procedure, you may wish to select another procedure to build a statistical model for your data. Depending on your goal, one of several procedures may be appropriate. Following is a list of goals with an indication of which procedure would be appropriate:

GOAL: build a model for predicting one variable given values of one of more other variables.
PROCEDURE: Relate - Multiple Factors - Multiple Regression

Summary Statistics from Hydrostudy Wells

	Well Depth (ft TOC)	*Bedrock Depth (ft bgs)*	*Static Water Level (ft TOC)*	*Specific Capacity (gal/min/ft)*	*Airlift Yield (gal/min)*	*Primary Yield Zone (ft bgs)*	*Secondary Yield Zone (ft bgs)*	*Median Transmissivity (ft2/day)**	*Median Storativity**
Count	1817	1806	1401	1395	1812	1749	920	1092	767
Average	417	29	25.6	0.80	22	294	250	240	3.1E-04
Median	390	25	23	0.131	10	262	202	48	7.0E-05
Geometric mean	380.52	24.37	-	0.14	-	247.31	209.51	41.17	7.4E-05
Standard deviation	182.46	19.85	18.55	3.87	41.37	174.45	162.29	852.73	1.0E-03
Minimum	50	2	0	0.0005	0	25	20	0.000012	3.0E-08
Maximum	1320	305	183	75	650	1235	1200	16400	1.4E-02
Range	1270	303	183	74.9995	650	1210	1180	16400	1.4E-02
Lower quartile	300	16	13	0.044	5	160	135	13.1	2.8E-05
Upper quartile	500	40	34.94	0.42	25	380	317.5	160	2.0E-04
Interquartile range	200	24	21.94	0.38	20	220	182.5	146.9	1.7E-04

Stnd. skewness	18.9	62.1	26.4	204.9	120.0	22.2	23.0	155.1	98.3
Stnd. kurtosis	13.9	293.4	51.6	1632.8	638.6	20.5	30.7	1199.4	511.7

*Median of each test well calculated from multiple observation wells.

The StatAdvisor

This table shows summary statistics for each of the selected data variables. It includes measures of central tendency, measures of variability, and measures of shape. Of particular interest here are the standardized skewness and standardized kurtosis, which can be used to determine whether the sample comes from a normal distribution. Values of these statistics outside the range of -2 to +2 indicate significant departures from normality, which would tend to invalidate many of the statistical procedures normally applied to this data. In this case, the following variables show standardized skewness values outside the expected range: **THESE SAMPLES ARE NOT NORMALLY DISTRIBUTED**

tbl_HYdros_consylds_geol.WELL_DEPTH
tbl_HYdros_consylds_geol.BEDROCK_DEPTH
PRETEST_STATIC
SPECIFIC_CAPACITY
AIRLIFT_YIELD
YIELD_ZONE
SECONDARY_WATER
Median_Trans
Median_Stor

The following variables show standardized kurtosis values outside the expected range:

tbl_HYdros_consylds_geol.WELL_DEPTH
tbl_HYdros_consylds_geol.BEDROCK_DEPTH
PRETEST_STATIC
SPECIFIC_CAPACITY
AIRLIFT_YIELD
YIELD_ZONE
SECONDARY_WATER
Median_Trans
Median_Stor

To make the variables more normal, you might try a transformation such as LOG(Y), SQRT(Y), or 1/Y.

SEE CORRELATION MATRIX BELOW:

Matrix of Pearson Product Moment Correlations for Hydrostudy Well Data.

	Well Depth (ft bgs)	Bedrock Depth (ft bgs)	Static Water Level (ft TOC)	Specific Capacity (gal/min/ft)	Airlift Yield (gal/min)	Primary Yield Zone (ft bgs)	Secondary Yield Zone (ft bgs)	Median Transmissivity (ft2/day)	Median Storativity
Well Depth	Correlation (Sample Size) P-Value	-0.1212 -1803 0	0.0418 -1399 0.1181	-0.1609 -1393 0	-0.1641 -1807 0	0.6657 -1747 0	0.6314 -918 0	-0.1404 -1091 0	-0.0433 -766 0.2313
Bedrock Depth	-0.1212 -1803 0		0.096 -1391 0.0003	0.0696 -1385 0.0095	-0.0337 -1796 0.1529	-0.066 -1742 0.0058	0.0109 -916 0.7419	0.113 -1082 0.0002	0.0881 -760 0.0148
Static Water Level	0.0418 -1399 0.1181	0.096 -1391 0.0003		0.04 -1391 0.1359	-0.0014 -1396 0.9588	0.0887 -1387 0.0009	0.0787 -721 0.0343	-0.0047 -1089 0.8764	-0.0199 -765 0.5823
Specific Capacity	-0.1609 -1393 0	0.0696 -1385 0.0095	0.04 -1391 0.1359		0.3452 -1390 0	-0.1079 -1381 0.0001	-0.0521 -721 0.1622	0.3385 -1085 0	0.1437 -763 0.0001
Airlift Yield	-0.1641 -1807 0	-0.0337 -1796 0.1529	-0.0014 -1396 0.9588	0.3452 -1390 0		-0.1045 -1742 0	-0.0544 -915 0.0996	0.2234 -1089 0	0.009 -764 0.8034
Primary Yield Zone	0.6657 -1747 0	-0.066 -1742 0.0058	0.0887 -1387 0.0009	-0.1079 -1381 0.0001	-0.1045 -1742 0		0.205 -920 0	-0.1071 -1078 0.0004	-0.05 -758 0.1684
Secondary Yield Zone	0.6314 -918 0	0.0109 -916 0.7419	0.0787 -721 0.0343	-0.0521 -721 0.1622	-0.0544 -915 0.0996	0.205 -920 0		-0.0744 -561 0.0783	-0.0235 -391 0.643
Median Transmissivity	-0.1404 -1091 0	0.113 -1082 0.0002	-0.0047 -1089 0.8764	0.3385 -1085 0	0.2234 -1089 0	-0.1071 -1078 0.0004	-0.0744 -561 0.0783		0.2449 -758 0
Median Storativity	-0.0433 -766	0.0881 -760	-0.0199 -765	0.1437 -763	0.009 -764	-0.05 -758	-0.0235 -391	0.2449 -758	

	0.2313	0.0148	0.5823	0.0001	0.8034	0.1684	0.643	0	

(yellow)	Statistically significant non-zero correlations at the 95.0% confidence level
(gray)	No statistically significant non-zero correlations at the 95.0% confidence level

The StatAdvisor

This table shows Pearson product moment correlations between each pair of variables. These correlation coefficients range between -1 and +1 and measure the strength of the linear relationship between the variables. Also shown in parentheses is the number of pairs of data values used to compute each coefficient. The third number in each location of the table is a P-value which tests the statistical significance of the estimated correlations**. P-values below 0.05 indicate statistically significant non-zero correlations at the 95.0% confidence level.** The following pairs of variables have P-values below 0.05:

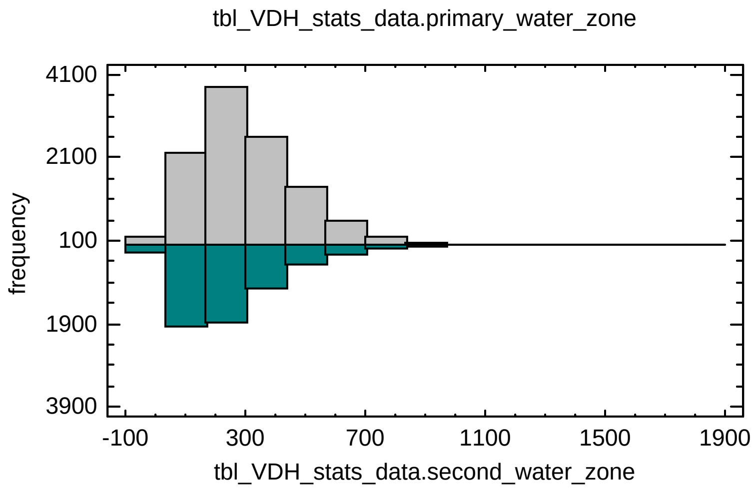
tbl_HYdros_consylds_geol.WELL_DEPTH and tbl_HYdros_consylds_geol.BEDROCK_DEPTH
tbl_HYdros_consylds_geol.WELL_DEPTH and SPECIFIC_CAPACITY
tbl_HYdros_consylds_geol.WELL_DEPTH and AIRLIFT_YIELD
tbl_HYdros_consylds_geol.WELL_DEPTH and YIELD_ZONE
tbl_HYdros_consylds_geol.WELL_DEPTH and SECONDARY_WATER
tbl_HYdros_consylds_geol.WELL_DEPTH and Median_Trans
tbl_HYdros_consylds_geol.BEDROCK_DEPTH and PRETEST_STATIC
tbl_HYdros_consylds_geol.BEDROCK_DEPTH and SPECIFIC_CAPACITY
tbl_HYdros_consylds_geol.BEDROCK_DEPTH and YIELD_ZONE
tbl_HYdros_consylds_geol.BEDROCK_DEPTH and Median_Trans
tbl_HYdros_consylds_geol.BEDROCK_DEPTH and Median_Stor
PRETEST_STATIC and YIELD_ZONE
PRETEST_STATIC and SECONDARY_WATER
SPECIFIC_CAPACITY and AIRLIFT_YIELD
SPECIFIC_CAPACITY and YIELD_ZONE
SPECIFIC_CAPACITY and Median_Trans
SPECIFIC_CAPACITY and Median_Stor
AIRLIFT_YIELD and YIELD_ZONE
AIRLIFT_YIELD and Median_Trans
YIELD_ZONE and SECONDARY_WATER
YIELD_ZONE and Median_Trans
Median_Trans and Median_Stor

7) Two-Sample Comparison - VDH_primary_water_zone & second_water_zone

Sample 1: tbl_VDH_stats_data.primary_water_zone
Sample 2: tbl_VDH_stats_data.second_water_zone

Sample 1: 11084 values ranging from 1.0 to 1609.0
Sample 2: 5586 values ranging from 0.42 to 1740.0

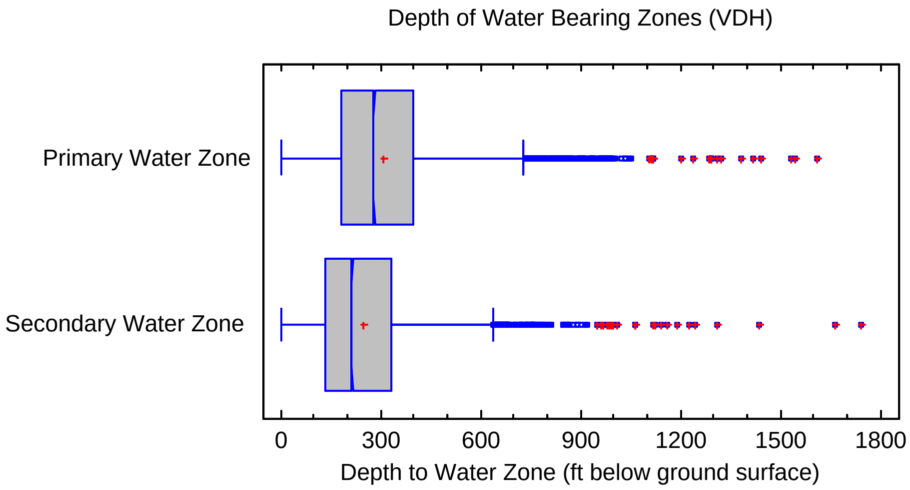
The StatAdvisor
This procedure is designed to compare two samples of data. It will calculate various statistics and graphs for each sample, and it will run several tests to determine whether there are statistically significant differences between the two samples.



Summary Statistics

	tbl_VDH_stats_data.primary_water_zone	*tbl_VDH_stats_data.second_water_zone*
Count	11084	5586
Average	306.71	250.923
Standard deviation	174.846	162.125
Coeff. of variation	57.0069%	64.6114%
Minimum	1.0	0.42
Maximum	1609.0	1740.0
Range	1608.0	1739.58
Stnd. skewness	48.1356	48.0232
Stnd. kurtosis	55.8449	81.7747

The StatAdvisor
This table shows summary statistics for the two samples of data. Other tabular options within this analysis can be used to test whether differences between the statistics from the two samples are statistically significant. Of particular interest here are the standardized skewness and standardized kurtosis, which can be used to determine whether the samples come from normal distributions. Values of these statistics outside the range of -2 to +2 indicate significant departures from normality, which would tend to invalidate the tests which compare the standard deviations**. In this case, both samples have standardized skewness values outside the normal range. Both samples have standardized kurtosis values outside the normal range. NON-NORMAL DISTRIBUTION.**



Comparison of Standard Deviations

	tbl_VDH_stats_data.primary_water_zone	*tbl_VDH_stats_data.second_water_zone*
Standard deviation	174.846	162.125
Variance	30571.1	26284.5
Df	11083	5585

Ratio of Variances = 1.16309

95.0% Confidence Intervals
Standard deviation of tbl_VDH_stats_data.primary_water_zone: [172.574, 177.179]
Standard deviation of tbl_VDH_stats_data.second_water_zone: [159.174, 165.189]
Ratio of Variances: [1.11207, 1.21809]

F-test to Compare Standard Deviations
Null hypothesis: sigma1 = sigma2
Alt. hypothesis: sigma1 NE sigma2
F = 1.16309 P-value = 1.11189E-10
Reject the null hypothesis for alpha = 0.05.

The StatAdvisor
This option runs an F-test to compare the variances of the two samples. It also constructs confidence intervals or bounds for each standard deviation and for the ratio of the variances. Of particular interest is the confidence interval for the ratio of the variances, which extends from 1.11207 to 1.21809. Since the interval does not contain the value 1, **there is a statistically significant difference between the standard deviations of the two samples at the 95.0% confidence level.**

An **F-test** may also be used to test a specific hypothesis about the standard deviations of the populations from which the two samples come. In this case, the test has been constructed to determine whether the ratio of the standard deviations equals 1.0 versus the alternative hypothesis that the ratio does not equal 1.0. **Since the computed P-value is less than 0.05, we can reject the null hypothesis in favor of the alternative.**

IMPORTANT NOTE: **the F-tests and confidence intervals shown here depend on the samples having come from normal distributions.** To test this assumption, select Summary Statistics from the list of Tabular Options and check the standardized skewness and standardized kurtosis values. **We already know that these samples are non-normally distributed, therefore we will use the non-parametric comparison of medians test below.**

Comparison of Medians
Median of sample 1: 280.0 (primary water zone)
Median of sample 2: 215.0 (secondary water zone)

Mann-Whitney (Wilcoxon) W test to compare medians
Null hypothesis: median1 = median2
Alt. hypothesis: median1 NE median2

Average rank of sample 1: 8920.15
Average rank of sample 2: 7175.41

W = -6.48027E6 P-value = 0.0
Reject the null hypothesis for alpha = 0.05.

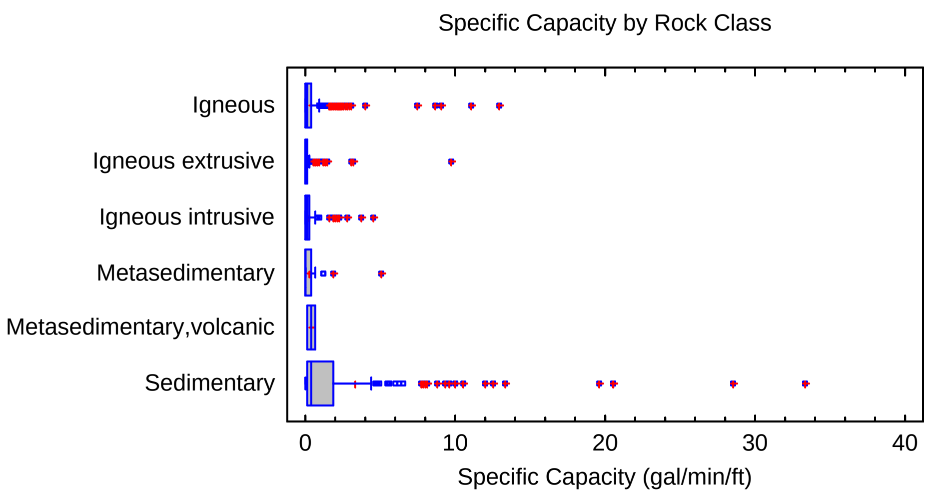
The StatAdvisor
This option runs a Mann-Whitney W test to compare the medians of the two samples. This test is constructed by combining the two samples, sorting the data from smallest to largest, and comparing the average ranks of the two samples in the combined data. Since the P-value is less than 0.05, **there is a statistically significant difference between the medians at the 95.0% confidence level. Note that Primary zone median is greater (deeper).**

8) Multiple Box-and-Whisker Plot - SPECIFIC_CAPACITY by Rock Class

Dependent variable: SPECIFIC_CAPACITY
Factor: BE_ROCK_CL

Number of observations: 1395
Number of levels: 6

The StatAdvisor
This procedure constructs box-and-whisker plots to compare the 6 samples of SPECIFIC_CAPACITY. For a detailed statistical analysis of this data, select Compare - Analysis of Variance - One-Way ANOVA from the main menu.



9) Simple Regression - base_elevation vs. tbl_VDH_stats_data.well_depth

Dependent variable: base_elevation
Independent variable: tbl_VDH_stats_data.well_depth
Linear model: Y = a + b*X

Coefficients

	Least Squares	*Standard*	*T*	
Parameter	*Estimate*	*Error*	*Statistic*	*P-Value*
Intercept	451.428	1.8833	239.7	0.0000
Slope	0.0938746	0.00702086	13.3708	0.0000

Analysis of Variance

Source	*Sum of Squares*	*Df*	*Mean Square*	*F-Ratio*	*P-Value*
Model	4.041E6	1	4.041E6	178.78	0.0000
Residual	2.4267E8	10736	22603.4		
Total (Corr.)	2.46711E8	10737			

Correlation Coefficient = 0.127982
R-squared = 1.63795 percent
R-squared (adjusted for d.f.) = 1.62879 percent
Standard Error of Est. = 150.344
Mean absolute error = 103.853
Durbin-Watson statistic = 1.44737 (P=0.0000)
Lag 1 residual autocorrelation = 0.276205

The StatAdvisor

The output shows the results of fitting a linear model to describe the relationship between base_elevation and tbl_VDH_stats_data.well_depth. The equation of the fitted model is

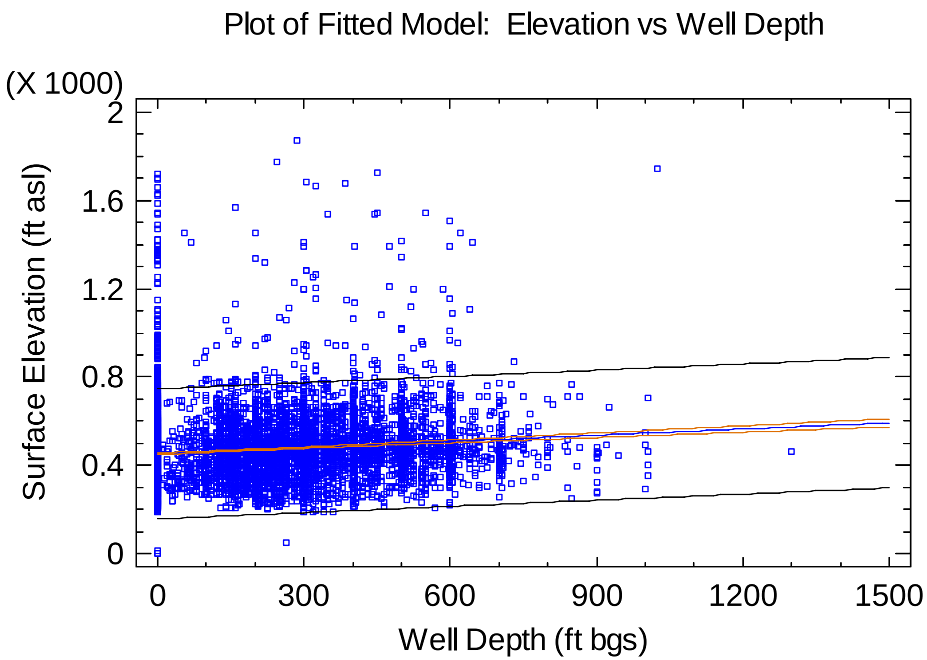
base_elevation = 451.428 + 0.0938746*VDH well_depth

Since the P-value in the ANOVA table is less than 0.05, **there is a statistically significant relationship between base_elevation and VDH_stats_well_depth at the 95.0% confidence level.**

The R-Squared statistic indicates that **the model as fitted explains 1.63795% of the variability in base_elevation**. The correlation coefficient equals 0.127982**, indicating a relatively weak relationship between the variables**. The standard error of the estimate shows the standard deviation of the residuals to be 150.344. This value can be used to construct prediction limits for new observations by selecting the Forecasts option from the text menu.

The mean absolute error (MAE) of 103.853 is the average value of the residuals. The Durbin-Watson (DW) statistic tests the residuals to determine if there is any significant correlation based on the order in which they occur in your data file. Since the P-value is less than 0.05, there is an indication of possible serial correlation at the 95.0% confidence level. Plot the residuals versus row order to see if there is any pattern that can be seen.

NONE NOTED.


Plot of Fitted Model: Elevation vs Well Depth
(X 1000)
2
1.6
1.2
0.8
0.4
0
Surface Elevation (ft asl)
0
300
600
900
1200
1500
Well Depth (ft bgs)

10) Simple Regression - tbl_VDH_ well_depth vs. tbl_VDH_ YEAR

Dependent variable: tbl_VDH_ well_depth
Independent variable: tbl_VDH_YEAR
Linear model: Y = a + b*X

Coefficients

	Least Squares	*Standard*	*T*	
Parameter	*Estimate*	*Error*	*Statistic*	*P-Value*
Intercept	-9721.53	167.795	-57.937	0.0000
Slope	5.0306	0.0843986	59.6053	0.0000

Analysis of Variance

Source	*Sum of Squares*	*Df*	*Mean Square*	*F-Ratio*	*P-Value*
Model	2.10625E8	1	2.10625E8	3552.79	0.0000
Residual	1.06344E9	17938	59284.2		
Total (Corr.)	1.27407E9	17939			

Correlation Coefficient = 0.406592
R-squared = 16.5317 percent
R-squared (adjusted for d.f.) = 16.527 percent
Standard Error of Est. = 243.484
Mean absolute error = 164.092
Durbin-Watson statistic = 1.2079 (P=0.0000)
Lag 1 residual autocorrelation = 0.387571

The StatAdvisor
The output shows the results of fitting a linear model to describe the relationship between tbl_VDH_well_depth and tbl_VDH_YEAR. The equation of the fitted model is

tbl_VDH_well_depth = -9721.53 + 5.0306*tbl_VDH_YEAR

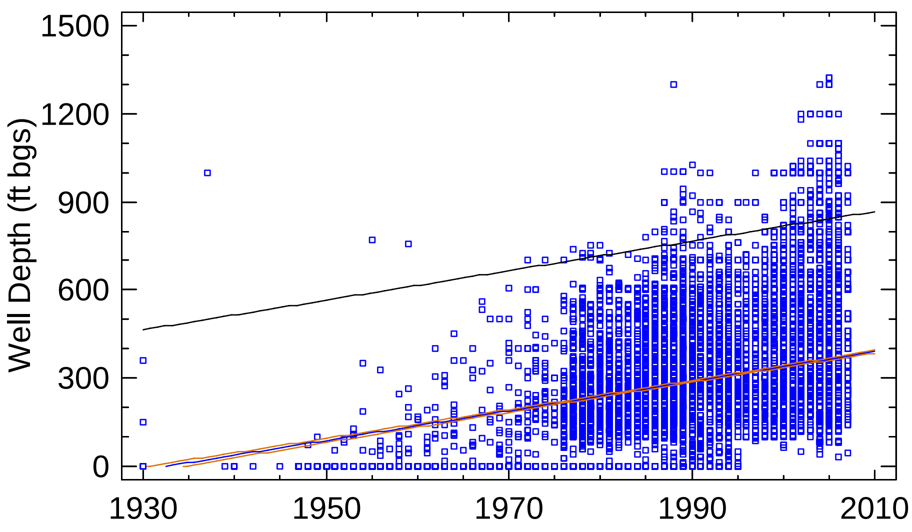
Since the P-value in the ANOVA table is less than 0.05**, there is a statistically significant relationship between tbl_VDH_well_depth and tbl_VDH_YEAR at the 95.0% confidence level**.

The R-Squared statistic indicates that the model as fitted explains 16.5317% of the variability in tbl_VDH_well_depth. The correlation coefficient equals 0.406592, **indicating a relatively weak relationship between the variables**. The standard error of the estimate shows the standard deviation of the residuals to be 243.484. This value can be used to construct prediction limits for new observations by selecting the Forecasts option from the text menu.

The mean absolute error (MAE) of 164.092 is the average value of the residuals. The Durbin-Watson (DW) statistic tests the residuals to determine if there is any significant correlation based on the order in which they occur in your data file. Since the P-value is less than 0.05, there is an indication of possible serial correlation at the 95.0% confidence level. Plot the residuals versus row order to see if there is any pattern that can be seen.

NONE NOTED

Plot of Fitted Model: Well Depth vs Year



11) Simple Regression - tbl_VDH static_water vs. YEAR

Dependent variable: tbl_VDH_stats_data.well_static_water
Independent variable: tbl_VDH_stats_data.WE_ID_YEAR
Linear model: Y = a + b*X

Coefficients

	Least Squares	*Standard*	*T*	
Parameter	*Estimate*	*Error*	*Statistic*	*P-Value*
Intercept	-1854.2	25.5102	-72.6847	0.0000
Slope	0.94389	0.0128349	73.5409	0.0000

Analysis of Variance

Source	*Sum of Squares*	*Df*	*Mean Square*	*F-Ratio*	*P-Value*
Model	2.99842E6	1	2.99842E6	5408.26	0.0000
Residual	8.94769E6	16139	554.414		
Total (Corr.)	1.19461E7	16140			

Correlation Coefficient = 0.500994
R-squared = 25.0995 percent
R-squared (adjusted for d.f.) = 25.0949 percent
Standard Error of Est. = 23.546
Mean absolute error = 15.6154
Durbin-Watson statistic = 1.60538 (P=0.0000)
Lag 1 residual autocorrelation = 0.19725

The StatAdvisor

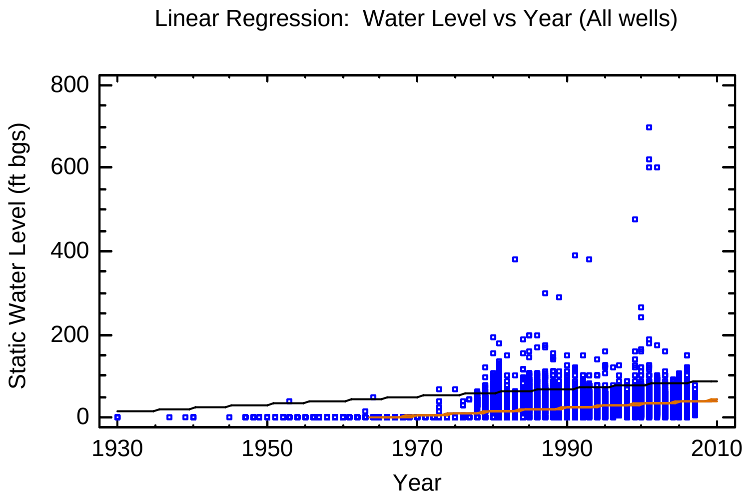
The output shows the results of fitting a linear model to describe the relationship between tbl_VDH_stats_data.well_static_water and tbl_VDH_stats_data.WE_ID_YEAR. The equation of the fitted model is

tbl_VDH_stats_data.well_static_water = -1854.2 + 0.94389*tbl_VDH_stats_data.WE_ID_YEAR

Since the P-value in the ANOVA table is less than 0.05, **there is a statistically significant relationship between tbl_VDH_stats_data.well_static_water and tbl_VDH_stats_data.WE_ID_YEAR at the 95.0% confidence level**.

The R-Squared statistic indicates that the model as fitted **explains 25.0995% of the variability in tbl_VDH_stats_data.well_static_water.** The correlation coefficient equals 0.500994, **indicating a moderately strong relationship between the variables**. The standard error of the estimate shows the standard deviation of the residuals to be 23.546. This value can be used to construct prediction limits for new observations by selecting the Forecasts option from the text menu.

The mean absolute error (MAE) of 15.6154 is the average value of the residuals. The Durbin-Watson (DW) statistic tests the residuals to determine if there is any significant correlation based on the order in which they occur in your data file. Since the P-value is less than 0.05, there is an indication of possible serial correlation at the 95.0% confidence level. Plot the residuals versus row order to see if there is any pattern that can be seen.
NONE NOTED


Linear Regression: Water Level vs Year (All wells)
Static Water Level (ft bgs)
800
600
400
200
0
1930
1950
1970
1990
2010
Year

12) Simple Regression - tbl_VDH_airlift yield vs. YEAR

Dependent variable: tbl_VDH_stats_data.stablizied_discharge
Independent variable: tbl_VDH_stats_data.WE_ID_YEAR
Linear model: Y = a + b*X

Coefficients

	Least Squares	*Standard*	*T*	
Parameter	*Estimate*	*Error*	*Statistic*	*P-Value*
Intercept	676.57	267.345	2.5307	0.0114
Slope	-0.327672	0.133541	-2.45372	0.0141

Analysis of Variance

Source	*Sum of Squares*	*Df*	*Mean Square*	*F-Ratio*	*P-Value*
Model	7183.21	1	7183.21	6.02	0.0141
Residual	8.34439E6	6994	1193.08		
Total (Corr.)	8.35157E6	6995			

Correlation Coefficient = -0.0293275
R-squared = 0.0860103 percent
R-squared (adjusted for d.f.) = 0.0717246 percent
Standard Error of Est. = 34.541
Mean absolute error = 17.7965
Durbin-Watson statistic = 1.64874 (P=0.0000)
Lag 1 residual autocorrelation = 0.175497

The StatAdvisor

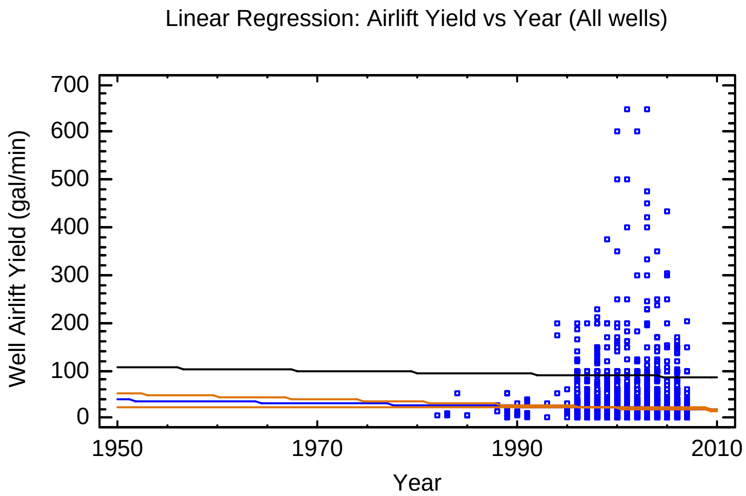
The output shows the results of fitting a linear model to describe the relationship between tbl_VDH_stats_data.stablizied_discharge and tbl_VDH_stats_data.WE_ID_YEAR. The equation of the fitted model is

tbl_VDH_stats_data.stablizied_discharge = 676.57 - 0.327672*tbl_VDH_stats_data.WE_ID_YEAR

Since the P-value in the ANOVA table is less than 0.05, **there is a statistically significant relationship between tbl_VDH_stats_data.stablizied_discharge and tbl_VDH_stats_data.WE_ID_YEAR at the 95.0% confidence level**.

The R-Squared statistic indicates that the model as fitted explains 0.0860103% of the variability in tbl_VDH_stats_data.stablizied_discharge. The correlation coefficient equals -0.0293275, **indicating a relatively weak relationship between the variables.** The standard error of the estimate shows the standard deviation of the residuals to be 34.541. This value can be used to construct prediction limits for new observations by selecting the Forecasts option from the text menu.

The mean absolute error (MAE) of 17.7965 is the average value of the residuals. The Durbin-Watson (DW) statistic tests the residuals to determine if there is any significant correlation based on the order in which they occur in your data file. Since the P-value is less than 0.05, there is an indication of possible serial correlation at the 95.0% confidence level. Plot the residuals versus row order to see if there is any pattern that can be seen.
NONE NOTED

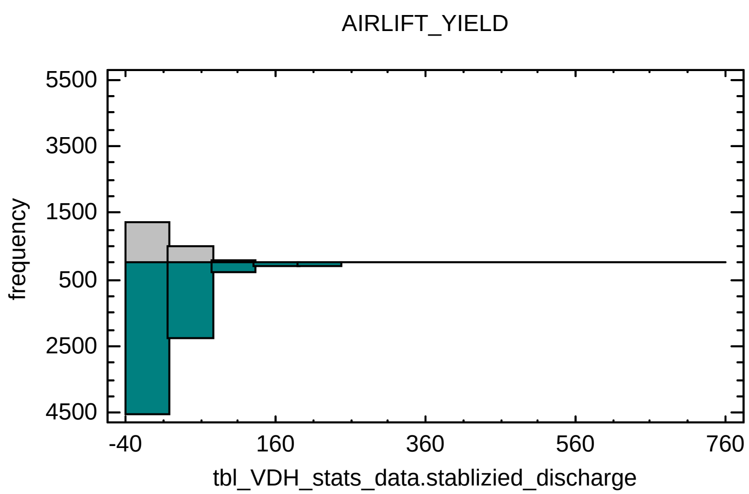

Linear Regression: Airlift Yield vs Year (All wells)
Well Airlift Yield (gal/min)
700
600
500
400
300
200
100
0
1950
1970
1990
2010
Year

13) Two-Sample Comparison - AIRLIFT_YIELD (Hydrostudies) & tbl_VDH_stablizied_discharge

Sample 1: AIRLIFT_YIELD
Sample 2: tbl_VDH_stablizied_discharge

Sample 1: 1812 values ranging from 0.0 to 650.0
Sample 2: 6997 values ranging from 0.0 to 650.0

The StatAdvisor
This procedure is designed to compare two samples of data. It will calculate various statistics and graphs for each sample, and it will run several tests to determine whether there are statistically significant differences between the two samples.

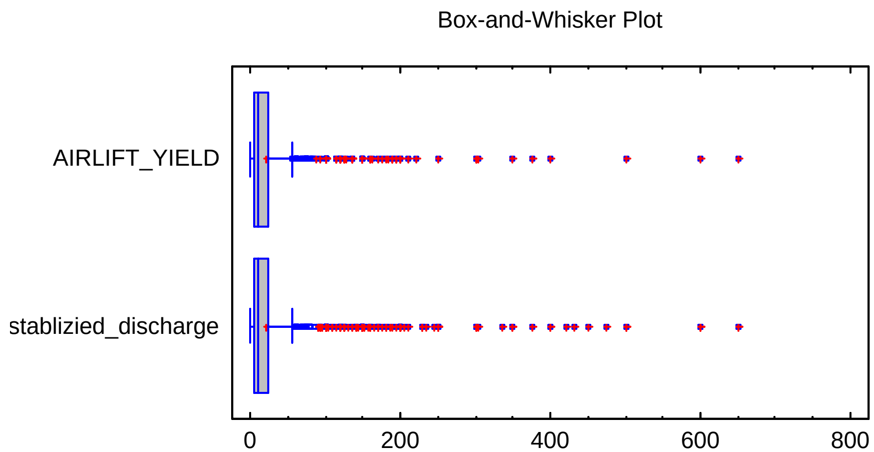


Summary Statistics

	AIRLIFT_YIELD	*tbl_VDH_stablizied_discharge*
Count	1812	6997
Average	22.4998	20.5776
Median	10.0	10.0
Geometric mean		
Standard deviation	41.3683	34.5516
Coeff. of variation	183.86%	167.909%
Minimum	0.0	0.0
Maximum	650.0	650.0
Range	650.0	650.0
Lower quartile	5.0	5.0

Upper quartile	25.0	25.0
Interquartile range	20.0	20.0
Stnd. skewness	**119.958**	**256.19**
Stnd. kurtosis	**638.571**	**1582.59**

The StatAdvisor
This table shows summary statistics for the two samples of data. Other tabular options within this analysis can be used to test whether differences between the statistics from the two samples are statistically significant. Of particular interest here are the standardized skewness and standardized kurtosis, which can be used to determine whether the samples come from normal distributions. Values of these statistics outside the range of -2 to +2 indicate significant departures from normality, which would tend to invalidate the tests which compare the standard deviations. In this case, both samples have standardized skewness values outside the normal range. Both samples have standardized kurtosis values outside the normal range.



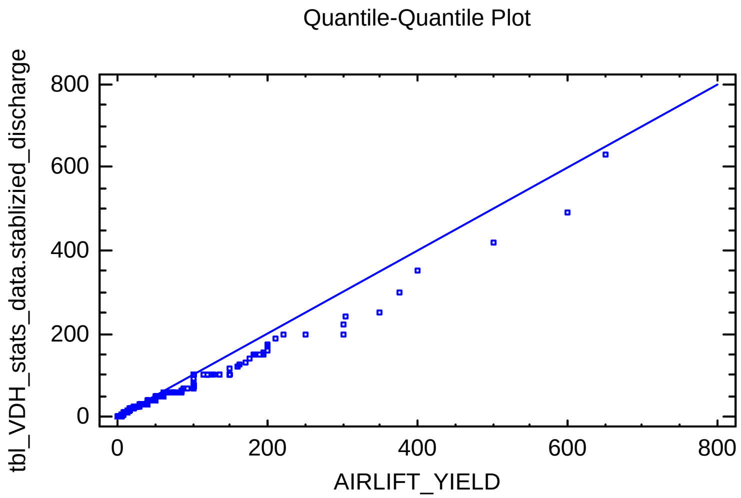
Comparison of Means
95.0% confidence interval for mean of AIRLIFT_YIELD: 22.4998 +/- 1.90475 [20.5951, 24.4046]
95.0% confidence interval for mean of tbl_VDH_stats_data.stablizied_discharge: 20.5776 +/- 0.809582 [19.768, 21.3872]
95.0% confidence interval for the difference between the means
assuming equal variances: 1.92222 +/- 1.86289 [0.0593334, 3.78511]

t test to compare means
Null hypothesis: mean1 = mean2
Alt. hypothesis: mean1 NE mean2
assuming equal variances: t = 2.02239 P-value = 0.0431355
Reject the null hypothesis for alpha = 0.05.

The StatAdvisor
This option runs a t-test to compare the means of the two samples. It also constructs confidence intervals or bounds for each mean and for the difference between the means. Of particular interest is the confidence interval for the difference between the means, which extends from 0.0593334 to 3.78511. Since the interval does not contain the value 0, there is **a statistically significant difference between the means of the two samples at the 95.0% confidence level**.

A t-test may also be used to test a specific hypothesis about the difference between the means of the populations from which the two samples come. In this case, the test has been constructed to determine whether the difference between the two means equals 0.0 versus the alternative hypothesis that the difference does not equal 0.0. Since the computed P-value is less than 0.05, we can reject the null hypothesis in favor of the alternative.

NOTE: these results assume that the variances of the two samples are equal. In this case, that assumption is questionable since the results of an F-test to compare the standard deviations suggests that there may be a significant difference between them. You can see the results of that test by selecting Comparison of Standard Deviations from the Tabular Options menu. **Samples are non-normally distributed**.



Comparison of Standard Deviations

	AIRLIFT_YIELD	*tbl_VDH_stats_data.stablizied_discharge*
Standard deviation	41.3683	34.5516
Variance	1711.34	1193.81
Df	1811	6996

Ratio of Variances = 1.43351

95.0% Confidence Intervals
Standard deviation of AIRLIFT_YIELD: [40.0639, 42.7611]
Standard deviation of tbl_VDH_stats_data.stablizied_discharge: [33.9885, 35.1338]
Ratio of Variances: [1.34453, 1.53166]

F-test to Compare Standard Deviations
   Null hypothesis: sigma1 = sigma2
   Alt. hypothesis: sigma1 NE sigma2
   F = 1.43351   P-value = 0.0
   Reject the null hypothesis for alpha = 0.05.

The StatAdvisor
This option runs an F-test to compare the variances of the two samples. It also constructs confidence intervals or bounds for each standard deviation and for the ratio of the variances. Of particular interest is the confidence interval for the ratio of the variances, which extends from 1.34453 to 1.53166. Since the interval does not contain the value 1, there is a **statistically significant difference between the standard deviations of the two samples at the 95.0% confidence level.**

An F-test may also be used to test a specific hypothesis about the standard deviations of the populations from which the two samples come. In this case, the test has been constructed to determine whether the ratio of the standard deviations equals 1.0 versus the alternative hypothesis that the ratio does not equal 1.0. Since the computed P-value is less than 0.05, we can reject the null hypothesis in favor of the alternative.

IMPORTANT NOTE: the F-tests and confidence intervals shown here depend on the samples having come from normal distributions. To test this assumption, select Summary Statistics from the list of Tabular Options and check the **standardized skewness and standardized kurtosis values**. **Samples are non-normally distributed**. Continue with comparison of medians below.
Comparison of Medians
Median of sample 1: 10.0
Median of sample 2: 10.0

Mann-Whitney (Wilcoxon) W test to compare medians
   Null hypothesis: median1 = median2
   Alt. hypothesis: median1 NE median2

   Average rank of sample 1: 4384.78
   Average rank of sample 2: 4410.24

   W = 36644.5   P-value = 0.703676

Do not reject the null hypothesis for alpha = 0.05.

The StatAdvisor
This option runs a Mann-Whitney W test to compare the medians of the two samples. This test is constructed by combining the two samples, sorting the data from smallest to largest, and comparing the average ranks of the two samples in the combined data. Since the P-value is greater than or equal to 0.05, **there is not a statistically significant difference between the medians at the 95.0% confidence level.**

14) ANALYSIS OF VDH STATIC WATER LEVEL BY YEAR

ANALYSIS OF VDH STATIC WATER LEVEL BY YEAR

Summary Statistics for VDH Static Water Levels by Year

YEAR	Count	Average	Median	Geometric mean	Standard deviation	Coeff. of variation	Minimum	Maximum	Range	Lower quartile	Upper quartile	Interquartile range	Stnd. skewness	Stnd. kurtosis
1975	1	69.00	69.0	69.0		%	69	69	0	69	69	0		
1976	4	26.25	30.0	20.6	14.93	56.9%	5	40	35	17.5	35	17.5	-1.13	1.06
1977	2	46.00	46.0	46.0	1.41	3.1%	45	47	2	45	47	2		
1978	57	38.23	38.00	36.40	10.93	28.6%	10	62	52	30	45	15	-0.30	0.52
1979	68	38.70	34.50	33.97	20.69	53.5%	7	123	116	24.5	49.5	25	5.13	5.97
1980	84	45.12	38.50	37.44	31.00	68.7%	10	195	185	22.5	53.5	31	8.22	13.03
1981	97	49.06	40.00	37.92	34.66	70.7%	5	180	175	21	66	45	4.78	2.67
1982	76	32.61	29.00	24.83	23.50	72.1%	1	150	149	20	40	20	7.81	14.40
1983	54	37.14	26.00	24.92	51.56	138.8%	1	383	382	17.5	45	27.5	17.73	59.54
1984	100	45.56	40.0	37.8	29.71	65.2%	2.5	190	187.5	29	56.5	27.5	8.53	13.36
1985	155	51.76	48.0	42.1	32.95	63.7%	5	200	195	30	67	37	8.17	11.52
1986	205	38.95	30.00	31.60	27.29	70.1%	4	196	192	20	50	30	12.28	20.81
1987	307	35.02	25.00	29.00	27.34	78.1%	3	299	296	19	45	26	30.38	112.56
1988	403	39.27	31.00	33.64	22.62	57.6%	3	156	153	21	50	29	11.90	14.23
1989	490	38.85	36.00	31.48	23.00	59.2%	1	289	288	22	60	38	24.67	123.39
1990	291	42.28	40.00	34.57	22.88	54.1%	1	150	149	25	60	35	4.94	5.13
1991	207	51.09	50.00	44.13	31.50	61.7%	1	390	389	33	62	29	36.14	190.13
1992	192	41.58	43.00	32.68	22.76	54.7%	1	150	149	23	56.5	33.5	3.28	5.03
1993	203	38.63	33.00	31.74	30.62	79.3%	1	380	379	21	50	29	40.77	221.54
1994	225	38.82	37.00	33.50	19.69	50.7%	2	140	138	25	50	25	7.02	9.91
1995	197	37.81	35.00	32.11	21.70	57.4%	4	159	155	22	50	28	10.65	20.40
1996	178	38.01	40.00	33.34	16.46	43.3%	3	122	119	30	50	20	2.39	7.49
1997	295	36.47	30.00	32.66	16.65	45.7%	5	125	120	25	50	25	6.66	8.59
1998	366	33.63	30.00	29.44	15.93	47.4%	1.5	90	88.5	20	50	30	4.10	-0.05
1999	516	36.14	30.00	30.52	27.21	75.3%	2	475	473	20	50	30	80.46	612.42
2000	685	34.59	30.00	29.73	21.88	63.2%	0.3	264	263.7	20	45	25	42.61	168.96
2001	677	39.49	30.00	31.32	45.60	115.5%	1	700	699	20	50	30	111.18	724.61
2002	569	37.15	30.00	31.51	30.17	81.2%	0.2	600	599.8	20	50	30	114.48	1041.18
2003	415	32.37	30.00	27.14	19.00	58.7%	1	158	157	20	45	25	13.81	23.87
2004	575	33.41	30.00	27.92	18.56	55.5%	1.2	95	93.8	17	50	33	5.63	-2.64
2005	725	34.84	30.00	29.14	19.98	57.3%	2	109	107	20	50	30	8.37	-0.38

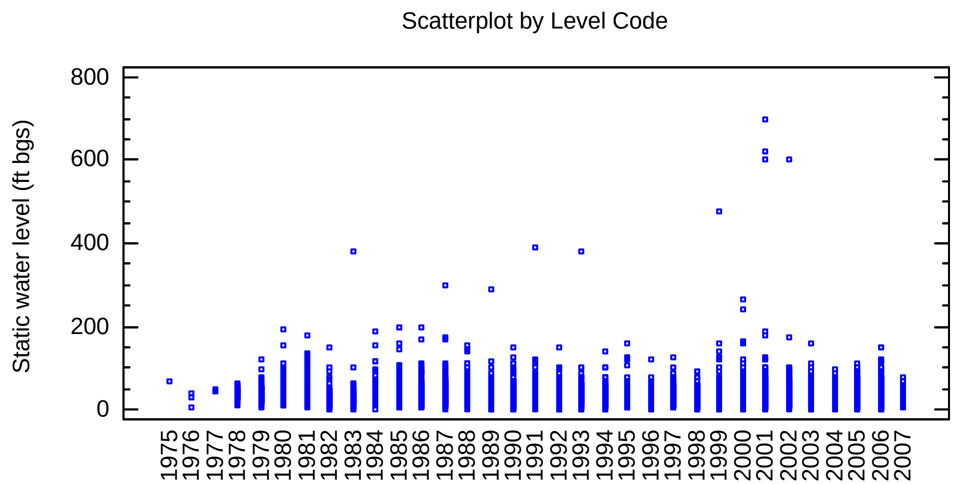
2006	795	37.74	32.00	32.42	20.09	53.2%	1	150	149	20	50	30	13.62	17.04
2007	96	44.67	50.00	40.20	17.15	38.4%	5	80	75	30	60	30	-1.82	-1.77

Indicates non-normal distribution

The StatAdvisor
The table above shows various statistics for each of the 33 columns of data. To test for significant differences amongst the column means, select Analysis of Variance from the list of Tabular Options. Select Means Plot from the list of Graphical Options to display the means graphically.

WARNING: There is more than a 3 to 1 difference between the smallest standard deviation and the largest. This may cause problems since the analysis of variance assumes that the standard deviations at all levels are equal. Select Variance Check from the list of Tabular Options to run a formal statistical test for differences among the sigmas. You may want to consider transforming the data to remove any dependence of the standard deviation on the mean.

WARNING: The standardized skewness and/or kurtosis is outside the range of -2 to +2 for 28 columns. This indicates some significant nonnormality in the data, which violates the assumption that the data come from normal distributions. You may wish to transform the data or use the Kruskal-Wallis test to compare the medians instead of the means.



ANOVA Table for tbl_VDH_stats_data.well_static_water by tbl_VDH_stats_data.WE_ID_YEAR

Source	*Sum of Squares*	*Df*	*Mean Square*	*F-Ratio*	*P-Value*
Between groups	158095.	32	4940.47	7.42	0.0000
Within groups	6.17453E6	9277	665.575		
Total (Corr.)	6.33263E6	9309			

The StatAdvisor

The ANOVA table decomposes the variance of the data into two components: a between-group component and a within-group component. The F-ratio, which in this case equals 7.42286, is a ratio of the between-group estimate to the within-group estimate. Since the P-value of the F-test is less than 0.05, there is a statistically significant difference between the means of the 33 variables at the 95.0% confidence level. To determine which means are significantly different from which others, select Multiple Range Tests from the list of Tabular Options.

Multiple Range Tests for tbl_VDH_stats_data.well_static_water by tbl_VDH_stats_data.WE_ID_YEAR

Method: 95.0 percent LSD

Level	*Count*	*Mean*	*Homogeneous Groups*
1976	4	26.25	XXXXXXXXXXXXX
2003	415	32.3687	X
1982	76	32.6118	XXXXX
2004	575	33.409	XX
1998	366	33.627	XX X
2000	685	34.5902	XXX X
2005	725	34.8428	XXX X
1987	307	35.0195	XXXXX
1999	516	36.1418	XXXXX
1997	295	36.4678	XXXXXX
1983	54	37.1389	XXXXXXXXXXX
2002	569	37.1511	XX XX
2006	795	37.7434	X XXX
1995	197	37.8122	XXXXXXX
1996	178	38.0112	XXXXXXX
1978	57	38.2281	XXXXXXXXXXX
1993	203	38.6305	XX XXXXX
1979	68	38.6985	XXXXXXXXXXX
1994	225	38.8178	X XXXXX
1989	490	38.8469	XXXX
1986	205	38.9488	X XXXXX
1988	403	39.273	XXXXX
2001	677	39.4919	XXXX
1992	192	41.5833	XXXX
1990	291	42.2766	XXX
2007	96	44.6667	XXX
1980	84	45.119	XXXX
1984	100	45.56	XXX
1977	2	46.0	XXXXXXXXXXXXX
1981	97	49.0619	XX
1991	207	51.087	X
1985	155	51.7613	X
1975	1	69.0	XXXXXXXXXXXXX

Contrast	*Sig.*	*Difference*	*+/- Limits*

1975 - 1976		42.75	56.533
1975 - 1977		23.0	61.9288
1975 - 1978		30.7719	51.0063
1975 - 1979		30.3015	50.9351
1975 - 1980		23.881	50.8648
1975 - 1981		19.9381	50.8247
1975 - 1982		36.3882	50.8963
1975 - 1983		31.8611	51.0307
1975 - 1984		23.44	50.8169
1975 - 1985		17.2387	50.7275
1975 - 1986		30.0512	50.6879
1975 - 1987		33.9805	50.647
1975 - 1988		29.727	50.6274
1975 - 1989		30.1531	50.6163
1975 - 1990		26.7234	50.6515
1975 - 1991		17.913	50.6867
1975 - 1992		27.4167	50.6962
1975 - 1993		30.3695	50.6891
1975 - 1994		30.1822	50.6769
1975 - 1995		31.1878	50.6929
1975 - 1996		30.9888	50.7065
1975 - 1997		32.5322	50.6503
1975 - 1998		35.373	50.6337
1975 - 1999		32.8582	50.6137
1975 - 2000		34.4098	50.6016
1975 - 2001		29.5081	50.602
1975 - 2002		31.8489	50.6091
1975 - 2003		36.6313	50.6256
1975 - 2004		35.591	50.6086
1975 - 2005		34.1572	50.5995
1975 - 2006		31.2566	50.5965
1975 - 2007		24.3333	50.8274
1976 - 1977		-19.75	43.7903
1976 - 1978		-11.9781	26.1544
1976 - 1979		-12.4485	26.0153
1976 - 1980		-18.869	25.8773
1976 - 1981		-22.8119	25.7984
1976 - 1982		-6.36184	25.9391
1976 - 1983		-10.8889	26.202
1976 - 1984		-19.31	25.783
1976 - 1985		-25.5113	25.6065
1976 - 1986		-12.6988	25.5278
1976 - 1987		-8.76954	25.4465

1976 - 1988		-13.023	25.4075
1976 - 1989		-12.5969	25.3853
1976 - 1990		-16.0266	25.4555
1976 - 1991		-24.837	25.5254
1976 - 1992		-15.3333	25.5443
1976 - 1993		-12.3805	25.5302
1976 - 1994		-12.5678	25.5061
1976 - 1995		-11.5622	25.5377
1976 - 1996		-11.7612	25.5648
1976 - 1997		-10.2178	25.4532
1976 - 1998		-7.37705	25.4201
1976 - 1999		-9.89182	25.3801
1976 - 2000		-8.34022	25.3561
1976 - 2001		-13.2419	25.3569
1976 - 2002		-10.9011	25.3711
1976 - 2003		-6.11867	25.4039
1976 - 2004		-7.15904	25.3701
1976 - 2005		-8.59276	25.352
1976 - 2006		-11.4934	25.3459
1976 - 2007		-18.4167	25.8037
1977 - 1978		7.77193	36.3765
1977 - 1979		7.30147	36.2766
1977 - 1980		0.880952	36.1778
1977 - 1981		-3.06186	36.1214
1977 - 1982		13.3882	36.222
1977 - 1983		8.86111	36.4107
1977 - 1984		0.44	36.1104
1977 - 1985		-5.76129	35.9846
1977 - 1986		7.05122	35.9286
1977 - 1987		10.9805	35.8709
1977 - 1988		6.72705	35.8432
1977 - 1989		7.15306	35.8275
1977 - 1990		3.72337	35.8773
1977 - 1991		-5.08696	35.9269
1977 - 1992		4.41667	35.9404
1977 - 1993		7.36946	35.9303
1977 - 1994		7.18222	35.9132
1977 - 1995		8.18782	35.9357
1977 - 1996		7.98876	35.9549
1977 - 1997		9.5322	35.8756
1977 - 1998		12.373	35.8522
1977 - 1999		9.85818	35.8239
1977 - 2000		11.4098	35.8068

1977 - 2001		6.50812	35.8074
1977 - 2002		8.84886	35.8174
1977 - 2003		13.6313	35.8407
1977 - 2004		12.591	35.8168
1977 - 2005		11.1572	35.8039
1977 - 2006		8.2566	35.7996
1977 - 2007		1.33333	36.1252
1978 - 1979		-0.470459	9.08051
1978 - 1980		-6.89098	8.6772
1978 - 1981	*	-10.8338	8.43887
1978 - 1982		5.61623	8.8599
1978 - 1983		1.08918	9.60228
1978 - 1984		-7.33193	8.39189
1978 - 1985	*	-13.5332	7.83271
1978 - 1986		-0.72071	7.57153
1978 - 1987		3.20853	7.29275
1978 - 1988		-1.04488	7.15544
1978 - 1989		-0.618869	7.07629
1978 - 1990		-4.04856	7.32408
1978 - 1991	*	-12.8589	7.56357
1978 - 1992		-3.35526	7.62709
1978 - 1993		-0.402472	7.57964
1978 - 1994		-0.589708	7.49796
1978 - 1995		0.415887	7.6049
1978 - 1996		0.216834	7.69545
1978 - 1997		1.76027	7.31594
1978 - 1998		4.60102	7.20012
1978 - 1999		2.08625	7.05769
1978 - 2000		3.63785	6.97054
1978 - 2001		-1.26381	6.9737
1978 - 2002		1.07693	7.02491
1978 - 2003		5.8594	7.14261
1978 - 2004		4.81903	7.02157
1978 - 2005		3.38531	6.95575
1978 - 2006		0.484674	6.9334
1978 - 2007		-6.4386	8.45512
1979 - 1980		-6.42052	8.2485
1979 - 1981	*	-10.3633	7.9974
1979 - 1982		6.08669	8.44048
1979 - 1983		1.55964	9.21671
1979 - 1984		-6.86147	7.94781
1979 - 1985	*	-13.0628	7.35494
1979 - 1986		-0.250251	7.07615

1979 - 1987		3.67899	6.77703
1979 - 1988		-0.574423	6.62904
1979 - 1989		-0.148409	6.54353
1979 - 1990		-3.5781	6.81073
1979 - 1991	*	-12.3884	7.06763
1979 - 1992		-2.8848	7.13557
1979 - 1993		0.0679875	7.08483
1979 - 1994		-0.119248	6.99738
1979 - 1995		0.886347	7.11185
1979 - 1996		0.687293	7.20859
1979 - 1997		2.23073	6.80198
1979 - 1998		5.07148	6.67724
1979 - 1999		2.55671	6.52341
1979 - 2000		4.10831	6.42902
1979 - 2001		-0.793347	6.43245
1979 - 2002		1.54739	6.48793
1979 - 2003		6.32985	6.61519
1979 - 2004		5.28949	6.48432
1979 - 2005		3.85577	6.41299
1979 - 2006		0.955133	6.38873
1979 - 2007		-5.96814	8.01455
1980 - 1981		-3.94281	7.53635
1980 - 1982	*	12.5072	8.00499
1980 - 1983		7.98016	8.81963
1980 - 1984		-0.440952	7.4837
1980 - 1985		-6.64224	6.85079
1980 - 1986		6.17027	6.55058
1980 - 1987	*	10.0995	6.22625
1980 - 1988		5.84609	6.06484
1980 - 1989	*	6.27211	5.97125
1980 - 1990		2.84242	6.26292
1980 - 1991		-5.96791	6.54137
1980 - 1992		3.53571	6.61472
1980 - 1993		6.48851	6.55995
1980 - 1994		6.30127	6.4654
1980 - 1995	*	7.30686	6.58912
1980 - 1996	*	7.10781	6.69342
1980 - 1997	*	8.65125	6.2534
1980 - 1998	*	11.492	6.11749
1980 - 1999	*	8.97723	5.9492
1980 - 2000	*	10.5288	5.84555
1980 - 2001		5.62717	5.84932
1980 - 2002	*	7.96791	5.91028

1980 - 2003	*	12.7504	6.0497
1980 - 2004	*	11.71	5.90631
1980 - 2005	*	10.2763	5.82791
1980 - 2006	*	7.37565	5.80121
1980 - 2007		0.452381	7.55454
1981 - 1982	*	16.45	7.746
1981 - 1983	*	11.923	8.58525
1981 - 1984		3.50186	7.206
1981 - 1985		-2.69943	6.5463
1981 - 1986	*	10.1131	6.23143
1981 - 1987	*	14.0423	5.88956
1981 - 1988	*	9.7889	5.71865
1981 - 1989	*	10.2149	5.6193
1981 - 1990	*	6.78522	5.92831
1981 - 1991		-2.0251	6.22176
1981 - 1992	*	7.47852	6.29883
1981 - 1993	*	10.4313	6.24128
1981 - 1994	*	10.2441	6.14183
1981 - 1995	*	11.2497	6.27194
1981 - 1996	*	11.0506	6.38143
1981 - 1997	*	12.5941	5.91825
1981 - 1998	*	15.4348	5.77446
1981 - 1999	*	12.92	5.59586
1981 - 2000	*	14.4716	5.48554
1981 - 2001	*	9.56998	5.48956
1981 - 2002	*	11.9107	5.55447
1981 - 2003	*	16.6932	5.70259
1981 - 2004	*	15.6528	5.55024
1981 - 2005	*	14.2191	5.46674
1981 - 2006	*	11.3185	5.43826
1981 - 2007		4.39519	7.27955
1982 - 1983		-4.52705	8.99944
1982 - 1984	*	-12.9482	7.69479
1982 - 1985	*	-19.1494	7.08077
1982 - 1986		-6.33694	6.79073
1982 - 1987		-2.4077	6.47844
1982 - 1988	*	-6.66111	6.32347
1982 - 1989	*	-6.2351	6.23377
1982 - 1990	*	-9.66479	6.51369
1982 - 1991	*	-18.4751	6.78186
1982 - 1992	*	-8.97149	6.85263
1982 - 1993		-6.0187	6.79978
1982 - 1994		-6.20594	6.70861

1982 - 1995		-5.20034	6.82792
1982 - 1996		-5.39939	6.92863
1982 - 1997		-3.85595	6.50454
1982 - 1998		-1.01521	6.37399
1982 - 1999		-3.52998	6.21264
1982 - 2000		-1.97838	6.11347
1982 - 2001	*	-6.88003	6.11707
1982 - 2002		-4.5393	6.17539
1982 - 2003		0.243167	6.30895
1982 - 2004		-0.797201	6.17159
1982 - 2005		-2.23092	6.0966
1982 - 2006		-5.13155	6.07108
1982 - 2007	*	-12.0548	7.76371
1983 - 1984		-8.42111	8.53907
1983 - 1985	*	-14.6224	7.9902
1983 - 1986		-1.80989	7.73434
1983 - 1987		2.11934	7.46165
1983 - 1988		-2.13406	7.3275
1983 - 1989		-1.70805	7.25023
1983 - 1990		-5.13774	7.49227
1983 - 1991	*	-13.9481	7.72655
1983 - 1992		-4.44444	7.78874
1983 - 1993		-1.49165	7.74228
1983 - 1994		-1.67889	7.66234
1983 - 1995		-0.673294	7.76701
1983 - 1996		-0.872347	7.85569
1983 - 1997		0.671092	7.48432
1983 - 1998		3.51184	7.37114
1983 - 1999		0.997067	7.23208
1983 - 2000		2.54867	7.14706
1983 - 2001		-2.35299	7.15014
1983 - 2002		-0.0122535	7.2001
1983 - 2003		4.77021	7.31497
1983 - 2004		3.72985	7.19684
1983 - 2005		2.29613	7.13264
1983 - 2006		-0.604507	7.11084
1983 - 2007		-7.52778	8.60123
1984 - 1985		-6.20129	6.48562
1984 - 1986	*	6.61122	6.16766
1984 - 1987	*	10.5405	5.82204
1984 - 1988	*	6.28705	5.64909
1984 - 1989	*	6.71306	5.5485
1984 - 1990		3.28337	5.86124

1984 - 1991		-5.52696	6.15788
1984 - 1992		3.97667	6.23574
1984 - 1993	*	6.92946	6.17761
1984 - 1994	*	6.74222	6.07712
1984 - 1995	*	7.74782	6.20858
1984 - 1996	*	7.54876	6.31916
1984 - 1997	*	9.0922	5.85106
1984 - 1998	*	11.933	5.70558
1984 - 1999	*	9.41818	5.52475
1984 - 2000	*	10.9698	5.41298
1984 - 2001	*	6.06812	5.41706
1984 - 2002	*	8.40886	5.48282
1984 - 2003	*	13.1913	5.63283
1984 - 2004	*	12.151	5.47855
1984 - 2005	*	10.7172	5.39393
1984 - 2006	*	7.8166	5.36507
1984 - 2007		0.893333	7.22503
1985 - 1986	*	12.8125	5.38215
1985 - 1987	*	16.7417	4.98234
1985 - 1988	*	12.4883	4.7791
1985 - 1989	*	12.9144	4.65976
1985 - 1990	*	9.48466	5.02808
1985 - 1991		0.674334	5.37094
1985 - 1992	*	10.178	5.46004
1985 - 1993	*	13.1307	5.39355
1985 - 1994	*	12.9435	5.27815
1985 - 1995	*	13.9491	5.429
1985 - 1996	*	13.7501	5.55512
1985 - 1997	*	15.2935	5.01622
1985 - 1998	*	18.1342	4.84574
1985 - 1999	*	15.6195	4.63146
1985 - 2000	*	17.1711	4.49755
1985 - 2001	*	12.2694	4.50245
1985 - 2002	*	14.6101	4.58136
1985 - 2003	*	19.3926	4.75987
1985 - 2004	*	18.3522	4.57624
1985 - 2005	*	16.9185	4.4746
1985 - 2006	*	14.0179	4.43976
1985 - 2007	*	7.09462	6.56724
1986 - 1987		3.92924	4.56075
1986 - 1988		-0.324172	4.3378
1986 - 1989		0.101842	4.20596
1986 - 1990		-3.32785	4.61068

1986 - 1991	*	-12.1382	4.98234
1986 - 1992		-2.63455	5.07826
1986 - 1993		0.318239	5.00671
1986 - 1994		0.131003	4.88217
1986 - 1995		1.1366	5.04487
1986 - 1996		0.937545	5.18036
1986 - 1997		2.48098	4.59774
1986 - 1998	*	5.32173	4.41111
1986 - 1999		2.80696	4.17458
1986 - 2000	*	4.35856	4.0255
1986 - 2001		-0.543095	4.03098
1986 - 2002		1.79764	4.11893
1986 - 2003	*	6.58011	4.3166
1986 - 2004	*	5.53974	4.11324
1986 - 2005	*	4.10602	3.99984
1986 - 2006		1.20538	3.96084
1986 - 2007		-5.71789	6.25343
1987 - 1988	*	-4.25341	3.83049
1987 - 1989	*	-3.82739	3.68052
1987 - 1990	*	-7.25709	4.13697
1987 - 1991	*	-16.0674	4.54752
1987 - 1992	*	-6.56379	4.65241
1987 - 1993		-3.611	4.5742
1987 - 1994		-3.79823	4.43754
1987 - 1995		-2.79264	4.61594
1987 - 1996		-2.99169	4.76364
1987 - 1997		-1.44825	4.12254
1987 - 1998		1.39249	3.91332
1987 - 1999		-1.12228	3.64463
1987 - 2000		0.429325	3.47287
1987 - 2001	*	-4.47233	3.47922
1987 - 2002		-2.1316	3.58075
1987 - 2003		2.65087	3.80647
1987 - 2004		1.6105	3.5742
1987 - 2005		0.176785	3.44309
1987 - 2006		-2.72385	3.3977
1987 - 2007	*	-9.64712	5.91282
1988 - 1989		0.426014	3.40034
1988 - 1990		-3.00368	3.88981
1988 - 1991	*	-11.814	4.32389
1988 - 1992		-2.31038	4.43407
1988 - 1993		0.642411	4.35194
1988 - 1994		0.455175	4.20807

1988 - 1995		1.46077	4.39579
1988 - 1996		1.26172	4.55064
1988 - 1997		2.80516	3.87446
1988 - 1998	*	5.6459	3.65105
1988 - 1999		3.13113	3.36146
1988 - 2000	*	4.68273	3.17442
1988 - 2001		-0.218923	3.18136
1988 - 2002		2.12181	3.29209
1988 - 2003	*	6.90428	3.53629
1988 - 2004	*	5.86391	3.28496
1988 - 2005	*	4.43019	3.14181
1988 - 2006		1.52956	3.092
1988 - 2007		-5.39371	5.74261
1989 - 1990		-3.42969	3.74221
1989 - 1991	*	-12.24	4.19161
1989 - 1992		-2.73639	4.30517
1989 - 1993		0.216397	4.22054
1989 - 1994		0.029161	4.07203
1989 - 1995		1.03476	4.26574
1989 - 1996		0.835703	4.42514
1989 - 1997		2.37914	3.72626
1989 - 1998	*	5.21989	3.49338
1989 - 1999		2.70512	3.18951
1989 - 2000	*	4.25672	2.99173
1989 - 2001		-0.644937	2.9991
1989 - 2002		1.6958	3.11631
1989 - 2003	*	6.47826	3.37326
1989 - 2004	*	5.4379	3.10878
1989 - 2005	*	4.00418	2.95712
1989 - 2006		1.10354	2.90414
1989 - 2007	*	-5.81973	5.64368
1990 - 1991	*	-8.81032	4.59759
1990 - 1992		0.693299	4.70136
1990 - 1993		3.64609	4.62398
1990 - 1994		3.45885	4.48884
1990 - 1995		4.46445	4.66528
1990 - 1996		4.2654	4.81146
1990 - 1997	*	5.80884	4.17771
1990 - 1998	*	8.64958	3.97139
1990 - 1999	*	6.13481	3.70692
1990 - 2000	*	7.68641	3.53818
1990 - 2001		2.78476	3.54441
1990 - 2002	*	5.12549	3.64413

1990 - 2003	*	9.90796	3.86615
1990 - 2004	*	8.86759	3.63769
1990 - 2005	*	7.43387	3.50896
1990 - 2006	*	4.53324	3.46443
1990 - 2007		-2.39003	5.95142
1991 - 1992	*	9.50362	5.06638
1991 - 1993	*	12.4564	4.99466
1991 - 1994	*	12.2692	4.86982
1991 - 1995	*	13.2748	5.03292
1991 - 1996	*	13.0757	5.16871
1991 - 1997	*	14.6192	4.58462
1991 - 1998	*	17.4599	4.39743
1991 - 1999	*	14.9451	4.16013
1991 - 2000	*	16.4967	4.01051
1991 - 2001	*	11.5951	4.016
1991 - 2002	*	13.9358	4.10428
1991 - 2003	*	18.7183	4.30262
1991 - 2004	*	17.6779	4.09856
1991 - 2005	*	16.2442	3.98475
1991 - 2006	*	13.3436	3.94559
1991 - 2007	*	6.42029	6.24378
1992 - 1993		2.95279	5.09034
1992 - 1994		2.76556	4.96791
1992 - 1995		3.77115	5.12789
1992 - 1996		3.5721	5.26123
1992 - 1997	*	5.11554	4.68868
1992 - 1998	*	7.95628	4.50581
1992 - 1999	*	5.44151	4.27453
1992 - 2000	*	6.99311	4.12906
1992 - 2001		2.09146	4.1344
1992 - 2002	*	4.43219	4.2202
1992 - 2003	*	9.21466	4.41334
1992 - 2004	*	8.17429	4.21464
1992 - 2005	*	6.74057	4.10405
1992 - 2006		3.83994	4.06604
1992 - 2007		-3.08333	6.32059
1993 - 1994		-0.187236	4.89474
1993 - 1995		0.818359	5.05704
1993 - 1996		0.619306	5.1922
1993 - 1997		2.16275	4.61108
1993 - 1998	*	5.00349	4.42502
1993 - 1999		2.48872	4.18927
1993 - 2000		4.04032	4.04074

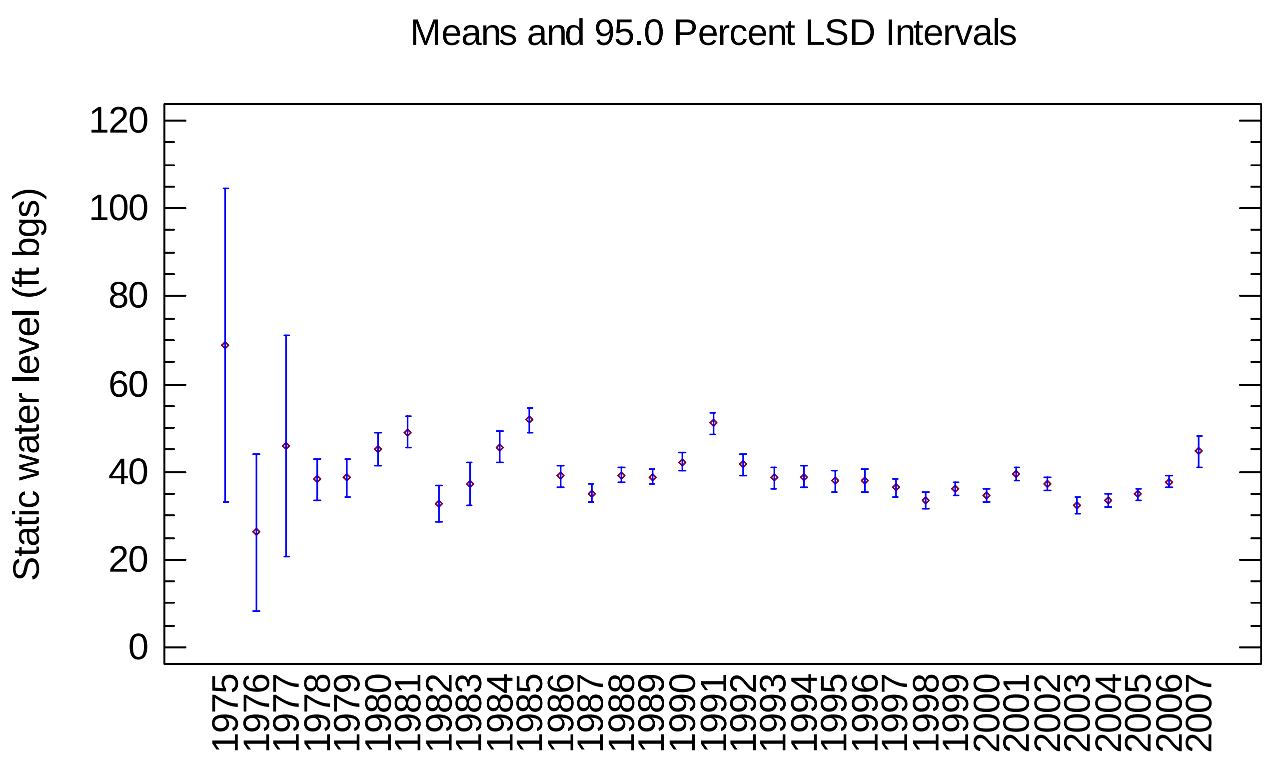
1993 - 2001		-0.861334	4.04619
1993 - 2002		1.4794	4.13382
1993 - 2003	*	6.26187	4.33081
1993 - 2004	*	5.2215	4.12815
1993 - 2005		3.78778	4.01517
1993 - 2006		0.887146	3.97632
1993 - 2007		-6.03612	6.26324
1994 - 1995		1.0056	4.93377
1994 - 1996		0.806542	5.07223
1994 - 1997		2.34998	4.47555
1994 - 1998	*	5.19073	4.2836
1994 - 1999		2.67596	4.03962
1994 - 2000	*	4.22756	3.88536
1994 - 2001		-0.674098	3.89103
1994 - 2002		1.66664	3.98208
1994 - 2003	*	6.4491	4.18622
1994 - 2004	*	5.40873	3.97619
1994 - 2005	*	3.97502	3.85877
1994 - 2006		1.07438	3.81832
1994 - 2007		-5.84889	6.16415
1995 - 1996		-0.199053	5.22901
1995 - 1997		1.34439	4.65249
1995 - 1998		4.18513	4.46815
1995 - 1999		1.67036	4.23481
1995 - 2000		3.22196	4.08793
1995 - 2001		-1.67969	4.09332
1995 - 2002		0.66104	4.17996
1995 - 2003	*	5.44351	4.37488
1995 - 2004	*	4.40314	4.17435
1995 - 2005		2.96942	4.06266
1995 - 2006		0.0687865	4.02426
1995 - 2007	*	-6.85448	6.29379
1996 - 1997		1.54344	4.79907
1996 - 1998		4.38419	4.62058
1996 - 1999		1.86941	4.39534
1996 - 2000		3.42102	4.254
1996 - 2001		-1.48064	4.25918
1996 - 2002		0.860094	4.34252
1996 - 2003	*	5.64256	4.53044
1996 - 2004	*	4.60219	4.33711
1996 - 2005		3.16848	4.22973
1996 - 2006		0.26784	4.19286
1996 - 2007	*	-6.65543	6.4029

1997 - 1998		2.84075	3.95637
1997 - 1999		0.325975	3.69081
1997 - 2000		1.87758	3.52131
1997 - 2001		-3.02408	3.52757
1997 - 2002		-0.683346	3.62775
1997 - 2003	*	4.09912	3.85072
1997 - 2004		3.05875	3.62128
1997 - 2005		1.62504	3.49194
1997 - 2006		-1.2756	3.4472
1997 - 2007	*	-8.19887	5.9414
1998 - 1999		-2.51477	3.45554
1998 - 2000		-0.96317	3.27388
1998 - 2001	*	-5.86483	3.28061
1998 - 2002	*	-3.52409	3.3881
1998 - 2003		1.25837	3.62584
1998 - 2004		0.218006	3.38117
1998 - 2005		-1.21571	3.24228
1998 - 2006	*	-4.11635	3.19403
1998 - 2007	*	-11.0396	5.79819
1999 - 2000		1.5516	2.94746
1999 - 2001	*	-3.35005	2.95494
1999 - 2002		-1.00932	3.07384
1999 - 2003	*	3.77315	3.33406
1999 - 2004		2.73278	3.0662
1999 - 2005		1.29906	2.91232
1999 - 2006		-1.60157	2.85851
1999 - 2007	*	-8.52484	5.62034
2000 - 2001	*	-4.90166	2.74029
2000 - 2002		-2.56092	2.8681
2000 - 2003		2.22154	3.14539
2000 - 2004		1.18118	2.85992
2000 - 2005		-0.25254	2.69428
2000 - 2006	*	-3.15318	2.63602
2000 - 2007	*	-10.0764	5.51051
2001 - 2002		2.34073	2.87578
2001 - 2003	*	7.1232	3.15239
2001 - 2004	*	6.08283	2.86762
2001 - 2005	*	4.64912	2.70245
2001 - 2006		1.74848	2.64438
2001 - 2007		-5.17479	5.51451
2002 - 2003	*	4.78247	3.26411
2002 - 2004	*	3.7421	2.98999
2002 - 2005		2.30838	2.83197

2002 - 2006		-0.592254	2.77661
2002 - 2007	*	-7.51552	5.57913
2003 - 2004		-1.04037	3.25692
2003 - 2005		-2.47408	3.11248
2003 - 2006	*	-5.37472	3.06219
2003 - 2007	*	-12.298	5.72662
2004 - 2005		-1.43372	2.82368
2004 - 2006	*	-4.33435	2.76815
2004 - 2007	*	-11.2576	5.57492
2005 - 2006	*	-2.90064	2.59667
2005 - 2007	*	-9.82391	5.49179
2006 - 2007	*	-6.92327	5.46345

* denotes a statistically significant difference.

The StatAdvisor
This table applies a multiple comparison procedure to determine which means are significantly different from which others. The bottom half of the output shows the estimated difference between each pair of means. An asterisk has been placed next to 191 pairs, indicating that these pairs show statistically significant differences at the 95.0% confidence level. At the top of the page, 13 homogenous groups are identified using columns of X's. Within each column, the levels containing X's form a group of means within which there are no statistically significant differences. The method currently being used to discriminate among the means is Fisher's least significant difference (LSD) procedure. With this method, there is a 5.0% risk of calling each pair of means significantly different when the actual difference equals 0.



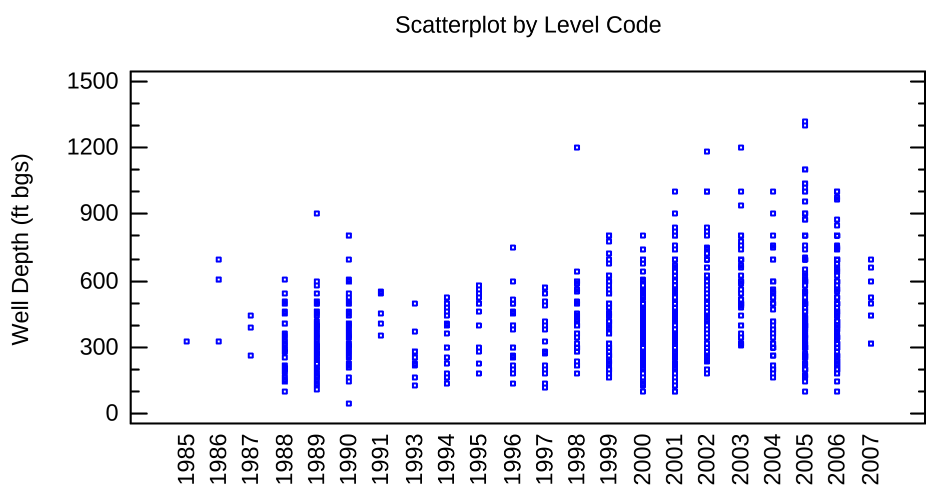
The dataset for the graph above was truncated due to insufficient data during years prior to 1975.

15) Multiple-Sample Comparison (Hydros Well Depth by YEAR_COMPLETED>1985)

Dependent variable: tbl_HYdros_consylds_geol.WELL_DEPTH
Factor: YEAR_COMPLETED
Selection variable: YEAR_COMPLETED>1985

Number of observations: 1816
Number of levels: 22

The StatAdvisor
This procedure compares the data in 22 columns of the current data file. It constructs various statistical tests and graphs to compare the samples. The F-test in the ANOVA table will test whether there are any significant differences amongst the means. If there are, the Multiple Range Tests will tell you which means are significantly different from which others. If you are worried about the presence of outliers, choose the Kruskal-Wallis Test which compares medians instead of means. The various plots will help you judge the practical significance of the results, as well as allow you to look for possible violations of the assumptions underlying the analysis of variance.



Summary Statistics Hydrostudies Well Depth by Year

YEAR	Count	Average	Median	Geometric mean	Standard deviation	Coeff. of variation	Minimum	Maximum	Range	Lower quartile	Upper quartile	Interquartile range	Stnd. skewness	Stnd. kurtosis
1985	1	330.00	330.0	330.0		%	330	330	0	330	330	0		
1986	4	558.75	605.0	537.2	162.14	29.0%	325	700	375	465	652.5	187.5	-1.24581	1.16861
1987	3	365.00	385.0	356.7	91.65	25.1%	265	445	180	265	445	180	-0.6613	
1988	58	281.60	285.00	261.15	113.60	40.3%	102	605	503	200	330	130	2.85886	0.438964
1989	109	316.22	300.00	294.54	122.47	38.7%	110	900	790	230	400	170	5.21719	7.67813
1990	64	392.66	360.00	364.22	144.45	36.8%	50	805	755	305	480	175	2.3512	1.62554
1991	5	459.00	450.00	452.38	86.20	18.8%	350	550	200	405	540	135	-0.0999003	-0.951049
1993	13	267.46	250.00	253.61	92.71	34.7%	125	500	375	225	280	55	1.72756	2.07126
1994	19	352.63	400.00	325.00	131.83	37.4%	140	520	380	225	480	255	-0.590737	-1.2611
1995	16	451.25	500.0	428.2	130.61	28.9%	185	580	395	350	540	190	-1.69312	-0.273183
1996	25	392.32	400.0	364.1	145.34	37.0%	140	750	610	260	500	240	0.485358	0.0407322
1997	16	350.63	352.50	314.26	155.48	44.3%	120	570	450	210	495	285	0.0637809	-1.14854
1998	38	418.82	400.00	390.48	178.38	42.6%	180	1200	1020	300	500	200	5.86061	11.2853
1999	88	397.50	380.00	365.80	163.90	41.2%	160	800	640	260	500	240	2.73375	-0.343667
2000	302	369.09	350.00	345.69	132.87	36.0%	100	800	700	266	440	174	4.51824	-0.0527422
2001	283	420.47	400.00	389.30	160.32	38.1%	100	1000	900	300	520	220	3.6125	0.00231144
2002	130	479.04	430.00	441.64	196.40	41.0%	180	1180	1000	300	600	300	4.0905	1.92606
2003	57	596.58	600.00	573.02	172.19	28.9%	310	1200	890	490	700	210	2.52916	2.65463
2004	63	432.54	380.00	396.09	185.47	42.9%	160	1000	840	300	550	250	2.77287	0.705955
2005	213	491.29	430.00	436.02	247.70	50.4%	100	1320	1220	300	600	300	6.16369	1.65399
2006	299	429.87	380.00	394.95	181.95	42.3%	100	1000	900	300	520	220	6.24439	0.383794
2007	10	482.00	470.00	463.46	140.30	29.1%	320	700	380	320	600	280	0.311699	-0.79001
Total	**1816**	**417.17**	**390.00**	**380.75**	**182.38**	**43.7%**	**50**	**1320**	**1270**	**300**	**500**	**200**	**18.9058**	**13.8854**

Indicates non-normal distribution.

The StatAdvisor
This table shows various statistics for each of the 22 columns of data. To test for significant differences amongst the column means, select Analysis of Variance from the list of Tabular Options. Select Means Plot from the list of Graphical Options to display the means graphically.

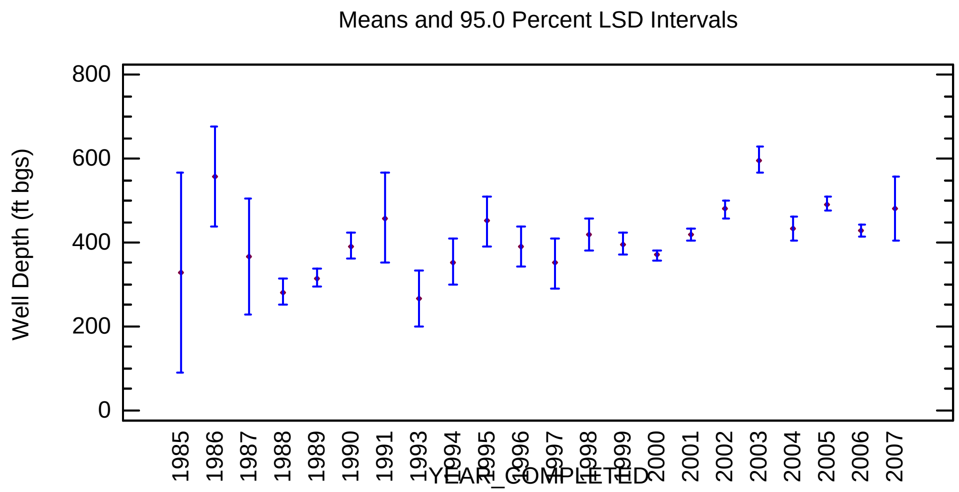
WARNING: There is more than a 3 to 1 difference between the smallest standard deviation and the largest. This may cause problems since the analysis of variance assumes that the standard deviations at all levels are equal. Select Variance Check from the list of Tabular Options to run a formal statistical test for differences among the sigmas. You may want to consider transforming the data to remove any dependence of the standard deviation on the mean.

WARNING: The standardized skewness and/or kurtosis is outside the range of -2 to +2 for 13 columns. This indicates some significant **non-normality** in the data, which violates the assumption that the data come from normal distributions. You may wish to transform the data or **use the Kruskal-Wallis test to compare the medians instead of the means**.

ANOVA Table for tbl_HYdros_consylds_geol.WELL_DEPTH by YEAR_COMPLETED

Source	*Sum of Squares*	*Df*	*Mean Square*	*F-Ratio*	*P-Value*
Between groups	7.13832E6	21	339920.	11.46	0.0000
Within groups	5.32322E7	1794	29672.3		
Total (Corr.)	6.03705E7	1815			

The StatAdvisor
The ANOVA table decomposes the variance of the data into two components: a between-group component and a within-group component. The F-ratio, which in this case equals 11.4558, is a ratio of the between-group estimate to the within-group estimate. Since the P-value of the F-test is less than 0.05, there is a statistically significant difference between the means of the 22 variables at the 95.0% confidence level. To determine which means are significantly different from which others, select Multiple Range Tests from the list of Tabular Options.



The StatAdvisor
This table shows the mean for each sample. It also shows the standard error of each mean, which is a measure of its sampling variability. The standard error is formed by dividing the pooled standard deviation by the square root of the number of observations at each level. The table also displays an interval around each mean. The intervals currently displayed are based on Fisher's least significant difference (LSD) procedure. They are constructed in such a way that if two means are the same, their intervals will overlap 95.0% of the time. You can display the intervals graphically by selecting Means Plot from the list of Graphical Options. In the Multiple Range Tests, these intervals are used to determine which means are significantly different from which others.

Multiple Range Tests for tbl_HYdros_consylds_geol.WELL_DEPTH by YEAR_COMPLETED

Method: 95.0 percent LSD

YEAR_COMPLETED	*Count*	*Mean*	*Homogeneous Groups*
1993	13	267.462	X
1988	58	281.603	X
1989	109	316.22	XX
1985	1	330.0	XXXXXXXX
1997	16	350.625	XXXX
1994	19	352.632	XXXX
1987	3	365.0	XXXXXXX
2000	302	369.088	X
1996	25	392.32	XX X
1990	64	392.656	XX X
1999	88	397.5	XX X
1998	38	418.816	XXX X
2001	283	420.473	X X
2006	299	429.866	X X
2004	63	432.54	XX X
1995	16	451.25	XXXXX
1991	5	459.0	XXXXXXX
2002	130	479.038	XX
2007	10	482.0	XXXXX
2005	213	491.291	X
1986	4	558.75	XXXX
2003	57	596.579	X

The StatAdvisor

This table applies a multiple comparison procedure to determine which means are significantly different from which others. At the top of the page, 8 homogenous groups are identified using columns of X's. Within each column, the levels containing X's form a group of means within which there are no statistically significant differences. The method currently being used to discriminate among the means is Fisher's least significant difference (LSD) procedure. With this method, there is a 5.0% risk of calling each pair of means significantly different when the actual difference equals 0.

Kruskal-Wallis Test for tbl_HYdros_consylds_geol.WELL_DEPTH by YEAR_COMPLETED

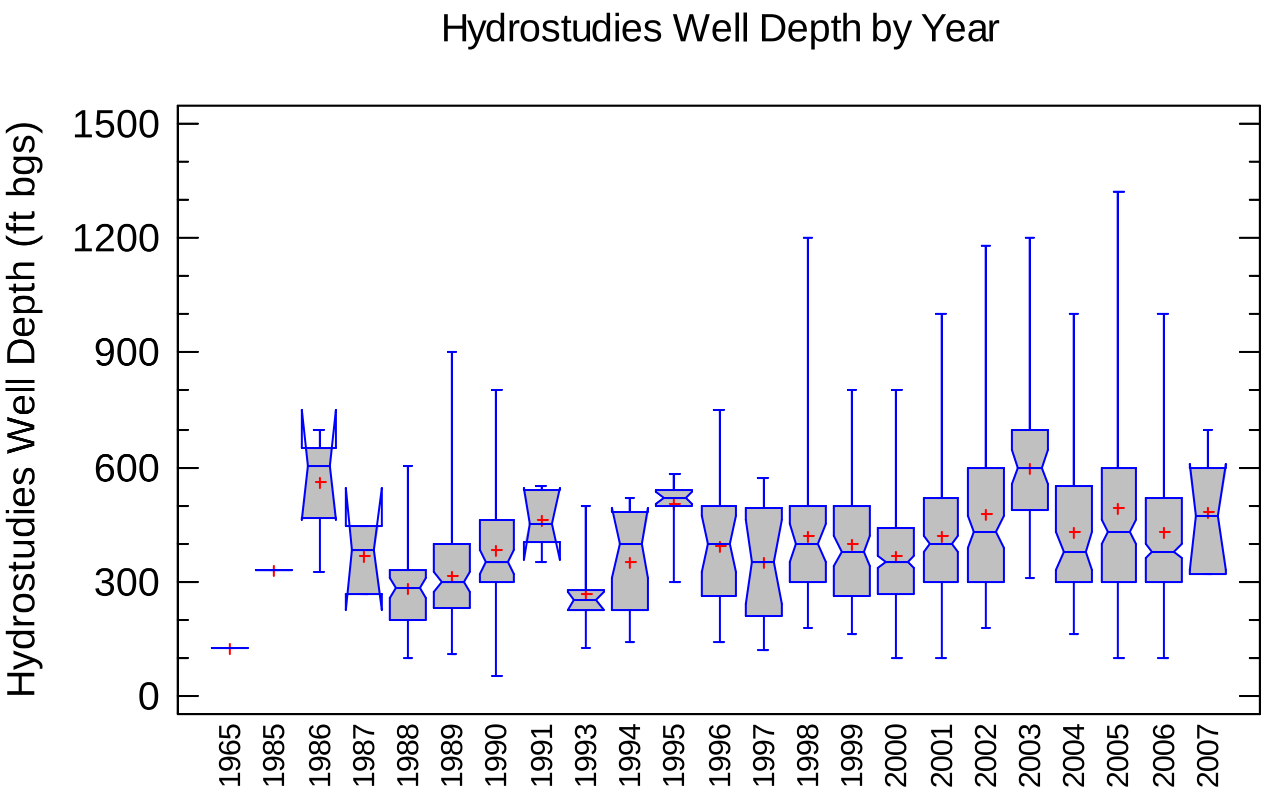
YEAR_COMPLETED	*Sample Size*	*Average Rank*
1985	1	754.5
1986	4	1404.5
1987	3	804.5
1988	58	481.397
1989	109	601.67
1990	64	890.391
1991	5	1167.1
1993	13	386.885

1994	19	754.368
1995	16	1082.34
1996	25	866.56
1997	16	735.938
1998	38	927.079
1999	88	853.17
2000	302	790.323
2001	283	947.265
2002	130	1079.22
2003	57	1416.04
2004	63	953.659
2005	213	1043.11
2006	299	944.311
2007	10	1192.15

Test statistic = 203.589   P-Value = 0.0

The StatAdvisor

The Kruskal-Wallis test tests the null hypothesis that the medians within each of the 22 columns is the same. The data from all the columns is first combined and ranked from smallest to largest. The average rank is then computed for the data in each column. Since the P-value is less than 0.05, **there is a statistically significant difference amongst the medians at the 95.0% confidence level**. To determine which medians are significantly different from which others, select Box-and-Whisker Plot from the list of Graphical Options and select the median notch option.


Hydrostudies Well Depth by Year
Hydrostudies Well Depth (ft bgs)
1500
1200
900
600
300
0
1965
1985
1986
1987
1988
1989
1990
1991
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007

Note: The year 1965 not included in statistical analysis due to insufficient data.

Mood's Median Test for tbl_HYdros_consylds_geol.WELL_DEPTH by YEAR_COMPLETED

Total n = 1816

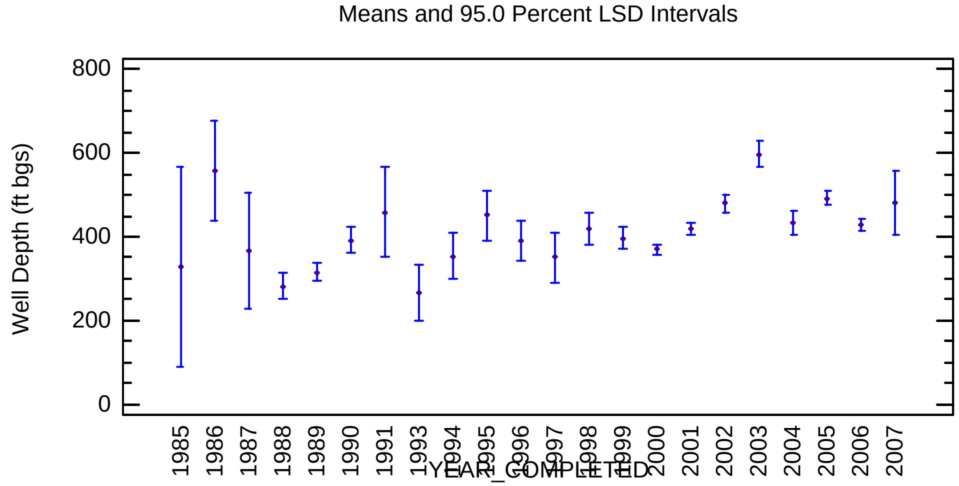
Grand median = 390.0

YEAR_COMPLETED	*Sample Size*	*n<=*	*n>*	*Median*	*95.0% lower CL*	*95.0% upper CL*
1985	1	1	0	330.0		
1986	4	1	3	605.0		
1987	3	2	1	385.0		
1988	58	48	10	285.0	205.0	305.0
1989	109	80	29	300.0	270.0	321.209
1990	64	37	27	360.0	335.855	401.829
1991	5	1	4	450.0		
1993	13	12	1	250.0	183.664	338.32
1994	19	9	10	400.0	212.765	486.118
1995	16	4	12	500.0	292.759	549.655
1996	25	10	15	400.0	264.166	500.0
1997	16	9	7	352.5	190.345	524.31
1998	38	17	21	400.0	300.0	445.825
1999	88	47	41	380.0	300.0	420.0
2000	302	178	124	350.0	320.0	380.0
2001	283	132	151	400.0	360.0	425.0
2002	130	44	86	430.0	420.0	500.0
2003	57	6	51	600.0	500.0	700.0
2004	63	32	31	380.0	300.0	500.0
2005	213	89	124	430.0	400.0	500.0
2006	299	151	148	380.0	340.0	420.0
2007	10	3	7	470.0	320.0	687.022

Test statistic = 137.268 P-Value = 0.0

The StatAdvisor

Mood's median test tests the hypothesis that the medians of all 22 samples are equal. It does so by counting the number of observations in each sample on either side of the grand median, which equals 390.0. Since the P-value for the chi-squared test is less than 0.05, **the medians of the samples are significantly different at the 95.0% confidence level**. Also included (if available) are 95.0% confidence intervals for each median based on the order statistics of each sample.


Means and 95.0 Percent LSD Intervals
Well Depth (ft bgs)
0
200
400
600
800
1985
1986
1987
1988
1989
1990
1991
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
YEAR_COMPLETED

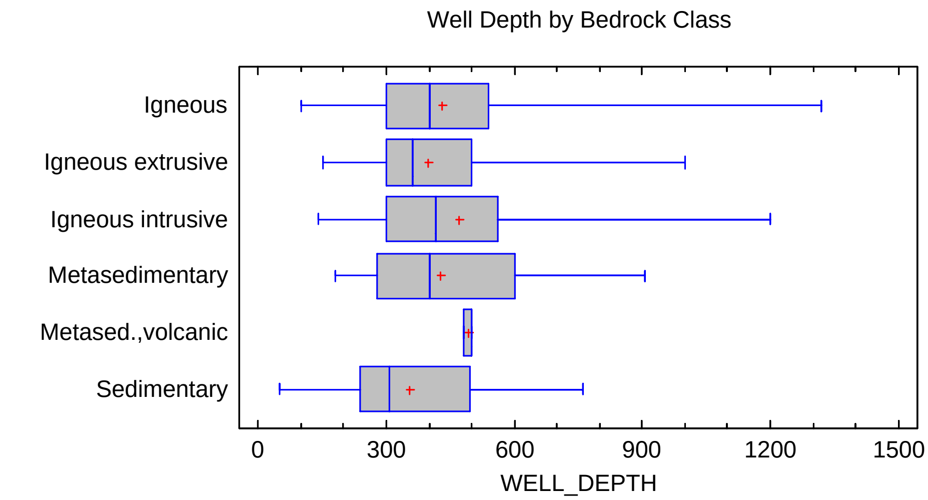
ANALYSIS OF VDH STATIC WATER LEVEL BY YEAR

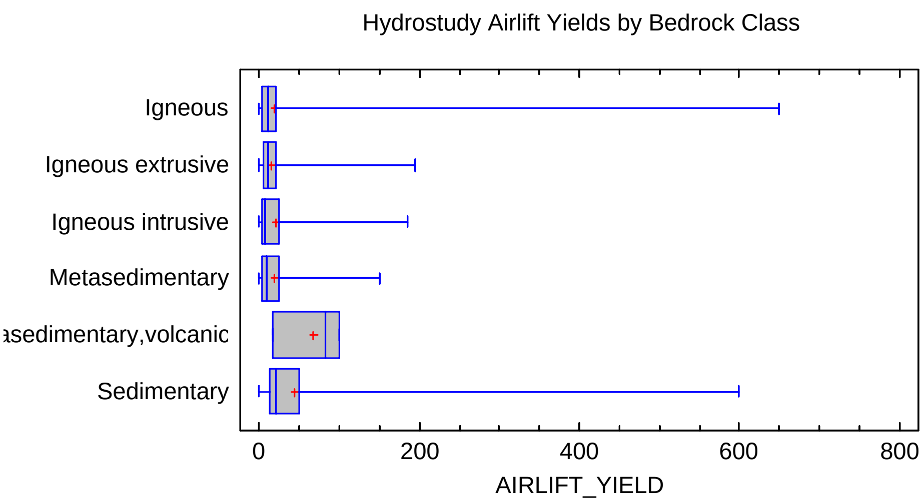
Summary Statistics for VDH Static Water Levels by Year

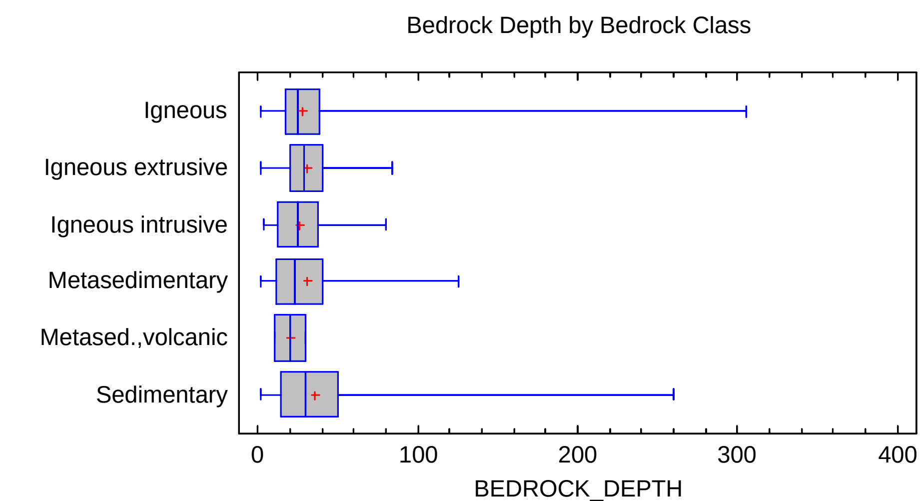
YEAR	*Count*	*Average*	*Median*	*Geometric mean*	*Standard deviation*	*Coeff. of variation*	*Minimum*	*Maximum*	*Range*	*Lower quartile*	*Upper quartile*	*Interquartile range*	*Stnd. skewness*	*Stnd. kurtosis*
1975	1	69.00	69.0	69.0		%	69	69	0	69	69	0		
1976	4	26.25	30.0	20.6	14.93	56.9%	5	40	35	17.5	35	17.5	-1.13	1.06
1977	2	46.00	46.0	46.0	1.41	3.1%	45	47	2	45	47	2		
1978	57	38.23	38.00	36.40	10.93	28.6%	10	62	52	30	45	15	-0.30	0.52
1979	68	38.70	34.50	33.97	20.69	53.5%	7	123	116	24.5	49.5	25	5.13	5.97
1980	84	45.12	38.50	37.44	31.00	68.7%	10	195	185	22.5	53.5	31	8.22	13.03
1981	97	49.06	40.00	37.92	34.66	70.7%	5	180	175	21	66	45	4.78	2.67
1982	76	32.61	29.00	24.83	23.50	72.1%	1	150	149	20	40	20	7.81	14.40
1983	54	37.14	26.00	24.92	51.56	138.8%	1	383	382	17.5	45	27.5	17.73	59.54
1984	100	45.56	40.0	37.8	29.71	65.2%	2.5	190	187.5	29	56.5	27.5	8.53	13.36
1985	155	51.76	48.0	42.1	32.95	63.7%	5	200	195	30	67	37	8.17	11.52
1986	205	38.95	30.00	31.60	27.29	70.1%	4	196	192	20	50	30	12.28	20.81
1987	307	35.02	25.00	29.00	27.34	78.1%	3	299	296	19	45	26	30.38	112.56
1988	403	39.27	31.00	33.64	22.62	57.6%	3	156	153	21	50	29	11.90	14.23
1989	490	38.85	36.00	31.48	23.00	59.2%	1	289	288	22	60	38	24.67	123.39
1990	291	42.28	40.00	34.57	22.88	54.1%	1	150	149	25	60	35	4.94	5.13
1991	207	51.09	50.00	44.13	31.50	61.7%	1	390	389	33	62	29	36.14	190.13
1992	192	41.58	43.00	32.68	22.76	54.7%	1	150	149	23	56.5	33.5	3.28	5.03
1993	203	38.63	33.00	31.74	30.62	79.3%	1	380	379	21	50	29	40.77	221.54
1994	225	38.82	37.00	33.50	19.69	50.7%	2	140	138	25	50	25	7.02	9.91
1995	197	37.81	35.00	32.11	21.70	57.4%	4	159	155	22	50	28	10.65	20.40
1996	178	38.01	40.00	33.34	16.46	43.3%	3	122	119	30	50	20	2.39	7.49
1997	295	36.47	30.00	32.66	16.65	45.7%	5	125	120	25	50	25	6.66	8.59
1998	366	33.63	30.00	29.44	15.93	47.4%	1.5	90	88.5	20	50	30	4.10	-0.05
1999	516	36.14	30.00	30.52	27.21	75.3%	2	475	473	20	50	30	80.46	612.42
2000	685	34.59	30.00	29.73	21.88	63.2%	0.3	264	263.7	20	45	25	42.61	168.96
2001	677	39.49	30.00	31.32	45.60	115.5%	1	700	699	20	50	30	111.18	724.61
2002	569	37.15	30.00	31.51	30.17	81.2%	0.2	600	599.8	20	50	30	114.48	1041.18
2003	415	32.37	30.00	27.14	19.00	58.7%	1	158	157	20	45	25	13.81	23.87
2004	575	33.41	30.00	27.92	18.56	55.5%	1.2	95	93.8	17	50	33	5.63	-2.64
2005	725	34.84	30.00	29.14	19.98	57.3%	2	109	107	20	50	30	8.37	-0.38
2006	795	37.74	32.00	32.42	20.09	53.2%	1	150	149	20	50	30	13.62	17.04
2007	96	44.67	50.00	40.20	17.15	38.4%	5	80	75	30	60	30	-1.82	-1.77

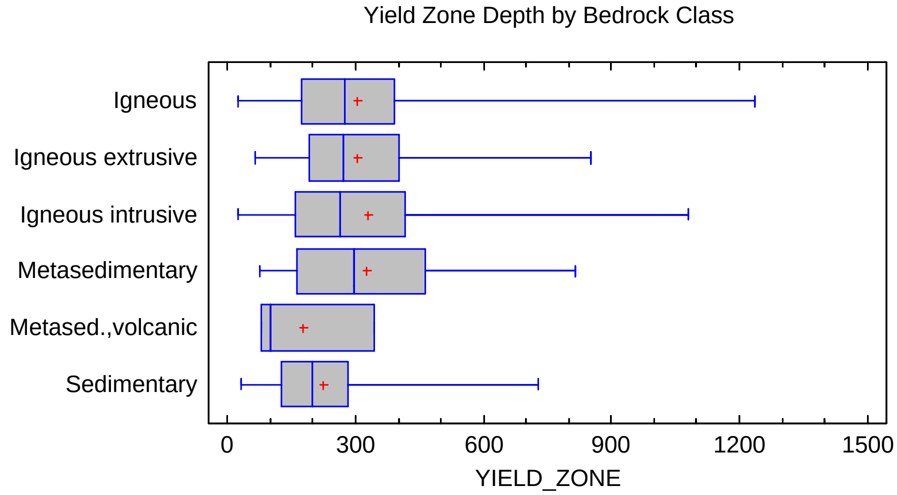
Indicates non-normal distribution

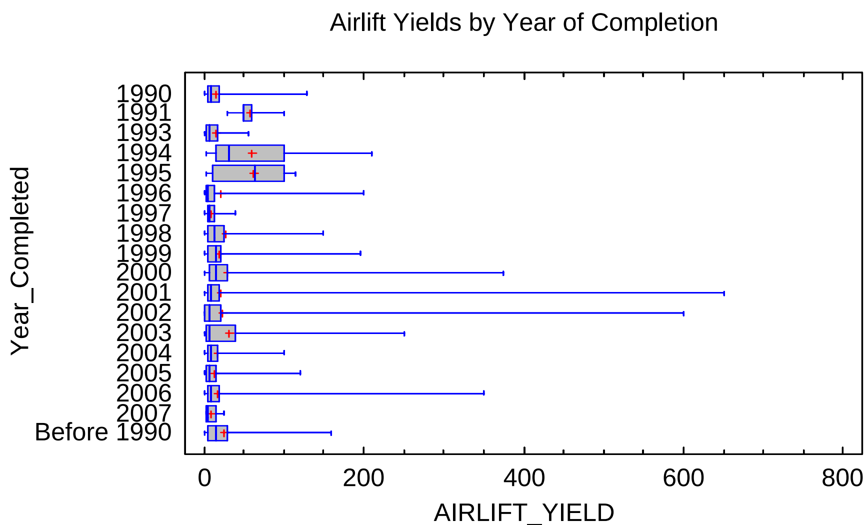
Section B) Box and Whiskers plots for various comparisons. These plots allow visual inspections of distributions of data and comparisons of mean and median values.

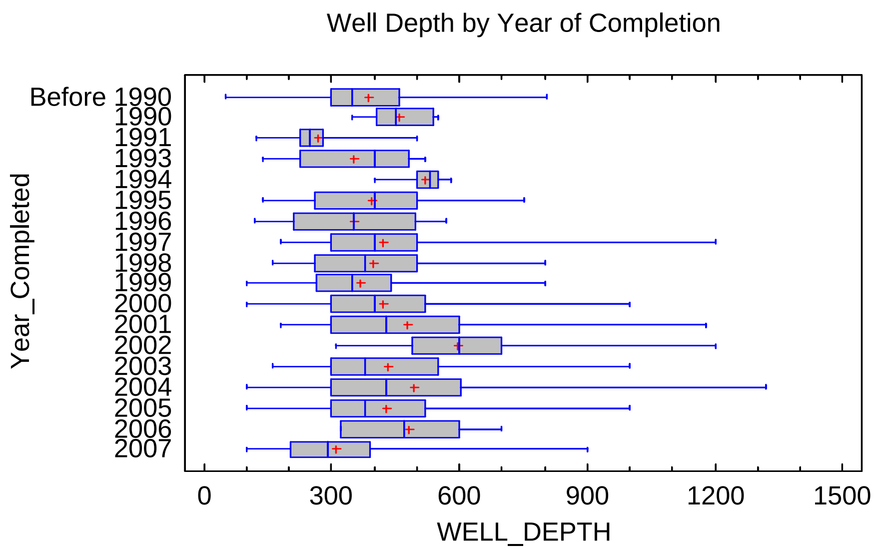

Well Depth by Bedrock Class
Igneous
Igneous extrusive
Igneous intrusive
Metasedimentary
Metased.,volcanic
Sedimentary
0
300
600
900
1200
1500
WELL_DEPTH


Hydrostudy Airlift Yields by Bedrock Class
Igneous
Igneous extrusive
Igneous intrusive
Metasedimentary
asedimentary,volcanic
Sedimentary
0
200
400
600
800
AIRLIFT_YIELD


Bedrock Depth by Bedrock Class
Igneous
Igneous extrusive
Igneous intrusive
Metasedimentary
Metased.,volcanic
Sedimentary
0
100
200
300
400
BEDROCK_DEPTH


Yield Zone Depth by Bedrock Class
Igneous
Igneous extrusive
Igneous intrusive
Metasedimentary
Metased.,volcanic
Sedimentary
0
300
600
900
1200
1500
YIELD_ZONE


Airlift Yields by Year of Completion
Year_Completed
1990
1991
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
Before 1990
0
200
400
600
800
AIRLIFT_YIELD


Well Depth by Year of Completion
Year_Completed
Before 1990
1990
1991
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
0
300
600
900
1200
1500
WELL_DEPTH

Section C) Detailed statistical analysis of Hydrostudy data, including parameters calculated from pumping tests.

ANALYSIS OF AIRLIFT YIELD (HYDROS) VS YEAR COMPLETED

Summary Statistics for AIRLIFT_YIELD

YEAR_COMPLETED	*Count*	*Average*	*Median*	*Geometric mean*	*Standard deviation*	*Coeff. of variation*	*Minimum*
1985	1	0.0	0.0			%	0.0
1986	4	7.75	5.5		8.65544	111.683%	0.0
1987	3	24.3333	25.0	23.811	6.02771	24.7714%	18.0
1988	55	24.6364	12.0		30.4156	123.458%	0.0
1989	110	26.0582	15.0		32.5877	125.057%	0.0
1990	63	15.5317	8.0		20.5789	132.496%	0.0
1991	5	58.0	50.0	53.7827	25.8844	44.6282%	30.0
1993	13	14.2731	6.0	6.73628	17.1736	120.322%	0.25
1994	19	60.7895	32.0	36.9294	57.3387	94.3235%	3.0
1995	16	49.25	35.0	26.3449	44.5159	90.3876%	2.0
1996	25	20.68	4.0	6.1995	43.6759	211.199%	0.25
1997	16	10.0313	7.75	7.28633	9.22581	91.9707%	1.0
1998	38	26.4474	13.0	11.4269	36.7794	139.067%	0.5
1999	88	20.1597	15.0		27.53	136.56%	0.0
2000	302	28.6846	15.0	14.7102	42.0343	146.539%	0.25
2001	282	22.0846	10.0		48.7932	220.938%	0.0
2002	131	22.9008	6.0		63.4494	277.062%	0.0
2003	56	31.4196	8.0		51.9462	165.33%	0.0
2004	63	17.5333	10.0	9.52158	23.081	131.641%	1.0
2005	212	17.1509	8.0		45.4419	264.953%	0.0
2006	299	17.0635	10.0		26.9276	157.808%	0.0
2007	10	8.3	5.0	5.83165	7.86059	94.7059%	2.0
Total	1811	22.504	10.0		41.3793	183.876%	0.0

YEAR_COMPLETED	*Maximum*	*Range*	*Lower quartile*	*Upper quartile*	*Interquartile range*	*Stnd. skewness*
1985	0.0	0.0	0.0	0.0	0.0	
1986	20.0	20.0	2.0	13.5	11.5	1.10776
1987	30.0	12.0	18.0	30.0	12.0	-0.347623
1988	150.0	150.0	5.0	40.0	35.0	6.2814
1989	160.0	160.0	4.5	30.0	25.5	8.95609
1990	128.0	128.0	4.0	20.0	16.0	10.3667
1991	100.0	70.0	50.0	60.0	10.0	1.12118
1993	56.0	55.75	3.0	16.8	13.8	2.4322
1994	210.0	207.0	15.0	100.0	85.0	2.14901
1995	115.0	113.0	11.0	100.0	89.0	0.628159
1996	200.0	199.75	2.0	14.0	12.0	6.94395
1997	40.0	39.0	4.5	13.25	8.75	4.04653
1998	150.0	149.5	5.0	25.0	20.0	5.33493
1999	195.0	195.0	4.25	21.0	16.75	14.2905
2000	375.0	374.75	8.0	30.0	22.0	29.5222
2001	650.0	650.0	5.0	20.0	15.0	59.8838
2002	600.0	600.0	1.5	21.0	19.5	32.0966
2003	250.0	250.0	2.5	40.0	37.5	7.95387
2004	100.0	99.0	5.0	18.0	13.0	7.71673
2005	500.0	500.0	3.0	16.5	13.5	51.6823
2006	350.0	350.0	5.5	20.0	14.5	54.5007
2007	26.0	24.0	3.0	15.0	12.0	1.97367
Total	650.0	650.0	5.0	25.0	20.0	119.89

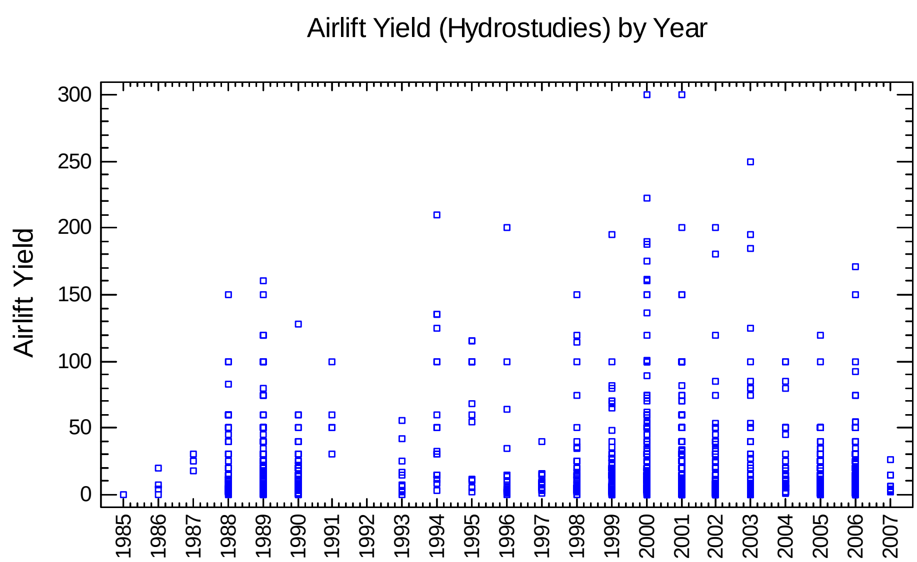
YEAR_COMPLETED	*Stnd. kurtosis*
1985	
1986	0.871335
1987	
1988	7.48114

1989	9.51572
1990	22.5996
1991	1.09508
1993	1.49035
1994	0.776674
1995	-1.39278
1996	12.7093
1997	6.21642
1998	4.82177
1999	36.2511
2000	83.5845
2001	348.7
2002	130.877
2003	10.8844
2004	8.53843
2005	249.311
2006	294.686
2007	1.12972
Total	638.029

The StatAdvisor
This table shows various statistics for each of the 22 columns of data. To test for significant differences amongst the column means, select Analysis of Variance from the list of Tabular Options. Select Means Plot from the list of Graphical Options to display the means graphically.

WARNING: There is more than a 3 to 1 difference between the smallest standard deviation and the largest. This may cause problems since the analysis of variance assumes that the standard deviations at all levels are equal. Select Variance Check from the list of Tabular Options to run a formal statistical test for differences among the sigmas. You may want to consider transforming the data to remove any dependence of the standard deviation on the mean.

WARNING: The standardized skewness and/or kurtosis is outside the range of -2 to +2 for 16 columns. This indicates some significant nonnormality in the data, which violates the assumption that the data come from normal distributions. You may wish to transform the data or use the Kruskal-Wallis test to compare the medians instead of the means.



ANOVA Table for AIRLIFT_YIELD by YEAR_COMPLETED

Source	*Sum of Squares*	*Df*	*Mean Square*	*F-Ratio*	*P-Value*
Between groups	90769.1	21	4322.34	2.57	0.0001
Within groups	3.0084E6	1789	1681.61		
Total (Corr.)	3.09917E6	1810			

The StatAdvisor

The ANOVA table decomposes the variance of the data into two components: a between-group component and a within-group component. The F-ratio, which in this case equals 2.57035, is a ratio of the between-group estimate to the within-group estimate. Since the P-value of the F-test is less than 0.05, there is a statistically significant difference between the means of the 22 variables at the 95.0% confidence level. To determine which means are significantly different from which others, select Multiple Range Tests from the list of Tabular Options.

Multiple Range Tests for AIRLIFT_YIELD by YEAR_COMPLETED

Method: 95.0 percent LSD

YEAR_COMPLETED	*Count*	*Mean*	*Homogeneous Groups*
1985	1	0.0	XXXXXXX
1986	4	7.75	XXXXXX
2007	10	8.3	XXXX
1997	16	10.0313	XXXX
1993	13	14.2731	XXXX
1990	63	15.5317	XX
2006	299	17.0635	X
2005	212	17.1509	XX
2004	63	17.5333	XX X
1999	88	20.1597	XXXX
1996	25	20.68	XXXX X
2001	282	22.0846	XXXX X
2002	131	22.9008	XXXX X
1987	3	24.3333	XXXXXXX
1988	55	24.6364	XXXX X
1989	110	26.0582	XXX X
1998	38	26.4474	XXXXXX
2000	302	28.6846	X XX
2003	56	31.4196	XXXX
1995	16	49.25	X X
1991	5	58.0	XXX
1994	19	60.7895	X

Contrast	*Sig.*	*Difference*	*+/- Limits*
1985 - 1986		-7.75	89.8601
1985 - 1987		-24.3333	92.8071
1985 - 1988		-24.6364	81.1007
1985 - 1989		-26.0582	80.7378
1985 - 1990		-15.5317	81.0087
1985 - 1991		-58.0	88.0446
1985 - 1993		-14.2731	83.4073
1985 - 1994		-60.7895	82.4613
1985 - 1995		-49.25	82.8469
1985 - 1996		-20.68	81.965
1985 - 1997		-10.0313	82.8469
1985 - 1998		-26.4474	81.424
1985 - 1999		-20.1597	80.8287
1985 - 2000		-28.6846	80.5063
1985 - 2001		-22.0846	80.5157
1985 - 2002		-22.9008	80.6795
1985 - 2003		-31.4196	81.0878
1985 - 2004		-17.5333	81.0087

1985 - 2005		-17.1509	80.5626
1985 - 2006		-17.0635	80.5076
1985 - 2007		-8.3	84.2962
1986 - 1987		-16.5833	61.3861
1986 - 1988		-16.8864	41.6223
1986 - 1989		-18.3082	40.9108
1986 - 1990		-7.78175	41.4428
1986 - 1991		-50.25	53.9161
1986 - 1993		-6.52308	45.9552
1986 - 1994	*	-53.0395	44.2149
1986 - 1995		-41.5	44.93
1986 - 1996		-12.93	43.2824
1986 - 1997		-2.28125	44.93
1986 - 1998		-18.6974	42.2488
1986 - 1999		-12.4097	41.0898
1986 - 2000		-20.9346	40.4519
1986 - 2001		-14.3346	40.4707
1986 - 2002		-15.1508	40.7956
1986 - 2003		-23.6696	41.5971
1986 - 2004		-9.78333	41.4428
1986 - 2005		-9.40094	40.564
1986 - 2006		-9.31355	40.4546
1986 - 2007		-0.55	47.5495
1987 - 1988		-0.30303	47.6523
1987 - 1989		-1.72485	47.0321
1987 - 1990		8.80159	47.4956
1987 - 1991		-33.6667	58.6964
1987 - 1993		10.0603	51.4801
1987 - 1994		-36.4561	49.9328
1987 - 1995		-24.9167	50.5671
1987 - 1996		3.65333	49.1089
1987 - 1997		14.3021	50.5671
1987 - 1998		-2.11404	48.2005
1987 - 1999		4.17367	47.1879
1987 - 2000		-4.35127	46.6335
1987 - 2001		2.24876	46.6497
1987 - 2002		1.43257	46.9319
1987 - 2003		-7.08631	47.6303
1987 - 2004		6.8	47.4956
1987 - 2005		7.18239	46.7307
1987 - 2006		7.26979	46.6358
1987 - 2007		16.0333	52.9082
1988 - 1989		-1.42182	13.2732
1988 - 1990		9.10462	14.8321
1988 - 1991		-33.3636	37.5423
1988 - 1993		10.3633	24.7864
1988 - 1994	*	-36.1531	21.388
1988 - 1995	*	-24.6136	22.8297
1988 - 1996		3.95636	19.3868
1988 - 1997		14.6051	22.8297
1988 - 1998		-1.811	16.9543
1988 - 1999		4.4767	13.8152
1988 - 2000		-4.04824	11.7831
1988 - 2001		2.55179	11.8473
1988 - 2002		1.7356	12.9137
1988 - 2003		-6.78328	15.258
1988 - 2004		7.10303	14.8321
1988 - 2005		7.48542	12.1624

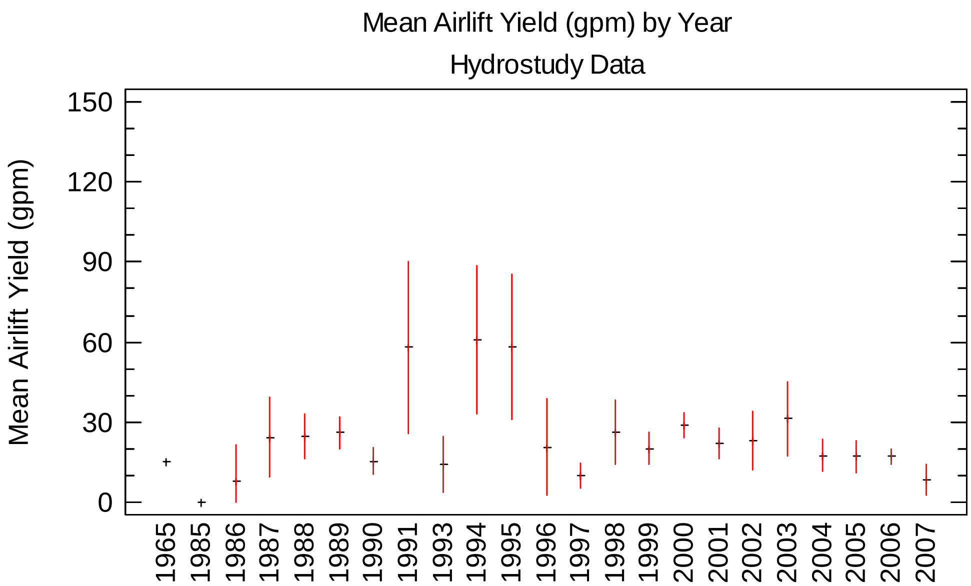
1988 - 2006		7.57282	11.7922
1988 - 2007		16.3364	27.6304
1989 - 1990		10.5264	12.699
1989 - 1991		-31.9418	36.7519
1989 - 1993		11.7851	23.572
1989 - 1994	*	-34.7313	19.968
1989 - 1995	*	-23.1918	21.5051
1989 - 1996		5.37818	17.8079
1989 - 1997		16.0269	21.5051
1989 - 1998		-0.389187	15.1236
1989 - 1999		5.89852	11.4949
1989 - 2000		-2.62642	8.95078
1989 - 2001		3.97361	9.03512
1989 - 2002		3.15742	10.3941
1989 - 2003		-5.36146	13.194
1989 - 2004		8.52485	12.699
1989 - 2005		8.90724	9.44443
1989 - 2006	*	8.99464	8.96276
1989 - 2007		17.7582	26.5464
1990 - 1991	*	-42.4683	37.3432
1990 - 1993		1.25867	24.4837
1990 - 1994	*	-45.2577	21.0364
1990 - 1995	*	-33.7183	22.5007
1990 - 1996		-5.14825	18.9982
1990 - 1997		5.5005	22.5007
1990 - 1998		-10.9156	16.5086
1990 - 1999		-4.62791	13.2644
1990 - 2000	*	-13.1529	11.1323
1990 - 2001		-6.55283	11.2002
1990 - 2002		-7.36902	12.3227
1990 - 2003	*	-15.8879	14.7612
1990 - 2004		-2.00159	14.3204
1990 - 2005		-1.6192	11.5329
1990 - 2006		-1.5318	11.1419
1990 - 2007		7.23175	27.3592
1991 - 1993	*	43.7269	42.2952
1991 - 1994		-2.78947	40.3976
1991 - 1995		8.75	41.1791
1991 - 1996		37.32	39.3747
1991 - 1997	*	47.9688	41.1791
1991 - 1998		31.5526	38.2357
1991 - 1999	*	37.8403	36.9511
1991 - 2000		29.3154	36.2404
1991 - 2001		35.9154	36.2613
1991 - 2002		35.0992	36.6236
1991 - 2003		26.5804	37.5144
1991 - 2004	*	40.4667	37.3432
1991 - 2005	*	40.8491	36.3654
1991 - 2006	*	40.9365	36.2433
1991 - 2007	*	49.7	44.0223
1993 - 1994	*	-46.5164	28.9293
1993 - 1995	*	-34.9769	30.0109
1993 - 1996		-6.40692	27.4829
1993 - 1997		4.24183	30.0109
1993 - 1998		-12.1743	25.8246
1993 - 1999		-5.88658	23.8814
1993 - 2000		-14.4115	22.7663
1993 - 2001		-7.8115	22.7996

1993 - 2002		-8.62769	23.3715
1993 - 2003		-17.1466	24.744
1993 - 2004		-3.26026	24.4837
1993 - 2005		-2.87787	22.9648
1993 - 2006		-2.79047	22.771
1993 - 2007		5.97308	33.8068
1994 - 1995		11.5395	27.2715
1994 - 1996	*	40.1095	24.462
1994 - 1997	*	50.7582	27.2715
1994 - 1998	*	34.3421	22.583
1994 - 1999	*	40.6298	20.3323
1994 - 2000	*	32.1049	19.0101
1994 - 2001	*	38.7049	19.0499
1994 - 2002	*	37.8887	19.7308
1994 - 2003	*	29.3698	21.3389
1994 - 2004	*	43.2561	21.0364
1994 - 2005	*	43.6385	19.2474
1994 - 2006	*	43.7259	19.0157
1994 - 2007	*	52.4895	31.4003
1995 - 1996	*	28.57	25.732
1995 - 1997	*	39.2188	28.4163
1995 - 1998		22.8026	23.9528
1995 - 1999	*	29.0903	21.8438
1995 - 2000		20.5654	20.6187
1995 - 2001	*	27.1654	20.6555
1995 - 2002	*	26.3492	21.2851
1995 - 2003		17.8304	22.7837
1995 - 2004	*	31.7167	22.5007
1995 - 2005	*	32.0991	20.8378
1995 - 2006	*	32.1865	20.6239
1995 - 2007	*	40.95	32.3995
1996 - 1997		10.6488	25.732
1996 - 1998		-5.76737	20.6976
1996 - 1999		0.520341	18.2154
1996 - 2000		-8.0046	16.7268
1996 - 2001		-1.40457	16.7721
1996 - 2002		-2.22076	17.5416
1996 - 2003		-10.7396	19.3326
1996 - 2004		3.14667	18.9982
1996 - 2005		3.52906	16.9961
1996 - 2006		3.61645	16.7332
1996 - 2007		12.38	30.0729
1997 - 1998		-16.4161	23.9528
1997 - 1999		-10.1284	21.8438
1997 - 2000		-18.6534	20.6187
1997 - 2001		-12.0533	20.6555
1997 - 2002		-12.8695	21.2851
1997 - 2003		-21.3884	22.7837
1997 - 2004		-7.50208	22.5007
1997 - 2005		-7.11969	20.8378
1997 - 2006		-7.0323	20.6239
1997 - 2007		1.73125	32.3995
1998 - 1999		6.28771	15.6014
1998 - 2000		-2.23723	13.8343
1998 - 2001		4.36279	13.889
1998 - 2002		3.54661	14.8091
1998 - 2003		-4.97227	16.8923
1998 - 2004		8.91404	16.5086

1998 - 2005		9.29643	14.1587
1998 - 2006		9.38382	13.842
1998 - 2007		18.1474	28.5654
1999 - 2000		-8.52494	9.73642
1999 - 2001		-1.92492	9.81402
1999 - 2002		-2.7411	11.0779
1999 - 2003		-11.26	13.7391
1999 - 2004		2.62633	13.2644
1999 - 2005		3.00872	10.1921
1999 - 2006		3.09611	9.74744
1999 - 2007		11.8597	26.8215
2000 - 2001		6.60003	6.65565
2000 - 2002		5.78384	8.40846
2000 - 2003		-2.73504	11.6938
2000 - 2004	*	11.1513	11.1323
2000 - 2005	*	11.5337	7.20148
2000 - 2006	*	11.6211	6.55707
2000 - 2007		20.3846	25.8336
2001 - 2002		-0.816189	8.49819
2001 - 2003		-9.33507	11.7585
2001 - 2004		4.55124	11.2002
2001 - 2005		4.93363	7.30605
2001 - 2006		5.02103	6.67175
2001 - 2007		13.7846	25.863
2002 - 2003		-8.51888	12.8323
2002 - 2004		5.36743	12.3227
2002 - 2005		5.74982	8.93214
2002 - 2006		5.83722	8.42122
2002 - 2007		14.6008	26.3685
2003 - 2004		13.8863	14.7612
2003 - 2005	*	14.2687	12.0758
2003 - 2006	*	14.3561	11.703
2003 - 2007		23.1196	27.5924
2004 - 2005		0.38239	11.5329
2004 - 2006		0.469788	11.1419
2004 - 2007		9.23333	27.3592
2005 - 2006		0.0873982	7.21637
2005 - 2007		8.85094	26.0088
2006 - 2007		8.76355	25.8378

* denotes a statistically significant difference.

The StatAdvisor
This table applies a multiple comparison procedure to determine which means are significantly different from which others. The bottom half of the output shows the estimated difference between each pair of means. An asterisk has been placed next to 46 pairs, indicating that these pairs show statistically significant differences at the 95.0% confidence level. At the top of the page, 7 homogenous groups are identified using columns of X's. Within each column, the levels containing X's form a group of means within which there are no statistically significant differences. The method currently being used to discriminate among the means is Fisher's least significant difference (LSD) procedure. With this method, there is a 5.0% risk of calling each pair of means significantly different when the actual difference equals 0.

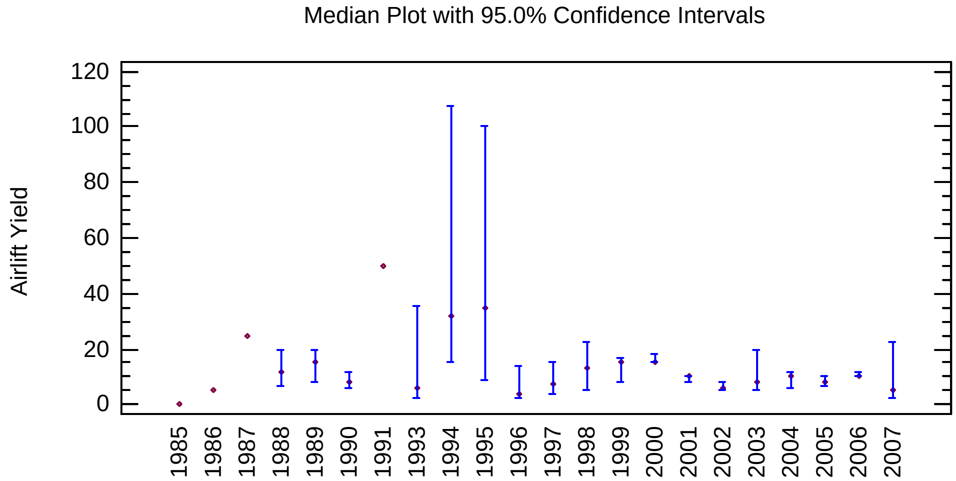


Kruskal-Wallis Test for AIRLIFT_YIELD by YEAR_COMPLETED

YEAR_COMPLETED	*Sample Size*	*Average Rank*
1985	1	16.5
1986	4	591.125
1987	3	1349.5
1988	55	964.545
1989	110	988.491
1990	63	814.833
1991	5	1624.8
1993	13	770.308
1994	19	1409.58
1995	16	1257.22
1996	25	678.34
1997	16	736.969
1998	38	949.671
1999	88	932.466
2000	302	1070.72
2001	282	874.239
2002	131	732.408
2003	56	867.098
2004	63	859.952
2005	212	777.231
2006	299	901.57
2007	10	637.2

Test statistic = 115.937 P-Value = 0.0

The StatAdvisor
The Kruskal-Wallis test tests the null hypothesis that the medians within each of the 22 columns is the same. The data from all the columns is first combined and ranked from smallest to largest. The average rank is then computed for the data in each column. Since the P-value is less than 0.05, there is a statistically significant difference amongst the medians at the 95.0% confidence level. To determine which medians are significantly different from which others, select Box-and-Whisker Plot from the list of Graphical Options and select the median notch option.



Mood's Median Test for AIRLIFT_YIELD by YEAR_COMPLETED
Total n = 1811
Grand median = 10.0

YEAR_COMPLETED	*Sample Size*	*n<=*	*n>*	*Median*	*95.0% lower CL*	*95.0% upper CL*
1985	1	1	0	0.0		
1986	4	3	1	5.5		
1987	3	0	3	25.0		
1988	55	26	29	12.0	7.0	20.0
1989	110	46	64	15.0	8.42236	20.0
1990	63	36	27	8.0	6.0	12.0
1991	5	0	5	50.0		
1993	13	8	5	6.0	2.39441	35.2951
1994	19	2	17	32.0	15.0	107.647
1995	16	4	12	35.0	8.55176	100.0
1996	25	16	9	4.0	2.10416	14.0
1997	16	11	5	7.75	3.75863	15.2241
1998	38	18	20	13.0	5.0	22.9127
1999	88	37	51	15.0	8.0	17.0
2000	302	110	192	15.0	15.0	18.0
2001	282	165	117	10.0	8.0	10.0
2002	131	87	44	6.0	5.0	8.44918
2003	56	32	24	8.0	5.0	20.0
2004	63	37	26	10.0	6.0	12.0
2005	212	141	71	8.0	6.6115	10.0
2006	299	161	138	10.0	10.0	12.0
2007	10	7	3	5.0	2.32444	22.4311

Test statistic = 107.815   P-Value = 0.0

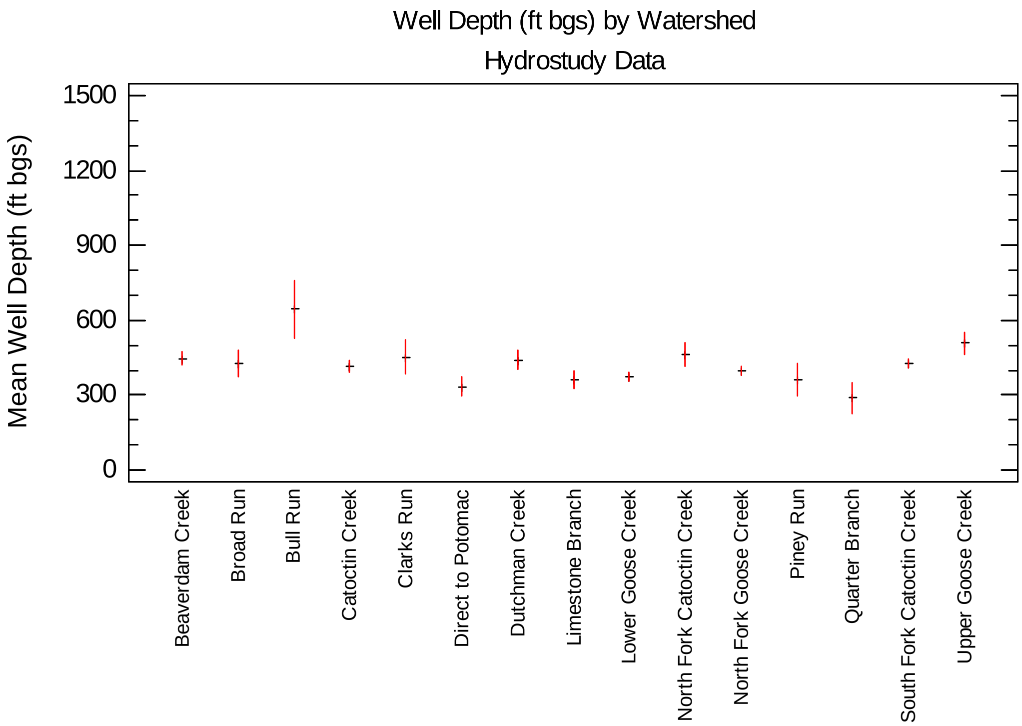
The StatAdvisor
Mood's median test tests the hypothesis that the medians of all 22 samples are equal. It does so by counting the number of observations in each sample on either side of the grand median, which equals 10.0. Since the P-value for the chi-squared test is less than 0.05, the medians of the samples are significantly different at the 95.0% confidence level. Also included (if available) are 95.0% confidence intervals for each median based on the order statistics of each sample.

Multiple-Sample Comparison Well Depth (hydros) by Watershed

Dependent variable: Hydros WELL_DEPTH
Factor: Watershed

Number of observations: 1817
Number of levels: 15

The StatAdvisor
This procedure compares the data in 15 columns of the current data file. It constructs various statistical tests and graphs to compare the samples. The F-test in the ANOVA table will test whether there are any significant differences amongst the means. If there are, the Multiple Range Tests will tell you which means are significantly different from which others. If you are worried about the presence of outliers, choose the Kruskal-Wallis Test which compares medians instead of means. The various plots will help you judge the practical significance of the results, as well as allow you to look for possible violations of the assumptions underlying the analysis of variance.



Summary Statistics for Hydros Well Depth

Watershed	*Count*	*Average*	*Median*	*Geometric mean*	*Standard deviation*
Beaverdam Creek	232	446.392	400.0	407.06	195.45
Broad Run	35	426.857	460.0	400.984	148.656
Bull Run	33	643.758	430.0	563.896	323.448
Catoctin Creek	234	412.701	350.0	377.245	179.435
Clarks Run	29	451.724	500.0	412.18	177.725
Direct to Potomac	55	332.455	300.0	304.373	143.103
Dutchman Creek	101	439.911	400.0	394.401	198.596
Limestone Branch	82	363.232	302.5	326.669	162.114
Lower Goose Creek	283	375.097	320.0	345.991	153.836
North Fork Catoctin Creek	104	461.442	390.0	403.412	243.524
North Fork Goose Creek	220	396.75	380.0	374.164	139.451
Piney Run	15	363.0	300.0	349.742	116.952
Quarter Branch	16	289.688	262.5	270.32	117.239
South Fork Catoctin Creek	334	424.766	400.0	393.229	168.628
Upper Goose Creek	44	509.273	509.0	485.824	148.217
Total	1817	417.01	390.0	380.523	182.455

Watershed	*Coeff. of variation*	*Minimum*	*Maximum*	*Range*	*Lower quartile*	*Upper quartile*
Beaverdam Creek	43.7844%	100.0	1300.0	1200.0	300.0	555.0
Broad Run	34.8257%	160.0	960.0	800.0	360.0	500.0
Bull Run	50.2437%	220.0	1100.0	880.0	430.0	960.0
Catoctin Creek	43.4783%	140.0	1180.0	1040.0	280.0	550.0
Clarks Run	39.3437%	160.0	900.0	740.0	300.0	580.0
Direct to Potomac	43.0445%	140.0	760.0	620.0	220.0	450.0
Dutchman Creek	45.1445%	120.0	800.0	680.0	300.0	600.0
Limestone Branch	44.6311%	50.0	800.0	750.0	230.0	500.0
Lower Goose Creek	41.0122%	100.0	1200.0	1100.0	280.0	480.0
North Fork Catoctin Creek	52.7744%	100.0	1320.0	1220.0	300.0	612.5
North Fork Goose Creek	35.1484%	140.0	980.0	840.0	300.0	455.0
Piney Run	32.2183%	300.0	700.0	400.0	300.0	400.0
Quarter Branch	40.4707%	140.0	600.0	460.0	200.0	340.0
South Fork Catoctin Creek	39.699%	125.0	1000.0	875.0	300.0	540.0
Upper Goose Creek	29.1037%	250.0	760.0	510.0	370.0	610.0
Total	43.753%	50.0	1320.0	1270.0	300.0	500.0

Watershed	*Interquartile range*	*Stnd. skewness*	*Stnd. kurtosis*
Beaverdam Creek	255.0	6.40076	4.16395
Broad Run	140.0	2.17225	4.55505
Bull Run	530.0	0.720565	-1.97231
Catoctin Creek	270.0	5.82615	2.60973
Clarks Run	280.0	-0.0174521	-0.130231
Direct to Potomac	230.0	2.34213	-0.0872207
Dutchman Creek	300.0	1.7373	-1.9488
Limestone Branch	270.0	1.99098	-1.02962
Lower Goose Creek	200.0	8.40328	10.8927
North Fork Catoctin Creek	312.5	4.39481	2.05973
North Fork Goose Creek	155.0	6.65857	6.69862
Piney Run	100.0	3.34663	3.40598
Quarter Branch	140.0	2.08898	1.66946
South Fork Catoctin Creek	240.0	6.15227	1.82544
Upper Goose Creek	240.0	-0.628545	-1.53574
Total	200.0	18.8844	13.8639

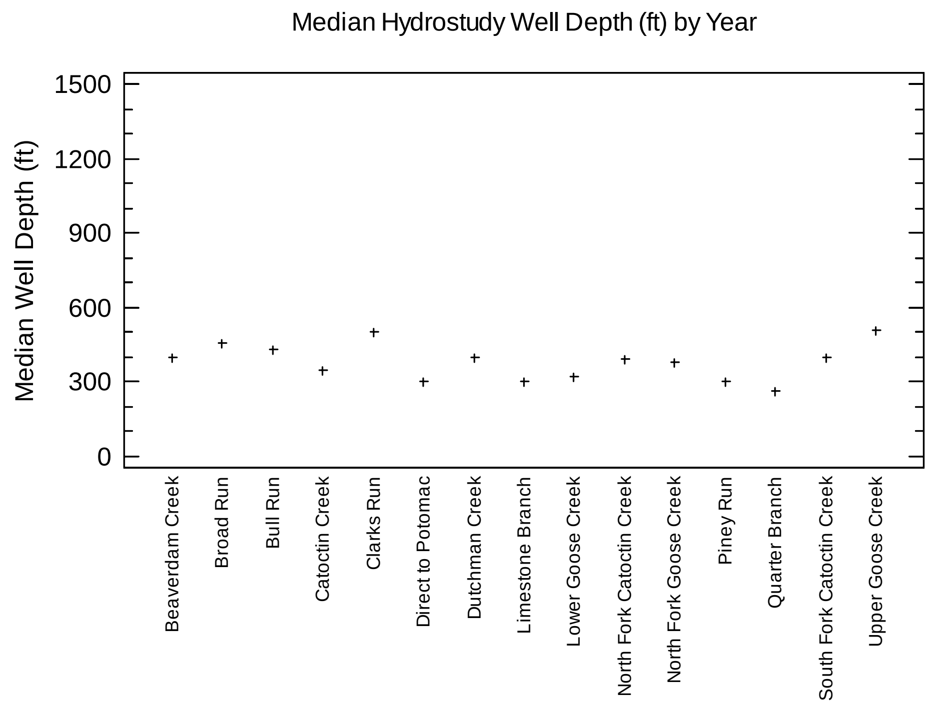
The StatAdvisor
This table shows various statistics for each of the 15 columns of data. To test for significant differences amongst the column means, select Analysis of Variance from the list of Tabular Options. Select Means Plot from the list of Graphical Options to display the means graphically.

WARNING: The standardized skewness and/or kurtosis is outside the range of -2 to +2 for 10 columns. This indicates some significant nonnormality in the data, which violates the assumption that the data come from normal distributions. You may wish to transform the data or use the Kruskal-Wallis test to compare the medians instead of the means.

ANOVA Table for Hydros Well Depth by Watershed

Source	*Sum of Squares*	*Df*	*Mean Square*	*F-Ratio*	*P-Value*
Between groups	4.11354E6	14	293824.	9.40	0.0000
Within groups	5.63405E7	1802	31265.5		
Total (Corr.)	6.04541E7	1816			

The StatAdvisor
The ANOVA table decomposes the variance of the data into two components: a between-group component and a within-group component. The F-ratio, which in this case equals 9.39771, is a ratio of the between-group estimate to the within-group estimate. Since the P-value of the F-test is less than 0.05, there is a statistically significant difference between the means of the 15 variables at the 95.0% confidence level. To determine which means are significantly different from which others, select Multiple Range Tests from the list of Tabular Options.



Multiple Range Tests for Hydros Well Depth by Watershed

Method: 95.0 percent LSD

Level	*Count*	*Mean*	*Homogeneous Groups*
Quarter Branch	16	289.688	X
Direct to Potomac	55	332.455	X
Piney Run	15	363.0	XXXXX
Limestone Branch	82	363.232	XX
Lower Goose Creek	283	375.097	XX
North Fork Goose Creek	220	396.75	XX
Catoctin Creek	234	412.701	XX
South Fork Catoctin Creek	334	424.766	XXXX
Broad Run	35	426.857	XXXXX
Dutchman Creek	101	439.911	XXX
Beaverdam Creek	232	446.392	XX
Clarks Run	29	451.724	XXXXX
North Fork Catoctin Creek	104	461.442	XX
Upper Goose Creek	44	509.273	X
Bull Run	33	643.758	X

Contrast	*Sig.*	*Difference*	*+/- Limits*
Beaverdam Creek - Broad Run		19.5351	62.8434
Beaverdam Creek - Bull Run	*	-197.365	64.4769
Beaverdam Creek - Catoctin Creek	*	33.6914	32.1087
Beaverdam Creek - Clarks Run		-5.3319	68.2589
Beaverdam Creek - Direct to Potomac	*	113.938	51.9754
Beaverdam Creek - Dutchman Creek		6.48135	41.3142
Beaverdam Creek - Limestone Branch	*	83.1605	44.5242
Beaverdam Creek - Lower Goose Creek	*	71.2951	30.6936
Beaverdam Creek - North Fork Catoctin Creek		-15.0501	40.8969
Beaverdam Creek - North Fork Goose Creek	*	49.6422	32.6134
Beaverdam Creek - Piney Run		83.3922	92.3296
Beaverdam Creek - Quarter Branch	*	156.705	89.5785
Beaverdam Creek - South Fork Catoctin Creek		21.6258	29.6192
Beaverdam Creek - Upper Goose Creek	*	-62.8805	56.9857
Broad Run - Bull Run	*	-216.9	84.0902
Broad Run - Catoctin Creek		14.1563	62.8082
Broad Run - Clarks Run		-24.867	87.024
Broad Run - Direct to Potomac	*	94.4026	74.9355
Broad Run - Dutchman Creek		-13.0537	67.9762
Broad Run - Limestone Branch		63.6254	69.9735
Broad Run - Lower Goose Creek		51.76	62.0967
Broad Run - North Fork Catoctin Creek		-34.5852	67.7234
Broad Run - North Fork Goose Creek		30.1071	63.0676
Broad Run - Piney Run		63.8571	106.952
Broad Run - Quarter Branch	*	137.17	104.586
Broad Run - South Fork Catoctin Creek		2.09068	61.5727
Broad Run - Upper Goose Creek	*	-82.4156	78.4938
Bull Run - Catoctin Creek	*	231.057	64.4425
Bull Run - Clarks Run	*	192.033	88.2108
Bull Run - Direct to Potomac	*	311.303	76.3106
Bull Run - Dutchman Creek	*	203.847	69.4891
Bull Run - Limestone Branch	*	280.526	71.4442
Bull Run - Lower Goose Creek	*	268.66	63.7493
Bull Run - North Fork Catoctin Creek	*	182.315	69.2418
Bull Run - North Fork Goose Creek	*	247.008	64.6955
Bull Run - Piney Run	*	280.758	107.92
Bull Run - Quarter Branch	*	354.07	105.575
Bull Run - South Fork Catoctin Creek	*	218.991	63.239
Bull Run - Upper Goose Creek	*	134.485	79.8075
Catoctin Creek - Clarks Run		-39.0233	68.2265
Catoctin Creek - Direct to Potomac	*	80.2463	51.9328
Catoctin Creek - Dutchman Creek		-27.21	41.2606
Catoctin Creek - Limestone Branch	*	49.4691	44.4745
Catoctin Creek - Lower Goose Creek	*	37.6037	30.6215
Catoctin Creek - North Fork Catoctin Creek	*	-48.7415	40.8428
Catoctin Creek - North Fork Goose Creek		15.9509	32.5455
Catoctin Creek - Piney Run		49.7009	92.3056
Catoctin Creek - Quarter Branch	*	123.013	89.5538
Catoctin Creek - South Fork Catoctin Creek		-12.0656	29.5444
Catoctin Creek - Upper Goose Creek	*	-96.5719	56.9469
Clarks Run - Direct to Potomac	*	119.27	79.5319
Clarks Run - Dutchman Creek		11.8132	73.0119
Clarks Run - Limestone Branch	*	88.4924	74.8751
Clarks Run - Lower Goose Creek	*	76.627	67.572
Clarks Run - North Fork Catoctin Creek		-9.71817	72.7767
Clarks Run - North Fork Goose Creek		54.9741	68.4654
Clarks Run - Piney Run		88.7241	110.221

Clarks Run - Quarter Branch	*	162.037	107.927
Clarks Run - South Fork Catoctin Creek		26.9577	67.0908
Clarks Run - Upper Goose Creek		-57.5486	82.893
Direct to Potomac - Dutchman Creek	*	-107.456	58.0767
Direct to Potomac - Limestone Branch		-30.7772	60.4024
Direct to Potomac - Lower Goose Creek		-42.6426	51.07
Direct to Potomac - North Fork Catoctin Creek	*	-128.988	57.7807
Direct to Potomac - North Fork Goose Creek	*	-64.2955	52.2463
Direct to Potomac - Piney Run		-30.5455	100.949
Direct to Potomac - Quarter Branch		42.767	98.4396
Direct to Potomac - South Fork Catoctin Creek	*	-92.3119	50.4315
Direct to Potomac - Upper Goose Creek	*	-176.818	70.0958
Dutchman Creek - Limestone Branch	*	76.6792	51.5157
Dutchman Creek - Lower Goose Creek	*	64.8137	40.1692
Dutchman Creek - North Fork Catoctin Creek		-21.5314	48.4152
Dutchman Creek - North Fork Goose Creek	*	43.1609	41.6545
Dutchman Creek - Piney Run		76.9109	95.8969
Dutchman Creek - Quarter Branch	*	150.223	93.2511
Dutchman Creek - South Fork Catoctin Creek		15.1444	39.3543
Dutchman Creek - Upper Goose Creek	*	-69.3618	62.6007
Limestone Branch - Lower Goose Creek		-11.8655	43.4639
Limestone Branch - North Fork Catoctin Creek	*	-98.2106	51.1817
Limestone Branch - North Fork Goose Creek		-33.5183	44.8402
Limestone Branch - Piney Run		0.231707	97.3229
Limestone Branch - Quarter Branch		73.5442	94.717
Limestone Branch - South Fork Catoctin Creek	*	-61.5348	42.7119
Limestone Branch - Upper Goose Creek	*	-146.041	64.764
Lower Goose Creek - North Fork Catoctin Creek	*	-86.3451	39.74
Lower Goose Creek - North Fork Goose Creek		-21.6528	31.1502
Lower Goose Creek - Piney Run		12.0972	91.8229
Lower Goose Creek - Quarter Branch		85.4097	89.0562
Lower Goose Creek - South Fork Catoctin Creek	*	-49.6693	28.0
Lower Goose Creek - Upper Goose Creek	*	-134.176	56.1612
North Fork Catoctin Creek - North Fork Goose Creek	*	64.6923	41.2407
North Fork Catoctin Creek - Piney Run	*	98.4423	95.7179
North Fork Catoctin Creek - Quarter Branch	*	171.755	93.067
North Fork Catoctin Creek - South Fork Catoctin Creek		36.6758	38.9161
North Fork Catoctin Creek - Upper Goose Creek		-47.8304	62.3261
North Fork Goose Creek - Piney Run		33.75	92.4824
North Fork Goose Creek - Quarter Branch	*	107.063	89.736
North Fork Goose Creek - South Fork Catoctin Creek		-28.0165	30.0921
North Fork Goose Creek - Upper Goose Creek	*	-112.523	57.233
Piney Run - Quarter Branch		73.3125	124.554
Piney Run - South Fork Catoctin Creek		-61.7665	91.4694
Piney Run - Upper Goose Creek	*	-146.273	103.618
Quarter Branch - South Fork Catoctin Creek	*	-135.079	88.6916
Quarter Branch - Upper Goose Creek	*	-219.585	101.175
South Fork Catoctin Creek - Upper Goose Creek	*	-84.5063	55.5812

* denotes a statistically significant difference.

The StatAdvisor
This table applies a multiple comparison procedure to determine which means are significantly different from which others. The bottom half of the output shows the estimated difference between each pair of means. An asterisk has been placed next to 59 pairs, indicating that these pairs show statistically significant differences at the 95.0% confidence level. At the top of the page, 8 homogenous groups are identified using columns of X's. Within each column, the levels containing X's form a group of means within which there are no statistically significant differences. The method currently being used to discriminate among the means is Fisher's least significant difference (LSD) procedure. With this method, there is a 5.0% risk of calling each pair of means significantly different when the actual difference equals 0.

Kruskal-Wallis Test for Hydros Well Depth by Watershed

Watershed	*Sample Size*	*Average Rank*
Beaverdam Creek	232	991.412
Broad Run	35	986.8
Bull Run	33	1264.92
Catoctin Creek	234	888.788
Clarks Run	29	1036.19
Direct to Potomac	55	643.0
Dutchman Creek	101	961.901
Limestone Branch	82	747.024
Lower Goose Creek	283	795.318
North Fork Catoctin Creek	104	971.288
North Fork Goose Creek	220	890.47
Piney Run	15	774.733
Quarter Branch	16	502.25
South Fork Catoctin Creek	334	951.799
Upper Goose Creek	44	1227.63

Test statistic = 91.0751   P-Value = 0.0

The StatAdvisor
The Kruskal-Wallis test tests the null hypothesis that the medians within each of the 15 columns is the same. The data from all the columns is first combined and ranked from smallest to largest. The average rank is then computed for the data in each column. Since the P-value is less than 0.05, there is a statistically significant difference amongst the medians at the 95.0% confidence level. To determine which medians are significantly different from which others, select Box-and-Whisker Plot from the list of Graphical Options and select the median notch option.

Mood's Median Test for Hydros Well Depth by Watershed
Total n = 1817
Grand median = 390.0

Watershed	*Sample Size*	*n<=*	*n>*	*Median*	*95.0% lower CL*	*95.0% upper CL*
Beaverdam Creek	232	103	129	400.0	387.785	420.0
Broad Run	35	11	24	460.0	383.723	500.0
Bull Run	33	6	27	430.0	430.0	900.0
Catoctin Creek	234	125	109	350.0	300.0	400.0
Clarks Run	29	10	19	500.0	300.0	580.0
Direct to Potomac	55	34	21	300.0	240.0	409.315
Dutchman Creek	101	47	54	400.0	320.0	500.0
Limestone Branch	82	51	31	302.5	266.007	389.981
Lower Goose Creek	283	165	118	320.0	300.0	362.506
North Fork Catoctin Creek	104	52	52	390.0	312.211	500.0
North Fork Goose Creek	220	112	108	380.0	360.0	400.0
Piney Run	15	11	4	300.0	300.0	482.183
Quarter Branch	16	14	2	262.5	190.345	372.069
South Fork Catoctin Creek	334	160	174	400.0	360.0	420.0
Upper Goose Creek	44	13	31	509.0	480.0	600.0

Test statistic = 61.4602   P-Value = 6.4953E-8

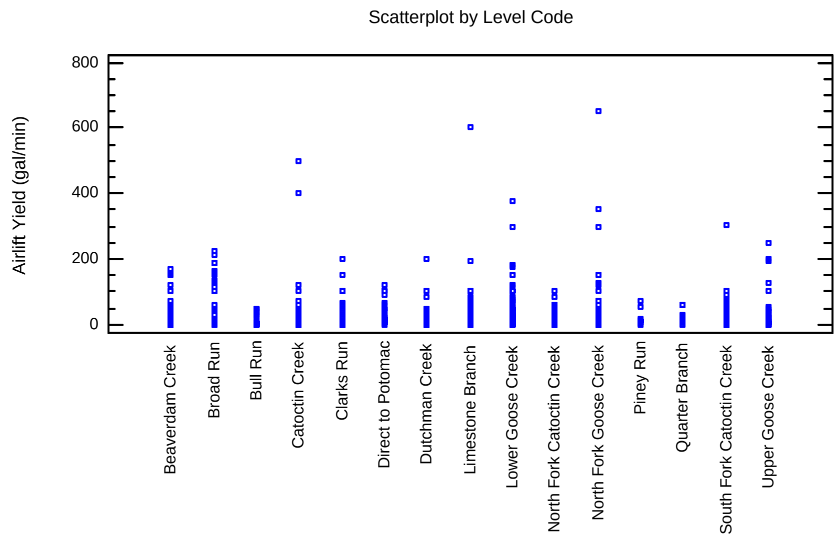
The StatAdvisor
Mood's median test tests the hypothesis that the medians of all 15 samples are equal. It does so by counting the number of observations in each sample on either side of the grand median, which equals 390.0. Since the P-value for the chi-squared test is less than 0.05, the medians of the samples are significantly different at the 95.0% confidence level. Also included (if available) are 95.0% confidence intervals for each median based on the order statistics of each sample.

Multiple-Sample Comparison Hydros Airlift Yield by Watershed

Dependent variable: AIRLIFT_YIELD
Factor: Watershed

Number of observations: 1812
Number of levels: 15

The StatAdvisor
This procedure compares the data in 15 columns of the current data file. It constructs various statistical tests and graphs to compare the samples. The F-test in the ANOVA table will test whether there are any significant differences amongst the means. If there are, the Multiple Range Tests will tell you which means are significantly different from which others. If you are worried about the presence of outliers, choose the Kruskal-Wallis Test which compares medians instead of means. The various plots will help you judge the practical significance of the results, as well as allow you to look for possible violations of the assumptions underlying the analysis of variance.



Summary Statistics for AIRLIFT_YIELD

Watershed	*Count*	*Average*	*Median*	*Geometric mean*	*Standard deviation*
Beaverdam Creek	231	15.6963	8.0		25.2612
Broad Run	35	79.25	51.0	40.1741	68.9867
Bull Run	33	11.697	3.0	3.93431	16.9132
Catoctin Creek	232	16.8922	8.0		43.5915
Clarks Run	29	37.5431	7.0		52.3938
Direct to Potomac	55	28.0364	20.0	18.2307	28.1365
Dutchman Creek	102	15.1127	8.0		26.0795
Limestone Branch	81	42.1049	27.0	22.9715	70.7297
Lower Goose Creek	284	28.1688	15.0	13.8524	41.2147
North Fork Catoctin Creek	104	13.7841	8.0	7.26389	17.7479
North Fork Goose Creek	217	24.0668	12.0		56.6691
Piney Run	15	15.6667	10.0	9.73426	19.6311
Quarter Branch	16	23.125	17.5	15.5674	19.8053
South Fork Catoctin Creek	334	17.0714	10.0		23.7122
Upper Goose Creek	44	34.5341	13.5		55.9689
Total	1812	22.4998	10.0		41.3683

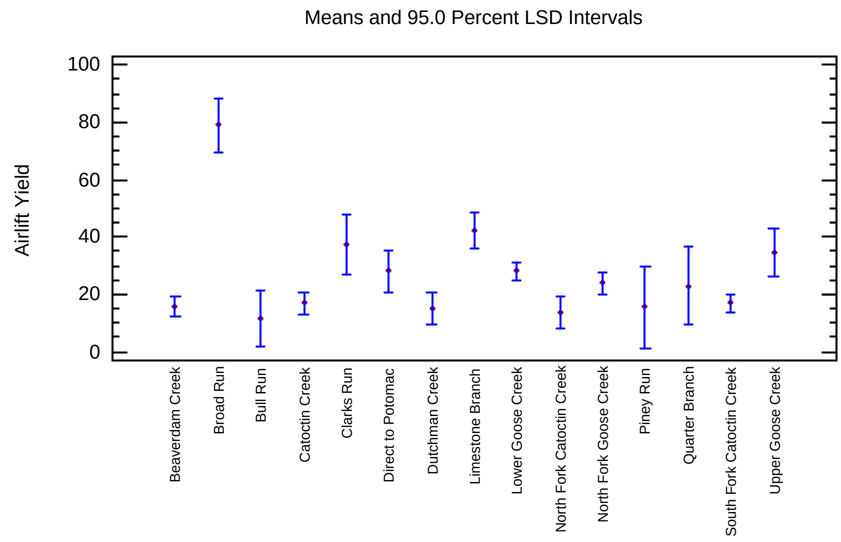
Watershed	*Coeff. of variation*	*Minimum*	*Maximum*	*Range*	*Lower quartile*	*Upper quartile*
Beaverdam Creek	160.937%	0.0	171.0	171.0	3.5	15.0
Broad Run	87.0495%	0.25	222.0	221.75	14.0	135.0
Bull Run	144.595%	0.25	50.0	49.75	1.5	10.0
Catoctin Creek	258.056%	0.0	500.0	500.0	3.5	20.0
Clarks Run	139.556%	0.0	200.0	200.0	1.0	60.0
Direct to Potomac	100.357%	2.0	120.0	118.0	10.0	35.0
Dutchman Creek	172.566%	0.0	200.0	200.0	4.0	12.0
Limestone Branch	167.984%	1.0	600.0	599.0	15.0	50.0
Lower Goose Creek	146.313%	0.15	375.0	374.85	6.0	30.0
North Fork Catoctin Creek	128.756%	1.0	100.0	99.0	2.75	15.0
North Fork Goose Creek	235.466%	0.0	650.0	650.0	5.0	20.0
Piney Run	125.305%	1.0	72.0	71.0	6.0	12.0
Quarter Branch	85.6446%	1.0	60.0	59.0	10.0	27.5
South Fork Catoctin Creek	138.9%	0.0	304.0	304.0	5.0	20.0
Upper Goose Creek	162.069%	0.0	250.0	250.0	4.0	40.0
Total	183.86%	0.0	650.0	650.0	5.0	25.0

Watershed	*Interquartile range*	*Stnd. skewness*	*Stnd. kurtosis*
Beaverdam Creek	11.5	24.4647	55.9083
Broad Run	121.0	1.29423	-1.26573
Bull Run	8.5	3.46035	0.678109
Catoctin Creek	16.5	56.0513	282.083
Clarks Run	59.0	3.52368	2.41329
Direct to Potomac	25.0	5.42356	3.95973
Dutchman Creek	8.0	18.7965	54.6745
Limestone Branch	35.0	23.6109	90.7452
Lower Goose Creek	24.0	28.5497	86.4911
North Fork Catoctin Creek	12.25	10.6766	15.3773
North Fork Goose Creek	15.0	47.4493	228.69
Piney Run	6.0	3.83202	4.10161
Quarter Branch	17.5	1.95824	0.169154
South Fork Catoctin Creek	15.0	45.8533	241.875
Upper Goose Creek	36.0	7.17196	9.19207
Total	20.0	119.958	638.571

The StatAdvisor
This table shows various statistics for each of the 15 columns of data. To test for significant differences amongst the column means, select Analysis of Variance from the list of Tabular Options. Select Means Plot from the list of Graphical Options to display the means graphically.

WARNING: There is more than a 3 to 1 difference between the smallest standard deviation and the largest. This may cause problems since the analysis of variance assumes that the standard deviations at all levels are equal. Select Variance Check from the list of Tabular Options to run a formal statistical test for differences among the sigmas. You may want to consider transforming the data to remove any dependence of the standard deviation on the mean.

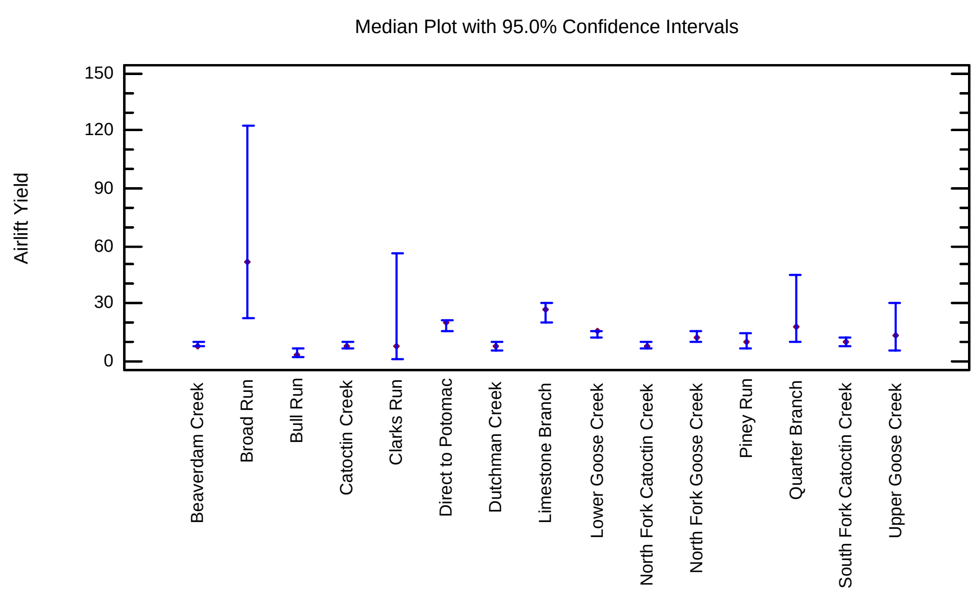
WARNING: The standardized skewness and/or kurtosis is outside the range of -2 to +2 for 13 columns. This indicates some significant nonnormality in the data, which violates the assumption that the data come from normal distributions. You may wish to transform the data or use the Kruskal-Wallis test to compare the medians instead of the means.



ANOVA Table for AIRLIFT_YIELD by Watershed

Source	*Sum of Squares*	*Df*	*Mean Square*	*F-Ratio*	*P-Value*
Between groups	213988.	14	15284.9	9.52	0.0000
Within groups	2.88524E6	1797	1605.59		
Total (Corr.)	3.09923E6	1811			

The StatAdvisor
The ANOVA table decomposes the variance of the data into two components: a between-group component and a within-group component. The F-ratio, which in this case equals 9.5198, is a ratio of the between-group estimate to the within-group estimate. Since the P-value of the F-test is less than 0.05, there is a statistically significant difference between the means of the 15 variables at the 95.0% confidence level. To determine which means are significantly different from which others, select Multiple Range Tests from the list of Tabular Options.



Multiple Range Tests for AIRLIFT_YIELD by Watershed

Method: 95.0 percent LSD

Level	*Count*	*Mean*	*Homogeneous Groups*
Bull Run	33	11.697	XXX
North Fork Catoctin Creek	104	13.7841	X
Dutchman Creek	102	15.1127	XXX
Piney Run	15	15.6667	XXXX
Beaverdam Creek	231	15.6963	X
Catoctin Creek	232	16.8922	XXX
South Fork Catoctin Creek	334	17.0714	X X
Quarter Branch	16	23.125	XXXXX
North Fork Goose Creek	217	24.0668	X X
Direct to Potomac	55	28.0364	XXX
Lower Goose Creek	284	28.1688	X
Upper Goose Creek	44	34.5341	XX
Clarks Run	29	37.5431	XX
Limestone Branch	81	42.1049	X
Broad Run	35	79.25	X

Contrast	*Sig.*	*Difference*	*+/- Limits*
Beaverdam Creek - Broad Run	*	-63.5537	14.2451
Beaverdam Creek - Bull Run		3.99935	14.6152
Beaverdam Creek - Catoctin Creek		-1.19592	7.29972
Beaverdam Creek - Clarks Run	*	-21.8468	15.472
Beaverdam Creek - Direct to Potomac	*	-12.34	11.7832
Beaverdam Creek - Dutchman Creek		0.583575	9.33646
Beaverdam Creek - Limestone Branch	*	-26.4086	10.1413
Beaverdam Creek - Lower Goose Creek	*	-12.4725	6.95832
Beaverdam Creek - North Fork Catoctin Creek		1.91219	9.27397
Beaverdam Creek - North Fork Goose Creek	*	-8.3705	7.42453
Beaverdam Creek - Piney Run		0.0296537	20.9258
Beaverdam Creek - Quarter Branch		-7.42868	20.3025
Beaverdam Creek - South Fork Catoctin Creek		-1.37509	6.72065
Beaverdam Creek - Upper Goose Creek	*	-18.8378	12.9181
Broad Run - Bull Run	*	67.553	19.0559
Broad Run - Catoctin Creek	*	62.3578	14.2411
Broad Run - Clarks Run	*	41.7069	19.7207
Broad Run - Direct to Potomac	*	51.2136	16.9813
Broad Run - Dutchman Creek	*	64.1373	15.3848
Broad Run - Limestone Branch	*	37.1451	15.8861
Broad Run - Lower Goose Creek	*	51.0812	14.0692
Broad Run - North Fork Catoctin Creek	*	65.4659	15.347
Broad Run - North Fork Goose Creek	*	55.1832	14.3055
Broad Run - Piney Run	*	63.5833	24.2366
Broad Run - Quarter Branch	*	56.125	23.7005
Broad Run - South Fork Catoctin Creek	*	62.1786	13.9531
Broad Run - Upper Goose Creek	*	44.7159	17.7877
Bull Run - Catoctin Creek		-5.19527	14.6113
Bull Run - Clarks Run	*	-25.8461	19.9897
Bull Run - Direct to Potomac		-16.3394	17.2929
Bull Run - Dutchman Creek		-3.41578	15.7281
Bull Run - Limestone Branch	*	-30.408	16.2188
Bull Run - Lower Goose Creek	*	-16.4719	14.4437
Bull Run - North Fork Catoctin Creek		-2.08716	15.6911
Bull Run - North Fork Goose Creek		-12.3699	14.674
Bull Run - Piney Run		-3.9697	24.4559

Bull Run - Quarter Branch		-11.428	23.9247
Bull Run - South Fork Catoctin Creek		-5.37444	14.3307
Bull Run - Upper Goose Creek	*	-22.8371	18.0854
Catoctin Creek - Clarks Run	*	-20.6509	15.4683
Catoctin Creek - Direct to Potomac		-11.1441	11.7783
Catoctin Creek - Dutchman Creek		1.7795	9.33029
Catoctin Creek - Limestone Branch	*	-25.2127	10.1357
Catoctin Creek - Lower Goose Creek	*	-11.2766	6.95005
Catoctin Creek - North Fork Catoctin Creek		3.10811	9.26776
Catoctin Creek - North Fork Goose Creek		-7.17458	7.41678
Catoctin Creek - Piney Run		1.22557	20.923
Catoctin Creek - Quarter Branch		-6.23276	20.2996
Catoctin Creek - South Fork Catoctin Creek		-0.179166	6.71208
Catoctin Creek - Upper Goose Creek	*	-17.6418	12.9137
Clarks Run - Direct to Potomac		9.50674	18.0229
Clarks Run - Dutchman Creek	*	22.4304	16.5273
Clarks Run - Limestone Branch		-4.56183	16.995
Clarks Run - Lower Goose Creek		9.37427	15.3102
Clarks Run - North Fork Catoctin Creek	*	23.759	16.4921
Clarks Run - North Fork Goose Creek		13.4763	15.5276
Clarks Run - Piney Run		21.8764	24.9774
Clarks Run - Quarter Branch		14.4181	24.4576
Clarks Run - South Fork Catoctin Creek	*	20.4717	15.2036
Clarks Run - Upper Goose Creek		3.00901	18.7846
Direct to Potomac - Dutchman Creek		12.9236	13.1382
Direct to Potomac - Limestone Branch	*	-14.0686	13.7218
Direct to Potomac - Lower Goose Creek		-0.132474	11.5698
Direct to Potomac - North Fork Catoctin Creek	*	14.2522	13.0938
Direct to Potomac - North Fork Goose Creek		3.96954	11.856
Direct to Potomac - Piney Run		12.3697	22.8764
Direct to Potomac - Quarter Branch		4.91136	22.3076
Direct to Potomac - South Fork Catoctin Creek		10.965	11.4284
Direct to Potomac - Upper Goose Creek		-6.49773	15.8846
Dutchman Creek - Limestone Branch	*	-26.9922	11.6882
Dutchman Creek - Lower Goose Creek	*	-13.0561	9.06568
Dutchman Creek - North Fork Catoctin Creek		1.32861	10.9442
Dutchman Creek - North Fork Goose Creek		-8.95408	9.42826
Dutchman Creek - Piney Run		-0.553922	21.7177
Dutchman Creek - Quarter Branch		-8.01225	21.1177
Dutchman Creek - South Fork Catoctin Creek		-1.95866	8.88456
Dutchman Creek - Upper Goose Creek	*	-19.4213	14.165
Limestone Branch - Lower Goose Creek	*	13.9361	9.89261
Limestone Branch - North Fork Catoctin Creek	*	28.3208	11.6384
Limestone Branch - North Fork Goose Creek	*	18.0381	10.2259
Limestone Branch - Piney Run	*	26.4383	22.0756
Limestone Branch - Quarter Branch		18.9799	21.4857
Limestone Branch - South Fork Catoctin Creek	*	25.0335	9.7269
Limestone Branch - Upper Goose Creek		7.57085	14.7079
Lower Goose Creek - North Fork Catoctin Creek	*	14.3847	9.00132
Lower Goose Creek - North Fork Goose Creek		4.10202	7.08102
Lower Goose Creek - Piney Run		12.5022	20.8064
Lower Goose Creek - Quarter Branch		5.04384	20.1794
Lower Goose Creek - South Fork Catoctin Creek	*	11.0974	6.3391
Lower Goose Creek - Upper Goose Creek		-6.36525	12.7238
North Fork Catoctin Creek - North Fork Goose Creek	*	-10.2827	9.36638
North Fork Catoctin Creek - Piney Run		-1.88253	21.6909
North Fork Catoctin Creek - Quarter Branch		-9.34087	21.0902
North Fork Catoctin Creek - South Fork Catoctin Creek		-3.28727	8.81887

North Fork Catoctin Creek - Upper Goose Creek	*	-20.75	14.1239
North Fork Goose Creek - Piney Run		8.40015	20.9669
North Fork Goose Creek - Quarter Branch		0.94182	20.3448
North Fork Goose Creek - South Fork Catoctin Creek	*	6.99541	6.8476
North Fork Goose Creek - Upper Goose Creek		-10.4673	12.9846
Piney Run - Quarter Branch		-7.45833	28.2255
Piney Run - South Fork Catoctin Creek		-1.40474	20.7281
Piney Run - Upper Goose Creek		-18.8674	23.4812
Quarter Branch - South Fork Catoctin Creek		6.05359	20.0986
Quarter Branch - Upper Goose Creek		-11.4091	22.9274
South Fork Catoctin Creek - Upper Goose Creek	*	-17.4627	12.5954

* denotes a statistically significant difference.

The StatAdvisor
This table applies a multiple comparison procedure to determine which means are significantly different from which others. The bottom half of the output shows the estimated difference between each pair of means. An asterisk has been placed next to 47 pairs, indicating that these pairs show statistically significant differences at the 95.0% confidence level. At the top of the page, 6 homogenous groups are identified using columns of X's. Within each column, the levels containing X's form a group of means within which there are no statistically significant differences. The method currently being used to discriminate among the means is Fisher's least significant difference (LSD) procedure. With this method, there is a 5.0% risk of calling each pair of means significantly different when the actual difference equals 0.

Kruskal-Wallis Test for AIRLIFT_YIELD by Watershed

Watershed	*Sample Size*	*Average Rank*
Beaverdam Creek	231	783.411
Broad Run	35	1409.99
Bull Run	33	581.773
Catoctin Creek	232	788.776
Clarks Run	29	860.69
Direct to Potomac	55	1159.6
Dutchman Creek	102	753.039
Limestone Branch	81	1261.51
Lower Goose Creek	284	1034.97
North Fork Catoctin Creek	104	768.096
North Fork Goose Creek	217	936.493
Piney Run	15	865.8
Quarter Branch	16	1115.69
South Fork Catoctin Creek	334	873.626
Upper Goose Creek	44	969.898

Test statistic = 158.909   P-Value = 0.0

The StatAdvisor
The Kruskal-Wallis test tests the null hypothesis that the medians within each of the 15 columns is the same. The data from all the columns is first combined and ranked from smallest to largest. The average rank is then computed for the data in each column. Since the P-value is less than 0.05, there is a statistically significant difference amongst the medians at the 95.0% confidence level. To determine which medians are significantly different from which others, select Box-and-Whisker Plot from the list of Graphical Options and select the median notch option.

Mood's Median Test for AIRLIFT_YIELD by Watershed
Total n = 1812
Grand median = 10.0

Watershed	*Sample Size*	*n<=*	*n>*	*Median*	*95.0% lower CL*	*95.0% upper CL*
Beaverdam Creek	231	154	77	8.0	7.0	10.0
Broad Run	35	5	30	51.0	21.8613	123.139
Bull Run	33	25	8	3.0	2.0	6.0
Catoctin Creek	232	140	92	8.0	6.0	10.0
Clarks Run	29	15	14	7.0	1.0	56.5316
Direct to Potomac	55	17	38	20.0	15.0	21.4382
Dutchman Creek	102	72	30	8.0	5.28954	10.0
Limestone Branch	81	15	66	27.0	20.0	30.0
Lower Goose Creek	284	118	166	15.0	12.0	15.0
North Fork Catoctin Creek	104	70	34	8.0	6.0	10.0
North Fork Goose Creek	217	105	112	12.0	10.0	15.0
Piney Run	15	11	4	10.0	6.0	14.4655
Quarter Branch	16	7	9	17.5	10.0	44.4824
South Fork Catoctin Creek	334	176	158	10.0	8.0	12.0
Upper Goose Creek	44	18	26	13.5	5.0	30.0

Test statistic = 142.825   P-Value = 0.0

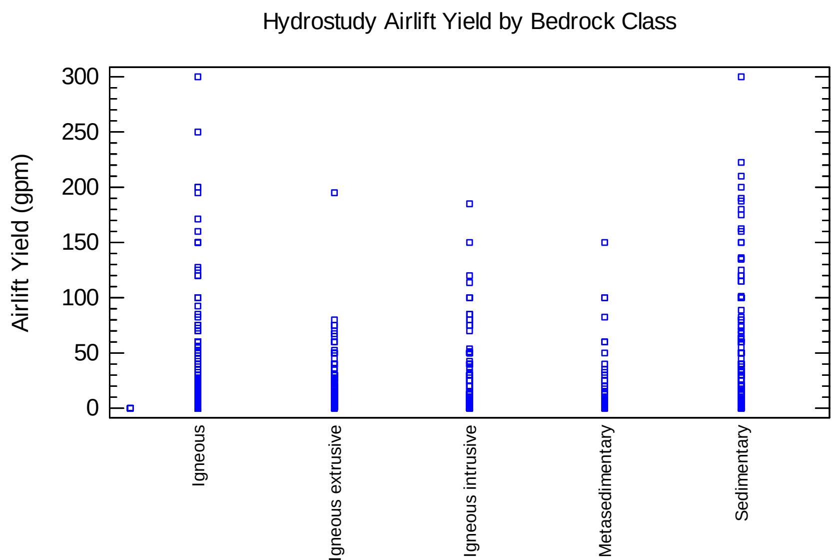
The StatAdvisor
Mood's median test tests the hypothesis that the medians of all 15 samples are equal. It does so by counting the number of observations in each sample on either side of the grand median, which equals 10.0. Since the P-value for the chi-squared test is less than 0.05, the medians of the samples are significantly different at the 95.0% confidence level. Also included (if available) are 95.0% confidence intervals for each median based on the order statistics of each sample.

Multiple-Sample Comparison Airlift Yield (hydros) by Rock Class

Dependent variable: AIRLIFT_YIELD_1
Factor: BE_ROCK_CLASS

Number of observations: 1812
Number of levels: 5

The StatAdvisor
This procedure compares the data in 5 columns of the current data file. It constructs various statistical tests and graphs to compare the samples. The F-test in the ANOVA table will test whether there are any significant differences amongst the means. If there are, the Multiple Range Tests will tell you which means are significantly different from which others. If you are worried about the presence of outliers, choose the Kruskal-Wallis Test which compares medians instead of means. The various plots will help you judge the practical significance of the results, as well as allow you to look for possible violations of the assumptions underlying the analysis of variance.



Summary Statistics for AIRLIFT_YIELD_1

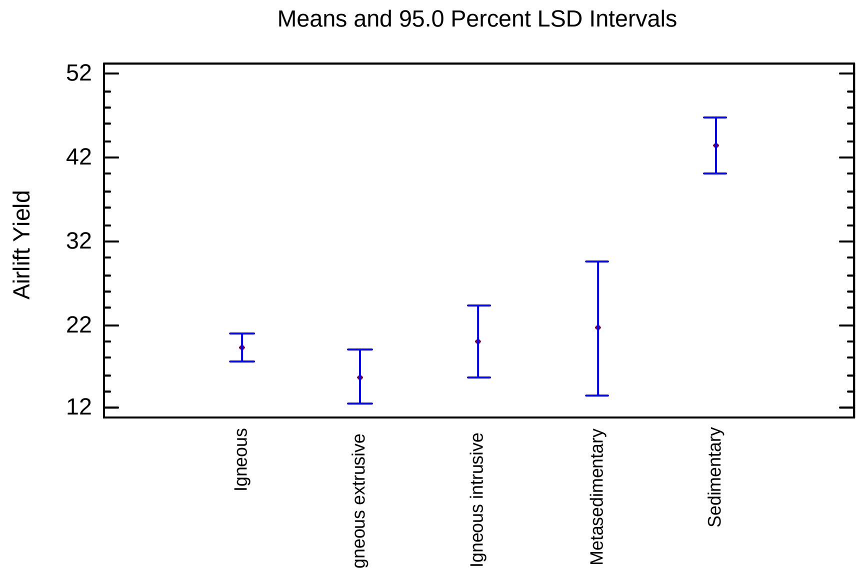
ROCK CLASS	*Count*	*Average*	*Median*	*Geometric mean*	*Standard deviation*	*Coeff. of variation*	*Minimum*
Igneous	1020	19.267	10.0		40.4258	209.819%	0.0
Igneous extrusive	306	15.7698	10.0		18.204	115.436%	0.0
Igneous intrusive	161	19.963	8.0		30.0662	150.609%	0.0
Metasedimentary	49	21.5969	10.0		30.8257	142.732%	0.0
Sedimentary	276	43.5489	20.0		60.1433	138.105%	0.0
Total	1812	22.4998	10.0		41.3683	183.86%	0.0

ROCK CLASS	*Maximum*	*Range*	*Lower quartile*	*Upper quartile*	*Interquartile range*	*Stnd. skewness*	*Stnd. kurtosis*
Igneous	650.0	650.0	4.0	20.0	16.0	107.987	622.926
Igneous extrusive	195.0	195.0	5.0	20.0	15.0	29.812	112.896
Igneous intrusive	185.0	185.0	3.0	25.0	22.0	13.7476	21.5365
Metasedimentary	150.0	150.0	3.0	25.0	22.0	6.97674	9.20988
Sedimentary	600.0	600.0	12.0	50.0	38.0	29.6214	103.027
Total	650.0	650.0	5.0	25.0	20.0	119.958	638.571

The StatAdvisor
This table shows various statistics for each of the 5 columns of data. To test for significant differences amongst the column means, select Analysis of Variance from the list of Tabular Options. Select Means Plot from the list of Graphical Options to display the means graphically.

WARNING: There is more than a 3 to 1 difference between the smallest standard deviation and the largest. This may cause problems since the analysis of variance assumes that the standard deviations at all levels are equal. Select Variance Check from the list of Tabular Options to run a formal statistical test for differences among the sigmas. You may want to consider transforming the data to remove any dependence of the standard deviation on the mean.

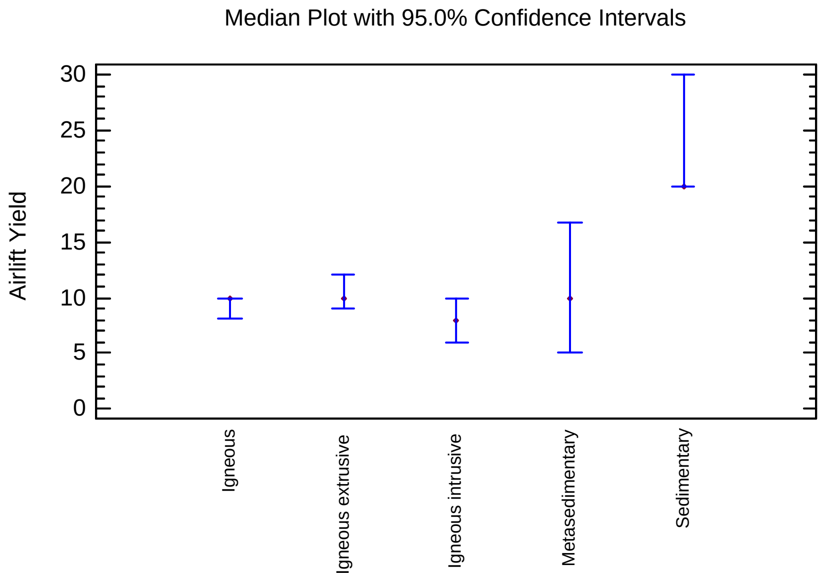
WARNING: The standardized skewness and/or kurtosis is outside the range of -2 to +2 for 5 columns. This indicates some significant nonnormality in the data, which violates the assumption that the data come from normal distributions. You may wish to transform the data or use the Kruskal-Wallis test to compare the medians instead of the means.



ANOVA Table for AIRLIFT_YIELD_1 by ROCK CLASS

Source	*Sum of Squares*	*Df*	*Mean Square*	*F-Ratio*	*P-Value*
Between groups	147882.	4	36970.4	22.64	0.0000
Within groups	2.95135E6	1807	1633.29		
Total (Corr.)	3.09923E6	1811			

The StatAdvisor
The ANOVA table decomposes the variance of the data into two components: a between-group component and a within-group component. The F-ratio, which in this case equals 22.6356, is a ratio of the between-group estimate to the within-group estimate. Since the P-value of the F-test is less than 0.05, there is a statistically significant difference between the means of the 5 variables at the 95.0% confidence level. To determine which means are significantly different from which others, select Multiple Range Tests from the list of Tabular Options.



Multiple Range Tests for AIRLIFT_YIELD_1 by Rock Class

Method: 95.0 percent LSD

ROCK CLASS	*Count*	*Mean*	*Homogeneous Groups*
Igneous extrusive	306	15.7698	X
Igneous	1020	19.267	X
Igneous intrusive	161	19.963	X
Metasedimentary	49	21.5969	X
Sedimentary	276	43.5489	X

Contrast	*Sig.*	*Difference*	*+/- Limits*
Igneous - Igneous extrusive		3.49724	5.16287
Igneous - Igneous intrusive		-0.696034	6.71726
Igneous - Metasedimentary		-2.32993	11.5843
Igneous - Sedimentary	*	-24.2819	5.37437
Igneous extrusive - Igneous intrusive		-4.19327	7.71196
Igneous extrusive - Metasedimentary		-5.82717	12.1881
Igneous extrusive - Sedimentary	*	-27.7791	6.57546
Igneous intrusive - Metasedimentary		-1.6339	12.9235
Igneous intrusive - Sedimentary	*	-23.5859	7.85513
Metasedimentary - Sedimentary	*	-21.952	12.2792

* denotes a statistically significant difference.

The StatAdvisor
This table applies a multiple comparison procedure to determine which means are significantly different from which others. The bottom half of the output shows the estimated difference between each pair of means. An asterisk has been placed next to 4 pairs, indicating that these pairs show statistically significant differences at the 95.0% confidence level. At the top of the page, 2 homogenous groups are identified using columns of X's. Within each column, the levels containing X's form a group of means within which there are no statistically significant differences. The method currently being used to discriminate among the means is Fisher's least significant difference (LSD) procedure. With this method, there is a 5.0% risk of calling each pair of means significantly different when the actual difference equals 0.

Kruskal-Wallis Test for AIRLIFT YIELD by ROCK CLASS

ROCK CLASS	*Sample Size*	*Average Rank*
Igneous	1020	847.18
Igneous extrusive	306	884.203
Igneous intrusive	161	804.109
Metasedimentary	49	862.449
Sedimentary	276	1217.99

Test statistic = 118.284 P-Value = 0.0

The StatAdvisor

The Kruskal-Wallis test tests the null hypothesis that the medians within each of the 5 columns is the same. The data from all the columns is first combined and ranked from smallest to largest. The average rank is then computed for the data in each column. Since the P-value is less than 0.05, there is a statistically significant difference amongst the medians at the 95.0% confidence level. To determine which medians are significantly different from which others, select Box-and-Whisker Plot from the list of Graphical Options and select the median notch option.

Mood's Median Test for AIRLIFT YIELD by ROCK CLASS

Total n = 1812
Grand median = 10.0

ROCK CLASS	*Sample Size*	*n<=*	*n>*	*Median*	*95.0% lower CL*	*95.0% upper CL*
Igneous	1020	586	434	10.0	8.09959	10.0
Igneous extrusive	306	163	143	10.0	9.0	12.0
Igneous intrusive	161	103	58	8.0	6.0	10.0
Metasedimentary	49	28	21	10.0	5.0	16.7264
Sedimentary	276	68	208	20.0	20.0	30.0

Test statistic = 104.882 P-Value = 0.0

The StatAdvisor

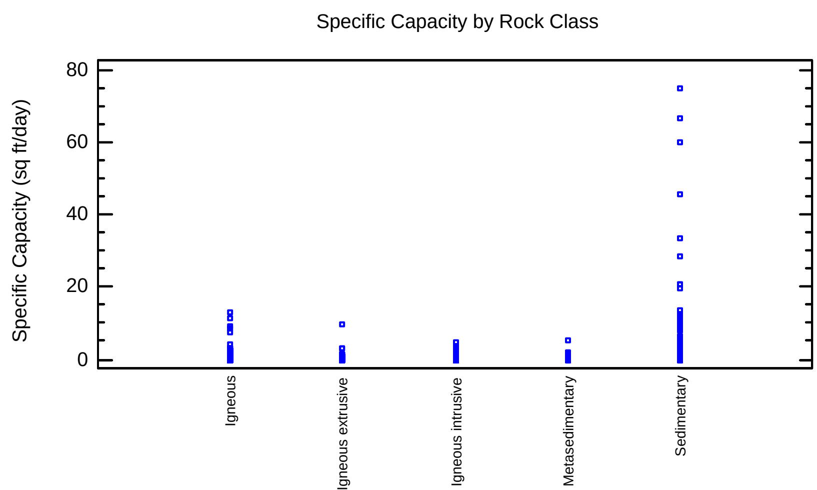
Mood's median test tests the hypothesis that the medians of all 5 samples are equal. It does so by counting the number of observations in each sample on either side of the grand median, which equals 10.0. Since the P-value for the chi-squared test is less than 0.05, the medians of the samples are significantly different at the 95.0% confidence level. Also included (if available) are 95.0% confidence intervals for each median based on the order statistics of each sample.

Multiple-Sample Comparison of Specific Capacity (hydros) by Rock Class

Dependent variable: SPECIFIC CAPACITY
Factor: BE_ROCK_CL_1

Number of observations: 1395
Number of levels: 5

The StatAdvisor
This procedure compares the data in 5 columns of the current data file. It constructs various statistical tests and graphs to compare the samples. The F-test in the ANOVA table will test whether there are any significant differences amongst the means. If there are, the Multiple Range Tests will tell you which means are significantly different from which others. If you are worried about the presence of outliers, choose the Kruskal-Wallis Test which compares medians instead of means. The various plots will help you judge the practical significance of the results, as well as allow you to look for possible violations of the assumptions underlying the analysis of variance.



Summary Statistics for SPECIFIC_CAPACITY_1

ROCK CLASS	*Count*	*Average*	*Median*	*Geometric mean*	*Standard deviation*	*Coeff. of variation*	*Minimum*
Igneous	793	0.428007	0.13	0.134046	0.953394	222.752%	0.00286369
Igneous extrusive	245	0.214567	0.0851064	0.0834826	0.708801	330.34%	0.005
Igneous intrusive	115	0.352562	0.123	0.101758	0.713225	202.298%	0.0005
Metasedimentary	45	0.383236	0.091	0.11331	0.823945	214.997%	0.00685714
Sedimentary	197	3.38564	0.501567	0.500396	9.69331	286.306%	0.008
Total	1395	0.800531	0.131	0.144444	3.87096	483.549%	0.0005

ROCK CLASS	*Maximum*	*Range*	*Lower quartile*	*Upper quartile*	*Interquartile range*	*Stnd. skewness*	*Stnd. kurtosis*
Igneous	12.9762	12.9733	0.043	0.42	0.377	85.2911	436.548
Igneous extrusive	9.83607	9.83107	0.038	0.17	0.132	70.3869	454.49
Igneous intrusive	4.61538	4.61488	0.0267755	0.32967	0.302895	16.9316	36.8684
Metasedimentary	5.15152	5.14466	0.0388098	0.406667	0.367857	13.0549	36.1099
Sedimentary	75.0	74.992	0.126	1.93182	1.80582	30.2821	88.9679
Total	75.0	74.9995	0.044	0.420402	0.376402	204.924	1632.8

The StatAdvisor
This table shows various statistics for each of the 5 columns of data. To test for significant differences amongst the column means, select Analysis of Variance from the list of Tabular Options. Select Means Plot from the list of Graphical Options to display the means graphically.

WARNING: There is more than a 3 to 1 difference between the smallest standard deviation and the largest. This may cause problems since the analysis of variance assumes that the standard deviations at all levels are equal. Select Variance Check from the list of Tabular Options to run a formal statistical test for differences among the sigmas. You may want to consider transforming the data to remove any dependence of the standard deviation on the mean.

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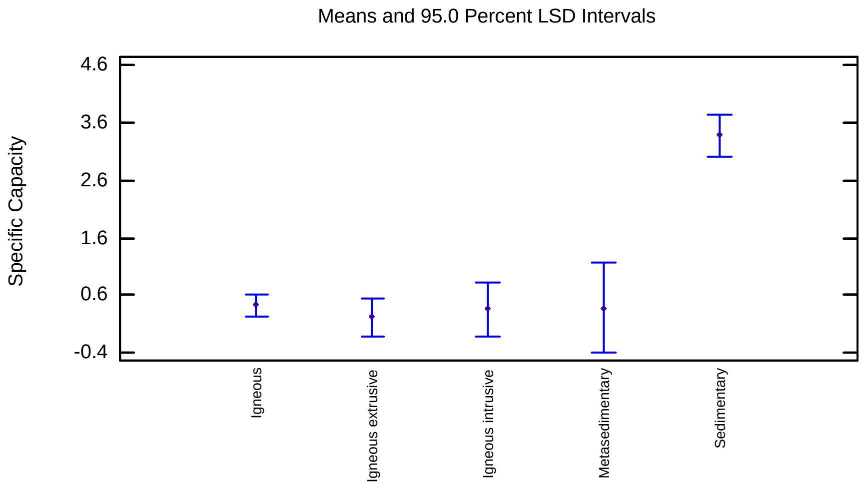


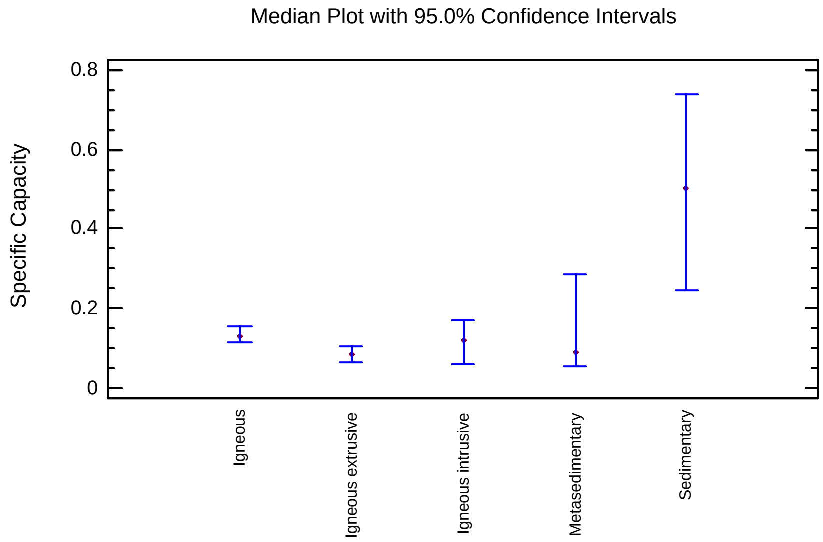
Multiple Range Tests for SPECIFIC CAPACITY by ROCK CLASS
Method: 95.0 percent LSD

ROCK CLASS	*Count*	*Mean*	*Homogeneous Groups*
Igneous extrusive	245	0.214567	X
Igneous intrusive	115	0.352562	X
Metasedimentary	45	0.383236	X
Igneous	793	0.428007	X
Sedimentary	197	3.38564	X

Contrast	*Sig.*	*Difference*	*+/- Limits*
Igneous - Igneous extrusive		0.21344	0.534469
Igneous - Igneous intrusive		0.0754453	0.729627
Igneous - Metasedimentary		0.0447711	1.12053
Igneous - Sedimentary	*	-2.95764	0.582092
Igneous extrusive - Igneous intrusive		-0.137994	0.826538
Igneous extrusive - Metasedimentary		-0.168669	1.18591
Igneous extrusive - Sedimentary	*	-3.17108	0.699743
Igneous intrusive - Metasedimentary		-0.0306743	1.28573
Igneous intrusive - Sedimentary	*	-3.03308	0.858102
Metasedimentary - Sedimentary	*	-3.00241	1.20812

* denotes a statistically significant difference.

The StatAdvisor
This table applies a multiple comparison procedure to determine which means are significantly different from which others. The bottom half of the output shows the estimated difference between each pair of means. An asterisk has been placed next to 4 pairs, indicating that these pairs show statistically significant differences at the 95.0% confidence level. At the top of the page, 2 homogenous groups are identified using columns of X's. Within each column, the levels containing X's form a group of means within which there are no statistically significant differences. The method currently being used to discriminate among the means is Fisher's least significant difference (LSD) procedure. With this method, there is a 5.0% risk of calling each pair of means significantly different when the actual difference equals 0.



Kruskal-Wallis Test for SPECIFIC_CAPACITY by ROCK CLASS

ROCK CLASS	*Sample Size*	*Average Rank*
Igneous	793	691.479
Igneous extrusive	245	562.637
Igneous intrusive	115	630.13
Metasedimentary	45	648.344
Sedimentary	197	943.556

Test statistic = 105.015   P-Value = 0.0

The StatAdvisor
The Kruskal-Wallis test tests the null hypothesis that the medians within each of the 5 columns is the same. The data from all the columns is first combined and ranked from smallest to largest. The average rank is then computed for the data in each column. Since the P-value is less than 0.05, there is a statistically significant difference amongst the medians at the 95.0% confidence level. To determine which medians are significantly different from which others, select Box-and-Whisker Plot from the list of Graphical Options and select the median notch option.

Mood's Median Test for SPECIFIC_CAPACITY by ROCK CLASS
Total n = 1395
Grand median = 0.131

ROCK CLASS	*Sample Size*	*n<=*	*n>*	*Median*	*95.0% lower CL*	*95.0% upper CL*
Igneous	793	399	394	0.13	0.116458	0.15842
Igneous extrusive	245	161	84	0.0851064	0.0677611	0.105328
Igneous intrusive	115	59	56	0.123	0.0616488	0.173932
Metasedimentary	45	26	19	0.091	0.0579183	0.286109
Sedimentary	197	53	144	0.501567	0.244951	0.736606

Test statistic = 67.4335   P-Value = 0.0

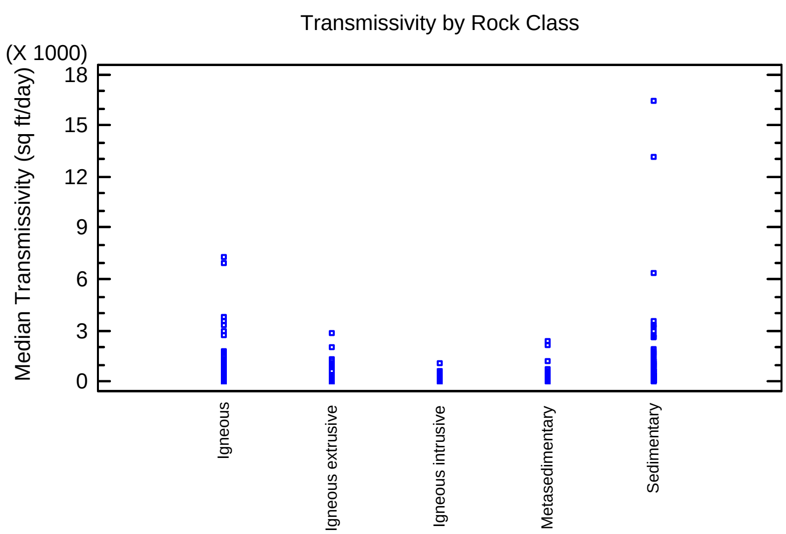
The StatAdvisor
Mood's median test tests the hypothesis that the medians of all 5 samples are equal. It does so by counting the number of observations in each sample on either side of the grand median, which equals 0.131. Since the P-value for the chi-squared test is less than 0.05, the medians of the samples are significantly different at the 95.0% confidence level. Also included (if available) are 95.0% confidence intervals for each median based on the order statistics of each sample.

Multiple-Sample Comparison; Median Transmissivity by Rock Class

Dependent variable: Median_Trans
Factor: ROCK CLASS

Number of observations: 1092
Number of levels: 5

The StatAdvisor
This procedure compares the data in 5 columns of the current data file. It constructs various statistical tests and graphs to compare the samples. The F-test in the ANOVA table will test whether there are any significant differences amongst the means. If there are, the Multiple Range Tests will tell you which means are significantly different from which others. If you are worried about the presence of outliers, choose the Kruskal-Wallis Test which compares medians instead of means. The various plots will help you judge the practical significance of the results, as well as allow you to look for possible violations of the assumptions underlying the analysis of variance.



Summary Statistics for Median_Trans

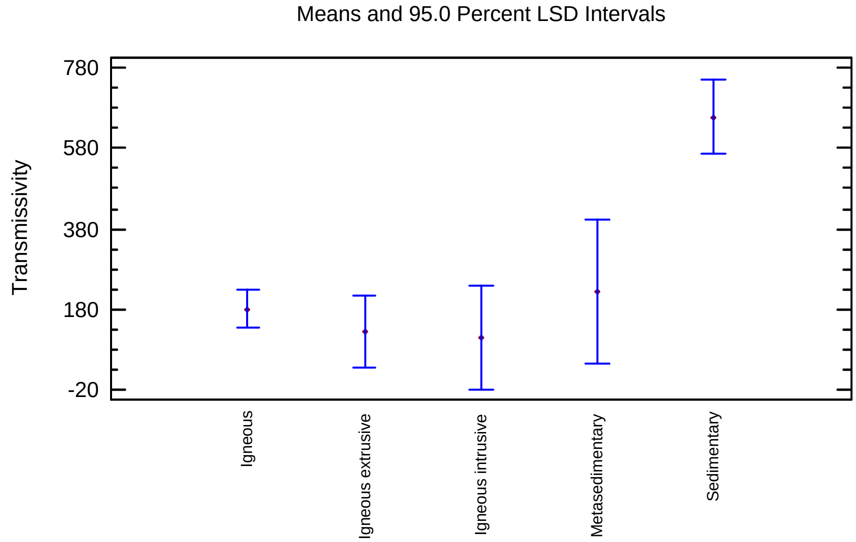
ROCK CLASS	*Count*	*Average*	*Median*	*Geometric mean*	*Standard deviation*	*Coeff. of variation*	*Minimum*
Igneous	632	181.451	45.975	36.563	554.242	305.449%	0.0000117
Igneous extrusive	173	126.165	31.11	28.7736	318.81	252.693%	0.19
Igneous intrusive	82	110.087	43.75	31.4694	174.959	158.927%	0.0000227
Metasedimentary	42	223.927	25.475	28.3367	521.41	232.848%	0.4
Sedimentary	163	656.796	130.75	120.212	1816.0	276.494%	0.54
Total	1092	239.921	48.0	41.1685	852.727	355.42%	0.0000117

ROCK CLASS	*Maximum*	*Range*	*Lower quartile*	*Upper quartile*	*Interquartile range*	*Stnd. skewness*	*Stnd. kurtosis*
Igneous	7280.0	7280.0	13.0	139.25	126.25	86.366	455.116
Igneous extrusive	2810.0	2809.81	9.9	93.0	83.1	30.0509	101.946
Igneous intrusive	1080.0	1080.0	16.0	123.0	107.0	11.6208	22.7719
Metasedimentary	2425.9	2425.5	6.7	86.0	79.3	8.60944	14.2043
Sedimentary	16400.0	16399.5	35.2	521.5	486.3	33.5705	126.474
Total	16400.0	16400.0	13.1	160.0	146.9	155.068	1199.41

The StatAdvisor
This table shows various statistics for each of the 5 columns of data. To test for significant differences amongst the column means, select Analysis of Variance from the list of Tabular Options. Select Means Plot from the list of Graphical Options to display the means graphically.

WARNING: There is more than a 3 to 1 difference between the smallest standard deviation and the largest. This may cause problems since the analysis of variance assumes that the standard deviations at all levels are equal. Select Variance Check from the list of Tabular Options to run a formal statistical test for differences among the sigmas. You may want to consider transforming the data to remove any dependence of the standard deviation on the mean.

WARNING: The standardized skewness and/or kurtosis is outside the range of -2 to +2 for 5 columns. This indicates some significant nonnormality in the data, which violates the assumption that the data come from normal distributions. You may wish to transform the data or use the Kruskal-Wallis test to compare the medians instead of the means.



Multiple Range Tests for Median_Trans by ROCK CLASS
Method: 95.0 percent LSD

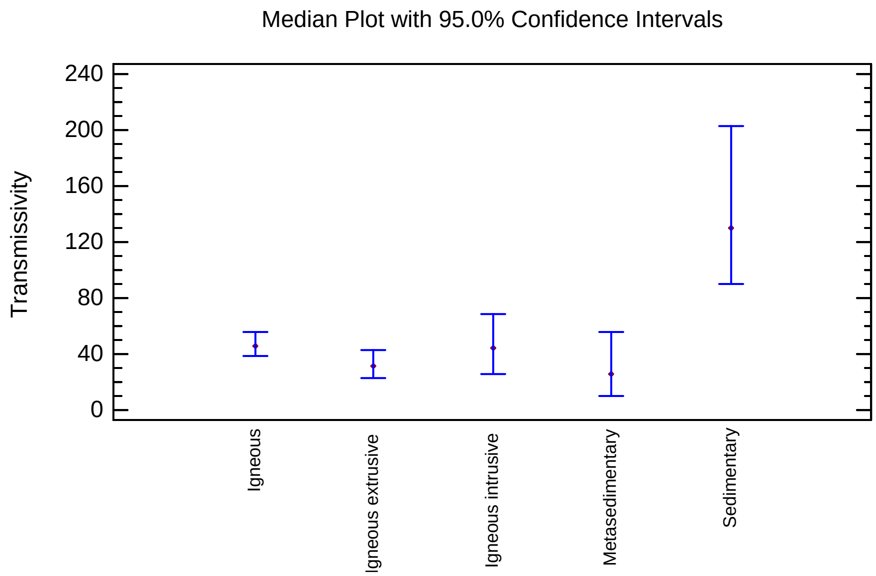
ROCK CLASS	*Count*	*Mean*	*Homogeneous Groups*
Igneous intrusive	82	110.087	X
Igneous extrusive	173	126.165	X
Igneous	632	181.451	X
Metasedimentary	42	223.927	X
Sedimentary	163	656.796	X

Contrast	*Sig.*	*Difference*	*+/- Limits*
Igneous - Igneous extrusive		55.2862	140.549
Igneous - Igneous intrusive		71.364	192.262
Igneous - Metasedimentary		-42.4755	261.01
Igneous - Sedimentary	*	-475.344	143.894
Igneous extrusive - Igneous intrusive		16.0779	219.609
Igneous extrusive - Metasedimentary		-97.7617	281.762
Igneous extrusive - Sedimentary	*	-530.631	178.798
Igneous intrusive - Metasedimentary		-113.84	310.806
Igneous intrusive - Sedimentary	*	-546.708	221.765
Metasedimentary - Sedimentary	*	-432.869	283.445

* denotes a statistically significant difference.

The StatAdvisor

This table applies a multiple comparison procedure to determine which means are significantly different from which others. The bottom half of the output shows the estimated difference between each pair of means. An asterisk has been placed next to 4 pairs, indicating that these pairs show statistically significant differences at the 95.0% conf. level. At the top of the page, 2 homogenous groups are identified using columns of X's. Within each column, levels containing X's form a group of means within which there are no statistically significant differences. The method currently being used to discriminate among the means is Fisher's least significant difference (LSD) procedure. With this method, there is a 5.0% risk of calling each pair of means significantly different when the actual difference equals 0.



Kruskal-Wallis Test for Median_Trans by ROCK CLASS

ROCK CLASS	*Sample Size*	*Average Rank*
Igneous	632	534.491
Igneous extrusive	173	472.202
Igneous intrusive	82	522.921
Metasedimentary	42	466.333
Sedimentary	163	704.436

Test statistic = 54.5683   P-Value = 4.00118E-11

The StatAdvisor
The Kruskal-Wallis test tests the null hypothesis that the medians within each of the 5 columns is the same. The data from all the columns is first combined and ranked from smallest to largest. The average rank is then computed for the data in each column. Since the P-value is less than 0.05, there is a statistically significant difference amongst the medians at the 95.0% confidence level. To determine which medians are significantly different from which others, select Box-and-Whisker Plot from the list of Graphical Options and select the median notch option.

Mood's Median Test for Median_Trans by ROCK CLASS
Total n = 1092
Grand median = 48.0

ROCK CLASS	*Sample Size*	*n<=*	*n>*	*Median*	*95.0% lower CL*	*95.0% upper CL*
Igneous	632	322	310	45.975	37.9592	55.0
Igneous extrusive	173	105	68	31.11	22.5556	42.8147
Igneous intrusive	82	44	38	43.75	26.0601	68.1541
Metasedimentary	42	26	16	25.475	9.1392	54.9282
Sedimentary	163	50	113	130.75	89.8729	203.933

Test statistic = 35.3073   P-Value = 4.01687E-7

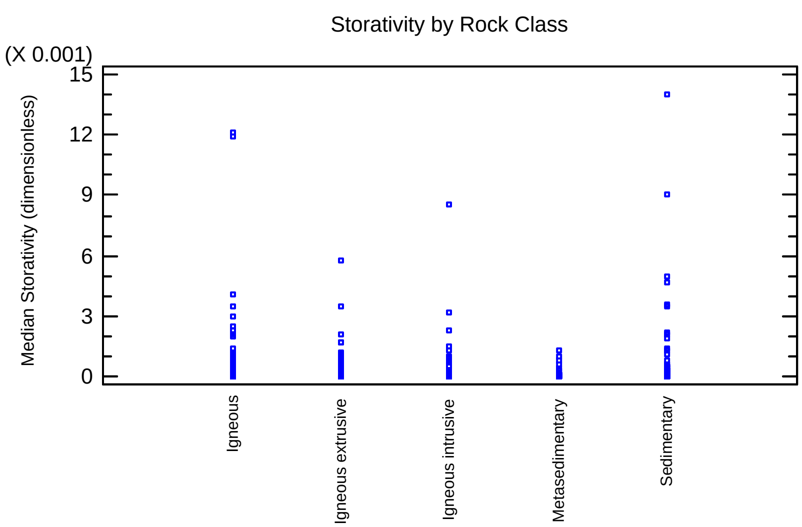
The StatAdvisor
Mood's median test tests the hypothesis that the medians of all 5 samples are equal. It does so by counting the number of observations in each sample on either side of the grand median, which equals 48.0. Since the P-value for the chi-squared test is less than 0.05, the medians of the samples are significantly different at the 95.0% confidence level. Also included (if available) are 95.0% confidence intervals for each median based on the order statistics of each sample.

Multiple-Sample Comparison; Median Storativity by Rock Class

Dependent variable: Median_Stor
Factor: ROCK CLASS

Number of observations: 767
Number of levels: 5

The StatAdvisor
This procedure compares the data in 5 columns of the current data file. It constructs various statistical tests and graphs to compare the samples. The F-test in the ANOVA table will test whether there are any significant differences amongst the means. If there are, the Multiple Range Tests will tell you which means are significantly different from which others. If you are worried about the presence of outliers, choose the Kruskal-Wallis Test which compares medians instead of means. The various plots will help you judge the practical significance of the results, as well as allow you to look for possible violations of the assumptions underlying the analysis of variance.



Summary Statistics for Median_Stor

ROCK CLASS	*Count*	*Average*	*Median*	*Geometric mean*	*Standard deviation*	*Coeff. of variation*
Igneous	465	0.000239295	0.00007	0.000069474	0.000874162	365.307%
Igneous extrusive	119	0.000272933	0.00005965	0.0000690543	0.000681237	249.598%
Igneous intrusive	64	0.000436303	0.00008935	0.0000897812	0.00116879	267.884%
Metasedimentary	23	0.00021188	0.000046	0.0000515208	0.000346386	163.482%
Sedimentary	96	0.00062815	0.0000788	0.000104135	0.00186885	297.516%
Total	767	0.000308801	0.00007	0.0000739287	0.00104923	339.775%

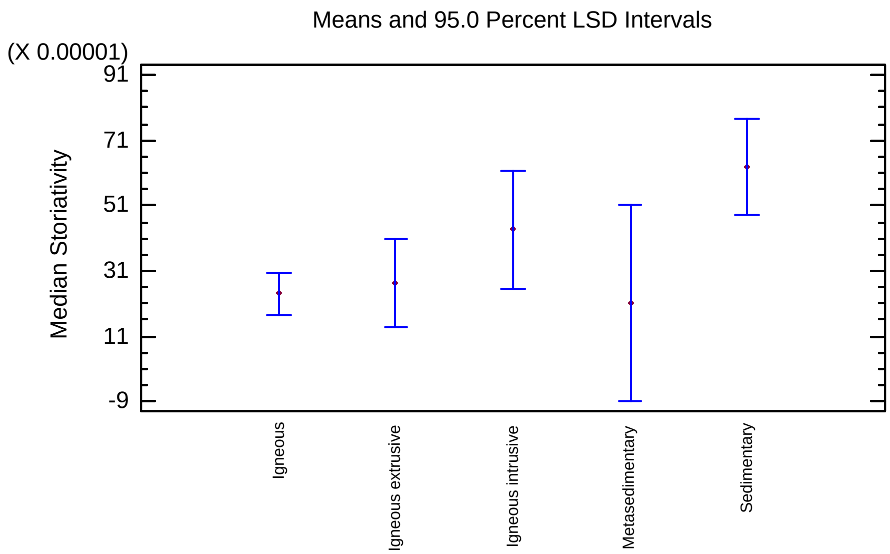
ROCK CLASS	*Minimum*	*Maximum*	*Range*	*Lower quartile*	*Upper quartile*	*Interquartile range*
Igneous	3.E-8	0.0121485	0.0121485	0.0000275	0.00018	0.0001525
Igneous extrusive	0.00000117	0.005755	0.00575383	0.000029255	0.0002145	0.000185245
Igneous intrusive	0.00000211	0.0085495	0.00854739	0.0000175	0.0003875	0.00037
Metasedimentary	0.00000203	0.00125	0.00124797	0.000016	0.00029	0.000274
Sedimentary	4.1E-7	0.014	0.0139996	0.00003385	0.000253	0.00021915
Total	3.E-8	0.014	0.014	0.000028	0.0002	0.000172

ROCK CLASS	*Stnd. skewness*	*Stnd. kurtosis*
Igneous	98.553	636.344
Igneous extrusive	25.3256	87.3148
Igneous intrusive	18.7972	62.1627
Metasedimentary	3.87195	3.09473
Sedimentary	20.9057	63.0742
Total	98.3006	511.728

The StatAdvisor
This table shows various statistics for each of the 5 columns of data. To test for significant differences amongst the column means, select Analysis of Variance from the list of Tabular Options. Select Means Plot from the list of Graphical Options to display the means graphically.

WARNING: There is more than a 3 to 1 difference between the smallest standard deviation and the largest. This may cause problems since the analysis of variance assumes that the standard deviations at all levels are equal. Select Variance Check from the list of Tabular Options to run a formal statistical test for differences among the sigmas. You may want to consider transforming the data to remove any dependence of the standard deviation on the mean.

WARNING: The standardized skewness and/or kurtosis is outside the range of -2 to +2 for 5 columns. This indicates some significant nonnormality in the data, which violates the assumption that the data come from normal distributions. You may wish to transform the data or use the Kruskal-Wallis test to compare the medians instead of the means.



Multiple Range Tests for Median_Stor by ROCK CLASS

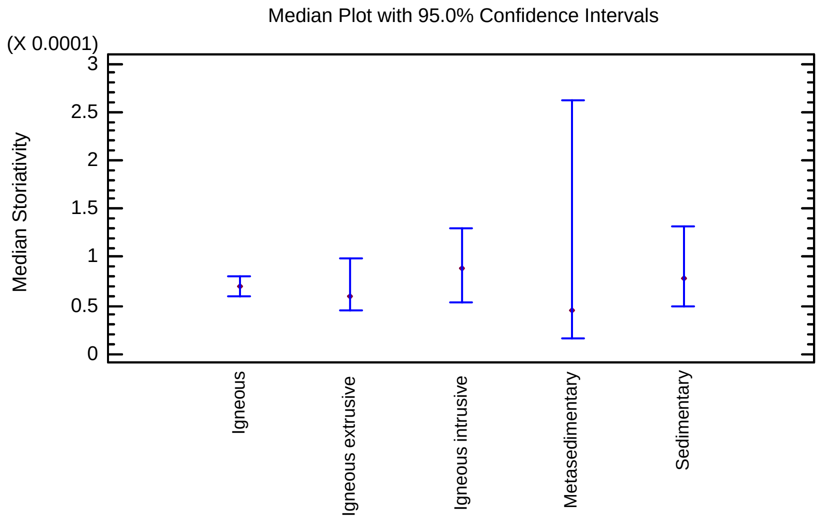
Method: 95.0 percent LSD

ROCK CLASS	*Count*	*Mean*	*Homogeneous Groups*
Metasedimentary	23	0.00021188	XX
Igneous	465	0.000239295	X
Igneous extrusive	119	0.000272933	X
Igneous intrusive	64	0.000436303	XX
Sedimentary	96	0.00062815	X

Contrast	*Sig.*	*Difference*	*+/- Limits*
Igneous - Igneous extrusive		-0.0000336381	0.000210122
Igneous - Igneous intrusive		-0.000197008	0.000272695
Igneous - Metasedimentary		0.0000274151	0.000436903
Igneous - Sedimentary	*	-0.000388855	0.00022929
Igneous extrusive - Igneous intrusive		-0.000163369	0.00031705
Igneous extrusive - Metasedimentary		0.0000610532	0.000465878
Igneous extrusive - Sedimentary	*	-0.000355217	0.000280592
Igneous intrusive - Metasedimentary		0.000224423	0.000497246
Igneous intrusive - Sedimentary		-0.000191848	0.000330065
Metasedimentary - Sedimentary		-0.00041627	0.000474832

* denotes a statistically significant difference.

The StatAdvisor
This table applies a multiple comparison procedure to determine which means are significantly different from which others. The bottom half of the output shows the estimated difference between each pair of means. An asterisk has been placed next to 2 pairs, indicating that these pairs show statistically significant differences at the 95.0% confidence level. At the top of the page, 2 homogenous groups are identified using columns of X's. Within each column, the levels containing X's form a group of means within which there are no statistically significant differences. The method currently being used to discriminate among the means is Fisher's least significant difference (LSD) procedure. With this method, there is a 5.0% risk of calling each pair of means significantly different when the actual difference equals 0.



Kruskal-Wallis Test for Median_Stor by ROCK CLASS

ROCK CLASS	*Sample Size*	*Average Rank*
Igneous	465	377.477
Igneous extrusive	119	378.697
Igneous intrusive	64	406.672
Metasedimentary	23	330.891
Sedimentary	96	419.776

Test statistic = 4.96603   P-Value = 0.2908

The StatAdvisor
The Kruskal-Wallis test tests the null hypothesis that the medians within each of the 5 columns is the same. The data from all the columns is first combined and ranked from smallest to largest. The average rank is then computed for the data in each column. Since the P-value is greater than or equal to 0.05, there is not a statistically significant difference amongst the medians at the 95.0% confidence level.

Mood's Median Test for Median_Stor by ROCK CLASS
Total n = 767
Grand median = 0.00007

ROCK CLASS	*Sample Size*	*n<=*	*n>*	*Median*	*95.0% lower CL*	*95.0% upper CL*
Igneous	465	234	231	0.00007	0.0000599343	0.0000809131
Igneous extrusive	119	65	54	0.00005965	0.0000453384	0.0000984152
Igneous intrusive	64	26	38	0.00008935	0.0000537879	0.000130274
Metasedimentary	23	15	8	0.000046	0.0000162619	0.000261187
Sedimentary	96	44	52	0.0000788	0.00005	0.000131735

Test statistic = 6.08197   P-Value = 0.19311

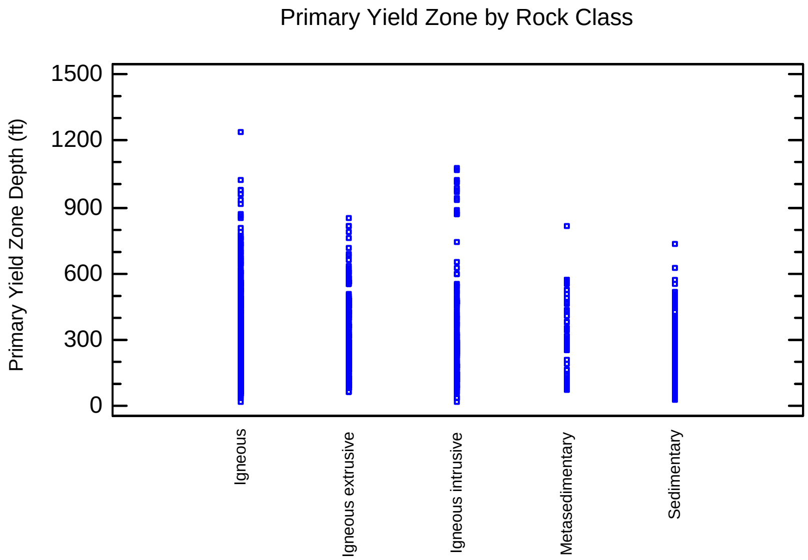
The StatAdvisor
Mood's median test tests the hypothesis that the medians of all 5 samples are equal. It does so by counting the number of observations in each sample on either side of the grand median, which equals 0.00007. Since the P-value for the chi-squared test is greater than or equal to 0.05, the medians of the samples are not significantly different at the 95.0% confidence level. Also included (if available) are 95.0% confidence intervals for each median based on the order statistics of each sample.

Multiple-Sample Comparison; PRIMARY YIELD ZONE BY ROCK CLASS

Dependent variable: YIELD_ZONE
Factor: ROCK CLASS

Number of observations: 1749
Number of levels: 5

The StatAdvisor
This procedure compares the data in 5 columns of the current data file. It constructs various statistical tests and graphs to compare the samples. The F-test in the ANOVA table will test whether there are any significant differences amongst the means. If there are, the Multiple Range Tests will tell you which means are significantly different from which others. If you are worried about the presence of outliers, choose the Kruskal-Wallis Test which compares medians instead of means. The various plots will help you judge the practical significance of the results, as well as allow you to look for possible violations of the assumptions underlying the analysis of variance.



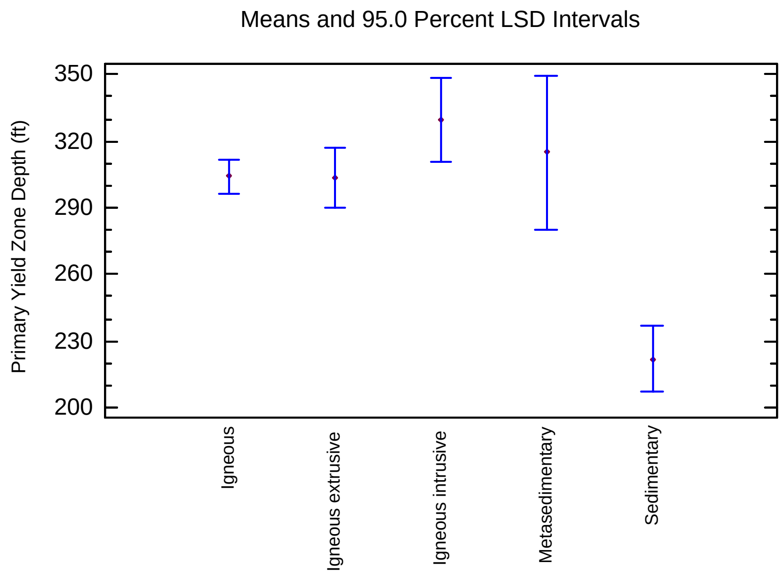
Summary Statistics for YIELD_ZONE

ROCK CLASS	*Count*	*Average*	*Median*	*Geometric mean*	*Standard deviation*	*Coeff. of variation*	*Minimum*	*Maximum*
Igneous	973	304.198	275.0	257.469	172.825	56.8134%	25.0	1235.0
Igneous extrusive	306	303.359	270.5	264.586	156.861	51.708%	65.0	850.0
Igneous intrusive	159	329.528	262.0	254.436	247.545	75.121%	25.0	1080.0
Metasedimentary	47	314.787	295.0	262.5	176.172	55.9655%	75.0	815.0
Sedimentary	264	222.087	197.0	191.785	120.772	54.3804%	32.0	730.0
Total	1749	294.244	262.0	247.313	174.45	59.2876%	25.0	1235.0

ROCK CLASS	*Range*	*Lower quartile*	*Upper quartile*	*Interquartile range*	*Stnd. skewness*	*Stnd. kurtosis*
Igneous	1210.0	172.0	390.0	218.0	14.1436	11.5475
Igneous extrusive	785.0	190.0	403.0	213.0	6.5652	2.24671
Igneous intrusive	1055.0	160.0	415.0	255.0	7.74612	4.351
Metasedimentary	740.0	150.0	461.0	311.0	1.44092	-0.34036
Sedimentary	698.0	126.0	280.5	154.5	6.88593	3.42209
Total	1210.0	160.0	380.0	220.0	22.2179	20.5297

The StatAdvisor
This table shows various statistics for each of the 5 columns of data. To test for significant differences amongst the column means, select Analysis of Variance from the list of Tabular Options. Select Means Plot from the list of Graphical Options to display the means graphically.

WARNING: The standardized skewness and/or kurtosis is outside the range of -2 to +2 for 4 columns. This indicates some significant nonnormality in the data, which violates the assumption that the data come from normal distributions. You may wish to transform the data or use the Kruskal-Wallis test to compare the medians instead of the means.



Multiple Range Tests for YIELD_ZONE by ROCK CLASS

Method: 95.0 percent LSD

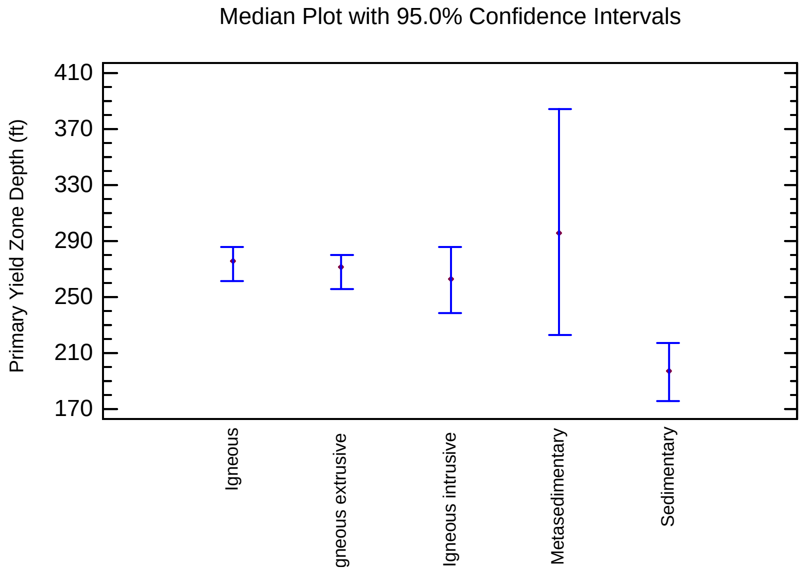
ROCK CLASS	*Count*	*Mean*	*Homogeneous Groups*
Sedimentary	264	222.087	X
Igneous extrusive	306	303.359	X
Igneous	973	304.198	X
Metasedimentary	47	314.787	X
Igneous intrusive	159	329.528	X

Contrast	*Sig.*	*Difference*	*+/- Limits*
Igneous - Igneous extrusive		0.838365	22.0711
Igneous - Igneous intrusive		-25.3305	28.8054
Igneous - Metasedimentary		-10.5894	50.2922
Igneous - Sedimentary	*	82.1107	23.3686
Igneous extrusive - Igneous intrusive		-26.1688	32.921
Igneous extrusive - Metasedimentary		-11.4278	52.7575
Igneous extrusive - Sedimentary	*	81.2724	28.2866
Igneous intrusive - Metasedimentary		14.7411	55.9104
Igneous intrusive - Sedimentary	*	107.441	33.8046
Metasedimentary - Sedimentary	*	92.7001	53.3133

* denotes a statistically significant difference.

The StatAdvisor

This table applies a multiple comparison procedure to determine which means are significantly different from which others. The bottom half of the output shows the estimated difference between each pair of means. An asterisk has been placed next to 4 pairs, indicating that these pairs show statistically significant differences at the 95.0% confidence level. At the top of the page, 2 homogenous groups are identified using columns of X's. Within each column, the levels containing X's form a group of means within which there are no statistically significant differences. The method currently being used to discriminate among the means is Fisher's least significant difference (LSD) procedure. With this method, there is a 5.0% risk of calling each pair of means significantly different when the actual difference equals 0.



Kruskal-Wallis Test for YIELD_ZONE by ROCK CLASS

ROCK CLASS	*Sample Size*	*Average Rank*
Igneous	973	911.32
Igneous extrusive	306	925.652
Igneous intrusive	159	891.513
Metasedimentary	47	944.351
Sedimentary	264	660.136

Test statistic = 56.9536   P-Value = 1.2652E-11

The StatAdvisor
The Kruskal-Wallis test tests the null hypothesis that the medians within each of the 5 columns is the same. The data from all the columns is first combined and ranked from smallest to largest. The average rank is then computed for the data in each column. Since the P-value is less than 0.05, there is a statistically significant difference amongst the medians at the 95.0% confidence level. To determine which medians are significantly different from which others, select Box-and-Whisker Plot from the list of Graphical Options and select the median notch option.

Mood's Median Test for YIELD_ZONE by ROCK CLASS
Total n = 1749
Grand median = 262.0

ROCK CLASS	*Sample Size*	*n<=*	*n>*	*Median*	*95.0% lower CL*	*95.0% upper CL*
Igneous	973	457	516	275.0	260.847	285.0
Igneous extrusive	306	144	162	270.5	255.0	280.0
Igneous intrusive	159	80	79	262.0	238.128	285.0
Metasedimentary	47	20	27	295.0	222.769	384.229
Sedimentary	264	181	83	197.0	175.0	217.19

Test statistic = 41.9385   P-Value = 1.71786E-8

The StatAdvisor
Mood's median test tests the hypothesis that the medians of all 5 samples are equal. It does so by counting the number of observations in each sample on either side of the grand median, which equals 262.0. Since the P-value for the chi-squared test is less than 0.05, the medians of the samples are significantly different at the 95.0% confidence level. Also included (if available) are 95.0% confidence intervals for each median based on the order statistics of each sample.

Summary Statistics from Hydrostudy Wells

	Well Depth (ft TOC)	*Bedrock Depth (ft bgs)*	*Static Water Level (ft TOC)*	*Specific Capacity (gal/min/ft)*	*Airlift Yield (gal/min)*	*Primary Yield Zone (ft bgs)*	*Secondary Yield Zone (ft bgs)*	*Median Transmissivity (ft2/day)**	*Median Storativity**
Count	1817	1806	1401	1395	1812	1749	920	1092	767
Average	417	29	25.6	0.80	22	294	250	240	3.1E-04
Median	390	25	23	0.131	10	262	202	48	7.0E-05
Geometric mean	380.52	24.37	-	0.14	-	247.31	209.51	41.17	7.4E-05
Standard deviation	182.46	19.85	18.55	3.87	41.37	174.45	162.29	852.73	1.0E-03
Minimum	50	2	0	0.0005	0	25	20	0.000012	3.0E-08
Maximum	1320	305	183	75	650	1235	1200	16400	1.4E-02
Range	1270	303	183	74.9995	650	1210	1180	16400	1.4E-02
Lower quartile	300	16	13	0.044	5	160	135	13.1	2.8E-05
Upper quartile	500	40	34.94	0.42	25	380	317.5	160	2.0E-04
Interquartile range	200	24	21.94	0.38	20	220	182.5	146.9	1.7E-04
Stnd. skewness	18.9	62.1	26.4	204.9	120.0	22.2	23.0	155.1	98.3
Stnd. kurtosis	13.9	293.4	51.6	1632.8	638.6	20.5	30.7	1199.4	511.7

*Median of each test well calculated from multiple observation wells.

Matrix of Pearson Product Moment Correlations for Hydrostudy Well Data.

	Well Depth (ft bgs)	Bedrock Depth (ft bgs)	Static Water Level (ft TOC)	Specific Capacity (gal/min/ft)	Airlift Yield (gal/min)	Primary Yield Zone (ft bgs)	Secondary Yield Zone (ft bgs)	Median Transmissivity (ft2/day)	Median Storativity
Well Depth	Correlation (Sample Size) P-Value	-0.1212 -1803 0	0.0418 -1399 0.1181	-0.1609 -1393 0	-0.1641 -1807 0	0.6657 -1747 0	0.6314 -918 0	-0.1404 -1091 0	-0.0433 -766 0.2313
Bedrock Depth	-0.1212 -1803 0		0.096 -1391 0.0003	0.0696 -1385 0.0095	-0.0337 -1796 0.1529	-0.066 -1742 0.0058	0.0109 -916 0.7419	0.113 -1082 0.0002	0.0881 -760 0.0148
Static Water Level	0.0418 -1399 0.1181	0.096 -1391 0.0003		0.04 -1391 0.1359	-0.0014 -1396 0.9588	0.0887 -1387 0.0009	0.0787 -721 0.0343	-0.0047 -1089 0.8764	-0.0199 -765 0.5823
Specific Capacity	-0.1609 -1393 0	0.0696 -1385 0.0095	0.04 -1391 0.1359		0.3452 -1390 0	-0.1079 -1381 0.0001	-0.0521 -721 0.1622	0.3385 -1085 0	0.1437 -763 0.0001
Airlift Yield	-0.1641 -1807 0	-0.0337 -1796 0.1529	-0.0014 -1396 0.9588	0.3452 -1390 0		-0.1045 -1742 0	-0.0544 -915 0.0996	0.2234 -1089 0	0.009 -764 0.8034
Primary Yield Zone	0.6657 -1747 0	-0.066 -1742 0.0058	0.0887 -1387 0.0009	-0.1079 -1381 0.0001	-0.1045 -1742 0		0.205 -920 0	-0.1071 -1078 0.0004	-0.05 -758 0.1684
Secondary Yield Zone	0.6314 -918 0	0.0109 -916 0.7419	0.0787 -721 0.0343	-0.0521 -721 0.1622	-0.0544 -915 0.0996	0.205 -920 0		-0.0744 -561 0.0783	-0.0235 -391 0.643
Median Transmissivity	-0.1404 -1091 0	0.113 -1082 0.0002	-0.0047 -1089 0.8764	0.3385 -1085 0	0.2234 -1089 0	-0.1071 -1078 0.0004	-0.0744 -561 0.0783		0.2449 -758 0
Median Storativity	-0.0433 -766 0.2313	0.0881 -760 0.0148	-0.0199 -765 0.5823	0.1437 -763 0.0001	0.009 -764 0.8034	-0.05 -758 0.1684	-0.0235 -391 0.643	0.2449 -758 0	

Statistically significant non-zero correlations at the 95.0% confidence level

No statistically significant non-zero correlations at the 95.0% confidence level

Summary Statistics for Hydrostudies Well Depths (ft bgs) by Year

YEAR	Count	Average	Median	Geometric mean	Standard deviation	Coeff. of variation	Minimum	Maximum	Range	Lower quartile	Upper quartile	Interquartile range	Stnd. skewness	Stnd. kurtosis
1985	1	330.00	330.0	330.0		%	330	330	0	330	330	0		
1986	4	558.75	605.0	537.2	162.14	29.0%	325	700	375	465	652.5	187.5	-1.24581	1.16861
1987	3	365.00	385.0	356.7	91.65	25.1%	265	445	180	265	445	180	-0.6613	
1988	58	281.60	285.00	261.15	113.60	40.3%	102	605	503	200	330	130	2.85886	0.438964
1989	109	316.22	300.00	294.54	122.47	38.7%	110	900	790	230	400	170	5.21719	7.67813
1990	64	392.66	360.00	364.22	144.45	36.8%	50	805	755	305	480	175	2.3512	1.62554
1991	5	459.00	450.00	452.38	86.20	18.8%	350	550	200	405	540	135	-0.0999003	-0.951049
1993	13	267.46	250.00	253.61	92.71	34.7%	125	500	375	225	280	55	1.72756	2.07126
1994	19	352.63	400.00	325.00	131.83	37.4%	140	520	380	225	480	255	-0.590737	-1.2611
1995	16	451.25	500.0	428.2	130.61	28.9%	185	580	395	350	540	190	-1.69312	-0.273183
1996	25	392.32	400.0	364.1	145.34	37.0%	140	750	610	260	500	240	0.485358	0.0407322
1997	16	350.63	352.50	314.26	155.48	44.3%	120	570	450	210	495	285	0.0637809	-1.14854
1998	38	418.82	400.00	390.48	178.38	42.6%	180	1200	1020	300	500	200	5.86061	11.2853
1999	88	397.50	380.00	365.80	163.90	41.2%	160	800	640	260	500	240	2.73375	-0.343667
2000	302	369.09	350.00	345.69	132.87	36.0%	100	800	700	266	440	174	4.51824	-0.0527422
2001	283	420.47	400.00	389.30	160.32	38.1%	100	1000	900	300	520	220	3.6125	0.00231144
2002	130	479.04	430.00	441.64	196.40	41.0%	180	1180	1000	300	600	300	4.0905	1.92606
2003	57	596.58	600.00	573.02	172.19	28.9%	310	1200	890	490	700	210	2.52916	2.65463
2004	63	432.54	380.00	396.09	185.47	42.9%	160	1000	840	300	550	250	2.77287	0.705955
2005	213	491.29	430.00	436.02	247.70	50.4%	100	1320	1220	300	600	300	6.16369	1.65399
2006	299	429.87	380.00	394.95	181.95	42.3%	100	1000	900	300	520	220	6.24439	0.383794
2007	10	482.00	470.00	463.46	140.30	29.1%	320	700	380	320	600	280	0.311699	-0.79001
Total	**1816**	**417.17**	**390.00**	**380.75**	**182.38**	**43.7%**	**50**	**1320**	**1270**	**300**	**500**	**200**	**18.9058**	**13.8854**

Indicates non-normal distribution.

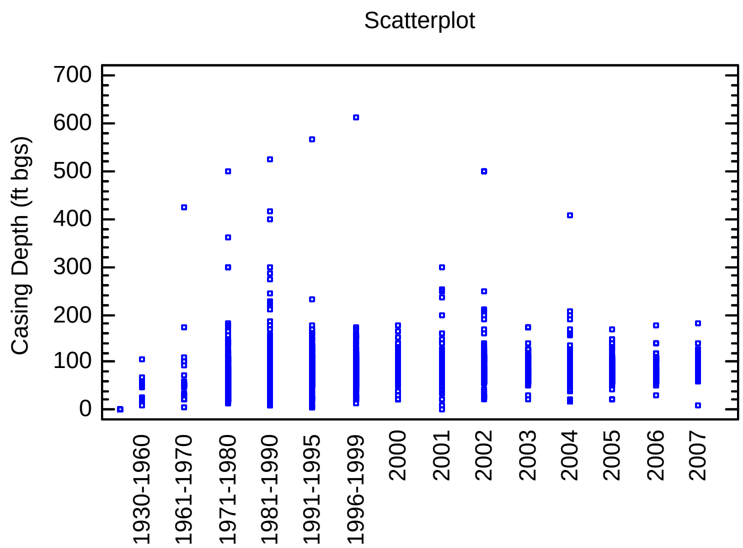
Section D) Detailed analysis of VDH well data.

Subset Analysis
Data variable: casing_depth_b
Code variable: Year_Code

Subset Analysis VDH Casing Depth by Year
Data variable: casing_depth_b
Code variable: Year_Code

Number of observations: 17953
Number of levels: 14

The StatAdvisor
This procedure calculates summary statistics for the values of casing_depth_b corresponding to each of the 14 levels of Year_Code. It also creates a variety of plots and allows you to save the calculated statistics. Further analyses can be performed on the data using the Oneway Analysis of Variance procedure under Compare on the main menu.



Summary Statistics
Data variable: casing_depth_b

				Standard	*Coefficient*				*Lower*	*Upper*
Year_Code	*Count*	*Average*	*Median*	*Deviation*	*of variation*	*Minimum*	*Maximum*	*Range*	*Quartile*	*Quartile*
1930-1960	13	47.8077	50.0	25.4587	53.2524%	9.5	107.0	97.5	25.0	58.0
1961-1970	36	63.9236	50.0	68.9968	107.936%	4.0	425.0	421.0	34.5	56.5
1971-1980	833	46.2114	40.0	33.7496	73.033%	15.0	500.0	485.0	25.0	55.0
1981-1990	3121	55.8998	55.0	27.8888	49.8907%	8.0	525.0	517.0	41.0	62.0
1991-1995	1117	71.2632	63.0	25.987	36.4663%	5.0	569.0	564.0	60.0	80.0
1996-1999	1491	71.563	68.0	20.7226	28.9571%	15.0	614.0	599.0	63.0	80.0
2000	848	76.5165	78.0	14.6208	19.1081%	20.0	176.0	156.0	68.0	84.0
2001	813	78.9594	80.0	20.8129	26.3589%	0.0	300.0	300.0	68.0	84.0
2002	607	78.4745	75.0	31.1835	39.7372%	21.0	500.0	479.0	65.0	83.0
2003	447	75.6957	72.0	16.7498	22.1279%	21.0	173.0	152.0	63.0	82.5
2004	671	73.7317	70.0	21.4937	29.1512%	18.0	410.0	392.0	63.0	82.0
2005	889	74.6665	73.0	12.652	16.9447%	21.0	170.0	149.0	63.0	82.0
2006	968	74.8701	75.5	11.9411	15.9491%	29.6	178.0	148.4	63.0	82.5
2007	119	80.105	78.0	21.0624	26.2935%	10.0	181.0	171.0	64.0	84.0
Total	11973	67.7016	65.0	26.0053	38.4116%	0.0	614.0	614.0	59.0	80.0

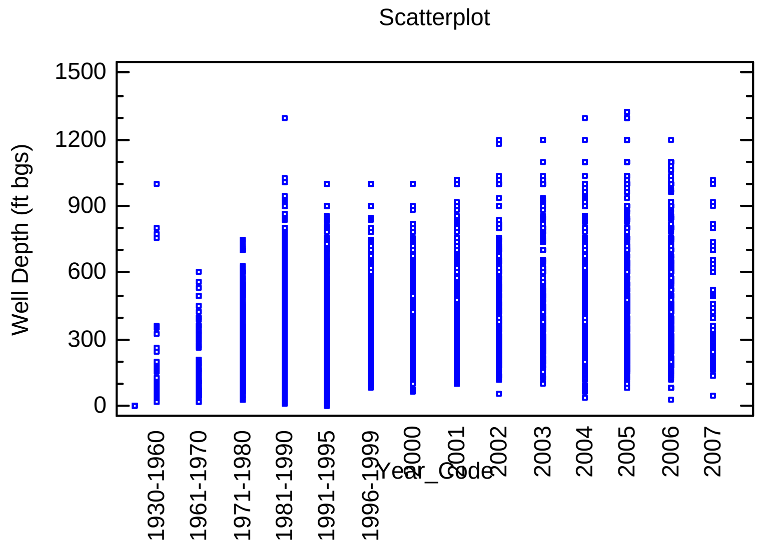
	Interquartile	*Standardized*	*Standardized*
Year_Code	*Range*	*Skewness*	*Kurtosis*
1930-1960	33.0	0.941206	1.007
1961-1970	22.0	10.7754	27.4639
1971-1980	30.0	66.0098	329.161
1981-1990	21.0	99.9625	560.508
1991-1995	20.0	99.4634	835.901
1996-1999	17.0	200.036	2494.45
2000	16.0	13.9554	44.8053
2001	16.0	45.1279	186.711
2002	18.0	89.9455	562.712
2003	19.5	15.4865	25.9778
2004	19.0	73.27	502.469
2005	19.0	19.9213	51.4012
2006	19.5	19.9976	51.5812
2007	20.0	6.01504	10.5378
Total	21.0	210.964	1589.21

The StatAdvisor
This table shows sample statistics for the 14 levels of Year_Code.

Subset Analysis
Data variable: well_depth
Code variable: Year_Code

Number of observations: 17953
Number of levels: 14

The StatAdvisor
This procedure calculates summary statistics for the values of well_depth corresponding to each of the 14 levels of Year_Code. It also creates a variety of plots and allows you to save the calculated statistics. Further analyses can be performed on the data using the Oneway Analysis of Variance procedure under Compare on the main menu.



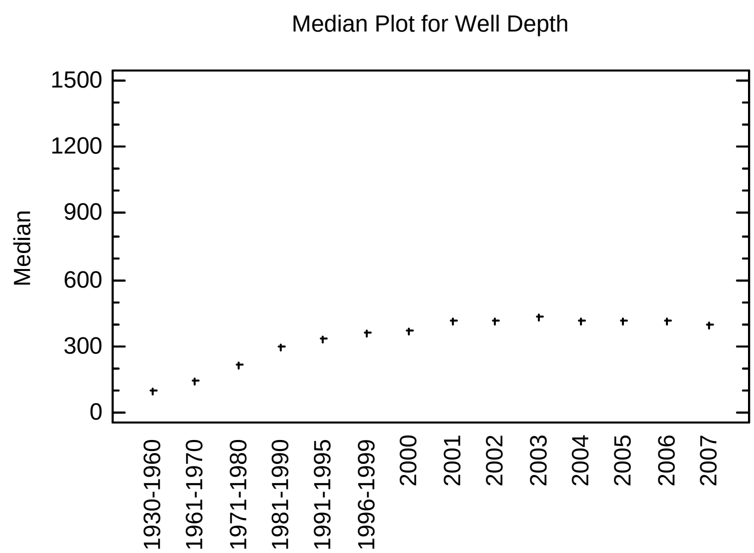
Summary Statistics
Data variable: well_depth

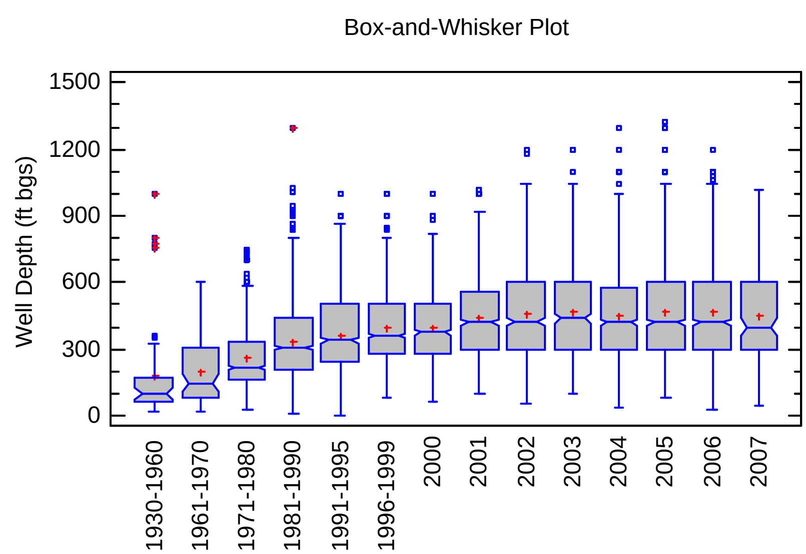
Year_Code	*Count*	*Average*	*Median*	*Standard Deviation*	*Coefficient of variation*	*Minimum*	*Maximum*	*Range*	*Lower Quartile*	*Upper Quartile*
1930-1960	46	179.348	100.0	221.284	123.382%	19.0	999.0	980.0	60.0	170.0
1961-1970	80	197.488	147.0	149.814	75.8602%	20.0	605.0	585.0	77.5	308.5
1971-1980	896	258.86	220.0	139.078	53.7272%	25.0	750.0	725.0	160.0	330.0
1981-1990	3343	336.841	305.0	158.956	47.1902%	10.0	1300.0	1290.0	205.0	445.0
1991-1995	1276	363.888	340.0	171.255	47.0625%	1.0	1000.0	999.0	240.0	500.0
1996-1999	1571	393.841	360.0	162.1	41.1587%	85.0	1000.0	915.0	280.0	500.0
2000	892	396.64	375.0	165.785	41.7974%	65.0	1000.0	935.0	280.0	500.0
2001	861	441.713	420.0	182.68	41.3571%	100.0	1020.0	920.0	300.0	560.0
2002	648	457.307	420.0	201.089	43.9723%	52.0	1200.0	1148.0	300.0	600.0
2003	471	471.52	440.0	208.74	44.2696%	100.0	1200.0	1100.0	300.0	605.0
2004	709	452.042	420.0	206.385	45.6562%	40.0	1300.0	1260.0	300.0	580.0
2005	905	472.158	420.0	231.338	48.9958%	80.0	1320.0	1240.0	300.0	600.0
2006	982	471.72	420.0	216.595	45.9159%	30.0	1200.0	1170.0	300.0	600.0
2007	120	452.767	400.0	214.648	47.4081%	45.0	1020.0	975.0	300.0	604.0
Total	12800	389.296	345.0	191.481	49.1864%	1.0	1320.0	1319.0	250.0	500.0

Year_Code	*Interquartile Range*	*Standardized Skewness*	*Standardized Kurtosis*
1930-1960	110.0	6.8891	7.89639
1961-1970	231.0	3.43785	-0.190725
1971-1980	170.0	13.2625	5.32472

1981-1990	240.0	16.9479	6.45154
1991-1995	260.0	6.96885	0.429393
1996-1999	220.0	8.81099	-1.42541
2000	220.0	8.21711	0.00178978
2001	260.0	6.78826	-0.244684
2002	300.0	6.5911	0.180076
2003	305.0	6.85206	0.866627
2004	280.0	8.71778	3.0259
2005	300.0	10.9914	2.64949
2006	300.0	10.4209	0.683612
2007	304.0	2.89914	-0.694039
Total	250.0	38.8975	17.7287

The StatAdvisor
This table shows sample statistics for the 14 levels of Year_Code.



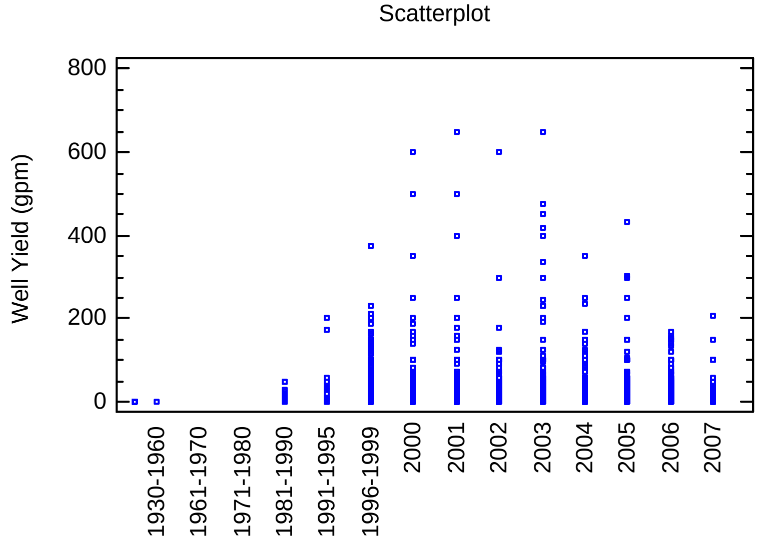


Subset Analysis VDH Well Yield by Year group

Data variable: stablizied_discharge
Code variable: Year_Code

Number of observations: 17953
Number of levels: 14

The StatAdvisor
This procedure calculates summary statistics for the values of stablizied_discharge corresponding to each of the 14 levels of Year_Code. It also creates a variety of plots and allows you to save the calculated statistics. Further analyses can be performed on the data using the Oneway Analysis of Variance procedure under Compare on the main menu.



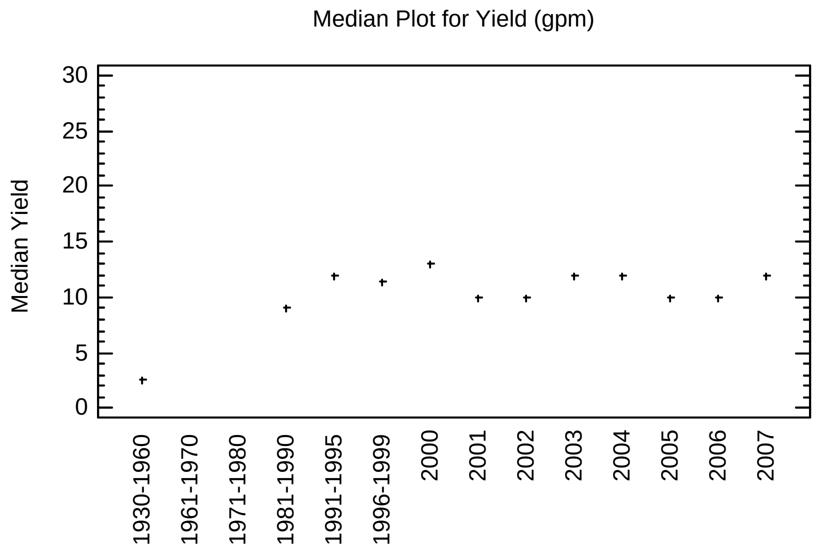
Summary Statistics
Data variable: stablizied_discharge

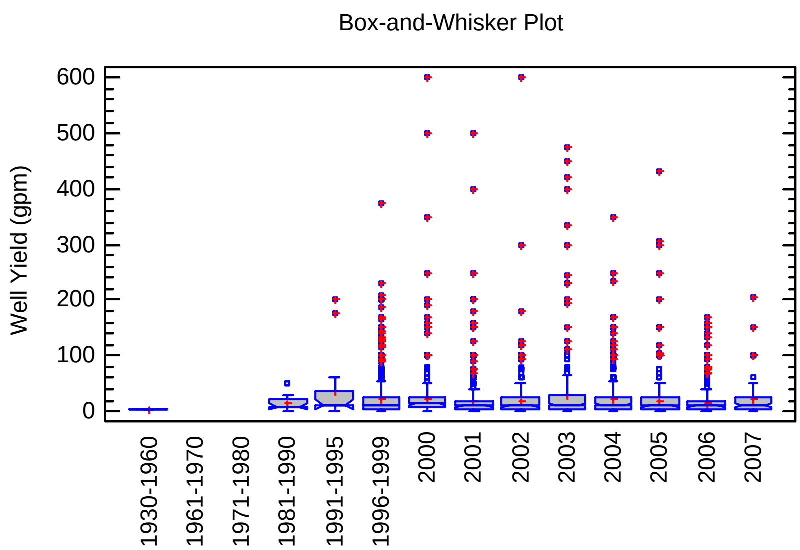
Year_Code	Count	Average	Median	Standard Deviation	Coefficient of variation	Minimum	Maximum	Range	Lower Quartile	Upper Quartile
1930-1960	1	2.5	2.5		%	2.5	2.5	0.0	2.5	2.5
1961-1970	0				%					
1971-1980	0				%					
1981-1990	20	16.4	9.0	16.2486	99.0766%	1.0	50.0	49.0	5.75	21.5
1991-1995	21	35.5357	12.0	53.3128	150.026%	0.25	200.0	199.75	10.0	35.0
1996-1999	1510	20.8041	11.5	29.5032	141.814%	0.0	375.0	375.0	5.0	25.0
2000	858	22.2244	13.0	37.4788	168.639%	0.0	600.0	600.0	6.0	25.0
2001	828	19.6327	10.0	39.9902	203.692%	0.0	650.0	650.0	5.0	20.0
2002	627	19.9112	10.0	34.254	172.034%	0.0	600.0	600.0	4.0	25.0
2003	460	28.4837	12.0	60.3058	211.721%	0.0	650.0	650.0	5.0	30.0
2004	689	22.0976	12.0	30.7529	139.169%	0.0	350.0	350.0	5.0	25.0
2005	899	19.4513	10.0	30.4629	156.611%	0.0	432.0	432.0	5.0	25.0
2006	968	15.8527	10.0	20.2949	128.022%	0.0	171.0	171.0	5.0	20.0
2007	116	21.7414	12.0	29.7904	137.022%	0.5	205.0	204.5	5.0	25.0
Total	6997	20.5776	10.0	34.5516	167.909%	0.0	650.0	650.0	5.0	25.0

Year_Code	Interquartile Range	Standardized Skewness	Standardized Kurtosis
1930-1960	0.0		
1961-1970			
1971-1980			

1981-1990	15.75	2.51951	0.615754
1991-1995	25.0	4.70851	5.46741
1996-1999	20.0	62.9183	196.182
2000	19.0	101.333	630.549
2001	15.0	104.026	653.993
2002	21.0	95.1929	709.743
2003	25.0	52.8647	195.183
2004	20.0	45.4759	154.495
2005	20.0	74.2514	360.648
2006	15.0	45.9904	115.314
2007	20.0	14.9587	33.1808
Total	20.0	256.19	1582.59

The StatAdvisor
This table shows sample statistics for the 14 levels of Year_Code.

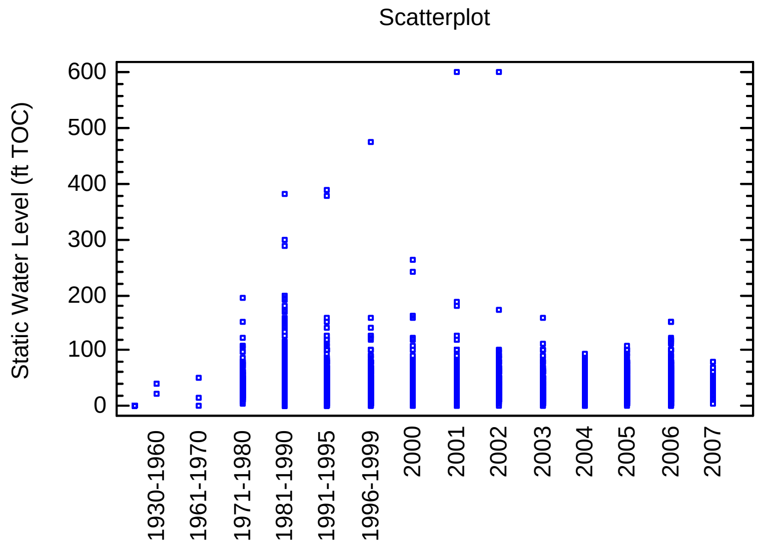




Subset Analysis
Data variable: well_static_water
Code variable: Year_Code

Number of observations: 17953
Number of levels: 14

The StatAdvisor
This procedure calculates summary statistics for the values of well_static_water corresponding to each of the 14 levels of Year_Code. It also creates a variety of plots and allows you to save the calculated statistics. Further analyses can be performed on the data using the Oneway Analysis of Variance procedure under Compare on the main menu.



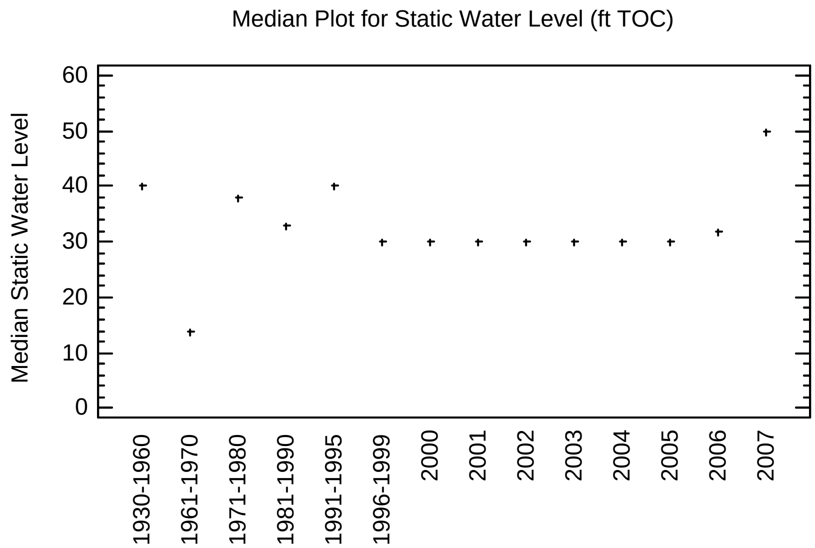
Summary Statistics
Data variable: well_static_water

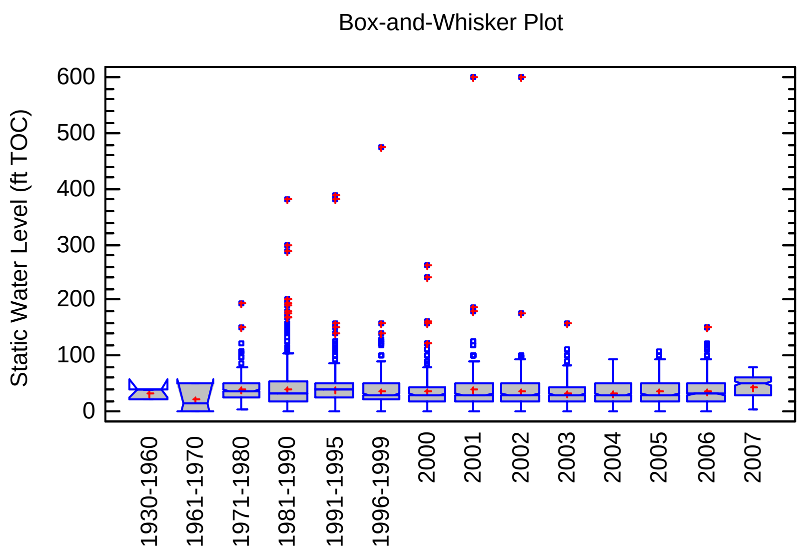
				Standard	*Coefficient*				*Lower*	*Upper*
Year_Code	*Count*	*Average*	*Median*	*Deviation*	*of variation*	*Minimum*	*Maximum*	*Range*	*Quartile*	*Quartile*
1930-1960	3	34.0	40.0	10.3923	30.5656%	22.0	40.0	18.0	22.0	40.0
1961-1970	3	21.6667	14.0	25.3837	117.156%	1.0	50.0	49.0	1.0	50.0
1971-1980	222	40.8626	38.0	23.4861	57.4758%	5.0	195.0	190.0	25.0	50.0
1981-1990	2178	40.2764	33.0	27.0766	67.227%	1.0	383.0	382.0	20.0	55.0
1991-1995	1024	41.5859	40.0	26.0994	62.7603%	1.0	390.0	389.0	26.0	52.0
1996-1999	1355	35.7791	30.0	21.1582	59.1357%	1.5	475.0	473.5	22.0	50.0
2000	685	34.5902	30.0	21.8772	63.2468%	0.3	264.0	263.7	20.0	45.0
2001	677	39.4919	30.0	45.5984	115.463%	1.0	700.0	699.0	20.0	50.0
2002	569	37.1511	30.0	30.1658	81.1974%	0.2	600.0	599.8	20.0	50.0
2003	415	32.3687	30.0	19.0026	58.7067%	1.0	158.0	157.0	20.0	45.0
2004	575	33.409	30.0	18.5581	55.5482%	1.2	95.0	93.8	17.0	50.0
2005	725	34.8428	30.0	19.9806	57.345%	2.0	109.0	107.0	20.0	50.0
2006	795	37.7434	32.0	20.0945	53.2399%	1.0	150.0	149.0	20.0	50.0
2007	96	44.6667	50.0	17.1505	38.3967%	5.0	80.0	75.0	30.0	60.0
Total	9322	37.7379	30.0	26.0739	69.0922%	0.2	700.0	699.8	20.0	50.0

	Interquartile	*Standardized*	*Standardized*
Year_Code	*Range*	*Skewness*	*Kurtosis*
1930-1960	18.0	-1.22474	
1961-1970	49.0	0.873386	
1971-1980	25.0	14.8638	32.2361

1981-1990	35.0	55.4206	207.011
1991-1995	26.0	64.0095	381.139
1996-1999	28.0	108.379	1036.8
2000	25.0	42.6095	168.955
2001	30.0	111.175	724.608
2002	30.0	114.477	1041.18
2003	25.0	13.8147	23.8693
2004	33.0	5.63093	-2.64391
2005	30.0	8.36892	-0.377262
2006	30.0	13.6211	17.0386
2007	30.0	-1.82041	-1.7703
Total	30.0	292.657	2754.98

The StatAdvisor
This table shows sample statistics for the 14 levels of Year_Code.





Summary Statistics for Health Department Static Water Level by Year.

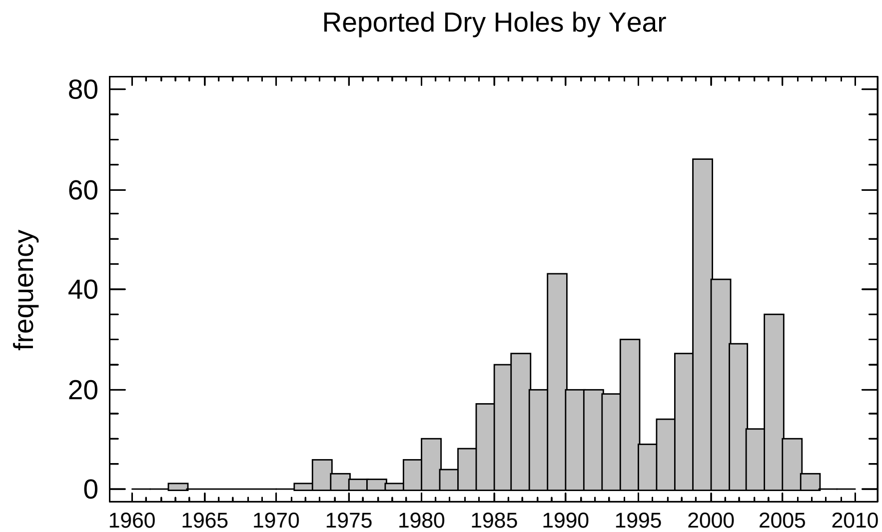
Year	*Count*	*Average*	*Standard deviation*	*Coeff. of variation*	*Minimum*	*Maximum*	*Range*	*Stnd. skewness*	*Stnd. kurtosis*
1930-1960	1	40		%	40	40	0		
1961-1970	3	22	25.4	1.17	1	50	49.00	1	
1971-1980	222	40.8626	23.4861	0.574758	5	195	190	14.8638	32.2361
1981-1990	2178.00	40.28	27.08	0.67	1.00	383.00	382.00	55.42	207.01
1991-1995	1024.00	41.59	26.10	0.63	1.00	390.00	389.00	64.01	381.14
1996-1999	1355	35.7791	21.1582	0.591357	1.5	475	473.5	108.379	1036.8
2000	685	34.5902	22	0.632468	0.3	264	263.7	42.6095	168.955
2001	677	39.4919	46	1	1	700	699	111.175	724.608
2002	569	37.1511	30.1658	0.811974	0.2	600	599.8	114.477	1041.18
2003	415	32.3687	19.0026	0.587067	1	158	157	13.8147	23.8693
2004	575	33.409	18.5581	0.555482	1.2	95	93.8	5.63093	-2.64391
2005	725.0	34.8	20.0	0.6	2.0	109.0	107.0	8.4	-0.4
2006	795.0	37.7	20.1	0.5	1.0	150.0	149.0	13.6	17.0
2007	96.0	44.7	17.2	0.4	5.0	80.0	75.0	-1.8	-1.8

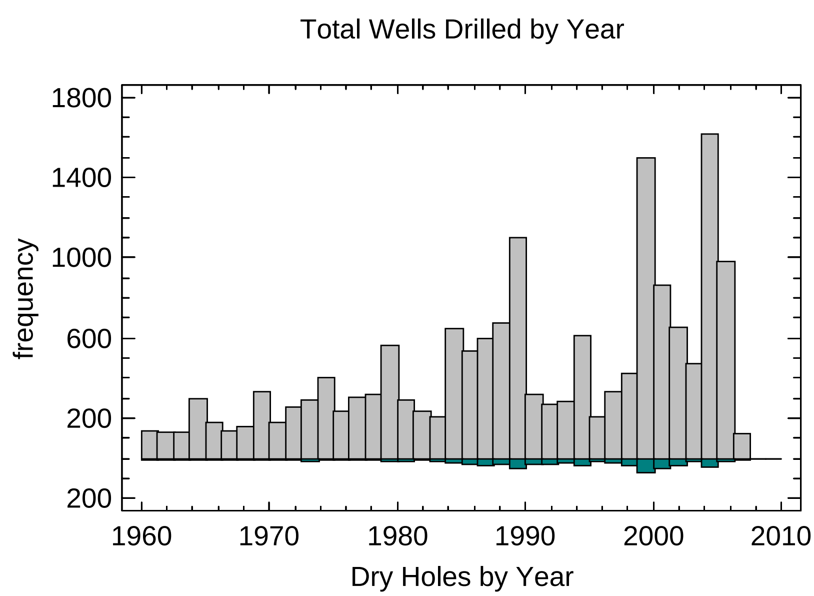
Summary Statistics from Health Department Wells

	Well Depth (ft TOC)	*Bedrock Depth (ft bgs)*	*Static Water Level (ft TOC)*	*Airlift Yield (gal/min)*	*Primary Yield Zone (ft bgs)*	*Secondary Yield Zone (ft bgs)*
Count	12792	12311	9320	6996	11084	5586
Average	389	25	37.7	20.58	307	251
Median	345	20	30	10	280	215
Geometric mean	341.64	-	31.48	-	252.56	199.52
Standard deviation	191.34	19.26	26.08	34.55	174.85	162.13
Minimum	1.5	0	0.2	0	1	0.42
Maximum	1320	500	700	650	1609	1740
Range	1318.5	500	700	650	1608	1739.58
Lower quartile	250	12	20	5	180	132
Upper quartile	500	35	50	25	400	335
Interquartile range	250	23	30	20	220	203
Stnd. skewness	39.0	139.8	292.6	256.2	48.1	48.0
Stnd. kurtosis	17.8	899.2	2754.3	1582.3	55.8	81.8

Section E) Analysis of dry hole data from VDH data set. Includes frequency histogram of reported dry holes by year, and frequency histogram of dry holes by year concurrent with total wells drilled by year. Also a table showing the number of dry holes for each rock class.

Graphical Analysis of Dry Holes (WWDH wells) from VDH data set.

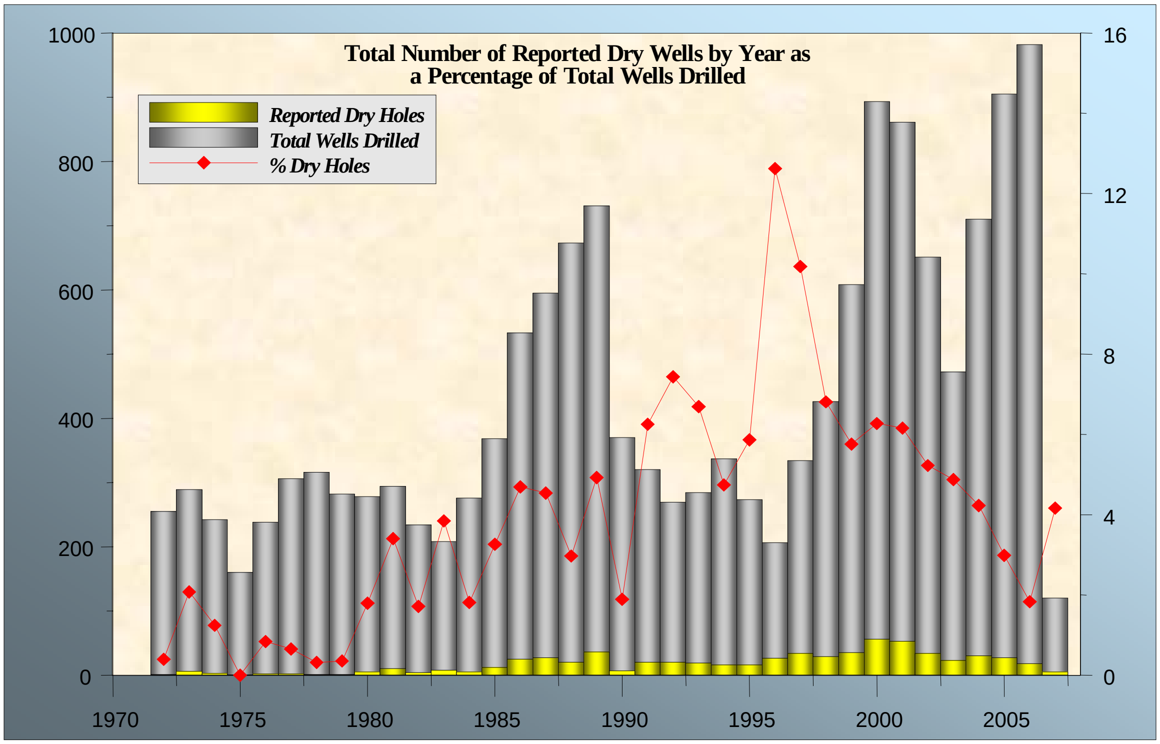




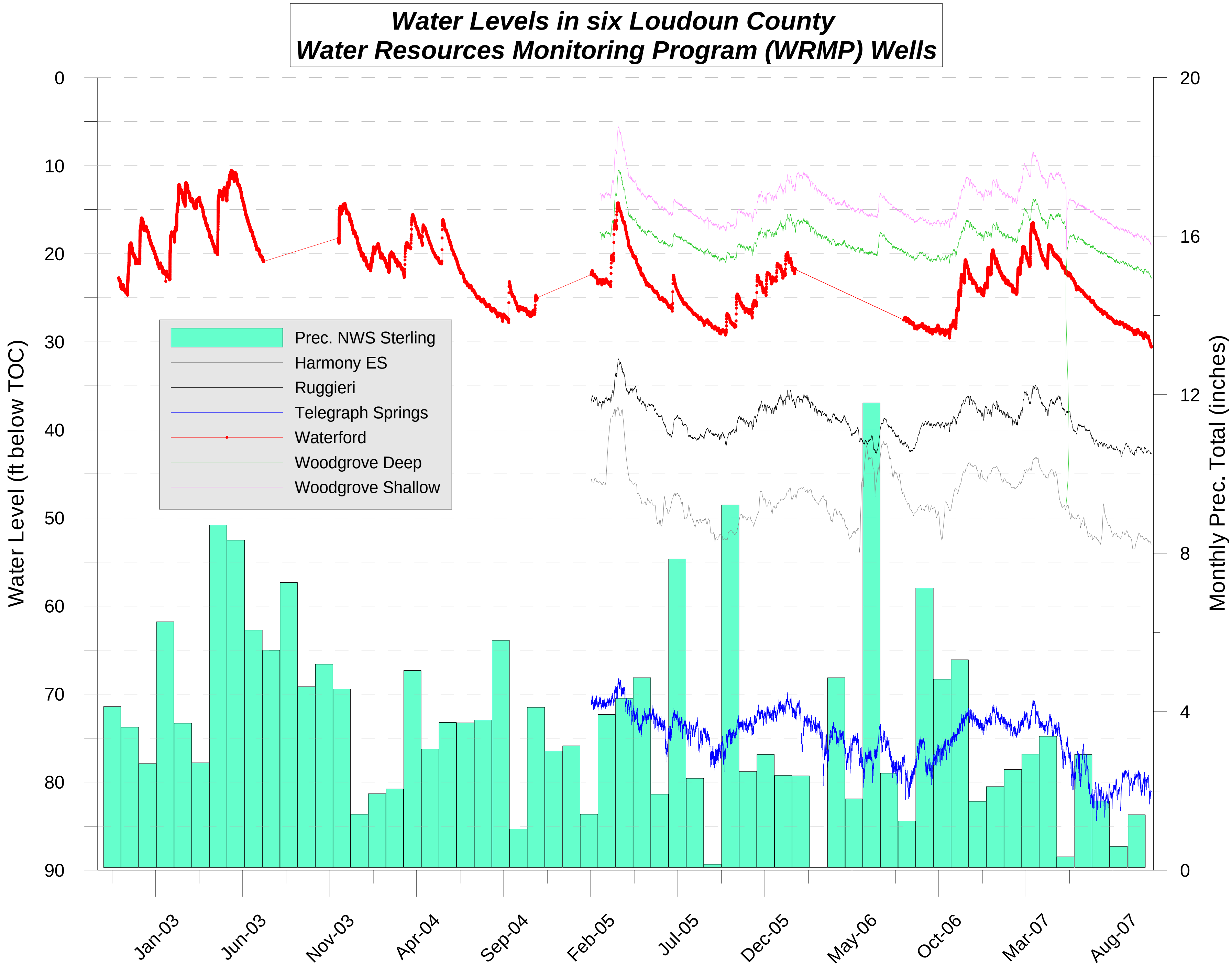
Summary Statistics

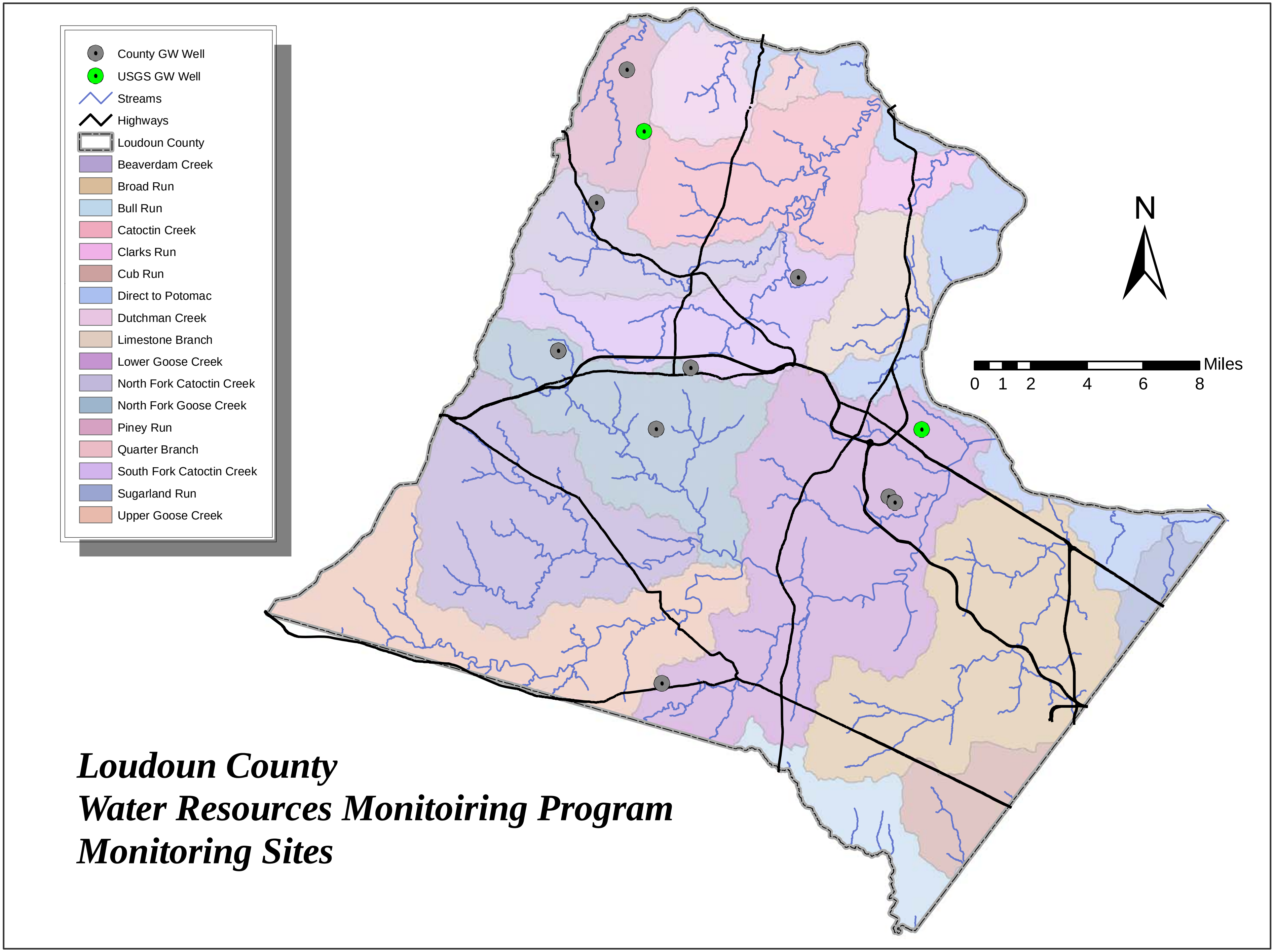
Dry Holes (reported by VDH as WWDH) by Bedrock Classification

BE_ROCK_CL	*Count*
Igneous	325
Igneous extrusive	87
Igneous intrusive	97
Metasedimentary	47
Sedimentary	88
Total	644



Total Number of Reported Dry Wells by Year as
a Percentage of Total Wells Drilled
Reported Dry Holes
Total Wells Drilled
% Dry Holes
1000
800
600
400
200
0
16
12
8
4
0
1970
1975
1980
1985
1990
1995
2000
2005


Water Levels in six Loudoun County
Water Resources Monitoring Program (WRMP) Wells
Water Level (ft below TOC)
Monthly Prec. Total (inches)
0
10
20
30
40
50
60
70
80
90
20
16
12
8
4
0
Prec. NWS Sterling
Harmony ES
Ruggieri
Telegraph Springs
Waterford
Woodgrove Deep
Woodgrove Shallow
Jan-03
Jun-03
Nov-03
Apr-04
Sep-04
Feb-05
Jul-05
Dec-05
May-06
Oct-06
Mar-07
Aug-07



Loudoun County
Water Resources Monitoiring Program
Monitoring Sites

B.3.5 Wells and groundwater quantity (using data sets 1.1, 1.2, 1.3, 1.5, and 3.1)

Hydrostudy Database

USGS Web Download

USGS Groundwater Web Download

This spreadsheet contains hyperlink to execute web queries from USGS NWIS web sites for the groundwater well in Loudoun and one in Prince William. The process includes a complete download of all **daily** data, approved and provisional. There is both field (historic) and daily min/max (more recent values).

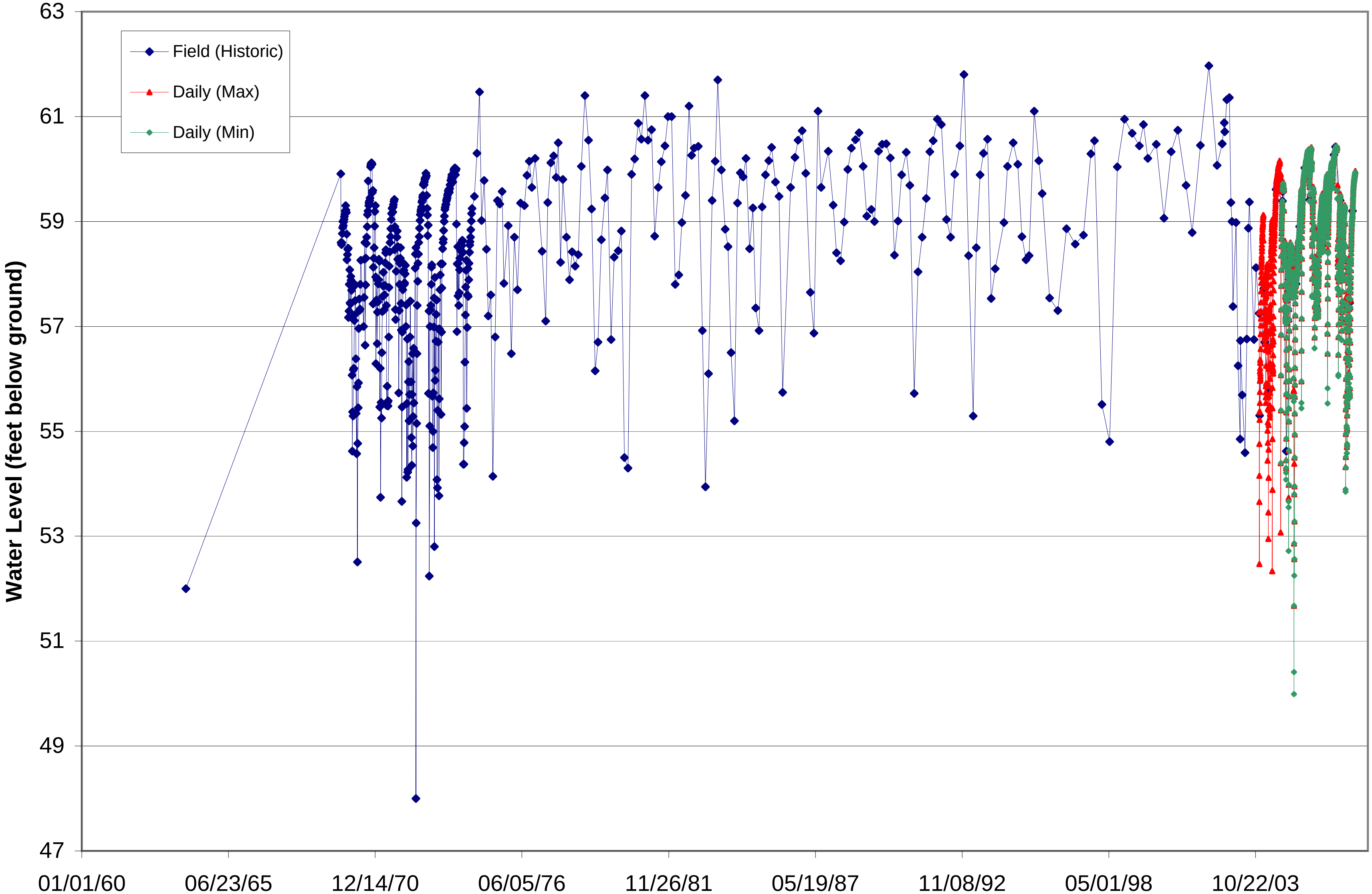
The spreadsheet offers the option to uses data "as is" from last update or update all stations. The update process will takes several minutes to process.

To ensure that data is updated correctly, 3 charts are linked to the data downloads.

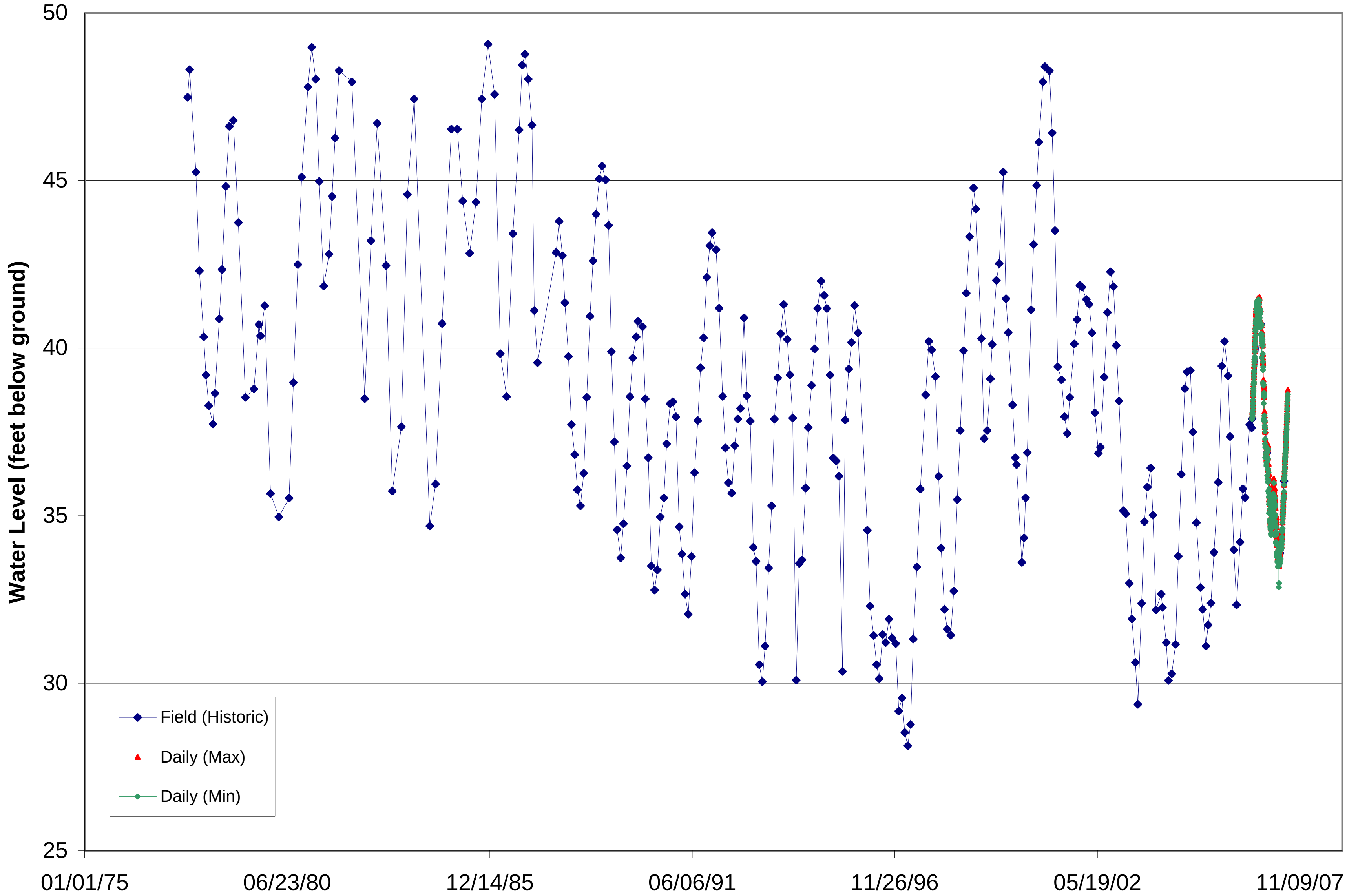
To prepare data for GIS, currently 6 tabs are manuall merged into one tab for loading to pgdb. (To be automated later possibly)

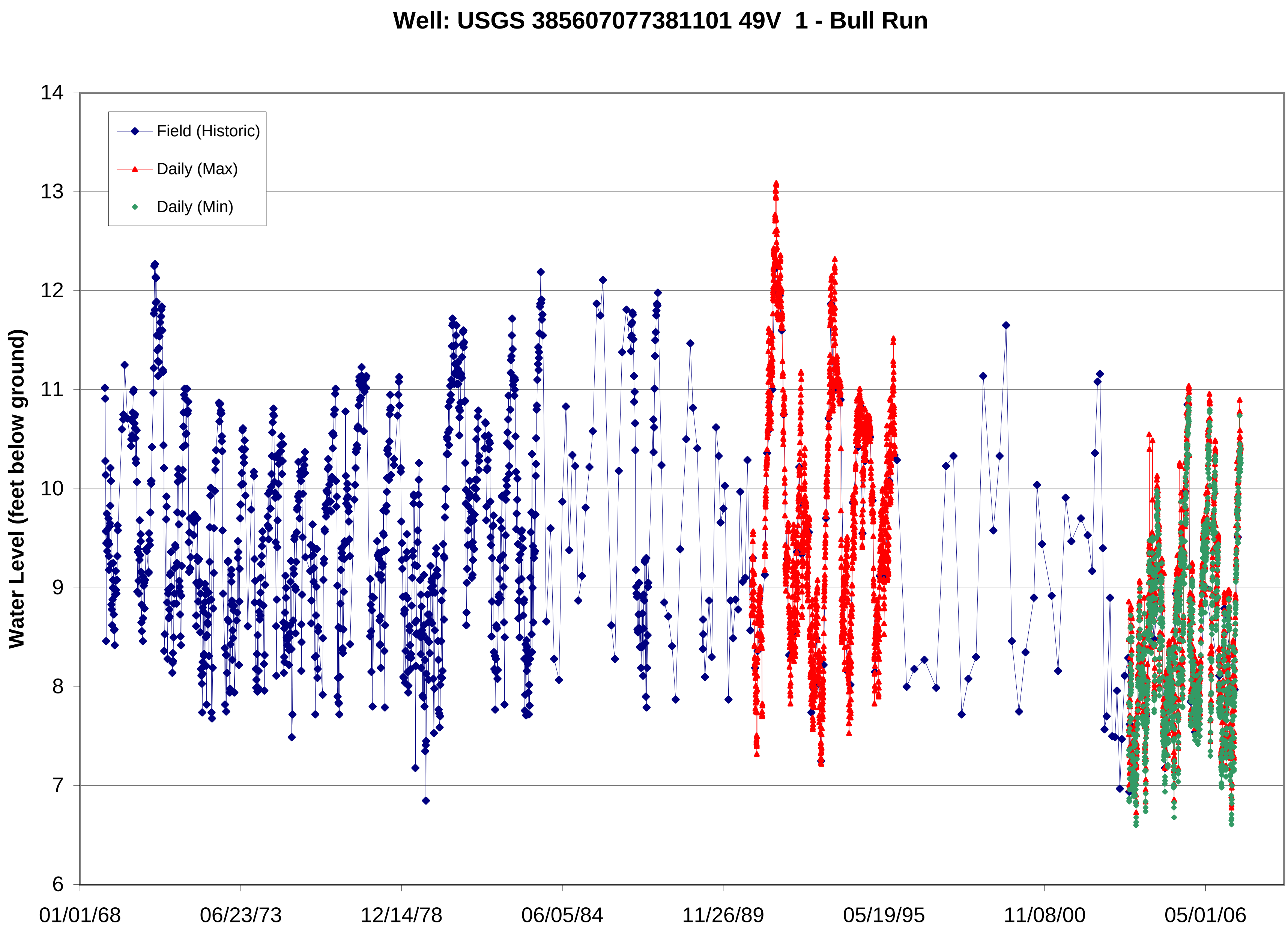
D Ward 7/13/2007

Well: USGS 391542077423801 - 49Y 1 SOW 022 - ATT



Well: USGS 390623077314201 50W 4C - Leesburg




Well: USGS 385607077381101 49V 1 - Bull Run
Water Level (feet below ground)
Field (Historic)
Daily (Max)
Daily (Min)
14
13
12
11
10
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