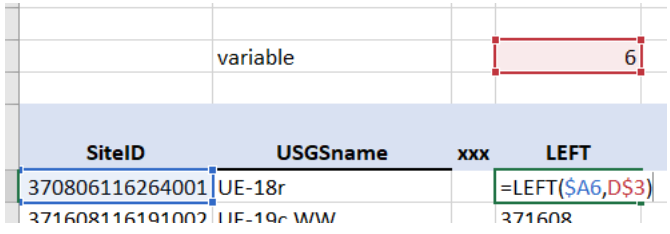
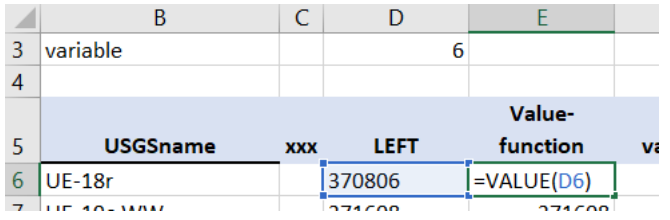
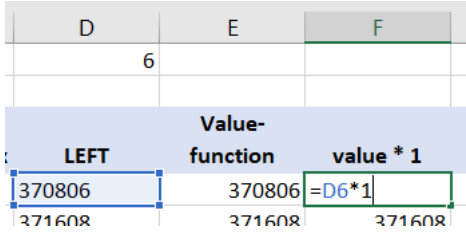
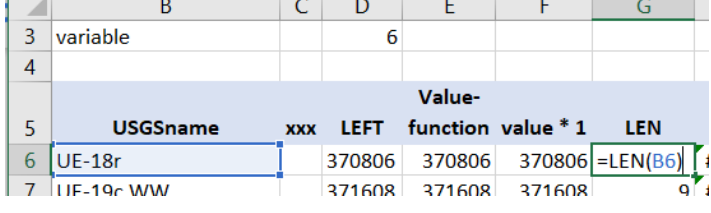
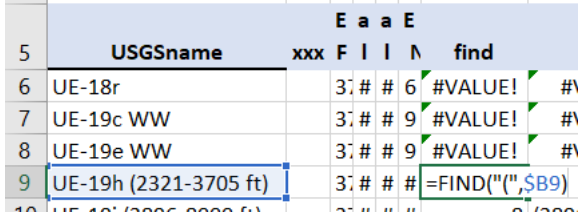


## 03\_Text+Logic\_Functions

Text manipulation is convenient for automating labelling and is necessary many logical tests. Basic text functions are introduced in this section.

### Basic functions – 01\_TextManipulate.xlsx

<p><b>LEFT</b></p> <p>Sample N leftmost characters from number or a text string.</p> <p>Converts numbers to text.</p>	
<p><b>VALUE</b></p> <p>Converts text to numeric value if text can be interpreted as a number.</p>	
<p>Any math operation, + - / *, converts text to numeric value if text can be interpreted as a number.</p>	
<p><b>LEN</b></p> <p>Returns number of characters in a string.</p>	
<p><b>FIND</b></p> <p>Reports position of first character or sub-string being sought in a string.</p> <p>For example, “(” is the 8<sup>th</sup> character in the string “UE-19h (2321-3705 ft).”</p>	

<p><b>MID</b></p> <p>Sample from a user specified position a given number of characters. Converts numbers to text.</p> <p>For example, Sampling 99 characters starting with the 8<sup>th</sup> character in the string “UE-19h (2321-3705 ft)” returns “(2321-3705 ft)”.</p>	
<p><b>RIGHT</b></p> <p>Sample N rightmost characters from number or a text string. Converts numbers to text.</p>	
<p><b>IF and ISNUMBER</b></p> <p>Capture errors with ISNUMBER function and return alternative result rather than an error such as “#VALUE!”.</p>	

Building and activating hyperlinks makes basic data more accessible and verifies site existence. Hyperlinks are created for USGS groundwater data and NDWR well logs in the following example.

## Text and hyperlinks – 01\_TextManipulate.xlsx

<p>Hyperlinks to USGS for groundwater levels in NWIS use</p> <p>“https://nwis.waterdata.usgs.gov/usa/nwis/gwlevels/?site_no=” and the 15-digit site identifier.</p> <p>Build the address with “=\$B\$2&amp;D5” where &amp; concatenates text strings.</p>	
<p>URL is converted to an active link with =HYPERLINK(E5,\$C5), where first entry is address and second entry is more readable text to display.</p>	

Addresses for well logs from NDWR are more complex because PDFs are stored in subfolders for every 1000 logs.

For example,

[http://images.water.nv.gov/images/well\\_logs/07000/7080.pdf](http://images.water.nv.gov/images/well_logs/07000/7080.pdf)

Well log 7080 is in subfolder 07000.

**WELL LOG AND REPORT TO THE STATE ENGINEER OF NEVADA**  
PLEASE COMPLETE THIS FORM IN ITS ENTIRETY

Log No. 7080  
Rec. 19  
Well No. 22.14  
Permit No. 14532  
*Do not fill in*

Owner James M. Daniels Driller L. G. Cook  
Address Salisbury, Nevada Address Box 244 Lathrop Wells, Nev. Lic. No. 779  
Location of well: NE 1/4 Sec. 7 N. T. 17 South 52 in Nye County  
of   
Water will be used for Irrigation Total depth of well 200'  
Size of drilled hole 24" Weight of casing per linear foot   
Thickness of casing 1" Temp. of water 46.0

Root address for NDWR in cell B12 where subfolder and name generalized to **00000** and **Fname** which created and replaced for each well log.

	A	B	C	D
12	NDWR:		<a href="http://images.water.nv.gov/images/well_logs/00000/Fname.pdf">http://images.water.nv.gov/images/well_logs/00000/Fname.pdf</a>	

Calculate subdirectory in C15 with  
"=INT(C15/1000)\*1000".

	A	B	C	D
12	NDWR:		<a href="http://images.water.nv.gov/images/well_logs/00000/F">http://images.water.nv.gov/images/well_logs/00000/F</a>	
13				
14			<b>Well No.</b>	<b>directory</b>
15			7080	=INT(C15/1000)*1000
16			9028	

Substitute **00000** with subfolder in  
=SUBSTITUTE(\$B\$12,E\$14,TEXT(\$D15,\$E\$14))

Subfolder 07000 was converted to text with format 00000 so that leading zero was added.

	A	B	C	D	E
12	NDWR:		<a href="http://images.water.nv.gov/images/well_logs/00000/Fname.pdf">http://images.water.nv.gov/images/well_logs/00000/Fname.pdf</a>		
13					
14			<b>Well No.</b>	<b>directory</b>	<b>00000</b>
15			7080	7000	=SUBSTITUTE(\$B\$12,\$E\$14,TEXT(D15,\$E\$14))
16			9028		

Substitute **Fname** with well log no. in  
=SUBSTITUTE(E15,F\$13,TEXT(C15,"0"))

Modified address in cell E15 is referenced instead of root address for NDWR in cell B12.

	C	D	E	F
14	<b>Well No.</b>	<b>directory</b>	<b>00000</b>	<b>NDWR address</b>
15	7080	7000	<a href="http://images.w">http://images.w</a>	=SUBSTITUTE(E15,"Fname",C15)
16	9028			

URL is converted to an active link with  
=HYPERLINK(F15,C15), where first entry is address and second entry is more readable text to display.

	C	D	E	F	G	H
	<b>Well No.</b>	<b>directory</b>	<b>00000</b>	<b>NDWR address</b>	<b>Hyperlink</b>	
	7080	7000	<a href="http://images.w">http://images.w</a>	<a href="http://images.water.nv.gov/imag">http://images.water.nv.gov/imag</a>	=HYPERLINK(F15,C15)	
	9028					

Bound range of plotted points with IF and AND functions.

## Apply logic functions – 02\_IFplus.xlsx

Highlight range B21:C448.	<table><tr><td></td><td>B</td><td>C</td></tr><tr><td>21</td><td>x</td><td>y</td></tr><tr><td>22</td><td>9.187781</td><td>1.995182</td></tr><tr><td>23</td><td>8.861307</td><td>1.60361</td></tr><tr><td>447</td><td>6.526946</td><td>7.176942</td></tr><tr><td>448</td><td>1.908852</td><td>4.200573</td></tr></table>		B	C	21	x	y	22	9.187781	1.995182	23	8.861307	1.60361	447	6.526946	7.176942	448	1.908852	4.200573																																														
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448	1.908852	4.200573																																																															
Insert a XY scatter plot.  Fix X and Y axes to range from 0 to 10.  Set markers to size 4 open circles with grey outlines.																																																																	
Define limits for X and Y values to plot in a new series.	<table><tr><td></td><td>A</td><td>B</td><td>C</td></tr><tr><td>18</td><td></td><td>X-limits</td><td>Y-limits</td></tr><tr><td>19</td><td>lower</td><td>3</td><td>3</td></tr><tr><td>20</td><td>upper</td><td>8</td><td>9</td></tr></table>		A	B	C	18		X-limits	Y-limits	19	lower	3	3	20	upper	8	9																																																
	A	B	C																																																														
18		X-limits	Y-limits																																																														
19	lower	3	3																																																														
20	upper	8	9																																																														
Define heading in cell D21, =B\$21>"&\$B\$19&" and "&B21<"&\$B\$20&" and "&\$C\$21>"&\$C\$19&" and "&C21<"&\$C\$20	<table><tr><td></td><td>B</td><td>C</td><td>D</td><td>E</td><td>F</td><td>G</td><td>H</td></tr><tr><td>18</td><td>X-limits</td><td>Y-limits</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>19</td><td>3</td><td>3</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>20</td><td>8</td><td>9</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>21</td><td>x</td><td>y</td><td>=B\$21&gt;"&amp;\$B\$19&amp;" and "&amp;B21&lt;"&amp;\$B\$20&amp;" and "&amp;\$C\$21&gt;"&amp;\$C\$19&amp;" and "&amp;C21&lt;"&amp;\$C\$20</td><td></td><td></td><td></td><td></td></tr><tr><td>22</td><td>5.169086</td><td>6.391983</td><td>.</td><td></td><td></td><td></td><td></td></tr><tr><td>23</td><td>6.679569</td><td>9.754276</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>24</td><td>2.912839</td><td>0.579992</td><td></td><td></td><td></td><td></td><td></td></tr></table>		B	C	D	E	F	G	H	18	X-limits	Y-limits						19	3	3						20	8	9						21	x	y	=B\$21>"&\$B\$19&" and "&B21<"&\$B\$20&" and "&\$C\$21>"&\$C\$19&" and "&C21<"&\$C\$20					22	5.169086	6.391983	.					23	6.679569	9.754276						24	2.912839	0.579992					
	B	C	D	E	F	G	H																																																										
18	X-limits	Y-limits																																																															
19	3	3																																																															
20	8	9																																																															
21	x	y	=B\$21>"&\$B\$19&" and "&B21<"&\$B\$20&" and "&\$C\$21>"&\$C\$19&" and "&C21<"&\$C\$20																																																														
22	5.169086	6.391983	.																																																														
23	6.679569	9.754276																																																															
24	2.912839	0.579992																																																															

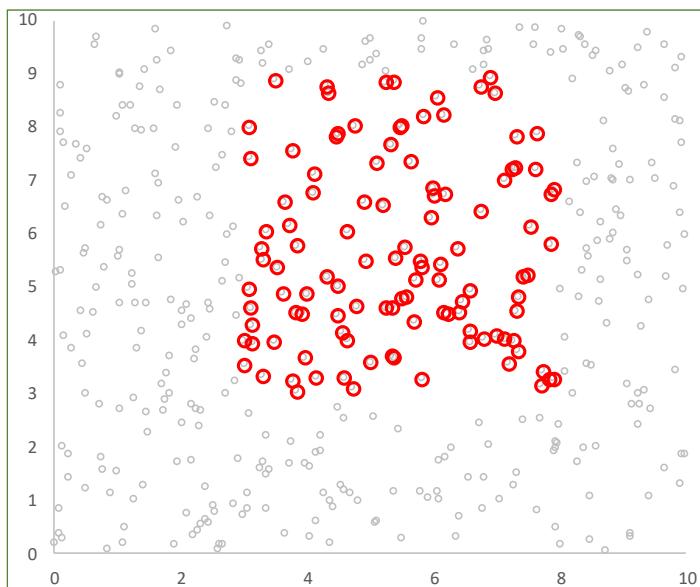
Add equation cell D22,  
`=IF(AND($B22>$B$19,$B22<$B$20,$C22>$C$19,$C22<$C$20),$C22,-9)`

	A	B	C	D	E	F	G	H	I	J
18		X-limits	Y-limits							
19	lower	3	3							
20	upper	8	9							
21		x	y	x>3 and x<8 and y>3 and y<9						
22		9.191685	1.655234	=IF(AND(\$B22>\$B\$19,\$B22<\$B\$20,\$C22>\$C\$19,\$C22<\$C\$20),\$C22,-9)						
23		6.847109	8.694526							

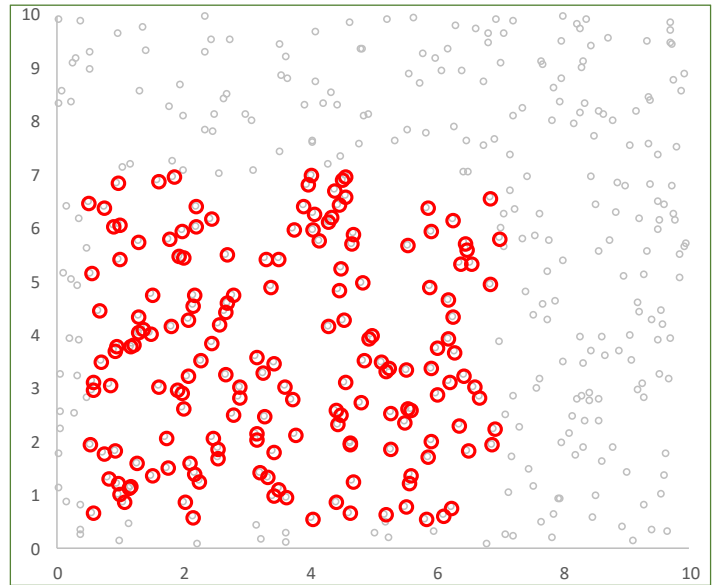
Select cell D22 and double-click lower, right corner of selected cell.

	A	B	C	D
18		X-limits	Y-limits	
19	lower	3	3	
20	upper	8	9	
21		x	y	x>3 and x<8
22		9.191685	1.655234	-9
23		6.847109	8.694526	
24		2.962313	6.398948	
25		4.744163	9.564223	
26		4.218936	8.281635	

Highlight range D21:D448.  
 Add to scatter plot.  
 Format series to a contrasting color.



Vary entries in range B19:C20 to test effect of IF-AND statements.



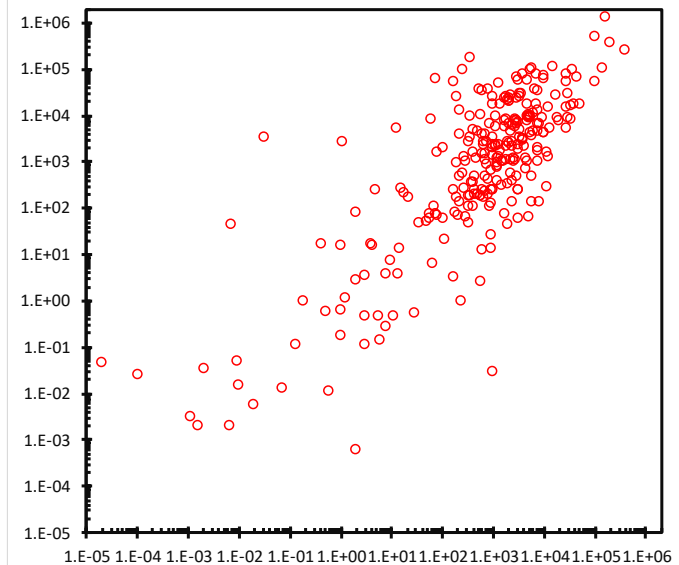
Differentiate aquifer-test results in scatter plots. Aquifer-test results and specific-capacity estimates are a basis and pumped volume is the other basis.

### Apply logic functions – 03\_TransmissivityDV3.xlsx

Highlight range E20:F291.

Insert a XY scatter plot.

Set markers to size 5 open circles with red, 0.75 pt outlines.



Fix X and Y axes to range from 1E-5 to 2.E6.

Set scales to logarithmic.

Specify opposing axis crosses at 1.0E-9.

**Format Axis**

Axis Options ☒ Text Options

☐ ☐ ☒ ☐

**Axis Options**

Bounds

Minimum

Maximum

Units

Major

Minor

Horizontal axis crosses

☐ Automatic

☒ Axis value

☐ Maximum axis value

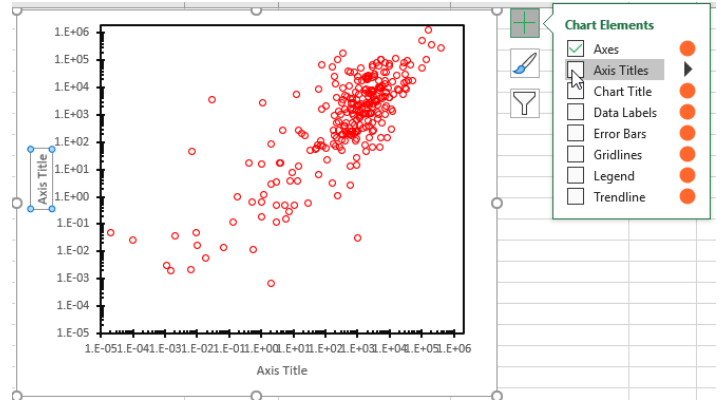
Display units

☐ Show display units label on chart

☒ Logarithmic scale

☐ Values in reverse order

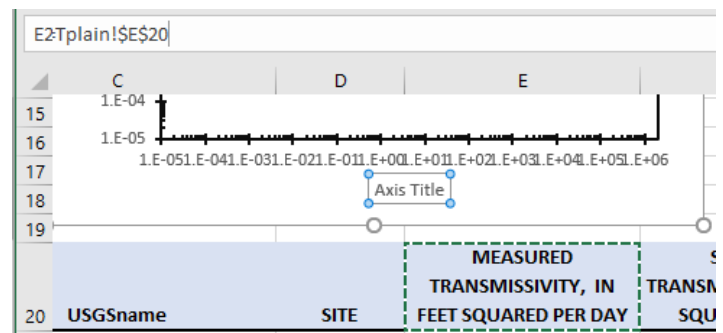
Add axis titles.



Select X-axis title.

Type = in formula bar.

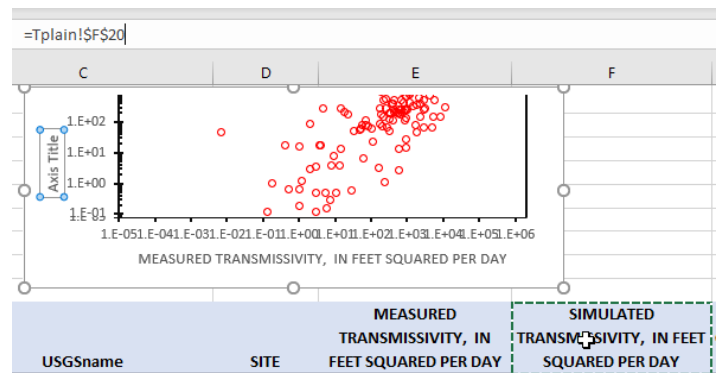
Select cell E20, MEASURED TRANSMISSIVITY, IN FEET SQUARED PER DAY, and return.



Select Y-axis title.

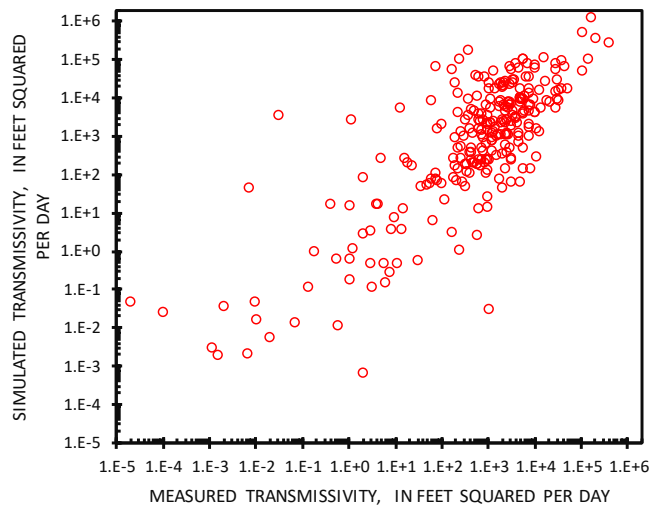
Type = in formula bar.

Select cell F20, SIMULATED TRANSMISSIVITY, IN FEET SQUARED PER DAY, and return.





Plot shows undifferentiated measured and simulated transmissivities. Measured transmissivities are results from aquifer tests and estimates from specific capacities. Simulated transmissivities were sampled from a numerical flow model.



## CATEGORIZE RESULTS—Aquifer test or Specific Capacity

Add new columns for categorizing results.

Label headings Volume, Aquifer Test, and Specific Capacity in cells I20, J20, and K20, respectively.

	G	H	I	J	K
19					
20	Q_Constant, gpm	Duration, days	Volume	Aquifer Test	Specific Capacity
21	239.3399	2			

Calculate volume pumped during aquifer test in cell I21 with  
 $=G21*H21*1440$

Multiplier of 1440 converts gpm to gpd.

	G	H	I	J
19				
20	Q_Constant, gpm	Duration, days	Volume	Aquifer Test
21	239.3399	2	$=G21*H21*1440$	
22	59.0622	2		

All aquifer test results were assigned a USGS site identifier which is 15 digits.

Filter based on length of SiteID.  
 $=IF(LEN(\$B21) = 15, \$F21, \$J\$19)$

	B	F	J	K	L
19			1E-07		
20	SiteID	SIMULATED TRANSMISSIVITY, IN FEET SQUARED PER DAY	Q	Aquifer Test	Specific Capacity
21	370806116264001	50,594.49	29	$=IF(LEN(\$B21)=15, \$F21, \$J\$19)$	

NDWR well logs are all less than 15 digits.

Filter based on length of SiteID.  
 $=IF(LEN(\$B21) <> 15, \$F21, \$J\$19)$

$LEN(\$B21) < 15$  also would work.

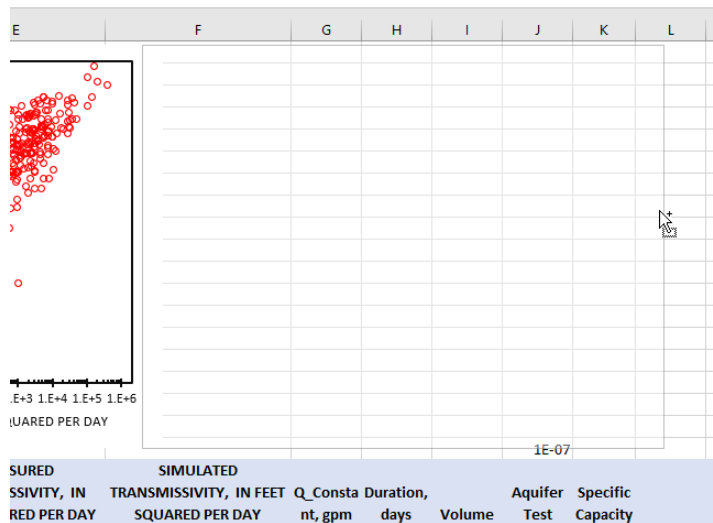
	B	F	J	K	L	M
19			1E-07			
20	SiteID	SIMULATED TRANSMISSIVITY, IN FEET SQUARED PER DAY	Q	Aquifer Test	Specific Capacity	
21	370806116264001	50,594.49	50594.49	$=IF(LEN(\$B21) <> 15, \$F21, \$J\$19)$		

Select range I21:K21 and double-click lower, right corner of selected range.

	H	I	J	K
19			1E-07	
20	Duration, days	Aquifer Volume	Test	Specific Capacity
21	2	689298.9	50594.49	1E-07
22	3			
23	0.145833			

Copy the chart with Ctrl+Drag.

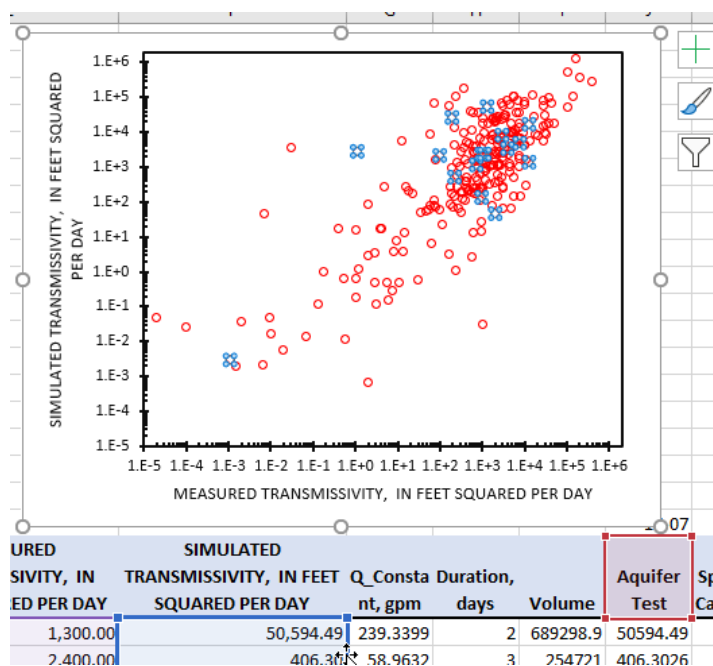
Let go of left-mouse button where you want copy.

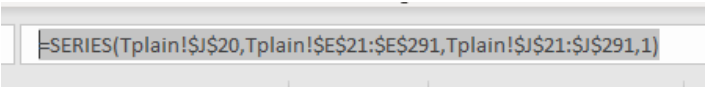
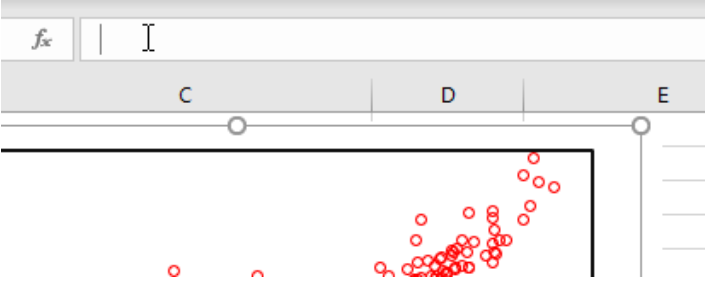
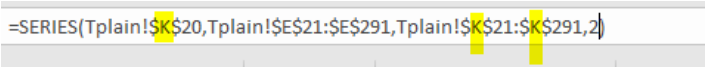
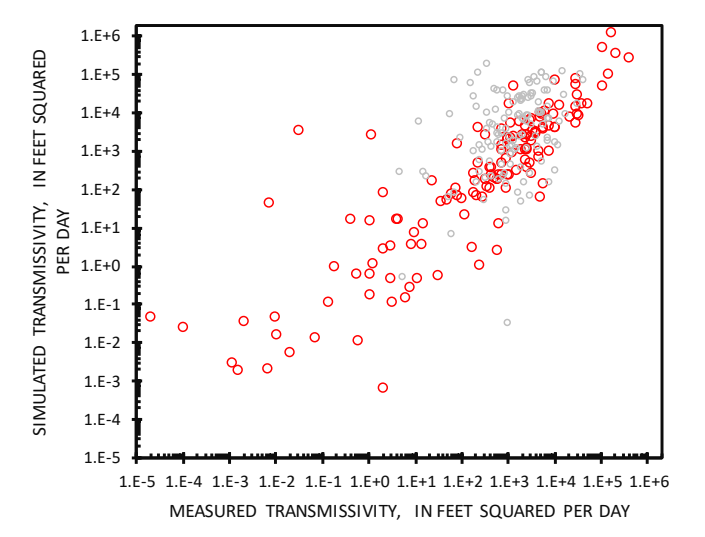
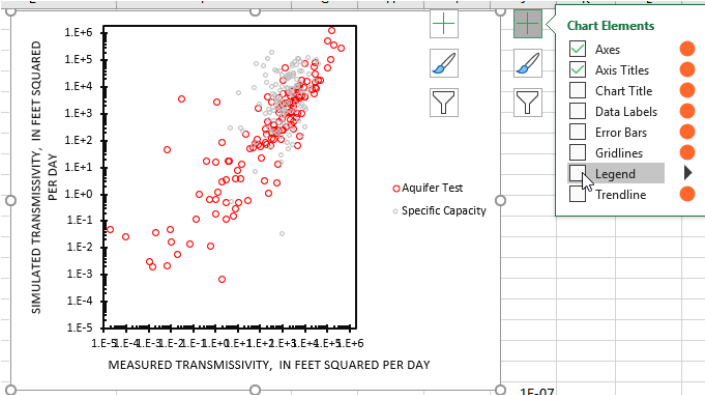


Select series,

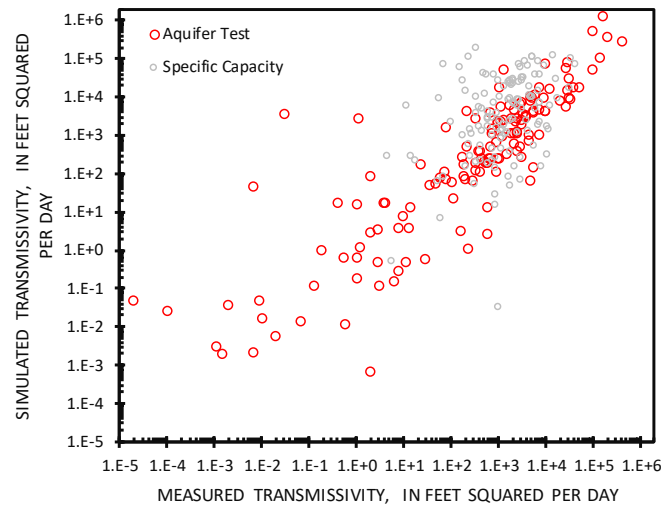
Grab frames around highlighted ranges and move to “Aquifer Test” heading in cell J20 and simulated transmissivities from just aquifer tests in range J21:J291.

Transmissivity estimates from specific capacities were assigned 1.E-7 and do not appear on the chart.



Copy series equation from formula bar.	
Select chart area and Paste series equation into empty formula bar.	
Edit <b>J</b> to <b>K</b> in pasted formula and Change last entry (series order) from <b>1</b> to <b>2</b> .	
Format new series Set marker to an unfilled, size 4 circle with a grey outline and a line weight of 1 pt.	
Add legend	

Move legend and resize plot area in chart.



## CATEGORIZE RESULTS—Pumped Volumes

Define bins of pumped volumes in gallons to categorize results.

Determine minimum volume pumped or displaced in cell L19.

	I	J	K	L	M
19		1E-07		=MIN(I21:I291)	
20	Volume	Aquifer Test	Specific Capacity		
21	689298.9	50594.49	1E-07		
22	254721	406.3026	1E-07		

Determine maximum volume pumped or displaced in cell O19.

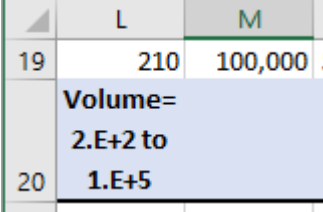
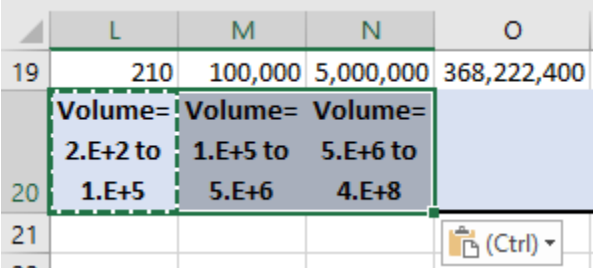
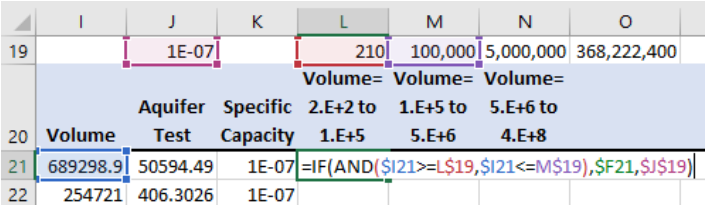
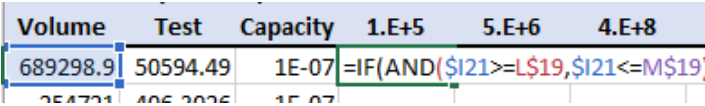
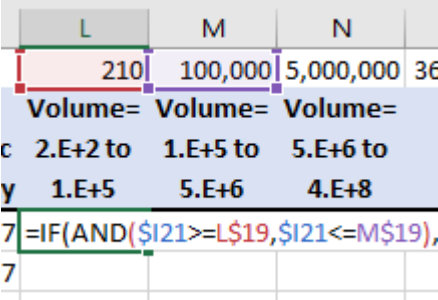
Assign breaks of 100,000 and 5,000,000 in cells M19 and N19.

	I	J	K	L	M	N	O
18	DAY						
19		1E-07		210			=MAX(I21:I291)
20	Volume	Aquifer Test	Specific Capacity				
21	689298.9	50594.49	1E-07				
22	254721	406.3026	1E-07				

Define headings with equations so that labels reflect assigned ranges.

Equation for first heading in cell L20 is =I\$20&"="&TEXT(L19,"0.E+0")&" to "&TEXT(M19,"0.E+0")

	I	J	K	L	M	N	O	P	Q
18	DAY								
19		1E-07		210	100,000	5,000,000	368,222,400		
20	Volume	Aquifer Test	Specific Capacity	=I\$20&"="&TEXT(L19,"0.E+0")&" to "&TEXT(M19,"0.E+0")					
21	689298.9	50594.49	1E-07						

Resulting heading shows,	
Copy cell L20 to range M20:N20.	
Filter based on pumped volumes entered in cell L21 and is =IF(AND(\$I21>=L\$19,\$I21<=M\$19),\$F21,\$J\$19)	
Locking of cell references is variable and significant. References to volume pumped for each aquifer test are \$I21 so column reference is fixed and row reference is relative.	
References to volume pumped for each category are L\$19 and M\$19 so row reference is fixed and column references are relative.	

Copy equation in cell L21 to range L21:N291.

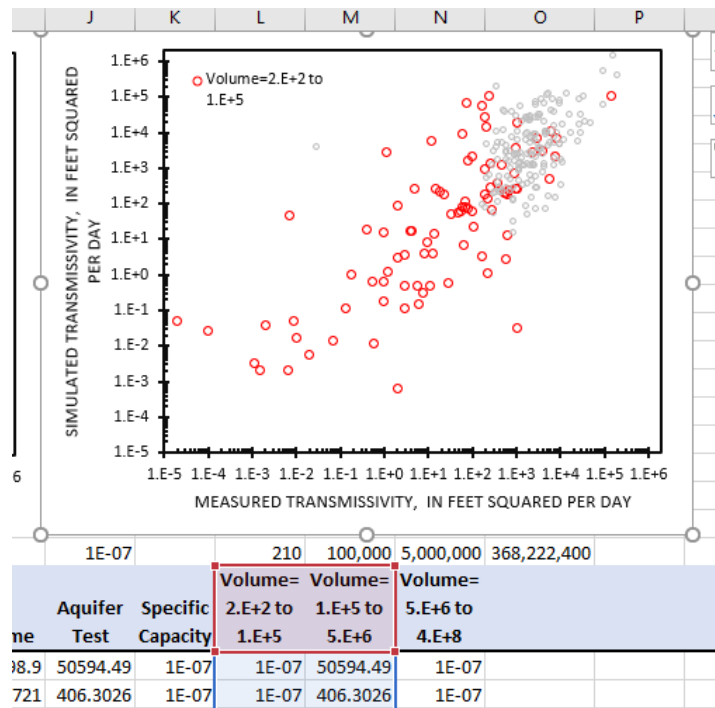
	L	M	N	
19	210	100,000	5,000,000	368,222,400
	Volume=	Volume=	Volume=	
	2.E+2 to	1.E+5 to	5.E+6 to	
20	1.E+5	5.E+6	4.E+8	
21	1E-07	50594.49	1E-07	
22	1E-07	406.3026	1E-07	
23	694.7257	1E-07	1E-07	
24	1E-07	18295.82	1E-07	

Copy the chart with Ctrl+Drag.

Let go of left-mouse button where you want copy.

Select Chart Area.

Drag references to first 2 volume categories in columns **L** and **M**.



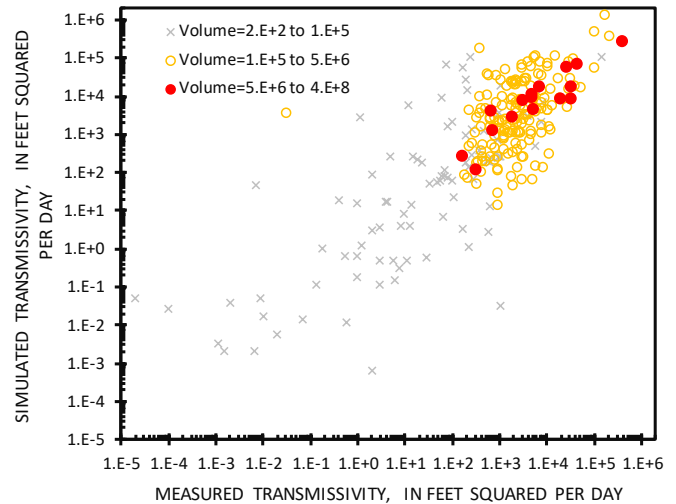
Grab upper, right corner of data range for plot.

	210	100,000	5,000,000	368,222,400
	Volume=	Volume=	Volume=	
	2.E+2 to	1.E+5 to	5.E+6 to	
	1.E+5	5.E+6	4.E+8	
7	1E-07	50594.49		
7	1E-07	406.3026	1E-07	

Drag so that data range expands from 2 columns to 3 columns.

210	100,000	5,000,000	368
Volume=	Volume=	Volume=	
2.E+2 to	1.E+5 to	5.E+6 to	
1.E+5	5.E+6	4.E+8	
1E-07	50594.49	1E-07	
1E-07	406.3026	1E-07	

Format markers so that small volumes are obscure and large volumes are prominent.

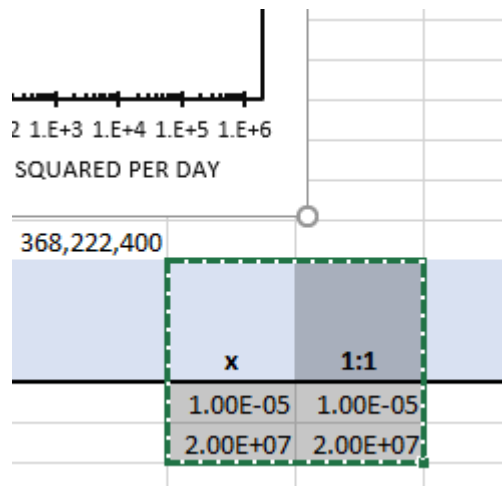


Create and add a 1:1 line.

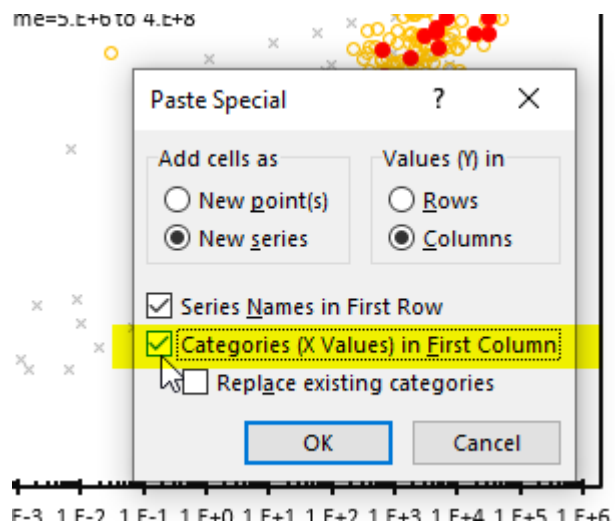
Note preceding apostrophe (') in cell Q20 so that entry is interpreted as text and not converted to a time value of 1:01.

Q20				
	P	Q	R	S
20	x	'1:1		
21	1.00E-05	1.00E-05		
22	2.00E+07	2.00E+07		

Copy range P20:Q22,  
Select chart area, and  
Paste special.

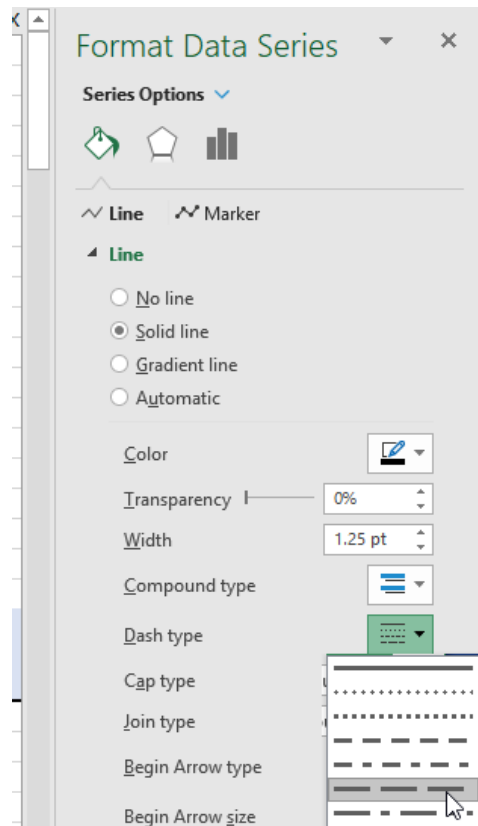


Check New series and  
“Categories (X Values) in First Column.”  
Select OK.

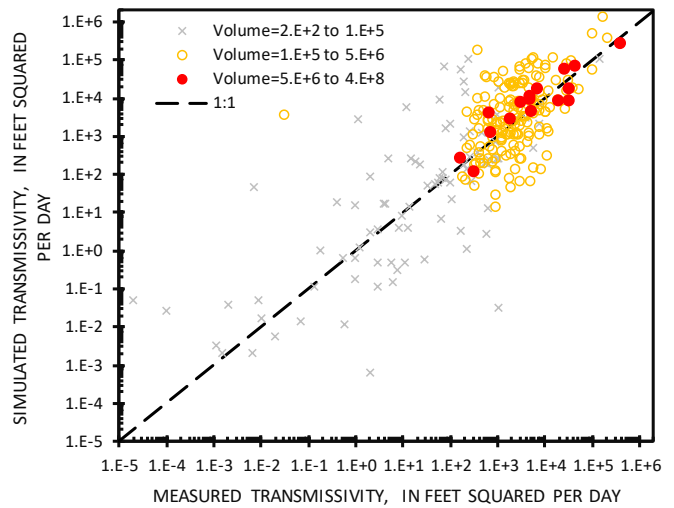




Format 1:1 series with  
No markers,  
Solid, black line with long dashes.

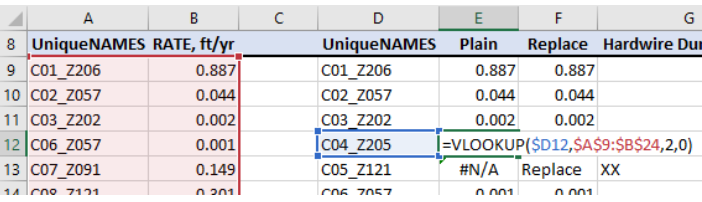
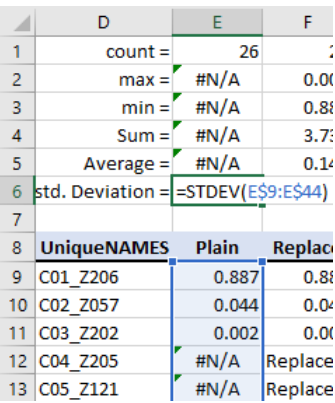
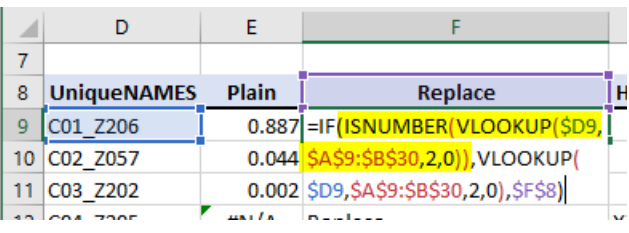
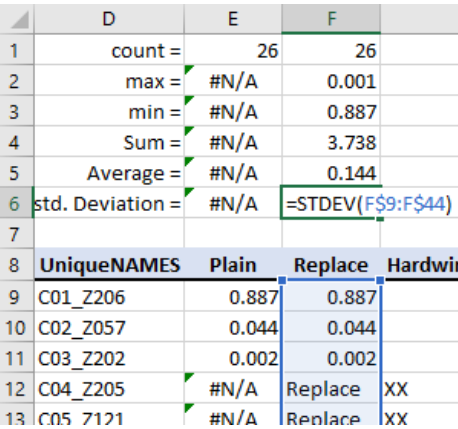


Final plot emphasizes larger pumped  
volumes.



MAX, MIN, SUM, AVERAGE, STDEV and other numerical functions that calculate summary statistics from ranges of data return errors if an error exists in the target range. Identifying errors with an IS.. function such as ISNUMBER and replacing error with a text string will keep statistical functions working correctly.

## Trap errors so statistical functions work – 04\_ErrorHandling.xlsx

<p>VLOOKUP and MATCH functions return an error, #N/A, if an exact match is specified and the sought entry is missing from the lookup range.</p>	 <p>Excel spreadsheet showing data in columns A through G. Row 8 has headers: UniqueNAMES, RATE, ft/yr, UniqueNAMES, Plain, Replace, Hardware. Rows 9-14 contain data. Row 12 shows a VLOOKUP formula: =VLOOKUP(\$D12,\$A\$9:\$B\$24,2,0). The result in cell E12 is #N/A, and the corresponding 'Replace' value in F12 is 'Replace'.</p>
<p>MAX, MIN, SUM, AVERAGE, STDEV functions that encounter a #N/A, #DIV/0!, #VALUE!, or any other error condition in a range echo the first error condition encountered in the target range.</p>	 <p>Excel spreadsheet showing statistical functions in columns D, E, and F. Row 1: count = 26. Row 2: max = #N/A. Row 3: min = #N/A. Row 4: Sum = #N/A. Row 5: Average = #N/A. Row 6: std. Deviation = =STDEV(E\$9:E\$44). Below this is a table with headers: UniqueNAMES, Plain, Replace. Rows 9-13 contain data, with #N/A values in the 'Plain' column and 'Replace' values in the 'Replace' column.</p>
<p>VLOOKUP in this example returns a number or #N/A.</p> <p>ISNUMBER says result is OK if true, so VLOOKUP occurs on TRUE side of IF.</p> <p>Text string in cell F8, Replace, is reported if ISNUMBER is FALSE.</p>	 <p>Excel spreadsheet showing data in columns D, E, and F. Row 8 has headers: UniqueNAMES, Plain, Replace. Row 9 shows an IF formula: =IF(ISNUMBER(VLOOKUP(\$D9,\$A\$9:\$B\$30,2,0)),VLOOKUP(\$D9,\$A\$9:\$B\$30,2,0),\$F\$8). The result in cell F9 is 0.887.</p>
<p>MAX, MIN, SUM, AVERAGE, STDEV functions work correctly if text string is encountered.</p>	 <p>Excel spreadsheet showing statistical functions in columns D, E, and F. Row 1: count = 26. Row 2: max = #N/A. Row 3: min = #N/A. Row 4: Sum = #N/A. Row 5: Average = #N/A. Row 6: std. Deviation = =STDEV(F\$9:F\$44). Below this is a table with headers: UniqueNAMES, Plain, Replace, Hardware. Rows 9-13 contain data, with #N/A values in the 'Plain' column and 'Replace' values in the 'Replace' column.</p>