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Goal Seek Pamphlet II forVIDRA© - HCID#1

(version 2.6 / December 18, 2008)

By:
Allen W. Sturdivant
Texas AgriLife Extension Service
Texas AgriLife Research and Extension Center, Weslaco, TX

M. Edward Rister, Ronald D. Lacewell
Texas AgriLife Research,
Department of Agricultural Economics, Texas A&M University, College Station, TX

Callie S. Rogers
Formerly with Texas AgriLife Research, Texas A&M University, College Station, TX

Texas Water Resources Institute Technical Report
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Texas Water Resources Institute
make every drop count

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***Goal Seek* Pamphlet II**

for

VIDRA© - HCID#1

(version 2.6 / December 18, 2008)

using

Microsoft® Excel® 2003

Texas Water Resources Institute Report:
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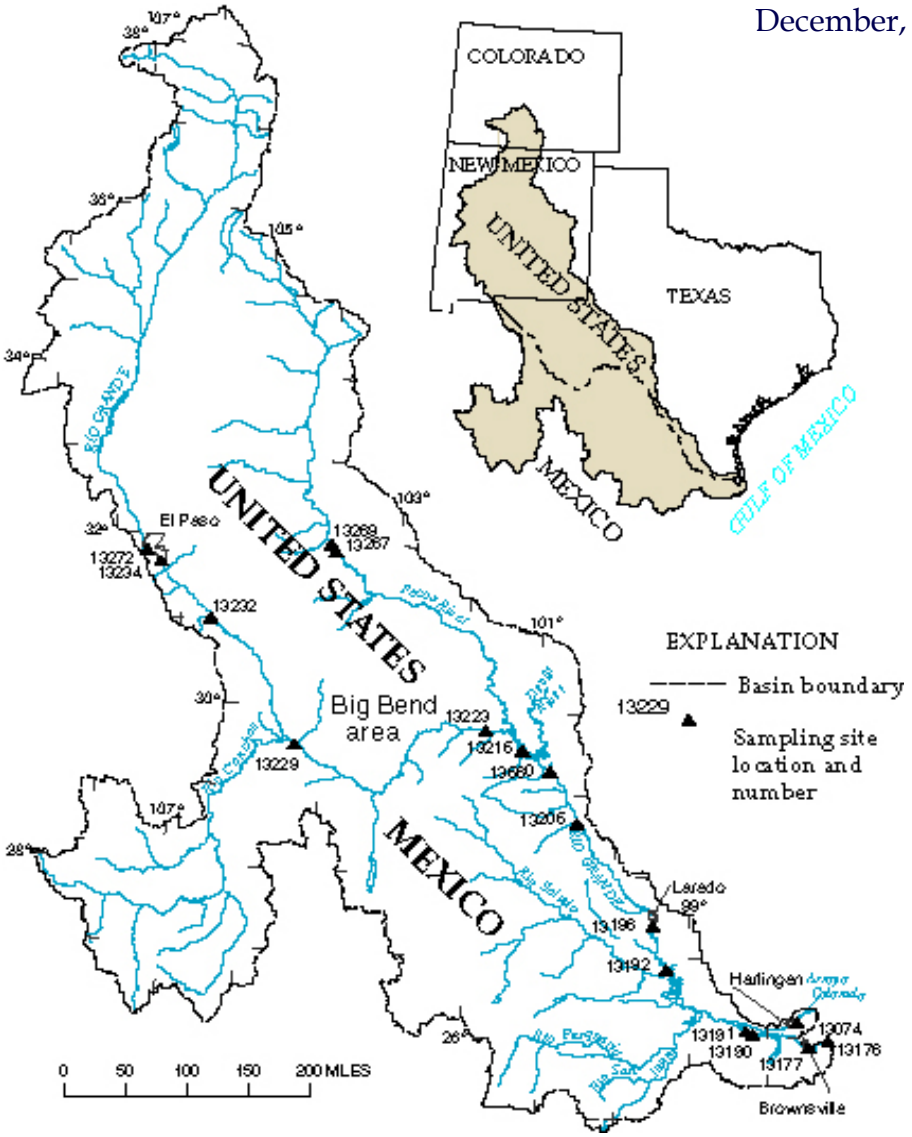

All photographic images of Excel® dialog boxes were obtained at http://www.experts-exchange.com and http://www.dslimited.biz/excel_tutorials/goalseek.html using Google™ Images at http://images.google.com/imghp

Cover page graphic obtained at http://pubs.usgs.gov/fs/1997/fs-098-97/fig1.htm using Google™ Images at http://images.google.com/imghp

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About VIDRA© - HCID#1

VIDRA© (Valley Irrigation District Rate Analyzer) is a work-in-process and is being (has been) developed with collaboration from Hidalgo County Irrigation District No. 1 (HCID#1) and other Lower Rio Grande Valley irrigation districts. The primary function of VIDRA© is to provide an irrigation district (ID) a means of 'what-if' analysis for analyzing an upcoming year's potential estimated financial data with simultaneous changes in rates, expenses, or other water-delivery related parameters for the irrigation district. In addition, one can make a separate VIDRA© worksheet copy and then input actual, end-of-the-year data for a post-year analysis. That is, both 'budgeted' and 'historical' versions of analysis are possible. Though robust, VIDRA©s purpose is to provide a focal point for conversation, information, and insights only, not provide absolute authority over the decision making of rates and/or other ID policies.

Though careful efforts to insure complete formulae accuracy have been incorporated, no expressed or implied guarantees are provided with regards to VIDRA© - HCID#1. All responsibility lies with the user. Analyses using VIDRA© require accurate, complete, and correctly-placed data input, as well as proper interpretive skills of the user. Substantial Microsoft® Excel® spreadsheeting skills are also a must. VIDRA© - HCID#1 is customized for HCID#1 ("the District") and meant for limited distribution. Providing copies to others separate from the District is prohibited.

Basics of Goal Seek

In typical spreadsheet operations, you enter input data and look at a formula-generated result value for the answer. And, sometimes, it is common to repeatedly change a data-input item until a desired result is obtained. Using the ***Goal Seek*** feature of Microsoft® Excel® is a great way to *cut to the chase* with *what-if* analyses in Excel® when you know your 'desired answer' for a particular formula, but need to know what the input data value is that provides that answer. So, rather than using the ususal 'hit or miss' technique for individual formulae, let's tell the spreadsheet what the answer is and let Goal Seek tell us what the correct data input is/was/should be. In effect, Goal Seek provides a simple sensitivity analysis; i.e., solves for a data input item while holding all other data input values constant.

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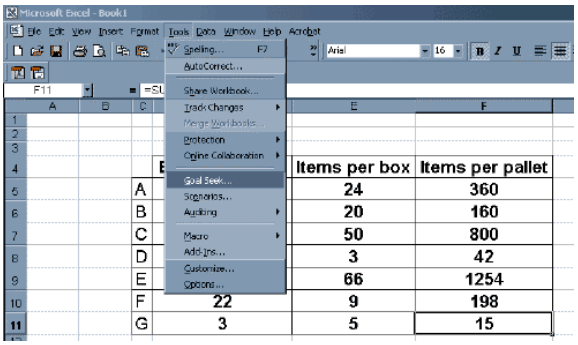
[1] Texas AgriLife Extension Service, TAMU AgriLife Research and Extension Center, Weslaco, TX.

[2] Texas AgriLife Research, Department of Agricultural Economics, Texas A&M University, College Station, TX.

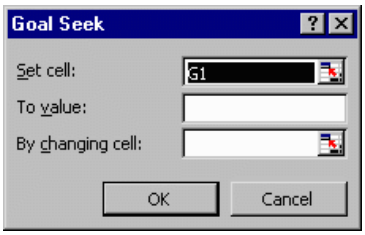
[3] Formerly with Texas AgriLife Research, Texas A&M University, College Station, TX.

Using Goal Seek (generically) in Excel® 2003

Step 1: Click ***Tools*** in the Excel® menu bar, and select ***Goal Seek***.

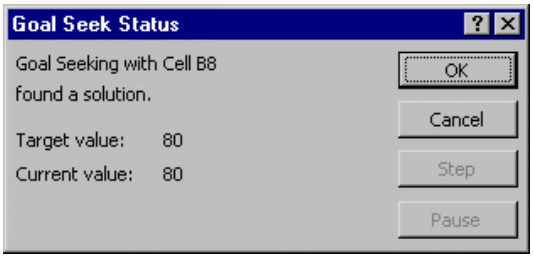


You will see a dialog box like this pop up:



Step 2: - Enter the cell address containing the formula you 'know the answer to' in **Set cell:**.
- Enter the 'answer' (or value) you wish to superimpose onto the formula in **To value:**.
- Enter the cell address of the data input you wish to know (or change) in **By changing cell:**.[4]
- Click **OK**.

Step 3: - After a moment, a dialog box similar to the one below will advise you that ***Goal Seek*** is finished.
- Simply click **OK** to close this dialog box and accept the data-input changes (or click on the **Cancel** button to ignore the data-input changes and exit the ***Goal Seek*** function).[5]



*Now, look at the cell address you entered in **Set cell**; it contains the value (or 'answer') you specified in **To value**. The 'answer' is also displayed in the dialog box as the Target Value -- the Current Value will likely be the same, but, in certain circumstances, may vary for 'rounding error' reasons. Look at the data-input cell you changed (or 'want to know') in **By changing cell** and you will see the data input level required to obtain the desired answer.*

---

4 This cell cannot contain a formula, only numbers.

5 If, after accepting the data input changes, you wish to return **Set cell** (i.e., the answer cell) to its beginning or starting value, simply reset (or overwrite) the data (i.e., **By changing cell**) to its original (prior) value.

The Goal Seek Area (in VIDRA©- HCID#1)

In the VIDRA© version custom built for HCID#1, you will see several individual cells which have been formulated and grouped together in an area below the main model area to facilitate *what-if* analysis of rate-related issues using the Goal Seek function. This clustered area of related Goal Seek functions are separate from the main model area and do not prohibit other, separate Goal Seek tasks being performed within the model. The difference is that Goal Seek tasks performed within this clustered Goal Seek area can be operated without affecting the baseline model solution results, while standard Goal Seek tasks performed within the main model area will affect such baseline results. The clustered Goal Seek formulae are easily identified as the golden-colored cells found within the cell range G570:G622 (see excerpt below).[6] These are the cell addresses you identify (individually) in the dialog box found in Step 2 (i.e., in **Set cell**) as containing the formula you 'know the answer to.' Don't worry, as long as the Worksheet Protection is turned on, you cannot accidentally delete the formulae in the golden-colored cells (i.e., **Set cell** areas).

	A	B	C	D	E	F	G
568							Goal Seek Values
569		1a) What are the revenue changes associated with an **Agriculture** (in & outside District) rate change ?					
570		» revenue with an Ag FLAT-RATE change from $ 18 to $ 18 per acre					$ -
571		» revenue with an Ag METERED DRIP change from $ 0 to $ 0 per ac-ft					$ -
572		» revenue with an Ag METERED FLOOD change from $ 18.75 to $ 18.75 per ac-ft					$ -
573		» revenue with an Ag Non-METERED FLOOD change from $ 11 to $ 11 per acre					$ -
574		» revenue with a METERED ACCOUNT for ponds, golf courses, nurseries change from $ 0 to $ 0 per ac-ft					$ -
575		» revenue with a NON-METERED ACCOUNT for residential lawns change from $ 18 to $ 18 per irrigation					$ -
577		» revenue with an OUTSIDE THE DISTRICT - Metered Drip change from $ 0 to $ 0 per ac-ft					$ -
578		» revenue with an OUTSIDE THE DISTRICT - Metered Flood change from $ 22 to $ 22 per ac-ft					$ -
579		» revenue with an OUTSIDE THE DISTRICT - Non-Metered Flood change from $ 17.39 to $ 17.39 per ac-ft					$ -
581		» revenue with an IRRIGATION DISTRICT #13 change from $ 22 to $ 22 per ac-ft					$ -
582		» revenue with a IRRIGATION DISTRICT #15 change from $ 12.73 to $ 12.73 per ac-ft					$ -
583		1b) What are the revenue changes associated with a **Municipal** (Delivery) rate change ?					
584		» revenue from Sharyland WSC (HCID #1 owned rights - for city) with a DELIVERY rate change from $ 0.1267 to $0.1267 per 1,000 gal.					$ -
585		» revenue from Sharyland WSC (Municipal owned rights) with a DELIVERY rate change from $ 0.1267 to $0.1267 per 1,000 gal.					$ -
586		» revenue from Sharyland WSC (HCID #1 owned rights - from subdivisions) with a DELIVERY rate change from $ 0 to $0 per 1,000 gal.					$ -
588		» revenue from NAWSC (HCID #1 owned rights - for city) with a DELIVERY rate change from $ 0.1267 to $0.1267 per 1,000 gal.					$ -
589		» revenue from NAWSC (Municipal owned rights) with a DELIVERY rate change from $ 0 to $0 per 1,000 gal.					$ -
590		» revenue from NAWSC (HCID #1 owned rights - from subdivisions) with a DELIVERY rate change from $ 0 to $0 per 1,000 gal.					$ -
592		» revenue from City of Edinburg (HCID #1 owned rights - for city) with a DELIVERY rate change from $ 0.1267 to $0.1267 per 1,000 gal.					$ -
593		» revenue from City of Edinburg (Municipal owned rights) with a DELIVERY rate change from $ 0 to $0 per 1,000 gal.					$ -
594		» revenue from City of Edinburg (HCID #1 owned rights - from subdivisions) with a DELIVERY rate change from $ 0 to $0 per 1,000 gal.					$ -
596		» revenue from City of McAllen (HCID #1 owned rights - for city) with a DELIVERY rate change from $ 0 to $0 per 1,000 gal.					$ -
597		» revenue from City of McAllen (Municipal owned rights) with a DELIVERY rate change from $ 0 to $0 per 1,000 gal.					$ -
598		» revenue from City of McAllen (HCID #1 owned rights - from subdivisions) with a DELIVERY rate change from $ 0 to $0 per 1,000 gal.					$ -
600		» revenue from New City #1 (HCID #1 owned rights - for city) with a DELIVERY rate change from $ 0 to $0 per 1,000 gal.					$ -
601		» revenue from New City #1 (Municipal owned rights) with a DELIVERY rate change from $ 0 to $0 per 1,000 gal.					$ -
602		» revenue from New City #1 (HCID #1 owned rights - from subdivisions) with a DELIVERY rate change from $ 0 to $0 per 1,000 gal.					$ -
604		» revenue from New City #2 (HCID #1 owned rights - for city) with a DELIVERY rate change from $ 0 to $0 per 1,000 gal.					$ -
605		» revenue from New City #2 (Municipal owned rights) with a DELIVERY rate change from $ 0 to $0 per 1,000 gal.					$ -
606		» revenue from New City #2 (HCID #1 owned rights - from subdivisions) with a DELIVERY rate change from $ 0 to $0 per 1,000 gal.					$ -
608		2a) What % change in ALL rates gives a pre-determined '***Operating Income/(Loss)***' ?					
609		» 'Operating Income/(Loss)' when all rates change (from the baseline) by 0 %					$ (862,092)
610		? baseline 'Operating Income/(Loss)' before rate changes ?					$ (862,092)
611		2b) What % change in ALL rates gives a pre-determined '***Net Income/(Loss)***' ?					
612		» 'Net Income/(Loss)' when all rates change (from the baseline) by 0 %					$ 1,329,480
613		? baseline 'Projected Profit' before rate changes ?					$ 1,329,480
614		3a) What ***individual rates*** force **Ag Revenue** (% total) to ***equal*** **Ag Deliveries** (% total) ?					
615		» Ag Revenue % minus Ag Deliveries % ? Ag FLAT-RATE from $ 18 to $ 18 per acre					-48.1%
616		» Ag Revenue % minus Ag Deliveries % ? Ag METERED DRIP (in District) from $ 0 to $ 0 per delivery					-48.1%
617		» Ag Revenue % minus Ag Deliveries % ? Ag METERED FLOOD (in District) from $ 18.75 to $ 18.75 per delivery					-48.1%
618		» Ag Revenue % minus Ag Deliveries % ? Ag NON-METERED FLOOD (in District) from $ 11 to $ 11 per delivery					-48.1%
620		3b) What % change in **ALL AG RATES** force **Ag Revenue %** to ***equal*** **Ag Deliveries %** ?					
621		» Ag Revenue (as a % of OPERATING REVENUES) minus Ag Deliveries % ?					-7.7%
622		» Ag Revenue (as a % of TOTAL REVENUES) minus Ag Deliveries % ?					-48.1%

[6] Range is correct for version 2.6 dated December 18, 2008.

Once you have performed a Goal Seek task and have accepted the data-input changes, note that the text to the left of the **Set cell** cell (i.e., golden-colored cell) changes to reflect the new rate. For example, if you were to **Set cell** G570 to 100000 (i.e., $100,000) **By changing cell** E511 (see below), the text beginning in B570 would change to reflect the new rate, while cell G570 would display $100,000.

Questions 2a and 2b are designed to provide baseline analysis results in cells G610 and G613, regardless of the Goal Seek analysis. This provides a means of comparing the "beginning" and the "new" values. For example, if you were to **Set cell** G609 to 0 (i.e., $0) **By changing cell** H509 (see below), you can compare a "break-even" situation with the prior baseline income/(loss) value of $(862,092) in G610.

	A	B	C	D	E	F	G	H	I
507									
508			Original Rates - click to set to default -	question(s):	1a, 1b, 3a		question(s):	2a, 2b, 3b	
509				Original Rate	Goal Seek Level	% change	100%	100.0%	Resulting
510		**Agriculture Irrigation Water - In District**							
511		Flat Rate (thereafter acres)		$ 18.00	$ 18.00	0.000%	$ 18.00	100.0%	$ 18.00
512		Metered Drip		$ -	$ -	0.000%	$ -	100.0%	$ -
513		Metered Flood		$ 18.75	$ 18.75	0.000%	$ 18.75	100.0%	$ 18.75
514		Non-Metered Flood		$ 11.00	$ 11.00	0.000%	$ 11.00	100.0%	$ 11.00
515		Metered Accounts: *ponds, golf courses, nurseries*		$ -	$ -	0.000%	$ -	100.0%	$ -
516		Non-Metered Accounts: *residential lawns*		$ 18.00	$ 18.00	0.000%	$ 18.00	100.0%	$ 18.00
517		**Agriculture Irrigation Water - Outside the District**							
518		Metered Drip		$ -	$ -	0.000%	$ -	100.0%	$ -
519		Metered Flood		$ 22.00	$ 22.00	0.000%	$ 22.00	100.0%	$ 22.00
520		Non-Metered Flood		$ 17.39	$ 17.39	0.000%	$ 17.39	100.0%	$ 17.39
521		**Agriculture Irrigation Water - to Other IDs**							
522		Irrigation District #13		$ 22.00	$ 22.00	0.000%	$ 22.00	100.0%	$ 22.00
523		Irrigation District #15		$ 12.73	$ 12.73	0.000%	$ 12.73	100.0%	$ 12.73
524		**Municipal Water - Delivery Rates**							
525		***Sharyland Water Supply Corp.***	» HCID #1 Owned Rights - (for city)	$ 0.1267	$ 0.1267	0.000%	$ 0.1267	100.0%	$ 0.1267
526			» Municipality Owned Rights	$ 0.1267	$ 0.1267	0.000%	$ 0.1267	100.0%	$ 0.1267
527			» HCID #1 Owned Rights - (from subdivisions)	$ -	$ -	0.000%	$ -	100.0%	$ -
528		***North Alamo Water Supply Corp.***	» HCID #1 Owned Rights - (for city)	$ 0.1267	$ 0.1267	0.000%	$ 0.1267	100.0%	$ 0.1267
529			» Municipality Owned Rights	$ -	$ -	0.000%	$ -	100.0%	$ -
530			» HCID #1 Owned Rights - (from subdivisions)	$ -	$ -	0.000%	$ -	100.0%	$ -
531		***City of Edinburg***	» HCID #1 Owned Rights - (for city)	$ 0.1267	$ 0.1267	0.000%	$ 0.1267	100.0%	$ 0.1267
532			» Municipality Owned Rights	$ -	$ -	0.000%	$ -	100.0%	$ -
533			» HCID #1 Owned Rights - (from subdivisions)	$ -	$ -	0.000%	$ -	100.0%	$ -
534		***City of McAllen***	» HCID #1 Owned Rights - (for city)	$ -	$ -	0.000%	$ -	100.0%	$ -
535			» Municipality Owned Rights	$ -	$ -	0.000%	$ -	100.0%	$ -
536			» HCID #1 Owned Rights - (from subdivisions)	$ -	$ -	0.000%	$ -	100.0%	$ -
537		***New Customer #1***	» HCID #1 Owned Rights - (for city)	$ -	$ -	0.000%	$ -	100.0%	$ -
538			» Municipality Owned Rights	$ -	$ -	0.000%	$ -	100.0%	$ -
539			» HCID #1 Owned Rights - (from subdivisions)	$ -	$ -	0.000%	$ -	100.0%	$ -
540		***New Customer #2***	» HCID #1 Owned Rights - (for city)	$ -	$ -	0.000%	$ -	100.0%	$ -
541			» Municipality Owned Rights	$ -	$ -	0.000%	$ -	100.0%	$ -
542			» HCID #1 Owned Rights - (from subdivisions)	$ -	$ -	0.000%	$ -	100.0%	$ -
543		**Industrial & Mining Water**							
544		Industrial Customer #1		$ -	$ -	0.000%	$ -	100.0%	$ -
545		Mining Customer #1		$ -	$ -	0.000%	$ -	100.0%	$ -
546		**Contract Sales**							
547		Contract (Spot) Sales - Ag		$ -	$ -	0.000%	$ -	100.0%	$ -
548		Contract (Spot) Sales - Municipal		$ -	$ -	0.000%	$ -	100.0%	$ -
549		Contract (Spot) Sales - Industrial		$ -	$ -	0.000%	$ -	100.0%	$ -
550		Contract (Spot) Sales - Mining		$ -	$ -	0.000%	$ -	100.0%	$ -
551									

Goal Seek results for questions 3a and 3b should be considered with caution. Situations where drastic differences in the percent of revenues coming from ag irrigation and the percent of deliveries being ag irrigation exist and, when one wishes to balance the two (i.e., **Set cell** to 0 (i.e., 0% difference)), can cause for unrealistic results. That is, these Goal Seek scenarios are individualistic in nature and when severe distortions between the percentages of ag revenues and ag deliveries exist, one cannot expect to collapse that difference by changing a single input variable. Furthermore, the two items associated with Goal Seek scenario 3b impacts Ag rates ONLY! Although the user will see changes made to municipal, industrial, and mining rates in cell range I525:I550 after solving a Goal Seek scenario, the user can disregard those changed rates and only pay attention to the changed Ag rates. A desire to facilitate changes to all rates in a common area (i.e., one area, versus one for ag, one for municipal and industrial, and one for all three) necessarily

forces this inconsistency.

The cell address of the data input you wish to know/change depends upon the question number and which sub-item. Cell range D508:I550 (see above) is segmented into two major portions – an area for questions 1a, 1b, and 3a, as well as an area for questions 2a, 2b, and 3b. The first area provides Goal Seek analysis for several individual rates (i.e., those with white background and blue numbers), while the second area simultaneously provides Goal Seek analysis for all rates. The cells with blue numbers (above in range E511:E542) are primarily intended to serve as *data-input items* the user wishes to change via Goal Seek scenarios (i.e., **By changing cell**), but they can also function as *standard data-input* in connection with Goal Seek equations. That is, they can work the issue/task in two different ways; i.e., "What is the value that gives the answer I am looking for?" Or, "at this data-input level, what is the effect on the Goal Seek item?"

By changing cell: Individual data-input items in E511:E550 and H509 (directly above) correspond with sub items (Goal Seek) in questions 1a through 3b found in G570:G622 on page 3. For the cells to work together in this manner, simply use the Goal Seek function normally (i.e., as discussed in the "Using Goal Seek (generically) in Excel® 2003" section on page 2, or as discussed in the examples below).[7]

Standard Data-Input: Operating in a manner opposite the Goal Seek data-input item operative function discussed above, changes to values in E511:E542 and H509 (relative to values in D511:D542 and G509) will result in an associated value change in the corresponding sub-item question in G570:G622 on page 3.

Using Goal Seek (in VIDRA©- HCID#1)

The first step to proper Goal Seek tasks in the clustered area of VIDRA© is to enact a macro (i.e., a predefined set of computer-coded instructions) which manually transfers all of the current individual rates to column D of the Goal Seek area. For user convenience, the macro is embedded in the blue oblong shape near rows 507-510 which looks like this:

To enact the macro, simply move the curser over the shape and left-click once. Non-formula values are the cornerstones of the included Goal Seek formulae, and this macro facilitates the need for those non-formula values (i.e., current rates). The macro simply transfers all of the current rates (found in several cells in cell range I184:L254) to cell range D511:D550. In essence, this macro provides a convenience by eliminating the need to manually reenter all of the current individual rates to column D of the Goal Seek area.

Currently, a total of thirty-seven individual Goal Seek scenarios are possible. Below, the steps to three such scenarios are provided. All other scenarios should be self-evident thereafter.

Example 1: You wish to answer **question 1b, sub-item 2** for the Sharyland Water Supply Corp. And, suppose the targeted revenue change is a $50,000 increase from a municipal rate increase impacting water delivered with municipal-owned rights. So, what is the municipal rate which facilitates this?

1 . . . . go to cell G585 (i.e., place your cell cursor on this cell)
2 . . . . click ***Tools*** in the menu bar, and select ***Goal Seek***
3 . . . . in the dialog box:
- enter G585 in **Set cell:**
- enter 50000 in **To value:**
- enter E526 in **By changing cell:**
- click **OK**

[7] Due to their relatively minor role in overall rate setting and revenue generation, cells with black numbers and yellow background (above in range E544:E550) do not have individual Goal Seek analyses associated with them. The inclusion of these individual rates in the Goal Seek area is to facilitate questions 2a, 2b, and 3b.

4 . . . . look at cell E526 for what the *Goal Seek Level* (i.e., new rate) is
5 . . . . look at cell F526 to see the % change in the new rate
6 . . . . click **OK** or **Cancel** [8]

Example 2: You wish to answer **question 2b**. And, suppose the targeted total net income/(loss) is $0.00 (i.e., "break-even"). So, what is the % change in ALL rates which facilitates this?

1 . . . . go to cell G609 (i.e., place your cell cursor on this cell)
2 . . . . click ***Tools*** in the menu bar, and select ***Goal Seek***
3 . . . . in the dialog box:
- enter G609 in **Set cell:**
- enter 0 in **To value:**
- enter H509 in **By changing cell:**
- click **OK**

4 . . . . look at cell range H511:H550 to see what the *% change* is
5 . . . . look at cell range I511:I550 to see the new resulting rates
6 . . . . click **OK** or **Cancel** [8]

Example 3: You wish to answer **question 1a, sub-item 1**. And, suppose the targeted revenue change is a $100,000 increase from a change in the agricultural flat rate. So, what is the ag flat rate which facilitates this increase?

1 . . . . go to cell G570 (i.e., place your cell cursor on this cell)
2 . . . . click ***Tools*** in the menu bar, and select ***Goal Seek***
3 . . . . in the dialog box:
- enter G570 in **Set cell:**
- enter 100000 in **To value:**
- enter E511 in **By changing cell:**
- click **OK**

4 . . . . look at cell E511 for what the *Goal Seek Level* (i.e., new rate) is
5 . . . . look at cell F511 to see the % change in the new rate
6 . . . . click **OK** or **Cancel** [8]

In summary, the Goal Seek feature of Microsoft® Excel® is a very useful tool which facilitates *what-if* analyses of spreadsheet models after baseline model solution results have been obtained. In VIDRA© - HCID#1, such usefulness can come from:

» Goal Seek tasks within the main model area (which affects/changes the baseline model solution results) found in the cell range B8:Y505, or
» in the specified Goal Seek area placed below the main model area (which does not affect/change the baseline model solution results) in the cell range B507:I622.

Although this paper briefly describes how Goal Seek works in a generic sense (on page 2) (i.e., applicable to the main model area), its purpose is to discuss the 'customized' Goal Seek area. That is, certain questions related to rates (of possible interest to ID managers) cannot be answered quickly with standard model features in VIDRA© - HCID#1. To get answers to those questions requires special mathematical equations designed to work in combination with the Goal Seek function. It is hoped the more-involved equations and work area targeting select key questions, clustered in cell range B507:I622, prove useful to HCID#1.

~ ~ ~ ~

[8] Make sure you have all of the relevant cells within the screen view – a view of 100% is suggested. IF, at the end of step 3, you are unable to view items noted in steps 4 and 5, either (a) reorient the screen view so you can view all relevant cells, or (b) proceed to step 6 and then to steps 4 and 5.

For additional questions about VIDRA© - HCID#1 and/or the Goal Seek functions within the model, contact:

Dr. M. Edward Rister
Texas AgriLife Research
Dept. of Agricultural Economics
318E John R. Blocker Building
2124 TAMU
College Station, TX 77843-2124
(979) 845-3801
e-rister@tamu.edu

Mr. Allen W. Sturdivant
Texas AgriLife Research & Extension Center
2401 E. Hwy. 83
Weslaco, TX 78596
(956) 969-5641
awsturdivant@agprg.tamu.edu