# Command Reference: ReadWellRightsFromHydroBase()

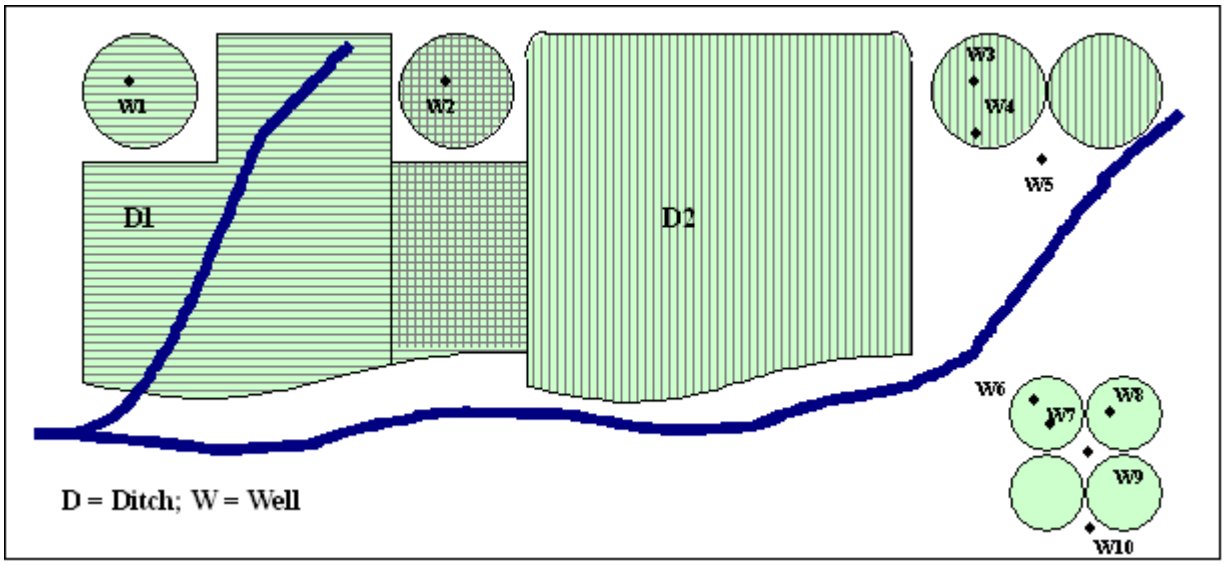
### Read well right data from HydroBase

### StateCU and StateMod Command

Version 3.09.00, 2010-01-25

The `ReadWellRightsFromHydroBase()` command reads well rights from HydroBase for each well station that is defined. The well rights can then be manipulated and output with other commands.

The following figure illustrates possible water supply for parcels.




ParcelSupplyDiagram

**Example Supply for Parcels**

In this example, two ditches (D1 and D2, represented with hatching in vertical and horizontal directions) provide surface water supply to the indicated parcels. In some cases, only one ditch provides supply. Both ditches supply water to shared parcels that are indicated by cross-hatching in the figure. Wells can supplement surface water supply (parcels shown above the river in the figure) or can be the sole supplier of water (lower right) and wells do not need to be physically located on a parcel to provide supply to the parcel. For StateCU, well-only lands are identified by CU locations that are defined by a collection (aggregate/system) of parcels. For StateMod, well-only lands are well stations that do not have a related diversion station (and consequently also are defined by a list of parcels). Lands irrigated by surface water are identified with ditch identifiers and parcels are associated with the ditches in HydroBase. Processing logic is different for ditch and well-only lands only in how the list of parcels is obtained. Once a list of parcels is obtained, the wells and corresponding rights/permits associated with the parcels can be processed. Explicit wells and groups of such wells can also be modeled, in which case a list of WDIDs is provided for the wells. StateMod and StateCU files do not contain enough detail to indicate all of these conditions and therefore well station aggregate and system information is used by StateDMI (see the `SetWellAggregate()`, `SetWellAggregateFromList()`, `SetWellSystem()`, and `SetWellSystemFromList()` commands).

A well (hole in the ground) in HydroBase can be a structure with water rights, a well permit, or both (a matched location). In HydroBase, the relationship between well structure and well permit has been determined in CDSS projects by using a common well attributes (e.g., name) or by spatial proximity analysis using GIS tools. For general well data in HydroBase, there has been no explicit link to help identify when a well structure matched a well permit: well structures do not reference permits and well permits don't reference well structures. **This relationship is only available as a result of DSS projects for modeling**. Well permit records can be difficult to interpret because of replacement wells. Typically, major wells do have water rights, although a corresponding permit may also exist, perhaps with different date and other information. The CDSS projects have attempted to uniquely identify holes in the ground such that subsequent data processing can treat the hole as a structure or permit, but not both (to avoid double-counting). Wells were first modeled in the Rio Grande RGDSS project and subsequently the South Platte.

The steps used to determine well rights are described below. Note that "well station" refers to the StateMod model node (which is often a collection of wells associated with groundwater-only lands, a ditch, or explicit well structures with WDIDs) and "well" refers to a hole in the ground that has physical characteristics, water rights, and/or well permits, and a relationship with one or more parcels.

Loop through each location that matches the ID pattern and perform the following:

For each year being processed (specified by the `Year` parameter or by default all available parcel years in HydroBase for the specified water division), perform the following:

1. Evaluate the type of location to set up further processing
    a. If the location is a diversion station or collection specified with part type `Ditch`, go to step 2.
    b. If the location is a well station or collection specified with part type `Parcel`, go to step 2.
    c. If the location is an explicit well (with WDID) or collection specified with part type `Well`, go to step 4 (no need to involve parcels in processing).
2. Get the list of parcels associated with the location (note that in a given year there may be zero or more parcels associated with a location):
    a. If the location is a groundwater-only location, get the list of parcels from the aggregate/system definitions, where `PartType=Parcel`.
    b. If the location diversion+well node (and/or an aggregate/system where `PartType=Ditch`):
        i. If the ditch is explicit (no aggregate/system information has been provided for the location), get the list of parcels associated with the single ditch.
        ii. If the ditch is an aggregate/system, get the list of parcels associated with each part of the aggregate/system and form one list of parcels.
3. Get the list of wells (holes in the ground) from the joined parcel/well data using the parcel identifiers.
    a. Query HydroBase to get the joined parcel/well data, using the parcel year, division, and parcel identifier.
4. Get the HydroBase well right/permit detailed data. Based on command parameters, read the HydroBase well rights and permits as follows:
    - If the `ReadWellRights=False`, use the well/parcel matching data without further reads; consequently the resulting well right information may not exactly match all the rights that are available in HydroBase because the well matching results are a sum of net amount rights.
    - If `ReadWellRights=True` and a well has a WDID, the well rights are re-read from the HydroBase net amounts table. This ensures that all information is considered, including APEX. This parameter setting is recommended and will always be used for explicit wells (those with no associated diversion).

- In either case, well permits are taken from the well/parcel matching data for quality control reasons and because HydroBase traditionally has not been distributed with well permit data.

Use the `DefineRightHow` parameter value to determine how to define the right.

If the value of `DefineRightHow=RightIfAvailable` (recommended in current procedures):

- Set the date.
  - If `ReadWellRights=True`, read the individual well rights from HydroBase. If a water right is available, use the appropriation date (and corresponding administration number) for the water right. If no date is available for the water right (this should not happen), assign the administration number to the value corresponding to the `DefaultAppropriationDate` parameter value or `99999.99999` as a final default.
  - If `ReadWellRights=False`, use the processed appropriation date determined during the irrigated lands load process.
- Set the decree amount.
  - If `ReadWellRights=True`, use the decree from the water rights (CFS). If `UseApex=True`, the alternate point/exchange values will also be added to the well right decree. Because well rights typically have either the decree or the APEX (not both), this will result in water rights that are either the decree or the APEX value. Multiply the right amount by the percent of the well that irrigates the parcel (AND the percent of the parcel that is irrigated by the ditch if the lands are associated with a ditch). If warnings are generated, it may be due to older well matching data indicating that well rights should be in HydroBase; however, subsequent changes now result in no net amounts in the database. Additional evaluation of loaded data may need to occur.
  - If `ReadWellRights=False`, assign the decree as the well yield determined from well matching (converted from GPM to CFS), multiplied by the percent of the well that irrigates the parcel (AND the percent of the parcel that is irrigated by the ditch if the lands are associated with a ditch).

Else if `DefineRightHow=EarliestDate` (used with Phase 4 Rio Grande data set):

- From the DSS well matching data, use the earliest of the right's appropriation date and permit's permit date. Convert the date to an administration number. If no date is available, assign the administration number to the value corresponding to the `DefaultAppropriationDate` parameter value or `99999.99999` as a final default.
- Assign the decree as the well yield, converted from GPM to CFS, multiplied by the percent of the well that irrigates the parcel (AND the percent of the parcel that is irrigated by the ditch if the lands are associated with a ditch).
- This option currently does not allow reading well right net amounts.

Else if `DefineRightHow=LatestDate` (used experimentally): similar to above, except the latest date is used.

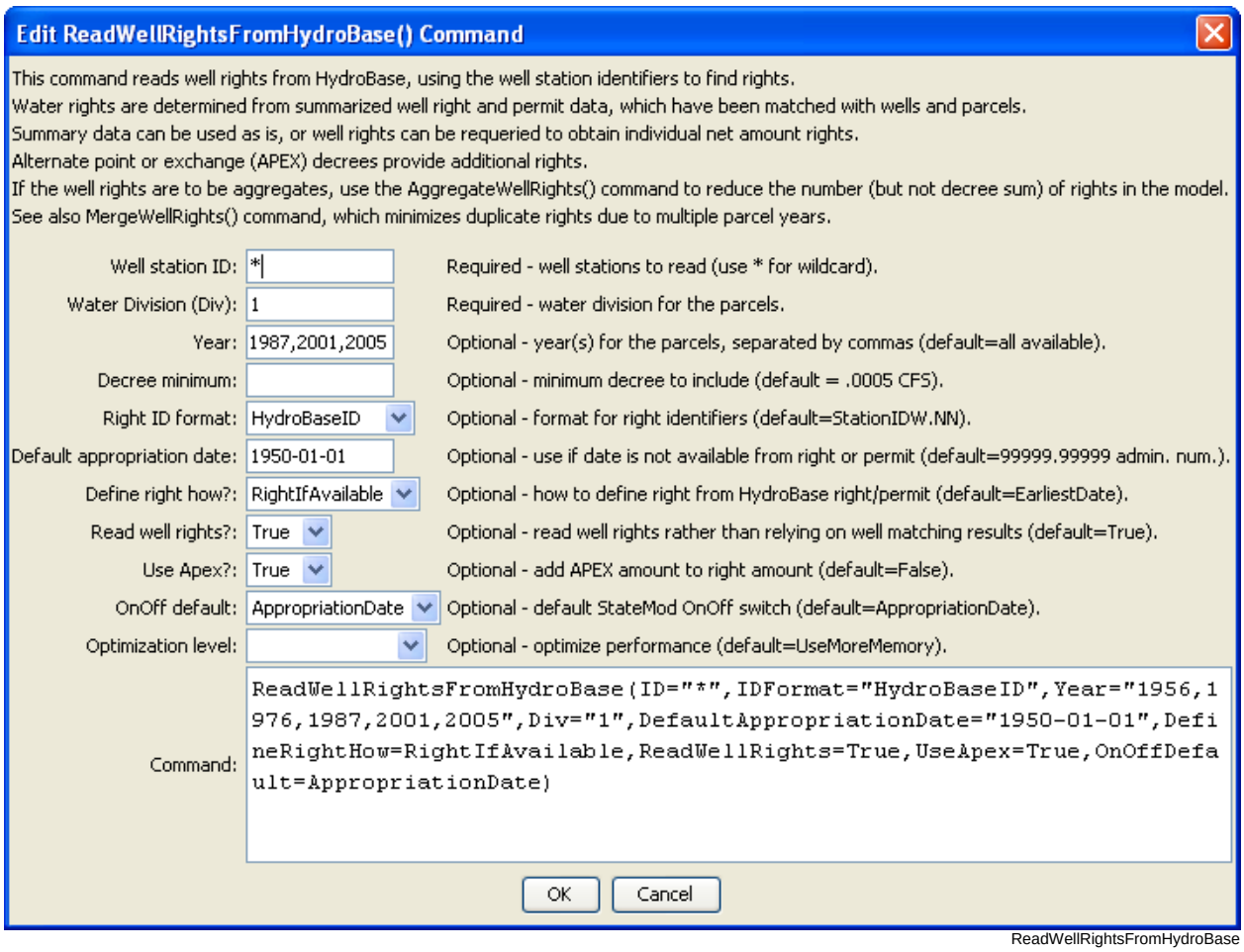
5. Add the StateMod well rights for the location by converting the HydroBase rights to StateMod rights.
   - Water rights from HydroBase that are less than the decree minimum (.0005 CFS, as per previously determined conventions) are ignored and during final output, water rights with a decree of 0.00 (the StateMod file format) are ignored.
   - The identifier will be assigned as specified by the `IDFormat` parameter.
   - The name of the final right will include either water right (WDID and name) or permit information (number, suffix, and replacement), depending on the input that was used.

In the above process, status messages and warnings are printed to the log file as appropriate and command status messages are added. For example, the following information is listed in the log file: the number of

parcels for a well station, the number of wells for the parcel, and the number of rights/permits for the well.

After reading the well rights from HydroBase, it is typical to write the results to a file similar to *rg2007_NotMerged.wer*. This file can then be used to fill crop pattern and irrigation practice acreage time series. The water rights determined from multiple years can then be processed with the `MergeWellRights()` command, resulting in a file that can be used for modeling (if all rights are to be modeled) and to set the irrigation practice pumping maximum time series – this file typically has a name similar to *rg2007.wer*. Finally, if aggregation of well rights by administration number class is desired, the `AggregateWellRights()` command can be used, and the results written to a file with a name similar to *rg2007_Agg.wer*.

The following dialog is used to edit the command and illustrates the syntax of the command.




ReadWellRightsFromHydroBase

**ReadWellRightsFromHydroBase() Command Editor**

An excerpt from a StateMod well rights file with data comments is shown below. The parcel year, well/parcel matching class, and parcel ID are shown on the far right and are not part of the standard StateMod well right file. Well class 4 and 9 are "estimated wells", which are essentially a copy of other wells. These values are used by the `MergeWellRights()` command. See CDSS technical memoranda for a description of well classes (SPDSS Task Memorandum "SPDSS, Spatial System Integration Component, Well Class Adjustments", March 15th, 2007)

```
#>   ID              Name             Struct          Admin #   Decree  On/Off  PYr--Cls--PID
#>---------eb--------------------eb----------eb--------------eb------eb------exb--exb--exb----e
2005001     W0006 WELL NO 01        200812          31592.00000    2.34    1936 1936    1   3107
2005001     W0006 WELL NO 01        200812          38836.00000    1.23    1956 1936    1   3107
2005001     W0006 WELL NO 01        200812          31592.00000    2.34    1936 1998    2  11016
2005001     W0006 WELL NO 01        200812          38836.00000    1.23    1956 1998    2  11016
2005001     W0006 WELL NO 01        200812          31592.00000    1.19    1936 2002    2  20901
2005001     W0006 WELL NO 01        200812          38836.00000    0.62    1956 2002    2  20901
2005001     W0006 WELL NO 01        200812          31592.00000    1.15    1936 2002    5  20902
2005001     W0006 WELL NO 01        200812          38836.00000    0.61    1956 2002    5  20902
```

The command syntax is as follows:

```
ReadWellRightsFromHydroBase(Parameter=Value,…)
```

**Command Parameters**

| Parameter | Description | Default |
|---|---|---|
| `ID` | A single well station identifier to match or a pattern using wildcards (e.g., `20*`). | None – must be specified. |
| `Div` | A water division to use for parcel data, needed to determine relationships between diversion stations/parcels/wells and for well aggregate/systems. | None – must be specified. |
| `Year` | A calendar year to use for parcel data, needed to determine relationships between diversion stations/parcels/wells and for well aggregate/systems. Separate multiple years with commas. If years are specified and data for a year in HydroBase is omitted, the results will be generated by ignoring the HydroBase data year – this is only advised if a year of data in HydroBase is purposefully being ignored for some reason. | Read all parcel years in HydroBase. |
| `DecreeMin` | Minimum decree to include, CFS. Well permits are converted from GPM to CFS prior to checking the value. Note that StateMod well right files typically have a precision of two digits after the decimal and therefore including small rights may result in a decree of zero (unless the rights sum/aggregate to a larger number). | `.0005` |
| `IDFormat` | Indicate the format to be used for water right identifiers, one of:<br>• `HydroBaseID` – use the 7-digit WDID if the well structure identifier is used. If a well permit, use the well receipt number followed by `:P` (see note below about estimated wells). The identifier that is used is controlled by the `DefineRightHow` parameter. This value should be used when wells are being explicitly modeled (no water right aggregation), such as on the South Platte.<br>• `StationIDW.NN` – use the well station identifier concantenated with `W.` and a two digit number. This convention matches the approach that has traditionally been used in earlier CDSS modeling, in particular in Phase 4 Río Grande modeling where | `StationIDW.NN` (because this was used in the Rio Grande; however, HydroBaseID is recommended when not aggregating rights, such as in the South Platte). |

| Parameter | Description | Default |
|---|---|---|
| | well rights are aggregated. Modeling in the South Platte requires that wells are not aggregated and using the `HydroBaseID` is necessary.<br><br>Estimated wells, as defined by well supply to parcel matching classes 4 and 9, have identifiers that are concatenated with `:PE` if a permit or `:WE` if a well right. This allows the wells to be uniquely identified when processed with the `MergeWellRights()` command. | |
| `Default Appropriation Date` | Some right/permit data does not have a date in data records. For example, very old well permits may not have a date. In these cases a default date can be assigned to be used as the appropriation date in the well water right. The appropriation date will be converted to a State of Colorado administration number in StateMod water rights. | The administration number is set to `99999.99999`. |
| `DefineRightHow` | Wells (holes in the ground) are matched with water rights, well permits, and occasionally "estimated" wells necessary because a water right or permit could not be found. In some cases a right and permit will both exist for a well, each with their own dates. This parameter indicates how to define the right in these cases and has a value of:<br>• `EarliestDate` – will use the earliest date determined from the right's appropriation date and the permit's permit date from well matching data. `ReadWellRights=True` is not enabled or used.<br>• `LatestDate` – will use the latest date determined from the right's appropriation date and the permit's permit date from well matching data. `ReadWellRights=True` is not enabled or used.<br>• `RightIfAvailable` – will always use the water right appropriation date, if available. If `ReadWellRights=True` (see below), the net amount rights are read. If `ReadWellRights=False`, the processed well data determined when irrigated lands are loaded into HydroBase are used. | `EarliestDate` |
| `ReadWellRights` | This parameter is only used when `DefineRightHow=RightIfAvailable`, and indicates whether individual water rights should be read from HydroBase. The following values are recognized:<br>• `True` – the net amounts data are read, which may result in multiple well water rights for a well WDID. See also the `UseApex` parameter.<br>• `False` –a single processed water right will be returned, which is the sum of net amount rights, using the oldest appropriation date found for the rights (APEX is not considered). This information is | `True` |

| Parameter | Description | Default |
|---|---|---|
| | taken from the well/parcel matching results. | |
| UseApex | This parameter indicates whether to use alternate point/exchange values when processing rights. The following values are recognized:<br>• True – the APEX values corresponding to well rights are added to the net amount right values, resulting in a larger decree being considered for some rights.<br>• False – the APEX values are not added to net amount rights.<br>Because net amount rights usually either have a decreed rate or an APEX amount, using True will generally result in more water rights, where the resulting right amount is either the decree or APEX. | False |
| OnOffDefault | Indicates how to set the on/off switch for all water rights that are processed. A value of 1 indicates that the right is on for the whole period. If the value is AppropriationDate, the switch is set to the year corresponding to the appropriation date, indicating that the right will be turned on starting in the year. Use set commands to reset the switch to other values. | AppropriationDate |
| Optimization | Indicate how queries are performed, one of:<br>• UseLessMemory – run time will be slower, but this may be required on computers that do not have enough memory for optimization<br>• UseMoreMemory – run time will be faster, but more computer memory is required | UseMoreMemory |

The following example command file illustrates how well rights can be defined, sorted, checked, and written to a StateMod file:

```
# Well Rights File (*.wer)
#
StartLog(LogFile="Sp2008L_WER.log")
# _____________________________________________________
# Step 1 - Read all structures
#
ReadWellStationsFromNetwork(InputFile="..\Network\Sp2008L.net")
SortWellStations()
# _____________________________________________________
# Step 2 - define diversion and d&w aggregates and demand systems
SetWellAggregateFromList(ListFile="..\Sp2008L_SWAgg.csv",PartType=Ditch,IDCol=1,
  NameCol=2,PartIDsCol=3,PartsListedHow=InColumn,IfNotFound=Warn)
SetWellSystemFromList(ListFile="..\Sp2008L_DivSys_DDH.csv",PartType=Ditch,IDCol=1,
  NameCol=2,PartIDsCol=3,PartsListedHow=InRow,IfNotFound=Warn)
#
SetWellAggregateFromList(ListFile="Sp2008L_AugRchWell_Aggregates.csv",PartType=Well,
  IDCol=1,PartIDsCol=2,PartsListedHow=InRow)
# _____________________________________________________
# Step 3- Set Well aggregates (GW Only lands)
# rrb Same as provided by LRE as Sp_GWAgg_xxxx.csv except non WD 01 and 64 removed
SetWellSystemFromList(ListFile="..\Sp2008L_GWAgg_1956.csv",Year=1956,Div=1,
  PartType=Parcel,IDCol=1,PartIDsCol=2,PartsListedHow=InColumn)
SetWellSystemFromList(ListFile="..\Sp2008L_GWAgg_1976.csv",Year=1976,Div=1,
```

```
  PartType=Parcel,IDCol=1,PartIDsCol=2,PartsListedHow=InColumn)
SetWellSystemFromList(ListFile="..\Sp2008L_GWAgg_1987.csv",Year=1987,Div=1,
  PartType=Parcel,IDCol=1,PartIDsCol=2,PartsListedHow=InColumn)
SetWellSystemFromList(ListFile="..\Sp2008L_GWAgg_2001.csv",Year=2001,Div=1,
  PartType=Parcel,IDCol=1,PartIDsCol=2,PartsListedHow=InColumn)
SetWellSystemFromList(ListFile="..\Sp2008L_GWAgg_2005.csv",Year=2005,Div=1,
  PartType=Parcel,IDCol=1,PartIDsCol=2,PartsListedHow=InColumn)
# _____________________________________________________________
# Step 4 - Read Augmentation and Recharge Well Aggregate Parts
SetWellAggregateFromList(ListFile="Sp2008L_AugRchWell_Aggregates.csv",PartType=Well,
  IDCol=1,PartIDsCol=2,PartsListedHow=InRow,PartIDsColMax=25,IfNotFound=Ignore)
SetWellAggregateFromList(ListFile="Sp2008L_AlternatePoint_Aggregates.csv",PartType=Well,
  IDCol=1,PartIDsCol=2,PartsListedHow=InRow,PartIDsColMax=1,IfNotFound=Ignore)
# _____________________________________________________________
# Step 5 - Read rights from HydroBase
ReadWellRightsFromHydroBase(ID="*",IDFormat="HydroBaseID",Year="1956,1976,1987,2001,2005",
  Div="1",DefaultAppropriationDate="1950-01-01",DefineRightHow=RightIfAvailable,
  ReadWellRights=True,UseApex=True,OnOffDefault=AppropriationDate)
# _____________________________________________________________
# Step 6 - Sort and Write
#  Write Data Comments="True" provides output used for subsequent cds & ipy acreage filling
#  Write Data Comments="False" provides merged file used for seting ipy max pumping
SortWellRights(Order=LocationIDAscending,Order2=IDAscending)
# _____________________________________________________________
WriteWellRightsToStateMod(OutputFile="Sp2008L_NotMerged.wer",WriteDataComments=True)
MergeWellRights(OutputFile="..\StateMod\Historic\Sp2008L.wer")
SortWellRights(Order=LocationIDAscending,Order2=IDAscending)
# _____________________________________________________________
WriteWellRightsToStateMod(OutputFile="Sp2008L.wer",
  WriteDataComments=False,WriteHow=OverwriteFile)
# Check the well rights
CheckWellRights(ID="*")
WriteCheckFile(OutputFile="Sp2008L.wer.check.html",Title="Well Rights Check File")
```