**CADSWES Maintenance Accomplishment Report Compilation -- November 2017**
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**November 2017 Maintenance Highlights:**

1. Unfunded Software Development
2. One Patch Release: 7.1.5 (11-14-2017)
3. Twenty five (25) completed bug fixes.
4. New CADSWES Linux Server, progress on Gnats bug tracking system.
5. Ongoing: Monitoring and maintaining daily RiverWare regression tests.
6. Ongoing: Installation Process and Licensing development and administration.

Report contributors:

* Substantial content from: Jessica, Bill, Phil, David, Patrick, Robynn
* Bug fix items from: Patrick (12), Phil (8), Bill (3), Mitch(1), Robynn (1).
* Indicated that they had no *maintenance* accomplishments to report this month: None

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| (I) New/Enhanced Software* (B) Unfunded Software Development
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**(I.B) Unfunded Software Development**

**Icon Development**

Various icons used within CADSWES programs were developed. There included:

* New CU/CADSWES logo, used in the RiverWare and RiverSMART "About" dialogs. This work also included maintenance updates for the About dialog.
* New RiverSMART and RiverWISE icons. Many candidates were composed based on various graphics motifs. We ended up using just the RiverWare "swoosh" with the words "SMART" and "WISE" presented vertically along the right side. Various sizes, ranging from 16x16 to 64x64 pixels were created. (The 16x16 versions use just one letter, "S" or "W").
* Revised Unit Converter toolbar icon used in RiverWare. Clearer graphics, and changed the motif from "m--in" to "m--ft".

**Display of full precision values**

Modified the maximum display precision from 17 to 15.

In some contexts, when a user entered the slot value .1, RiverWare would displays that value as .09999999999999999999. To avoid this mismatch between the entered value and the displayed value, RiverWare now displays values with a maximum of 15 digits (2 less than full model precision).

Technical explanation:

17 decimal digits are, in general, necessary to represent 64 bit floating point numbers. That is, the 17th digit can represent a real distinction between two numbers, so in order to display to users the internal representation, 17 digits are required.

For example, the following two numbers can be represented as floating point numbers and differ only in the 17th decimal digit:

18014398509481982
18014398509481980

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| (II) RiverWare Software Maintenance1. Releases, Patches and Snapshots
2. Software Updates, Bug fixes (not associated with new development)
3. Development tool improvements; issue tracking software; modelcomp
4. Enhancements or changes to regression tests (not part of development tasks)
5. Download, Install and Release Processes
6. Updates to license software/procedures
7. Updates to download/install/configure user documentation
8. Modification to Web pages for downloads and installs
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**(II.A) Releases, Patches and Snapshots**

The following release was generated this month:

* RiverWare 7.1.5 Patch Release (11-14-2017)

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| Summary of Changes in RiverWare Patch Release 7.1.5**Improved Performance when Writing RDF File**The performance was improved when writing RDF output through MRM outputs, RDF File Output devices, or Excel Output devices. There is a reasonable improvement when writing to a local disk and a significant improvement when writing to network locations.**Distribution Canal Request Routing**The Distribution Canal now allows a monthly model to propagate requests if the lag is set to zero.**Water User Dispatch Slots**On the Water User, the Return Flow Salt Mass was added as a linkable dispatch slot. This slot can be linked for certain salinity modeling approaches.Bugs:The following issues were addressed:* 5735: An internal error could occur when typing a value into the edit account dialog.
* 5866: The reliability was improved for the Database DMI using DSS Datasets with paired data.
* 5988: An internal error could occur when deleting a link to a multi-slot.
* 6001: In the Script Dashboard, the Script description is shown with improved wrapping.
* 6025: On the workspace, the Add Text and Add Image dialogs were opening partially off screen.
* 6026: Link arrows on the workspace were incorrect for multi-slots.
* 6029: The SCT display could become out of alignment after changing the configuration.
* 6030: When saving a model without outputs, R flags were incorrectly saved.
* 6031: After an aborted run, changes to the run parameters incorrectly raised the diagnostic output after each keystroke.
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**(II.B) Software Updates, Bug fixes (not associated with new development)**

In November CADSWES staff made a push to address many bugs. As a result, many old bugs were tested and closed as they were fixed, no longer existed, were not applicable, or not reproducible. Approximately 50 bugs were closed as part of this effort.

**The following twenty five bugs were fixed:**

1. Unfiled: RDF output
2. Bug 933: Allow CPLEX problems and subproblems to be saved selectively
3. Bug 4321: Pre/Post Execution DMI issues
4. Bug 5211: Problems when adding a constraint which evaluates to false
5. Bug 5467: RPL debugger is not breaking on an error
6. Bug 5631: Bad use of DBL\_MIN in RiverWare C++ code as seed for getting max table value
7. Bug 5674: Internal error resulting from inconsistent timesteps
8. Bug 5749: Opt Analysis Satisfaction incorrect after first iteration of Repeated Minimax
9. Bug 5781: RPL set editor 'saved with model' state icon visibility
10. Bug 5817: Save as Baseline gives bogus warning about unloading ruleset
11. Bug 5883: Value set by initialization rule with Z flag displays incorrect tool tip
12. Bug 5906 Unit type mismatch in an opt constraint not caught as an error
13. Bug 5909: Multiple derived objectives in one opt goal has unexpected behavior
14. Bug 5918: POSAT incorrectly reporting the number of frozen constraints
15. Bug 5919: POSAT displays frozen new constraints as prior constraints
16. Bug 5964: Init Rule grows Integer Indexed Agg Series slot unnecessarily
17. Bug 6001: Add word wrapping to the description label on the Script Dashboard
18. Bug 6018: Excel and table series slot row labels
19. Bug 6026: Link arrows go the wrong direction for multislots
20. Bug 6029: SCT display out of alignment after changing configuration
21. Bug 6030: Saving without outputs is not clearing R flags
22. Bug 6031: Diagnostics Window mismanaged after aborted run
23. Bug 6033: Plot step curve symbols shown at begin and end of timesteps
24. Bug 6034: Rule name uniqueness should also apply to inactive rules
25. Bug 6038: Bug with Pre-defined function CompletePartialDate

**The following twenty two items were analyzed and closed with no change:**

1. Bug 3323: When a method category is invalid (because of dependencies), its selected method should go back to the default.
2. Bug 3820: Table Interpolation warning message is not clear
3. Bug 4233: CPLEX error of Duplicate Entry stops the run
4. Bug 4260: Water rights - control point - monthly timestep - begin of reference year cannot be Feb
5. Bug 4351: Internal error with MRM consecutive run
6. Bug 5196: Missing diagnostic when constraint is skipped because it modifies a frozen constraint
7. Bug 5236: Enabling a portion of a goal after disabling makes the goal invalid
8. Bug 5261: Inadequate diagnostic for predefined function
9. Bug 5309: Slot dialogs show and save 12 sig figs even when value is essentially miniscule
10. Bug 5520: When RHS of constraint references list item, issues an error
11. Bug 5541: File association after install of 6.5 and 6.5.1
12. Bug 5651: A slightly negative diversion supply will not allow account to resolve outflow
13. Bug 5746: RPL comparison tolerance is not applied correctly
14. Bug 5820: DataTimes set in slots are always FullDateTime not specified user units
15. Bug 5895: Outflow reserve constraints need additional defined slots
16. Bug 5907: Evaluating expression slots after opening a global functions set results in assertion failure
17. Bug 6004: Opt comments on variables in frozen constraints use incorrect satisfaction value
18. Bug 6011: Assertion Failed
19. Bug 6019: RPL validation fails loading RiverWare from batch script with global set(s)
20. Bug 6026: Link arrows go the wrong direction for
21. Bug 6030: Saving without outputs is not clearing R flags
22. Bug 6032: Outflow does not equal Release plus Spill when Outflow is negative with Unreg Spill

**Additionally, analysis was done on the following eight bugs:**

1. Unfiled bug: table interpolation behaves differently in RPL than in engineering methods
2. Bug 3649: Table interpolation diagnostics should support timestep filtering
3. Bug 5232: Correcting piecewise slopes for proper convexity is broken
4. Bug 5491: Interpolation tolerance for 3-D interpolation too tight
5. Bug 5893: Uninstall leaves folders behind
6. Bug 6022: Editing a script while paused does not reset Script Dashboard
7. Bug 6023: Crash with large memory usage from numerous diagnostic messages
8. Bug 6041: Configure Existing Slots dialog doesn't allow Apply operation

**RDF output (unfiled)**

This was a simple fix which provided tremendous benefit to a user. When writing to disk C++ buffers output to improve performance. Furthermore, there are two ways to end lines – with std::endl and ‘\n’ – a significant difference being that std::endl flushes the buffer while ‘\n’ doesn’t. The code which generates RDF output, from either the output manager or a multiple run, was ending lines with std::endl which meant that effectively there was no buffering. Switching to ‘\n’ reduced the time for the user’s model to generate its RDF output from ~2 hours to ~30 seconds.

**Pre/Post Execution DMI issues (4321)**

Users can configure pre- and post-execution DMIs for a RPL block. Previously they had to enter the name of the DMI; now they can select the DMI from a drop-down menu.

**Excel and table series slot row labels (6018)**

This bug concerned writing TableSeriesSlot data to an Excel workbook using the Excel DMI. The problem reported by the user was that the slot’s row labels were written to Excel as strings rather than dates. This occurred because throughout RiverWare row labels are strings. To address the bug the concept of row labels as variants was introduced. (A variant is a variable which can hold one of multiple types.) The row label variant holds a date/time (TableSeriesSlot) or a string (all other slots). The change percolated though several layers of code until it reached the low-level Excel connection code, which was modified to handle the variant’s different types.

**Investigation: Crash with large memory usage from numerous diagnostic messages (6023)**

After the initial investigation in October, a more detailed analysis was performed in November to inspect the stack and exception trace coming from Qt when this crash occurs. The goal was to determine whether opportunities exist to catch and handle the exception that occurs during the memory allocation error.

It was determined that Qt is catching its own internal exception and terminating RiverWare. This leaves RiverWare with no opportunity to catch and handle the exception or to throw its own exception. Because of this and because the error is a caused by a lack of contiguous system memory at the moment, it will differ from machine to machine. For this reason, is not possible to reliably predict when the error will occur.

Setting a static limit on the maximum allowable number of diagnostic messages could help to avoid the crash in some, but not every instance. With this in mind, the team agreed that setting a static limit on the max number of diagnostic rows should be used as a partial solution as long as it is accompanied by an interactive pop-up window to be displayed at the earliest possible moment stating the limit has been reached and allowing a selection of OK to halt diagnostics before continuing or "CONTINUE ANYWAY" with risk of unexpected behavior.

**(II.C) Development tool improvements; issue tracking software; modelcomp**

**New CADSWES Linux Server**

In November work continued on porting CADSWES bug tracking to the new Linux server animas. To summarize from previous reports, CADSWES bug tracking is comprised of Perl scripts and the Gnats open source bug tracking software. The Perl scripts run from a web server and:

* Generate web pages containing forms for users to fill in, for example the form for users to file a bug.
* When users submit a form, invoke a Gnats executable with the form contents as its input.
* Gather the output from the Gnats commands.
* Parse the executable's output and generate a web page containing its results.

This is analogous the Gnats from the command line which is comprised of Bourne shell scripts which invoke Gnats executables. In previous months there was a good deal of effort expended to get the Perl scripts executing from the web server. Many of the problems encountered were related to animas being SELinux (Security Enhanced Linux; with the problems resolved, in November it was time to test the Perl scripts. Initially, the problems encountered with the Perl scripts were relatively easy to identify and fix. But then a problem was encountered with the pr-edit executable which couldn’t be overcome.

The Perl scripts invoke pr-edit to update bug reports, for example changing the bug’s state from open to closed or adding additional information to the bug. The updates are either to single line fields or to multi-line fields, the syntax for the updates being (continuing with the example):

pr-edit –append=Unformatted –file=/path/to/file

For the first command the file contains the single line’s new value, for example “closed”. For the second command the file contains the additional information. The problem encountered was that the first command was failing silently – it didn’t report an error, it didn’t update the bug report, it did exit with a non-zero status (indicating it recognized it failed) and it did leave the bug report locked.

Several things were tried to understand why the command was failing. The strace(1) command was used to trace pr-edit’s system calls and signals. pr-edit’s code was examined to see where behavior for replace and append differed. Neither of these provided any insight. Finally, an attempt was made to build a debug version of pr-edit, which was unsuccessful.

Keep in mind this effort was being expended on a bug tracking system that we recognized (in 2010!) was not adequate for our needs. Given this, we decided to cut our losses and keep using the bug tracking system on the old Linux server alamosa, and to move to a modern bug tracking system as quickly as possible.

**Issue tracking software**

Forty Four bug tracking product names were included in a list for initial consideration as potential candidates to evaluate for the purpose of replacing CADSWES' bug tracking system, Gnats. This list was divided into 5 software categories: 1) on-premise proprietary, 2) on-premise open source, 3) hosted proprietary, 4) hosted open source, and 5) not applicable.

Eleven products were demoed: seven from category 1, two from category 2, and two from category 3. An evaluation of products was performed taking into consideration: availability of on premise installation, self-service customer portal, integration with source control and attachment size. Price and configurability were also considered. Jira Service Desk was determined to be the best match for CADSWES at the best price. CADSWES is currently working with the Office of Information Technology at the university to proceed with procurement and installation of Jira Service Desk.

**(II.D) Enhancements or changes to regression tests (not part of development tasks)**

The regression tests continue to be maintained on a daily basis. This involves updating the regression tests to exercise new developments in the code. Also, as new code is added to the development area, the model comparisons performed in the nightly regression tests usually show differences (for example, because a new method category may have been added). When this occurs, the regression tests need to be updated to reflect the current state of the development area so model comparisons do not fail. In addition, every week, the daily history of each regression test is analyzed to determine if the run time or model size has significantly changed because of new development.

In November, CADSWES continued to investigate spurious differences that appeared in overnight results.

**(II.E) Download, Install and Release Processes**

* Completed setting up the initial IS2016 project file for releasing the 64-bit version 7.2 Snapshot release.
	+ RiverWISE is added as a sub-feature of RiverWare.
	+ o The RiverWISE shortcut has been added. It is added to the Start/All Programs/CADSWES menu, but not to the desktop. The shortcut displays the name “RiverWISE Snapshot.” When you click on the shortcut, the last installed version of RiverWISE starts.
	+ o Set up the file type association for the files with an extension of “.wise”. When you double click on a file with the extension of .wise, the latest installed RiverWISE will start and load the wise file.
	+ Added the RiverWISE help file to the project file as a new component.
* Worked with the gnats error when trying to close Bug# 5541: File association after install of 6.5 and 6.5.1.
* Worked on Bug #5893: Uninstall leaves folder “servers” behind. This error does not occur if there is only one version (sometimes two) of RiverWare installed on the system. Trying to fix this in the new IS2016 7.2 Snapshot project file.

**(II.F) Updates to license software/procedures**

* Maintaining RiverWare licenses for internal development systems. Issuing licenses for internal or external training classes. This is an ongoing task.
* Setting up Reprise Activation Pro (ActPro) License Center and database for Viewer license
	+ Updating the internal document “RiverWare License Activation Key Administrative Manual.” Working on adding a new section which contains the instructions for creating a new product key.

**(II.G) Updates to download/install/configure user documentation**

None reported for November 2017.

**(II.H) Modification to Web pages for downloads and installs**

None reported for November 2017.

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