The Central Florida Coordination Area (CFCA) Modeling and Tools Support team met with members of the public in the CFCA to have a technical discussion on the modeling tools proposed for use in Phase II of the CFCA work effort. The meeting was held at the St. Cloud Field Station of the South Florida Water management District on September 21, 2010. A summary of the questions provided to the team ahead of the meeting as well as those asked by attendees are presented below along with the responses provided by team members. A copy of the attendance list is attached at the end of this summary.

Questions and answers from the September 21st Technical Meeting and Discussion on CFCA Modeling Tools.

Future condition simulation:

- How will the Upper Kissimmee River water levels be represented in the ECFT model for runs representing hypothetical future conditions instead of the historical conditions for which the model was set up and calibrated (e.g., for runs used to assess the probable future limiting conditions of maximum allowable utility withdrawals corresponding to the WMDs' estimate of maximum groundwater availability)?
- How will future land use changes (especially those that may affect net recharge) be represented in the assessment of maximum groundwater availability?

The model scenarios that will be used for the current phase of the work are developed with the intent of being used as described below.

1) The models are calibrated to available data based on best available information for a period covering 1996 through 2006.
2) The model for this period implements a mix of boundary condition considered appropriate and representative of the system during the calibration period.
3) The boundary conditions include representation of several lakes and rivers using the MODFLOW river package that specified a stage (based on daily observed values) to the lake or river reaches in parts of the model. Note some lakes are simulated dynamically within the model and are not represented by these internal boundary conditions.
4) Land use changes during the calibration period is updated in increments of approximately 5 years (based on data collection and compilation cycle) and reflects generally the progression of land use change through the calibration period.
5) Once developed, this calibrated model is used for evaluation of conditions as follows.
    a. The withdrawal (pumpage for multiple uses) corresponding to desired base periods such as 1995, 2006 and 2013 are developed. These withdrawals are applied throughout the duration of a simulation (with variation that responds to hydrologic conditions) with no further changes to the calibration parameters. The resulting runs do not represent the year 1995 or the year 2006 or the year 2013 directly but represent the model prediction of the hydrologic response of the simulated region based on hydrology and conditions experienced during the calibration period but with a 1995, 2006 or 2013 level of

withdrawals. This technique of using a developed model to evaluate different withdrawal regimes has been successfully applied to several projects in the past. It however needs to be clearly understood so that the results of the modeling can be properly interpreted.

6) For the reasons stated above, the water levels in the lakes used as internal boundaries are not modified when looking at the different withdrawal scenarios (since the simulation is not of some future condition but of some future withdrawal levels in the calibration period.) What is checked and is used as part of the evaluation of the model results are the changes to these internal boundaries (flux in and out of the boundary) as a result of the different withdrawal scenarios. As an example, if an examination of the seepage into or out of an internal boundary (lake) changes significantly between scenarios, then it is understood that the increase or decrease in seepage from that boundary has to be factored in the interpretation of the results and evaluated for reasonableness. If on the other hand, all evaluated scenarios show minimal change at an internal boundary, then it may be interpreted that any effect of the internal boundary is minimal relative to other contributing sources.
7) While the approach proposed does not vary the land use or the internal boundary conditions in the main evaluation steps, it does not preclude (and the intent is indeed to have) sensitivity runs to test specific assumptions including the potential impact on the results of engineering solutions or change in land use performance resulting from recently implemented management.

Regarding the two questions and for the reasons given above, the internal boundaries are not varied and the land use is not changed to reflect future conditions in the current phase of the work with the exception of exploring specific questions in a sensitivity analyses mode to explore the potential effect on conclusions drawn, of engineering or management changes that may have been recently implemented or are planned. The contribution of the internal boundary or retention of the land use characteristics will be considered in the evaluation and interpretation of the results of the modeling and the determination of the ground water availability. Please note that the foregoing pertains only to the current phase of the work which is focused on determining availability, lack thereof and spatial variations of any. We anticipate that a different modeling strategy will be required for the solutions phase of the CFCA effort which is scheduled to start in 2011.

Time discretization:

- Why with data often available in monthly increments are we using daily time steps for the transient model?

The model ECFT model applies a daily time step for a number of reasons. First, some of the available calibration data is available at daily or shorter time steps. In addition, some of the dynamics that need to be captured to provide confidence in the model occurs at time steps less than monthly (which is the natural scale for processing several of the outputs of the model). More importantly though, the WETLAND package which is used to represent the effect of overland flows and depict relevant and appropriately sized wetland systems performs best on a reduces time scale (applicable for regional

overland flow). While a finer time step smaller than a daily time step could be used, the overhead for completing simulations make this impractical. Similarly, a larger time step perhaps monthly can also be used, but there is a tradeoff (resolution/accuracy for speed) which in our opinion may be unacceptable when considering the model implementation. The choice of daily time steps was a convenient compromise which does still have some overhead (the models runs over several hours) but provides information at a useful resolution which can then be consolidated for monthly reporting while allowing reasonable use of the specialized packages such as the wetland package.

Status of ECFT model Implementation:

- Is the ECFT model "finished," or are staff still modifying the model setup and calibration as new information is made available (e.g., from the USGS data mining study and the observations of the Environmental Assessment Team)?

The modeling team has made a decision to use the best available information at the time to support the decision that needs to be made. This approach while difficult on a schedule allows the incorporation of new information when and where they are timely received. The ECFT and DWRM models are both in a ready to use form. However, both are still undergoing minor (and in some cases significant) revisions where it is deemed necessary to make them best suited for CFCA use. The approach we have implemented is based on the following principles and considerations.

1) If new information (such as the SE Polk APT results) become available, the team assesses the data and its quality, checks to see if it confirms (matches) estimated parameters in the model or if it provides new information (does not match the calibrated parameters in the model), forms an opinion on the potential impact to model results and estimates impact to schedule and presents the decision to the project leadership with a recommendation. In the case of SE Polk, the decision provided the team was to incorporate the data and find ways to minimize slippage to the schedule from this change order. The changes have been implemented in the ECFT and discussions are underway regarding the appropriateness or otherwise of implementing the new test results in DWRM (based on the conceptualization and the representation in the model of the formation in which the data was collected).
2) We understand that new APT information from Cypress Lake may become available in December 2010 timeframe. It is very unlikely that this data will be available in time to be used in the current phase of the work. This as well as any information gleaned from ongoing work by others or SFWMD teams will be incorporated into the work plan and strategy for the solutions phase estimated to occur in 2011.
3) The information garnered by the other CFCA related efforts will be used if appropriate to refine or improve the understanding of the model. While we do not expect to recalibrate to match the results obtained by the EA team, we do expect to compare the model results against their findings and hopefully find and explain reasons for any discrepancy observed. In very specific circumstances (where differences are significant and model field data unavailable), minor

modifications to the model parameters will be entertained so long as it does not result in a deterioration of model performance at hard data locations.

4) The Model Team is currently in the process of evaluating and comparing the response of both models to determine if they yield consistent results. It is anticipated that there will be some refinements to parameters in one or both models, and potentially a revision to the calibration.
5) Over the next couple of months, as preliminary information from the USGS study becomes available, the Model Team will examine the data and assess the level of consistency between the modeling tools and the other analyses. While not anticipated, it is possible that some additional refinement of the models may occur.

Kissimmee Reservation:

- How does this SFWMD effort affect the CFCA process and the availability developed through the Reservation process? Will the AFET-W or other tools (MIKESHE models) used for the Reservations inform the CFCA work in any way, specifically, will boundary conditions from future scenarios in the ECFT be drawn from the AFET-W which does simulate the dynamics of many of the lakes in the Kissimmee basin?

While both efforts are progressing and SFWMD staff participating on the modeling for both efforts have been aware of progress by the other (and more recently coordinated efforts), both efforts are different. First the Reservation tools and focus differ from the CFCA tools. While an early attempt was made to ensure consistency between the MIKESHE based AFET-W and the ECFT both models have evolved from that common point to address specific issues they were developed to address. We are aware that the Reservations team have recently completed some work and are initiating the public communication and participation needed to complete that process. We believe they have or will be scheduling meetings with you all shortly.

Regarding the follow up questions about using the results of the MIKESHE based AFET-W model to generate boundary condition in the ECFT model when simulating future conditions, it is not expected that this will be done. First, as earlier noted, the scenarios run for this phase of the work represent not a future condition but represent the impact of projected future withdrawals in the base model (for the calibration period) and the impact of the specified internal boundaries on results of the model will be assessed based on examination of contribution to the budget from these internal boundaries. Second, there would be a need to justify the AFET-W and demonstrate its suitability to provide the boundary condition (based on model error in its prediction and bias compared to historic measured lake stage).

Calibration:

- The model is calibrated for 1995 to 2006, how will the changes in land use in the future be incorporated?

The ECFT is calibrated to observed data from 1995 to 2006. Within this calibration period as previously discussed, the land use is updated in approximate five year increments. When simulating the different withdrawal scenarios for comparison, the 1995, 2006 and 2013 withdrawal conditions, the land use specified in the model is retained and not varied. What are altered are the withdrawals between the projected water use for each of the scenarios.

The model as noted is calibrated from 1995 through 2006. During the calibration process, the historical monthly PWS demands were used. Irrigation demands were obtained from historical or estimated demands within the SWFWMD. For the SFWMD and the SJRWMD the irrigation demands were calculated using the AFSIRS program. Commercial/Industrial uses were generally obtained from permitted demands unless actual pumpage information was available. The land use for the calibration period changed through time. Irrigation demands for 1995 through 1998 were estimated from the 1995 land use, irrigation demands for 1999 through 2003 used the 2000 land use and the irrigation demands from 2004 through 2006 used the 2004/2005 composite land use. It should also be noted that in areas where irrigation demands were known to have been replaced by reuse water, those use were also incorporated into the data set.

For the 2013 simulations the CFCA Modeling Tools team has no intention of creating a "2013" like land use. For the 2013 projected simulation the land use and associated irrigation demands discussed above for the calibration period will be utilized for this scenario. There are still discussions underway regarding how to simulate the permitted simulation and what demands and distributions for all users should be included.

To conclude, at this time there are no plans either with the DWRM2/CFCA model or the ECFT model to incorporate future changes in land use.

Withdrawal representation in model:

- How will future withdrawals be represented in the model? Will stakeholders have the opportunity to inform or participate in that process (utilities are interested in how future withdrawals are located and sited)

The representation of the irrigation demands is included in the calibration discussion question above. Responses to this question focused primarily upon the Utility demands. For both the Utility 2013 projected simulation and the permitted simulation, the distribution of the demands by permittee, source and facility will be identical to the 2006 scenario or in cases where the water use permit records contains information that could be used in placing the withdrawals, that information is considered. That is, no unpermitted proposed facility will be included in either of these runs. However, during the alternative formulation scenarios (following the availability determination phase,) demand distributions, withdrawal locations and sources for the utilities will be determined through an interactive process between the three Water Management Districts and the Utilities and their representatives.

- How will future recharge be represented? Recharge patters and volumes will change in time in response to engineering, will the models capture this change?

The approach proposed for the current phase of the work does not simulate future conditions but simulates the effect of future withdrawal levels in the calibrated model. While future recharge as described by new efforts to enhance recharge through engineering solutions (or projects) is not intended to be part of the base, it is understood that sensitivity runs and specific scenarios that represent possible future recharge corresponding to land use types (as a result of engineering practice of actual recharge enhancement projects) can and potentially will be conducted. Simulations that make changes to land use to represents transition from one land use type to the other however are not planned in this phase of the work

Note that there are two forms of recharge into the model. One from water table recharge due to rainfall and the other from RIB flows. The tools have been developed to allow determination of and representation of each of these components and combine these as input into the model. Regarding recharge to the model from rainfall, recharge to the ECFT model is calculated using the AFSIRS program. The drain function of AFSIRS is generally utilized as the component for the downward flux to the water table in the recharge package of MODFLOW. This method is utilized in the model for developed areas (agricultural and urban) or pine type forest areas. In wetlands, lakes and other natural areas were the water table is at or very near land surface, rainfall is generally equal to recharge in the ECFT model. Regarding the potential for changing rainfall patterns, the existing rainfall patterns observed from 1995 through 2006 will be used for all scenarios, including the 2013 projected and 2013 permitted scenarios. Sensitivity analysis or separate scenarios could be conducted following the determination of availability.

Based on our current plans, flows to the RIBs for the 2013 projected and the permitted scenarios will be identical to the historical RIB flows from the calibration run. No attempt has been made to adjust the inflows to the RIBS for these two base runs as a result of increased withdrawals. This assumption is based in part on the uncertainty of the flows to the RIBS from the increased use and the off-set associated with increased irrigation demands on the RIBS during the same period.

Model update and refinement:

- What progress has been made with incorporating new APT's in the model?

Both models have reviewed additional APT data that have recently been obtained during the initial phases of the CFCA process. This includes the recent tests at the TWA's north Cypress Lake wellfield UFA test and the Polk Utilities SE Polk LFA test. These have or are been incorporated into the models were applicable and should be included by the release of the first four base case scenarios. It should be noted that at this time, it is not proposed to include the TWA's south Cypress Lake wellfield test because this information is not anticipated to be available until the beginning of 2011. It should be noted that depending upon the quality of the south Cypress Lake test, there still exists the potential to include this data in the solution development phase of the analysis scheduled to start in 2011.

Integration of tools:

- How will the various tools, numerical models and statistical and data mining be used in concert to address the question of availability?

The approach the districts are taking to determine if additional groundwater is available is to use "multiple lines of evidence." This means using different analytical and modeling tools to see if they all point toward the same conclusion. The analysis of available data will be used to confirm or corroborate the conceptualizations and responses of the models. For example, if through statistical analysis we show a strong relationship between decreased water levels in a surface water body and increasing pumping, then we would expect the groundwater models to also show drawdown due to pumping. Because the statistical analysis will focus on evaluation of sites with long-term data (more than 20 years), the technique will give us more insight into the long-term behavior of the data and increase our level of confidence in being able to determine the significant factors affecting water level changes. When the analysis of individual sites is completed, we will look at how the results vary over the area to see if the results are correlated with modeled drawdown.

The numerical models will be the key tools used for the assessment of the impacts of withdrawals on key performance indicators, the other information will help interpret and provide confidence in the conclusions drawn from the results of the modeling.

Evaluation of non-MFL lakes:

- How will non-MFL lakes and wetlands be addressed from the point of view of constraints when looking at water availability?

  The answer to this is still being worked on and will be discussed during our next public meeting.
- What method is anticipated to be used for comparison of projected future limiting conditions to the non-MFL "lakes and wetlands of concern" identified by the Environmental Assessment Team?

  The response to this question is currently outside the scope of the modeling task. It is however an issue that is being looked at by other teams involved in the CFCA effort as well as other staff at each of the Water Management Districts.

Evaluation of Salt Water Intrusion:

- How will salinity intrusion risk be assessed and used in the assessment of maximum groundwater availability)?

Currently the ECFT is a groundwater flow model and does not incorporate density-dependent flow. Thus, it cannot directly evaluate saltwater intrusion.

However, the eastern boundaries are set along the saltwater interface (5000mg/l isochlor). These boundaries are general head boundaries (GHB's). If a proposed scenario produces a significant change in flow along the GHB, this may infer a potential for saltwater intrusion. Performance measures along the interface are being developed to provide indicates in potential changes in fluxes as a result of a proposed scenario.

Documentation:

- What is the status of model documentation?
- It appears that final reports on some key elements supporting the assessment of maximum groundwater availability cannot be completed before that is performed (e.g., documentation of the ECFT groundwater model, the methods of handling interactions between the ECFT and DWRM models, and possibly the USGS data mining study). As we've commented in the past, we are concerned about the potentially limited level of documentation of the technical basis for the assessment of maximum groundwater availability. It is difficult for members of the regulated community to assess and buy into a technical basis if it is substantially undocumented. We recognize that the CFCA timeline places significant constraints on WMD staff – it places similar constraints on us. Even if final reports are infeasible at this time, we would encourage WMD staff to create some written summary for the record of these study elements before the assessment of maximum groundwater availability is made, rather than leaving all formal documentation to a later date.

There are two levels of documentation for modeling that need to be completed.
First is the technical documentation of the model which includes the model technical report, user guide and theory manual. These documents have been previously developed for the model used in the CFCA work, as part of earlier peer review efforts. For the CFCA application however, the models have undergone some refinement, either to incorporate peer review comments or to address specific needs of the CFCA project. These changes to the model have not been documented in updates to the relevant manuals. At this times, there are no short term plans to formally update these documents (mainly due to the staff resource commitments necessary to create these updated manuals and conflict with the need to complete the modeling for CFCA).
The second documentation effort is the application documents which capture the introduction, background, methods, justification of approach, results and interpretation of the results related to the application of the models to the specific project, in this case CFCA. This documentation will be produced based on the schedule presented in the CFCA work plan. To facilitate early access to the documents, collaborative authoring solution such as the WIKI will be contemplated. It may not be possible to share access to the site access to this tool with the public, but it is expected that the development team may use such tools to ensure timely and ongoing documentation of the application of the modeling tools to CFCA.

We will explore the opportunity to allow either read only access to early documentation products or see if regular periodic updates of completed sections of the documents can be posted to the CFCA site. Either way, the team remains committed to an open tool application environment with frequent public input opportunity through workshops and working technical meetings.

DWRM/ECFT Integration:

- How will the results of each model be interpreted considering the other, will they affect the other in the overlay area?
- How will the DWRM model be used to interact with the ECFT model? In particular,
    a) How will boundary conditions be assigned to the ECFT model based on results from the DWRM model, and vice versa?
    b) How will differences in the two models' results be reconciled in the area of the active domain that's shared by both models?

It is the goal of the districts that the two models yield consistent results in the overlap area, or at a minimum are not inconsistent. Currently, the districts are evaluating how the two models respond to similar stresses in the overlap area. Factors that we believe contribute to a difference in the responses include different model conceptualization, proximity of withdrawal to model boundaries, and model parameterization. Based on the outcome of this assessment, it is possible that some model parameters will need to be adjusted.

While the actual sequence of running the tools in concert has not been finalized (will be based on the outcome of the ongoing effort to evaluate the consistency of the tools in the overlap area), it is understood that the outcome could result in either dedicated use of one model to address specific performance measure or in an approach that uses both models to update the other. When using the models for withdrawals in the common area (with the latter option), it is anticipated that both models would be run to determine if adjustments to boundary heads or flows for one or both models will be needed. In this way, effects that are created in one model can be transferred to the other model. It is expected and very likely that this method of application may not be necessary in the current phase of the work and the ECFT and DWRM may be able to suitably address system performance at key locations.

The western boundary of the ECFT model is assigned as a general head boundary. For these boundaries to work it is necessary to assign potentiometric surface levels at some distance from the boundary and a conductance term. For the calibration period, the potentiometric levels were assigned based on levels obtained from wells and the USGS potentiometric surface maps. As part of evaluating consistency of the two models, fluxes across the western boundary of the ECFT model for the calibration period will be compared to the internal fluxes calculated from the DWRM2/CFCA model for the area coinciding with the location of the western boundary. Adjustments to either heads or conductance terms may be made if significant differences are found or basis for the difference determined such that subsequent interpretation of model performance or output can be informed. When different pumping scenarios are

run, changes in fluxes across the western boundary of the ECFT model will be evaluated to determine changes from the "baseline" simulation period. These changes will be compared to changes in model fluxes that occur in DWRM2/CFCA model for the same area. The decision to modify ECFT boundary conditions will be based on comparison of these relative changes. If it is determined that a significant change has occurred, ECFT boundary heads or flows may be adjusted. The same process will be used for the eastern boundary of the DWRM2/CFCA model.

Schedule for updating the tool:

- Is there a schedule for making periodic updates to the tool?

There is no set schedule for updating the CFCA applications although the various numerical models DWRM, and ECFT, as part of other ongoing use, will be subject to continuous improvement and regular updates. The DWRM2/CFCA model will undergo annual or bi-annual updates to include updated pumping files and adjustments to model parameters as needed. The SFWMD has committed significant funds (in its 2011 budget) to gather additional data to help better understand the hydrostratigraphy of central Florida and gather information on key parameters to help improve the model. It is expected that these efforts will not be in time for the current work but would help improve the tools over the next several years.

Recharge options and feature description:

- How was the recharge specified in the model around the ridge?
- How was supplemental recharge applied in the model?
- Can the addition of recharge be introduced? How is this being handled by the team?

Recharge to the ridge areas was based upon land use with some accounting for the deep water table. A discuss of the methodology for calculating recharge from rainfall and RIB flows is included in the response to the second bullet associated with the "Withdrawal representation in model" question. The discussion here focus primarily on the potential for users of the Floridan aquifer some distance away potentially drawing down water levels along the ridges and what methods could be included in the model to offset impacts. Additional RIB sites and changes in existing or proposed RIB flows can be easily added to the model with minimal effort though this is not planned with the determination availability phase of the CFCA modeling. The tool is capable of conducting such scenarios if necessary.

RIB flows were obtained from the respective utilities. The data were converted into inches/day and added to the recharge package for the corresponding model cells. This is basically the same procedure used for the ECF steady state model (McGurk and Presley).

New RIB sites can be introduced into the model for scenario analysis during the solution phase. Specific items needed to include additional RIBS or revised RIB flows should include in the Alternative Formulation stage a minimum of the location and size of the RIBS, estimated in and out flow to and from the RIBs,

potential users and locations of the reuse from the RIBS and any new hydrologic data (i.e. hydraulic conductivity of the sands at the site, etc).

MFLs in the Ridge area & model performance:

- What is the calibration performance in the ridge area?
- How did calibration match with the field data?
- Are there any well clusters measuring both surface and groundwater levels at any of the wetlands in Lake County.?

The model calibration in the ridge is good and meets the predetermined calibration requirements. The Surficial Aquifer performance while generally good at most locations do show occasional high residuals at some observation locations along the ridge. This behavior is expected since there is significant topographic relief across single model cells that could result in large residual between simulated and observed potentiometric surface depending on the location of the observation relative to the cell center.

Overall, most of the simulated values show a significant positive linear correlation with the observed values. Thus the observed and simulated values match well.

No, but there are several well clusters at other locations in the County