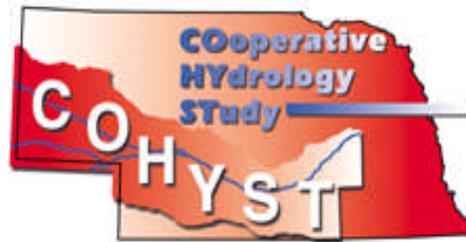


Operating Plan:  
2009 -2012

Cooperative Hydrology Study  
Phase III



September 2, 2009

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## **INTRODUCTION**

The Nebraska COoperative HYdrology STudy (COHYST) was initiated in 1998 for the purpose of working cooperatively to improve understanding of the hydrological and geological conditions in the Platte Basin in Nebraska upstream of Columbus, Nebraska. The COHYST sponsors and partners joined together to develop scientifically supportable hydrologic databases, analyses, modeling, and other information to:

Assist the State of Nebraska to meet the obligations of the three-state and federal Cooperative Agreement now the Platte River Recovery Program (PRRIP),

Assist the Platte River Natural Resources Districts (Districts) in their efforts to regulate and manage the water resources appropriately,

Provide a technical basis for water policy development, and

Assist with the analysis of activities proposed for the PRRIP and other Nebraska programs

One of the benefits of the COHYST effort is providing fundamental data and background analyses needed to build elements to better understand the groundwater resources and groundwater/surface-water interaction to fulfill a need to quantify river gains and losses to the Platte River above Columbus from interaction with groundwater uses.

COHYST has constructed three regional groundwater models of an area encompassing the Platte River in Nebraska (figure 1) during the first phase of the study from 1997-2001. During the second phase of the study 2001- 2008, a number of coordinated projects were conducted to build upon and utilize the COHYST tools and databases. The projects collected additional information for the models to help fill gaps in hydrologic understanding. The refined and enhanced Groundwater Models have been utilized to:

- \* Assess the effects of groundwater irrigation development post 1997 through 2005 on Platte River Base flows.
  - \* Identify the location and magnitude of new groundwater related activities that need to be managed and/or offset.
- A number of reports were written and published during Phase I and Phase II of the study and are listed in Appendix A, and many can be found on the project website at <http://cohyst.dnr.ne.gov>. In addition, a peer review of the models was completed.

### **1. PURPOSE**

COHYST's over-riding purpose is to further understand the hydrology and geology of the Platte River Basin and develop tools to help ensure a consistently high standard of analysis and improve water resource management decisions.

During Phase III, efforts will focus on enhancing the data bases and recalibrating the models to achieve project goals. In addition, objectives will be undertaken to clarify questions that have developed during Phase II. The following initiatives will be undertaken during Phase III to ensure that the studies completed to date are as accurate as possible based on present understandings to assist with management of water resources in the Platte Basin and to provide a mechanism for additional work products to be developed with COHYST input and oversight.

This document provides a framework of the COHYST organizational structure and processes employed to accomplish the goals and objectives enumerated herein.

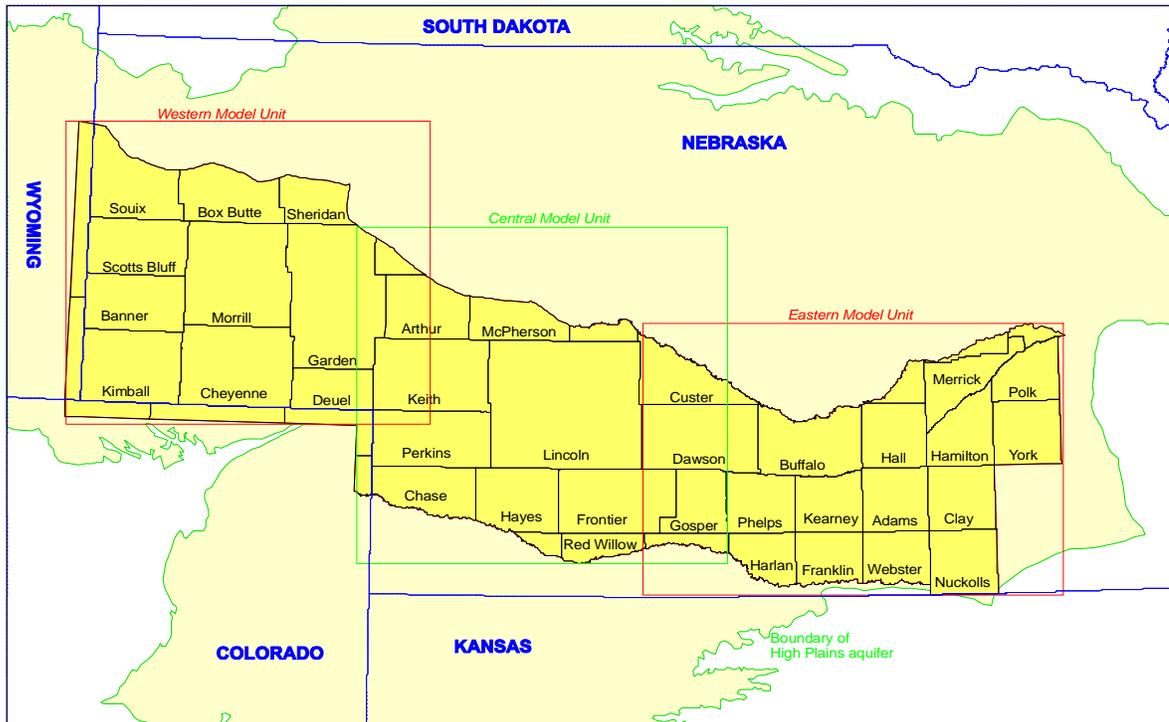


Figure 1. COHYST study area and model units.

## 2. GOALS and OBJECTIVES

Since the COHYST was initiated, the Platte River Recovery Implementation Program (Program) has been signed by the State of Nebraska and LB962 has been enacted. Both identify modeling/analysis needs that could be provided by COHYST. The Program began as a planning process and evolved to a fully funded federal and interstate program with explicit requirements and obligations. The Nebraska legislature has made significant changes to Nebraska's laws regarding surface and ground water regulation when it passed LB 962 in 2004 and several additional laws since then. Due to these changes, and to clarify the questions that have been identified during Phase II, the original goals set forth need updating.

Goal 1) Assist the State of Nebraska to meet the obligations of the three state and federal Cooperative Agreement; now the Platte River Recovery and Implementation Program

Goal 2) Assist the Platte River Natural Resources Districts (Districts) and the Department of Natural Resources in their efforts to regulate and manage the water resources and meet the requirements of LB962

Goal 3) Provide a sound technical basis for water policy development

Goal 4) Assist with the analysis of activities proposed for the Program and other Nebraska programs

Goal 5) Build cooperation and common understanding among the Sponsors to help comply with the Program and state law.

Goal 6) Maintain high technical standards to ensure that studies performed within the Platte Basin utilize the best available data and science so that the widest acceptance of the studies is achieved.

Goal 7) Assess scientific investigations of surface water and groundwater and develop documentation that contributes to the understanding of surface and groundwater relationships in the COHYST area.

Goal 8) Prioritize studies within the COHYST area to ensure that available resources are utilized in a way that provides necessary information while mitigating costs.

Workplans will be developed for each study pertaining to an objective. Some objectives may require more than one study, and corresponding workplan, as multiple analyses may be conducted within the scope of said objective(s). Objectives designed to accomplish Phase III goals include:

Objective 1) Ensure the COHYST models are properly calibrated for the purpose of determining the groundwater component of stream flow accretions and depletions. At a minimum, this calibration must take into account: A balanced water budget, which apportions precipitation between consumption, runoff, and recharge; Temporally variable stresses (e.g. monthly), including precipitation recharge, recharge from surface water irrigations, and groundwater pumping; base flow and/or total flow calibration targets; co-mingled acres consumptive use; and municipal and industrial water use to provide a complete hydrologic perspective.

Objective 2) Develop a tracking and accounting system to assist the state with compliance with the Platte River Recovery and Implementation Program and with integrated water management in accordance with Nebraska State Statutes. Utilizing the calibrated model(s) discussed above, this accounting system will be capable of determining the temporal changes (e.g. monthly) to Platte River base flows from: recharge due to surface water use, groundwater pumping from development that occurred prior to 1997; and the net level of groundwater pumping from development and retirement of acres that occurred after 1997.

Objective 3) Explore available methodologies and select appropriate method (or methods) to facilitate the incorporation of the water budget as it relates to the surface water component of streamflow such that the COHYST will contribute to the regional understanding of surface water and groundwater interaction as it relates to integrated management planning.

Objective 4) Perform alternatives analyses of management and regulation alternatives available to decision makers. Management and regulation alternatives may include management mechanisms relating to acres-related controls and/or allocation of water use, and others as determined by the Sponsors. Additional analyses may include, but are not limited to: crop mix water use calculations, residue management alternatives, reduced till and/or no till land management practices, riparian vegetation management strategies.

Objective 5) Develop policy for making data & information available to the public.

Objective 6) Maintain and update data sets necessary for the development and implementation of regional and subregional investigations and analyses. Update all original COHYST data sets to incorporate added data to 2008. Update all original COHYST temporal data sets to incorporate data up to 2005 at a minimum.

Objective 7) Develop and implement formal archival procedures and protocols.

### **3. STUDY ORGANIZATION**

For this third phase of the COHYST Study the Project Organization will consist of the Sponsors (table 1), the Technical Committee (table 2), Senior Hydrologist(s), Senior Modeler(s), Project Coordinator(s), and work groups as needed (figure 2, table 3). Each will be responsible for providing a specific function in the development of the COHYST process.

The Sponsors will have ultimate responsibility for all decision making, resource allocations, prioritizing study objectives, and projects. The Sponsors will assign tasks to the Technical Committee through the Technical Chair or

assign projects to a Project Coordinator. A work group may be established by the Sponsors to work on projects or may be proposed by the Project Coordinator and approved by the Sponsors.

The Technical Committee Chair and/or Project Coordinator will bring work plans (scope of work, schedules, budgets, human resources, models) analyses, reports, models, peer review, or any other work product to the Sponsors for approval. In addition, the Technical Chair will bring to the Sponsors project updates, tee up for the sponsors any technical issues for resolution and request any guidance necessary regarding policy matters or other items necessary to complete their assignments.

Project Coordinator's will utilize the Technical Committee for review and recommendations for the project's scope of work, technical objectives, standards or their work products. Copies of these comments and recommendations shall be forwarded to the Sponsors. The Project Coordinators will utilize modelers, contractors or other Sponsor-supplied technical staff as approved by the Sponsors through the work plan to provide work or data for various tasks.

The Senior Hydrologist will provide guidance to the Sponsors regarding the COHYST goals, objectives, tasks, technical issues and projects and may be used by the Coordinators for input into projects and tasks. The work plan for each tasks and project will identify the role and function of the Senior Hydrologist and the costs of their involvement. All guidance and recommendations of the Senior hydrologists shall be provided in writing to the Sponsors and the Project Coordinator of Technical Committee Chair as appropriate.

## **Projects**

A project may be implemented through a Project Coordinator and may include the establishment of a work group by the Sponsors. A single objective may incorporate more than one project to fully address the issues addressed. The work will be completed through agreements for Sponsors' staff time, or through contractors.

The Work Groups assigned by the Sponsors may draw upon the modelers, senior modeler(s), and contractors as specified in the work plan. Other technical staff from each sponsor and partner agency may be utilized to provide work or data for various tasks by contributing in-kind services to the overall project effort if approved by the Sponsors and authorized by the Sponsor whose technical staff will be performing the work under the work plan. COHYST modelers and/or Contractors shall provide feedback and recommendation to the Project Coordinator in order to enhance completion of the assignments.

## **Tasks**

Tasks generally have a more limited scope, and typically do not require a workplan. A task may be implemented through the Technical Committee Chair or Project Coordinators and may include the establishment of a work group. A single objective (or workplan) may incorporate more than one task to fully provide the necessary information. The work will be completed through agreements for Sponsors' staff time, or through contractors when necessary. The work groups may draw upon Technical Committee members. Work groups may additionally utilize the senior modelers, hydrologists, or contractors as authorized by the Sponsors. COHYST modelers and/or Contractors shall provide feedback and recommendation to the Technical Committee Chair in order to enhance completion of the assignments.

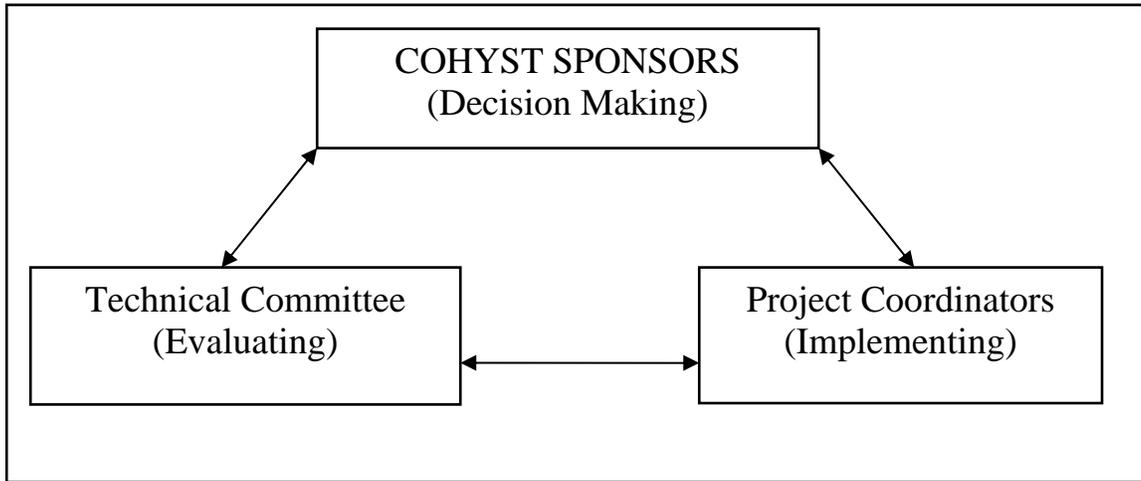


Figure 2. COHYST Project Organization and Fundamental Responsibilities

**a. Sponsors**

To meet the goals and objectives of COHYST, the Sponsors will direct and oversee the COHYST activities and will assign tasks to the Technical Committee Chair or Project Coordinators and projects to the Project Coordinators. The Sponsors will provide, as necessary, direction, funding, guidance, peer review requirements, or other information regarding the assignments. The Sponsor will decide whether a work group needs to be formed for completion of projects.

The Sponsors shall be responsible for:

- Establishing goals and objectives,
- Ensuring the success in achieving the purposes and goals of COHYST,
- Promoting the adoption of the COHYST modeling process and quality assurance methodologies,
- Establishing annual budgets and provide for necessary funding for projects developed by one or more Sponsors, OR providing budgetary advise to project developers for projects developed by non-sponsors,
- Approving expenditures and contribution levels of Sponsors,
- Assigning tasks to the Technical Committee Chair or Projects to a Project Coordinator,
- Designating Project Coordinators,
- Approving contracts as needed with consultants, modelers, customers and others as determined necessary,
- Approving contracts for utilization of the COHYST tools with either Sponsors, a group of Sponsors or Parties not members of the COHYST Project,
- Approving studies, work plans, models, reports, analyses, or any other work products of the COHYST,
- Adopting studies as COHYST-endorsed products,
- Providing time to address resolution of any project management or technical issues.
- Determining if COHYST should be trademarked.
- Determining the need for additional projects or studies
- Other policy or technical items that may occur

The Sponsors will execute their responsibilities in accordance with the Interlocal Cooperation Agreement [ILCA].

Table 1: COHYST Sponsors organizations and delegated representatives.

<u><b>Sponsors</b></u>	
Twin Platte NRD	Kent Miller
Tri-Basin NRD	John Thorburn
Central Platte NRD	Ron Bishop
Nebraska Department of Natural Resources	Jim Schneider
Nebraska Game & Parks Commission	Frank Albrecht
CNPPID	Don Kraus (chair)
NPPD	Brian Barels

**b. Technical Support Staff**

Technical Support staff includes members of the Technical Committee, the Senior Hydrologist(s), the Senior Modeler(s), and any contracted consultant(s). The coordinated efforts of technical support staff as outlined in subsequent sections of this document will provide a solid technical basis for development of data bases and tools needed for policy development.

**i. Technical Committee**

The Technical Committee (TC) will provide evaluations of various work products, work plans and Requests for Proposals (RFP’S), techniques and proposed studies as requested. A chair will be approved by the Sponsors and funding will be provided for the TC. The Committee Chair will report to the Sponsors on a regular basis regarding the various tasks assigned to the TC and any evaluations conducted.

The TC will be comprised of one or more people representing each of the COHYST members (table 2).

The TC will be responsible for:

- Reviewing quality assurance guidelines and proposing revisions,
- Critically reviewing work products and documentation,
- Providing documentation of requested technical evaluations to the Sponsors and/or Project Coordinator(s),
- Performing Quality Assurance/ Quality Control (QA/QC) protocols for each analysis performed within the Modeling Process.

Findings of the TC may be in two forms: a consensus, or a majority opinion and minority opinion. Areas of disagreement regarding evaluations performed by the TC will be documented and resolved with the Sponsors through the process outlined in Section 4.c.

Table 2: COHYST Sponsors organizations and delegated Technical Committee representatives.

<b><u>Technical Committee</u></b>	
CPNRD CNPPID Tri- Basin NRD	Duane Woodward (chair) Mike Drain, Hayden Strickland Rich Holloway
NDNR	Doug, Hallum, Mahesh Pun, Rick Vollertsen
NPPD NGPC Twin Platte NRD	Jeff Shafer, Michael Krondak Tim McCoy, Keith Koupal Kevin Spelts

**ii. Project Coordinator(s)**

A Project Coordinator will be designated by the Sponsors to provide project management direction to insure successful completion of each project relating to an objective as described in the work plan. Project Coordinator(s) will be responsible for project design and implementation,

The Project Coordinator will utilize the Technical Committee to review and provide comments and recommendations for the project scope of work, technical objectives and standards, analyses, models or other work products. Copies of these comments and recommendations shall be forwarded to the Sponsors.

The Project Coordinator will report to the Sponsors on a regular basis regarding progress of the project. Table 3 shows examples of possible project committees under the framework of this document.

The Project Coordinator will be responsible for:

- Developing a work plan to achieve a COHYST goal or objective,
- Identifying the project costs (in dollars, in-kind staff time, or both),
- Identifying schedules for the project,
- Ensuring assumptions utilized by the project are clearly identified
- Ensuring that project deliverables are received on schedule,
- Ensuring that archiving of models, analyses, and results is completed ,
- Reporting progress on the project to the Technical Committee, and/or the Sponsors when requested,
- Providing copies of comments and recommendations of the technical committee or Senior Hydrologists, or Modelers on their project to the Sponsors
- Teeing up any technical or policy issues to the Sponsors for resolution
- Together with the Technical Committee, ensuring that quality assurance guidelines are implemented consistent with the Workflow and Project Implementation section of this document.

Table 3: Examples of potential COHYST Projects and likely representatives.

<u><i>Project</i></u>	<u><i>Coordinator</i></u>	<u><i>Members</i></u>
Irrigated Acres Redevelopment	Duane Woodward	Duane Woodward, Rick Vollersen
COHYST 2010	TBD	Doug Hallum, Duane Woodward

**iii. Senior Hydrologist(s)**

Senior Hydrologist(s) may be retained by the Sponsors. The Senior Hydrologist(s) has the primary responsibility to advise the sponsors with respect to developing a sound technical approach to accomplish management goals and answer management questions. The Senior Hydrologist(s) will provide advisory-level guidance to the Sponsors regarding COHYST goals, projects, and tasks. For each project, the work plan will identify the role and function, as necessary, and an associated cost estimate for the Senior Hydrologist for that effort. Copies of the Senior Hydrologist guidance and recommendations shall be provided to the Sponsors. The Senior Hydrologist may also advise the Sponsors regarding a proper level of quality assurance for any COHYST work products.

Depending on the project, the Senior Hydrologist is expected to complete one or more of the following tasks when requested:

- Meet with the Sponsors to develop an understanding of the COHYST goals and objectives that need to be accomplished
- Working with the Sponsors, Technical Committee, Project Coordinator(s), and Senior Modeler(s); determine analyses and models that would provide the tools to address study objectives in an efficient and cost-effective manner.
- Working with the Sponsors, Technical Committee, Project Coordinator(s), and Senior Modeler(s); evaluate scopes of work, project progress reports, and project findings.
- Review the sufficiency of available data and methods as it pertains to scopes of work contained in the various workplans.
- Make recommendations regarding content and format of the database(s).
- Meet with Project Coordinators (s) to insure that study methods and objectives are clearly understood.
- Review work products and provide critical reviews and advice on how to proceed. Be available for consultations and problem solving.
- Prepare a review of completed studies noting their strengths and limitations.
- Collaborate with Sponsors to provide direction for additional work and analyses, and advise the Sponsors regarding quality assurance for all COHYST work products.
- To the degree possible, assure work products provide the tools and or results necessary to meet the goals and objectives developed by the Sponsors
- Provide sponsors with recommendations regarding technical approaches

#### **iv. Modelers**

Modelers, for the purposes of this document, shall be defined as various Sponsors' staff, or contractors capable of designing, constructing, and executing model analyses. Modelers will support the Project Coordinators and Technical Committee Chair in completing; tasks outlined in workplans, or assigned to the Technical Committee Chair or Project Coordinators, and projects under the direction of a Project Coordinator in the execution of a workplan in accordance with an approved contract.

#### **v. Senior Modeler(s)**

A Senior Modeler(s) may be retained to aid in the implementation of tasks or projects for the Sponsors, participate in selecting and implementing modeling methodologies and reviewing work and work products. Specific roles and tasks may include:

- Assist Technical Committee Chair or Project Coordinators in developing an understanding of the methodological problems that need to be addressed.
- Working with the Technical Committee Chair, Project Coordinator(s), and Senior Hydrologist(s); determine analyses and models that would provide useful tools to address study objectives.
- Evaluate scopes of work, project progress reports, and project findings.
- Identify data needs.
- Make recommendations regarding content and format of the database(s).
- Participate in implementing the work plans as directed by the sponsors.
- Review work products and provide critical reviews.
- Be available for consultations and problem solving.

#### **vi. Consultant(s)**

Additional consultants may be hired to complete tasks relating to the various work plans under the study objectives. These tasks will be defined in detail in the service contract to meet the study objectives and satisfy the requirements of the appropriate work plan

### **4. WORKFLOW AND PROJECT IMPLEMENTATION**

Figure 3 shows a flowchart of how study work will be conducted to meet COHYST goals. This will be called the Modeling Process. While the process represents industry standards with respect to numerical groundwater models, this process outlined here may apply to any project conducted by the COHYST.

In terms of project technical work, COHYST Sponsors are primarily responsible for framing management questions and providing guidance relating to the intended application of the efforts underway. Therefore, they are assumed to be intimately involved in the design phase (Defining the Problem, Designing the Conceptual Model) of each investigation. The Project Coordinator(s) (including a work group where necessary) will conduct the bulk of the workplan design and implementation, as well as quality assurance and publication, and will therefore be involved in every phase of an investigation for which they are responsible. The Technical Committee will be largely responsible to provide evaluations and technical feedback to facilitate Sponsors' decisions, providing much of their involvement in the design phase of each investigation, along with the additional responsibility of providing a thorough evaluation during the quality assurance phase of each study (Dealing with Limitations and Uncertainty).

#### **a. The Modeling Process**

The COHYST recognizes that numerical groundwater modeling has limitations and that typical modeling studies employ a rigorous process by which studies are advanced. Figure 3 provides a schematic diagram of a commonly accepted process. This will be the foundation of COHYST work products. Following is a detailed description of the process with respect to COHYST analyses. The procedures outlined below will be used on all models and investigations as appropriate.

**i. Defining the Problem**

Management objectives, approaches, and other requirements will be evaluated to determine a list of priority management questions to be addressed. The management questions will then be evaluated for the purpose of developing a list of technical questions capable of being answered through an analysis conducted within the modeling process adopted herein. A Coordinator will be assigned who is responsible to develop a workplan to address the various questions that have been posed. Workplans will include the scope of work to be completed, the project schedule and duration, and a project budget. The workplan can be completed directly through a Project Coordinator (including a work group, when necessary), or through a RFP process employing consultants, or another method as designated by the Sponsors. The workplan will be evaluated and the contract negotiated.

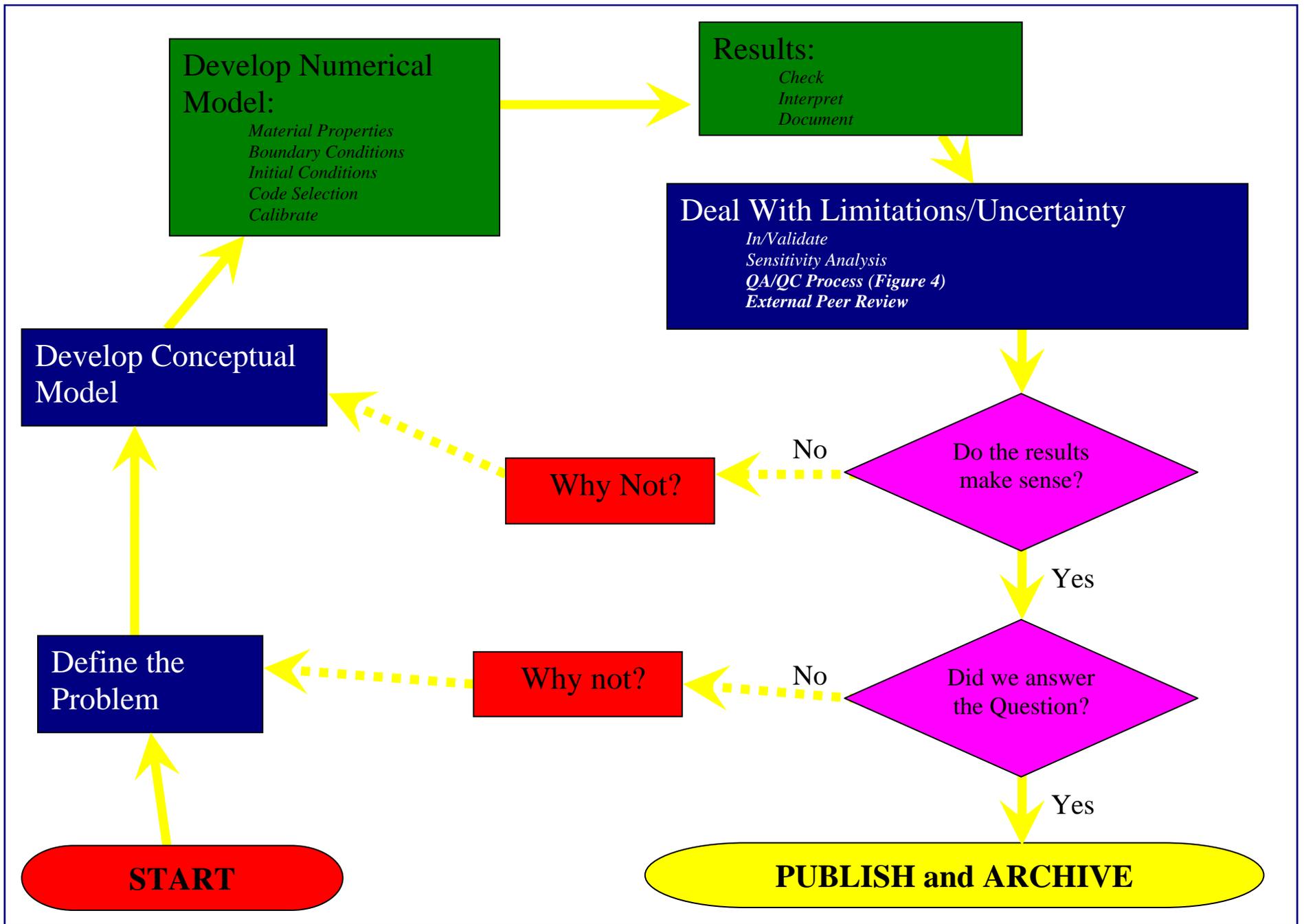


Figure 3: Schematic Diagram of modeling process employed by COHYST Sponsor

## **ii. Developing the Conceptual Model**

When the contracts are in place, a conceptual model of the system (or analysis) will be developed and evaluated. A decision will be documented relating to the conceptual models adequacy before proceeding. When the conceptual model is determined to be adequate, the study will proceed to development of the numerical model.

In the instance that the project is not a numerical model, the concepts employed in the Modeling Process may be adapted and applied to any workplan developed. At a minimum, they will define the problem as described above, describe the process involved to solve the problem, resolve any workplan changes, provide periodic updates, provide an appropriate QA/QC procedure, incorporate a review, follow the archive process outlined herein, and provide documentation suitable for publication in hardcopy and digital format.

## **iii. Developing the Numerical Model**

Model development and checking and interpreting (figure 3) initial results will be conducted in accordance with the workplan. Periodically, a status report will be provided. Feedback provided relating to Project status reports will be considered and incorporated where appropriate.

## **iv. Checking and Interpreting the Results**

Checking and interpreting initial results will be conducted in accordance with the workplan. Periodically, a status report will be given to the Technical Committee and/or Sponsors. Feedback provided relating to Project status reports will be considered and incorporated where appropriate.

## **v. Dealing with Limitations and Uncertainty**

Modeling investigations employed though the process outlined here will make every effort to quantify uncertainty in results to the degree possible, and to mitigate the uncertainty where necessary. Typical approaches to uncertainty mitigation include sensitivity analysis of various boundary conditions, utilizing a variety of spatial distributions of aquifer parameters, automated uncertainty analyses, or automated calibration techniques.

### **(1) Validation/Invalidation**

Where possible, to provide the most rigorous possible calibration, analyses conducted by the COHYST will employ a calibration period and a validation period as an iteration in the calibration process. The form of this step will be described in the respective workplans and employed by the Coordinator.

## (2) QA/QC Process

A critical component of the modeling process which determines the relative success or failure of a modeling study is the QA/QC process. Each analysis conducted by the COHYST will be analyzed within the QA/QC process described herein. Quality of data and analyses is critical to establishing and maintaining high technical standards and provides a measure of due diligence with respect to analysis results.

The process can best be described in terms of three basic tests, or benchmarks to meet. These tests have typically been described as a series of questions to be answered pertaining to the analysis. The problem must be properly conceptualized and understood. The analysis must also be reproducible, where the documentation and data deliverables are sufficient to recreate the analysis independently. And the results must be reasonable and validated through a series of exercises designed to identify possible weaknesses in the model and/or analysis.

The purpose, or problem being addressed provides the foundation for the rest of the analysis. The following questions provide a starting point for the QA/QC process: Is the problem clearly stated and understood? Is the conceptual model sufficient to answer the question? Which model packages and input data sets will contribute the most uncertainty?

The ability to reproduce the analysis is fundamental to scientific and technical analysis. Inability to reproduce an analysis creates questions relating to quality, casts doubt, and can ultimately undermine the credibility of the study. The questions here, along with an actual re-creation of the analysis, help ensure that COHYST analyses can be reliably reproduced, they include: Are all the files in the documentation present in the archive? Are there files noted in the documentation that are not in the archive? Are there files in the archive that are not referenced in the documentation? Is the process description sufficient to reproduce the analysis? Are results produced within rounding error of the original analysis? Do all the files have metadata sufficient to determine their use and relationship to the analysis?

Results of the analysis can be effectively evaluated to determine if they are reasonable and do not contain fatal flaws that may be discovered after publication if not for a formal QA/QC. Questions contributing to this step of the QA/QC process include: Does the total water budget close? Does the water budget close at the zone (analysis unit – NRD, reach, county, irrigation district) scale? Does the water budget close at an individual cell scale? Are there anomalies or outliers in the results? Is the total volume of introduced stress accounted for in the analysis? What (if any) portion of the introduced stress is unaccounted for? Which packages may account for any missing water? Are the results reasonable with respect to known conditions? Are the results within normal tolerances of observed historical calibration values? Are the model input data sets within the range of observed values within the study area?

### **(3) External Peer Review**

Many projects may benefit from a peer review conducted by professionals who have expertise in the type of analysis proposed. This differs from the QA/QC process only inasmuch as the reviewer has limited experience with and exposure to the COHYST process. External peer review can be a powerful mechanism to establish credibility and build acceptance of COHYST analyses in professional circles well beyond local and regional entities. The Sponsors will determine if a peer review is warranted for any analysis, revision to a model or any project that is proposed during the development of the workplan. Any analysis requiring an external peer review will incorporate the peer review process costs and schedule into the workplan.

#### **vi. Post-Analysis Questions (Audit)**

After each analysis task is completed, the Modeling Process prescribes asking two questions: Do the results make sense? and Did we answer the Question? These questions go beyond the considerations in the QA/QC process to the degree that they incorporate a broader context of research and study.

Asking if the results make sense incorporates a consideration for the history of similar research to that point in time. The essential consideration in question is whether the current study conforms to previous findings or is divergent from those findings. An analysis of any precedence that has been set by previous research must be completed and deviations from the previous research must be explained to justify the departure from previously held knowledge. As a result of this investigation, an argument may be made, and will be documented, when previous analyses are deemed inappropriate and/or obsolete. If the results of the study do not conform to the existing body of research, AND an argument to supersede that body of evidence cannot be made, the Study must reconsider the conceptual model of the system and repeat the analysis under the new conceptual model. Another workplan may be needed (and approved through the process outlined above) if the original did not have a contingency for iterations of this sort.

The final consideration if the question posed was answered. The evaluation considers all the information and findings of the Modeling Process to this point, as well as the management objective that was the subject of the original question, or purpose to be addressed. If the question has been satisfactorily addressed, the project will proceed to the Archival Process. If it is determined that the objective in question has not been achieved, the management problem, and technical question(s) derived from the management problem will be re-examined to determine if either need to be reformulated. The problem may be redefined the Modeling Process begun again with a redefined technical question, or to archive the analysis as it exists and document the insufficiency of the findings.

**vii. Archival Process**

The COHYST intends to maintain a consistent and reliable set of publically available archives. The archival process is implemented in large measure during the QA/QC process described above. The QA/QC was designed to ensure that all necessary components of an analysis are available in the analysis archive. A permanent Archive Coordinator will be named and will be responsible for packaging the data and documentation created from the QA/QC process and incorporating it into the COHYST database, which is available on the internet at: <http://cohyst.dnr.ne.gov/>.

**viii. Approval and Publication**

The documentation, data and archival files will be reviewed for completeness and submitted for final approval by the Sponsors. Once final approval is published in the Sponsors meeting minutes, the archive will be published on the COHYST website.

## Preliminary Results (Figure 3)

### *Project Conceptualization*

*Is the problem clearly stated and understood by the modelers?  
Is the conceptual model sufficient to answer the question?  
Which model packages will contribute the most uncertainty?*

### *Project Reproduceability*

*Are all the files noted in the documentation present in the archive?  
Are there files needed that are not in the archive? Documentation?  
Is the process description sufficient to reproduce the analysis?  
Are results produced within rounding error of the original analysis?*

### *Reasonable and Valid Results*

*Does the water budget close? (zone and model scale)  
Are there anomalies/outliers in the results?  
Is the total volume of introduced stress accounted for in the analysis?  
What portion of the introduced stress is unaccounted for?  
Are there packages that may account for the unaccounted water?*

## Post-Analysis Questions (Figure 3)

Figure 4: Schematic Diagram of QA/QC process employed by COHYST Sponsors.

**b. Projects Developed outside the COHYST Project Organizational Structure**

**i. Projects Developed by One or More Sponsors**

A goal of COHYST is to encourage cooperation among the Sponsors to help comply with the PRRIP and the requirements of the Groundwater Management and Protection Act. In addition, COHYST is interested in maintaining high technical standards to ensure that studies performed within the Platte Basin utilize the best available data and science so that the widest acceptance of the studies is achieved and the most productive use of limited resources is accomplished. In order to achieve these goals, COHYST encourages that analyses and studies used for management plans be coordinated with the COHYST. This can be accomplished in the following ways: If a Sponsor identifies studies or analyses that are needed for an Integrated Management Plan (IMP) and submits a proposal or workplan to COHYST, the COHYST will provide an evaluation of the proposal or plan and a contract for review of the analysis in the Modeling Process which may require funding from the Sponsor. Or, if any studies are completed by a Sponsor or group of Sponsors that are needed for an IMP and a request is made to COHYST for technical evaluation, COHYST will review the request and may provide a proposal to subject the work product to the QA/QC and archival and publication processes described in this document.

**ii. Projects Developed by Non-Sponsors**

COHYST is interested in maintaining high technical standards to ensure that studies performed within the Platte Basin utilize the best available data and science so that the widest acceptance of the studies is achieved. In order to achieve these goals, COHYST encourages that analyses and studies used for regional and sub-regional analysis be coordinated with the COHYST in the interest of providing complementary benefits. This can be accomplished in the following ways: If an entity identifies studies or analyses that are needed for a regional or sub-regional analysis and submits a proposal or workplan to COHYST, the COHYST will provide an evaluation of the proposal or plan and a contract for inclusion of the analysis in the Modeling Process. Or, if any studies are completed by entities not currently involved with the COHYST and a request is made to COHYST for technical evaluation, COHYST will review the request and may provide a proposal to subject the work product to the QA/QC and archival and publication processes described in this document.

**c. Technical Issue Resolution Process**

At the end of each Sponsor meeting a separate Technical Issue Resolution session will be convened. Personnel may include the Sponsors, Technical Committee Chair, Project Coordinator, the Senior Hydrologist, and members of the work group, as needed. If the issue needs outside expertise to assist the Sponsors, one or more experts in the field may

be asked to provide advice regarding the issue. A facilitator may be retained if needed. The sponsors may request written opinions from any/all of the participants.