

**U.S. DEPARTMENT OF ENERGY
OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT**

**PRESENTATION TO
THE NUCLEAR WASTE TECHNICAL REVIEW BOARD**

**SUBJECT: CALICO HILLS RISK/BENEFIT
ANALYSIS**

- **DESCRIPTION OF FRAMEWORK
FOR EVALUATING ALTERNATIVES**
- **DESCRIPTION OF THE EXPERT
ASSESSMENTS**

PRESENTER: HOLLIS CALL

**PRESENTER'S TITLE
AND ORGANIZATION: PRINCIPAL DECISION ANALYST,
APPLIED DECISION ANALYSIS, INC.**

**PRESENTER'S
TELEPHONE NUMBER: (415) 854-7101**

JULY 24-25, 1990

**U.S. DEPARTMENT OF ENERGY
OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT**

**PRESENTATION TO
THE NUCLEAR WASTE TECHNICAL REVIEW BOARD**

**SUBJECT: CALICO HILLS RISK/BENEFIT
ANALYSIS**

- DESCRIPTION OF FRAMEWORK
FOR EVALUATING ALTERNATIVES
- DESCRIPTION OF THE EXPERT
ASSESSMENTS

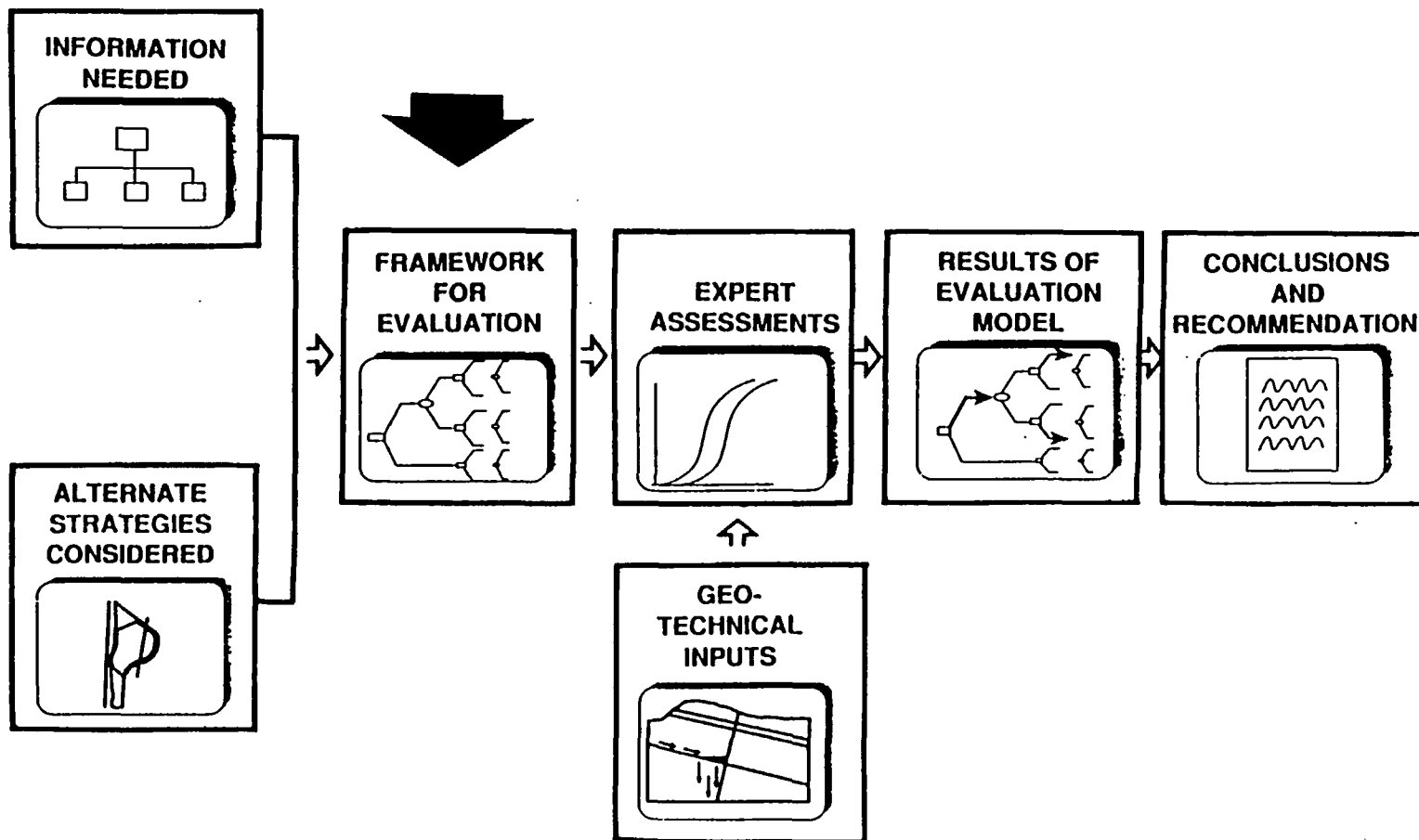
PRESENTER: HOLLIS CALL

**PRESENTER'S TITLE
AND ORGANIZATION: PRINCIPAL DECISION ANALYST,
APPLIED DECISION ANALYSIS, INC.**

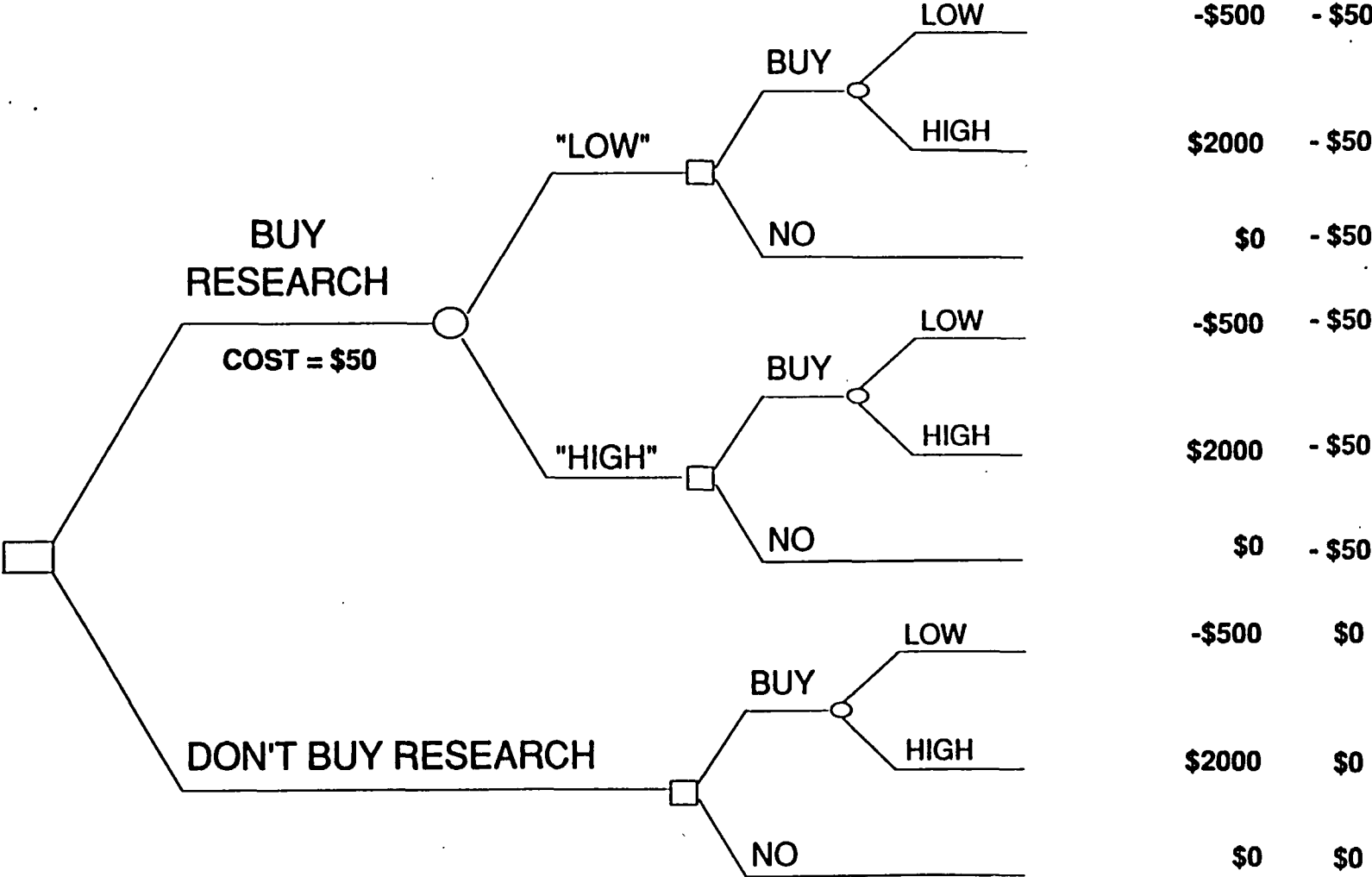
**PRESENTER'S
TELEPHONE NUMBER: (415) 854-7101**

JULY 24-25, 1990

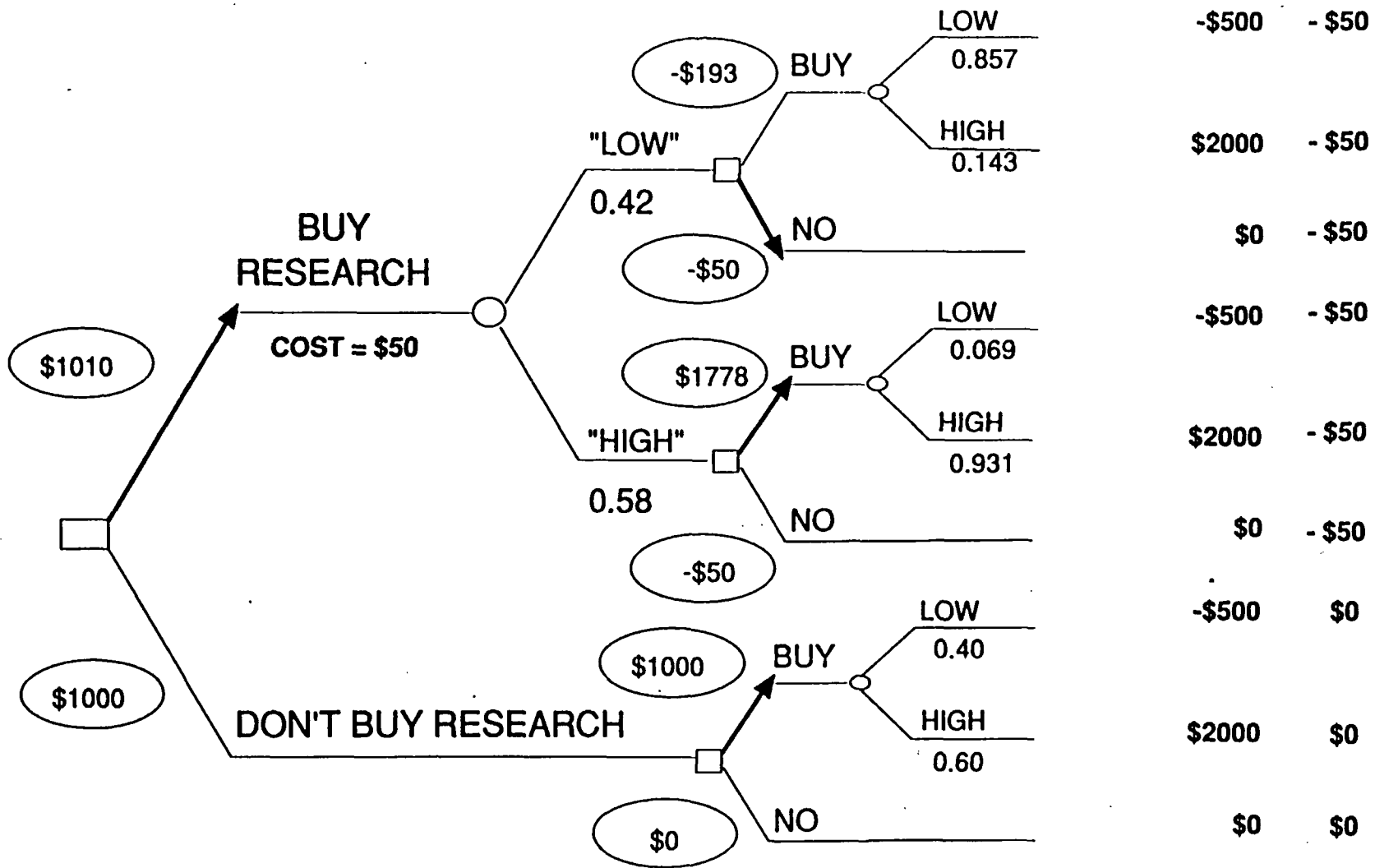
STRUCTURE OF THE CALICO HILLS RISK/BENEFIT PRESENTATION



OUR "VALUE OF INFORMATION" MODEL IS BASED ON THE CLASSIC VIEW OF HOW INFORMATION ADDS VALUE TO DECISION MAKING



RESEARCH DECISION RESEARCH RESULTS INVESTMENT DECISION STOCK PERFORMANCE OUTCOMES



RESEARCH
DECISION

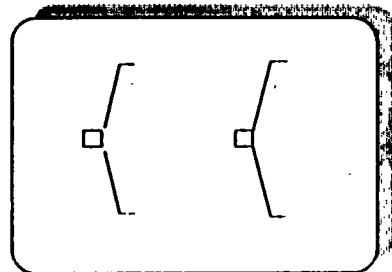
RESEARCH
RESULTS

INVESTMENT
DECISION

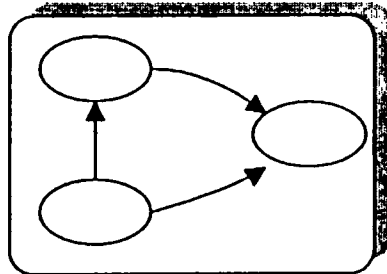
STOCK
PERFORMANCE

OUTCOMES

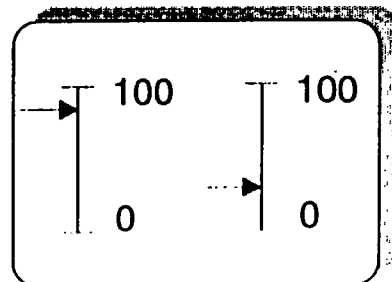
THERE ARE THREE MAJOR STEPS TO IMPLEMENT THE VALUE OF INFORMATION FRAMEWORK



IDENTIFY MAJOR DECISIONS



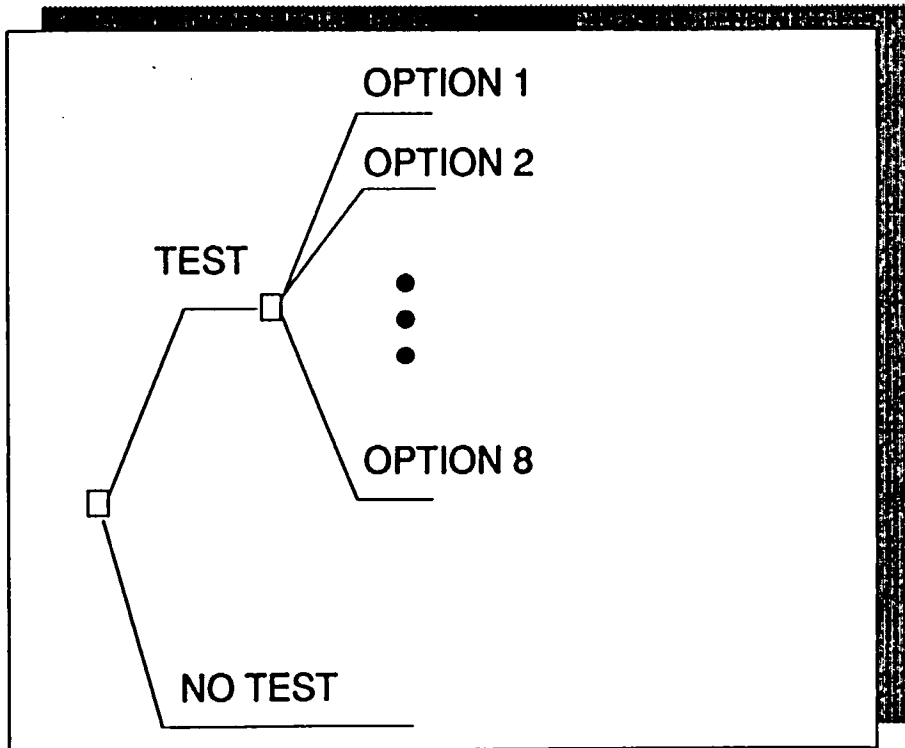
**IDENTIFY KEY UNCERTAINTIES
AND PROBABILISTIC
RELATIONSHIPS**



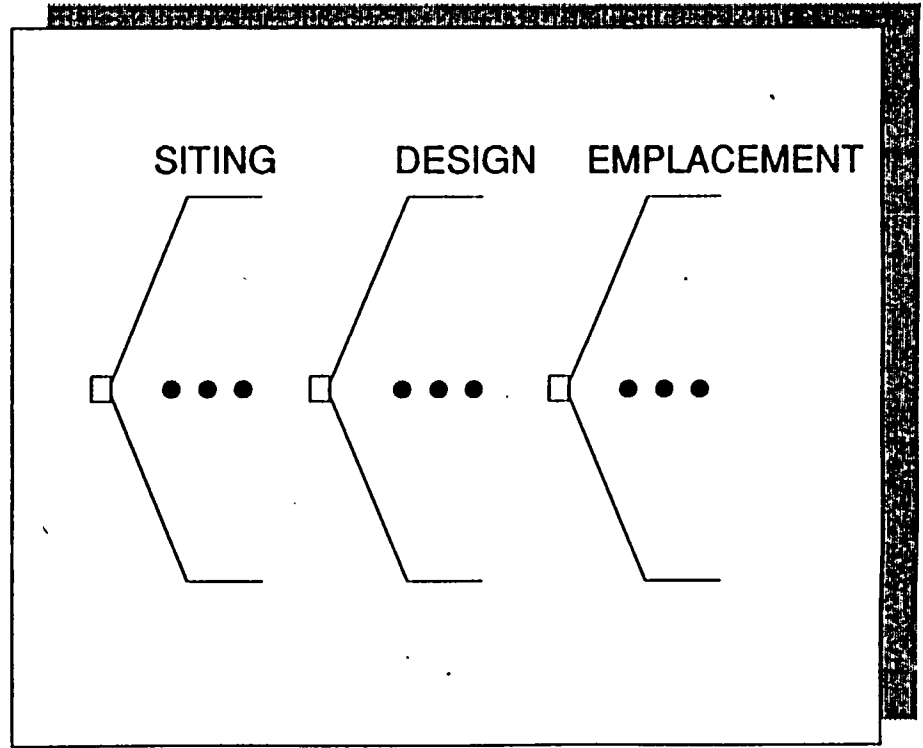
**IDENTIFY OUTCOMES AND
VALUES**

STEP 1: IDENTIFY MAJOR DECISIONS

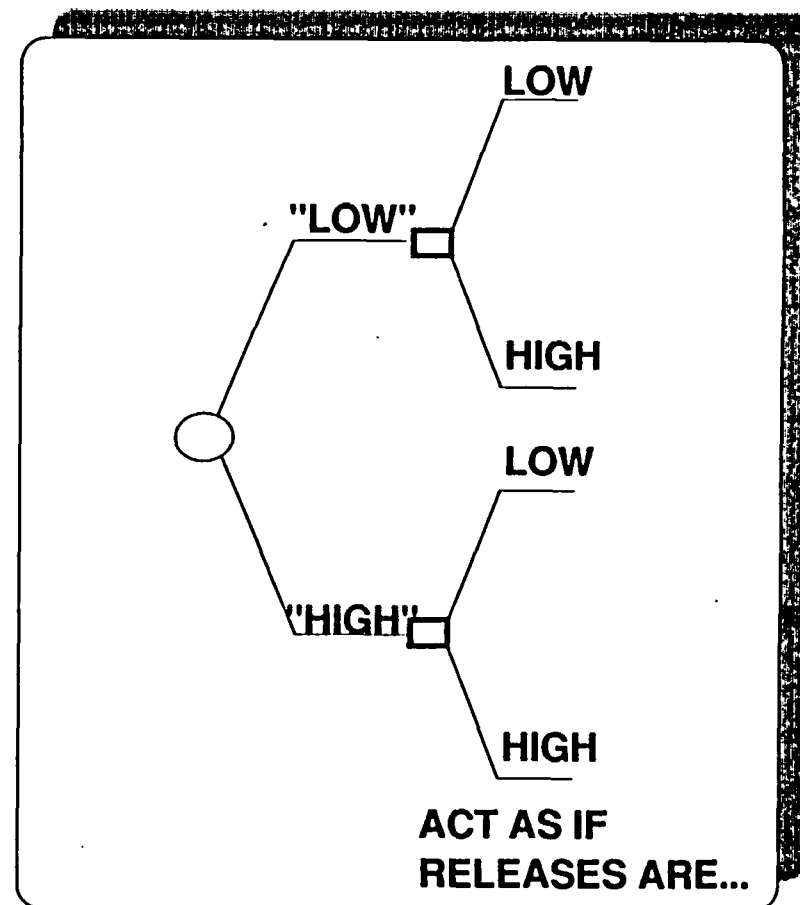
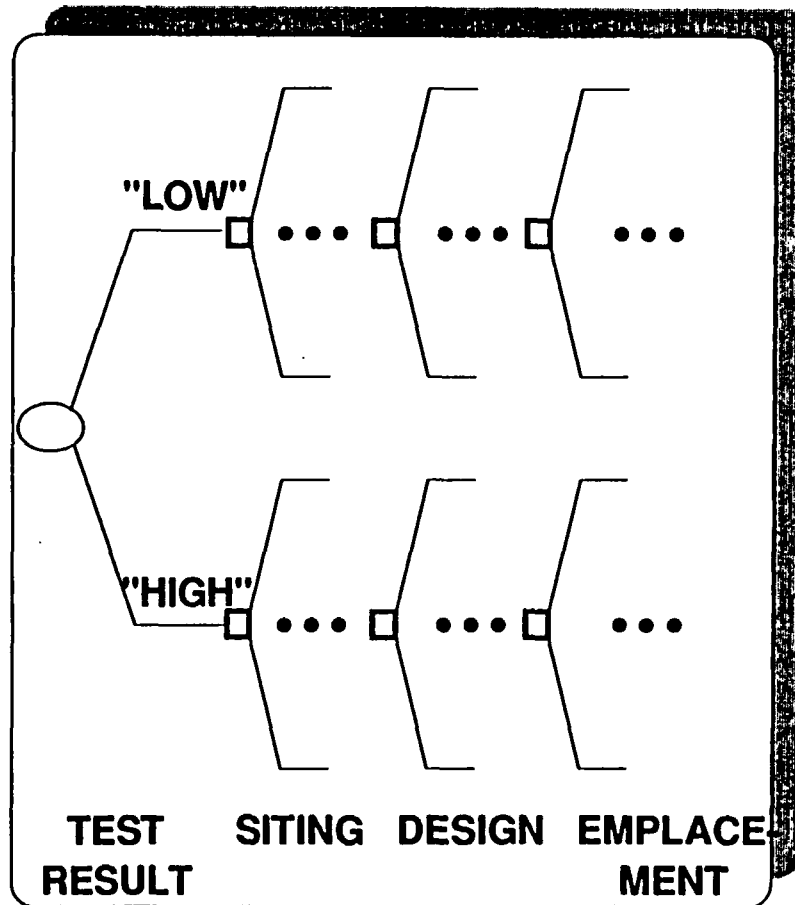
"IMMEDIATE" DECISIONS



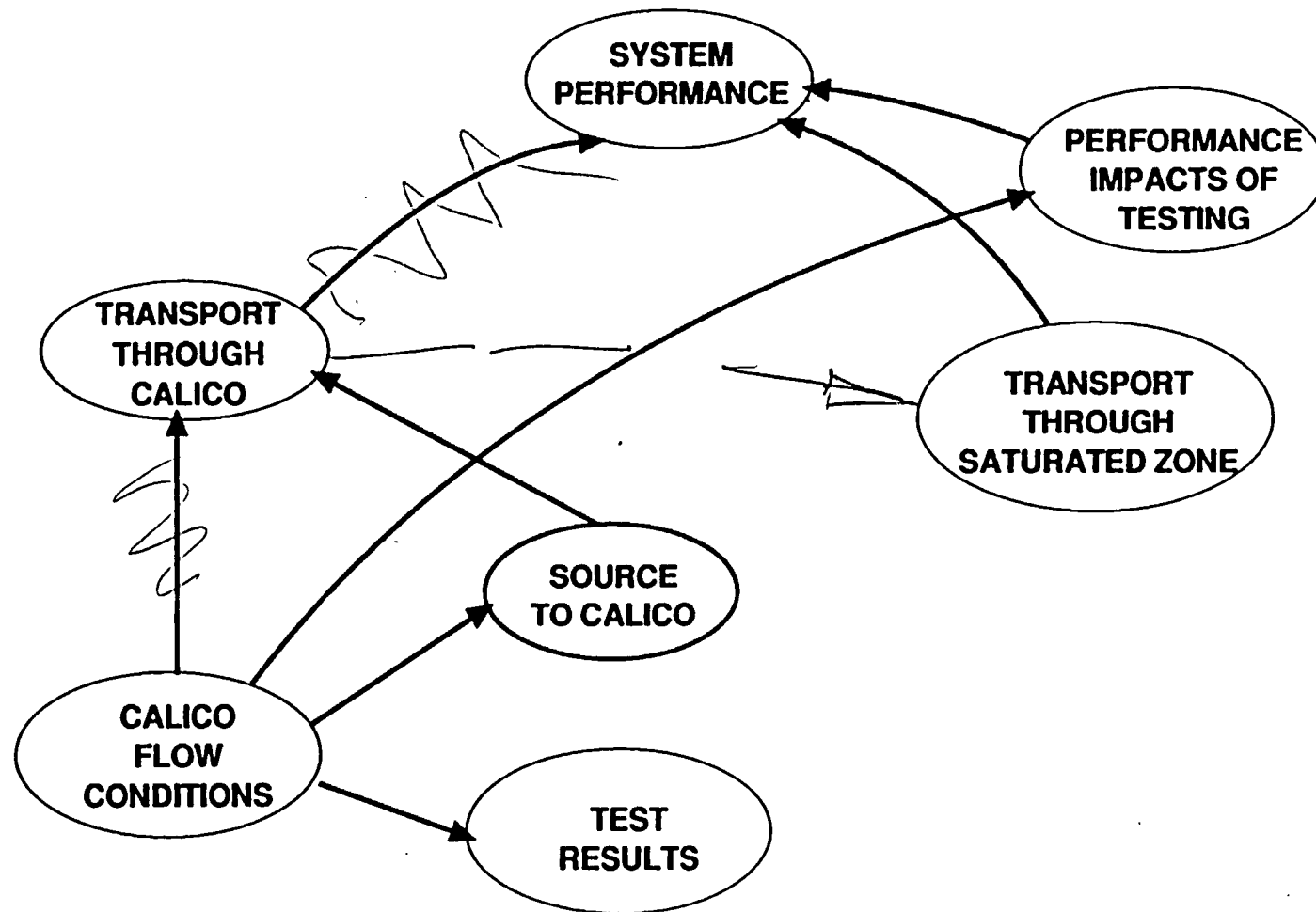
"FUTURE" DECISIONS



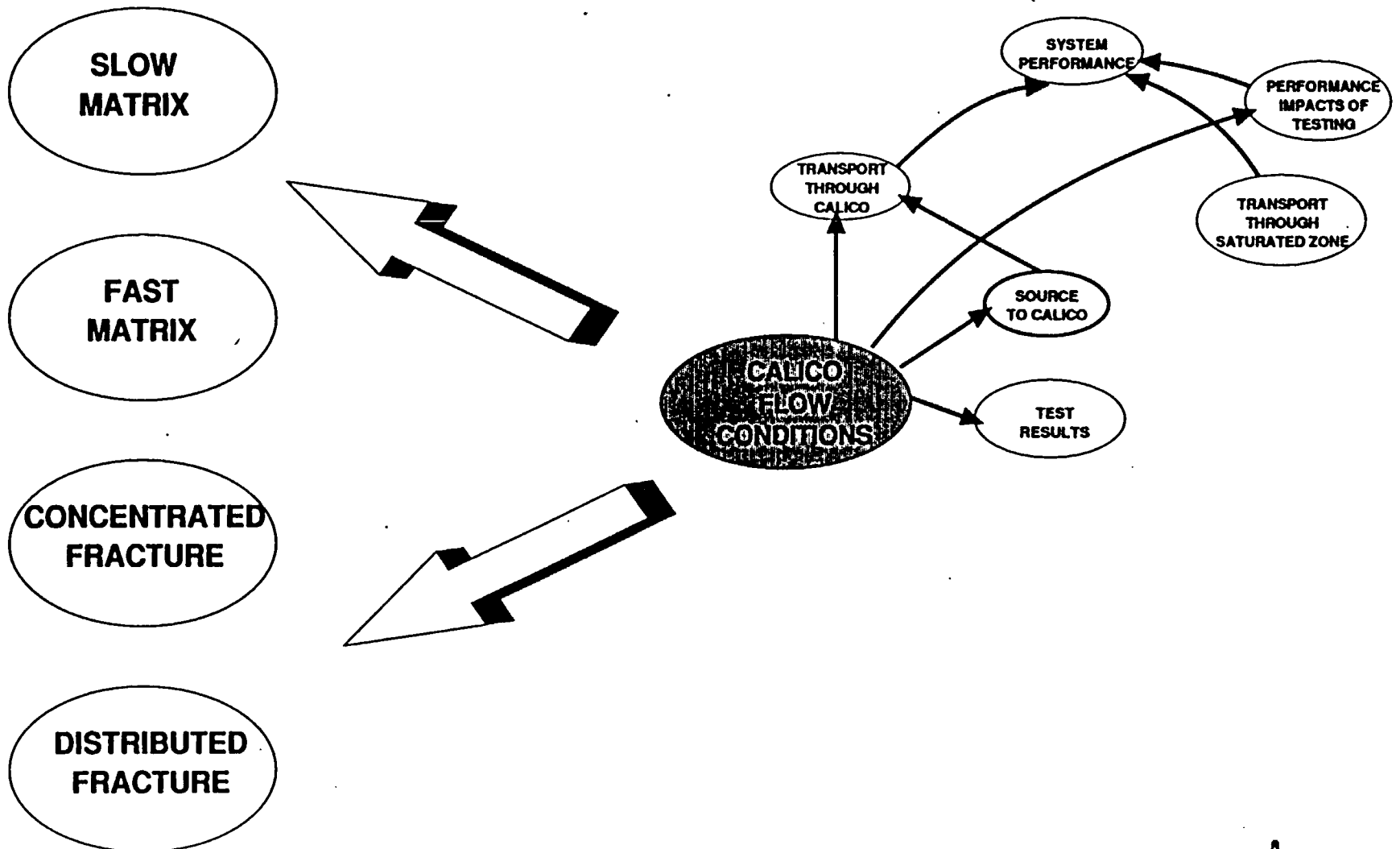
BUT, THE COMPLEXITY OF THE DECISION MAKING PROCESS REQUIRED SIMPLIFICATION IN OUR MODEL



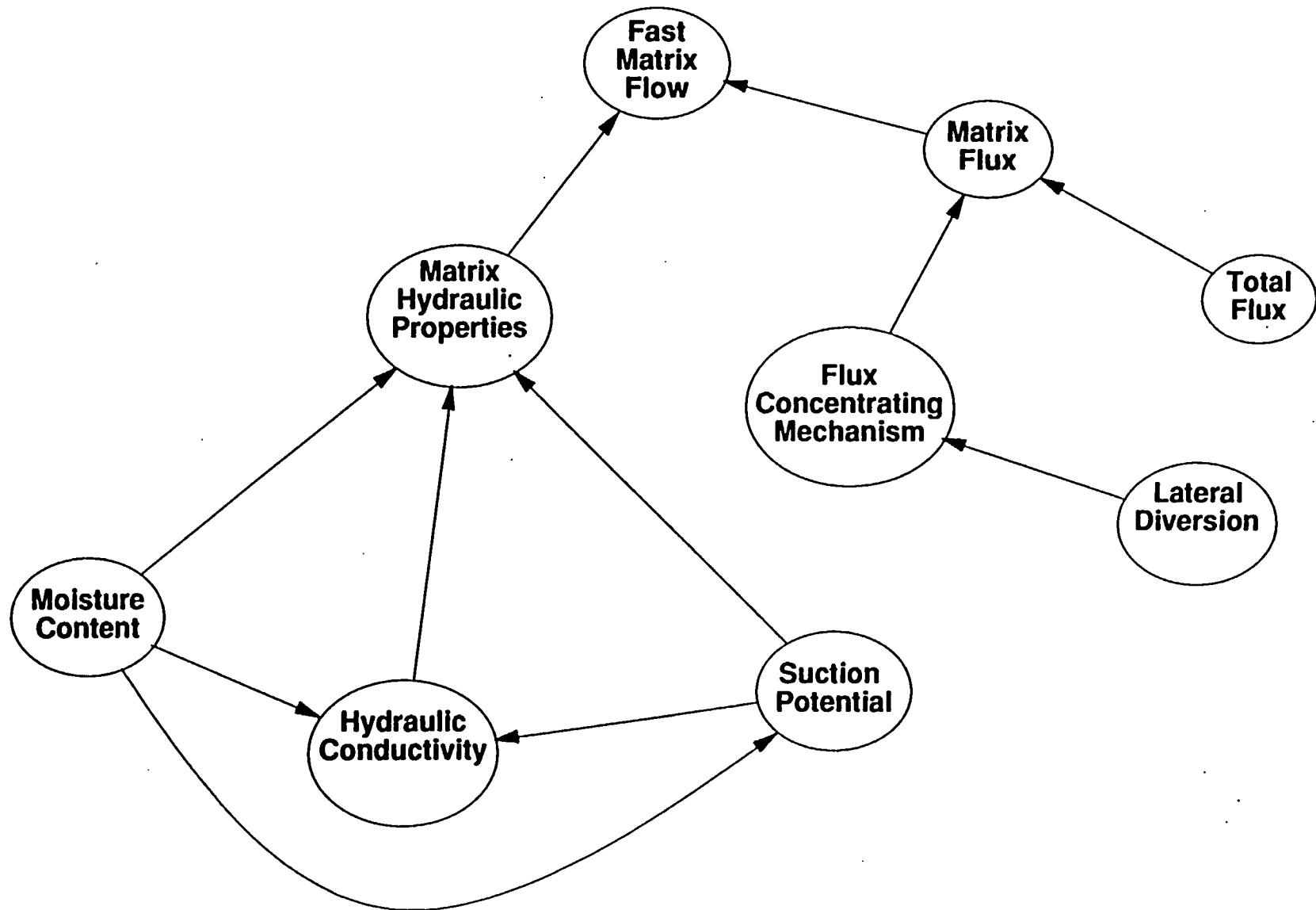
STEP 2: IDENTIFY KEY UNCERTAINTIES AND PROBABILISTIC RELATIONSHIPS



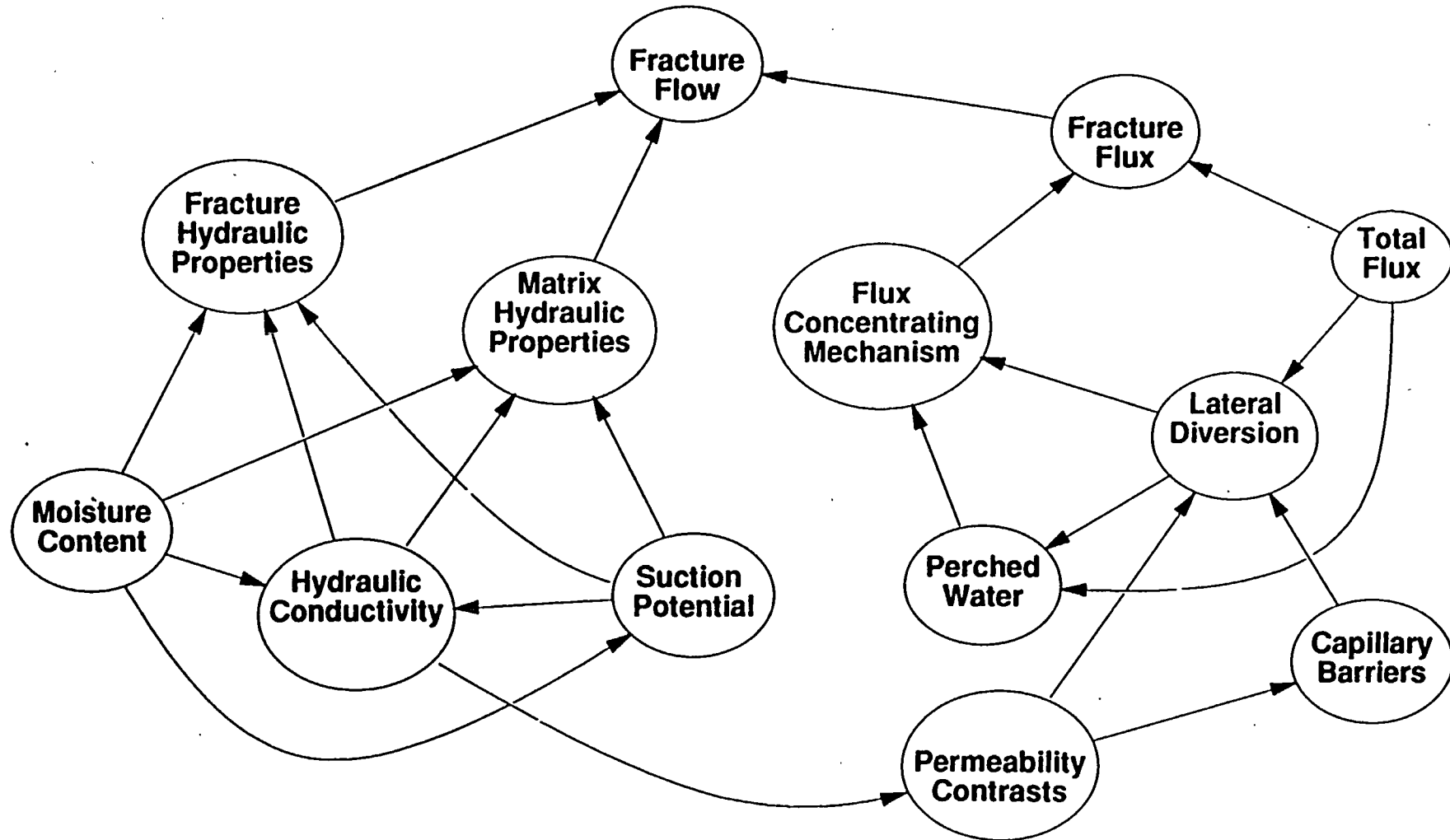
MORE DETAILED CONCEPTUAL MODELS WERE DEVELOPED FOR SEVERAL KEY VARIABLES



Influence Diagram for Fast Matrix Flow Condition

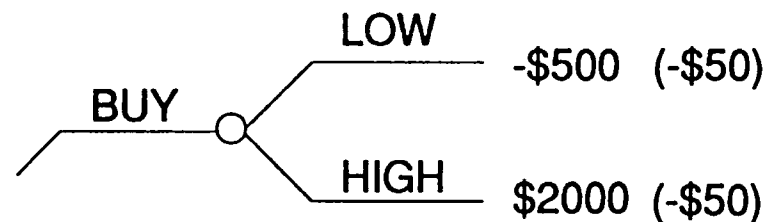


Influence Diagram for Fracture Flow Conditions



STEP 3: IDENTIFY OUTCOMES AND VALUES

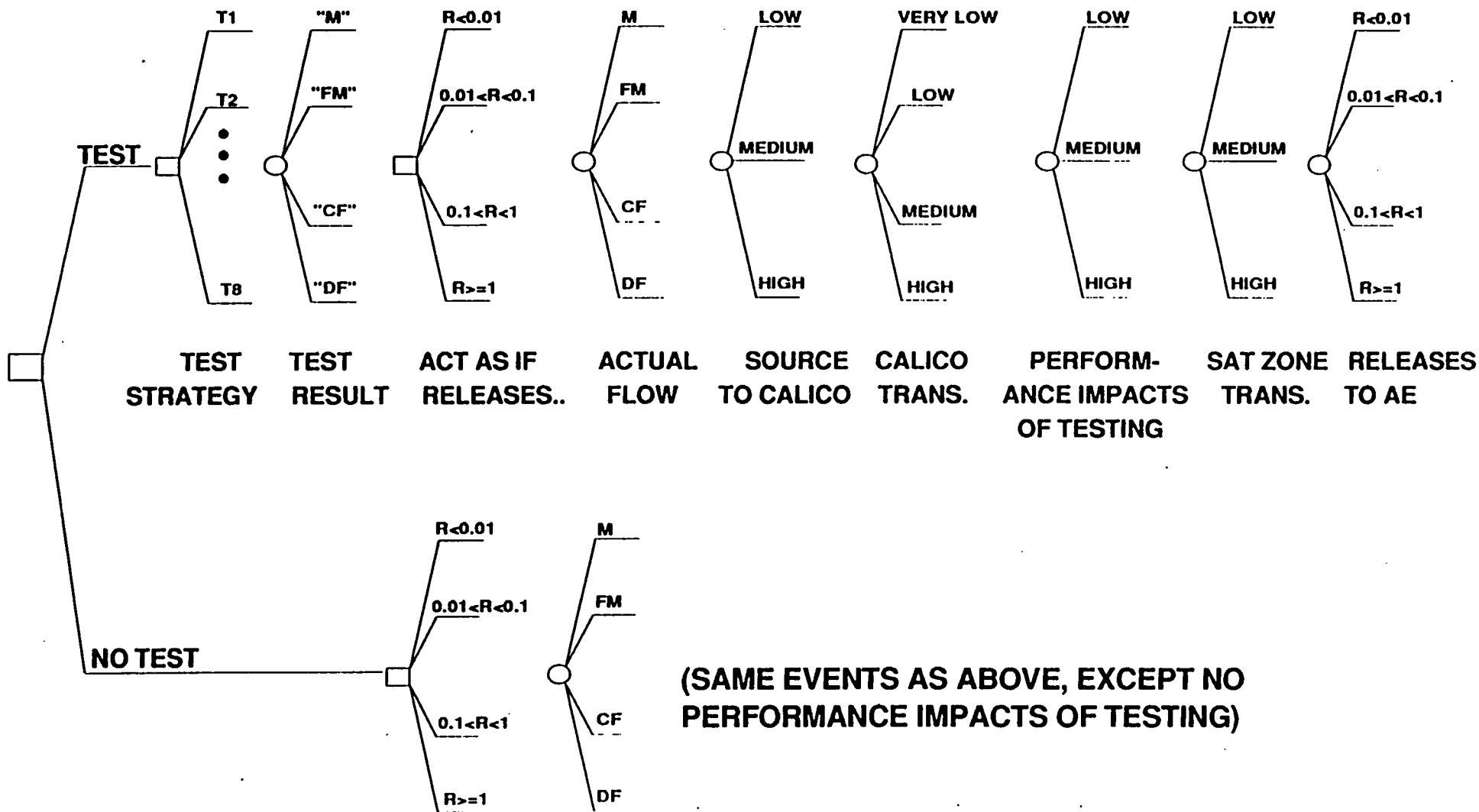
In the investment decision example, the outcomes were gains and losses in stock value, and the cost of research.



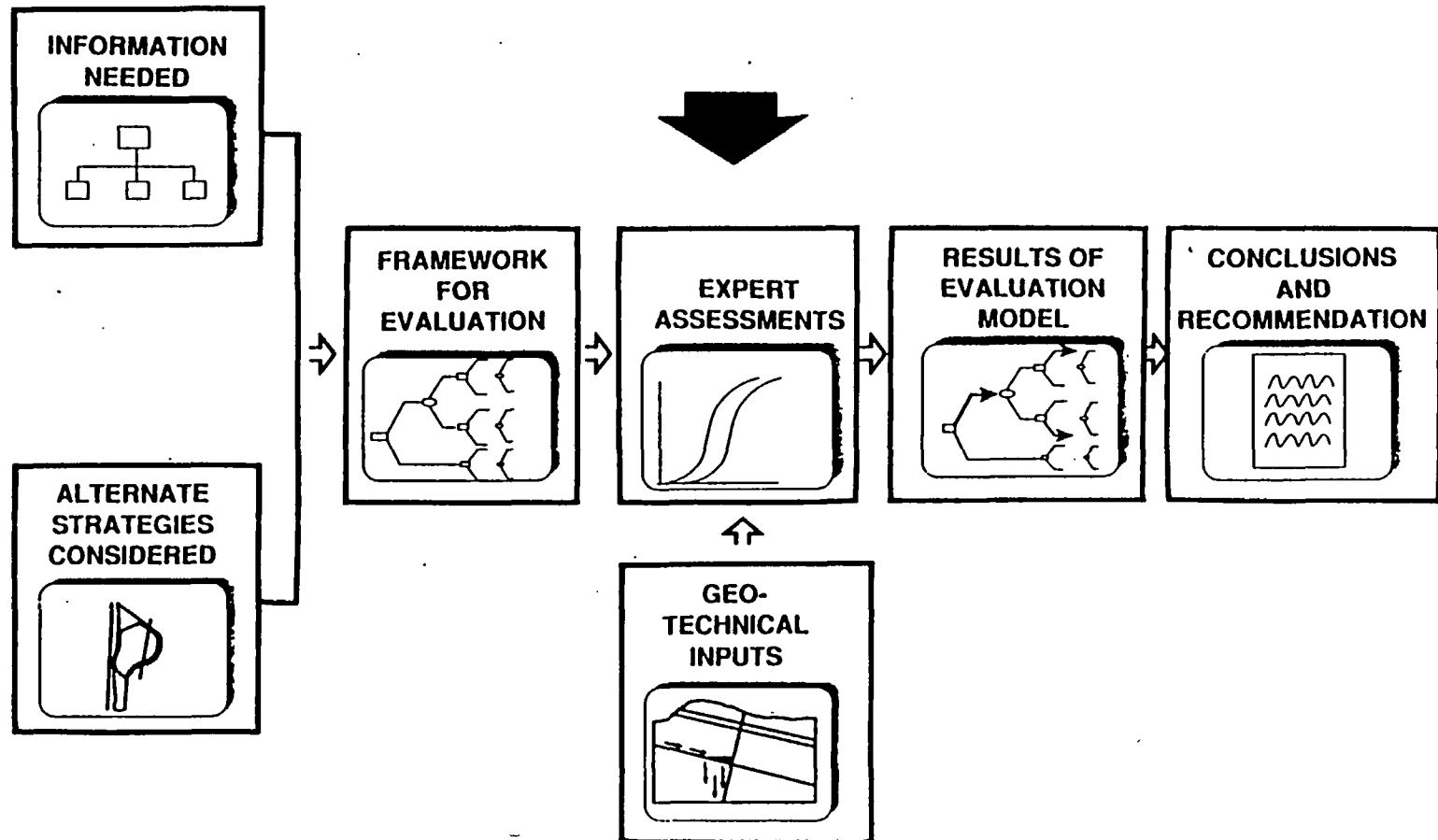
In the Calico Hills study, the outcomes to be valued include:

- ➔ **Cost of Testing Strategies**
- ➔ **Benefits/Risks of "Act As If" Decision Compared to Decision Based on True Releases**
- ➔ **Impacts of Testing on Waste Isolation**

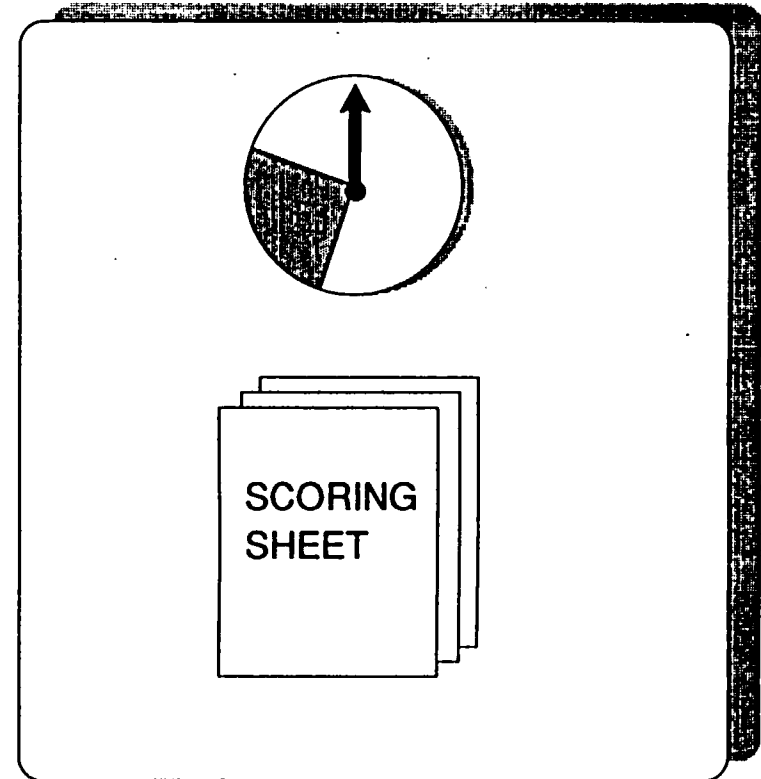
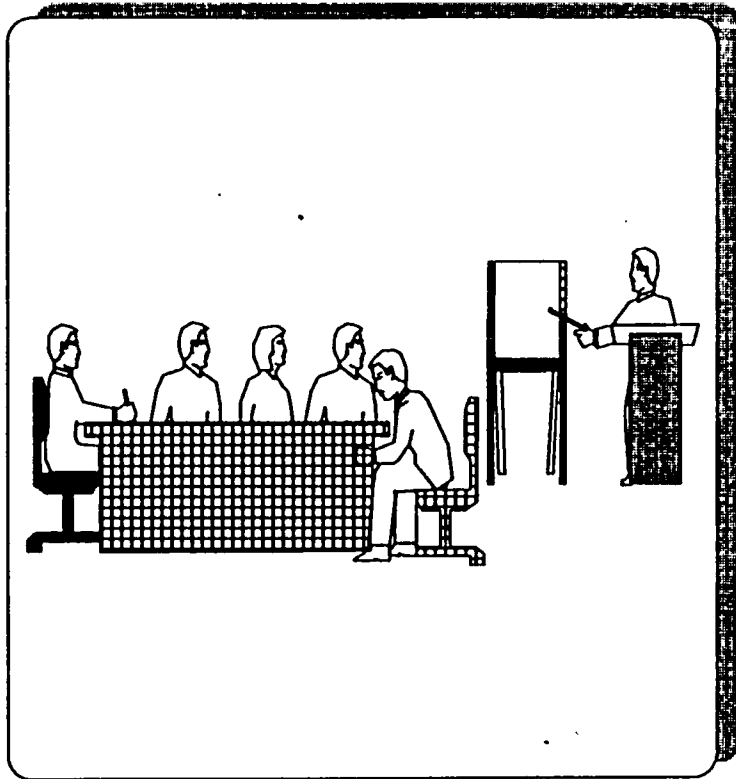
A SCHEMATIC OF THE COMPLETE CALICO HILLS DECISION TREE



STRUCTURE OF THE CALICO HILLS RISK/BENEFIT PRESENTATION

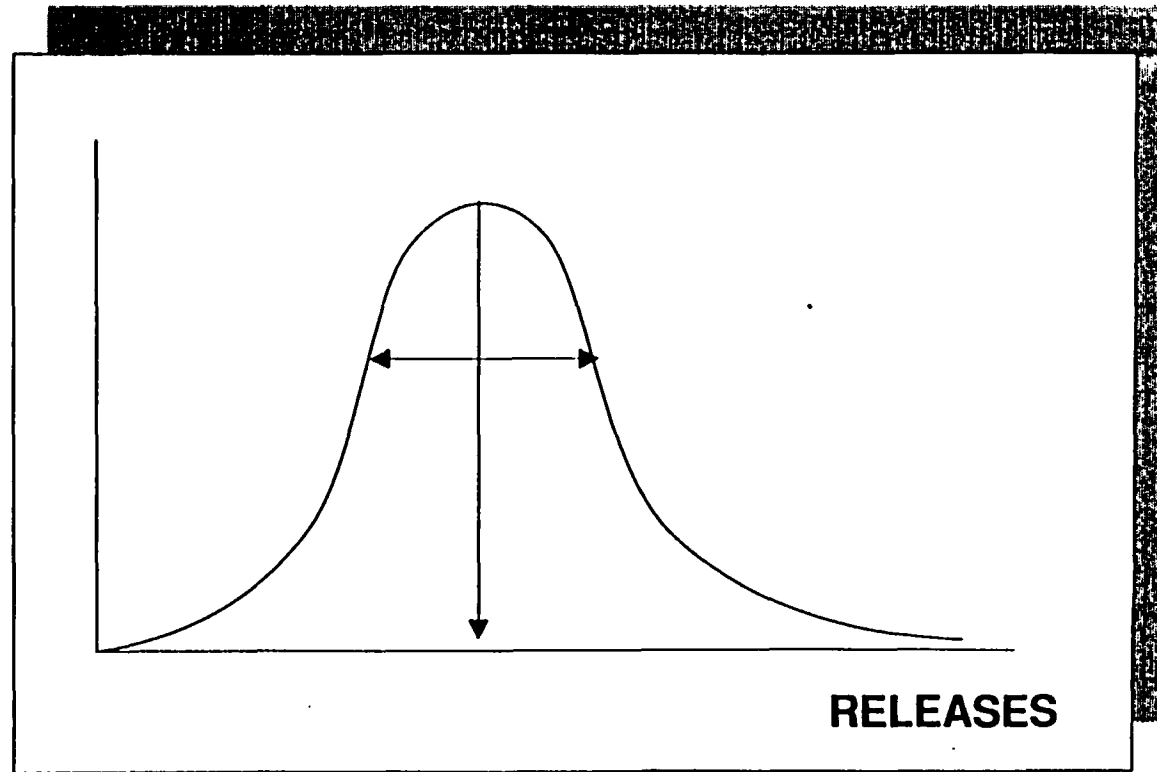


PROBABILISTIC INPUTS WERE DEVELOPED BY THE PANEL OF TECHNICAL EXPERTS, USING STANDARD TECHNIQUES FOR ELICITATION OF EXPERT JUDGMENT



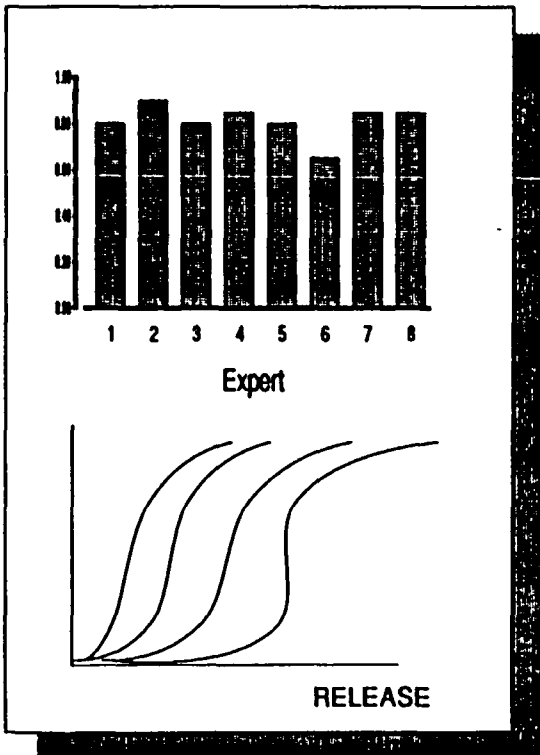
SAMPLE QUESTION: Given the true flow condition is concentrated fracture flow, what is the probability that you would conclude this using test strategy #2?

**THE PURPOSE OF THE ASSESSMENT PROCESS IS TO
QUANTIFY THE EXPERT'S UNCERTAINTY**



THE JUDGMENTS OF THE EXPERTS WERE DISCUSSED AT LENGTH, AND THEN AGGREGATED INTO SINGLE "GROUP RECOMMENDATION" JUDGMENTS

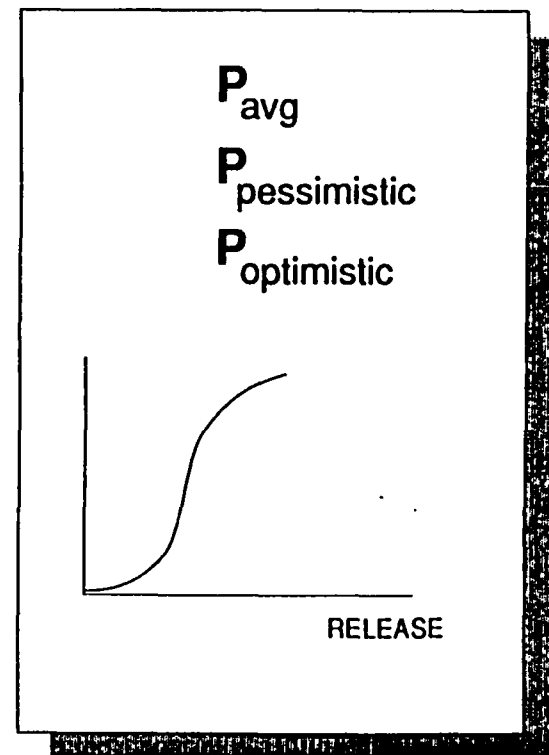
Group Judgments



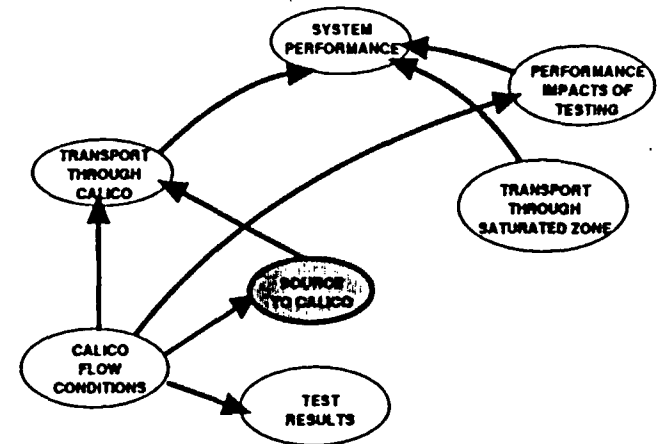
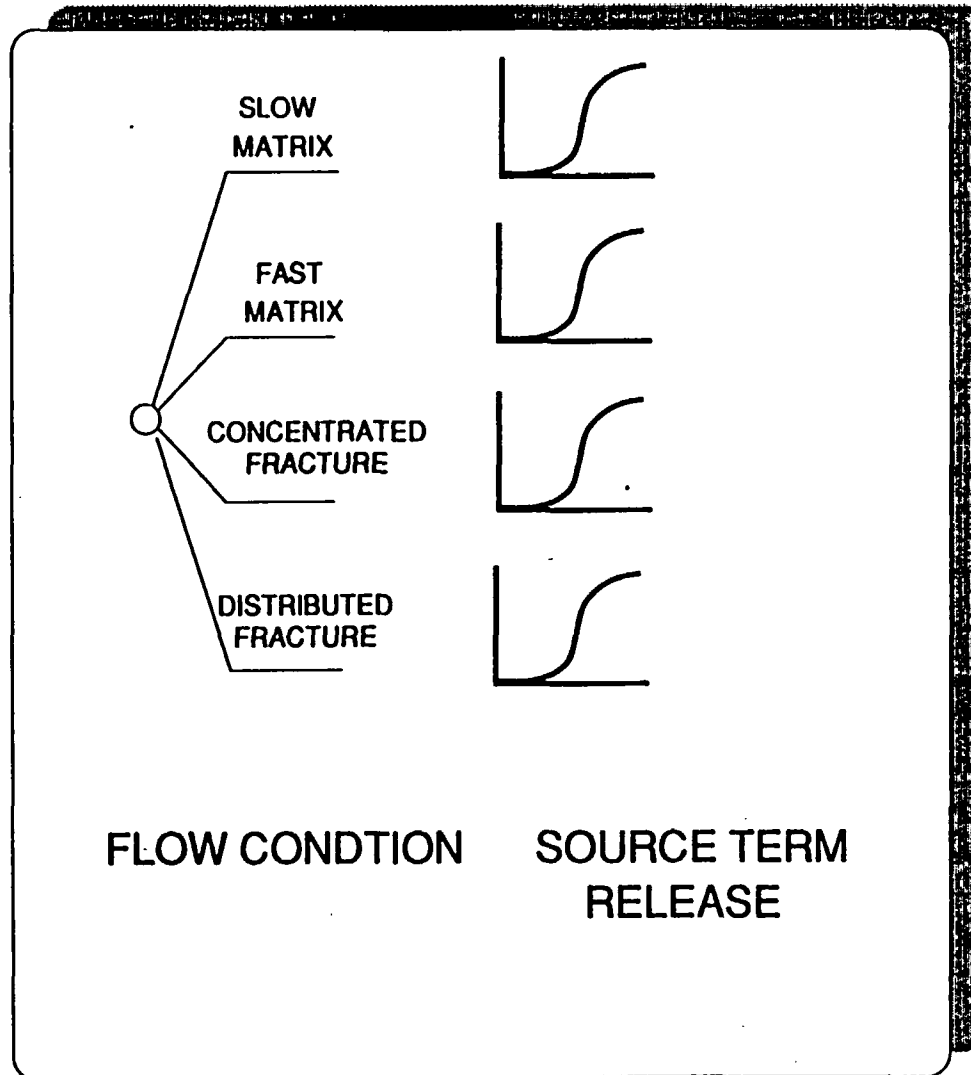
Aggregation Techniques

Arithmetic Average
Geometric Average
Max/Min of Endpoints,
Geometric Mean of
Interior Pts
"Optimistic"/ "Pessimistic"
Opinions

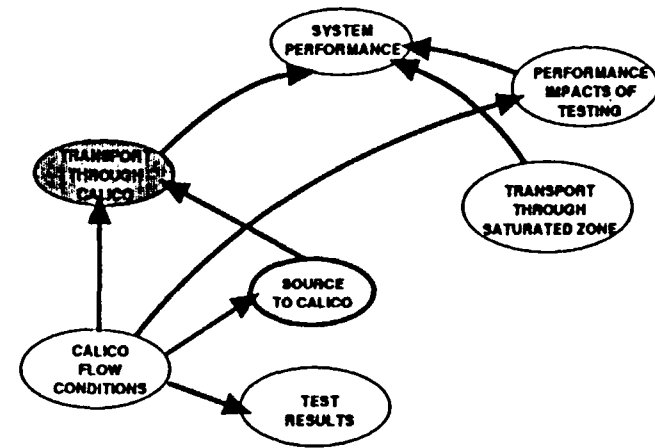
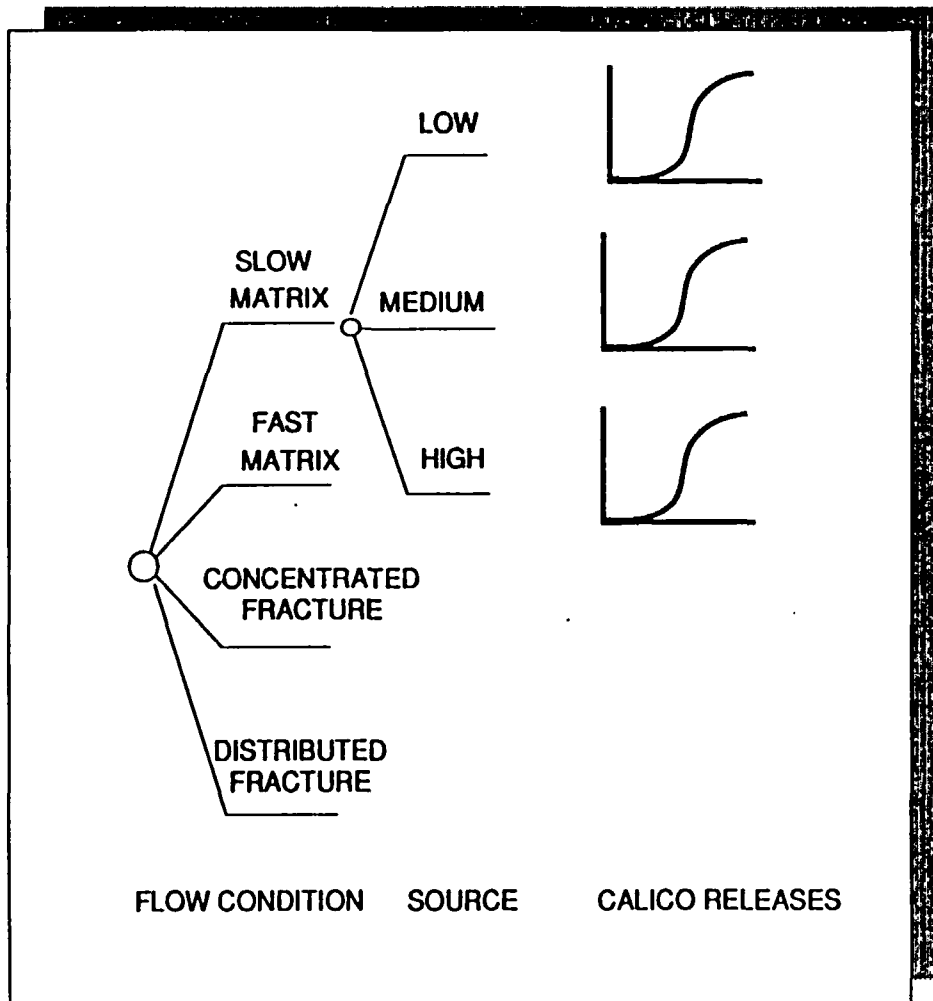
Resulting Distributions



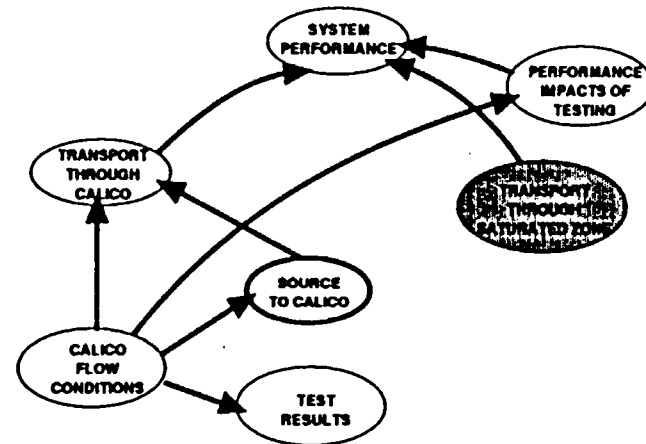
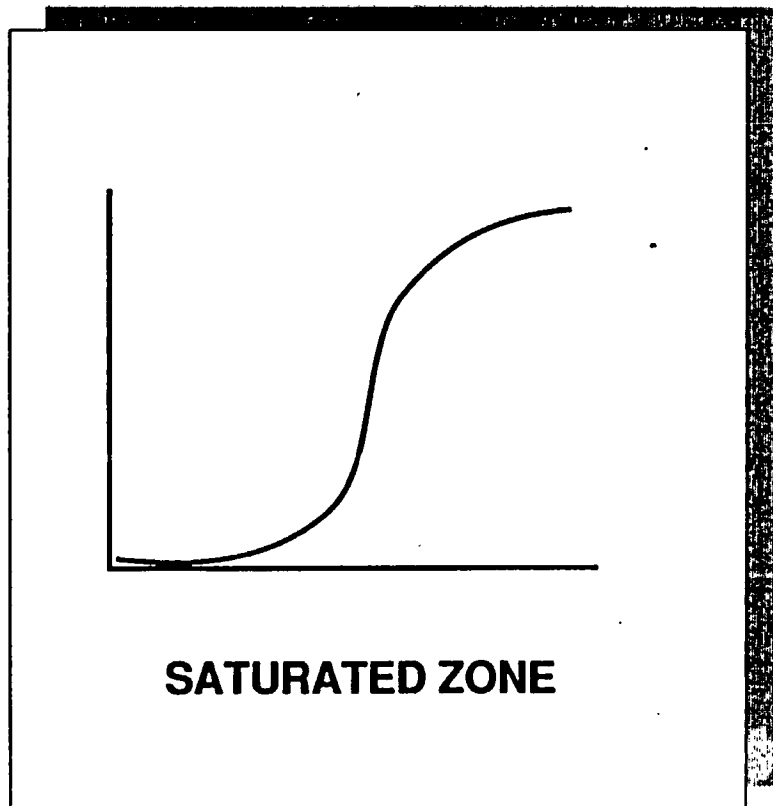
RELEASE FROM THE "SOURCE" WAS ASSESSED AS DEPENDENT ON CALICO FLOW CONDITIONS



RELEASES FROM THE CALICO WERE ASSESSED AS CONDITIONAL ON THE FLOW MODE AND THE SOURCE TERM



THE EFFECTS OF THE SATURATED ZONE WERE ASSESSED AS A REDUCTION FACTOR ON CALICO RELEASES



OUR VALUE ASSESSMENT MEASURED THE VALUE OF OVER-PREDICTING, UNDER-PREDICTING, AND BEING "RIGHT" ABOUT RELEASES

		Actual Releases			
		$R < 0.01$	$0.01 < R < 0.1$	$0.1 < R < 1$	$R > 1$
"Predicted" Releases	$R < 0.01$	0			
	$0.01 < R < 0.1$		0		
	$0.1 < R < 1$			0	
	$R > 1$				0

INCREASING COSTS

INCREASING COSTS

The release intervals imply that decisions and events are sensitive to changes from one interval to another.