

a1-1 Orgn. & plans,
San Joaquin study.

Work for Hwang

April - Finish job #1, one - two weeks

Do job 4, ^{two}~~one~~ week or ~~less~~ more

May - Job 5 (Times of max storage need)

Jobs 2, 3 - - - finish these before beginning anything new now.

Manipulations of data desired, 5

32. Take Fotostat of Tulare Co. acreages from Althouse p. 27, compute % of each ~~section~~^{twsp.} which is ^{not} ~~ind.~~ (1940). Thus illustrate scatter. use last 2 columns.

If in doubt about figures, take microprint to projector. Magnifying glass available here should be adequate.

Rate the twsps roughly, ordinarily, by distance from Kwh or Tule axes. Note hi % dry land along each axis.

Check census for comparable figures.

Scatter is the more remarkable because leaving Visalia, both n & s, one encounters poor soils - along Ctrwd & Lewis Crks. (Wilson & Clamm. p 46)

33. cf. monthly pattern of diversions vs flows, major streams.

Show on Twd. etc. diversions are according to demand, max. in

Aug. cf. Kwh etc.

On annual basis, show neg. p of diversions & flows. Plug in rainfall & temp, see if they explain.

34. Regressions of diversions & flows
acreages & flows.

E.g. Sacto. V. — data all ready in "Sc CV" file.

35. Use Thornthwaite's method & compute variations in need for irrg. wtr from time to time & place to place.

Probably not nec.

Manipulations of data desired, 4

24. Correlate ^{annual or} monthly or daily $\frac{\sigma}{\bar{x}}$ with annual flow - if low yrs are more vble, jrs. doubly hit; (if hi yrs more vble, flood storage need 4d?) For individual rivers. We know that in low yrs there is less ~~flow~~ % of flow in summer - isn't that enough?

6. 25. Critics will claim variation among diverters' per acre use is due to diff. needs. So take ID which changes for wth use, show less variation among individuals. Might find graph on upper left, #5, best for showing of con. (Bull 23 shows water per acre for individual diverters; but what shows use per acre in any I.D.? Madera Report?)

26. Where storage peaks coincide, you can make them diverge by appropriate pricing wth in time. Work up e.g.
(May end up showing can do more w MC pricing than with intrn.!!)

27. Combine demands, get steadier demand, hence fuller season-long use of distribn. (Find e.g. a, of excess facilities that shd hv bn integrated: b. of good projects unbuilt bcs this econ. was precluded.) E.g. of a on Kaweah R., where some ditches get only part season flows, & very unsteady, as capac. neeq.

28. E.g. how intra minimizes time wth spends in storage (+ thus shifting peak revs fwd, & keep's flood space open longer). E.g. area of early flows & late demand can store elsewhere.

29. E.g. how get given flood control with less storage by intrn.

30. E.g. how reduced variability outside irrn season helps hydroel - reduces alternate peak's capac. requirements. (P & E already exploits this angle, no?)

31. Possible effects seasonal pricing - min. at peak storage, max at late summer.

Manipulations of data desired, 3

17. Correlate hourly flows, if can find. These are signif. only when resrs nearly full, e.g. at flood crest ($\pm$ my WSP 843), or at storage peak; or where no storage.

18. Correlate 10 yr mov'g avers., CV streams (maybe hi correlations are due to yr-to-yr correspondence, while big cycles differ. Use Moroney on analysis of variance.) (Maybe inspection of cumulative departures is adequate for this.) (cf. 15)

19. Cf. variability Kings R e.g. above & below regs. Show how lose much potential benefit storage bes must release rts based on nat. flows. (but remember they can store there)

20. For given period, say 1 yr or 3-4, ~~figure deviations of monthly flows from month long time mean for the mo.~~ of each of several rivers, with ~~S_x~~ ~~or~~ correlate actual flows w ave., individually & jthly. (or take S_{xy}), monthly. This seems to add little to what we've done already.

21. Predictability of flow from ~~first~~ pre-planting flows, several rivers individually & jointly.

22. Take flood year, correlate monthly flows (they may be poorer would then, hopefully)

23. Est. MP wth by cty value of output, yrs of hi & low flows

Manipulations of data desired. 2

6. 8. Compute LCR on ownership (or enjoyment) of wtr, of LCR on land area. (Cf. ifson w correlation coeff. of 7.)
2. 9. Compute physical MP of Δl storage in terms of wtr concerned annually. Figure what stage of returns present-proposed dams are in. ~~Discount future returns properly - probably assume some regular period, evaluate~~ Solve starting-assumptions problem.
7. 10. Combine some rivers for improved salinity. Check fr. of delta as salt resr.
11. Cumulative departures from mean, CV streams, of yrs of max storage need. (Using mean instead of some lower figure doesn't change time of max need any) (If you do not plan enough storage for yr of max need, then what is relevant is periods of no effective storage which will be varying with cost of storage on particular river. Make rough est.) Cf. Tuol & Motz. No elaborate data needed to show periods will differ
8. 12. Russian R. - σ , both seasonally & over yrs. Cf. Tuol & Motz.
Correlate & combine with ^{Eel} Cache C, Putah C, Alameda C (?), Coyote, & c w. which might be brought to cooperate
13. Correlate ^{& combine} Cache & Putah & Stony & Trinity & Sacto. (might even try Sta Ynez with of - check Cal Wtr Plan first.)
14. Correlate & combine daily flows for 2 adjacent small streams, such as might be used w/o surface storage, but integrated for recharge bed supply e.g.
15. Cf. σ for inter month, interday, & interyr, & inter decade flows, to see where is greatest variability. (Cf. 18)
16. Get daily σ on Kern & Kings, show what inconvenience they ^{once} put up with rather than build storage

Manipulations of data desired. Give priorities before begin.

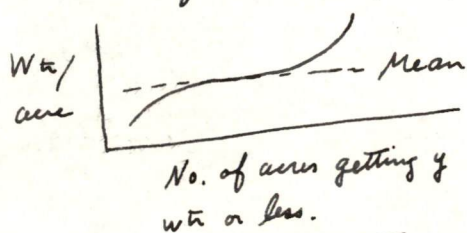
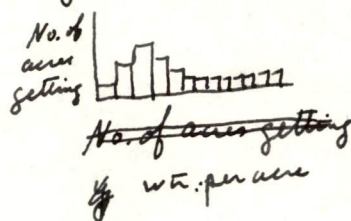
4. 1. Kern, Tule, Kaweah, Kings rivers, correlate with Sf etc
over yrs
monthly

5. 2. Relate patterns of seasonal supply & demand, various rivers - either
by correlating, or figuring max storage need. Get peak storage time,
all rivers - they probly differ, cd shuffle some wts back & forth in 2 or 3
critical mos - forget rest of yr. those are what count.

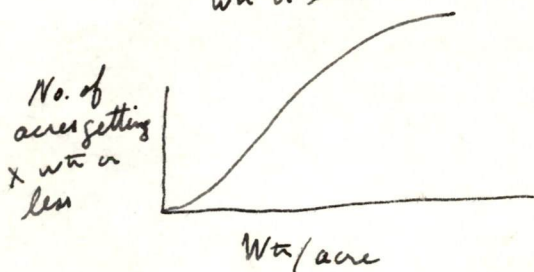
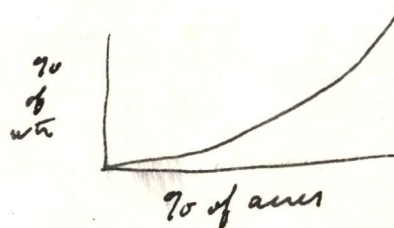
3. Correlate all CV streams, monthly, actual data, for several
individual years. (rough index) (also, useful for hydrel, reduce need
for steam plant capacity). Be sure you have flows above storage.

1. 4. Cf. variability of Kings, Kaweah, Tule, ^{& Kern} rivers, with variability
of residues after diversions - & with the individual diversions.
annually, monthly, daily. (Irrn season mainly)

6. 5. Curve of distribn. of wtr use per acre by individual diverters from some river:



Use 2
layouts on
right.



6. 6. σ of above distribn.

6. 7. Correlate wtr/acre & size of ownership
cf. seasons of scarcity vs seasons of abundance, e.g. on Kaweah.

The Jnl of Law & Econ

Contribute to.

Additional data needed:

1. Costs for dams etc of varying height - for mgmt analysis.
2. Flood danger, by mos., predictability, & need for reserved capacity.
(try Cal, studies referred to in '23 etc rpt
" Floods, recent book.
3. Salinity tolerance limits etc.
4. Cost of underground recharge
5. Hourly flows, near flood crest.
6. Length of storage in soil, upstream, in rd
7. What interwashed diversions to get better pun routes have bn blocked by
fm. interests below?

LAND AND WATER ECONOMICS

Proposed Research

I. An economic evaluation of Missouri water law.

There is a widespread movement in Eastern States to re-examine archaic water laws. The Western appropriative doctrine is being considered for adoption, in whole or part, in many.

At present I am engaged in a study of riparian and appropriative doctrines in California, the one State where the two have been quite evenly balanced for a long period. I propose to spend my first few months in Missouri completing this study. My present thesis is that neither system is nearly good enough, and I am working out a proposed system more in accord with economic principles. I am keeping this within the bounds of familiar institutions such as the taxing district.

My next interest would be to apply the conclusions in Missouri conditions. This calls for study of Missouri's water economy, and a systematic laying-out of Missouri's water law, as expressed in leading court decisions.

Some of the features to be incorporated into an economically ideal system of water legislation would be as follows: an equimarginal distribution among different users on the basis of productivity; a flexible system of allocation that would permit transfers of water in keeping with changes of technology and demand; a comprehensive system that integrates ground waters and surface waters into one water market, storage and distribution network.

II. The rural-urban division of land and water.

This study would investigate the value of cities and towns to farmers and develop criteria for an optimal division of land and water resources between town and country. It would consider optimal patterns of town location, and integration of town and country to enrich rural life. Its focus would be distinct from that of many current studies which tend to regard cities as aggressive enemies "encroaching" on farm land.

It would consider the causes of urban decadence and stagnation at the center, and seek to develop policies to help cities flourish, the better to serve agriculture. It would analyze deliberate restrictive policies of city governments working to the disadvantage of farmers -- much as many previous U.S.D.A. studies have emphasized restrictive policies of industries and the farmers' interest in breaking through them.

The study would consider the economics of distributing water, and collecting sewage, in rapidly expanding rural-urban fringe areas, and the problem of integrating these networks with other utilities and transportation. It would look to the causes of uneconomically scattered settlement and its influence on economic instability. It would evaluate proposed policies for alleviating the problems.

A separate problem would be a study of economics of scale in developing and storing and distributing water, to arrive at an optimal sized water system.

III. Interstate integration of water economics and control, with especial reference to administration of the Missouri Basin, Federal-State relations, compacts vs. Valley Authorities vs. Basin Commissions.

IV. Optimal adaptation to an unpredictably variable climate, with especial reference to water storage and distribution.

V. Establishment of an information clearing house on water economics and hydrology. Secrecy, or simple neglect to gather data, keep much important information from being recorded or publicized. This makes for duplication of effort, wasteful exploratory drilling for water, blind planning, etc.

The first effort along this line might well be to write something dramatizing the multiple economic benefits of pooling scientific information and opening it to general use.

VI. Watershed treatment. The effort would be to find or develop concepts for defining an optimal balance of timber, grazing, runoff, and storage from wooded lands, both in the mountains and on farm woodlots. Then to see to what extent free market forces achieve the optimal balance, and how best they might be amended to allow for offsite water storage benefits.

This analysis should also be applied to non-forested land of course.

VII. Benefit-cost analysis. Incidental attention will be given to questions of optimal scale of structures, and priority among structures, but primary emphasis will be on working out a conceptual framework for dealing with the vexed question of secondary benefits in project justification.

Another question of interest is the relative value of different kinds of project benefits: irrigation, navigation, flood control, power, for example. This has obvious interstate implications, and must be integrated with that aspect of the studies (item III).

VIII. Studies of scale of farming. Criticism of prevailing emphasis on fuzzily conceived "profit" criterion of optimal scale. Applying economic criteria of efficient use of resources to farm management data.

One especially promising aspect of this study is use of data from the acreage limitation program to find marginal productivities of land on farms of different scale.

IX. Studies of land taxation. Effect of Federal Income Tax laws on the relative burden of real estate taxes to those in high and low tax brackets, and the effect of this on distribution of land and scale of farming.

X. Studies in the training of agricultural economists and economists. Means for achieving an optimal balance among conceptual ability, factual information, community aspiration and responsibility, practical competence and judgement, originality and communication, initiative and discipline.

Call it research in ec. of land & wtr - + thus keep land ec. alive.

I. Ec. eval. of Mo. w. law.

Nationwide movement ~~rehabilitate~~ re-examine archaic w. law.

Movement ~~expose~~ expose apprs. from w.

Study 2 doctrines together, Cal.

Apply condns in Mo conditions. ^{Systematize & lay out Mo. prevail'g law.} Emphasize urban-rural division, poll-n.

Consider other insts. Work out opt. system. - ^{flexible. Attract new ind-y.} surface & ground w. (opt level)

Policy rec-m for Mo leg-n.

Interstate problems

II. Layout of

Water & sewer networks in ^{rapidly dev'g rural-urban fringe} suburban areas.

Integr-n w other xpm & pu networks (esp. hydro power)

Problems of scattered settlement

~~Extra~~ Extra cost

Delay -

Instability

Ec. of scale in dev. w., & opt scale of one supply & distr. net.

III. Interstate ~~integr-n~~ integr-n of w control, esp. ref. Mo. Basin

MBC, MVA, Compact.

Fed. State rel-ns.

(Relative benefits of multiple purpose outputs)

IV. ^{Optimal} Adaptation to variable, ^{unpredictable} climate - esp. role of w. control,

but integrate w whole structure of society.

V. Work w GS, est. info center on w. supplies. ^{inventory them.} Get well depths

etc., avoid duplicat'g, facilitate find'g w. Integrate research, make all qnly available. Demonstrate ^{multiple} ec. benefits of pool'g info.

VI. Watershed treatment.

Opt. combo of timber, grazg, & runoff & storage. In mts. & on fms. Subsidy to fm woodlots?

Policies to achieve

Ozarks; & upper Mo.

VII Ben-cost analysis

Opt. size structures

Priority

2 dry benefs

Integrat'g many proj's on same ~~watershed~~ basin

Land & w. for urban dev.

II. 1 Encourag'g urban dev. to help fms. Break'g thm restrictive

barriers, Δg comp'n among cities for fm trade.
Precedent - OA studies of restriction policies by ind'y, effect on fm, ec.
Opt. location cities, towns.

Int-g town & country, enrich fm life.

VIII. Study scale of fm

Trends

Causes - are they ec? (mean'g desirable)

Policy.

IX. Land tax-n

Prop. tax. - effect of inc. tax

Effect of land taxes on scale of fm.

X. Integr-g educ., conceptual ^{competencies} ability, ^{communication} social responsibility, ^{community} aspirations & ^{prudence} practicality, ^{factual} knowledge. (confidence, adaptability, tempered w.)

VII

~~XI~~

Prod-n ec.

End of scale

Input-n

Criteria for efficient use of resources. Criticism of
prevail's emph on 'profit', poor conceptual & op-nl def's.

UNIVERSITY OF MISSOURI
Agricultural Experiment Station



DEPARTMENT Agr. Economics

PROJECT NO; 363

**Release of
Information Plan**

for the year ending
June 30, 1960

1. Title of project

Economics of Water Resource Utilization

2. List here the month or months when you expect to have information ready for release through the Agricultural Editor's Office to press, radio, and/or television.

September 1959

3. Do you plan to publish a bulletin this year on results of this work? Yes (yes or no)
If so, about what month will it be submitted to the Agricultural Editor's Office?

December

4. Do you think the results from this research would make a good movie, either by itself or as part of a larger story?

Yes

Approved

Mason Giffney
(Project Leader)

Elmer R. Kiehl
(Department Chairman)

Two copies for Director's Office--one for department chairman--one for project leader.

Objections of project

To evaluate the economic performance of different systems and facts of water law from studies of ~~actual~~ water use in practice.

Take from green sheet.

Emphasize developing methods, of analysis, to apply in qunt. & in Mo.

Accomplished to date. Oct. 14, 1959

1. Analyzed flows and allocation of water from one river, the Kaweah, from 1919 - date. ~~analyzed freq. distrib., & ~~selected best~~ diff. forms of measure thereof; selected most approp. Computed measures~~ Subjected data to analysis of variance, experimented with different ~~measures~~ kinds of analysis, and devised ~~new~~ measures of variance most appropriate to compare actual ~~var~~ define an optimal response to variability of flow, and to evaluate actual water distribution in terms of this optimum. Worked on new measure of clustering of deficits. The evaluation thus far indicates there is scope for vastly increasing the serviceability of given water supplies by a different method of division.

2. ~~Accumulated data and~~ ~~Accumulated~~ ~~data and~~ ~~Devised~~ technique for determining what stage of increasing or decreasing returns to storage has been achieved on given streams. Used technique to test whether resources were being optimally allocated among several interconnected streams, and found large deviations from the optimal: overdevelopment on some cfd. to underdevelopment on others.

3. Prepared correlations of crop output and water input under wide range of conditions, ~~correcting for ~~measurable~~ weather variation~~ Thus far correlations are remarkably low, indicating water is generally being applied in excess. Interregional comparisons should show that this varies from place to with location. Results thus far are encouragingly instructive, showing  shape, inverted U- or arch shaped, with ^{by} bulk of points in negative sloping part, indicating widespread overirrigation. Ties in with study by soils dept.

4. Accumulated ~~several~~ several kinds of data; to test hypothesis that mp of water differs inordinately and uneconomically among adjacent districts

∴ pumping depths and costs;
water conservation expenditures

5. Demonstrated that system of water law has led to ^{unnec.} expenditures for large excess capacity. Also scattering of served areas.

5. This excess capacity & claims commensurate to water tier up much more water than is used, ~~deterring further development.~~

6. Assessed potential reduction of variability from integrating divert of 9 related streams; both annual flows; & flood flows.

7. Demonstrated that law has caused many users to take more water in drier years - negatively correlated with supply.

8. Shown many water users get a supply more variable than wasted flood waters.

9. Accum. ^{long} list of 11 canals carry wtr in opposite directions, and c. manifest diseconomies.

10. Developed system of pricing water to optimize use of works thru time.

11. " " " adapting variable supplies to variable demand thru flexible pricing & taxing so as to max. ^{net} benefits, far above those achievable today. Let use vary with supply.

12. Examined what is feasible under prevailing inst'l limitations, to approximate optimal system.

13. Analyzed legal doctrine on ^{fixed} rate of flow vs fixed amt; and effect of stipulating flows in rates on possibilities for economizing - e.g. most obviously, of winter storage.
14. Continued gather data on ~~the~~ costs of storage, pumping, distributing, etc.
15. ~~the~~ Compiled legal obstacles to transfer of water.
16. Compiled legal & c. institutional deterrents to water storage development.
17. Worked out method of ~~stratified~~ sampling, ^{degree of confidence in results} to permit analysis of voluminous monthly & daily flow data.
18. Shown system affords users 100% steady supply for some weeks, ff. by extremely erratic. (List this with numerous defects noted).
19. Orgd & cleared up ambiguities in raw data; tested for internal contradictions; checked vs. other sources.
20. Aside from variability, but in conjunction with it, cfd ^{mean annual} ~~aggr.~~ supply, ^{per acre} to see who was starved, who glutted.
21. Used excess capae. in systems by cfd vs. use.

UNIVERSITY OF MISSOURI
Agricultural Experiment Station
PROJECT PLAN



DEPARTMENT Agr. Econ.
FED. FUND Ketch
PROJECT NO. 363

1. Title of Project

Economics of Water Resource Utilization
(Short Title: Water Resources)

2. Advisory Departments and Agencies

Various Departments of the College of Agriculture and of the University. Informal advisory arrangements will likely also include various state and local agencies concerned with water hydrology, utilization and allocation.

3. Cooperating Departments and Agencies. List Number and Short Title of Major Projects in Cooperating Departments and Agencies.

See back of this sheet for information to be supplied on additional sheets

APPROVED

Project Leader

M. Mason Gaffney (EKC)

Date

June 6, 1958

Chairman of Department

Elmer R. Kiehl

Date

June 6, 1958

Associate Director

Sam B. Shirk

Date

6-9-58

Director

J. H. Lugo

Date

June 9, 1958

Director, State Experiment Station Division Agricultural Research Service, U. S. D. A.

Date

DEPARTMENT OF AGRICULTURE
FED. FUND
PROJECT NO. 302

UNIVERSITY OF MISSOURI
Agricultural Experiment Station
PROJECT PLAN

Use additional sheets for the following:

4. Major Objectives. A clear, complete, and logically arranged statement of the specific objectives of the project. List, using capital letters: A-B-C etc. An annual plan and report will be required for each objective. All objectives do not need to be active in any one year.
5. Reasons for Undertaking the Work. A statement as to (1) The importance of the problem to the agriculture or rural life of the State or region, (2) any groups of citizens that have requested the research, and (3) the expected use to which the results will be put.
6. Previous Work and Present Outlook. A brief summary covering previous research on the problem (citing the more important publications), the status of current research, and the additional information needed, to which the project is expected to contribute.
7. General Method of Attack. A concise summary of the essential working plans and methods to be used in attaining each of the stated major objectives. These summaries should cover:
 - a. Plan of investigation
 - b. Location of work
 - c. Quantitative indication of extent of investigation
 - d. Procedures to be followed
 - e. Records to be kept.
8. Probable Duration. An estimate of the maximum time probably required to complete the project and publish results. Project plans will not be approved for more than five years at one time.
9. Financial Support. Estimated cost for work covered by this plan.

Note: Whenever any material change in the objectives or procedures of a project is found advisable, a new or revised project outline should be prepared.

8-11-1937

Approved: _____
Chairman of Department

Approved: _____
Associate Professor

Approved: _____
Director

Approved: _____
Director, State Experiment Station, Division of Agricultural Research

Approved: _____
Secretary, U. S. D. A.

4. Major Objectives.

The major objectives of this research include the following:

- A. To study systematically the present legislation dealing with water as expressed in the principal decisions of the courts.
- B. To develop principles of an economical feasible system of water utilization which would include the following features:
 - 1) A flexible procedure of allocation that would permit use of water in response to changes in technology and demand.
 - 2) An equimarginal distribution of water among different users on the basis of productivity.
 - 3) A system which might integrate ground and surface waters in one water market.
 - 4) To apply principles developed to specific analyses of watershed programs, allocation of water to competing urban and agricultural uses, and other water programs.

5. Reasons for Undertaking the Work.

There is a widespread movement to re-examine water laws and water utilization among competing uses. Over the years two major doctrines concerning water use have developed. The appropriative doctrine appears to be used principally in the Western states while the Riparian doctrine is recognized principally in the Eastern states. It appears that neither doctrine is exclusively the appropriate approach, particularly in the Midwest. A new approach based on and in accord with economic principles of production and utilization of water within the given bounds of familiar institutions will probably yield the most equitable and economic use of water.

A number of problems have arisen as population centers have expanded, greater use of water in the industrial sectors resulting in competition for water for domestic and industrial use. In addition, problems relating to control of water and storage for use in flood regulation, navigation, irrigation use in agriculture, recreation, and power generation suggest the complexity of competing uses. The present situation with respect to these alternative uses cannot be resolved until an appropriate

analytical framework is developed to permit the development of procedures which recognize the economical utilization of water within the legal-political framework of rights of competing current and potential users. Restrictive policies have been developed among some urban groups, industrial and others that work to the disadvantage to smaller communities and to agriculture generally.

The overall problem is complex. The interests of many groups and agencies have become intertwined. For example, the related aspects of watershed protection programs have been the subject of considerable discussion, much of it lacking in scientific bases. This has led to extreme statements and militant partisanship. Further, an appropriate analytical structure is needed to determine the balance between soil treatment under various cropping uses and storage reservoirs for water control.

6. Previous Work and Present Outlook.

The work at this station related to water use has been limited to analysis of selected flood control structures on agricultural production. These studies included the Grand, the South Grand and Black River systems. Missouri Agricultural Experiment Station Research Bulletin No. 564, October, 1954, included an analysis of the problem of appraising impact of flood control structures and an empirical analysis of this impact in the Grand River Basin.

The research proposed under this project is broader. It proposed that greater emphasis will be placed initially on a systematic analysis of the legal aspects of the states' water laws. After this phase, a study from primary and secondary data will be undertaken to develop a framework for analysis of the many ramifications of water utilization. Later detailed empirical work will be pursued to determine specific application to various types of water utilization in agriculture.

The literature in the field is more or less scientific in character. Much work is underway in various states by resources agencies, Agricultural Experiment Stations and in the U. S. Department of Agriculture. Some of the pertinent literature includes the following:

Water-The Problem in Missouri, Report No. 17, Committee on Legislative Research, General Assembly of the State of Missouri, 1957.

Missouri: Land and Water, Report of the Missouri Basin Survey Commission, 1953.

Illinois Water Use Law by Fred L. Mann, Research Report AERR19, June 1957.

Economic Evaluation of Use of Soil Conservation and Improvement Practices. in Western Iowa, Technical Bulletin No. 1162, ARS, U.S.D.A. and Iowa Agricultural Experiment Station.

Richard Witmer, Documents on the Use and Control of the Waters of Interstate and International Streams, U. S. Department of Interior, 1956.

Reports of the President's Water Resources Policy Commission, Volumes I and 2, 1950.

Carl P. Heisig, Income Stability in High Risk Farm Areas, Journal of Farm Economics, 1946.

Sherman E. Johnson, Irrigation Policies and Programs in the Northern Great Plains Region, Journal of Farm Economics, 1936.

7. General Method of Attack

Initially considerable efforts will be devoted to analyzing the relevant secondary data available pertaining to the states' water resources. The Missouri State Legislature has released a report of a special study. The Missouri State Geologist and U. S. Geological Survey have collected primary data useful for this investigation. Other data from regularly published sources will be utilized. It is expected that primary data will be required in particular areas. These can not be fully anticipated at present. Initially work will emphasize an analysis of the water problems in Missouri and will require study of existing materials.

8. Probable Duration

It is expected that research in the area proposed will require a minimum of three years. However, revision of this outline of work is anticipated within a year inasmuch as the approach and nature of empirical investigations will be modified as the result of the initial efforts undertaken during the first year.

FOLDER INSIDE FOLDER

Ford Proposal

~~Intro. & Rough Drafts :~~
Ford Project Outline

This image shows a blank, aged, cream-colored page, likely an endpaper or flyleaf from an old book. The paper has a slightly textured appearance with some minor discoloration and faint, illegible cursive handwriting visible in the background. A large, dark, diagonal smudge or ink blot is prominent on the left side of the page, obscuring any text that might have been there. The overall tone is warm and historical.

Wm. W. W.

Francis

4

2. Significance of the study.

Water is a critical limitational resource. In recent years ~~water~~
~~shortages have~~ our expanding economy has pressed against the limits of
the resource in many ~~places~~, ^{areas} ~~many of them in the~~ humid ~~areas~~ as well as
arid, ~~areas~~. More than a nuisance, such shortages ^{may one day} ~~could~~ seriously restrict
our ~~growth~~; ^{our growth}, threaten the expansion of ~~our economy~~, in some ^{places} ~~areas~~, where water has
^{even already} been mined, they have forced retrenchment.

To p. 4

^{& technology}
~~Water shortages often appear long before the limits of nature/are~~
~~reached.~~ The fault appears to lie in human institutions. that guide water
users in economizing on and allocating this scarce resource. The writer
could detail many examples of ~~water~~ waste ~~in the~~ ~~use of~~ ~~water~~
^{shortage}
Striking contrasts of waste ~~adjacent to~~ nearby to ~~water~~ ~~resources~~
~~are commonplace:~~ The Merced Irrigation District, e.g.
^{the}
for example, wastes out ~~its~~ tailways of its primary distribution system
more water than is used in the ~~adjacent~~ ^{entire} ^{equally extensive} Madera Irrigation District,
adjacent, which is precious of its water; Salt Lake City ^{was} flushed out
its gutters with running water, ^{last year} while domestic water is rationed ^{was} in
Ogden, ~~40 miles away~~; irrigators in the Simi ~~valley~~ of
Ventura Cty Calif. ^{pump wells} ~~dig down~~ over 100 feet for water, while a few miles
^{deep}
north in the Santa Clara Valley ~~wells~~ no one ~~bothers~~ ^{troubles} to drill over ten
feet, and in January water may be seen flowing freely ^{down} into the ocean. ^{the Santa Clara} ^{Pacific}
New industries filing for water rights in humid western Oregon discover..
Shortages, it seems, may result from

^{Such}
~~These~~ contrasts suggest ^{the presence of inst.} some sort of invisible barrier, to the transfer
of water
(the lack of inst. channels to facilitate xfr of water from
surplus to shortage, ^{areas} & even the presence of inst. ~~obstacles~~ barriers

~~Present~~ Present inconveniences, and the prospect of future crisis, seem to ~~be~~ spring as much from the inadequacy of ~~humanized~~ social institutions as from a shortage of natural supplies, and might be *substantially* ~~in large part from the lack of adequate social institutions for economizing on water.~~

~~vastly~~ *economizing techniques.* meliorated by the application of some elementary ~~economic~~ principles to the economy of water. In some humid areas water has been treated by legislatures as though it were a ~~courts and legislatures have treated~~ the public has not troubled to install

Even in the arid states it is not uncommon to see water squandered ~~lavishly utterly wasted nearby to~~ the nominee knows of instance after instance ~~where~~ *nearby to* water is wasted ~~nearby to~~ in the face of ~~desperate~~ urgent need, ~~nearby.~~ *For example to p. 3*

is its inadequate provision for transfer of water from ~~traditional~~ ^{value} agricultural uses of low/productivity -- even at supported prices -- to much more productive urban and industrial uses. ~~As The Paley Commission~~ out of agriculture, with its historic priorities, where ^{even at supported prices} value productivity is often very low, ~~even at supported prices~~. The Paley Report Commission/cited instances ~~where/water~~ of water productivities fifty times higher in industry than adjacent agriculture, and Louis Koenig of the Southwest Research Institute has gone so far as to ~~recommend a western economy~~ maintained that the arid west should rationally devote almost all its water resources to industry.

One might also protest that demineralization of ocean water, which ~~is/approaching~~ now seems to be approaching the threshold of economic feasibility, may soon make obsolete a concern over ~~water~~ ~~and/therefore~~ the traditional water provide an abundance of fresh water such as to obviate the ^{task of} ~~unpleasant social frictions~~ involved in achieving a closer economy of traditional supplies, with the ^{unhappy social frictions involved.} That is, indeed, remotely possible, but only remotely. And in ^{Such abundance} ~~That~~ is, indeed, remotely possible, but only remotely. And in ^{priced and} any event the new supplies would have to be/distributed, matters to which ^{much of the proposed study} ~~which/it/it/it/it~~ would be devoted.

~~An important by-product of the project, the nominee anticipated, would be~~ ^{be significant for its yield significant valuable} The study ^{may} should also yield ~~important~~ by-products. ^{It involves, as will be} The most ^{seen, an analysis of the economics of distributive networks. (Hypothesis 4-7) (37)} important of these would be in the study of ~~ideal pricing for~~ ~~distributive networks.~~ [←] Distributive networks of many kinds, for power, gas, ^{telephones} and above all the movement of vehicles, play a major role in our economic life. Each type of network has its unique technological aspects, but ~~each~~ ^{all} they have, too, a great deal in common. ^{analysis of water distribution may have considerable carry-over value} ~~Much of what proves good for water distribution may have application for the others.~~

nominee

The ~~writer~~ attaches especial importance to the dynamic aspect of the growth of distributive networks. He notes that the lag of land settlement by private occupants behind the provision of basic public utilities is a serious problem ~~tending to~~ in the expansion *not just* of water systems, ^{but almost all} and others as well. He conceives that this lag may ~~play an important role in~~ contribute substantially to the problem of overall economic instability. He does not expect to have time to develop this aspect of the study in the first year; but he does expect that the experience of this study will contribute greatly to a subsequent study of this lag as a factor in business cycles.

Other by-products should be ~~of~~ ^{consideration of:} one aspect of Federal-state-local relations; methods of reconciling ~~inter-govern-~~ ^{claims to water, conflicts among betw. diff. state & local govt's} ~~mental disputes~~, which might have some bearing on the reconciliation of ^{similar} international disputes/ ~~over water~~; aspects of public finance, which are involved in pricing and financing distributive networks; and the ^{general} ~~application~~ the problem of ^{making} ~~applying~~ economic principles/ ^{practicable} ~~in~~ ^{practical situations/} the framework of our laws and customs.

§. Hypotheses to be tested in the study

1. MP of water varies among diff users, signif. ^{involving aggregate losses} ~~more~~ ^{greater} than ~~the~~ ^{physical consequences} costs.
2. ~~The technology of water distrib. & use is not such as to preclude~~ (specify "among users")
It is possible to devise an ^{ec.} system of water allocation, consistent w. the techn. requirements of water distrib. & use, that would appreciably ~~Δ~~ [↑] the net value product of ~~output from~~ ~~from~~ given land & water resources. ^{over its present level.} This would ^{the use of a pricing system, a pooling of water resources, and would achieve} entail an equiproportional allocn of water, with due account of ~~costs~~ ^{consequences} ~~taken~~.
3. It is possible to approximate this ideal system w-in the framework of ~~existg~~ ^{existing} law & custom in America through extension of the p.u. concept, as exemplified by existg water districts. This is as feasible in the east as in the west.
4. Unit costs of water distribution are appreciably inflated by ^{failure to} ~~the~~ ^{developing lands in compactly settled} ~~scattering of water users~~; and also by ^a ~~the~~ ^{dynamic} ~~related~~ ^{phenomenon}, of ~~the~~ lag of settlement behind construction of basic facilities. Scattered settlement in early dev. ^{may sometimes} ~~tends to~~ become frozen into a permanent pattern as the lands first developed acquire claims to ^{entire} ~~the~~ water supply.
5. It is possible to devise an ec. system of financing & pricing the services of distrib. ~~sys~~ networks that wd. substantially meliorate both problems. (of hyp. 4)
This wd. involve an application of principles of MC pricing, w. esp. consideration to ^{ed be devised around} ~~for~~ dynamic aspects. ~~(see above)~~ ^{as a system based on} MC pricing ~~wd~~ ^{not} tend to ^{inflationary} ~~encourage~~ ^{encourage} settlement in early stages of project; & evolve so as to enforce economy on overloaded distrib. facilities. in later yrs.
6. It is also possible to approximate this ideal system in practice, thru extens. of p.u. . . .

(7.) The lag of settlement behind construction of basic p.u. has tended to lead to an over expansion ^(over)
This may seem like an unduly ambitious set of hypotheses. The nominee wd. defend them on 2 grounds. a, He has already devoted ~~over~~ much of his own time to advancing projects, ^{so is well along} b, The problems of water allocn & distrib. are so bound up together it is ^{much} ~~far~~ ^{more} ~~better~~ ^{fruitful} to study ^{them together} ~~one~~ ^(over) ~~the other~~. ~~The most ambitious aspect of the project (over)~~

~~the study of the lag of settlement behind~~

- (c) ~~There is sufficient elasticity in the hypotheses to permit of~~
~~Should time~~ Hypotheses (3) & (6) will be reserved until the
last, and should a deadline impend may be omitted ~~without damage~~ & still leave an
~~the project~~ ~~self~~ integral project. Hypothesis (4) may be drastically curtailed,
& ~~even taken as a postulate~~
as the phenomenon of lag has been studied rather well documented in the past
- (d) The ~~writer~~ nominee ~~is~~ plans to pursue this study ~~on the~~ after the expiration of
the grant in any event, & has included more than may be possible in one yr
to afford the Foundation a ~~better~~ view of ~~the~~ his longer range plans,
(7), in particular

of p.w. in boom times, followed by a complete collapse when ^{enough of} the ~~slower~~-developed
lands finally come into production. This phenom. may be analyzed in terms of the
"cobweb theorem". It is familiar ~~in~~ in all areas of where more intensive land uses
are superseding less intensive. It ~~is a~~ may ~~to~~ contribute substantially to
problem of ~~an~~ instability

~~At~~ B. Sources and methods

Part of the ~~study~~ proposed project ~~would~~ consist of analysis, conceptual development, and creative thought. This is involved in answering question c, and testing hypotheses 2 and 5. While the nominee does not expect the entire project to spring a priori from his own meditation, he does expect to put his own stamp on it. This will require a certain allocation of time simply to the development and organization of thought.

The nominee would also look ~~for inspiration and~~ ^{for insp.} ~~to~~ several sources. ~~First~~ He knows of no formal/~~precedent~~ ^{economic analysis} to help ^{directly} with hypothesis #2; but he would ~~survey the practical approximations~~ ^{precedents in} For example look ~~to~~ the world of experience. /The Bureau of Reclamation under Commissioner Straus seemed to be groping towards a plan of integrated use; many irrigation districts, ^{& mutual water co.s} allocate their water under modified pricing schemes/. electric power has been pooled over wide areas, under the initiative of private utilities and public agencies such as Bonneville Power Administration, ^{TVA,} and SEPA. There has been some economic analysis of this, which the ~~writer~~ ^{nominee} would survey.

He wd. also consider whether newly developed programming techniques might be useful (over)

For hypothesis 5, again the nominee knows of no formal/^{economic} work ~~in the field~~ bearing specifically on water. But certainly there is a vast literature on pricing policies for public utilities in general. The nominee would ~~become familiar with~~ acquaint himself with the basic issues there discussed. ^{also} He would take advantage of his proximity to Harold Hotelling to receive criticism of his ~~hypotheses~~ developing hypotheses from a leading advocate of marginal cost pricing. ^{He wd. test his ideas exp. vs the criticisms of MC pricing so abundant in lit. (over)} He is fortunate ~~also~~ in having as a colleague Dr.

Thomas Martinsek ~~whose analysis of~~ who has done original/work in conceptual

this field which the nominee finds very provocative.

the municipal Water Works Association as long ago as 1907
gave serious attention to water pricing in its "Coffin Report";
✓ Fritz Phillip has accumulated a valuable bibliography, "A Review
of the Literature on Differential Charges for Water on Irrigation
Projects";

in solving the scheduling problem, a major one due to irregularity & unpredictability
of flow. But he wd. avoid ~~the error of over~~ ^{the error of over} ~~emphasizing~~ ^{simply} to this technique just because it is new &
popular.

He leans toward the mc pricing doctrine, but is not satisfied w. ~~the~~ its present dev-nt.
He is esp. as regards treatment of time, & ~~He wd. dist. SR & LRMC & adapt P to~~
~~SR~~ ^{handlg of LR & SRMC.} He expects his contribution
to lie in the treatment of this time problem.

Other parts of the proposed project would involve field studies. These are Question a; hypotheses 1 and 4 (which answer question b); and hypotheses 3 and 6 (which answer questions d and e).

To answer question (a) the nominee would rely primarily on past study, by which he has grasped the basic legal and administrative problems involved. He would, as indicated, bring his information up to date by reference to leading recent cases. During the Foundation-financed year, however, his major effort regarding this question would be to learn more of informal field procedures which may considerably meliorate the application of uneconomically conceived legal doctrines.

The major field effort will be devoted to testing hypothesis #1.

The nominee would test the hypothesis in an area with which he is already quite familiar, the ^{east side of the} San Joaquin Valley. ^{This would involve a form of} ~~Time permitting~~ ^{The area includes numerous units, each with water rights of different priority, and} ~~he would extend the study to the west side; and to Ventura County, another area with which he is familiar.~~

He would apply several methods of testing. First would be simply an analysis of present water law. It is fairly evident, e.g., that ^a ~~the riparian doctrine~~ ^{either} allows for no consumptive use ^{or, where modified to allow con-} upstream from ^a the holding with riparian rights, ~~or, where modified to allow con-~~ or insists that all rival riparian claimants receive water in proportion to the ~~smallest unsubdivided holding that~~ or, where modified to allow of consumptive use, insists that ~~rights be prorated among riparian holders in proportion to the~~ ^{private} smallest unsubdivided/riparian holding that has existed since the land was public domain. ^{This has no relation to productivity.} The right is nebulous, ^{often} the subject of costly litigation; It can be used on riparian land only, ~~and~~ is virtually inalienable, even among riparian owners; ⁸ ~~It may be held~~ maintained indefinitely without being used. ^{It is likewise notorious that} The appropriative

(

& many w no irad-l water rts, but 40 yr contracts w. P.R. Also includes
many cities, & some for
major in water ~~supply~~ of city of S.F.

or on claims of intent to use, doctrine, based on use, tends to encourage premature preclusive claims and wasteful use, ² ~~At best~~ it is based on historical priorities with little present meaning. Rights are difficult to transfer. Being based on nebulous concepts like "beneficial use" and "due diligence", rights are also far from clear, and ~~lead~~ subject to costly litigation. It would be remarkable indeed if either system ^{achieved} ~~permitted~~ of optimum utilization of water resources. These and other shortcomings of water law have been pointed out (over) The writer will study the application of these two doctrines in the San Joaquin Valley, the application being often different ~~from~~ ~~what the law seems to~~ --- sometimes for the better, sometimes the worse --- from what the law seems to envision.

Second, the nominee would develop quantitative statements of ~~the~~ losses of water productivity. He would ~~examine~~ contrast the ~~marginal~~ productivities of water in water-rich and water-poor districts, ~~and~~ and compare the differentials with the ~~marginal~~ cost of ^{conveying} transporting water between the areas. He would make this comparison in marginal ^{terms, & also in terms of a substantial transfer of water.} ~~and total terms.~~

He would estimate marginal productivities of water in several ways. First, there are several direct studies of the subject, many ~~made~~ by the Bureau of Reclamation, others by ~~the~~ University economists and the state Agricultural Experiment Station. Second, there are pumped wells in most areas, whose marginal costs of operation are easy to determine, ^{& the subject of studies by CEC & BR.} It ~~is~~ ~~probably~~ seems plausible that these marginal costs would equal the marginal productivity of water. Well depths vary ^{markedly} ~~enormously~~ among the districts. Third, one may observe the care with which water is handled. The nominee has observed that in some districts the demand for water is carefully solicited and tabulated in advance, schedules are ~~carefully~~ prepared, and irrigators often aroused ~~at~~ at midnight to receive their share;

already
/ by S.T. Harding, Conkling and Hyatt, Milo Williams, and others.

and scarcely a drop allowed to pass out the tailways; while in others farmers sleep ~~through~~ ^{through} irrigations scheduled at night, ^{a high proportion of diverted to waste, spillways} while the water runs ^{down} the main canal, wasteful irrigation techniques are ^{the rule,} common, and there is little investment in water conservation facilities. ^{Data on these matters should provide signif. indices to} It may be possible to develop some ^{value & hence presumably MP of water.} meaningful quantitative data from ~~this sort of observation.~~

^{the potential of} Measuring total productivity ^{from a large xfer of water} presents a more difficult task. ~~One can infer a great deal from simple facts such as that the Kings & Truckee~~ The nominee proposes to estimate the total increase of output that would result from moving ^{specific} (a quantity of water) from a district of surplus to a district of shortage, ^{such that} until the marginal productivities of water in the two areas, net of ^{convergence} transportation costs, ^{became} were equal. ^{construct full} This will involve schedules of marginal productivity of water in the two districts, ^{would} These must be composed from available ^{on the} data ^{schedules of} on the marginal productivity of water applied to particular crops, ^{in the} 2 areas, with cognizance of the fact that water users in each district ~~would~~ shift to different crops to adapt to ^{such a water} transfer. ~~Such a data transfer would probably decrease with the amount of water transferred.~~ ^{est. benefit from several xfers, including} ^{trans. cost.}

~~Additional~~ ^{76 time permits} relevant data are abundantly available. Stream flows are gauged by the Geological Survey; ~~diversions are recorded by~~ ^{amounts of water diverted,} the state Division of water resources records ~~diversions and~~ irrigated acreages, ^{irrig. from area diversion} crops value of products, ^{from area diversion,} and much other information; ^{the BGE provides data on} the Bureau of Reclamation has many studies of pumping costs, ^{as has} ^{BR, BGE with} volumes of data on all aspects of irrig-on; ^{the irrig-on census records, well depths & inv. in irrig facilities.} the PGE Co.; individual irrigation districts publish records of their water diversions and use, including waste -- and to judge from records the nominee has seen are ^{sometimes} frank to include very large wastes. ^{Faced w. such a wealth of raw} ^{evaluation} ^{selecting} ^{orig's} ^{interpretg} ^{expos'n} ^{rather than further collection.} the nominee expects to find (and concentrate on)

One might approximate an answer roughly simply by off per acre water cons. & outputs
in the 2 districts. ^{abundant data are available for this.} Again, he might establish a ~~large~~ ^{large} gain by postulating
simply the xfer of all water that runs to waste in ^{certain} surplus areas, ~~such as Mod. Tent,~~
~~Mod. 40s, & has no mgd prod.~~ In ~~the~~ Mod Tent Men. e.g. this consists subseq. part of
all water diverted. ^{But the} If proves feasible nominee wd go further

~~contrasts, which are great.~~
~~of water used per acre in diff. districts. One may also~~
~~Rivers discharge~~

~~This task may be much simplified by selectg as the surplus area one in~~
~~which the Mt of large quantities of water are completely wasted. The Modesto,~~
~~Turlock, & Merced P.D. wd. all qualify. They could lose large quantities of water~~
~~or virtually no loss of productivity. The task becomes Furthermore there are~~
~~enough storage dams nearby. The task may be further simplified by~~
~~as~~

satisfactory ways of to move the ^{likely net.} gains to be realized ~~by making it~~ ^{from xfers of water.}
~~institutionally possible to xfer water.~~ He may safely expect to be able to

Many of these would involve virtually none, but only a change in pt. of discussion.

The nominee anticipates little difficulty in securing estimates of ^{consequence} ~~transportation~~ costs. ^{army,} Bureau, state, and private consulting engineers have estimated the costs of hundreds of potential water projects. The major difficulty will be translating these estimates, first, into current prices, and second, into the framework of ~~ideal~~ pricing for distributive networks which the nominee proposes to devise. Neither of these seems to present insuperable difficulties. As to the latter, ~~the nominee will avoid the overstating his case by computing transportation costs at higher levels~~ should transportation costs under the nominees proposed system of accounting be substantially lower than under systems now in use he would avoid overstating his case by submitting two figures, one ~~estimate of transportation costs~~ for each level of transportation costs.

Top 14

Hypotheses 3 and 6, as indicated, may ~~never be~~ not be reached during the project year. When they are reached, however, the sources of information ~~is~~ are the many water supply systems within which water is ^{allocated} ~~transferred to areas of high demand~~ with varying degrees of flexibility. These range from tiny municipal systems through good sized irrigation districts to the ^{giant} ~~sprawling~~ Metropolitan Water District of Southern California, ~~the giant of its type~~. Most of these systems keep good accounts which are of public record and are ~~available~~ centrally collected in Sacramento. ~~Their practices, however, are best~~ These should serve rather well for study of their financing and pricing policies. To ~~study~~ learn ~~their practices~~ their practices of water allocation, however, the nominee has discovered no substitute for talking with the local water master. Informal and unpublicized practices are the essence of many systems.

Hypothesis #4 is in general ~~fairly~~ well established among students of ^{water} irrigation development. The nominee's contribution would not be to establish this hypothesis, but ~~to~~ possibly to provide quantitative estimates and some description of the current situation. While the nominee's plans for attacking this question are not as yet fully formulated, in general they are as follows: he would select an ~~area~~ identifiable water distribution system whose unit costs have been inflated by scattered settlement and whose settlement pattern effectively /frozen by the low transferability of claims to water. He would estimate the costs of distributing the same water to a compact settlement, and contrast the two sets of costs. He has in mind two likely test areas: the service area of the Friant-Kern Canal; and the San Mateo County "Peninsula" commuting area. ^{Each} Both of these ^{has} ~~have~~ reached the limits of ^{its} ~~the~~ ~~presently~~ ~~available~~ water supply, ~~and~~ ^{with} ~~have achieved~~ very scattered settlement patterns.

to p. 13

4. Relationship to work of others.

The proposed project would draw on the work of many others.

~~In the~~ From the realm of theory it draws on the general body of price ~~theory~~ and welfare economics, and especially that much of it pertaining to marginal cost pricing, public utility rate making and financing. From the realm of practice it draws on the work of ~~lawyers~~ ^{western legalists} such as Wells Hutchins; ~~Ralph Wertheimer, Edmund G. Brown, and to a lesser extent easterners like R.H. Marquis, R.M. Freeman, and M.S. Heath, Jr.;~~ of engineers like Congling and Hyatt, who have written one of the more ^{constructive critiques of} ~~inceptive/analytical~~ western water law, and Sidney T. Harding; of political scientists like Vincent Ostrom; ^{and} ~~J.F. McGarty, of the Bureau of Reclamation, and of interested parties such as the Irrigation Districts Association and the National Reclamation Association; of bureaucrats in the Bureau of Reclamation; and a host of others whose work touches on the economics of water.~~

The uniqueness of the proposed study would be its application of ~~economic/technical~~ the economists's techniques and overriding concern for the general welfare to a field ^{cultivated hitherto only} ~~dominated~~ by others, ^{often unduly} ~~special~~ professions, ^{and the pleading of affected interests.}

Other economists have worked and are working in the field of water resource development, but none known to the nominee has focussed his attention on ^{a general analysis of} ~~the~~ problem of the allocation of surface waters. Ground water appears to be the primary ^{present} concern of S.V. Wantrup and Stephen Smith at Berkeley, Herbert Snyder at Davis, and Jere Milliman at UCLA. De Haven, Gore and Hirshleifer of the Rand Corporation in 1953 produced an excellent ^{brief survey} ~~study~~ of the Los Angeles ~~area~~ water problem, but it was primarily descriptive.

~~Wm. Brede's paper on the Water Resource Development Committee of the Western Agric.~~

The Water Resource Development Committee of the Western Agric.

Econ. Research Council has stimulated study and discussion of

water pricing problems, but so far as the nominee can determine

~~the emphasis has been entirely on cost allocation~~

but the only result known to the nominee is Wm. Brede's ~~paper on~~

"Framework for Water Pricing Policy" (in the 1953 proceedings), which

~~this paper~~ concerns ~~the question of~~ cost allocation from federally

subsidized projects, ~~and not the~~ Such questions of federal

policy have absorbed most of the attention economists have given

to water development. Allocation of funds among different projects,

economics of multi-purpose development, inter-agency disputes, ~~have~~

~~the question of subsidizing water for agriculture,~~

~~the 160 acre limitation,~~ are some of the major

topics. ~~The nominee's~~ ^{primary} concern is ~~with the allocation of surface~~

~~waters to the most productive use. To this problem, the most relevant~~

~~of these studies is the topic of price discrimination~~

~~between agriculture and industry for federally developed water.~~

Probably the most ^{relevant} ~~of these~~ work has been done ^{by economists in} in the

Bureau of Reclamation. But ~~the Bureau's~~ ^{controversial} ~~work on~~

~~a political agency, subject to the~~

~~most bitter and intense pressures, does not provide an ideal~~

~~environment for the free flowering of creative new thought.~~

But Bureau personnel are inhibited by ^{unusually} ~~the~~ intense and bitter political

pressures ~~of the Bureau~~ from undertaking the sort of ^{basic conceptual} study that

an outsider with ~~foundational~~ independent funds could ^{essay} ~~write~~. Too,

the Bureau ^{also} has its own ^{orthodox} ~~traditions, shibboleths, slogans, catchwords, loyalty~~

~~to which may permit the free flowering of original thought.~~

R.P. Teele and David Weeks have each produced excellent ^{descriptions} ~~studies~~ of the lag of settlement behind irrigation construction. But ~~both~~ ^{comparable has appeared} ~~these studies~~ nothing, since the mid-twenties. Now as another period of expansion appears to be closing it may be appropriate to survey the damage again.

The land & water section of Prod. E. Branch of ARS is vitally interested in these problems. ~~It is~~ ^{Thus for their work, too, appears to have been primarily descriptive.} ~~Norman has been in close contact w. H. Steele & not without crop arrangements~~ anticipates that under his leadership the section will move towards more fundamental & unapplied type of research.

XV. Present state of the project.

The nominee has acquainted himself with the background of ~~California~~ water ~~resource~~ problems in a number of ways. While a graduate student at the University of California he took ~~24~~ ^{many} hours of course credit under Professors S.V. Wantrup and David Weeks, much of which was devoted to ^{aspects of} water economics. In 1950 he worked for six months with the U.S. Census of Irrigation as Irrigation Economist, (GS-9), ~~in charge of~~ with responsibility for irrigation aspects of the census in 14 counties from Sacramento to Ventura. His doctoral dissertation, "Land speculation as an obstacle to ideal allocation of land," grew in ~~large~~ part out of his observations of land problems in irrigated areas. In 1953-54 he taught a graduate and upper division course at the University of Oregon in the economics of water conservation. In August and September of 1955 he devoted a month of his own time to ~~research~~ ^{and} research in the San Joaquin Valley and the Giannini Library at Berkeley in development of the project. He has ~~sustained~~ maintained an active interest in the project over a number of years and accumulated ~~extensive~~ a large filing drawer full of relevant information ~~and the products of his data and his formative ideas.~~ data and notes on his developing hypotheses.

~~He can only~~ The project is in a fairly advanced stage. The nominee ^{been} has, indeed, planning to write up the results of his research at the earliest opportunity. A foundation grant would present such an opportunity

certainly
 the nominee would expect to complete testing of hypotheses
 1, ²4, and 5, and exposition of results, within one year. He will
 if possible incorporate consideration of hypothesis 3 and 6 as
 well, but leaves them as excludable options in the event of
 delays. Hypotheses 4 and 7 lead into the more ambitious project
 that the nominee intends to pursue after he completes those
 aspects ^{of the project} that bear more uniquely on water. ~~this study of water~~
~~economies.~~

7. Places of work

The nominee would remain in Raleigh for the first few weeks
 to ~~begin~~ inventory and organize his present ~~data~~ materials,
 and plan out his work, and discuss it with local leaders in
 water resource development. He would try to secure the use of
 office space in Berkeley, Davis, ~~or~~ Sacramento, or Fresno through
 University, state, and Bureau of Reclamation contacts, and his
 location would to some extent depend
 He would spend most of the project year in California, ~~mostly in~~
 Sacramento, Davis, Berkeley, and Fresno. working in the project
 area, and in state and Bureau of Reclamation offices in Sacramento,
 and at the Universities in Davis and Berkeley.

Plans for publication

7. As mentioned, the nominee includes exposition ~~and~~ publication
 as part of the project. He would submit a series of articles to
~~Land/Economics~~ the major economic journals. Confer w. Cal. & Chap. H. H.
 Messers on book. Approach H. Steele Has received some encouragement from H. Steele, wd.
 look into publication thru him.

Fellowship plans:

1. a. Questions research intends to answer

b. Their significance

2. Main hypotheses to be tested. (This need not be whole study. Accumulating info., under 1, is part).

3. Sources & methods to be used

4. Relationship to work being done by others in same genl area.

5. Present state of project

a. Progress to date

b. Completion date. 1st installment, 1 mo. Then advance.

6. Place(s) of work

7. Expect-n & plans for publication. Approach NC state, showed intense interest.
Dewey Weaver director of Ect. Serv.

8. Itemized est. of expenses. Beverly Snow, Chief Eng, Div of Water Res.

4. Relationship to work of others.

Integrate th^y & practise. Put exst tools to work on problem hitherto handled mainly by lawyers & eng^{-rs}.

~~catching & Hgath~~
Milliman Ground water. Wamtrup, S. Smith, H. Snyder

Hutchins, Wertheimer, legal emphasis. ~~Margolis, Freeman & Heath, Tenn. Law Rev., best.~~
~~Wester Feels~~ Inter-agency disputes, Fed. level, adm., Fed. subsidy - not my concern.

Pres: Water Res. Policy Comm., 1950. Multi-purpose dev^{-mt}, power. I concern con-
sumptive use, distrib., more. ~~Presidential Advisory Committee on Water Res. Policy.~~
1955 study, too. Incidental attⁿ to water res. - ex^{cl}. with characteristic bias
of time & adm. that produced it.

B.B. 9c contracts.

Political agency, ^{subject to most intense pressures; suspect of serv'g own interests} cannot g^{en}ly publish objective analyses.

J. W. Powell. Reified. But ideas re distr. good.

'55 DA Ybk, technolog. Is basic, but dim. ret. is much of what rest needs to know.

Subcomm. on Ben. & Costs, Fed. Inter-Agency River Basin Comm., '50.
allocⁿ of funds among projects. - not water among users.

NAM & Consⁿ Fdn, entirely descriptive

Water Masters. Allocⁿ w⁻ⁱⁿ exist^g units. I wd. alloc. among.

Rand '53. Focussed on LA area. "Brief Survey of the Technology & Econ of
de Haven, Gore, & Hirschleifer Water Supply." '53.
Western Ag. Ex. Res. Council - Ag. oriented?

Wm. Breds, Stanf^d Res. Inst. Institutional, descriptive

V. Ostrom - adm. Also J^r McCarthy, of B.P.A, B-y, on T.D. movement in Cal.

General: Garmsey, Huffmann, Renne, Lee, Clauson

Maass: Interagency squabble

Hansen: CVP

Strickland, L. J., U. of Tenn. AES, Knoxville. Contact before go, & when return, for ideas
on what to look for
Edmund G. Brown.

1. Questions research intended to answer

a. ~~What~~ By what legal, adm., ec., & informal processes is water alloc. today? ^{1st 45}
^{Writer familiar. Up to date, recent ct. decisions, congressional action. Pelton dam, Savannah R.}
^{Get down to actual field work - much legal error may be righted there. - is much xfer, but w/o security.}

b. What is eff. of alloc. system? Define eff. Est. by sample, or just devise means of test's & apply on small scale, straighten concepts.

vs. ideal. Means defining ideal. ^(Means of weight's alternatives) Ideal system of pri's for distrib. network. ~~Also~~ MC pri's - drawn on work in power, munic. water.

Also best feasible system. ~~W-in~~ W-in our mores. Extend p.u. concept.

^{Closest approximation to ec. ideal}
Include adm. costs in such system; & legal costs in present
(Tendency toward undue conc. of landholdings under controlled water supply?)

c. ~~Problem of lag of dev. mt.~~ ^{Hard to} ~~Can't apply perfect system unless solve it, but mgmt lands get drained when~~
d. ~~How modify lessons of W-n experience to apply to east.~~ ^{slow central lands finally}
^{correct in. Or central lands never}
^{get water. Hyman, Smith, G.P. & 26-}
^{Long & Short term, 1955}
^{concrete.}

Ideal involves techn., too. Scheduling, by rates or units, etc.

(Incidentally, how do foreigners do it. Read Fr. Gm, Ap, will try find out. ^{claims.}

Ruhr supposed to be very good.

Utah fractional system

Canada

Signif. - bring in cycles here?

Basic res., just learning to eaze on it. Often critical - stop ec. expansion.
Critical element often in human inst's, not nature, es. W. Ore
Priorities based on hist. data, poor basis for ec. g's today. E.g. priority of xptn.

Writer knows numerous instances good water runing waste amid dry lands. SLC. vs
Ogden; Modesto-Turlock vs Madera; Sta. Clara vs Simi V.; K's R. vs Tuolumne - have to pump to ^{lower}
^{water table. BR. I.D.s,}

Too much ag. prod. anyway? ~~If so~~ If so, problem is how move water to urban use, ^{over}
^{at Paley Comm recommended; & Dr. Louis Koenig of S.W. Research Inst,}
where many times more productive. & in such a way it can come back if nec. ^{of San Antonio,}
^{at Albuquerque}

Remineraliz-n solve? Help. But not free, new res. to be alloc.

Local-central controversy

Urban areas, much immensely valuable urban land held as watershed, cd. use if import water.

Western experience - apply in east, avoid errors, so quickly frozen into vested ints.

55 DA probk. 55 S.W. Gov's Conf.

Conflict of Fed. vs state. Sta. Margarita, San Joaquin, Pelton.

155 w/ly.
Orig. decline. Barrett Bill

pay for water, so ee-ze.

3. Sources & methods to be used
No sub. for 1st hand knowledge of field.

Network of personal contacts.

Commonwealth Club

Div. of Water Res., Sacto. Gnl publications, & history. Carl Werner.
Bowles, ^{Rollin} A. Atty for State in Pelton Dam

Geological Survey

K. O'Connell, Eugene.
M. Strauss

Interest groups: NRA, WDA (WWN). But doubt value - get right to grass roots,
see what's be'g done.

B.R. Bendon, John F.

Sacto. office

Repts, vast data - e.g. '53 rept. on I.D.s under canals. Cf. them, pay'g for
water, vs. Trachymene users.

Conkling, Harding, ~~Etchewary~~ hr. given much constructive thought to
sol'g problem.

EBMUD; MWDSC; S.F. Water Dept; SCVWCD

Water Masters - K's R. irrig

Dave Weaver

Come on areas I know: Cal. betw. S.F. & L.A.

Wm. Smart

Hr'gs, Subcomm. on Irr. & Recl. of Committee on Interior & Insular Affairs,
H.R.; & correspond'g Sen. Comm.

Fritz Phillipp, "A Review of The Lit. on Differential Changes for
Water on Irrig. Projects" (A Suppl. to Rept on Problem 13, Col.
Basin Jt. Invest'g-s) Jan '43 (typewritten)

~~Hotelling, re MC pricing~~

~~Water Works Assoc. 1907 Coffin rept, gave att'n to pricing. Probably since~~

UNESCO, Advisory Committee on Arid Zone Research, has sponsored
conferences in Albuquerque, Ankara, Jerusalem, Montpellier, & New Delhi.

1

basic

Proposed study, An economic evaluation of ~~western/water/lay~~ the/institutions
controlling the allocation of water in ~~the/western/united/states/~~ California

1. Questions the study is intended to answer

The study poses four related questions:

a. By what legal, administrative, economic, and informal processes
in California
is ~~western~~ water/allocated today?

b. What are the major faults in this system/ or systems?
economically

c. What would be an/ideal system for allocating water?

d. What approximations to the ideal are feasible ~~within/the/zones~~

~~of/today/ in/the/united/states/today/~~ in California today?

e. ~~What~~ lessons from western experience ~~may~~ be applied ^{under} in eastern con-
ditions?
~~Let the writer expand/elaborate on each one.~~

~~As~~ California is chosen for two reasons. First, the ^{nominee} writer is
already ~~quite~~ familiar with California water problems. (~~see item 5~~).
Second, California ~~lay~~ is unique among western states in ~~the~~ retaining
~~cons/der~~ appreciable vestiges of riparian law, along with the ~~prop~~
appropriative law which other western states favor almost exclusively.

~~As most eastern states still use riparian law, analysis of problems in~~
California therefore provides a laboratory for evaluation of both systems,
observed in operation side by side. As most eastern states still ^{apply the} use
riparian law, ^{a study of Calif. water problems has esp. interest for them.} it is evident the conclusions of the study may have much
wider usefulness.

^{nominee}
The ~~writer~~ does not intend to become ~~a/water/ foremost~~ expert in the
finer points of water law; but only to grasp firmly the basic principles
and their application. He has ~~already acquired most of this information,~~
~~through study of leading law cases, of treatises such as S.T. Harding's~~
~~Water Rights for Engineers~~ He is already quite familiar with most of
this material through previous study ^(see items) and contact with field problems, and
plans to use project time only to refresh his ~~own~~ knowledge and master
the more recent developments such as ~~the Pelton Dam decision,~~ the
County-of-origin ruling, ~~the Barrett Bill,~~ and the several San Joaquin cases;
& relevant national developments such as the Pelton Dam & Savannah R. cases, & Barrett Bill.