Appendix I: Public Costs Associated with Delta Agriculture

The sustainability of Delta agriculture from an economic perspective depends upon the profits and costs of doing business and the level at which society is willing to subsidize agriculture. Farmers themselves absorb the lost agricultural production associated with temporary and permanent flooding. But there are larger costs associated with Delta agriculture behind failure-prone levees that are defrayed largely by the public. These include:

i. the cost of levee maintenance, levee repair, and island rehabilitation after flooding events;

ii. the economic costs associated with allowing diversions to be unscreened (such as reduced commercial salmon catch) and the costs of screening them;

iii. the economic costs associated with treating Delta agricultural discharges for drinking water;

iv. the contribution of Delta agriculture to endangered species problems; and

v. the social costs associated with reduced habitat, impaired ecosystem function, reduced fish populations, and the probable loss of substantial amounts of terrestrial habitat in the future once the islands fail.

Information exists for the costs of only a few of these impacts--levees, screening, and drinking water treatment.

Levee subsidies: From 1980-1986 (the last date for which we have information as of yet), emergency subsidies for levees cost the state and federal governments over $90 million or about $15 million per year. State subsidies for routine maintenance and repair of non-project levees have recently been running between $2 million and $5 million annually. In addition, the state has spent $27 million since 1989 for a special Flood Protection Program for eight Delta islands and two Delta communities (with a total commitment of $35 million through 1997). These costs will only increase in the future as islands continue to subside.

Screening: Virtually none of the approximately 1,900 diversions in the Delta are screened. Current screening policies may be changing, however. The Department of Fish and Game (DFG) has recently written "Plan of Action for Screening Diversions," and there is some indication that the U.S. Fish and Wildlife Service is advocating a more rigorous screening policy in the Delta. If DFG were to order diversions in the Delta

screened, it would wind up bearing most of the costs.[1] The potential costs for installing screening are roughly estimated at $3,000 - $5,000 per cfs at each siphon type intake (where average maximum flow for Delta diversions is about 10-15 cfs); it is estimated that screening the multitude of Delta diversions would cost more than $100 million. Operation and maintenance costs would also be significant.

Drinking water treatment: The incremental cost for drinking water treatment caused by Delta island discharges may be as high as several hundred million dollars per year in the future.

[1] Under the Fish and Game Code, DFG is responsible for installation and maintenance costs for diversions installed prior to 1972, and smaller than 250 cfs--which includes most Delta diversions)

APPENDIX 2: Learning Laboratories

a. Twitchell Island subsidence reversal learning laboratory

Subsided island surface elevations are the single largest constraint to large-scale restoration in the Delta. NHI, USGS, DWR, and private consultants have joined in a major initiative to establish a large scale learning laboratory for reversing subsidence of Delta islands. This subsidence reversal learning laboratory will test the three most promising subsidence reversal techniques currently known: reusing dredged materials, cultivating wetland vegetation to accelerate peat formation, and capturing natural sediment loads currently being transported through the Delta. Over the long term, the Twitchell Island project will not only develop information necessary to create a Delta restoration plan, but it will also result in over 1,500 acres of tidal marsh habitat in the western Delta and benefit several endangered species, including Delta smelt, Sacramento splittail, and Chinook salmon. Figure 6 depicts how subsided lands will evolve over time under the subsidence reversal program.

b. The Big Break shallow water habitat restoration learning laboratory

CALFED has adopted shallow water and tidal marsh restoration as the centerpiece of its restoration program, yet biologist disagree about the value of these habitats to native fishes and some even argue that creation of shallow water and tidal marsh would harbor exotic predators harmful to native fish. This issue is so fundamental to the future of restoration in the Delta and must be resolved as soon as possible. NHI is collaborating with the Delta Science Center at Big Break in a project designed to simultaneous restore shallow water habitat, learn about the impacts and benefits of shallow water habitat, and educate the public about the promise of restoration in the Delta.

The Big Break restoration site at the Mouth of Marsh Creek is uniquely suited to test the value of shallow water habitat because it can be implemented fairly quickly with few engineering problems and third party impacts. It is one of the few areas in the western Delta that can be restored to tidal marsh offering lessons that can no be learned from restoring tidal marsh on the perimeter of the Delta. Finally, the diversity of elevations and potential microhabitats at Big Break provide an excellent opportunity to study the relative benefits and impacts of different types of shallow water habitat.

c. Sacramento Splittail restoration in the Yolo Bypass

Fish biologists hypothesize that inundated floodplain habitat is very desirable for a variety of native fishes, but this hypothesis is very difficult to test in the field because of the diffuse nature of flood plains and the unpredictable frequency of flood events. The Yolo bypass is an ideal place to test this hypothesis because 1) all fish utilizing the

bypass must leave through one point, and 2) the bypass can be operated to flood in a predictable fashion.

NHI has organized a group of scientists, and government land and water managers to restore the frequency of inundated floodplain habitat in the Yolo Bypass as part of a carefully designed experiment to understand impacts and benefits of floodplain habitat. The project will focus on changes in conditions for the Sacramento splittail, a rapidly declining native fish, but will also evaluate the effects on several other species including Chinook salmon. The Sacramento splittail is currently proposed for listing under the Endangered Species Act by the U.S. Fish and Wildlife Service, and listing could result in curtailment of the operation of the south Delta export pumps with significant adverse effects on water supply reliability. Yet, these curtailments would do little to recover the species. What is needed to recover the species the ESA probably cannot compel, namely the creation of shallow water habitat during low flow years to enhance spawning success. The best prospect is to increase the frequency of years in which the Yolo By-Pass is inundated. This will almost certainly have collateral benefits for some additional fish species including, most importantly, several runs of Chinook salmon.

d. watershed science program

Watershed management and river restoration are hot buzzwords, but far too often, well-intended efforts to restore or improve creeks and their watersheds are not based on a scientifically sound understanding of the system, resulting in misguided efforts that are, at best, a misallocation of public resources. In watersheds throughout California, citizens are bursting with energy to implement restoration actions but are lacking the data and knowledge necessary to make informed decisions.

In an effort to productively harness this local enthusiasm for watershed restoration, NHI is working to implement the Watershed Science Program in small watersheds throughout the larger Bay-Delta watershed. The Watershed Science Program can be summarized into the following three basic steps: develop an understanding of the environmental past and how it has changed into the present; based upon the understanding of change, develop quantitative resource objectives for the future; and monitor progress toward the objectives, including the risk factors that may prevent the objectives from being achieved.

NHI is currently launching a watershed science study in Carmen Creek on the North Fork of the Feather River and has submitted a proposal for a similar study on Marsh Creek which drains the backside of Mt. Diablo into the western Delta. These two vastly different watersheds are learning laboratories for increasing our knowledge about the opportunities and problems confronting small watersheds throughout the greater Bay/Delta watershed. Carmen Creek watershed is a degraded upper watershed. Among other things, our study will investigate and quantify opportunities for increasing late season water yield through land management practices and restoration of incised meadow systems. Marsh Creek is a rapidly urbanizing watershed that drains directly into the important western Delta. Our proposed study would evaluate the threats to the Marsh

Creek system and the Delta from human activities in the watershed and advance objectives for preserving and restoring the watershed.

APPENDIX 3: Legal Analysis of Groundwater Banking and Retrieval

a. Conjunctive use through import and active recharge.

i. What rights does the program want?

The organizer of the conjunctive use program will enjoy the best legal position to extract the groundwater that it has stored if it is a public agency, if the recharge water is imported, and if the area of origin statutes do not apply. Under these circumstances, the right to extract the stored groundwater enjoys a high priority. Such a right prevails over all rights except in the following circumstances:

- It is inferior to the state-held public trust interest of the people of California, as are all usufructory rights;

- It is of equal priority with pueblo rights, but, since pueblo rights apply only to native water, disputes between the two result in apportionment to the importer of the quantity of groundwater attributable to imports;[2]

- It is of equal priority with other public and private importers in the watershed of destination and use, but disputes between these parties are also resolved by apportioning to each importer "the amounts attributable to the import deliveries of each."[3]

An importer's right to recapture imported recharge water is established by manifesting such intent prior to importation.[4] A conjunctive use program is predicated upon such an intent. Under the conjunctive use arrangements NHI is currently exploring, however, water might be introduced into a groundwater basin at one location and extracted at another some distance away. This raises the question of the hydrologic interconnections that must be maintained between the imported recharge water and the extracted water in order to preserve the importer's preference right. "Imported water" is "foreign water imported from a different watershed."[5] The advantage of obtaining the rights of an importer is that California law gives high priority to these rights in order "to credit the importer with the fruits of his expenditures and endeavors in bringing into the basin water

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[2]. City of Los Angeles v. City of San Fernando, 537 P.2d 1250, ____, 14 Cal.3d at 288 (Cal. 1975).

[3]. City of Los Angeles v. City of San Fernando, 537 P.2d 1250, ____, 14 Cal.3d at 260-62 (Cal. 1975).

[4]. City of Los Angeles v. City of Glendale, 142 P.2d 289, ___, 23 Cal.2d at 78 (Cal. 1943); City of Los Angeles v. City of San Fernando, 537 P.2d 1250, ____, 14 Cal.3d at 257-58 (Cal.1975).

[5]. City of Los Angeles v. City of San Fernando, 537 P.2d 1250, ____, 14 Cal.3d at 261 n.55 (Cal. 1975).

that would not otherwise be there."[6] Under this rationale, it would appear that the area of recharge must be hydrologically connected to the area of discharge such that the program is pumping groundwater that "would not otherwise be there" but for the recharge. In other words, the two areas must be sufficiently proximate and interconnected so that the recharge water would be expected to replenish the area of discharge within the timeframe of the two events.[7]

The advantage of the program organizer being a public entity is that that status precludes the potential for adverse rights attaching to the program's stored groundwater through prescription. WHILE CAL. CIVIL CODE 1007 (West 1982) literally protects "any public entity" from prescription, the courts have been reluctant to afford the statute its broadest application[8] and may try to limit the definition of "public entity" to exclude some marginal parties. Therefore, care should be exercised in choosing or establishing the program organizer. Further research is needed regarding the outer bounds of the "public entity" definition. For instance, it would be useful to know whether a conjunctive use program organizer that was the creature of a memorandum of understanding between the state and federal government might qualify.

The areas-of-origin protections confer a preference right for local water uses in opposition to export uses. To perfect the right, local users must demonstrate an economic need for the water. NHI's preliminary research has revealed no instances where areas-of-origin rights have been exercised in California to cut off export rights.

ii. What type of groundwater does the program want rights to?

The organizer of the conjunctive use program should seek to obtain rights to groundwater that is percolating, used off-tract, imported to the watershed of use, and required for reasonable beneficial use. The universe of parties with potential claims to such water includes: the people of California through the public trust, and importers, prescribers and appropriators--both private and public.

The public trust is omnipresent. No disadvantage is incurred by using water of this type, since no type of water escapes the reach of the trust.

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6. City of Los Angeles v. City of San Fernando, 537 P.2d 1250, ____, 14 Cal.3d at 261 (Cal. 1975).

7. One of the cases holds that it is possible to establish a right to imported water by making deliveries and withdrawals within one's own reservoir and alleging in a complaint that one intended to capture return flow from waters imported into the basin. City of Los Angeles v. City of Glendale, 142 P.2d 289, ___, 23 Cal.2d at 78 (Cal. 1943); City of Los Angeles v. City of San Fernando, 537 P.2d 1250, ____, 14 Cal.3d at 257-58 (Cal.1975). The issue, then, is whether the conjunctive use program would be viewed as delivering and withdrawing water from within the same underground reservoir.

8. *See* City of Los Angeles v. City of San Fernando, 537 P.2d 1250, ____, 14 Cal.3d at 272, 274, 276 (Cal. 1975).

Prescribers, overlying users, and other importers are not of concern, if water of this type is used. If the organizer of the conjunctive use program is a public entity, as described above, prescribers are eliminated from competition for water imported by the organizer. The only colorable claim of overlying groundwater users to water of type 5 would result if the importer abandoned the imported water once it was in the ground. Neither spreading nor delivery for surface use constitutes such abandonment.[9] Other importers, as noted above, can claim only rights to a quantity of water attributable to their own imports--a situation that does not threaten the operation of a conjunctive use program. Thus, a public importer of water of this type need only be concerned about being displaced by appropriators.

Appropriators have a superior claim to water of this type only if the importer fails to require the water for reasonable beneficial use--that is, if the water is considered "surplus." The burden of proof would be on the would-be appropriator to show that such water was, in fact, surplus.[10] Storage of groundwater for domestic, irrigation, and municipal purposes is typically considered a reasonable beneficial use.[11] Storage of groundwater is a beneficial use if the water is later applied to the beneficial purposes for which the water was first appropriated on the surface.[12] Thus, it is important that, in addition to manifesting an intent to recapture imported waters stored in the ground, the organizer of the conjunctive use program demonstrate that such waters are being stored for later application to reasonable beneficial uses. In this way, the storage itself will be considered beneficial.

Thus, if the organizer of the conjunctive use program holds rights of this type to water of type 5, the program should be able to deposit water in the ground and, by right, withdraw it again.

iii. From what source(s) should the program obtain the water?

One consideration in selecting a source of program water is the fixed capital requirements of the program. If the program requires appreciable new physical infrastructure, the costs of those capital investments will presumably have to amortized by the project itself over a period of time. In that circumstance, the program will require a reliable source of water

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[9]. City of Los Angeles v. City of Glendale, 142 P.2d 289, ___, 23 Cal.2d at 76-78 (Cal. 1943).

[10]. Miller v. Bay Cities Water Co., 107 P. 115, ___ (Cal. 1910); Allen v. California Water & Tel. Co., 176 P.2d 8, ___ (Cal. 1947) (burden on appropriator to show existence of surplus); Monolith Portland Cement Co. v. Mojave Public Utilities Dist., 316 P.2d 713, ___ (Cal. Ct. App. 1957) (burden on off-tract user to show existence of surplus); 62 Cal. Jur. 3d, Water § 410 (1981).

[11]. Rank v. Krug, 142 F.Supp. 1, 111-12, 113-14 (S.D. Cal. 1956), *affirmed in part and reversed in part*, California v. Rank, 293 F.2d 340 (9th Cir. 1961), *modified upon rehearing*, 307 F.2d 96 (9th Cir. 1962), *affirmed in part*, City of Fresno v. California, 372 U.S. 627 (1963), *overruled*, California v. FERC, 495 U.S. 490 (1990).

[12]. CAL. WATER CODE § 1242 (West 1971).

over that same time horizon. If, by contrast, the program does not require capital investment, the program water can be intermittent or less reliable. Should precipitation, geohydrology, or legal considerations render a once-viable source troublesome, the program can move on to a new source or even take a hiatus. Therefore, an early question to be resolved is whether the program can be based on an interruptible source of water, or does it require a durable source? For instance, if an intermittent supply is sufficient, the preference right conferred by the area-of-origin statutes would be of less importance.

iv. Where should the program put the water?

To simplify the legal situation, the groundwater storage basin should be composed of percolating strata and be isolated from surface waters, such as streams or the underflow of streams. This would minimize the interplay of various legal doctrines, avoid factual disputes, and make the legal outcomes more predictable. As a result, the participants in the program will feel more secure about their rights.

Many California cases determining groundwater rights turn on geohydrologic characteristics of the groundwater aquifers. In addition to locating a storage site that is factually simple, it would be useful to locate one that is scientifically well-studied; ideally, one where the pertinent scientific facts have been determined in prior adjudications. Such prior judicial fact finding may not be binding on parties to any future suit but would at least serve as an advance indicator of what the program might expect from future litigation.

v. What parties should be involved?

The program organizer should seek contractual arrangements with parties owning land overlying groundwater since they may possess both spreading grounds and a right to extract groundwater. Their participation and cooperation may be secured by sharing the benefits of the program with them.

b. Conjunctive use through in-lieu storage

A program of conjunctive use involving in-lieu storage outside of southern California would be more difficult to achieve. Under an in lieu system, the program would enter into arrangements with overlying landowners who already have access to both groundwater and surface water sources. During periods when the program desires to recharge groundwater, the landowners would forego pumping and accept a substitute surface delivery from the program instead. Then, when the program desires to withdraw groundwater, the landowner would curtail its surface water use and substitute groundwater pumping.

The basic problem with such an arrangement is that the program will not be withdrawing groundwater that it has put into the aquifer through an active recharge program. Instead, it will cause groundwater rights holders to forego pumping water that they are otherwise

legally entitled to extract in some years, and offset that forbearance by drawing more heavily on the aquifer in other years. The problem is that the contracting landowners have no better right to the underlying groundwater than do all of the other landowners overlying that same aquifer. The rights are "correlative", that is, of equal stature and limited by the principle of mutual avoidance of harm. Thus, in years of forbearance, the other pumpers would be entitled to extract the water that the program intended to store. In years of extraction, the contracting landowner's rates of withdrawal may impair the rights of the correlative pumpers. Recognizing in the organizer a superior right to groundwater stored when surface water is used in-lieu, would involve upsetting an established set of property rights and investment-backed expectations, something courts are typically loathe to do.

This problem may be avoided where groundwater basins have been adjudicated such that the particular extraction rights have been quantified. This is the situation with a number of groundwater basins in southern California.

The technique of in-lieu storage can be used outside southern California, but special arrangements will be necessary. There are several potential approaches:

- The correlative rights problem can be avoided by bringing all of the correlative rights holders into the contractual arrangement, or mitigated by bringing most of them into it. The ability of any one rights holder to upset the program by withholding consent remains, however.

- The program could be operated in a manner that would presumptively avoid injury to correlative rights holders by foregoing pumping for a period sufficient to assure that when accelerated pumping occurred, it would not disadvantage the correlative rights holders compared to the status quo. That might mean designing the program so that the number of sequential years of accelerated pumping was limited.

- Special legislation might be enacted to preclude suits against the program by non-contracting landowners where the groundwater that the program causes to be extracted in any one year was limited to amounts that could have been extracted in any previous year but for the forbearance imposed by the program. This would be a legislative interpretation of the "no harm" rule as applied in the narrow context of an in lieu conjunctive use program. While a general groundwater management regime may be beyond reasonable legislative expectations, a modest enactment of this sort may be realistic.