COMMENT ON THE RECENT UCDAVIS PROPOSAL TO DEVELOP LABORATORY FLUME FACILITIES AS SUBSTITUTE FOR THE TRACY DEMONSTRATION FISH FACILITY

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A major consideration for a future demonstration/test facility for fish protection is it needs to be operated in whole while challenged by the variable and diverse physical, chemical and biological conditions annually occurring in the Delta. A large effort using laboratory flumes in "out-of Delta" conditions has already been undertaken the past 12+ years at considerable public expense and interagency review and oversight, providing much information already used and incorporated into designs for a Tracy Demonstration Fish Facility (TDFF) as now envisioned (USBR 2003). All of the technical staff involved with this effort at USBR over the years are unanimous in the position that we must now move into the South Delta environment, coupling all the key components of a test facility together, and operating to determine feasibility of long-term effectiveness, and operations and maintenance compatibility. At least five lab flumes testing new and creative ways for sorting and holding fish, removing debris, and other aspects have been developed and tested already at the Denver Labs using debris and fish delivered from the Delta, and other materials. These tests are still ongoing and would continue to serve developments through feedback actions with TDFF operating experience.

Some Examples Of South Delta Conditions Impossible to Simulate in Disconnected ("Out of Delta") Laboratory Flume Experiments

The value of physically modeling aspects of south Delta fish facilities (existing, and new experimental components) and testing engineering and biological aspects in labs has long been recognized by USBR Tracy staff. As noted, much effort and expense have been devoted to this approach the past 12+ years, and much has been learned for present concepts of TDFF. However, we also have recognized major shortcomings, mainly that we could only work with a limited set of conditions but could never simulate in total (or even a significant fraction) of the real world of the South Delta. With the emphasis on biological protection, clearly no organization would "build out" a major production level fish protection facility from lab flume work alone. Eventually, a complete ("all components") working model in the real environment must be developed, put in place and tested before multi-million dollar decisions could be intelligently made. This was the process even back in the 1950's when a 5-7 year "in Delta" testing program at Tracy was necessary to build the existing louver systems (a much simpler time, with fewer fish species to address, much less debris interference, and more compatible hydraulic conditions). Some examples of the variable characteristics of the South Delta that must be addressed with a future facility are noted below.

Water Quality Parameters (Data from April 2000 to March 2001; Craft et al., 21002)

- *Water Temperature* (Degrees Celsius)

  - Range 7.3 – 27.4
  - Mean 16.9
  - Max. Daily Range 4.4

- *Conductivity* (uS/cm)

  - Range 201 - 1080
  - Mean 429
  - Max. Daily Range 874 (reflects daily tidal patterns and influences)

- *Dissolved Oxygen* (ppm)

  - Range 3.4 – 13.1
  - Mean 8.5
  - Max. Daily Range 8.6

- *pH* (Standard Units)

  - Range 6.28 – 8.65
  - Mean 7.67
  - Max. Daily Range 1.45

- *Turbidity* (NTU)

  - Range <1 - 712
  - Mean 29.9
  - Max. Daily Range 454

Fish

Some 51 fish species have been collected at Tracy over the years with large variances in time of appearance and abundance, sizes and life stages (18 native species, 33 non-native species; Attachment I). The TDFF would operate in this environment, and would need to prove that all potential components (i.e., intakes, screens, louvers, debris cleaners, bypass systems, fish lifts and separators, fish crowders, holding tanks, fish transfer systems, fish transport and release systems) could work compatibly for improved salvage success with minimal fish harm or stress. That would include fish predation concerns. Of special interest are juvenile salmonids, Delta smelt, splittail, American shad, striped bass, tule perch and sturgeon.

Entrainment and Observations of South Delta Juvenile Fish with the TDFF: An Important Test of TDFF Feasibility and Potential for Enhancing Fish Salvage

TDFF is uniquely designed to test short or lengthy runs (days and weeks) both experimentally (fish and other local materials insertions) and through monitoring and observations of entrained natural background Delta materials. This is not attainable with "out of Delta" lab flumes. The TDFF as planned would draw source water directly from the Delta Mendota Canal Intake Channel (DMCIC) through fish friendly lifts, immediately downstream of the Tracy Fish Facility louvers. A regular flow of juvenile fish through the inch-spaced louvers (louver slippage) assures high numbers of fish of many species available for entrainment into the TDFF test channels throughout the year. This is based on two lengthy periods of intensive netting below secondary louvers at Tracy (Bowen et al., 1998; Bowen et al., 2004). Fish sieve nets were fished below secondary louvers for ten minutes a total of 254 times during October 27, 1993 to September 20. 1995 (**Period I**), and for a total of 456 times during March 15, 1996 to November 9, 1997 (**Period II**). The following data were obtained:

	Period I	**Period II**
No. of 10-Minute Samples	254	456
Total No. Fish Sampled	11,065	10,225
Ave. No Fish Per Minute Slipping Through Secondary Louvers	4.36	2.24
Estimate of Fish Slipping Through For Entire Period	4,350,930	1,946,825
No. of Species	28	33
Percent Composition of Major Species		
	%	%
Splittail	56.2	2.2
American Shad	14.1	11.6
Striped Bass	1.3	15.7
Threadfin Shad	14.1	31.8
White Catfish	4.6	3.3
Sculpin	<1	7.7
Sacramento Sucker	<1	5.6

Chinook Salmon	1.3	2.6
Sacramento Blackfish	2.5	<1
Largemouth Bass	<1	4.2
Delta Smelt	<1	3.8
Gobies	0.7	4.6
Bluegill	0.9	3.3

The above data on juvenile fish give indication of what TDFF will entrain during both short and longer periods of test operations. These provide high value opportunistic observations on how the local fish fauna of Old River will handle the new operations and features of the TDFF, as important for decisions on future facilities as observations from controlled insertion trials for key species. Further, the above data do not really show the whole picture as most fish < 25 mm were probably missed with the netting methods. Large swarms of these smaller fish (post-larval, pre-juvenile fish) are known to move into the DMCIC. New features of the TDFF include tests of small mesh screens, and these would recover many of the smaller fish for additional observations.

The above data also point out the great biological variations occurring naturally at Tracy. For example, splittail comprised over half of all fish sampled during Period I, but only 2.2 % during Period II. Striped bass comprised only 1.3 % of Period I collections, but 15.7 % in Period II. Further, total fish numbers escaping the louvers during Period I (4.36/minute) was roughly twice the number escaping during Period II (2.24 fish /minute). Other variances could be noted, but the point is that TDFF (and any "in-Delta" fish salvage facility) must cope with these large variances over several years. Observations must be made over a drawn out time period for valid conclusions.

Of note is that the above netting data refer only to the secondary louver fish slippage The pool of available fish for the TDFF would be much greater because of primary louver slippage which is not well quantified at this time. However, it may be reasonable to assume that juvenile fish potentially available to the TDFF for entrainment observations could at least be doubled. This should be a true representation of the South Delta juvenile fishes exposed to a TDFF.

<u>Availability of Naturally Occurring Large Juvenile, Sub-Adult, and Adult Fish Near TDFF for Entrainment and Observation</u>

The fish communities in the DMCIC immediately below the TFCF have been intensively sampled in the past by USBR Tracy biologists. Collections from gill netting, fyke netting and electrofishing demonstrate a diverse fish community, one reflective of the nearby South Delta environment (Liston et al., 1994). These fish in turn would be subject to entrainment into the TDFF and would provide important information on their fate and survival within a TDFF.

Gill Netting, 1991 and 1992

Briefly, a total of 104 experimental gill net sets in the DMCIC below TFCF over several seasons produced 872 fish of 15 species. Lengths ranged widely from 1.9 inches (threadfin shad) to 30.7 inches (common carp). Percent composition varied during the seasons, but overall was as follows:
:

Species	**Percent Composition**
Striped Bass	48.2 %
Tule Perch	16.6
White Catfish	13.5
Splittail	7.6
Threadfin Shad	7.3
Largemouth Bass	2.5
Channel Catfish	0.9
Sacramento Blackfish	0.8
Common Carp	0.7
White Crappie	0.7
Black Crappie	0.3
American Shad	0.3
Sacramento Sucker	0.2
Yellowfin Goby	0.2
Bluegill	0.1

Fyke Netting

Fyke nets are trap-like nets set near the substrate that usually sample a different fisheries component than other methods. Fyke nets were tethered in the DMCIC near structures of the TFCF and sampled fish that especially seek cover around structure. A total of 44 fyke nets samples were taken during 1991 and 1992. Interestingly, catfish clearly dominated, demonstrating a sizable population expected to be attracted to TDFF intake structures, thus especially available for entrainment and observation. Of 642 fish collected, 578 (90.0%) were white catfish, and 41 (6.4%) were channel catfish. All other species comprised only 3.6% and included threadfin shad, striped bass, black crappie, white crappie, bluegill, and tule perch (13 individuals). Night catches clearly dominated over daytime catches.

Electrofishing

Electrofishing shallow water of the DMCIC directly below TFCF in 1991 further demonstrated a locally abundant fish fauna, reflective of the South Delta, that will be available for entrainment and survival observations at TDFF. Both day (total of 53.4 minutes shocking time) and night sampling (total of 56.4 minutes shocking time) was conducted in September and December. A total of 883 fish were collected of 15 species. The most abundant fish was the native tule perch, a local shoreline inhabitant. Fish

lengths ranged from 1.6 inches (inland silverside) to 31.5 inches (common carp). Species and percent composition were as follows:

Species	Percent Composition
Tule Perch	33.6
Striped Bass	23.7
Inland Silverside	12.2
Gobies	10.9
Threadfin Shad	5.8
White Catfish	2.7
Largemouth Bass	2.6
Bigscale Logperch	2.3
Common Carp	1.5
Goldfish	1.4
Sculpin	1.4
Golden Shiner	1.1
Redear Sunfish	0.5
American shad	0.1
Channel Catfish	0.1

Planned Experimental Fish Insertion Trials

In addition to providing observations on many South Delta species entrained into TDFF, the TDFF is well designed for extensive use of standardized fish insertion trials. Fish sources will be from hatcheries; nearby spawning and rearing facilities; on-site spawning, rearing and holding facilities; and, from the regular salvage products at TFCF. Species especially targeted for these experiments will be juvenile salmonids, Delta smelt, splittail, striped bass, American shad, threadfin shad, tule perch, catfish and juvenile sturgeon. Transportation to TDFF insertion locations will be minimal with full use of the already developed Tracy fish holding facilities. These facilities including trained staff have been developed the past several years in preparation for a Tracy test facility. Further, facilities have been developed to provide instant response to opportunities afforded by species availability and numbers in the regular fish salvage process.

Debris

Perhaps the greatest challenge for the TDFF will be debris handling. There is really no substitute for testing this component in the real Delta world at this stage in our development of modern fish salvage technologies. We have learned a great deal from debris experiments both at Tracy and in the Denver labs, but cannot accurately simulate the whole debris situation with the rapidly changing debris loadings that will challenge an “in-Delta” facility.

Aquatic plant growth in the Delta has increased greatly in recent years and will likely continue this trend. New exotic invasions of both plant and animal types may

appear on top of those already present (mitten crab; zebra mussel, *Hydrilla*?). Exotic water hyacinth and the rooted aquatic *Egeria* already present great challenges to fish facilities causing dangerous head differentials, clogging racks, louvers and screens, although few technologies have been developed to really combat and handle these invaders effectively. A TDFF will address these challenges, providing flexible tests to determine what can be done efficiently and with less threat to salvaged fish. Additional out of Delta lab developments cannot do this.

The severity of the debris problem/challenge is increased further when considering smaller debris types such as duckweed, fragmented parts of larger plants, peat, sediments and sand. Freshwater sponge growth on facility components appears to be increasing. Sponges grow on both sides of louvers sometimes to a depth of ¼ to 1/3 inch, creating upwards of ½ inch of lost space between louver slats. These problems are not impossible to solve, even with smaller mesh screens, but "in-Delta" testing is necessary to guide future technical applications intelligently.

An indication of potential rates of build-up of debris in existing holding tanks of south Delta facilities was provided by an earlier Tracy study (Karp et al., 1997). From 1993 to 1996, a total of 210 - 2 hr collections from holding tanks (materials concentrated in the holding tanks from typical louvering of incoming Tracy flows) were analyzed totally for wet weight debris accumulation with fish. During one period (February 1996) debris was accumulating at rates of over 100 to 112 Kg per two-hour period, though most observations were less than 15 kg per two hours. For a 24-hour period, these data extrapolated would be 1344 kg (2,828 lbs) per day using highest values; 180 kg per day (379 lbs) using the lower value. These debris inputs are not steady but peaks abruptly occur following lower debris inputs of several weeks (figure 7; Karp et al. 1997). More quantitative data on debris inputs are available (i.e., traveling mitten crab screen, others; White et al., 2000), but the point is that no "out of Delta" lab flumes or testing can simulate these real conditions properly. Tests in Denver labs of debris handling with traveling and angled stationary screens using debris imported from the Delta have provided excellent guidance for present designs for the TDFF. However, until the TDFF is challenged with the complete set of debris conditions in the South Delta, recommendations for improved production level facilities cannot be safely made.

Experimental Debris Insertion Experiments

The TDFF will facilitate extensive experimentation with local debris types and amounts. Debris of all major types (Hyacinth parts, *Egeria,* duckweed, peat, woody plant parts, clam shells, sediment, sands*)* will be inserted, and observations, both quantitative and qualitative, will be made on how TDFF handles these interfering materials, and how they may affect fish survival and condition. South Delta debris for experiments is readily available within feet of TDFF from the regular operations of the TFCF. As with fish, debris will be studied from both an entrainment/monitoring and experimental insertion approach.

TDFF Study Plan Development

As part of the overall FYO4 study plan for Tracy, an important activity outlined is for a TDFF initial three-year investigation program (see Attachment II). The TTAT team has been engaged since2000 in developing ideas and objectives for research on an eventual Tracy test facility. Draft documents have been developed cooperatively that addressed earlier, larger designs for a Test facility. These included a shakedown period followed be several years of technical studies and observations. With a TDFF initiation, study plan development including extensive review by TTAT and other outside parties would be completed prior to construction of TDFF.

Summary and Conclusions

The proposed Tracy Fish Demonstration Facility is an outcome of a long history of on-site Tracy research into understanding the TFCF, new "in-field" developments such as fish friendly lifts with above ground collecting tanks and small mesh screens (Helfrich et al., 2001; McNabb et al., 2003) and many others, and numerous years of testing laboratory fisheries engineering flumes and models at Denver. Significant lab findings for designs of modern facilities involving major outlays of financial and staff resources have given excellent guidance on aspects such as (but not limited to): separating fish predators from prey; hydraulic behavior of positive barrier screen; debris cleaning mechanisms; fish behavior around and near louvers; improved bypass entrance configurations; improved holding tank designs with smaller mesh screens and active debris cleaners. Still, as seen above, the complex and variable conditions in the South Delta will challenge new facilities in many ways that cannot be simulated in the labs. The "proof in the pudding" will be how a TDFF can operate to enhance fish salvage while also being feasible from an operations and maintenance standpoint. This is the true value and necessity for implementing the TDFF program. Any further outlays for laboratory flume work offered as a substitute for the TDFF, disconnected from the real world of the south Delta, would be a step back and a very questionable use of public monies.

Of further significance is that a test facility at Tracy became a "directed action" by CALFED as early as 1998. Test facility developments and recommendations prior to 1998 were being made to help "fix" the Tracy Fish Collection Facility as per CVPIA requirements of 1992. The present scope and size of the TDFF was similar to what Reclamation was aiming for as an experimental facility at Tracy, one that would not interfere with the main mission of the Tracy Pumping Plant. With CALFED interest and ROD decisions to rely on and encourage a test site at Tracy for broader application to large Delta diversion screening in general, Reclamation fully complied and brought forth all necessary resources and experienced professional staff to assist. An interagency CALFED technical team of advisors (the Tracy Technical Advisory Team, or TTAT) was assembled in fall, 1998, and has met monthly for countless hours (all records of meetings published, distributed and available to all) designing and redesigning a test facility, recommending and reviewing annual study plans and products, and in general providing excellent input and assistance. TTAT is represented by Reclamation, CDWR,

CDFG, USFWS, NMFS, CALFED, water users, consultants and University staff. A Tracy test facility for broad application as envisioned by TTAT required a larger system to study than earlier proposed by Reclamation. The test facility, in my opinion, grew too large and complex, and, with each additive, became less flexible as a research facility and more like a demonstration system with minimal opportunity for flexibility or replicated trials. I mean no discredit to the numerous professional staff involved in design modifications and demands. This is truly a pioneering effort and with the major facilities being proposed in the late 1990's in "fast track" fashion, perhaps there was justification in going large and trying to simulate near sized production level facilities. However, I am much more comfortable now with the flexibility, size and cost of present TDFF designs, and am confident that, armed with the information gathered at TDFF through a disciplined science based program, we can provide excellent recommendations from which to build out new facilities, if that is eventually the decision. Without a TDFF program, we will be pretty much, as now, prisoners of past salvage facility designs and functioning with 1950's technologies developed for what now seems an almost prehistoric, more simpler time when Delta conditions were quite different from the present and resource protection was much more narrowly defined.

LIST OF PEER REVIEWED TRACY TECHNICAL REPORTS AND TEXT CITATIONS

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Bowen, M., B. Baskerville-Bridges, K. Frizell, L. Hess, C. Karp, S. Siegfried, and S. Wynn. 2004. *Empirical and experimental analyses of secondary louver efficiency at the Tracy Fish Collection Facility, March 1996* – Novenber 1997. Tracy Fish Facility Studies, Volume 11. U.S. Bureau of Reclamation, Mid-Pacific Region and Denver Technical Service Center. 33 pp + figures.

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White, R. B. Mefford, and C. Liston. 2000. *Evaluation of mitten crab exclusion technology during 1999 at the Tracy Fish Collection Facility, California.* Tracy Fish Facility Studies, Volume 14, U. S. Bureau of Reclamation, Mid-Pacific Region and Denver Technical Service Center, and USGS Cooperative Fishery Research Unit, Montana State University. 43 pp + appendices.

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Frizell, W. *Recent hydraulic assessments at the Tracy Fish Collection Facility, including recommendations for future automated instrumentation*. [Volume 15]

Hanna, L., B.Mefford and M. Bowen. *Tracy Fish Facility passive separator fish sorting investigations in laboratory physical models*. [Volume 27}

Johnson, P., M. Campbell and J. Higgs. *Physical model study of a primary bypass intake with louvers at the Tracy Fish Collection Facility*. [Volume 28]

Karp, C., J. Kubitschek and L. Hanna. Results of fish louvering and separator rsearch in Denver's large experimental flume during 1998 – 2002. [Volume 20]

Karp, C. *Movements of splittail in the vicinity of the Tracy Fish Collection Facility as determined by biotelemetry*. [Volume 10]

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White, R., R. Tullis, L. Hess, B. Mefford and C. Liston. *Evaluation of mitten crab exclusion technology during 2000 at the Tracy Fish Collection Facility*. {Volume 23]

Boutwell, J. and D. Sisneros. *Evaluations of the mitten crab traveling screen for continuous debris removal in front of louvers at the Tracy Fish Collection Facility*. [Volume 30]

ATTACHMENT I
List of Fishes Appearing in the Salvage at the Tracy Fish Collection Facility

	Common Names		
Family	Native	Non-Native	Abundance Index[2]
Lamprey	Pacific lamprey		1
	River lamprey		1
Sturgeon	Green Sturgeon		1
	White Sturgeon		2
Herring		American Shad	4
		Threadfin Shad	4
Salmonid	Chinook Salmon		3
	Steelhead		3
Smelt	Delta Smelt		2
	Longfin Smelt		1
		Wakasagi	2
Minnow		Goldfish	2
		Common Carp	2
		Golden Shiner	2
		Red Shiner	1
		Fathead Minnow	1
	Sacramento Pileminnow		1
	Splittail		4
	Hitch		1
	Sacramento Blackfish		1
Sucker	Sacramento Sucker		1
Catfish		White Catfish	4
		Channel Catfish	3
		Brown bullhead	2
		Black Bullhead	2
		Yellow Bullhead	1
		Blue Catfish	1
Goby		Yellowfin Goby	3
		Shimofuri Goby	2
		Cheekspot Goby	1
		Tridentiger barbatus	1

ATTACHMENT I, CONTINUED
List of Fishes Appearing in the Salvage at Tracy

Family	Common Names[1] Native	Non-Native	Abundance Index[2]
Mullet		Striped Mullet	1
Livebearer		Mosquitofish	1
Killifish		Rainwater Killifish	1
Silverside		Inland Silverside	3
Stickleback	Threespine Stickleback		2
Sea Bass		Striped Bass	4
Sunfish		Green Sunfish	2
		Redear Sunfish	2
		Bluegill	3
		Warmouth	1
		Black Crappie	3
		White Crappie	2
		Largemouth Bass	3
		Smallmouth Bass	2
		Spotted Bass	1
Perch		Bigscale Logperch	2
Surfperch	Tule Perch		3
Sculpin	Prickly Sculpin		1
	Riffle Sculpin		1
Righteye Flounder	Starry Flounder		1

[1]Common fish names from Robins et al., 1991; Wang 1986
[2]General abundance index: 1 = rare; 2 = occasional; 3 = common; 4 = abundant

ATTACHMENT II
TRACY STUDY PLAN FOR FY04 – DEVELOPING THE INITIAL THREE-YEAR STUDY PLAN FOR THE TDFF

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Introduction and Background

An on-site Tracy testing facility has been in the planning and design stages since 1998 (Liston et al. 2000). A test facility is required to develop new technologies for upgrading South Delta fish salvage facilities. Through extensive work and meetings with USBR fisheries engineering staff and interagency staff on the Tracy Technical Advisory Team (TTAT/TFRED - a CALFED authorized team comprised of staff from USBR, CDFG, CDWR, USFWS, NMFS, water user groups, Universities and consultants) several design options for a test facility have been advanced. . All designs prior to 2003 have been rejected by upper management from involved agencies due to high costs and changing economic conditions. The most recent design now appears acceptable in scope, size, and cost though details are still under development (USBR 2003).

This study plan assumes that the latest test facility design, called the Tracy Demonstration Test Facility (TDTF), will move forward and that final engineering designs will be completed in 2004, with construction to be finished in 2005. The TDTF will be smaller than previous designs, will be built above ground, and will address all the objectives detailed in earlier reports (Liston et al. 2000: USBR 2003). A science based study plan needs to be developed through interagency assistance prior to operation of a facility.

Study Summary

This study will continue work with the TFRED to refine draft study plans developed for earlier test facility designs and schedules. Draft plans are already available that include interagency inputs and recommendations developed during monthly meetings held the past two+ years. Plans will be developed during meetings with TFRED members in California during FY04. A draft report will be completed by USBR and distributed for further outside technical review by late September, 2004.

Methods/Approach

Upon acceptance by the South Delta Fish Facilities Forum (SDFF – a recent forum chartered under the Bay Delta Authority and led by top managers and decision makers

from State and Federal agencies) , the TTAT/TFRED will be reassembled by Reclamation and will assist development and prioritization of initial three years studies for TDTF. We expect this direction from SDFF by early fall, 2003. USBR will provide a concept report on TDTF to the SDFF in August, 2003, and will present and explain further details at September, 2003 SDFF meetings.

A draft study plan will be distributed for further internal and outside review by September 30, 2004. Following incorporation of technical review comments and recommendations, a final study plan report will be distributed by January, 2005. This should be approximately 11 months prior to completion of construction of TDTF, which gives adequate time to prepare staff and support materials for studies to begin immediately following construction .

We expect the following objectives to be addressed by TDTF, which will be reflected and prioritized in the study plan report:

- Develop efficient "fish friendly" abilities to handle and minimize debris and sediment in facility components including screens, louvers, fish separation systems, and holding tanks
- Determine the feasibility of using small mesh positive barrier screens for collecting fish and retaining them in holding tanks prior to transport
- Determine the feasibility for long term use of "fish friendly" lifts for providing bypass flows and flows to above ground fish separating/holding facilities
- Determine the feasibility of gravity-fed bypass systems for providing flows from a main experimental flume to fish separation/holding facilities
- Development of efficient, gentle fish transfer systems from holding tanks to transport tanks and vehicles
- Develop enhanced predator control abilities through:
    - Developing abilities to sort fish by size up front by using a combination "leaky louver" and positive barrier screen in the main experimental flume
    - Determining effective use of fish crowders in flumes and holding facilities for moving fish rapidly to bypasses or through sorters
    - Developing fish sorting systems in flows emanating from bypasses driven either by fish lifts or gravity
    - Maintaining fish collections segregated by size in holding tanks for transfer to designated transport tanks
- Developing and assuring that all systems are user friendly, reliable, and economical for future operations and maintenance staff
- Carrying out all developments using established fish facility design criteria whenever possible, plus testing components using different criteria (variances from criteria) as deemed needed to establish workable future fish salvage facilities

Coordination

This study will be extensively coordinated as an interagency team (TTAT/TFRED) will be assisting study plan development. Further, the TFRED is responsible for monitoring

all progress of TDTF studies and is provided frequent updates of study results. Annual study plans for all Tracy investigations are prepared in advance of each new Federal fiscal year for reviews by TFRED and other outside technical staff.

Resources and Capabilities

The principal investigator is a former Associate Professor of Fisheries (Michigan State) and has been conducting and directing research on fisheries engineering structures for over 30 years, including Great Lakes programs, and many USBR studies throughout the western US. He has been a Research Aquatic Scientist with the USBR (Denver and MP Region) since 1989, and has overseen and conducted studies at Tracy since 1989. Numerous technical reports and journal publications have been produced from his studies and research leadership.

The co-investigator (Perry Johnson) performed as a research hydraulic engineer at USBR for almost 30 years, participating and leading many fisheries engineering studies throughout the Western U.S. He has developed and carried out many engineering research plans the past 30+ years, and has produced a long record of technical publications. He has intimate familiarity with Tracy, and was key to the Red Bluff Pumping Plant development and research success.

Endangered Species Issues, "Take" Considerations

The study plan will address all ESA issues and will determine which studies may require a Section 10 research permit. Having the TDTF draw water for testing downstream from the Tracy Fish Collection Facility should significantly reduce conflicts with ESA policies and requirements.

Dissemination of Results (Outcomes, Deliverables

As noted earlier, A draft TDTF study plan will be developed and distributed for further review by late September, 2004. We plan on a final report for general distribution by January, 2005. The report will serve as the guidance document for the first three years of TDTF studies.

References

Liston, C., R. Christensen, B. Mefford and A. Glickman. 2000. A proposed technology development facility to support improvement or replacement of fish screening and salvage facilities in the Sacramento-San Joaquin Delta, California. U.S. Bureau of Reclamation, Mid Pacific Region and Denver Technical Service Center. 61 pp + figures and appendices.

U. S. Bureau of Reclamation. 2003. A Tracy demonstration test facility (TDTF) to provide technology development for upgrading South Delta fish salvage facilities, California. Draft report prepared for review by the Bay Delta Authority South Delta Fish

Facilities Forum, August, 2003. USBR, MP Region and Denver Technical Service Center. 17 pp +figures and appendices.