

TESTIMONY BY WILLIAM R. BROWNLIE

State Water Resources Control Board
Hearing Name IID Transfer - Phase 2
Exhibit: 3
For Ident: _____ In Evidence: _____

INTRODUCTION

MY NAME IS DR. WILLIAM BROWNLIE. I AM A SENIOR VICE PRESIDENT WITH TETRA TECH, INC. FOR THE PAST FOUR YEARS I HAVE BEEN WORKING ON THE SALTON SEA RESTORATION PROJECT UNDER CONTRACT TO THE SALTON SEA AUTHORITY AND THE US BUREAU OF RECLAMATION. I RECEIVED MY PHD IN CIVIL ENGINEERING FROM THE CALIFORNIA INSTITUTE OF TECHNOLOGY IN 1981. I AM A LICENSED CIVIL ENGINEER, REGISTERED IN CALIFORNIA AND SEVERAL OTHER STATES. I HAVE BEEN PRACTICING CIVIL AND ENVIRONMENTAL ENGINEERING FOR OVER 20 YEARS, SPECIALIZING IN LARGE WATER RESOURCE PROJECTS.

AREA OF TESTIMONY

MY MOST RECENT WORK ON THE SALTON SEA RESTORATION PROJECT HAS INVOLVED COMPILATION OF COST DATA RELATED TO RESTORATION ALTERNATIVES. COST INFORMATION HAS BEEN DEVELOPED BY THE US BUREAU OF RECLAMATION, AN ENGINEERING TEAM THAT INCLUDED PARSONS ENGINEERING AND THE URS CORPORATION, AND TETRA TECH. AS PART OF MY WORK, I HAVE INVESTIGATED HOW RESTORATION COSTS MIGHT BE AFFECTED BY CHANGES TO THE INFLOW TO THE SALTON SEA.

I RECENTLY SERVED AS PRINCIPAL AUTHOR OF A REPORT TITLED "ASSESSMENT OF SALINITY AND ELEVATION CONTROL" FOR THE SALTON SEA RESTORATION PROJECT. I AM SUPPLYING A COPY OF THAT REPORT AS PART OF MY TESTIMONY. THE REPORT PROVIDES APPRAISAL-LEVEL COST ESTIMATES OF VARIOUS METHODS TO CONTROL SALINITY AND ELEVATION IN THE SEA. THE REPORT SPECIFICALLY ADDRESSED HOW THE METHODS OF SALINITY AND ELEVATION CONTROL WOULD HAVE TO BE MODIFIED IF THE INFLOW TO THE SEA IS REDUCED. IT ALSO ADDRESSES HOW THE COSTS WOULD VARY IF

INFLOW IS REDUCED. I WILL DISCUSS SOME OF THE CONCLUSIONS PRESENTED IN THAT REPORT.

IN ADDITION TO MY COMMENTS REGARDING RESTORATION COST, I WILL MAKE A FEW REMARKS ABOUT THE BASELINE HYDROLOGY IN THE DRAFT ENVIRONMENTAL IMPACT STATEMENT/ENVIRONMENTAL IMPACT REPORT (EIS/EIR) FOR THE TRANSFER PROJECT. BEFORE I BEGIN THESE DISCUSSIONS, I WILL PROVIDE A BRIEF OVERVIEW ON THE BALANCE OF WATER THAT SUSTAINS THE SALTON SEA AND HOW THAT AFFECTS SALINITY. I WILL ALSO PROVIDE A BRIEF OVERVIEW OF THE METHODS THAT ARE BEING CONSIDERED TO CONTROL SALINITY AND ELEVATION.

BACKGROUND ON SALINITY AND ELEVATION OF THE SEA

THE SALTON SEA IS LOCATED BELOW SEA LEVEL AND HAS NO NATURAL OUTLET. THE SEA IS SUSTAINED BY A DELICATE BALANCE BETWEEN INFLOW AND EVAPORATION. SIGNIFICANT REDUCTIONS IN THE INFLOW TO THE SEA WOULD DRAMATICALLY CHANGE THAT BALANCE. THE WATER SURFACE WOULD BEGIN TO DROP PRECIPITOUSLY, AND SALINITY WOULD INCREASE RAPIDLY, REACH CRITICAL LEVELS IN ABOUT A DECADE.

FOR THE PAST 40 YEARS, THE AVERAGE INFLOW TO THE SEA HAS BEEN ABOUT 1.34 MILLION ACRE-FEET PER YEAR. FOR THE PAST 10 TO 20 YEARS THIS INFLOW HAS BEEN IN BALANCE WITH EVAPORATION, LEAVING THE ELEVATION OF THE SEA FAIRLY STABLE NEAR ITS CURRENT LEVEL OF -227 FEET BELOW SEA LEVEL.

ALTHOUGH RECENTLY THE ELEVATION OF THE SEA HAS BEEN FAIRLY STABLE, THE SALINITY HAS BEEN RISING BECAUSE EACH YEAR AGRICULTURAL RUNOFF ADDS ABOUT 4 MILLION TONS OF NEW SALT. THIS RISE IN SALINITY HAS BEEN VERY GRADUAL. THE SEA CURRENTLY HAS A SALINITY OF ABOUT 44 PARTS PER THOUSAND, ABOUT 25 PERCENT HIGHER THAN OCEAN WATER. IF HISTORIC INFLOWS WERE TO CONTINUE, SALINITY WOULD RISE BY ONE PART PER THOUSAND ABOUT EVERY FOUR YEARS.

THE MAIN SOURCES OF INFLOW ARE THE AGRICULTURAL RUNOFF THAT ENTERS THE SEA THROUGH THE ALAMO, NEW AND WHITEWATER RIVERS AND ASSORTED AGRICULTURAL DRAINS. TOGETHER THESE SOURCES MAKE UP OVER 90 PERCENT OF THE WATER THAT FLOWS INTO THE SEA EACH YEAR. OTHER POSSIBLE SOURCES OF WATER HAVE BEEN CONSIDERED TO MAINTAIN THE SEA, BUT NONE HAVE BEEN IDENTIFIED. THEREFORE, IF THE INFLOW TO THE SEA IS REDUCED, EVAPORATION WILL OUTSTRIP INFLOW AND THE SEA WILL BEGIN TO SHRINK UNTIL A NEW BALANCE IS ACHIEVED.

SHRINKING OF THE SEA WOULD CAUSE THE SALTS THAT ARE CURRENTLY IN THE SEA TO CONCENTRATE. TO UNDERSTAND HOW THIS WOULD HAPPEN, CONSIDER THE TOP LAYER OF WATER IN THE SEA. THE TOP FIVE TO SIX FEET OF THE SEA CONTAIN ABOUT 100 MILLION TONS OF SALT. IF THE SEA WERE TO DROP BY JUST FIVE OR SIX FEET, THESE 100 MILLION TONS WOULD CONCENTRATE IN THE REMAINING WATERS OF THE SEA. THE PROPOSED ACTION FOR THE TRANSFER PROJECT WOULD CAUSE THE SEA TO DROP ABOUT 20 FEET. THE RATE OF RISE IN SALINITY WOULD INCREASE BY MORE THAN A FACTOR OF ABOUT FIVE. IN OTHER WORDS, INSTEAD OF RISING BY ONE PART PER THOUSAND OVER FOUR YEARS, IT WOULD RISE THAT MUCH IN LESS THAN A YEAR.

RISING SALINITY IS THREATENING THE HIGHLY PRODUCTIVE FISHERY IN THE SEA. A SALINITY OF 60 PPT IS CONSIDERED THE POINT AT WHICH THE MAJORITY OF THE FISH IN THE SEA WOULD CEASE TO BE ABLE TO REPRODUCE. IF HISTORIC INFLOWS WERE TO CONTINUE, THE SEA WOULD LIKELY BE ABLE TO SUPPORT A FISHERY FOR ALMOST 60 YEARS WITHOUT ANY RESTORATION ACTIONS.

HOWEVER, WITH LESS THAN A 10 PERCENT REDUCTION FROM THE HISTORIC INFLOW, THE SALINITY IN THE SEA WOULD RISE MUCH MORE QUICKLY. NOTE THAT WHEN I SAY HISTORIC INFLOW, I MEAN ESSENTIALLY THE PRESENT INFLOW CONDITIONS, AS THEY HAVE BEEN FOR THE PAST 40 YEARS. THE

BASELINE INFLOW TO THE SEA, AS SHOWN IN THE TRANSFER EIS/EIR, SUGGESTS THAT THE INFLOW WITHOUT THE WATER TRANSFER PROJECT WOULD BE ABOUT A 10 PERCENT REDUCTION FROM HISTORIC INFLOWS. UNDER THIS SCENARIO, THE SEA WOULD LIKELY BECOME TOO SALTY TO SUPPORT A FISHERY WITHIN THE NEXT 20 TO 25 YEARS.

UNDER THE PROPOSED ACTION FOR THE TRANSFER PROJECT, SALINITY WOULD RISE EVEN FASTER. THE FISHERY COULD BE LOST WITHIN 10 YEARS. LOSS OF THE FISHERY AND INVERTEBRATE POPULATIONS WOULD SEVERELY AFFECT THE TENS OF THOUSANDS OF BIRDS THAT FORAGE AT THE SEA AND ADVERSELY AFFECT REGIONAL POPULATIONS OF FISH-EATING BIRDS AND SHOREBIRDS OF WESTERN NORTH AMERICA.

THEREFORE, WE CONSIDER SALINITY TO BE THE ACUTE, TIME-SENSITIVE PROBLEM THAT MUST BE DEALT WITH IMMEDIATELY. OTHER ASPECTS OF WATER QUALITY ARE CHRONIC, MORE COMPLEX PROBLEMS. IF NOT ADEQUATELY DEALT WITH, THOSE PROBLEMS WILL ALSO RESULT IN CONTINUED PROBLEMS WITH THE HEALTH OF THE SEA. THE INVESTMENT IN CONTROLLING SALINITY WILL BE LOST IF THE OTHER PROBLEMS ARE NOT ALSO ADDRESSED.

METHODS OF SALINITY AND ELEVATION CONTROL

SALINITY OF THE SALTON SEA CAN BE CONTROLLED BY USING ONE OF SEVERAL METHODS TO REMOVE SALTY WATER, EVAPORATE THE WATER, AND DISPOSE OF THE SALT RESIDUE PRODUCTS. THE LEAST EXPENSIVE OF THESE METHODS APPEARS TO BE ON-LAND SOLAR PONDS. SOLAR PONDS AT THE SALTON SEA WOULD BE SIMILAR TO THE EVAPORATION PONDS THAT ARE USED TO PRODUCE SALT IN SAN DIEGO BAY, SAN FRANCISCO BAY AND AT THE GREAT SALT LAKE.

WHILE SOLAR PONDS ON LAND WOULD BE THE LEAST EXPENSIVE, CONSTRUCTING PONDS ON LAND WOULD NOT ASSIST IN MAINTAINING THE WATER SURFACE ELEVATION, IF THE INFLOW TO THE SEA IS REDUCED IN THE

FUTURE. CONSTRUCTING SOLAR PONDS WITHIN THE SEA WOULD HELP MAINTAIN WATER SURFACE ELEVATION, BUT WOULD BE SIGNIFICANTLY MORE EXPENSIVE THAN ON-LAND PONDS. IN-SEA PONDS WOULD REDUCE THE EVAPORATIVE SURFACE AREA OF THE SEA, AND THUS WOULD COMPENSATE FOR REDUCED INFLOW. WITH A REDUCED SURFACE AREA, A NEW BALANCE BETWEEN INFLOW AND EVAPORATION COULD BE ACHIEVED WITHOUT A DECLINE IN ELEVATION.

COST ESTIMATES

I WOULD NOW LIKE TO DISCUSS THE COST ESTIMATES FOR CONSTRUCTING SOLAR PONDS UNDER DIFFERENT INFLOW SCENARIOS. PLEASE KEEP IN MIND THAT THESE ARE APPRAISAL-LEVEL COST ESTIMATES BASED ON CONCEPTUAL DESIGNS. FOR NOW, THEY ARE THE BEST ESTIMATES WE HAVE.

FOR HISTORIC INFLOWS, AN ON-LAND SOLAR POND SYSTEM COULD BE CONSTRUCTED TO REDUCE THE SALINITY TO ABOUT 43,000 MG/L IN 30 YEARS WITH ABOUT A FIVE FOOT DROP IN ELEVATION. THE COST OF THIS ACTION, COULD BE LESS THAN \$250 MILLION. WITH THE ADDITION OF SOME IN-SEA PONDS, SALINITY COULD BE REDUCED TO 40,000 MG/L AND ELEVATION MAINTAINED AT -230 FT. MSL, JUST THREE FEET BELOW THE SEA'S CURRENT LEVEL FOR ABOUT \$400 MILLION.

WITH THE BASELINE CONDITION IN THE TRANSFER EIS/EIR, SALINITY AND ELEVATION CAN STILL BE CONTROLLED, BUT IT WOULD BE MORE DIFFICULT AND MORE EXPENSIVE. THE DRAFT EIS SUGGESTS THAT UNDER THIS INFLOW CONDITION, THE ELEVATION IN THE SEA WOULD ULTIMATELY DROP ABOUT 7 FEET AND ABOUT 25 SQUARE MILES OF SEDIMENTS WOULD BE EXPOSED.

FOR THE BASELINE SCENARIO, SALINITY COULD BE CONTROLLED WITH ON-LAND PONDS FOR UNDER \$400 MILLION; HOWEVER, THE POND SYSTEM WOULD BECOME VERY LARGE, OCCUPYING MORE THAN 50 SQUARE MILES. THERE WOULD ALSO BE A SIGNIFICANT DROP IN ELEVATION AND 55 SQUARE MILES OF

SEA BOTTOM SEDIMENTS WOULD BE EXPOSED. EXPOSURE OF THIS MUCH SEDIMENT AND ORGANIC MATERIAL HAS THE POTENTIAL TO EXACERBATE EXISTING DUST PROBLEMS IN THE IMPERIAL AND COACHELLA VALLEYS. AN IN-SEA POND SYSTEM WOULD CONTROL SALINITY AND MAINTAIN ELEVATION AT JUST A FEW FEET BELOW THE CURRENT, BUT THE ESTIMATED PRESENT VALUE COST WOULD BE \$930 MILLION.

NOTE THAT AN INFLOW RATE COMPARABLE TO THE BASELINE IN THE TRANSFER EIS/EIR COULD ALSO BE ACHIEVED IF TRANSFERS ARE ACCOMPLISHED THROUGH CONSUMPTIVE USE FALLOWING OF AGRICULTURAL LAND. AN INFLOW COMPARABLE TO THE BASELINE ALSO COULD BE ACHIEVED IF TRANSFERS ARE MITIGATED THROUGH FALLOWING AS PROPOSED IN THE DRAFT EIS/EIR HABITAT CONSERVATION PLAN NUMBER 2. CONSUMPTIVE USE FALLOWING, ALSO SOMETIMES KNOWN AS EVAPOTRANSPIRATION (ET) FALLOWING, IS A MECHANISM TO TRANSFER WATER THAT WOULD HAVE BEEN CONSUMED IN THE AGRICULTURAL PROCESS. IT REPRESENTS ABOUT 2/3 OF DELIVERED WATER.

WITH THE PROPOSED ACTION, THE AVERAGE INFLOWS TO THE SEA WOULD BE REDUCED TO 0.93 MILLION ACRE-FEET PER YEAR, COMPARED TO THE PRESENT INFLOW OF 1.34 MILLION ACRE-FEET PER YEAR. AT THIS INFLOW LEVEL ON-LAND EVAPORATION POND SYSTEMS WOULD NOT BE EFFECTIVE IN CONTROLLING SALINITY. EVEN WITH VERY LARGE SYSTEMS, OCCUPYING OVER 100 SQUARE MILES, THE PEAK SALINITY WOULD EXCEED 60,000 MG/L WHICH WOULD CAUSE AT LEAST A TEMPORARY LOSS OF THE FISHERY. EVENTUALLY THE SALINITY LEVEL COULD BE RETURNED TO A HEALTHY LEVEL FOR FISH, BUT THE SEA WOULD SHRINK BY MORE THAN A THIRD IN AREA AND BY TWO-THIRDS BY VOLUME. THE SEA ELEVATION WOULD DROP ABOUT 20 FEET WITHOUT ANY RESTORATION ACTIONS AND WITH ON-LAND PONDS, IT WOULD DROP ABOUT 30 FEET. ABOUT 140 SQUARE MILES OF BOTTOM SEDIMENTS WOULD BE EXPOSED TO POSSIBLE WIND EROSION.

AN IN-SEA POND SYSTEM COULD CONTROL SALINITY AT AN ESTIMATED PRESENT VALUE OF NEARLY \$2 BILLION, BUT THERE WOULD BE AN 18-FOOT DROP IN ELEVATION. WITH ADDITIONAL IN-SEA PONDS, SALINITY COULD BE REDUCED TO 40,000 MG/L AND ELEVATION MAINTAINED AT -230 FT, MSL, BUT THE PRESENT VALUE COST WOULD RISE TO ABOUT \$3.4 BILLION. AT THIS LEVEL, THE IN-SEA CONSTRUCTION PROJECT WOULD BECOME SO LARGE THAT A NUMBER OF TECHNICAL AND ENVIRONMENTAL ISSUES WOULD RENDER IT AT LEAST IMPRACTICAL AND POSSIBLY UNFEASIBLE.

COMMENTS ON THE TRANSFER BASELINE

I HAVE THREE BASIC COMMENTS ABOUT THE BASELINE INFLOW IN THE TRANSFER DOCUMENT:

1. THE DOCUMENT DOES NOT CLEARLY LAY OUT HOW THE BASELINE WAS ACHIEVED. THEREFORE, IT IS DIFFICULT TO ASSESS WHETHER THE CALCULATIONS ARE REASONABLE.
2. ONE CONTRIBUTING FACTOR IN REDUCING THE BASELINE FROM THE HISTORIC INFLOWS IS THE "INFLOW REDUCTION DUE TO ENTITLEMENT ENFORCEMENT" OF 56,856 ACRE-FEET PER YEAR. HOW WAS THIS VALUE DETERMINED? HOW WOULD THIS REDUCTION BE IMPLEMENTED? IS IT RELATED TO SOME SPECIFIC CONSERVATION PROJECT OR PROJECTS? SHOULD IT HAVE A FULL EFFECT ON THE INFLOW TO THE SEA, OR SHOULD THE EFFECT ON THE SEA BE MORE LIKE 1/3, AS ONLY ABOUT ONE THIRD OF THE DIVERTED WATER ACTUALLY ENTERS THE SEA? THESE QUESTIONS NEED TO BE ANSWERED.
3. THE CALIFORNIA ENVIRONMENTAL QUALITY ACT REQUIRES THAT THE SIGNIFICANCE OF IMPACTS BE RELATED TO PRESENT CONDITIONS. IT IS CERTAINLY REASONABLE AND APPROPRIATE TO ALSO COMPARE IT TO A FUTURE BASELINE. HOWEVER, AS WITH MOST PROJECTS THERE IS SOME CONTROVERSY ABOUT WHAT THE APPROPRIATE FUTURE BASELINE SHOULD BE. THEREFORE, I BELIEVE ADDITIONAL DISCUSSION OF THE SIGNIFICANCE OF IMPACTS COMPARED TO CURRENT CONDITIONS SHOULD BE PROVIDED OR AT LEAST CONSIDERED.

CONCLUSIONS

1. APPRAISAL-LEVEL COST ESTIMATES SUGGEST THAT THE SALTON SEA RESTORATION PROJECT WOULD COST BETWEEN \$250 AND \$400 MILLION DOLLARS IF HISTORIC INFLOWS WERE TO CONTINUE.
2. UNDER THE SUGGESTED BASELINE INFLOW FOR THE TRANSFER PROJECT, RESTORATION IS STILL FEASIBLE, BUT MORE DIFFICULT, AND THE COST WOULD INCREASE BY ABOUT A FACTOR OF TWO OR MORE, TO ACHIEVE COMPARABLE LEVELS OF SALINITY AND ELEVATION CONTROL.
3. UNDER THE PROPOSED ACTION FOR THE TRANSFER PROJECT, RESTORATION BECOMES ESSENTIALLY UNFEASIBLE WITH COSTS ESCALATING ABOVE \$3 BILLION.