REVIEW OF ECONOMIC TECHNICAL REPORT
ODESSA SUBAREA SPECIAL STUDY

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INTRODUCTION

The Draft Economic Technical Report (DETR) on the Odessa Subarea Special Study reports on the analysis by US Bureau of Reclamation (Reclamation) of the economic feasibility of bringing Columbia River water to farms irrigating with groundwater in the Odessa Subarea of Eastern Washington. The results of the economic analysis and some of the data are also reported in the Draft Environmental Impact Statement (DEIS) for the Odessa Subarea Special Study that was prepared by Reclamation and the Washington State Dept. of Ecology and also released in October 2010.

The results of the economic analysis are very discouraging for the prospects of proceeding with construction of any of the eight Action Alternatives evaluated in the study. The Draft DEIS and the DETR for the Odessa Subarea Special Study report that "all of the alternatives result in negative net benefits….As a result, none of these alternatives would be considered economically justified." (DETR, p.4)

According to US Bureau of Reclamation Standards, as confirmed in a September 2008 release from the Odessa Subarea Special Study, Reclamation is authorized to continue development of the Columbia Basin Project only if the benefits exceed the costs, as determined according to the federal Principles and Guidelines (P&G) (US Water Resoures Council, Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies, Federal Register, March 10, 1983; http://www.usace.army.mil/CECW/PlanningCOP/Documents/library/Principles_Guidelines.pdf). Since none of the eight Odessa Subarea Alternatives is expected to have benefits exceeding costs, none are eligible to be appropriated federal funds for construction.

Normally, if no economically feasible alternatives are identified, further federal spending is considered unwarranted, and project investigations do not proceed. When continued development of the Columbia Basin Project was last studied, in the 1980s, the study was terminated in 1989 for lack of an economically feasible alternative, and the Draft DEIS became the final report on the project.

Reclamation has stated (Public meeting, Moses Lake Washington, November 18, 2010) that they will continue preparation of the Final EIS for the Odessa Subarea Study; however, the Full Replacement Alternative will not be considered further. Constructing facilities to supply water to the 45,000 project acres north of I-90 is so costly, $45,000 per acre benefited, that the benefit-cost ratio for the full 102,600 acre development falls to a clearly infeasible 0.44, according to Reclamation's analysis.

Nevertheless, Reclamation intends to continue preparation of the Final DEIS because it is anticipated that further investigation may identify additional municipal and industrial benefits sufficient to make Partial Replacement Alternatives 2A and 2B economically feasible. Reclamation has suggested that the additional benefits needed for economic feasibility may come from increases in the M&I benefits or from a BCA using an interest rate of 3%. However, the M&I benefits are admittedly already "overstated" (DETR p.46), and it is impossible to imagine the seven-fold increase needed to provide the $106.5 million in benefits required to bring total benefits up to equal with total costs.

Reclamation also implies that the positive net benefits for Partial Development Alternatives 2A and 2B found using a 3% discount rate (DETR, Table NED_BCA2, p. 5) indicates the possibility of economic feasibility, and funding. However, the US General Accounting Office determined in 1986 that an interest rate other than the official rate, could not be used to determine economic feasibility. The DETR notes correctly on page 5 that the results using a 3% discount rate "are presented for informational purposes only." The showing of positive net benefits with a 3% discount rate does not change the conclusion that "none of these alternatives would be considered economically justified."

The only possibility left for economic feasibility for Alternatives 2A and 2B would be finding enough overlooked Agricultural Benefits to provide the necessary $106.5 increase in total NED benefits. This too is improbable. Agricultural benefits are already greatly inflated. The assumptions and methods used for the estimation do not conform to the P&G. Further review will significantly decrease, rather than increase, estimated agricultural benefits and further confirm the impossibility of finding enough additional benefits to achieve economic feasibility for any of the Alternatives.

Since satisfying P&G rules is a requirement for federal funding there is no chance that any of these Alternatives will qualify for federal funding and thus little purpose in further analysis and the presentation of this report.

REVIEW OF AGRICULTURAL BENEFITS ESTIMATE

This review will focus on some of the major problems and issues bearing on the analysis of economic feasibility of getting surface water to deep well farms in the Odessa Subarea. Also, we suggest some clarifications for the reporting of the procedures, assumptions, and data used in the analyses and for the interpretation of the results. Care needs to be taken to avoid misleading interested parties into believing that the project is closer to economic feasibility than it is in reality.

Prior to this review we sent a list of questions to the project manager seeking additional information that would be helpful in a review of the study. We are hopeful that the requested information will reach us in time to make revisions and corrections to these comments before the close of the comment period. Since the DETR is a subset of the broader Environmental Impact Study conducted by USBR we will also reference the DEIS when necessary to complete the review process.

We will attempt to bring to light a more realistic view of the economic feasibility of this project. But, for lack of access to data, models and information used by USBR our analysis will not be complete in all respects. We will focus only on elements of the study that are obviously wrong or out of line with reality but important in the determination of economic feasibility.

Present Crop Acreage

Table AgBen7 shows the existing land use in the deep well irrigated project area. Approximately 15% of the irrigated land is in potatoes, 42% in irrigated wheat, and the remainder in a mixture of other crops including some dryland wheat. This crop distribution accounts for 102,370 acres of the study area. The rest of the irrigated land in the four county area, mostly in the CBP, has 12% of irrigated land in potatoes.

Well Levels

Many, if not most, of the wells in the Odessa Subarea are experiencing a decline in the level of groundwater due to mining of the aquifer. Some are also experiencing reduction in capacity or decline in the quality of the water pumped from the wells. Some have already returned to dryland farming and others will be forced to follow in the future.

The DETR forms a qualitative classification among the existing wells according to their current dependability and suitability for production of potatoes. These distinctions are labeled as well levels 1-5. The current distribution of farms among the well level categories is shown in Table AgBen 8.

Specific criteria and data used for the classification are not reported. Current pumping depth and cost and rate of decline in the static level of groundwater do not enter into the classification. The rate at which wells drop to a lower productivity level or are abandoned altogether also appears to be unrelated to pumping depth or cost.

Well level 1 represents those farms with wells that are showing sufficient capacity to irrigate high value crops such as potatoes and apparently no significant decline in water level. These farms represent about 5% of the study area.

Level 2 wells, currently serving about 30 percent of the study area lands, are suitable for producing high value crops but are projected to eventually experience reduced productivity and dependability. Level 3 and 4 wells represent 60 percent of the study area acres. These wells are already of reduced productivity and cannot support high value crop production. Level 5 wells represent about 5 percent of the area and have already returned to dryland farming practices, primarily wheat/fallow rotations.

The DETR relies on a spread sheet analysis to determine the life of wells in each category. This analysis is summarized in Table AgBen 14 as the No Action alternative. Level 1 farms are assumed to exist through 2125 without being diminished. About 6000 acres of level 2 farms will exist through 2025 but be mostly gone by 2050. Level 3-4 farms continue to represent about 40 percent of the acreage in 2025 and 9 percent as long as 2050. By 2075 most of the well irrigated land will have returned to dryland farming with an injection of surface water from the Columbia River. **It should be noted that Table AgBen 14 (No Action Alternative) shows 3,828 acres of unused land in 2019, and this unused land eventually declines to near zero in 2125. There is no explanation for this land use category.**

This brief discussion of well levels described in the DETR is only to set the stage for our review of the economic analysis. We agree that land will continue to go back to dryland farming in the absence of more surface water. However, the progression will be slow and easily absorbed into the regional and state economies. Potatoes are the only high value crop currently being produced in the study area and the current 15,000 acres of potatoes can be readily moved into the existing 670,000 acres of the Columbia Basin Project as market conditions dictate. **We argue that the No Action alternative will have a non-measurable impact on the regional and state economies. That is, the desperate measures being considered in the DETR to bring surface water to the farms of the Odessa Subarea are not justified.**

Representative Farm Budgets

Without Project Budgets

The DETR analysis of farm profitability was conducted using representative farm budgets reflecting the range of dryland farming, well irrigation, and surface water irrigation. The "without" project farms represented current and future deep well irrigated farms and the ultimate dryland wheat/fallow farm. The farms relying on deep well irrigation are shown in Table AgBen 10. Each farm type will be discussed in order. All of the well irrigated farms are assumed to be 1470 acres in size with 1400 acres in crops.

In general, we suggest that there were fundamental problems with the farm budgets used in this analysis. There were frequent measures of negative net farm income for farms that have existed for many years and projections of these same farms existing with negative net farm income for another 100 years. Such conditions could not exist for an agricultural industry that has been and is expected to remain viable and stable for many years. It suggests that the farm budget analysis is flawed and unreliable for measuring agricultural benefits either with or without the proposed projects.

The first representative farm is for well level1 which has a sustainable water supply and is capable of producing high value crops. The crop rotation on this farm includes 25 percent potatoes and 75 percent irrigated wheat. The crop rotation is probably realistic for this well level. It allows for land to be in potatoes only once every four years, which is generally required for disease and weed control. However, this farm with the best quality well is shown to incur an annual net loss of $53 per acre in the without project situation. The USBR analysis assumes that, without the project, this farm will continue to operate for 115 years with a loss of about $75,000 each year, an economic impossibility. **Such farms in the region would not exist at all if not profitable and certainly none of the lower quality well level farms could exist. One has to conclude that the crop data, budgets, and/or methods used to construct the net farm income for this farm were wrong or improperly used.**

Representative farm well level 2 reflects the supposed current practices of farms in the next best category of well quality. Strangely, however, this farm is allocated a crop rotation including 46 percent potatoes, 41 percent wheat, and the remainder in "mixed crops" represented by dry beans. It is not clear how this farm with a lower quality of well can sustain a more intense cropping pattern than that of well level 1. Moreover, a farm with 46 percent potatoes is not sustainable over time because of crop rotation requirements for potato production. Most farms producing potatoes will keep potato acreage between 25 and 30 percent of total crop acreage for reasons of disease control. **The crop selection for one or both 1 and 2 well level farms seems to be contradictory or inconsistent with the well level definition. Apparently there was a need to bring the acreage of potato and mixed crop production up to the current levels shown in Table AgBen 7. But the logic of this process is not discernable.**

It will be noted that the well level 2 farm does show a net farm income of positive $167 per acre, a plausible and economically sustainable condition if not agronomic sustainable. This profitability is largely due to the inclusion of more high value crops in the rotation. **It is not clear and seemingly implausible that the farm with the best wells are losing money while the lower quality well level 2 is showing a profit.**

Well levels 3-4 are combined into a single representative farm, though there is no explanation of why this is done. In any case, this farm contains a crop rotation of 50 percent irrigated wheat and 50 percent mixed crops. Whether or not this is an accurate reflection of what is currently being done in the study area the farm budget reflects a distinctly unsustainable condition with an annual net loss of $309 per acre per year. The farm is shown to be losing $454,354 per year. Yet Table AgBen 14 shows the acreage of this farm with more than 39,000 acres in 2025 and still producing on more than 9,000 acres in 2050. This condition is impossible and, like some of the anomalies of the budgets for well levels 1 and 2, cast serious doubts on the reliability of the socioeconomic analysis in the DETR. The only obvious motivation for using the budgets for well level 3-4 production is to show a great economic loss for current production with wells making even a small profit with surface water look good. That is, the difference between a significant net farm income loss (without case) and a modest profit (with case) reflects well on the gains from surface water deliveries. **If the NFI losses were as great as shown for farms with well levels 1 and 3-4 they would have all quit production long ago. Again, the validity of these data should be considered with deep suspicion.**

The DETR explains that "the primary driver for agricultural benefits comes from a change in pumping costs" and that "The 'without' project condition was….based on a

900-foot [pumping] lift." (DETR, p. 24) However, groundwater level projections presented in Table NED_MUNI2 and DEIS map 2. Groundwater Level Decline in Aquifers of the Odessa Subarea, 1981-2007 both show that pumping depths average far less than 900 feet at this time and are not expected to reach that level before almost all irrigation wells are abandoned. **There is no explanation for why pumping depths were not established on the basis of the extensive groundwater research conducted as a part of the Odessa Subarea Special Study by both the State of Washington and Reclamation and also recently released studies by the US Geological Survey. It is clear that, had more realistic pumping depths been used, NFI in the No Action Alternative would have been much higher and agricultural benefits lower.**

Since all lands currently with well levels 2-5 are projected to eventually return to dryland farming in the without project alternative, it is necessary to also have a budget for the wheat/fallow farm to complete the production alternatives. The farm budget for well level 5 is shown in Table AgBen 11. This farm is now considered to include 4070 acres with 4000 acres in crop or fallow. This farm budget is probably the most egregious of all for the without project alternatives. Keep in mind that wheat/fallow farms have existed for over 100 years in the region and are projected to exist for more than another 100 years by the USBR analysts. **In order to have existed for so long and with the expectation of continued existence such farms have to be profitable.**

Yet the budget for the dryland wheat farm shows an annual net loss of $205 per acre, or a negative net farm income of $820,991 per year. To begin, the variable costs for this farm are nearly 2.5 time total farm revenue. First year economic students are taught that if variable costs exceed total revenue all production stops in the short run. And if total costs exceed total revenue in the long run (say more than 5-8 years) production will stop. According to this budget there should be no dryland wheat/fallow production in the region. Neither could it have existed for the past 100 years and certainly cannot exist for the next 100 years as projected by USBR economists. The negative farm income for dryland agriculture does create a potential for great income gains from surface water irrigation and accounts for about one-fourth of claimed benefits for the project.

With project budgets

The farm budgets for the various well level farms after receiving surface water are shown in Table AgBen 12. In most all respects the crop rotations and crop yields are the same as for the same farms irrigating with well water. The major difference in net farm income being accounted for by the elimination of well pumping and receiving free surface water for irrigation in the with project case. **It is not clear why a single surface irrigated farm would not be used for the "with" project analysis, or why well farms would continue to maintain their distinctions after receiving surface water.**

Well level 1 farm now shows a net farm income with the project of $124 per acre while growing the same crops as with groundwater. The only difference between with and without farms crops is an increase of wheat yield from 101 bushels per acre to 125 bushels per acre. There is no explanation for why switching from an adequate supply of groundwater to an equally adequate supply of surface water would result in a yield increase. However, the increase in yield does add $130,725 per year to farm income, accounting for more than one-half of the increase in net farm income achieved with the project. Since acreage of potatoes and wheat are the same with the project as before receiving surface water, the other half of the gain in net farm income must come from the elimination of energy costs from well pumping. **There is insufficient detail in the DETR to know why variable costs decline (probably energy pumping) and fixed costs increase after receiving surface water.**

The well level 2 farm budget has the same crop distribution with surface water as in the without project case. And the crop yields are the same except for the modest increase in wheat yield to 125 bushels per acre. But in this farm budget the variable costs (pumping costs) decrease by $332,000 per year while fixed costs remain the same as with the deep well pumping. It would seem logical that the abandonment of deep wells and their capital requirements that fixed costs would decline with the arrival of surface water. Again, there is insufficient information in the DETR to discern why some of these budget inconsistencies and anomalies occur. The end result of the budget for this farm shows a net farm income of $439 per acre, a significant increase over the without project case.

The with project representative farm for pumping levels 3-4 is also shown in Table AgBen 12. The crops on this farm are divided evenly between irrigated wheat and mixed crops (represented by beans) as in the without project case but with higher yields. As with the level 2 farm the variable costs decline while fixed costs remain constant after receiving surface water. Net farm income for this farm is $110 per acre which is nearly the same as for the level 1 farm which grows potatoes and irrigated wheat.

Income with the project for the level 3 and 4 farms is irrelevant to the estimation of net benefits since all of those farms are assumed to be transformed by the supply of surface water into Level 2 farms. That is, the level 3-4 farm budget with project water is not used in the USBR analysis. According to the DETR, the level 3 and 4 farms will, with the project's supply of surface water, enjoy a $750 per acre increase in NFI. Since 60% of the project land is assigned to these farms, the contribution to annual benefits is a very substantial $46 million per year, accounting for 70% of the claimed total annual benefits from the Full Replacement Alternatives.

Using the Level 2 farm budget for all with-project lands except for Level 1 implicitly assumes that the 65% of land in Levels 3, 4, and 5 change from raising no potatoes to having 46% of their land in potatoes. This is an unreasonably high concentration of potato production and implies that the study area would progress from producing about 15% of the 100,000 acres of potatoes produced in the four-county region to producing 45%. The other 740,000 acres of irrigated land would drop from 11% potato production to only 7%.

In calculating irrigation water requirements (DETR p. 35) and Regional Economic Impacts (DETR, p.96), it is assumed that the production of potatoes will not change from the 2010-level of 15,495acres and $59 million. **This is inconsistent with the NFI and benefits calculations.**

The net farm income in the crop budget tables is based on the total acreage in the farm rather than the cropped acreage of each farm. This is incorrect procedure since the purpose of the budget exercise is to determine the value of production per cropped acre. **That is, the NFI for each farm should be based on cropped acres not total farm acres.**

Another matter that should have received some attention in the DEIS is that of farm size. After receiving surface water from a federal project the farm size should have to conform to USBR limits. Theoretically farm size for single ownership (husband and wife) is still limited to 960 acres. The USBR has been negligent in enforcing this limitation for many years but, at least, in the discussion of new projects it should be recognized.

Finally, the P&G stipulate that only basic crops, such as wheat, mixed crops as defined by USBR in this analysis, and hay, can be used in calculating national economic benefits. High value (market constrained) crops cannot be used in project evaluation because it is presumed that increased production in the project area will be balanced by reduced production in another region as land is forced out by competition from the project area. There may be substantial gains to the farmers in the project area; however, these are balanced by losses in other areas and hence no national economic benefit. Enforcing this rule would eliminate the use of both level 1 and 2 farm budgets from use in the with project case. Only the budget for well level 3-4 qualifies for use in this analysis. That is, the budget that was not used by USBR.

At the time this is written there is insufficient information to further critique the crop budgeting analysis, reconstruct the crop budgets, or examine the data used therein. Hence, we will turn to the manner used by USBR to evaluate the project net benefits.

Measuring Irrigation Benefits

With versus Without

The net benefits of replacing deep wells with surface water is appropriately measured comparing total net farm income from the no action alternative to that of the with project alternatives. The DETR does this for each irrigation alternative.

In the absence of surface water the assumption in the DETR is that deep wells would continue to decline in quality and water yield over time. Eventually most of the land would return to dryland farming using a wheat/fallow rotation. Only the lands served by well level 1 would be able to sustain irrigated production for the next 100 years. In the analysis it is assumed that the irrigation project would be constructed in phases with completion by 2025. Production is then evaluated over the next 100 years. The net present value of both with and without project conditions are compared in terms of year 2025. That is, costs and benefits are compounded forward from the present to 2025 and then discounted back to that year from the next 100 years.

A spread sheet analysis was used by USBR to predict the rate of land transfer from the higher to lower quality well levels over time in the without project case. The acreage in each category is shown in Table AgBen 14. By 2125 there are still 5131 acres irrigated from wells under well level 1. Essentially the lands under well levels 2-4 would have returned to dryland farming by 2075, approximately a 65 year transition period.

It is noted that in all evaluations of deep well pumping by the USBR, fixed and variable costs are based on the assumption that, without the proposed project, all farms from Level 1 through Level 4 will be pumping from a depth of 900 feet. The DETR explains that "the primary driver for agricultural benefits comes from a change in pumping costs." However, present pumping depths average about half as much. In Table NED_MUNI2, groundwater levels without the project are not projected to reach 900 feet for most project areas until 2075. DEIS map 2., Groundwater Level Decline in Aquifers of the Odessa Subarea, 1981-2007, shows declines of less than 125 feet in 27 years over most of the Study Area. Doubling pumping depth increases both fixed and variable pumping costs and leads to a significant underestimate of NFI without the project. **There is no explanation for why pumping depths were not established on the basis of the extensive groundwater research conducted as a part of the Odessa Subarea Special Study by both the State of Washington and Reclamation and also recently released studies by the US Geological Survey. It is clear that, had more realistic pumping depths been used, NFI in the No Action Alternative would have been much higher and agricultural benefits lower.**

The cost benefit analysis conducted by USBR is summarized in Table NED_BCA1. It was briefly discussed above. The benefit cost ratios ranged from 0.9 for alternative 2A down to 0.4 for alternative 3C. The total NED benefits for the partial replacement alternatives 2A-2D were the same at $1,170.2 million and for the full replacement alternatives $1,820.5 million. Costs differed for each alternative creating the range of values for the CBR. This evaluation is accomplished by comparing NED benefits (including municipal and industrial) for 100 years of production without the project and 100 years with each project alternative. This part of the review, however, will focus only on the agricultural benefits with and without the project. Municipal and industrial impacts are discussed in a later section. Table Ag Ben 13 summarizes the per acre irrigation pumping benefits from with and without project farm budgets. These measures of net farm income resulted in the BCR values described above.

We have previously discussed the whole farm budgets used by the USBR and the perceived problems therein. Because of the many problems presented by these budgets, it is our opinion that the resulting CBR values are not acceptable. Since we do not have the detailed information about crop budgets available to the USBR we cannot reconstruct them in detail. We will, however, evaluate the irrigation benefits using more realistic farm budget values for net farm income. Since we do not have access to the spread sheet information used to transfer wells from one category to another over time in the without project case we will accept the USBR values for this exercise. **Our purpose in this exercise is to present a more realistic measure of project irrigation benefits than those developed by USBR.**

First it may be helpful to briefly describe the process followed by the USBR. Table AgBen 15 shows the residual net farm income by well level for the no action alternative. It will be noted, for example, that total residual net farm income in 2025 is a negative $21,509,291. This huge loss of net farm income is based on the farm budgets of Tables AgBen 10 and 11. Most all of the farming is assumed to be losing money with wells or dryland farming. From this assumed position of losing money without the project it is not difficult for the USBR to show a gain in net farm income in the with project alternatives.

To conclude discussion of USBR methods we turn to Table AgBen 17. This table shows the acreage of irrigated lands with project water and in various well level categories for lands not served by project water in the partial replacement alternative. Using the farm budgets of Tables AgBen 12 for project served lands and the budgets of Tables AgBen 10 and 11 for remaining lands, it is shown in Table AgBen 18 that the residual net farm income for 2025 is $21,630,949. The difference between the net gain with the partial replacement alternative and the large negative income in the no action case is $43,140,240. Such values are calculated for the next 100 years and discounted to a NPV for 2025 to compare with project costs. This procedure results in the benefit cost ratios discussed earlier.

No Action Alternative (reconstructed)

The first step in our analysis is to revisit the dryland wheat budget shown in Table AgBen11. The USBR has determined that this farm will lose $205 per acre for the next 100 years. Since we know that dryland wheat farming has a long history in the region it has to be marginally profitable and sustainable. We assumed that dryland wheat would provide a net farm income of $25 per acre over time. We believe this to be a modest but realistic assumption.

Next we revisit the whole farm budgets shown in Table AgBen 10 for the no action alternative. We contend that the well level 1 farm pumping from a modest depth and a stable water supply must be marginally profitable. Otherwise it could not continue to exist for more than 100 years as the USBR assumes. We changed the residual net farm income from -$52.97 to $50. Since the well level 2 farm is shown to be profitable with a large measure of high value crops we made no changes for this farm, though the intensity of potato production at 46 percent of farm acreage is unrealisic. It was assumed by USBR that farms would transition from level 2 to level 3-4 category over time. However, the level 3-4 farm budget was shown to have a large negative net farm income and could not be sustainable over time. Hence, we assumed that when wells transitioned below level 2 they would go directly to dryland farming, which by our assumption, would be profitable at $25 per acre.

Using the acreage transitions shown in Table AgBen14 we calculate a net farm income for the no action alternative. Again we will stay with the example of year 2025. Following the budget adjustments described in the previous two paragraphs we calculate a residual net farm income for 2025 of $3,532,075. This compares to the negative $21,509,291 developed under USBR assumptions. It is a modest but sustainable income for the no action alternative and that is the point at which the farms would largely transition to dryland farming and continue for another 100 years.

(*It will be noted that we could not reproduce the values in the row labeled Level 3-4 of Table AgBen18. Possibly there is an omission or mistake of some kind here)*

Partial Replacement Alternative (reconstructed)

The next step is to calculate a residual net farm income for the partial replacement alternative using appropriate adjustments in USBR budgets. In this process we imposed the rules of the P&G that disallow the use of high value crops in water project evaluation.(Principles and Guidelines, p.24-25) Since both level 1 and 2 budgets in Table AgBen 12 contain potatoes they were disqualified. We turned then to the use of the level 3-4 farm for calculating the net farm income from project water. Using this budget with a net income of $110.24 the lands served with project water in 2025 would show a net farm income of $6,291,397. This compares to the USBR value of $24,172,797. Using the same procedure described for the no action alternative we calculate a residual net farm income for lands not served by project water in 2025 to achieve a value of $1,567,642. Adding this value to the net farm income of project lands we get a total residual net farm income of $7,859,029. Now subtracting the without project net farm income for that year ($3,532,075) we obtain a net benefit from the partial alternative of $4,326,954. This compares to the USBR number of $43,140,240.

This procedure was followed for all of the years shown in Table AgBen 18. Our calculated annual benefits from the project were 10 percent of those presented by USBR in 2025 and stabilized at about 13 percent for the next 100 years. **It is our considered opinion that the net agricultural benefits from project development calculated by USBR should be reduced by at least 85 percent. There are other adjustments to the cost side of the BCR that will further reduce that value for each action alternative. This would create a CBR for the partial alternative close to 0.1 as compared to the USBR value of 0.9.**

Municipal and Industrial Benefits

The Draft Environmental Impact Statement points out that “municipal and industrial uses in the Study Area would likely be impacted by continued groundwater level declines under the No Action Alternative” and that this decline “would result in increased pumping costs and the eventual need to replace pumps and deepen wells.” (DEIS, p.4-49)

The DEIS goes on to point out for each of the eight Alternatives that “municipal and industrial users would benefit by the lack of continued groundwater level decline by having longer-life wells with more stable pumping costs.” (DEIS, p.4-52)

Benefits from Reducing Municipal Pumping Costs

The savings in municipal pumping cost are overestimated. The Draft Economics Technical Report Table NED_MUN15 shows pumping costs for the 8 municipalities in or close to the project area rising from 2019 to 2125, in the No Action Alternative, by 400 times. This incredibly large increase may be due to some error of arithmetic or document preparation, but the Draft Economics Report acknowledges that “alternative specific pumping cost saving estimates may also be overstated (Economics Report, p. 46).”

Reclamation estimates benefits from the reduced rate of groundwater level declines by subtracting estimated pumping costs with the Partial and Full Alternatives from the cost with the No Action Alternative. The steps to cost estimation were:

1. Project population growth to 2125 in each of the 8 municipalities
2. Assume a constant rate of water use per person
3. Project groundwater level to 2125 for each Alternative
4. Calculate the pumping cost for each relevant depth
5. Multiply water requirement by pumping cost
6. Calculate savings by subtracting pumping cost with each Replacement Alternative from the cost with No Action

The approach is reasonable; however, several key assumptions that are not warranted by the facts cause a large exaggeration of the projected municipal benefits from the Replacement Alternatives. For example:

1. Assumption: All Municipal wells in or near to the project area are assumed to pump from the rapidly declining lower Grande Ronde aquifer.

   Facts: Several municipal wells are continuing to pump from the Wanapum aquifer which has lower pumping lifts and, according to the GWMA report, Groundwater Level Declines in the Columbia River Basalts, has been stable for 30 years. The GWMA report also points out that the Grande Ronde and Wanapum aquifers are completely separated and further decline in static water level in the Grande Ronde will have no effect on water level in the Wanapum aquifer. There is no reason for believing that reducing pumping from the lower aquifer would raise water levels in the upper aquifer unless the uncased boreholes are sealed off.

2. Assumption: Without a supply of replacement water, pump lifts for municipal wells will continue to increase at the recent rates of decline of groundwater level in the irrigation wells in the Project Phase closest to the municipal wells.

   Facts: No data are presented to show that the pump lifts for the municipal wells have been increasing at the same rate as in the irrigation wells in the Project area. The DEIS p.4-49 states: "most municipal and industrial users are outside of areas experiencing the greatest groundwater level declines."

   The two largest cities for which benefits have been claimed, Othello and Moses Lake, are located several miles within the CBP area that has been supplied surface water for more than 50 years. Both report that pumping lifts in their wells average about 300 feet and are declining by 3-4 feet per year. The DETR assumes pumping depths and rates of decline are about twice what are actually being experienced.

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   Four other supposedly threatened municipalities are located on the western edge of the Project area and close to the East Low Canal. According to Map 1-2 of the Draft DEIS, the four are within the zone where the total decline for irrigation wells was less than 50 feet from 1980 to 2007.

3. Assumption: Replacing irrigation withdrawals in the project area will stop declines in municipal wells of Odessa and Lind, which are located outside the project area.

   Facts: Both Odessa and Lind are located approximately 10 miles from the eastern edge of the area that would be eligible to receive water under the proposed project. No evidence is presented from the extensive groundwater modeling studies to indicate that replacing groundwater withdrawals at that distance would offset the effects of continued pumping close to the towns.

4. Assumption: If the project is not completed, withdrawals from the aquifer will not be limited to protect prior appropriators and non-irrigation users from excessive depletion of their water supply.

   Facts: WAC 173-130A calls for Dept. of Ecology to take action to prevent too rapid a rate of decline (more than 30 feet in 3 years) or drawdown to more than 300 feet below 1967 static water levels. The Odessa Subarea Groundwater Management Policy also requires casing and sealing of wells in order to protect the municipal and other users from drawdown of the aquifer reserved for them from the depleting effect of water cascading of water from the upper aquifer to the lower.

Industrial Benefits from Replacing Groundwater

According to the Draft DEIS, decline in groundwater level and increase in pumping depth and pumping costs will impact industrial users in the same way as municipalities. However, industrial benefits are based not on preventing groundwater decline but rather on the project making it possible for the East Irrigation District to continue delivering 4700 acre-feet per year of irrigation water for use in diluting processing waste water. After dilution, the 4700 acre-feet is applied to irrigated

The explanation given for stopping deliveries to the industrial users is that with the No Action Alternative—no construction of enlargements to the system—"there is not sufficient capacity within the canal for delivery to all users." (DETR, p. 53)

The value lost due to removing water from industrial users is estimated in the Economics Report to be $111 per acre-foot, which is "the agricultural benefit per acre-foot of water less the cost of industrial water." The explanation for valuing lost industrial deliveries on the basis of agricultural benefits is that, after the industrial use, the water is applied to irrigated crops. So, it is presumed that denying the water to the industries also denies it to irrigators and reduces the total irrigation from the system.

This rationale needs explanation. If the water is currently being supplied to the industrial users, why does the No Action Alternative, which presumes no new irrigation, cause a shortage of canal capacity? Why would industrial users be denied water when their use causes no net reduction to the amount of water supplied for irrigation? If the industries are denied use of CBP water for dilution, why can't the loss of agricultural benefits be avoided by rerouting the water to the same or other lands and continuing to use it for irrigation? If the industries are denied CBP water, won't they have to find other, potentially costly means of disposing of high nutrient content process wastewater?

In conclusion, no clear reason is presented for cutting off the industrial users if the CBP is not expanded. Also, there is no explanation for why refusing to allow industries to inject their wastewater into irrigation water would result in ceasing to use the water for irrigation.

Energy Costs

To discuss the energy cost issue for this analysis we return to the DEIS. Section 4.17.1 of the DEIS describes the methods and assumptions used by USBR to calculate the energy costs for water diversions and farm delivery. The USBR does consider both lost hydropower and energy use in pumping for water delivery in this section of the DEIS. However, in the final analysis of the CBR for each development alternative the USBR deliberately omits some energy costs. This omission should invalidate the energy costs for development shown in Table NED_BCA2 of the DETR. In this table the "lost hydropower" costs are shown as $219.3 million for partial alternative and $557.3 for the full development alternative. These values were obtained by using the Bonneville Power

Administration models to calculate the amount lost hydropower and then applying some value to this energy and then discounting the annual values over 100 years back to the year 2025. **There is no explanation of what cost per unit value the USBR used in this calculation.** (A footnote to Table 4-91 in the DEIS does indicate that the energy for pumping from Grand Coulee into Banks Lake was included as part of the lost hydropower.)

To continue we will briefly point to some errors of assumption and procedure used by USBR in calculating the energy costs. First note that on page 4-235 of the DEIS it is shown that the project alternatives would divert from Grand Coulee 176,343 acre feet of water (3.09 af/a) for the partial development alternatives and 347,137 acre feet (3.38 af/a) for the full development alternatives. These were not the values used by USBR in calculating energy costs however. First, it was assumed by USBR that the considered development alternatives would include the 30,000 acre feet of diversion already designated under the Management Program MOU and the Coordinated Conservation Program. Since this designated diversion by the State of Washington would presumably continue with or without the USBR development alternatives the cost of energy associated with the 30,000 acre feet of water was eliminated from the USBR energy cost calculation. We consider this to be an egregious error. **It does not matter that the State has previously designated this amount of water to be used for irrigation in the Odessa Subarea it still incurs lost hydropower and energy pumping if delivered for irrigation. Such costs cannot be ignored in this analysis.**

Second, the USBR analysis assumed that there would be significant irrigation return flows that could be recaptured to create hydropower. This assumption was apparently based on models used for current irrigation within the existing Columbia Basin Project (CBP). However, given the assumed farm delivery of 3.0 acre feet per acre for USBR development alternatives there would be no irrigation return flows captured for surface use from irrigation in the Odessa Subarea. **It is our opinion that total diversions of water must be used for calculation of lost and used energy in this analysis.**

Third, the USBR analysis simply omitted a significant amount of surface water pumping for water delivery. The amount of pumping was estimated by USBR and shown in Table 4-92. In fact, the amount of energy used for surface water pumping is as much as 176 percent of the lost hydropower that was used by USBR in its cost calculation. The surface water pumping by USBR in water delivery would be heavily subsidized by regional ratepayers. The USBR would charge the farmers about 3 mills per kWh for this power and it would cost the region more than 50 mills per kWh for replacement. **This pumping energy was eliminated by the USBR by assuming that there is a regional surplus of energy production capacity currently in the region. Hence, the region could presumably absorb this additional pumping at zero cost. This is a fallacious argument because all lost hydropower and subsidized energy use will eventually have to be replaced in the region.**

We have calculated energy costs per acre of development as shown in Table 1 below. In this calculation we have assumed that total diversions must be used to determine the amount of lost hydropower. Second, we have included the surface water pumping shown in Table 4-92 (DEIS). We include the pumping from Grand Coulee into Banks Lake at an assumed pump lift of 285 feet. There was no allowance provided for irrigation return flows to create downstream hydropower. It was assumed that the on-farm pumping is included in costs of crop production so we do not include that cost in Table 1.

Table 1. Energy costs for Odessa Subarea Development*

	Partial Dev.	Full Dev.
Hydropower Loss (kWh/A)	3176	3434
Grand Coulee to Banks (kWh/A)	1100	1204
Water delivery pumping (kWh/A)	4620	4396
Total Energy (kWh/A)	8896	9034
Cost $/A (@50m/kWh)	$443	$452

*Based on diversions of 3.09 af/a for partial development and 3.38 af/a for full development.

The sum of lost hydropower and used energy for surface pumping is shown to be 8896 kWh/A for partial development and 9034 kWh/A for full development. Valuing this energy at 50 mills per kWh provides an estimated annual energy cost per acre of $443 per acre for partial development, twice the amount of $219 per acre estimated in the draft report. Full development costs would be $452 per acre per year. Either of these costs far exceed the estimated annual net farm income from surface water irrigation. **Hence, even if construction costs for water delivery facilities were zero, the net farm income could not cover the imposed energy costs. Moreover, it is likely that the cost of replacing this lost and used energy would be as much as 100 mills per kWh, or twice the costs shown above.**

The NPV of the energy costs for partial development ($447/acre) results in a value of $577.1 million. This is more than twice the cost of lost hydropower shown in Table NED_BCA2 (DETR) as calculated by the USBR. **Again, the USBR has biased the cost of this project to show a BCR that is greater than in reality.**

Summary and Conclusions

This review focused only on the socioeconomic portion of the project DEIS and did not attempt to determine whether problems exist with other, mainly environmental, aspects of the DEIS report. We have shown that:

- Agriculture benefits from project development were seriously overestimated by the USBR.
- Municipal and industrial benefits were overestimated.
- Energy costs were understated by USBR by as much as 75 percent.
- Correcting for the above errors would result in a benefit/cost ratio close to 0.1 for partial development and an even lower value for full development
- It is not logical to propose spending $15,000 to $30,000 per acre in development costs to raise land values in the project area from $500 per acre (dryland wheat) to $2500 per acre (with project irrigated value).

The USBR and the State DOE should quickly admit that this project is far short of economic feasibility. There are no economically viable options for delivering surface water to this region and "saving the deep well irrigators." There should be no further spending of public funds on planning, studies and building of portions of the facilities for delivering surface water to the Odessa Subarea. Agency leaders and politicians for both State and Federal levels should admit this reality and turn to more productive alternatives for use of taxpayers' money. The minor amount of agricultural production from deep well irrigation in the study area can be easily absorbed into the remainder of the irrigated regions of the state. To cease production from deep wells in the region would result in a small, immeasurable impact on the state economy. There is no rational reason to propose spending hundreds of millions of taxpayer and rate payer dollars to "save" the irrigation of this region.

Finally, the DEIS and DETR reports and general discussion of the alternatives for expanding the Columbia Basin Project into the Odessa Subarea makes reference to the adverse impacts on the local economies that will happen if replacement water is not provided to the deep-well irrigators. Most commonly cited are estimates by Bhattacharjee and Holland (B&H, School of Economic Sciences, Washington State University, June 6, 2005) (http://www.agribusiness-mgmt.wsu.edu/AgbusResearch/docs/PotatoCommission_finalreport.pdf#search=%22Holland%20Bhattacharjee%22). The B&H study of potato production benefits of this region. has been seriously misinterpreted and misused. It describes gross values of production and economic activity in the region if failure to supply replacement water results in regional loss of 35,000 acres of potato production and associated processing. Political leaders and project proponents have used these numbers to claim as much as $1.6 billion per year of benefit to the region from potato production. THIS IS NOT A CORRECT INTERPRETATION OF THE B&H STUDY. The acreage "saved" by supply of replacement water would be no more than one-fourth as much. Furthermore, the impact

should be properly viewed through the value added (net income) created by potato production. This would be far smaller figure approaching zero in reality. For a proper interpretation of the B&H report one should read the review of that report by Joel Hamilton, Professor of Agricultural Economics Emeritus, University of Idaho. A Review of "The Economic Impact of a Possible Irrigation-Water Shortage in Odessa Sub-Basin: Potato Production and Processing",
(http://www.columbiana.org/PDFs/HamiltonAnalysis.pdf)

It makes little sense to claim $1.6 billion of benefits from an industry that is losing more than $20 million annually (USBR calculations, Table AgBen 15, year 2019, DETR). Even our own calculation of approximately $4.3 million net income for that year would not support a claim of regional benefits of $1.6 billion.

Market Solution

We suggest that the plans for delivering surface water to the Odessa Subarea should be permanently abandoned. Quit spending money on studies of irrigation development that are clearly infeasible. Even if the partial development alternative were to be adopted and built, there would still remain more than 100,000 acres of deep well irrigation that would eventually run out of water. Hence, the USBR plan, despite its unreasonably high costs, would not save the deep well irrigators or the aquifer. The partial development alternative would not deliver water to farms north of I-90, the area of greatest decline in aquifer productivity and wells most in danger of shutting down. It is time to turn to more realistic alternatives.

The first alternative to consider is to do nothing and let the aquifer eventually be depleted and the land returned to wheat/fallow production. Some irrigated agriculture would continue to exist in the region for at least another 40-50 years. The adjustment to dryland farming would be slow and changes in irrigated crop production easily absorbed into the remaining irrigated lands of the state as market conditions would dictate. This alternative would not, however, save the aquifer and any permanent dependence on it (say municipalities) would have to seek other alternatives. With this alternative there is a known ending and all parties would have ample time to adjust to the required changes.

We propose another alternative that is much less costly and could actually save what remains of the aquifer. That is, seek a market solution to the problem. It is currently estimated that irrigated land in the Odessa Subarea has an average market value between $1600 and $1700 per acre. Lands with good wells probably have a bit higher value and lands with wells approaching demise would be expected to be much lower. Finally, land without deep well irrigation has a market value of $500 to $600 per acre. It should be possible to buy the well irrigation rights in this region at a reasonable price and return all land to dryland production. For example, if farmers of the region were offered, say, an average of $1200 per acre to shut down the wells and return to dryland farming we believe there would be wide acceptance. The farmers would retain current accumulated wealth and still be able to farm indefinitely while their alternative is to watch the aquifer decline and their land values dissipate. In this example, it would be possible to retire 100,000 acres of deep well irrigation for a cost of $120 million. This is an amount that could be managed by the State without federal assistance if it is deemed necessary to save the farmers in some way. The aquifer would be stabilized at current capacity. The loss of production from irrigated agriculture would be negligible. Municipalities and others dependent on the aquifer for existence could probably expect at least another 100 years of dependable water supply. Regional economies should not be severely impacted because every landowner in the region would suddenly have a large amount of cash in hand with some expectation to spend a portion locally. Compared to the USBR alternatives of spending $15,000 to $30,000 per acre for water delivery facilities while imposing very significant energy costs on the region, a market solution seems quite reasonable and attainable. Indeed, the cost benefit ratio of spending $120 million to save the tax payers $1.6 billion is 13.3, highly favorable from an economic feasibility stance.

Reader Response

This review of the DETR and DEIS is intended for public view and response. It will be submitted to the USBR in response to its request for public comment. However, it will also be available to anyone who wishes to use our comments and analysis. We each have more than 40 years of professional experience in the fields of irrigation development economics and water policy and believe our comments merit serious consideration and welcome debate and responses from all respondents.

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