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Memorandum

To: Walker Basin Restoration Program
From: WestWater Research
Date: May 21, 2019
Re: Economic Impacts Analysis – Sustainable Agriculture Pilot Project

Background and Purpose

The Walker Basin Restoration Program (Walker Program) is acquiring land and water rights from willing sellers as part of an effort to restore and maintain Walker Lake an at-risk Desert Terminal Lake in Nevada. Once acquired, the Program will administratively transfer the water rights to enhance flows for the benefit of the Walker River and Walker Lake, thereby reducing salinity levels in the Lake which are currently too high to support Lahontan cutthroat trout (LCT) survival.

Changing the acquired water rights from irrigation to environmental use will affect the total level of agricultural production in the Walker Basin and the associated levels of income and employment. To help understand the economic effects and the evolving direction of agriculture in the Basin, the Walker Program implemented an innovative Sustainable Agriculture Pilot Project (Pilot Project) with a local organic and conventional vegetable grower. Under the agreement, the local grower purchased a portion of the land and primary ground water rights acquired by the Walker Program and agreed to document its efforts to develop organic vegetable production on land that previously was used to grow alfalfa hay. By converting from alfalfa hay, a crop with relatively low production input requirements, to organic vegetables which have high input requirements, the pilot tests whether the negative regional economic effects from the permanent retirement of land and water rights devoted to alfalfa hay production can be offset through partnerships with local agricultural producers to convert a much smaller land area to a higher valued crop.

This analysis provides an estimate of the economic effects associated with the Pilot Project. It is intended to identify the potential changes to the regional economy associated with a reduction in the irrigated land base applied to alfalfa hay production and the potential scale of similar projects that would be necessary to offset Program water right acquisitions. An economic analysis of a broader set of Walker Program activities are addressed in a separate report.¹

¹ WestWater Research, March 30, 2017. "Economic Impacts Analysis – Walker Basin Restoration Program." Prepared for the Walker Basin Restoration Program.

The contents of this memorandum are organized as follows:

- **Pilot Project Description:** This section includes a description of the Pilot Project to provide context for the economic analysis.
- **Estimated Economic Impacts:** This section describes the approach applied to estimate the economic effects of the Pilot Project and the results of the analysis.
- **Summary:** This section provides a summary of the analysis and its conclusions. In addition, it offers observations concerning the potential economic effects associated with scaling up partnerships between the Program and Walker Basin agricultural producers to increase organic vegetable production.

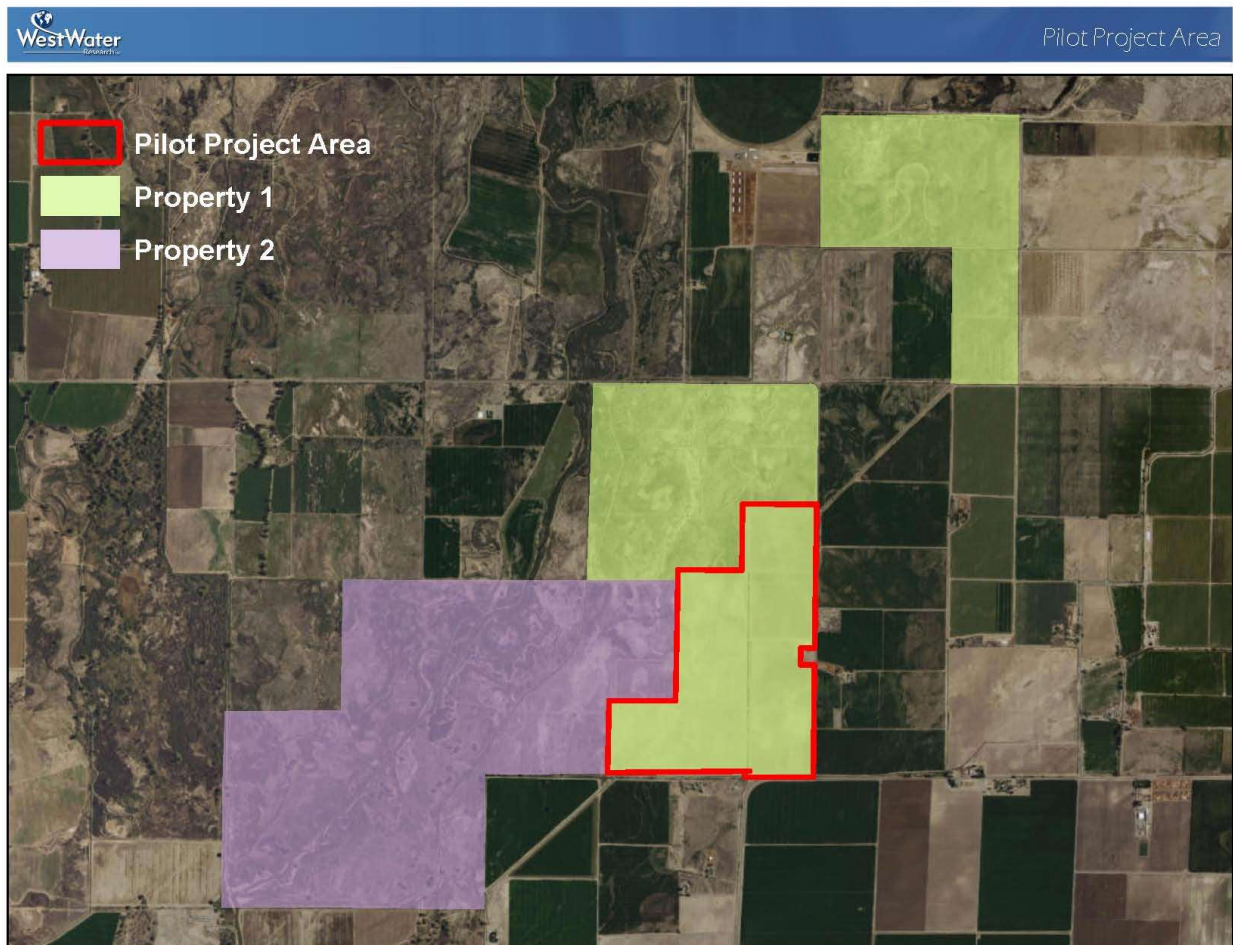


Pilot Project Description

During 2010 and 2011, the Walker Program acquired approximately 2,000 water-righted acres in Mason Valley associated with two properties. The properties had been in irrigated alfalfa and pasture production for many years prior to the acquisitions. In 2012, the Walker Program sold at market value and conveyed approximately 358 acres of the property and previously acquired primary groundwater rights to a local agricultural producer to measure the economic effects associated with its conversion from hay production to the production of high valued, organic vegetable crops (organic onions and leafy greens).

Conversion of the property to organic vegetable production requires a number of years to obtain organic certification. Beginning in 2013, the agricultural producer began transitioning the property from alfalfa hay to onions and leafy greens (e.g. lettuce, cauliflower). As of 2016, all the land previously devoted to forage crop production had been planted to organic vegetables. In the future, crops will be rotated between onions, broccoli, cauliflower, and other leafy greens. All the land is irrigated using a mix of sprinkler and drip irrigation. Figure 1 provides a map of the Program acquired properties and 358-acre Pilot Project area.

Figure 1. Walker Program Pilot Project Area



Estimated Economic Benefits of the Pilot Project

This section estimates the economic effects associated with the Pilot Project through application of a “before and after” analysis. Specifically, this analysis compares the agricultural production and associated economic effects prior to and following acquisition of the property by the Walker Program and development of the pilot. This analysis does not consider the economic effects associated with ongoing revegetation activities on the acquired property outside of the Pilot Project area. In addition, the analysis does not account for the increased recreational opportunities available to the public following transfer of the property not associated with the Pilot Project area to the state of Nevada.

Two baseline conditions are considered to represent agricultural production on the properties absent acquisition by the Program:

1. The level of agricultural production in the years prior to the sale.
2. The potential level of agricultural production as represented by the available water supply and typical alfalfa and rotation crop yields in the region.

Agricultural production conditions on the two properties prior to the acquisition by the Walker Program were obtained through interviews with the previous owner-operator of one property and an agricultural producer that leased the other property for hay production. This information was supplemented with published information on crop production costs, yields, and prices to develop the two “no acquisition” conditions.² The following describes the agricultural production conditions on the two properties:³

- Property 1: In the years leading up to the acquisition by the Walker Program, only a portion of one of the properties was being actively farmed. Of the total 860 acres, 364 acres of alfalfa were in production with an average reported yield of 4.0 tons per acre.⁴ Crop yields were relatively low as the alfalfa stand had not been re-established in many years. In comparison, the water rights allow for the potential irrigation of 860 acres. According to available information, a well-managed alfalfa crop in the Walker Basin with adequate water supply can yield approximately 6.5 tons per acre over four cuttings.⁵ Given the reliability of the surface water rights previously applied on the property, this likely represents an upper bound on possible alfalfa production.
- Property 2: The property included approximately 1,140 water-righted acres including decree natural flow and New Land rights. Due to the low water allocation associated with New Land rights and the less than full reliability associated with the natural flow rights, the landowner actively farmed 860 acres with the water rights. Approximately 206 acres were planted to alfalfa, 34 acres to grain hay, and the remaining 620 acres to pasture. According to the prior owner, alfalfa yields averaged 5.0 tons per acre. This analysis assumes that the land and water rights

² Published alfalfa prices were obtained from the National Agricultural Statistics Service, www.nass.gov.

³ The title-verified acres for Property 1 is 855 acres, 5 acres less than the irrigated area allowed by the water right. This analysis assumes 860 irrigated acres for the “potential production” baseline condition.

⁴ Personal communication with the agricultural producer that rented the property for several years prior to the Program’s acquisition.

⁵ University of Nevada Cooperative Extension, 2008. “Northwestern Nevada Alfalfa Hay Establishment, Production Costs and Returns.” Special Publication 08-10.



were being used for maximal production. As a result, the agricultural production is the same for the two baseline conditions.

Currently, 318 acres of the property have transitioned from alfalfa to a rotation of organic onions, lettuce, and cauliflower. The remaining 40 acres of the Pilot Project area is not in crop cultivation and is used for farm roads, an irrigation pond, and a staging area for irrigation equipment. This analysis applies the average crop mix from 2013 through 2017 which consists of approximately 201 acres of onions, 26 acres of lettuce, 30 acres of cauliflower, 31 acres of broccoli, and 20 acres of melons.⁶ Approximately 9.6 acres of the 318 acres have been idled on average from 2013 through 2017. Vegetable crop yields were obtained directly from the agricultural producer managing the Pilot Project.

The alfalfa and pasture price applied in the analysis represents a five-year average (2013-2017) as reported by the National Agricultural Statistics Service (NASS). The average prices received for vegetable crops from 2013-2017 were obtained from sales information reported by the agricultural producer managing the Pilot Project. Multiplying crop prices by crop yields provides the gross revenue per acre. As shown the gross revenue from alfalfa production on the property ranges from \$832 to \$1,352 per acre. The estimated average gross revenue for the pilot project area is \$14,858 per acre assuming a rotation of four years in lettuce followed by one year in onions.

Table 1 provides a summary of the agricultural production assumptions applied to the two “no acquisition” conditions and the Pilot Project.

Table 1. Pilot Program Economic Analysis Assumptions

	No Acquisition		Pilot Project
	Actual	Potential	
Acres in Production	1,224	1,720	318
Crop(s)	Alfalfa, Pasture	Alfalfa	Onions, Lettuce, Broccoli, Cauliflower, Melons
Gross Revenue (\$/acre)	\$832	\$1,352	\$16,732

Table 2 provides a comparison of the estimated levels of agricultural revenues, and production expenses with and without the pilot program. As shown, estimated annual gross revenue for the pilot project area is approximately \$5.3 million compared to \$581,288 to \$968,366 absent the pilot project. The increase of between \$4.4 and \$4.8 million is due to the large increase in crop revenues associated with vegetable and melon production within the Pilot Project area. This is *despite* the fact that significantly fewer acres are in production (318 versus a potential of 1,720 acres in alfalfa, grain hay, and pasture). Expenses on fertilizer, chemicals, custom operations, and seed also show a significant net increase. In addition, the Pilot Project is estimated to use much less water for irrigation than was estimated to be previously applied

⁶ It is anticipated that onions will be grown 1 out of 5 years with the remaining acres planted to a mix of vegetables including lettuce, broccoli, and spring mix. An equal mix of lettuce and cauliflower are applied in this analysis to represent all vegetable acres.



to the two properties. This is due to the smaller irrigated area but also due to the lower per acre water application associated with vegetable and melon crops.

Table 2. Estimated Change in Agricultural Production, Selected Expenses, and Water Use

	No Acquisition		Pilot Project	Net Change (\$)
	Actual	Potential		
Crop Revenue (\$)	\$566,053	\$961,605	\$5,320,428	\$4,353,823 to \$4,754,375
Fertilizer, Herbicide/Pesticide, Seed (\$)	\$70,169	\$330,586	\$595,448	\$264,862 to \$525,279
Water Application	4,118	5,501	1,157	(3,250) to (4,633)

The total economic impact of Walker Program activities consists of direct, indirect, and induced effects. Direct effects are represented by the change (increase) in total crop sales in the regional economy (approximately \$4.4 to \$4.8 million as shown above). Indirect impacts measure the change in economic output in businesses related to agriculture resulting from the change in total crop sales. For example, an increase in agricultural production is likely to result in an increase in business activity at a local farm supply store. Induced impacts cover a broader spectrum of the local economy and measure how increased income in the agricultural sector and related industries translates into increased economic activity across all sectors (e.g. retail goods and services).

Often an input-output model (e.g. IMPLAN) is used to measure the indirect and induced impacts. In a previous analysis of the agricultural economy of the Walker Basin, IMPLAN was applied to estimate the economic impacts associated with water rights acquisitions and the subsequent potential uses of the affected land.⁷ The study estimated the annual economic impacts on a per acre basis associated with various crops in production (or that could potentially be produced) in the Walker Basin.

Table 3 provides the results from the analysis for three of the more commonly produced crops.⁸ According to the IMPLAN estimates, it takes approximately 100 acres of alfalfa to generate one job in the Walker Basin, compared to approximately 12 acres per job for onions.⁹ Put another way, the same number of acres planted to onions rather than alfalfa produces approximately 8 times the number of jobs. Alfalfa is more machinery-intensive, while onions require more hand labor. Value Added indicates the portion of regional output generated by economic activity occurring within the Walker Basin and is similar to gross regional product. It is used to estimate the economic impact to the region from changes in agricultural production.

⁷ R. Bartholet et al. 2009. "Economic and Fiscal Impacts and Economic Development Strategies: Consequences to the Agricultural Economy in the Walker Basin."

⁸ Total value added was the only economic impact metric provided for pasture in the Bartholet report.

⁹ Similar data for leaf lettuce was not provided in the Bartholet 2009 study. This analysis assumes that the direct, indirect, and induced effects for leaf lettuce are similar to onions.



Table 3. Estimated Annual Economic Impacts by Crop (\$/Acre)

Crops	Category	Direct	Indirect	Induced	Total
Alfalfa	Labor Income	\$73	\$61	\$17	\$151
	Value Added	\$476	\$101	\$40	\$617
	Employment (jobs/acre)	0.007	0.002	0.001	0.01
Vegetables¹⁰	Labor Income	\$1,983	\$643	\$343	\$2,969
	Value Added	\$3,251	\$1,296	\$778	\$5,325
	Employment (jobs/acre)	0.054	0.016	0.011	0.08

Source: Bartholet, 2009.

The economic impact estimates provided in Table 3 reportedly are based upon crop prices from 2007. In order to adjust the values for application in this analysis, a multiplier for each crop is estimated by comparing the total value added to gross crop revenues using 2007 crop prices.¹¹ This assumes that there have been no structural changes in the regional economy since the study was completed. Table 4 provides the estimated multipliers for the selected crops. This means that for every \$1 million of alfalfa production, an additional \$660,000 of value added revenue is generated. For vegetables, \$1 million of production generates an additional \$890,000 of value added revenue. The higher value added multiplier for vegetables is due to the more intense production and post-harvesting activities.

Table 4. Estimated Multipliers by Crop

Crop	Value Added Multiplier
Alfalfa	0.66
Vegetables	0.89

Tables 5 and 6 provide a summary of the estimated economic impacts to Lyon County resulting from the Pilot Project. The results indicate that Lyon County will experience an increase in total value of agricultural production of \$4.4 to \$4.8 million. In addition, the Pilot Project will add between 8 and 13 jobs over employment prior to the acquisition of the property by the Program. Total value added was estimated to increase by \$4.1 to \$4.4 million. This represents approximately 4% of the total county gross revenue product (GRP) associated with crop and animal production and a small fraction of the county's total GRP of \$1.3 billion.

¹⁰ This study uses the estimated annual economic impacts for onions to represent all vegetable crops.

¹¹ It should be noted that the 2009 Bartholet study does not report the gross revenues assumed for each crop. This analysis assumes that they are identical to the crop revenues report in the 2008 University of Nevada crop budgets.



Table 5. Pilot Project Compared to “Actual” Baseline

Crop	Net Change (Acres)	Total Crop Revenues	Employment (jobs)	Value Added
Alfalfa	-569	-\$484,294	-5.69	-\$321,031
Pasture	-620	-\$74,366	-6.20	-\$49,296
Vegetables	318	\$4,724,907	25.75	\$4,192,523
Total	-871	\$4,166,247	13.87	\$3,822,196

Table 6. Pilot Project Compared to “Potential” Baseline

Crop	Net Change (Acres)	Total Crop Revenues	Employment (jobs)	Value Added
Alfalfa	-1,066	-\$871,371	-10.66	-\$577,619
Pasture	-620	-\$74,366	-6.20	-\$49,296
Vegetables	318	\$4,724,907	25.75	\$4,192,523
Total	-1,367	\$3,779,169	8.90	\$3,565,608



Summary

During 2010 and 2011, the Walker Program acquired approximately 2,000 water-righted acres in Mason Valley associated with two properties. The properties had been in irrigated alfalfa and pasture production for many years prior to the acquisitions. In 2012, the Walker Program sold at market value and conveyed approximately 358 acres of the property and previously acquired primary groundwater rights to a local agricultural producer to measure the economic effects associated with its conversion from hay production to the production of high valued, organic vegetable crops (organic onions and leafy greens). This analysis provides an estimate of the economic effects of the pilot project on the Lyon County economy.

A portion of the acquired properties experienced relatively low management intensity prior to the Program's acquisition. As a result, alfalfa production and inputs were likely lower than they had been historically. For comparison purposes, two baselines were developed – one reflecting the agricultural production conditions as they existed in the years prior to the Program's acquisition; the other reflecting the potential alfalfa and pasture production should the land and water be managed more intensely.

The resulting economic analysis indicates that the conversion from alfalfa to organic vegetable production significantly benefits the regional economy through increased value of production and sales, and increased local employment. The total annual value of crop production is estimated to increase between \$3.8 and \$4.2 million while the value added will generate an additional \$3.6 and \$3.8 million in local sales, reflecting the significant crop inputs and post-harvest activities associated with vegetable production. Overall employment is estimated to increase by approximately 9 to 14 jobs, not including seasonal harvest labor.

The results indicate that one acre in organic vegetable production provides the equivalent economic value of 12 to 13 acres of alfalfa hay to the Lyon County economy as measured by employment and value added. This suggests that there is a large potential for the Program to mitigate for the economic effects associated with retirement of alfalfa hay and pasture ground through supporting the conversion of a relatively small land area to organic vegetable production. More intense crop management within a smaller geographic footprint will also generate environmental benefits through reduced overall water use and higher inflows to Walker Lake. While not quantified in this analysis, the conversion of idled farmland from private to public use creates additional economic benefits in Lyon County due to expanded recreation-based tourism and associated spending. Further, Program expenditures on the revegetation of idled cropland results in increased economic activity and employment in the region.

A major focus of opposition to programs that transfer water away from agriculture to alternative uses (e.g. environment, municipal) is the potential for the loss of income and employment within the regional economy. This study demonstrated that the conversion from traditional crops (alfalfa) to a smaller area of higher valued alternative crops can benefit the regional economy and offset the economic impacts associated with agricultural to environmental water right transfers. Facilitating an increase in the pace and scale of similar crop conversions provides an opportunity for the Walker Program to benefit the Lyon County economy and achieve its objective of improving habitat conditions in Walker Lake. Additional research would be necessary to identify the most efficient path toward scaling up the opportunity and



understanding potential limiting factors such as market limits for organic vegetables and the availability of suitable land and primary groundwater rights to support the transition.

