

# DOI 2012 Assessment of Potential Changes to Real Estate Resulting from Dam Removal: Klamath Secretarial Determination Regarding Potential Removal of the Lower Four Dams on the Klamath River: DOI 2012

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## ***I. Introduction and Background:***

This study is in support of the Secretarial Determination on the removal of four dams on the Klamath River and related restoration activities in the Klamath basin. The four dams are Copco I, Copco II, J.C. Boyle and Iron Gate. Lands under these reservoirs and adjacent lands associated with the hydroelectric project and owned by PacifiCorp are to be transferred to the states of Oregon and California or an entity yet to be determined. Lands adjacent to Keno Dam presently owned by PacifiCorp are to be transferred to the Department of Interior to support the continued operation of the Keno dam and impoundment. All of these lands are described in the Klamath Hydroelectric Settlement Agreement (KHSA) as Parcel B lands and represent approximately 8000 acres of property owned by PacifiCorp. These lands are to be managed for public interest purposes such as fish and wildlife habitat restoration, public education, and public recreational purposes as outlined in section 7.6.4 of the KHSA. Lands adjacent to Keno Impoundment are intended to support the continued operation of Keno Impoundment for the Klamath Project.

Adjacent to Copco 1 Reservoir and in the vicinity of all four reservoirs are private lands, some of which have primary or secondary residences constructed on them. There are also lands administered by various state and federal agencies in the vicinity of all four dams. Drawdown of the reservoir areas is expected to alter the hydrology of the Klamath River and impact lands immediately adjacent to the reservoirs or downstream.

Amongst the considerations regarding dam removal is the effect on real estate. Real estate issues are varied and fall into a number of categories for discussion. These categories include:

- Lands being transferred to the States, including lands currently inundated by the reservoirs
- Lands needed in support of the project
- Adjacent private lands that may be affected by the project

## ***II. Purpose:***

The purpose of this real estate report is to present to the Secretary the potential impacts and liabilities of an affirmative decision to remove the dams real estate including affected categories of land.

## ***III. Lands being transferred to the States:***

A. The KHSA stipulates that the States of California and Oregon will take ownership of certain lands of PacifiCorp, including formerly inundated lands, and manage them for the benefit of the public. The States or a designated third party approved by the signatories to the KHSA may accept ownership. While the

intent of the KHSA (section 7.6.4) is that these lands would be managed for the benefit of the public, it provides an option to allow for other uses based on agreement by the settlement parties. At the date of this report, neither Oregon nor California has developed specific management plans.

B. The disposition of PacifiCorp structures (houses) on lands near Iron Gate and Copco Reservoirs is unknown at this time. PacifiCorp has provided an inventory but no details about size or condition were included in the inventory. As more information becomes available the State of California will make a determination regarding their plans for the structures upon transfer to the State.

#### ***IV. Lands needed in support of the project include:***

##### **Temporary use of access roads for construction and staging areas:**

1. Access routes identified for use during construction are on PacifiCorp lands, lands managed by BLM or within FERC project boundaries. The same is true for construction and staging areas.
2. Currently existing public roads will be used for removal of metal and other construction waste to landfill sites. All local weight and load restriction will be adhered to. No private roads have been identified for use at this time.

##### **Permanent rights to be acquired**

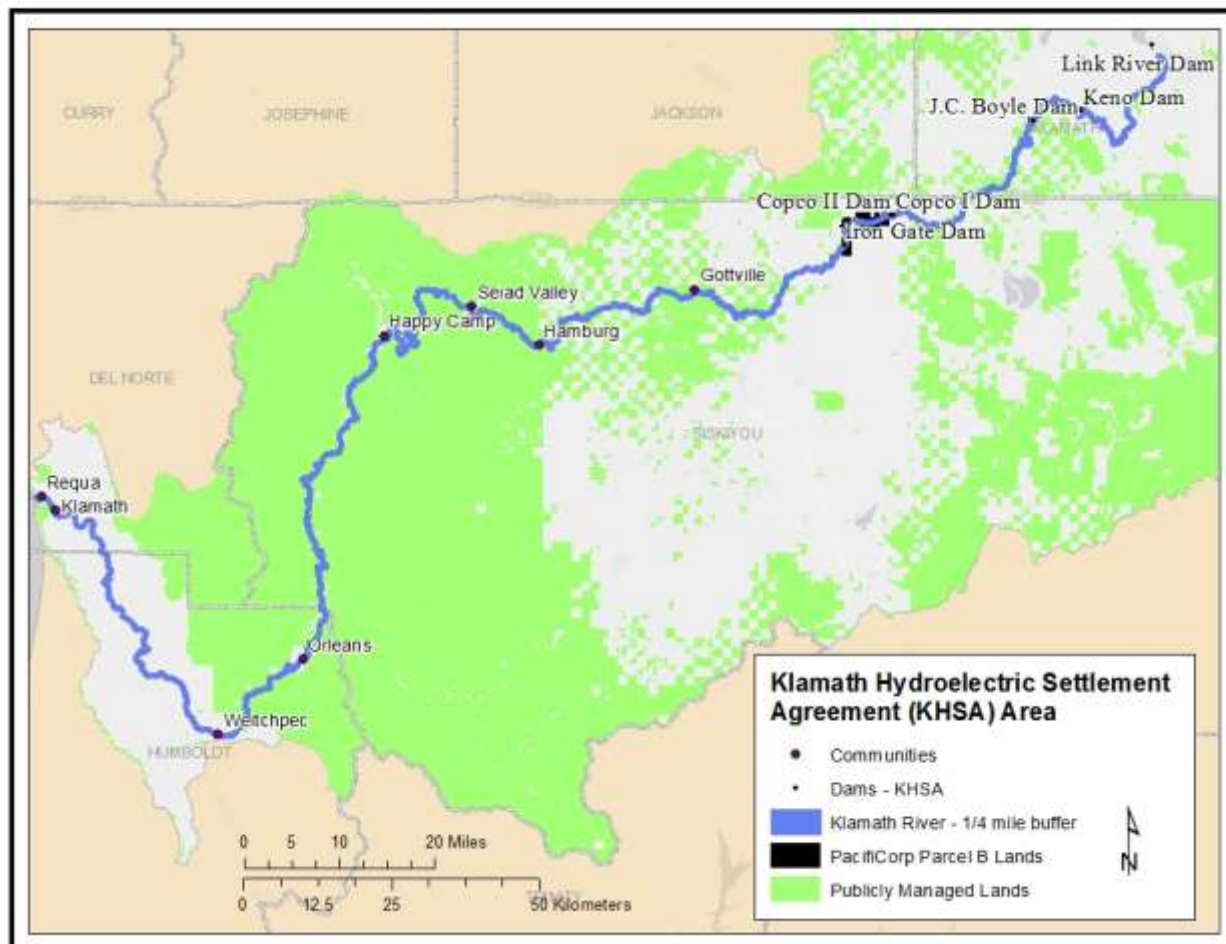
1. Mitigation sites, spoil sites and any lands needed permanently as a result of the project are identified as being located on PacifiCorp lands, lands managed by BLM and adjacent private lands.
2. Permanent rights for lands to support the operation of Keno Dam by Reclamation for Klamath project purposes will be transferred from PacifiCorp to DOI. A description of the real estate to be transferred will be presented in a separate report to be available upon conclusion of negotiations on details of the transfer.

#### ***V. Affected lands***

There are private lands adjacent to or within close proximity to the reservoirs. These are lands with access to or views of the reservoirs and are generally around Copco 1 and Iron Gate reservoirs. Construction of the Copco and Iron Gate dams created reservoirs behind the dams. These reservoirs are open to the general public and have been utilized for recreational purposes (fishing, boating, etc.) for many years. In turn, these recreational uses have led to light residential development of some of the privately held real estate surrounding the reservoirs.

Other affected lands are lands adjacent to the river and downstream of Iron Gate Dam to the estuary for the Klamath River. The Klamath River passes through federally designated wilderness, National Forests, public land managed by the BLM, private lands, and rural tribal reservations for most of its course downstream of Iron Gate Dam. There are several unincorporated communities downstream of Iron Gate Dam such as Happy Camp, Hamburg, Seiad Valley, Gottville, Orleans, Weitchpec, Klamath, and Requa. Within a one-quarter mile buffer of the Klamath River downstream from Iron Gate Dam to the Estuary, there are approximately 40,500 acres of open space and public lands, 15,600 acres of

agricultural lands, 290 acres of residential uses (of various densities), 24 acres of tribal reservation lands, 2,478 acres of urban reserve<sup>1</sup>, and 26 acres of commercial use. In addition, the entire Klamath River is designated a wild and scenic river downstream of Iron Gate.



### A. Case studies on effects to property values

Appendix A contains a review of previously completed reports and studies on the effects to real estate of dam removal. The purpose of this literature review was to attempt to locate and review documents and studies which have examined the impacts of dam removal on private property values. By reviewing the conclusions of the previous studies it was hoped it would be possible to draw parallels with the potential impacts that removal of the four Klamath River dams could have

<sup>1</sup> The following communities have been designated “Urban Reserve” in their county’s General Plans to accommodate future growth: Orleans, Humboldt County at RM 48; Weitchpec, Humboldt County at RM 43; Klamath Glen, Del Norte County at RM 6; Requa, Del Norte County located 0.75 miles north of RM 1.25; Requa, Del Norte County located 0.75 miles north of Estuary (General Plans – Land Use [computer file]. Sacramento, CA: California Resources Agency/ University of California, Davis, 2004.)

on the value of private property around Iron Gate and Copco Reservoirs.

As described in Battelle, 2007, *Economic Support for the Elwha River Watershed: Final Economic Characterization Report with Monitoring Recommendations*, “the economic costs associated with dam removal are complex and difficult to define.” These case studies point out this complexity and illustrate the challenge of forecasting impacts on property values in other situations, however similar.

Factors identified as important to consider in a property value analysis include background conditions and trends in the property market study area that can impact values outside of dam removal. Forecasts and studies of changes in property value after dam removal cannot be examined in a vacuum, but must incorporate previous and ongoing market trends. Additionally, the results of analysis of impacts to private property values following dam removal can vary greatly depending on the geographical location of the dams and private property. Indeed, while it is not an easy or straightforward task to monetize the impacts of environmental outcomes, the case studies described below have drawn some applicable conclusions that should be used to inform the impact analysis of the KHSAs.

An additional literature review was done in 2012 to ascertain whether or not a relationship could be found between impacts to private property values due to the effects of wildfire and wildfire risk (Appendix B). Given the lack of conclusive studies available on the effects of dam removal on private property values it was hoped that this literature review could provide some additional useful insight.

#### ***Conclusions from Case Studies:***

The overall conclusion from the evidence presented in the literature is that dam removal has complex and varied effects (both environmentally and socioeconomically) that are, in part, dictated by local circumstances and ongoing background economic trends (Doyle, 2000; Born et al., 1998). The majority of previous studies on the impacts of dam removals on private property values were done on small dams with small impoundments and several authors note the general lack of data and studies about property value impacts (Provencher, et al., 2006; Pennsylvania Organization for Watersheds and Rivers, no date). Some of the factors that make it challenging to predict the impacts of dam removal on property values include:

- The existence of several different frameworks that can be used to study the economic impacts of dam removal (Battelle, 2007);
- Property values are determined by local conditions such as water quality or the desirability of living near a certain city/town (Bohlen and Lewis, 2008; Lewis, et al., 2008);
- The presence of multiple stakeholders with differing priorities for the watershed/river (Doyle, 2000); and,
- The condition and future use/ownership of lands that are exposed following the drawdown of reservoirs (Kruse and Scholtz, 2006; Provencher et al., 2006, Kruse and Ahman, 2009).

In terms of the direct impacts to private property values, some studies reported increases in value following dam removal (i.e. Bohlen and Lewis, 2008; Born et al., 1998). Increases in value were generally related to improvements in water quality, removal of dam structures, and the

enhancement of the natural riparian environment. Other studies described private property values decreasing briefly and regaining value by the end of two years (Kruse and Scholz, 2006). These studies should be interpreted with some caution due to the small size of the impoundments. It is questionable whether this conclusion should be extended to large impoundments where activities such as fishing, boating, and swimming are popular (Provencher et al., 2006).

Kruse and Ahmann (2009) is the only study to model the effects of lot size and proximity to the Klamath River, Copco 1 and Iron Gate reservoirs on private residential property values. The study concluded that lake adjacency does have a positive and significant impact on residential property values and that, all things being equal, properties on a lake, with lake proximity or a lake view are worth more than properties without these characteristics. The authors also attempted to look at property value impacts associated with river frontage, however, there was an insufficient sample size to estimate any positive effect associated with river front properties adjacent to the Klamath River downstream of Iron Gate Dam.

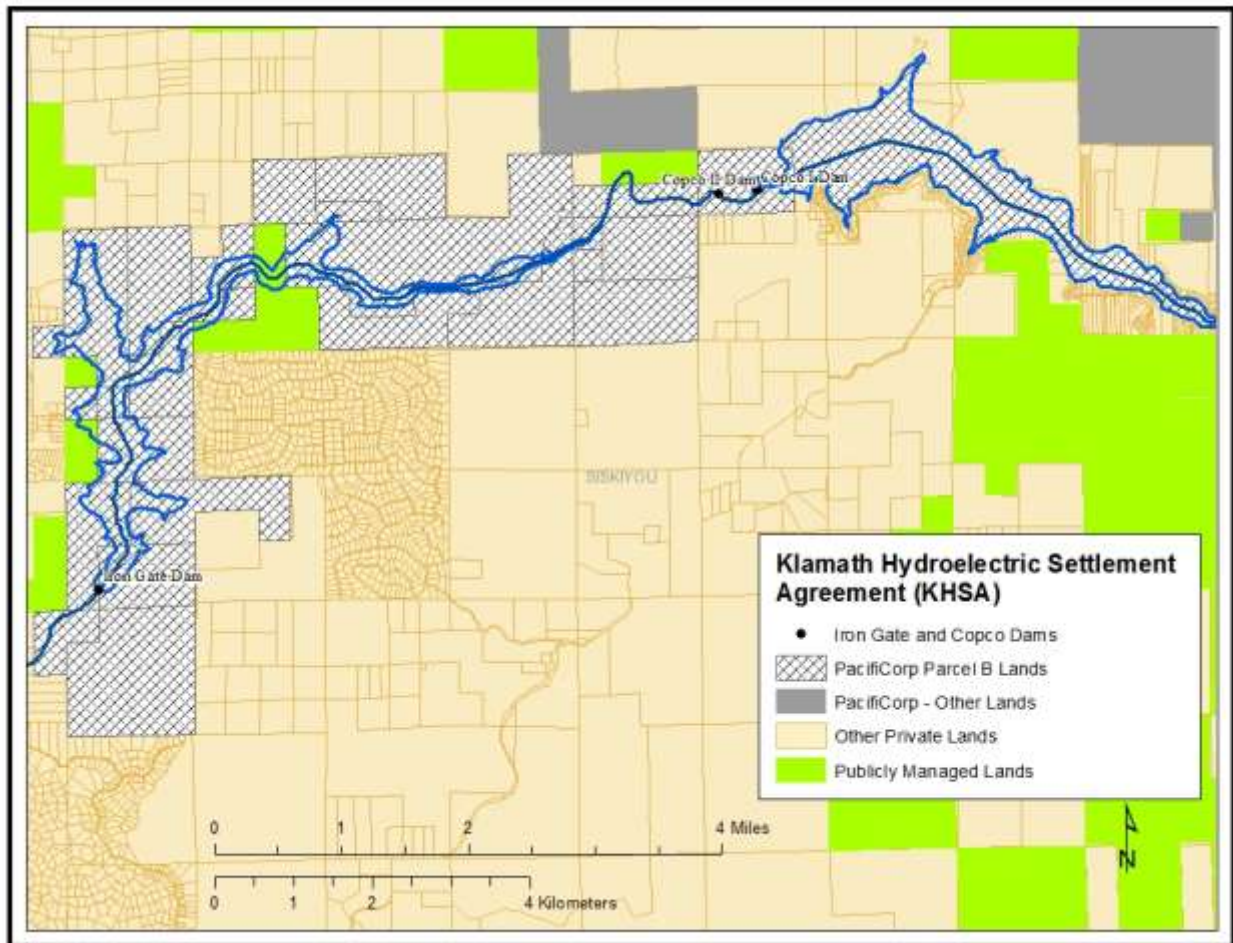
The review of studies on wildfire and wildfire risk did not provide any information pertinent to the effects on property values with dam removal. Dam removal represents a fundamental change in the landscape from a lake to eventually a restored upland and riparian landscape. Wildfire is a change in the vegetation of a landscape that is expected to recover over time to the same or a similar vegetative community. The risk of wildfire is a risk not only to the existing vegetation for the area, but also a risk to property. Most of the wildfire studies focus on this risk and the perception of that risk. This is not the situation with the proposed action of dam removal and reservoir drawdown.

## **B. *Dam removal real estate evaluation reports***

### ***Introduction***

The Klamath Hydroelectric Settlement Agreement specifies that further appropriate studies were to be completed to inform the Secretary of Interior's decision on whether or not to remove the four dams on the Klamath River. Recognizing the need to identify and understand the affects dam removal would have on private property values around Copco 1 and Iron Gate reservoirs a property value impact study titled *Dam Removal Real Estate Evaluation Report for U.S. Department of the Interior March 2011* was completed. This report was supplemented in 2012 with the *Dam Removal Real Estate Evaluation Report for U.S. Department of the Interior, June 2012*. (referred to jointly as the *Real Estate Evaluation Report*)

Construction of the Copco and Iron Gate dams created reservoirs behind the dams. These reservoirs are open to the general public and have been utilized for recreational purposes (fishing, boating, etc.) for many years. In turn, these recreational uses have led to light residential development of some of the privately held real estate surrounding the reservoirs. Thus, the purpose of the *Real Estate Evaluation Report* was to study the potential impacts on the aggregate values of the surrounding real estate and the Siskiyou County tax roll from potential draining and closing of the reservoirs if the dams are removed.



The *Real Estate Evaluation Report* studied the impact of dam removal on land values and not effects on any improvement component of real property interest. In accordance with established appraisal theory, view and locational attributes are associated with the land component of the real property interest and not the improvement component. Therefore it was determined that it was not necessary to analyze the entire house/lot component but rather only the land component of the impacted parcels to assess the impact of the dam removal on the affected parcels

**Methodology**

The *Real Estate Evaluation Report* studied private properties potentially impacted by the proposed dam removal. These potentially impacted parcels (PIPs) were identified as being influenced by the dams and their reservoirs. As part of the study, the project team investigated the population, industry, and services of Siskiyou County and the smaller community areas in order to determine the type of markets affecting the study area. General information was gathered on parcels included in the study in relation to access, topography, and views of the area reservoirs.

Overall, there is limited development on the lands considered for property value impacts. Of the PIPs, 88 percent have land use indicating that the parcel is undeveloped (vacant), and twelve

percent have land use indicating development (land is improved based on assessed value). Many of the parcels in the area are not ideal for building and are used by their owners as camping sites.

An initial list of 1,467 PIPs was generated based on location, views, and potential impacts from dam removal. Parcels excluded from the study included public lands, PacifiCorp-owned lands, or parcels without assessed values. The PIPs were classified based on their location at Iron Gate or Copco, reservoir frontage/access, reservoir view, no view, land use, lot size, and accessibility (both vehicular access and availability of utilities). From this initial list of PIPs, the impacted parcels which continued on for analysis of impacts were derived based on the Hypothetical Conditions made in the *Real Estate Evaluation Report*. These conditions included the following assumptions:

- The reservoir water in the “after” condition will recede to the center of the historical river foot-print, thus resulting in most reservoir frontage parcels in the “before” condition becoming river view parcels in the “after” condition. Reservoir views in the “before” condition will have no view in the “after” condition, due to water receding to the center of the canyon foot-print; and,
- The river in the “after” condition will have similar public access as the reservoirs have in the “before” condition but not necessarily the same use (i.e. boating and water skiing). Access to the river is assumed to be similar over public land and accessible to all in the “after” condition.

Based on the Hypothetical Conditions listed above, a final list of 668 parcels was analyzed for impacts to property value. This group of impacted parcels consists of parcels with views of Iron Gate Reservoir and parcels with views or frontage/access to Copco I in the “before” condition. The value of these properties was deemed to be negatively affected as a result of dam removal.

The 668 impacted parcels were separated into categories based on the parcel riparian influence, access, and finally by parcel size. For each category the median parcel size was used to create an aggregate value for the whole category. The categories of parcels include;

Iron Gate Partial Reservoir View;

Copco Partial Reservoir View; and

Copco Reservoir Frontage/Access.

### ***Description of Potentially Impacted Lands***

The Siskiyou County Assessor’s land use classifications were used to classify the list of the 668 impacted parcels. Table V-1 Land Use Breakdown summarizes these land uses.



**Table V-1. Land Use Breakdown**

Land Use	No. of Impacted Parcels
Vacant Commercial	2
Commercial	5
Rural (20 acre min.)	3
Vacant Rural Land (20 acre min.)	13
Single Family Residence	127
Vacant Residential Land	518
<b>Total Parcels</b>	<b>668</b>

The appeal of the Iron Gate and Copco reservoir areas is mainly for recreation. Many of the parcels in the area are not appropriate for building, but are used by their owners for camping and fishing. The following table V-2 Single Family Homes on Copco and Iron Gate indicates that less than one-third of the single family homes in the area are occupied by primary residents based on LandVision.

**Table V-2 Single Family Homes on Copco and Iron Gate**

	Single Family Residence	Homeowner Exemption	Percent Primary Residents
Partial View of Copco Reservoir	40	11	28%
Partial View of Iron Gate Reservoir	13	5	38%
Copco Reservoir Frontage/Access	74	23	31%
Total	127	39	31%

Around Iron Gate Reservoir, most land fronting the reservoir is owned by PacifiCorp with a few parcels under public ownership. No properties with reservoir frontage are owned by private parties. Most of the impacted parcels in the Iron Gate neighborhood are located within the Iron Gate Lake Estates development, established in the 1980s. While there are some parcels with full views of the reservoir, the majority have only partial views or no view. Properties with views of the reservoir are located on a ridge and have steep and sloping lots, thus limiting the site utility. Outside of the Iron Gate Lake Estates, impacted parcels are characterized by partial to no views and steep terrain.

In the Copco Reservoir neighborhood, there are impacted parcels fronting the reservoir. While owners who have property fronting the reservoir at Copco Reservoir in the “before” condition may lose the ability to fish directly from their property in the “after” condition, the assumption was made that public access in the “after” condition will be similar to existing access; therefore, these activities will continue on the river. Most of these sites are located along the southern shore on Patricia Avenue and Ager-Beswick Road. Some of the properties fronting the reservoir are on relatively level parcels, thus having higher site utility. Most, however, are elevated from the lakeshore and have steep terrain limiting site utility.

**Market Conditions**

Market conditions for Siskiyou County for 2004 were found to be increasing until about 2006. These market conditions are considered in the analysis of potential impacts to private property values include the declining trend in property values experienced in Siskiyou County beginning in 2007. This county-wide value trend can be seen in the Siskiyou County tax roll which shows the rate of growth in the county expanding through the 2006-2007 tax roll and then contracting to the rate beginning in 2007-2008, with a negative rate for the 2010 year. This is also demonstrated in the median values of real estate sold in Siskiyou County which peaked at \$240,000 in 2006 and declined to \$165,000 in 2009.

**Table V-3 depicts the total assessed values for Real Property in Siskiyou County from 1998 to 2010. This information was provided by Siskiyou County.**

Tax Year	Total Tax Roll \$\$	% Diff. - Prior Year	Real Property \$\$	% Diff. - Prior Year
2010-11	4,340,595,136	-0.50%	4,135,339,161	-0.35%
2009-10	4,362,231,744	2.43%	4,149,813,901	2.59%
2008-09	4,258,731,629	6.94%	4,045,175,610	7.20%
2007-08	3,982,342,899	7.91%	3,773,418,849	8.34%
2006-07	3,690,452,593	10.32%	3,482,877,333	10.51%
2005-06	3,345,175,983	8.53%	3,151,659,202	8.51%
2004-05	3,082,139,619	5.92%	2,904,376,159	7.03%
2003-04	2,909,863,166	5.23%	2,713,619,092	5.54%
2002-03	2,765,363,015	6.15%	2,571,062,331	5.95%
2001-02	2,605,213,194	5.21%	2,426,731,651	5.69%
2000-01	2,476,280,505	3.53%	2,296,021,743	4.74%
1999-2000	2,391,924,942	3.72%	2,192,132,200	3.32%
1998-99	2,306,143,541	1.99%	2,121,666,045	2.70%

**Summary of Findings**

Historically, property sales around Iron Gate and Copco Reservoirs have been slow due to the remoteness of the location as well as the lack of good building sites and affordable utility connections. The remote location of this area is recognized in the market by lower prices than for lands in the Lake Shastina area. Lot values had increased from 2004 and 2006 with stable to

slightly increasing values into 2008. Generally prices began declining in 2008 with steep declines in 2009. This is similar to market conditions throughout California following collapse of the financial market.

There are two different sale markets for Iron Gate and Copco Reservoirs. The Copco market had been superior even though the typical lot size is approximately one third the size of lots in the vicinity of Iron Gate (0.94 acres compared to 2.70 acres). At Iron Gate, no parcels physically touch the reservoir. Parcels around Iron Gate have distant views of the reservoir or no views at all. Parcels with views of the reservoir have fair access via unpaved roads and limited access to utilities. Parcels in the vicinity of Copco Reservoir typically are close to or on the shore of the reservoir. They generally have average access over paved roads and access to utilities.

The study identified several categories of adjustments based on the location of the parcels or site characteristics. These are:

- Differential for increasing site size of the base per acres size – 36 percent all years
- Discount for fair access versus average access by road or utilities – 50 percent all years
- Discount for river view (after condition) from reservoir frontage (before condition) – 25 percent all years
- Discount for no view (after condition) from reservoir view (before condition) – 35 percent for 2006 and 2008, 45 percent for 2004.

The size differential was used to adjust the valuation estimates for the separate groups of impacted parcels. The discount for fair access compared to average access was applied to parcels associated with Iron Gate and some parcels associated with Copco. These are view of Iron Gate Reservoir with fair access, view of Copco Reservoir, and frontage on Copco Reservoir.

The data supports a diminution in value resulting from a change from reservoir frontage or reservoir view and no view. The following Table (Table V-4) summarizes the value before and after dam removal as well as the change in value due to dam removal for each of the three years analyzed.

**Table V-4 Real Property Value Changes After Dam Removal**

Reservoir		# of Parcels	Aggregate Value 2004		Aggregate Value 2006		Aggregate Value 2008	
			Before \$	After \$	Before \$	After	Before	After
Copco	Waterfront & Avg. Access	190	\$3,471,080	\$2,603,310	\$3,791,040	\$2,843,280	\$4,118,000	\$3,088,500
Copco	Waterfront & Fair Access	16	\$620,875	\$465,656	\$681,625	\$511,219	\$741,616	\$556,212
Copco	View & Avg. Access	241	\$1,176,400	\$647,172	\$1,645,200	\$1,069,380	\$1,711,000	\$1,112,410
Copco	View & Fair Access	9	\$60,000	\$33,000	\$95,500	\$63,075	\$100,000	\$65,000
Iron Gate	View & Fair Access	212	\$1,470,560	\$808,808	\$2,197,865	\$1,428,612	\$2,336,000	\$1,518,400
<b>Grand Total</b>		<b>668</b>	<b>\$6,798,915</b>	<b>\$4,557,946</b>	<b>\$8,411,230</b>	<b>\$5,915,566</b>	<b>\$9,006,616</b>	<b>\$5,340,522</b>

The Real Estate Evaluation Report concluded a total value decrease after dam removal for all impacted parcels in the areas around Iron Gate and Copco Reservoirs of approximately 2.7 million dollars. This represents a 30 percent decrease in land values for the impacted parcels. Table V-6 summarizes the aggregate market impact upon removal of the dams. The value after dam removal is compared to the 2008 tax roll (the aggregate sum of land only for the impacted parcels).

The Real Estate Evaluation Report also concluded that properties with fair access and without a view of Iron Gate Reservoir had a 35 percent discount compared to similar properties with a view in 2006 and 2008. This differential was found to be 45 percent for the 2004 base year. Fair access refers to properties on unpaved roads and limited access to power lines. Fair access properties had a discount of up to 50 percent compared to properties with average access.

With very limited data for sales with reservoir frontage at Copco Reservoir, the report concluded that conversion from reservoir frontage to river view would have a discount of 25 percent.

**Table V-5. Aggregate Market Impact**

Year	“Before” Value Aggregate	“After” Value Aggregate	Difference	Percent Difference
<b>2004</b>	\$6,785,415	\$4,552,997	\$2,232,418	32.90%
<b>2006</b>	\$8,411,230	\$5,914,566	\$2,496,664	29.68%
<b>2008</b>	\$9,006,616	\$6,340,522	\$2,666,094	29.60%

The impact to the Siskiyou County tax roll for the affected parcels is lower than the aggregate difference of the market values because of the influence of Proposition 13. Table V-6 summarizes the impact to the Siskiyou County tax roll.

**Table V-6. Impact to Siskiyou County, Iron Gate and Copco Impacted Parcels Tax Roll (Land Value)**

<b>Siskiyou County Assessed Land Value and Impacted Parcel 2008</b>	<b>“After” Value Aggregate</b>	<b>Difference</b>	<b>Percent Difference</b>	<b>Percent of Siskiyou County 2008 Tax Roll</b>
\$8,750,030	\$6,350,7850	\$2,219,245	26%	0.001%

**Note:** Six of the 668 impacted parcel APNs were not represented in the 2008 tax roll, most likely due to parcel number change.

The value after dam removal (Table V-6 Impact to Siskiyou County Tax Roll (Land Value)) is compared to the 2008 tax roll (the aggregate sum of land only for the impacted parcels). The \$2.22 million impact to the Siskiyou County tax roll represents less than 1/10<sup>th</sup> of 1 percent of the total 2008 tax roll.

***Proposition 13 Impact on Analysis***

The difference between the values in Tables V-5 and V-6 is a direct result of lower assessed land values relative to market values due to Proposition 13. The property tax system in California was amended in 1978 by Article XIII to the State Constitution, commonly referred to as Proposition 13. It provides for a limitation on property taxes and for a procedure to establish the current taxable value of real property by reference to a base year value, which is then modified annually to reflect inflation (if any). Annual increases cannot exceed 2 percent per year.

The base year was set at 1975-1976 or any year thereafter in which the property is substantially improved or changes ownership. When either of these two conditions occurs, the property is to be re-appraised at market value. This value then becomes the new base year assessed value. Proposition 13 also limits the maximum tax rate to 1 percent of the value of the property, exclusive of bonds and supplemental assessments. Bonded indebtedness approved prior to 1978, and any bonds subsequently approved by a two-thirds vote of the district in which the property is located, can be added to the 1 percent tax rate. Properties that have been under the same ownership for several years are typically assessed below current market values.

***C. Potential effect on property values in the Klamath basin due to improved water reliability***

Among the outcomes anticipated from implementation of the KBRA is an expectation of increased reliability of water deliveries to farmers and ranchers for irrigation. This potentially could translate into increases in property values. There are numerous other factors that could affect values such as completion of the Klamath Basin water rights adjudication process and larger regional and national

economic influences outside the scope and influence of the KBRA. Therefore, potential increases in property values for agricultural lands will not be addressed in this report.

#### ***D. Potential effect on properties values downriver of Iron Gate Dam***

Results of studies and reports (Bohlen 2008, Leggett 1998, revised 1999) conclude an increase in property value for properties adjacent to rivers where dams are removed and water quality is improved. Dam removal is expected to reduce or eliminate many of the effects of poor water quality in the river such as extensive algae mats, odors and algal toxins. Presently, there is not enough comparative data and the timeframe for actual improvement is too far in the future to quantify effects. However, increases in value for downstream properties adjacent to the river can be expected as anticipated improvements in water quality are realized.

#### ***E. Landowner docks***

Removal of the dams at Copco and Iron Gate Reservoirs would result in the transformation of the reservoirs to a free-flowing river and riparian environment. This would result in numerous and varied effects, one of which is related to existing docks on Iron Gate and Copco Reservoirs. In total, there are approximately 75 existing docks on these two reservoirs, with approximately nine docks located on Iron Gate Reservoir and 64 docks located on Copco Reservoir (Howison, 2010a)<sup>2</sup>.

The docks around Iron Gate are owned by PacifiCorp and are used for company operations as well as recreation. The docks closest to the dam are used for PacifiCorp operations while the remaining docks in the northern portion of the reservoir are part of the recreation facilities for the public (Howison, 2010a). Docks located on Copco Reservoir are connected to the private development extending around the reservoir.

Currently, there are no active permits in affect for any of these docks. While PacifiCorp issued some permits in the early 1980s, they allowed all of the dock permits to expire in the mid-1990s while they were in the process of developing a comprehensive dock policy (Howison, 2010a; Howison, 2010b). In addition to expired dock permits, some of the docks were never issued permits from PacifiCorp (Howison, 2010b).

Since allowing the Klamath dock permits to expire, PacifiCorp has been working on a shoreline management plan and dock policy (Howison, 2010b). Dependent on the outcome of the Secretarial Determination on the Klamath Hydroelectric Settlement Agreement (KHSA), it is PacifiCorp's intent to re-permit the docks on Copco and Iron Gate Reservoirs pursuant to a Federal Energy Regulatory Commission (FERC) approved shoreline management plan and dock policy. However,

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<sup>2</sup> The number and location of docks at the two reservoirs is based on email and telephone conversations with Russ Howison (Hydro Resources, PacifiCorp Energy) as well as a Real Estate Management Lease Abstract (File Number: CA SI-0016-A Copco Lake Dock Permits) supplied by Mr. Howison.

until a FERC-approved policy is developed, PacifiCorp has no definitive plans to bring the existing docks under new permits (Howison, 2010b).

Siskiyou County requires a building permit for a dock, and PacifiCorp indicated that the permits must be renewed if a new license is issued for the Klamath Hydroelectric Project. It is unknown whether the existing docks meet current building codes in the county; therefore, the owners may be subject to costs for corrective measures, unrelated to the potential for dam removal, associated with the docks during any potential future re-permitting process.

The docks under private ownership around Copco Lake are a specialized improvement built specifically to take advantage of the reservoir frontage. The specific value of the docks is speculative to determine at the current time given the re-permitting required for the docks and potential corrective measures to meet building code. The docks would contribute no value to properties if the dams are removed.

### ***References***

Howison, Russ. 2010a. Hydro Resources Group, PacifiCorp Energy. Email communications with Alexandra Kleyman, Environmental Planner, CDM. August 27 and August 30, 2010.

Howison, Russ, 2010b. Hydro Resources Group, PacifiCorp Energy. Phone communication with Alexandra Kleyman, Environmental Planner, CDM. August 27, 2010.

### ***F. Erosion along shoreline of Copco I reservoir***

Portions of the shoreline along Copco 1 may be subject to sloughing or erosion and could be affected by drawdown of water levels for dam removal. Design features have been built into the drawdown plan including the speed at which drawdown would occur to eliminate or minimize erosion.

### ***G. Undesirable conditions during reservoir restoration***

Effects from conditions before restoration of the reservoirs is complete such as odors from drying reservoir sediments, invasive weeds, and windblown sediment are undesirable for adjacent landowners, recreationists and others. Plans to minimize the effects are outlined in the Reservoir Restoration Plan found at Reclamation (2011). Reservoir Area Management Plan for the Secretary's Determination on Klamath River Dam Removal and Basin Restoration, Technical Report No. SRH-2011-19. Prepared for Mid-Pacific Region, U.S. Bureau of Reclamation, Technical Service Center, Denver, Co (Reclamation, 2011a) and the Detailed Plan for Dam Removal – Klamath River Dams (Reclamation, 2011b).

## ***H. Floodplain information downstream of Iron Gate dam***

The full removal of the four dams is expected to have some effects on the Klamath River flood plain downstream of Iron Gate Dam (river mile 190) to about the community of Happy Camp (river mile 105). The PacifiCorp dams were not designed for nor are they operated for flood control purposes. During high flow periods such as a 100 year flood event, the dams provide very little attenuation of the flood flows. They do however serve to attenuate and slow the timing of peak flows. Private lands adjacent to the river could be affected by a change in flood flows. The hydrology section of Reclamation's study of hydrology and sediment transport (Reclamation, 2011c) describes the modeling effort to identify these risks and the structures that may be affected. With dam removal, it is estimated that some 49 structures could be at risk of flooding. Not all of these are permanent structures. Both Klamath County, Oregon and Siskiyou County, California participate in the National Flood Insurance Program (NIF) of FEMA. Under this program, the counties can be expected to submit an application for revision of the flood inundation areas shown in the current FEMA map series to reflect the changes in flood hydrology with removal of the dams. The risk from flooding is further described in the hydrology section of this report.



## *Appendix A – Effects of dam removal on adjacent property values*

### **Literature Review: Impacts to Private Property Values after Dam Removal**

#### *Introduction:*

As described in Battelle, 2007, *Economic Support for the Elwha River Watershed: Final Economic Characterization Report with Monitoring Recommendations*, “the economic costs associated with dam removal are complex and difficult to define.” The documents reviewed in this literature review point to this complexity and illustrate the challenge of forecasting impacts on property values.

Factors that are important to consider in a property value analysis include background conditions and trends in the property market study area that impact values outside of dam removal. For example, in the Elwha River case study area these conditions and trends included the ex-urbanization of Seattle, increases in the retired population, and the decline of the timber industry (Battell 2007). Each of these had impacts on property values in the Elwha River study area; however, it is necessary to separate out background conditions and influences on property values from the impacts of dam removal and changes to property in close proximity to reservoirs. Forecasts and studies of changes in property value after dam removal cannot be examined in a vacuum, but must incorporate previous and ongoing market trends. Additionally, the varied case studies presented below point to the fact that analysis of impacts to private property values following dam removal can vary greatly depending on the geographical location of the dams/private property.

Indeed, it is not an easy or straightforward task to monetize the impacts of environmental outcomes; however, the case studies described below have drawn some applicable conclusions that should be used to inform the impact analysis of the KHSAs.

#### *Methodology:*

The purpose of this literature review was to locate and review documents and studies examining the impacts that dam removal may have on private property values and to relate conclusions of previous studies to removal of the four Klamath River dams and potential impacts to the value of private property around Iron Gate and Copco Reservoirs.

The search included articles and documents provided by the Real Estate Sub-Team as well as documents available through a variety of internet search engines. In addition, the following sub-team agencies and organizations were contacted for information and sources analyzing the varied impacts of previous dam removals:

- The United States Bureau of Land Management;
- The Department of the Interior National Business Center;
- The California Department of Fish and Game;
- The United States Bureau of Reclamation;
- The National Oceanic and Atmospheric Administration;
- The River Management Society

When inquiries began to produce redundant results the searching phase ended and evaluation of the materials began. The materials reviewed on the effects of dam removal totaled 27 articles and studies. The reports and studies reviewed provided information on over 40 years of dam removal, including: the removal of approximately 44 dams in Michigan; the 1999 removal of the Edwards Dam on the Kennebec River in Maine; the removal of dams between 1993 and 2002 in south-central Wisconsin; the removal of the Saeltzer Dam on

Clear Creek in California; the removal of Mussers Dam on the Middle Creek in Pennsylvania; and, the removal of the Elwha Dam on the Elwha River on the Olympic Peninsula in the State of Washington.

It is important to note that, in addition to examining the potential impacts to private property values from dam removal, the articles reviewed for this research analyzed numerous potential effects that can result during and after dam removal. Some of these other effects include issues related to:

- The cost of dam removal and economic impacts on the surrounding areas;
- Future ownership of reclaimed land following dam removal;
- Future access to the stream/river compared to lake access with the dams;
- Improved water quality following dam removal;
- Lake bottom and flood plain restoration following dam removal;
- The need to dispose of contaminated sediments;
- Potential impacts on the water table and corresponding effects on nearby wells;
- The loss of hydropower;
- Potential impacts on recreation resources including fishing, canoeing and kayaking.

All of these issues listed above have the potential to result in economic impacts to the surrounding communities as a result of dam removal. However, the impacts focused on for this analysis included only a direct discussion of impacts on adjacent property values. Other economic impacts are analyzed both in different technical reports for the Secretarial Overview Determination Report and in the Klamath Facilities Removal Environmental Impact Statement/Environmental Impact Report.

Several of the articles reviewed included some discussion relating to property values, but most provided no empirical data or specific conclusions about impacts to private property values.

#### Relevant Dam Removal Case Studies:

Thirteen of the articles found in this literature review discuss the impacts to private property values following dam removal. This section presents these articles and a summary of their approach and main conclusions related to private property values:

#### **1. Battelle, 2007. *Economic Support for the Elwha River Watershed: Final Economic Characterization Report with Monitoring Recommendations*. Prepared for the Coastal Services Center National Oceanic and Atmospheric Administration. August 15, 2007.**

The purpose of this document was to examine guidance for carrying out a study of the economic impacts from dam removal and provide a framework to establish the economic baseline for Clallam County (location of Elwha Dam). From their literature review, the authors conclude that the economic costs associated with dam removal are complex and difficult to define. In addition, there are numerous methods recommended by various federal agencies for evaluating economic impacts including benefit-cost analysis, cost effectiveness analysis, economic impact analysis, and equity assessments. The authors determined that the appropriate framework for their study is the economic impact analysis framework advanced by the U.S. Environmental Protection Agency (USEPA). They described that this approach offers a more thorough assessment of the economic impacts of dam removal on the local community and addresses questions relating to who benefits and who bears project-related costs.

In addition to the complexity of calculating the economic impacts of dam removal, this report describes that the vast majority of the discussion of the economic benefits of dam removal is focused on small dams. The reason for this is that of the 500 dams removed in the last 100 years in the United State, the majority have been small dams. Small dams are defined as a dam for which the removal decision and undertaking can be

entirely handled by local entities.

Besides this description of approaches to economic analyses and the complexity of drawing conclusions related to the impact of dam removal on private property values, this article did not draw direct conclusions about the potential impacts of the Elwha Dam removal on private property values.

**2. U.S. Department of the Interior, U.S. Bureau of Reclamation. 2008. *Evaluation and Determination of Potential Liability Associated with the Decommissioning and Removal of four Hydroelectric Dams on the Klamath River*. Prepared by Camp Dresser and McKee**

The report found that there could be a loss of property values as a result of dam removal. The potential property value loss and PacifiCorp property reimbursement has the potential to equal \$13 million to \$27 million. In addition, the report concluded that real estate values could drop in certain areas such as Copco Reservoir where owners “will lose access to a major amenity.” This report was completed prior to the signing of the KHSA and before the disposition of PacifiCorp lands was known.

**3. Bohlen, Curtis and Lynne Y. Lewis. 2008. *Examining the Economic Impacts of Hydropower Dams on Property Values Using GIS*. *Journal of Environmental Management* (2008): 1-12.**

The authors examined the effects of dams along the Penobscot River in Maine on residential property values, and compared property value findings from the study of the Edwards Dam removal (removed in 1999).

Their results are summarized below:

a. Kennebec River Study:

- i. Found a penalty for living close to a dam site, which has declined since Edwards Dam was removed. Results suggest that removal of Edwards Dam increased the value of nearby properties.

b. Penobscot River Study:

- i. Did not find strong evidence that proximity to dams per se along the Penobscot acts as a dis-amenity, but removal of the dams might still increase property values if removal contributed to restoration of rivers.
- ii. Found a negative relationship between proximity to the Penobscot River and housing prices. Maine’s rivers were often badly polluted, smelled bad in the summer, and offered few recreational opportunities.

**4. Born, Stephen, et al. 1998. *Socioeconomic and Institutional Dimensions of Dam Removals: The Wisconsin Experience*. *Environmental Management* 22(3): 359-370.**

The authors describe that while substantial study is being given to the environmental aspects of dam removal, very little attention has been given to the socioeconomic and institutional dimensions associated with removal of dams. These factors play a critical role in the dam removal decision-making process. The

authors studied 14 previous dam removals to understand the decision-making process leading up to dam removal and the socioeconomic impacts following dam removal.

The authors state the following in relation to the impacts to private property values:

- a. Shoreland owners generally seem to believe that their property is worth more as “lakefront” than as “river-frontage,” although there is little information to support or refute such perceptions.
- b. The Michigan Department of Natural Resources has studied property value changes along the AuSable River and reports that “river frontage was at least equal to, if not more valuable than, the original lake or reservoir frontage.”

The authors do not make any specific conclusions of their own in terms of the impacts dam removal has on private property values. Instead, their findings point to the fact that states should consider more inclusive decision-making processes when determining whether to repair or remove dams. Their findings point to the fact that some communities were able to “capitalize on their ‘new’ free-flowing river following dam removal.” These types of benefits were gained through expanded recreation, economic opportunities, and riverway parks. Given the potential for these economic benefits from dam removals, the authors conclude that there is a greater need for open communication and information sharing with stakeholders concerning the value of free-flowing rivers and river restoration.

**5. Doyle, Martin W., et al. 2000. Dam Removal: Physical, Biological, and Societal Considerations. American Society of Civil Engineers Joint Conference on Water Resources Engineering and Water Resources Planning and Management, Minneapolis, MN, July 30-August 2, 2000.**

This article presents the current-day focus on river restoration and the fact that dams throughout the country continue to pose a significant challenge to restoring riparian ecosystems. The authors examine the historical and regulatory context of dam removal, physical, ecological, and societal considerations in dam removal.

The authors describe that (as quoted in Schmidt et al. 1998), “effective environmental restoration, in addition to being based on sound science, must be based on a clear definition of the value of riverine resources to society. Further, the authors state that “societal values as they relate to dams and reservoirs add a further complication “ to discussions of the scientific foundation for dam removal.

The authors conclude that calculating the impact on land values from dam removal is difficult to quantify in cost-benefit analyses, which often drive dam removal. Some complicating factors to quantifying impacts to land values can include:1) the historical value that the local community places on dams (many of which were built prior to 1900), and 2) the fact that riparian landowners and businesses often purchase land based on the presence of the reservoir and thus high water levels. As a result of these complex issues and the divergent values that different groups place on dams and dam removal, the authors conclude that property value can change dramatically when dams are removed. Moreover, these changes can either be positive or negative.

**6. Kruse, S. A. and Scholz, A. J., 2006. Preliminary Economic Assessment of Dam Removal: The Klamath River. January 31.**

This article refers to previous studies conducted in Wisconsin (Sarakinos and Johnson, 2002, *Social Perspectives on Dam Removal*) which examined the impacts to property values due to changing from “lake front” to “river front” property. These studies found that adjacent property values either remained constant or decreased briefly, but regained their entire value by the end of two years. One study concluded that property values may actually increase after a dam removal if there are improvements in water quality, river ecosystem restoration and/or new or improved recreational activities.

Another potential effect that the authors examine is the use and ownership of exposed lands after dam removal. They describe four main findings:

- i. Conversion of the land to a park or conservation easement would provide non-market benefits to society and would mitigate the negative impacts of dam removal on property values.
- ii. Transfer of the land to the county or private lake-front property owners would help mitigate lost property value and/or the associated property taxes.
- iii. Lakeside property owners unable to purchase exposed land between their current property line and the new river channel (distance of a quarter to half a mile) would lose both their lake frontage and river view/access. Loss of water access would likely lead to a decline in property values.
- iv. Owners without current lake-front properties, but with existing lake views may experience a decrease in property values.

The report generally concludes that there could be a negative impact to property values because of the loss of lake view and uncertainty over property rights of land under reservoirs.

**7. Leggett, C. G. and Bockstael, N. E., 1998 (revised 1999). *Evidence of the Effects of Water Quality on Residential Land Prices*. *Journal of Environmental Economics and Management* 39, 121-144 (2000).**

This study uses hedonic techniques to show that water quality has a significant effect on property values along the Chesapeake Bay. The study looked at levels of fecal coliform bacteria from various sources and found that waterfront homeowners have a positive willingness to pay for reductions in fecal coliform concentrations and improvements in water quality. While fecal coliform bacteria is not a concern for water quality in the Klamath River, the findings from this study suggest that there is a possibility for similar increases in property values as water quality improves in the river.

**8. Lewis, L. Y., Bohlen, C., and Wilson, S., 2008. *Dams, Dam Removal, and River Restoration: A Hedonic Property Value Analysis*. Paper submitted to the *Journal of Contemporary Economic Policy*. November 2006.**

The authors examined the effect of the removal of the Edwards Dam on the Kennebec River in Maine through consumers’ marginal willingness to pay to be close to or distant from the dam site. Data from both before and after the dam was removed are used to estimate changes in marginal prices. A similar data set is also utilized to look at the effects of the remaining upstream dams on property values. The authors also

examine the effects of other environmental variables such as the river itself, and other amenities such as open space. The report describes that while there are limitations to the uses of hedonic models, they are useful because they allow us to determine whether or not environmental variables are reflected in the housing market. This study looked at homes and home value, not just land value.

The removal of the Edwards Dam represented the first time a functioning hydropower facility, undergoing relicensing under the U.S. Federal Energy Regulatory Commission (FERC) was removed with the goal of restoring aquatic ecosystems.

The three dams examined are (1) the Edwards dam which was removed in 1999, located in Augusta (2) the Fort Halifax Dam, a dam at the mouth of the Sebasticook River where it meets the Kennebec located in Winslow, and (3) the Lockwood Dam, a dam on the main stem of the Kennebec between Waterville and Winslow.

The findings of this study show that being closer to the river close to the dam site confers negative value – property values are smaller as they are closer to the dam, which means closer to the river. The dam was found to be the driving factor. Residents were willing to pay more to be further from the dam before it was removed. After the dam was removed, the willingness to pay to be further away from the former dam site shrinks dramatically. Removal of the Edwards Dam resulted in improvements in conditions near the old Dam site. An alternative hypothesis is that a long-term improvement in conditions along the river led to more willingness to pay to be near it (or not as much of a difference between willingness to pay to be away from dam/river and being near dam/river once the dam is removed).

Contrary to the findings that may be expected, this paper documents an apparent penalty for being near the river in both the Augusta and Waterville real estate markets. As the authors describe, typically, proximity to water is highly valued by homeowners, leading to higher real estate values close to aquatic resources. The Maine case is somewhat different since proximity to the river and dams meant proximity to downtown Waterville and Augusta, which, prior to dam removal, were relatively undesirable locations.

The authors found that following dam removal and the continuing increases in water quality that came with the closure of industrial facilities along the river, property values increased close to the river. Long-term trends such as these have been influencing conditions along the river for decades. Thus, increases in property values are likely due to long-term trends in water quality and urban revitalization initiatives undertaken by the cities in addition to dam removal.

## **9. National Park Service, Rivers, Trails, and Conservation Assistance Program, 2001. *Economic Benefits of Conserved Rivers: An Annotated Bibliography*. June 2001.**

This bibliography examined articles and studies reporting on several factors related to dam removal: floodplain management; instream flow; adjacent property value; general value to the public; recreation and tourism; removal of unsafe/obsolete dams; water quality; and, wildlife, habitat, and riparian issues. For the purposes of this report for the SDOR, the focus was on articles related to adjacent property value.

While the articles included in this bibliography focus on the numerous potential benefits afforded by rivers, they are included here for the purpose of examining potential long-term impacts under a dams out scenario along the Klamath River.

- A. Epp, D.J., & Al-Ani, K.S., 1979. *The Effect of Water Quality on Rural Non-farm Residential Property Values*. American Journal of Agriculture and Economics, 61 (3), 529-534. This article concluded that improvements in water quality have positive correlation with economic value of

adjacent properties.

B. Kulshreshtha, S.N., & Gillies, J.A., 1993. *Economic Evaluation of Aesthetic Amenities: A Case Study of River View*. Water Resources Bulletin, 29 (2), 257-266. Looks at aesthetic amenities provided by rivers. Two major areas in which greater aesthetic amenities provide greater value are ownership of property and rental of private property. Aesthetic amenities provided by the river accounted for approximately 10 percent of the annual economic contribution the river makes to the city.

C. Leefers, L., & Jones, D.M., 1996. *Assessing Changes in Private Property Values Along Designated Natural Rivers in Michigan*. Lansing, MI: Michigan State University, Department of Forestry. This comprehensive study examines property values and selling prices along areas with 'Natural River' designation in Michigan. The results reveal that property values and selling prices are indeed higher along areas with 'Natural River' designation. The study details the procedures used as well as the methods for data evaluation.

**10. Pennsylvania Organization for Watersheds and Rivers. No date. *Small Dam Removal in Pennsylvania: Free-Flowing Watershed Restoration*. Watershed Fact Pack. Prepared by Sara Nicholas, American Rivers available at <http://pawatersheds.org/wp-content/uploads/2009/04/damremoval.pdf>.**

The report describes that there is very little factual information available to determine whether property values will be reduced following dam removal. The report cites studies of dam removal completed in Wisconsin showing that property values stayed the same following dam removal. The Wisconsin studies did find that there was a slight decline in property values of homes located several blocks from the impoundment because residents lost their lake view.

**11. Provencher, B., Sarakinos, H., and Meyer, T., 2006. *Does Small Dam Removal Affect Local Property Values? An Empirical Analysis*. Agricultural and Applied Economics, Staff Paper Series No. 501. July, 2006.**

This study used a hedonic analysis to examine the impacts on property value in the context of the presence/absence of a dam and the distance between a property and the impoundment. Hedonic analysis applies statistical techniques to market data to determine the relative contribution to property values of the various properties attributes. The study includes small impoundments (surface area: 8-194 acres; maximum depth 5-15 feet).

The authors examined single family residential properties within ¼ mile of a water body and analyzed impacts to land improvements in addition to property values. The analysis included market sales data over the period 1993-2002 for three types of sites in south-central Wisconsin: 1) those where a small dam remains intact, 2) those where a small dam was recently removed, and 3) those where a river or stream has been free-flowing for more than 20 years. Examination of these three types of sites made it possible to separately identify the relative effect on property values of an intact small dam/impoundment.

This study also supports the conclusion that there is a gap of data and analysis concerning the impacts of dam removal on private property values. The authors' study represents one of the first formal investigations if the effect of dam removal on local property values.

The authors describe that "frequently, property owners who view their property as 'lake' frontage rather than 'river' frontage fear that the value of their property will decline with the loss of the dam and its

associated impoundment (as cited in Born, et al. 1998). However, the primary conclusions that emerge from the data are that residential property located in the vicinity of a free-flowing stream is more valuable than identical property in the vicinity of a small impoundment, and that shoreline frontage along small impoundments confers no increase in residential property value compared to frontage along free-flowing streams. Further, the study concluded that removing a dam does little harm to property values in the short run (2 years in the study), and serves to increase property values in the long run, as the stream and associated riparian zone matures to a “natural” free-flowing state, or is managed as a desirable open space.

The authors note that their results should be interpreted with some caution due to the fact the price premium conferred by free-flowing rivers on residential property compared to impounded waters is likely due to the small size of the impoundments at their study sites.

It is questionable whether this conclusion should be extended to large impoundments where such activities as fishing, boating, and swimming are especially attractive.

One question that the analysis does not completely answer is the effect of dam removal on shoreline properties. If these properties retain their frontage, then the results indicate that at least in the long run (after the waterway gains the appearance of a “free-flowing” stream) there is no *frontage-specific* significant change in property price, except for the increase associated with the expansion of the lot size. In the case that properties lose their frontage as the impoundment waters recede to the original contours of the stream, then the relevant issue is what occupies the land formerly submerged in water. The authors describe that if the riverside is developed into a public open space area, this can result in increases in housing and property values.

**12. Sarakinos H and Johnson SE. 2003. "Social Perspectives on Dam Removal". In: *Dam Removal Research: Status and Prospects*. The H. John Heinz Center for Science, Economics and the Environment: Washington, DC.**

The authors cite previously conducted studies in Wisconsin which found that riparian property values after dam removal either remained unchanged or decreased temporarily. After two years, these values rebounded. Ten years after removal, property values were no lower than before removal.

**13. American Rivers and Trout Unlimited. 2002. *Exploring Dam Removal: A Decision Making Guide*. August 2002.**

This study reports that it has generally been observed that property adjacent to a lake or river is more valuable than property farther away from the water. If a lake is drained, then it is possible that properties near the lake would decline in value. Property values farther from the lake would likely not be affected.

The authors describe the following examples of property value effects after dam removal:

- a. Woolen Mills Dam, Milwaukee River, Wisconsin: Exposed land was made into a city park and has raised property values.
- b. Indianford Dam, Lake Koshkonong, Wisconsin: Predicted property value decrease of approximately \$23,000,000 around the impoundment. This decrease was based on the property values around the current impoundment compared with those off the impoundment and the number of properties expected to lose waterfront. It did not consider the numerous other factors that influence property values.



**14. Sarah A. Kruse and Josh Ahman. 2009. *The Value of Lake Adjacency: A Hedonic Pricing Analysis on the Klamath River, California*. Ecotrust Working Paper Series 5, Portland Oregon. 2009**

This study used an hedonic pricing analysis to estimate the current value of varying levels of lake proximity, including: lake frontage, lake proximity, and lake view. The study area included properties located on and around a stretch of the Klamath River west of Iron Gate Dam, properties around Iron Gate Reservoir (there is no waterfront) and properties on or adjacent to Copco Reservoir. Comparisons were made between properties with waterfront and with; view of reservoir, view of river, and no view of either. Based on sales data between 1998 and 2006, the hedonic model indicated that properties with water frontage on Copco I Reservoir have significantly increased property values of 107 percent. Removal of the reservoirs would reduce the value for properties with water frontage by approximately 52 percent. For properties across the road from Copco I, property values could be reduced by approximately 40 percent. Removal of Iron Gate and Copco Dams would eliminate views of the reservoirs. Properties with current view of either reservoir are expected to have reduced property values of about 21 percent. The sample size was not sufficient for any clear effect on property values for adjacency to the Klamath River. The study recognized that it could not address what the effects on property values would be after the transition from inundated reservoirs to approximately 2000 acres of new land with a different set of environmental values.

**Summary of Dam Removal Case Studies:**

The overall conclusion from the evidence presented in the literature is that dam removal has complex and varied effects (both environmentally and socioeconomically) that are, in part, dictated by local circumstances and ongoing background economic trends (Doyle, 2000; Born et al., 1998). The majority of previous studies on the impacts of dam removals on private property values were done on small dams with small reservoirs, and several authors note the general lack of data and studies about property value impacts (Provencher, et al., 2006; Pennsylvania Organization for Watersheds and Rivers, n.d.). Some of the factors that make it challenging to predict the impacts of dam removal on property values include:

- The existence of several different frameworks that can be used to study the economic impacts of dam removal (Battelle, 2007);
- Property values are determined by local conditions such as water quality or the desirability of living near a certain city/town (Bohlen and Lewis, 2008; Lewis, et al., 2008);
- The presence of multiple stakeholders with differing priorities for the watershed/river (Doyle, 2000); and,
- The condition and future use/ownership of lands that are exposed following the drawdown of reservoirs (Kruse and Scholtz, 2006; Provencher et al., 2006).

In terms of the direct impacts to private property values, some studies reported increases in value following dam removal (i.e. Bohlen and Lewis, 2008; Born et al., 1998). Increases in value were generally related to improvements in water quality, removal of dam structures, and enhancement of the natural riparian environment. Other studies described private property values decreasing briefly and regaining value by the end of two years (Kruse and Scholz, 2006). These studies should be interpreted with some caution due to the small size of the impoundments. It is questionable whether this conclusion should be extended to large impoundments where activities such as fishing, boating, and swimming are popular (Provencher et al., 2006). Beginning immediately down stream of Iron Gate Reservoir (river mile 190), water quality is expected to improve with the removal of the dams. While this improvement can be expected to reach to the mouth of the Klamath River, the greatest improvement is expected immediately downstream of Iron Gate Dam to the Seiad Valley (river mile 130).

The 2009 study by Kruse and Ahman indicated that proximity to Iron Gate and Copco reservoirs significantly increases the value of adjacent properties. It concluded that removal of the dams and drawdown of the reservoirs are expected to:

- Reduce the value of properties with lake frontage by approximately 52 percent at Copco I Reservoir
- Reduce the value of properties across the street from the reservoir by approximately 40 percent.
- Reduce the value of properties with a view of Copco or Iron Gate Reservoirs by approximately 21 percent.
- The effect of a view of the Klamath River on property values could not be quantified by the study but had a positive effect on property values.

With dam removal, the inundated lands will be revegetated with upland and riparian vegetation and are expected to remain as publicly accessible open space. The effect of this change in amenity values over time is uncertain.

## *Appendix B – Effects of wildfire on adjacent property values*

### **Literature Review: Impacts to Private Property Values after Dam Removal**

#### Introduction

In 2012, it became apparent that the review of existing literature in dam removal was not revealing any clear conclusions. An additional literature review was then done to identify any relationships that could be identified from studies on the effects of wildfire and wildfire risk on property values. The thought was that a landscape scale disturbance such as wildfire and its impacts on property values could perhaps provide some insight on a landscape change such as the return of large reservoirs to a riverine environment. The literature review served to point out the dissimilarities between the affects on private property values from dam removal versus wildfire. This review of studies on wildfire and wildfire risk did not provide any useful information on the effects on property values with dam removal. Dam removal represents a fundamental change in the landscape from a lake to eventually a restored upland and riparian landscape. Wildfire is a change in the vegetation of a landscape that is expected to recover over time to the same or a similar vegetation community. Additionally, the risk of wildfire is a risk not only to the existing vegetation for the area, but also a significant risk to property. Most of the wildfire studies focus on this risk and the perception of that risk. This is not the situation with the proposed action of dam removal and reservoir drawdown.

The following section summarizes the available literature on wildfire impacts relevant to private property values.

#### *Wildfire Case Studies:*

Ten articles found in this literature review discuss the impacts to private property values from direct wildfire impacts and the risk of wildfire impacts. This section presents these articles and a summary of their approach and main conclusions related to private property values:

**1. Donovan, Geoffrey, H.; Donovan, P. A.; and, Butry, D. T. 2007. *Wildfire Risk and Housing Prices: A Case Study from Colorado Springs*. *Land Economics*, May 2007. 83 (2): 217-233.**

This research article looks at the effect of increased knowledge of wildfire risk on home prices. Specifically, the authors examined 3 questions: 1) Do parcel-level wildfire risk ratings affect housing prices in a wildland-urban interface area?; 2) If there is an effect, is it similar to the effect of a wildfire event on housing prices?; 3) Are there tradeoffs between wildfire risk factors and natural amenity values?

At the time of the study, Colorado Springs was a city of 361,000. The city is located on the front range of the Rocky Mountains, approximately 70 miles south of Denver. The study area covered 45 square miles on the western edge of the city along the border of the Pike National Forest. In 2000, the Colorado Springs Fire Department began a project to rate the wildfire risk of 35,000 parcels in the wildland-urban interface, and to make the information available on a website. For each parcel, up to 25 variables were used to calculate an overall wildfire risk rating (low, medium, high, very high, or extreme). Four variables were mainly responsible for determining a parcel's wildfire risk rating: construction material (roof and siding), proximity to dangerous topography, vegetation density around the house, and the average slope of the surrounding area.

Data on house sales and housing and neighborhood characteristics were obtained from El Paso County and

consist of 9,903 home sales between January 1, 1998 and September 21, 2004. Of these, 6,787 sold pre-website, and 3,116 sold post-website. The typical house in the study was 27 years old, had 7.8 rooms, 3.5 bedrooms, 2.9 bathrooms, was 1,970 square feet, and had a 16,000 square foot lot.

The study used the hedonic price method to estimate the effect of wildfire risk on residential property prices. The hedonic price method is used to value an attribute or a change in an attribute when the attribute's value is capitalized into the price of an asset, such as houses. This method offers benefits because it provides a way to overcome problems from omitted variables and self-selection bias.

### ***Summary of Findings***

The authors found that pre-website, positive amenity values (such as densely wooded lots) outweighed the negative effect of wildfire risk on housing price. However, post-website, the results of the models suggest that the positive amenity values were offset by the increased wildfire risk associated with such parcels. The authors found that the total price of a representative house declined post-website. For example, the price of a pre-website house was \$290,000, while the price of a post-website house was \$250,000. They also found that, by comparing sales between July 2002 and July 2003 to those in July 2003 and September 2004 the effect of increased awareness of wildfire risk through the website campaign decreased over time. The authors admit that this finding is for a relatively short time period.

This study is different from the two main types of studies that examine the effect of natural disasters on housing prices: those evaluating the effect of natural hazard risk on house price and those that examine the effect on house price before and after a natural disaster occurs. This study examined whether an educational campaign can have the same effect as a natural disaster. Results indicate that the educational campaign and the increased awareness of wildfire risk had the same qualitative effect – a more negative effect of risk on house price, which diminishes over time.

## **2. Loomis, John. 2004. *Do nearby forest fires cause a reduction in residential property values?* Journal of Forest Economics. 10 (2004) 149-157.**

This study examines risk perception and its impact on the demand for houses in high amenity and high hazard natural areas. The overall question the author addresses is whether the occurrence of natural disasters, such as forest fires, result in an information feedback by which homeowners reduce their demand for houses in high hazard (and high amenity) areas. If this was the case, then after natural disasters occurred, the reduced desirability of living in what was revealed to be a more hazardous location should be reflected in the housing market.

The author used linear and semi-log hedonic property models to identify a statistically significant decrease in property values in a town that was 2 miles from the Buffalo Creek fire, a major wildfire in May 1996 that burned 12,000 acres, and destroyed 10 houses. The study town of Pine did not directly experience the fire, but rather was near the town of Buffalo Creek in Jefferson County, Colorado that has similar vegetation and topography to Pine. The study question was whether the wildfire in the nearby town of Buffalo Creek results in the homeowners in the unburned town of Pine updating their risk of forest fire or not. House sales data was collected for three years prior to the fire (1993-1996), and five years after the fire from Jefferson County, Colorado. This resulted in over 500 observations, with 307 observations, an average of 44 sales per year, following the fire. The data includes 134 observations, averaging 38 sales per year, following the fire. While houses in the town of Pine were not directly affected by the fire or post-fire flooding, residents of Pine amenity levels could have been reduced due to the presence of burned trees in the area in which they commute or recreate. Therefore, the author explains, both an increase in perceived risk and reduced amenity levels could be operating in the study to reduce property values in the unburned town of Pine.

### ***Summary of Findings***

The house price drop in the unburned community was about 15 percent or approximately \$17,095 per house (linear model). The semi-log model estimated a similar loss of \$18,519 per house or 16 percent of the house price. This suggests that home buyers and sellers appear to revise upward their perceptions of fire risk after a major fire as well possibly reflecting some loss in forest amenity value in the broader geographic area surrounding the unburned town. These factors combine to reduce the desirability of living in the forest, reducing house prices.

### **3. Stetler M., Kyle; Venn, T. J.; and, Calkin, D. E. 2010. *The effects of wildfire and environmental amenities on property values in northwest Montana, USA. Ecological Economics, 69: 2233-2243.***

This study used the hedonic price framework to examine the effects of 256 wildfires and environmental amenities on home values in northwest Montana between June 1996 and January 2007. The study area comprised Flathead, Lake, Sanders, and Lincoln Counties, and the northern portion of Missoula County. These counties are located in the northern Rocky Mountains of northwest Montana. The entire study area covered 4 million hectares and included three national forests, five wilderness areas, and one national park.

The authors point out one of the main complexities of valuing homes in the wildland urban interface and determining the impacts of wildfire. Home prices in the wildland urban interface are “a function of many property, neighborhood, and environmental amenities (e.g. recreation opportunities, and aesthetically pleasing vistas), that may be enhanced or diminished by wildfire” (Stetler et al. 2010).

House sale prices, structural and neighborhood characteristics for 18,785 transactions in the study area over the period of June 1996 to January 2007 were acquired from the Northwest Montana Association of Realtors, a multiple listing service (MLS) group. The data set excluded private transactions not made through a realtor. The MLS data included information about the number of bedrooms and bathrooms, square footage of the house, type of garage, age and style of the home, lot size, type of waterfront access, asking price, sold price, and list and sold date.

### ***Summary of Findings***

The study revealed environmental amenities, including proximity to lakes, national forests, Glacier National Park and golf courses, have large positive effects on property values in northwest Montana. However, proximity to and view of wildfire burned areas has had large and persistent negative effects on home values. Sales price data in the study area is also influenced by the background context of the boom in the housing market in that location from 2002 to the first quarter of 2007.

The hedonic models in the study revealed that wildfire had a dramatic effect on home sale prices in northwest Montana. Specifically, sale prices within 5 km of a wildfire burned area were 13.7 percent (\$33,232) lower than equivalent homes at least 20 km from a fire. Sale prices of homes between 5 km and 10 km from a wilderness burned area were 7.6 percent (\$18,924) lower than equivalent homes at least 20 km from a fire. Sale prices of homes between 10 km and 15 km, and 15 km and 20 km from the nearest wildfire burned area were not statistically significantly different from homes greater than 20 km from a previously burned area. Additionally, having a view of a wildfire burned area decreased the mean sale price of a home by \$6,610 relative to a home without a view of a burned area. The analysis supports an argument that homebuyers may correlate proximity to and view of a wildfire burned area with increased wildfire risk. Also, the data show that proximity to a large wildfire (defined as impacting greater than 1,000 acres) negatively affects homebuyer willingness to pay more than proximity to small wildfires.

Overall, the models showed the importance of view of wildfire burned areas on environmental amenity

values and wildfire risk perceptions, as capitalized into home sale price. Negative coefficients all increased for model variables of large fire, 0-5 km from fire and 5-10 km from fire. The study did not find recovery of house sale prices with time within the seven year timeframe of the dataset. This finding suggests that recovery of house sale prices with time since fire in northwest Montana takes considerable time (greater than the maximum period of seven years post fire examined in this study. This finding is consistent with house sale price trends found in Loomis 2004. A small increase in house sale price with time since fire was projected for homes without a view of the wildfire. This result suggests that properties without views of burned areas increase in value at a faster rate than homes with views of burned areas.

### ***Summary of Findings***

The authors concluded that reductions in home sale prices arose from changes in the quality of environmental amenities (e.g. aesthetic and recreation opportunities) and in perceived wildfire risk. Much of the price loss was believed to be associated with increased perception of wildfire risk.

#### **4. Troy, Austin and Romm, J. 2007. *The Effects of Wildfire Disclosure and Occurrence on Property Markets in California. Chapter 6 in Living on the Edge: Economics, Institutional and Management Perspectives on Wildfire Hazard in the Urban Interface: Advances in the Economics of Environmental Resources, Volume 6, 101-119. Elsevier Ltd.***

This chapter looks at the effects on housing prices of fire hazard disclosure in real estate transactions following the 1998 passage of the Natural Hazard Disclosure Law (AB 1195) in California. AB 1195 requires sellers to fill out a form disclosing to potential buyers the location of their residence in a statutory flood, wildfire, or seismic zone.

One of the issues this article points to is the price premium homebuyers pay for living in a wildfire hazard area. This is due to the amenity values placed on the same topography and natural resources which translate into high fire hazards (e.g. steep topography, heavily forested). This study specifically looked at the effects of disclosure under AB 1195, and thus increased awareness of hazard, on property values in wildfire-hazard zones throughout California. The study did not quantify how the housing market responds to different levels of risk of natural hazard, rather it looked at whether increased information and awareness following disclosure under AB1195 had an effect on market behavior and home prices.

The authors sampled zip codes from across the state and individual house sale transaction records from within those zip codes. Data was collected for the period starting 18 months before the implementation of the law in June of 1998 to 19 months after it. The control variables used were similar to many of the other articles cited in this review, and included: property characteristics, locational characteristics, and neighborhood socioeconomic characteristics.

The authors used a hedonic analysis of property transactions to isolate sales price differentials in statutory fire zones before and after passage of AB 1195 to determine how disclosure of increased risk affected prices. The study does not quantify how housing markets respond to different levels of risk, only how disclosure of location in a statutory fire zone affected market behavior.

### ***Summary of Findings***

The authors found a positive price premium of 3% for homes located in a fire zone both before and after disclosure under AB 1195. As noted above, this premium points to the amenity values that homebuyers place on housing in the urban-wildland fringe (where fire hazards are high).

While there was no impact from increased awareness of fire risk alone, the study does find that increased awareness of fire hazard (through disclosure under AB 1195) combined with proximity to a recent wildfire does negatively affect home prices. Specifically, a house selling in a statutory fire zone after passage of AB 1195 that was also within 5 km of a major (greater than 300 acres) and recent (within the last 10 years) fire,

sold for 5.1% less than a comparable fire zone home selling after disclosure was mandated that was not within 5 km of a recent fire. Alternatively, the results of the study indicate that location near a recent fire by itself was not enough to reduce property values. Rather increased awareness through disclosure under AB 1195 was also necessary.

**5. Huggett Jr., R.J.; Murphy, E. A.; and, Holmes, T. P. 2008. *Forest Disturbance Impacts on Residential Property Values. Chapter 11 In T. P. Holmes et al. (Eds.), The Economics of Forest Disturbances: Wildfires, Storms, and Invasive Species, 209-228.***

Similar to Donovan et al. 2007, the authors describe the complex relationship between natural amenities of many natural areas and the risk of disamenity to the household they can represent. The article looks at a set of three wildfires that burned over 180,000 acres in the Wenatchee National Forest in Chelan County, on the east side of the Cascades in central Washington, during the summer of 1994.

Data for the study included residential housing transactions for 1992 through 1996 obtained from the Chelan County Assessor's Office. Data reviewed from federal fire records shows that the three large fires in 1994 comprised the largest fire event recorded over the period covered by the data set of sales transactions. In addition to sales price, the data set included a variety of structural variables including date of sale, date of construction, type of roof, and whether the house included a fireplace, hot tub, garage, carport, patio, or basement. Lot size in acres was also included.

***Summary of Findings***

The results indicate that during the time period of the fire (second half of 1994 to the first half of 1995) general price levels fell by \$16,377, representing a drop of 13 percent to 14 percent of mean price. The authors describe that this finding is between the upper bound of 11 percent in the PricewaterhouseCoopers report (2001) on the Cerro Grande fire and the 15 percent loss that Loomis (2004) found with the Buffalo Creek fire. The price reduction found appears to be short-lived as the price level in the second half of 1995 increased to pre-fire levels. Additionally, the findings revealed the while the fires had no impact on the overall value that households placed on living near the national forest, the value for living near the burned area did fall in the first half of 1995 in response to decreased amenity levels. However, this response was temporary and disappeared after the first six months of 1995. Overall, the results revealed significant post-fire price impacts on the general price level, the valuation of forest amenity, and the valuation of self-protection.

In the case of the Chelan fires, the 421 residential properties that sold in the first half of 1995 experienced a total decline in sales price of almost \$6.9 million compared to a hypothetical sale date in the second half of 1994 assuming all else equal. This figure does not include impacts from decreased amenity values.

**5. Lynch L., Dennis. 2004. *What do Forest Fires Really Cost? Journal of Forestry. 102, 6: 42 – 49.***

The article discusses the Hayman fire, which took place in 2002, and affected four counties within the Pike National Forest in Colorado. One form of economic loss associated with wildfire is the loss of tax revenue to counties for burned dwellings.

***Summary of Findings***

County assessors from the four counties in the Hayman fire (Douglas, Jefferson, Park, and Teller Counties) devised a method of reducing taxes on partially burned properties. They concluded that all properties in burn areas, whether damaged or not, would receive a 10% "stigma adjustment". Properties with low damage received an additional 20% reduction; moderately burned property values were reduced another

40%, and severely burned properties were reduced by an additional 60%. Overall, assessed values were reduced between 10 and 70% for partially burned property.

The author concludes that, in some ways, people who suffered partial damage to their homes may be worse off than those who lost entire structures. For example, many are left surrounded by nuclear winter with lingering smoke odor, blowing ash, and the threat of flash flooding. In addition to the reduction in value of surviving structures, reductions in home values results in property tax revenue losses for the counties. The study found that for the four counties, property tax revenue losses ranged from \$11,638 in Park County to \$312,100 in Jefferson County.

**7. Mission Mortgage of Texas, Inc. Wildfires and Real Estate. September 20, 2011. Accessed online at: <http://missionmortgage.com/wildfires-and-real-estate>**

This source is a summarized overview of the impacts of wildfire on home prices written by a mortgage company in Texas. The article does not present primary data or analysis, but rather offers a professional summary of insights into the effects of fire on home values.

***Summary of Findings***

The article concludes that the most significant impact to the local market happens in the immediate aftermath of the fire. In a case where a large number of homes were partially or completely destroyed, the real estate market immediately following a wildfire will likely experience a lull in sales activity, whether new or resale. Those in the path of destruction are not ready to move forward and will likely have delays associated with insurance claims. Those who were looking in the area before the fires hit are likely to delay their purchase or begin searching elsewhere. Because the natural beauty of the land is so drastically altered after a large wildfire, the desire to move into such an area will decrease, at least in the short term.

If the area contains rental units, those displaced residents will seek new accommodations elsewhere. Because they did not own, they would not have the ability to wait for rebuilding to occur before they find a new place to live. If the area contains owner-occupied structures, insurance delays and the time to rebuild will slow any normal real estate activity. Owners in the area whose homes were up for sale and not damaged by the wildfires will find fewer potential buyers interested in their homes, thus delaying the time for them to sell and move to another location as originally planned.

One of the lingering impacts of a wildfire is on property taxes. While rare, in some instances following a larger fire event, the tax district will reappraise the homes that are destroyed providing a much-needed break to the wildfire victims. However, by reappraising homes at a lower value as the result of a fire, the taxing entity (city, county, school district, etc) would take in less money to provide nearly the same amount of services. The authors note that in these times of tight budgets and looming shortfalls, lowering tax revenue can hurt more people than it helps. Of course, every wildfire has its own unique set of circumstances and decisions of this nature are taken by each location independently. At face value, reappraisal seems like a nice thing to do, but a look at the impact of reappraisal quickly makes it clear how much the taxing entity could suffer as a result. Just from the properties that will not rebuild, the overall tax collections are going to decrease, so reappraising an entire area could have a major impact on government services and budgets going forward.

By some estimates, values of the land could decrease 50% or more. The article describes that this decrease is the result of the visual beauty of an area being destroyed or damaged, and fewer people wanting to reside there, thus bringing values down.

**8. Mueller, Julie; Loomis, J.; and, Gonzalez-Caban, A. 2007. *Do Repeated Wildfires Change***



***Homebuyers' Demand for Homes in High-Risk Areas? A Hedonic Analysis of the Short and Long-Term Effects of Repeated Wildfires on House Prices in Southern California. Journal of Real Estate Finance and Economics. (2009) 38: 155-172.***

While the focus of this article is on the long-term effects on house prices from wildfire occurrences as well as the effect of repeated wildfires, the authors also discuss the impact of natural disaster on the public's perception of risk. The authors note that a lack of information on natural disaster risk may contribute to the public's inaccurate perception of the probability of loss due to natural disasters.

The study area is southern California, where from October 21 to November 3, 2003, there were 14 wildfires in five southern California counties. Over 750,000 acres were burned, and 3,710 homes were destroyed. The authors used the hedonic property method to attempt to understand how the public responds to wildfires. In particular, the question they aimed to answer was: do first wildfires have a different effect than second wildfires on the demand for housing and hence housing prices in high-risk areas? Unlike most hedonic studies that analyze the effects of a one-time event, this paper analyzes the effects of forest fires that are several years apart in a small geographical area.

For their hedonic property model, the authors used the dependent variable of the log of real estate price adjusted by the housing price index for Los Angeles, Riverside, and Orange Counties (1983 base year). Each housing parcel was a single-family residence located within 1.75 miles of a relevant wildfire. All parcels sold at least once between 1989 and 2003. Each wildfire was mapped with a series of quarter mile rings from the fire center, until the 1.75 mile ring from the center. A target of 25 houses for each distance strata and each year was used. The study area was affected by five fires that occurred in the 1990s, and were grouped for this study as follows: the Sylmar and Polk fires; the Sierra and Placerita fires; and, the Towseley fire. All three fire groups were of comparable size – 937 acres, 818 acres, and 977 acres, respectively. To address the temporal effects of wildfires on house prices, a sale date for each house was required. To measure and analyze both the initial and long-term effects of multiple wildfires on house prices, the authors used two different variables to measure the impact after the first fire and after the second fire. They also used time since first fire and time since second fire variables to measure how house prices changed after the initial shock of the wildfires.

The authors describe the inclusion of macroeconomic issues in their model to control for market fluctuations that could shift housing demand unrelated to wildfire effects.

***Summary of Findings***

The authors find that the first fire reduced house prices by 9.71 percent, while the second fire reduced house prices by 22.7 percent, a statistically significant difference. The pattern of these results is robust to several alternative econometric specifications. The drop in prices following the first wildfire was followed by a continued decrease in house price, but the second wildfire caused an initial drop followed by a subsequent increase in house prices. The exact length of time it was found to take for the house price to recover after the second fire depended on the length of time between the first and second fires. The authors graph out the time path for an average-priced house to recover in three possible fire event combinations. They found that it could take between 5 and 7 years for house prices to recover after a second fire. The authors conclude that this timeframe for price recovery seems reasonable based on the presumption that within a few years, the natural vegetation near the house would have regenerated and, if several years pass without a fire, people may begin to forget about the risk of fire.

One explanation that the authors assign to the larger initial decrease in house price caused by second wildfires is that a single wildfire may not be sufficient stimulus to cause homeowners to move, while a second wildfire causes more risk-averse homeowners to move to areas less prone to wildfire. Overall, the

results indicate that demand for houses located near wildfires decreases immediately following each wildfire, and that demand decreases more after repeated wildfires.

**9. Price Waterhouse Coopers. 2001. Economic Study of the Los Alamos Post-Fire Residential Real Estate Market. Final Report published by the Office of Cerro Grande Fire Claims. March 28, 2001.**

This article assesses whether the value of residential property not physically damaged by the Cerro Grande Fire (the Fire) declined as a result of the fire. Specifically, the Office of Cerro Grande Fire Claims (OCGFC) asked PricewaterhouseCoopers to determine whether the fire caused a decline in property values and, if so, which types of properties and which communities or neighborhoods were most affected. The authors used the following four methods to understand what effect, if any, the fire had on Los Alamos County residential real estate values:

1. An examination of descriptive statistics for sales prices, sales volumes, and price per square foot in Los Alamos County;
2. A regression analysis to compare Los Alamos County's pre-fire price trend to its post-Fire price trend;
3. A regression analysis to compare Los Alamos County's post-fire sales price trend to a community similar to Los Alamos, referred to as a comparable community; and
4. An examination of specific post-fire sales in the North Community and Western Area.

The regression analysis was based on data from the Multiple Listing Service (MLS) for residential properties sold in Los Alamos County between January 1, 1996 and January 31, 2001. The analysis controlled for factors, such as age, size and location, which would be expected to influence the sales price of a residence.

***Summary of Findings***

For single-family houses not physically damaged by the fire, the authors found the overall level of diminution attributable to the Cerro Grande Fire to be in the range of 3% to 11%. This result is statistically significant at the 95% level, the standard level of statistical confidence for accepting results of this kind. While the overall diminution is in the range of 3-11%, some properties have likely lost more than 11% in value, and other have likely lost less than 3% in value.

The authors describe that they believe the results presented in this report give a clear picture of the current state of Los Alamos County housing prices and the effects of the fire on those prices. The authors are also careful to note that their results are historical in nature and should not be used for forecasting purposes. As the Los Alamos County housing market adjusts to the after-effects of the fire, the response of the market could change from that presented in this study. Also, additional data available in the future could shed new light on the behavior of the Los Alamos County housing market and could also change the results and conclusions in this report.

**10. Reddy, M. A. 2005. *The Wildfire Season of 2002: How one assessor's office responded to wildfires and the valuation challenges they created.* Fair and Equitable, Magazine of the International Association of Assessing Officers. 3, 9: 9-13; 30-31.**

This article looks at the impacts on property values following major wildfires that took place in Colorado during the summer of 2002. The two largest fires that summer accounted for over 200,000 burned acres – the Hayman fire in central Colorado destroyed 140,000 acres and the Missionary Ridge fire in La Plata County burned 73,000 acres.

The article discusses reductions to property values as well as reductions to improvements. No specific numbers are provided for reductions to property values. As described in more detail below, the authors used specific value reductions for improvements on fire-affected properties. Data used in the article comes from field visits made by the appraisal staff of La Plata County during the course of the fires and immediately afterwards. Once the full extent of the fire was determined through field visits, the assessor's office devised a classification system for describing and quantifying damage to individual properties for valuation purposes.

### ***Summary of Findings***

The author notes that the effect of structure damage on property value was relatively simple to determine since buildings were either completely destroyed or had minor damage that was soon repaired. However, the effect of land damage on value was more complex because of the varying size and configuration of burned areas, the degree of burn intensity, and the collateral effect on the value of the site's structure. The assessor's office determined that tree loss was the best measure of fire impact for valuation purposes. The four basic groups that were determined were no tree loss, limited 0-25 percent tree loss, moderate 26-75 percent tree loss, and extreme 76-100 percent tree loss.

The author describes five factors gleaned from a review of market data from other burned area:

- a) wildfires did create detrimental conditions which had an adverse effect on property values;
- b) larger acreages were not as adversely impacted as smaller acreages with limited building sites;
- c) impact on and recovery of value varies with local market conditions;
- d) offsetting amenities, such as views or river frontage, can lessen the adverse impact on value; and,
- e) not all factors affecting value impact and recovery can be isolated or analyzed.

The author notes that for La Plata County, local market conditions were most significant for informing the analysis of the wildfire impact on value in the county. The county had been experiencing a strong demand for building sites and development property, with a steadily appreciating market. The author describes that the assessor's office developed a policy for determining a reduction in value of fire-affected properties. The reductions were based on the percentage of tree loss in burned areas and the size of the property. Parcels from 1 to 10 acres received the greatest reduction, parcels from 11 to 35 acres received a moderate reduction, and parcels over 35 acres received a limited reduction. The article does not specifically say what the amounts of these reductions were; however, it seems to be a similar valuation approach to that described in Lynch 2004. In order to account for the stigma of vegetation damage on the value of improvements on the property, an additional 10 percent reduction was applied to all structures on fire-affected properties.

The findings in the county for sale prices in early 2003 indicated that the value adjustments made by the assessor's office had been correct. By January 2005, the author describes that there was sufficient sales data to reassess the value adjustments that had been made following the fire. There were a total of 25 sales (eight improved and 15 vacant properties). The sales took place in three different economic areas. A sales ratio analysis comparing the adjusted sales prices for the eight improved properties to the assessor's valuation indicated that the value adjustments for these sales in 2005 were 4 percent below the market. Countywide, the values were 17 percent below the market, and the average of the three economic areas was 14 percent below the market. For the 15 vacant properties, the assessor's office values for sales in early 2005 were 33 percent below market; countywide, 35 percent below market; and, average 31 percent below market.

The results of this article are interesting compared to the rest of the literature studying wildfire impacts on real estate values because they cover both improved and vacant properties. The author describes that the vacant properties that sold were not representative of typical vacant fire-affected properties. Most had offsetting amenities, such as a view or high-demand location, or were located on the fringes of the burn area, which made them more desirable than most other fire-affected properties. The author did not have sufficient

data to estimate how typical vacant fire-affected properties might differ from these more desirable fire-affected properties.

***Summary of Findings***

The article concludes by stating that it is the buyer who ultimately sets the market and, unlike the owner who has experienced the disaster’s impact firsthand and knows what the property was like before, the buyer is most often seeing the property for the first time. Thus, it is the buyer’s evaluation of a property’s worth that will ultimately determine the impact of the fires on property values in La Plata County.

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