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Cost-Benefit Analysis of Disposition Options for Wright-Patterson Air Force Base Brick Quarters Historic District Housing

Environmental Science Division

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by
Timothy Allison, Konstance Wescott, and Ellen White
Environmental Science Division, Argonne National Laboratory

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EXECUTIVE SUMMARY

The United States Air Force (USAF, or Air Force) recently prepared a Draft Environmental Impact Statement (EIS) to examine alternatives for providing housing for 30 Key and Essential (K&E) personnel at the required Air Force Instruction (AFI) 32-6001 standard, for meeting Air Force housing demand under existing and projected Wright-Patterson Air Force Base **(**WPAFB**)** mission requirements in a cost-effective manner, and for satisfying historic preservation obligations under the National Historic Preservation Act (NHPA). Section 111 of the NHPA obliges the Air Force to assume responsibility for the preservation of historic properties which it either owns or over which it has control, and lease these properties if a lease would adequately ensure the preservation of the historic property. Three of the alternatives in the EIS consider continued Air Force ownership rather than leasing, with renovation, upgrading, or demolition of some units, and operation and maintenance of some or all Brick Quarters Historic District (BQHD) housing units over a 50-year period, with continuation of current BQHD housing arrangements. Two alternatives consider USAF ownership of BQHD housing on completion of restoration, with either privatization or leasing by a property manager. Under the five privatization alternatives, BQHD housing would be leased to a suitable private developer; with the assistance of federal and state tax credits, the developer would renovate, upgrade and maintain BQHD housing; demolish some portion of the BQHD inventory when maintaining and renting were no longer financially viable; construct some replacement housing, and operate and maintain BQHD housing over the 50-year period. Although the EIS contains detailed cost information on the impact of each alternative, this cost-benefit analysis includes a larger number of economic variables to provide a broader basis for the comparison of each alternative.

Specifically, this analysis compares private costs (low and high building costs, operation and maintenance costs, off-base commuting costs and off-base rents) and private benefits (BQHD housing rents, property developer margins and tax credits under privatization) with public costs (regional economic impacts of lost operation and maintenance expenditures) and public benefits (regional economic impacts of continuing O&M spending, restoration, upgrading, construction and rental revenue expenditures). All costs and benefits are specified separately for the first 15 years of the proposed leasing period and for the remaining 35 years.

The analysis finds that the alternatives that produce the largest overall net benefits are those that emphasize renovation and upgrading, and the leasing of a large number of units over a 50-year period under privatization (Alternative 8, 5, and 4). These alternatives feature minor off-base commuting and rental costs, higher BQHD rental revenues and developer margins, tax credit benefits for restoration under privatization (Alternative 8), higher operation and maintenance spending, and higher consequent economic impacts. Alternatives that emphasize demolition in the short-term under USAF ownership (especially Alternative 2), result in minor restoration, operation and maintenance spending, and consequent economic impacts, as well as higher levels of off-base commuting and renting costs; alternatives that emphasize demolition in the short-term have lower (and negative) overall net benefits.

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1 INTRODUCTION

The 1996 National Defense Authorization Act provided the Air Force with the authority to privatize, divest, or demolish housing that does not meet Air Force standards, or is surplus to requirements, by allowing the use of private and government funding.[1] In accordance with Department of Defense (DOD) policy, the Air Force is required to ensure that its government-owned housing inventory meets requirements.[2] Housing that is surplus to requirements can be either demolished or converted to other uses to avoid unnecessary operating costs, or retained if the three-year average occupancy rate is at least 97 percent.

The housing privatization program at WPAFB began in 1998 and was completed in 2002, involving 1,536 housing units, with 100 government-owned houses in the BQHD retained to provide housing for individuals designated as K&E personnel and other officers, consolidated in one on-base location to enhance security, and various other ranks, including but not limited to General Officer and Senior Officer.[3] Although a Housing Requirements and Marketing Analysis (HRMA) conducted in 2006 found that 986 housing units would be required to support Base housing needs over the period 2006 through 2011, indicating a surplus of approximately 650 units, none were found to meet the AFI 32-6001 requirements for K&E personnel.[4] To examine alternatives for providing housing for 30 K&E personnel at the required AFI 32-6001 standard, for meeting Air Force housing demand under existing and projected WPAFB mission requirements in a cost-effective manner, and for satisfying historic preservation obligations under the NHPA, the Air Force recently prepared a draft EIS (WPAFB 2017). The draft EIS evaluated 10 action alternatives, with consideration given to the renovation, upgrading, new construction, or demolition of housing units in the BQHD; the continued operation of housing by the USAF, or their privatization and lease. A No Action alternative reflected the continuation of existing conditions with no change in the legal or physical disposition of BQHD housing units. Except for No Action, each alternative would provide housing for 30 K&E personnel.

An important part of the evaluation of housing disposition alternatives is the requirement under Section 111 of the NHPA, that the Air Force, as a federal agency, assumes responsibility for the preservation of historic properties which are owned or controlled by the Air Force, and that to the extent practicable, establish and implement alternatives for historic properties, including adaptive use, that are not needed for current or projected Air Force purposes; the Air Force may lease an historic property to any person or organization if it determines that the lease will adequately insure the preservation of the historic property. The proceeds of any lease may be retained by the Air Force and used to defray the costs of administration, maintenance, repair, and

[1] 10 United States Code [U.S.C.] Section 2871-2885, as amended.

[2] DOD 4165.63-M, DOD Housing Management, 28 October 2010.

[3] Personnel with duties requiring their immediate availability on an installation because of military necessity or operational requirements, or emergencies that could impact installation readiness, safety and security, or health and welfare of the Base population, as determined by the Commander (Air Force Instruction (AFI) 32-6001 (USAF 2002).

[4] K&E housing must meet current life safety codes; Base security requirements; and provide a comfortable and appealing living environment comparable to the off-base community for quality of life and floor space requirements (AFI 32-6001) (USAF 2002).

related expenses. A Section 111 Lease would require the listing of historic properties which are owned by, or are under the jurisdiction or control of, the Air Force, on the National Register of Historic Places (NRHP). The Air Force may enter into contracts for the management of historic property with such terms and conditions as the Air Force deems necessary or appropriate to protect the interests of the United States and insure adequate preservation of historic property.

Although the EIS contains a large amount of information on the impact of each alternative, there is insufficient data presented to provide a comprehensive analysis of the costs and benefits associated with each alternative. As a result, this cost-benefit analysis is being prepared to provide a broader basis for the comparison of each alternative than was the case in the EIS.

1.1 BQHD HOUSING INVENTORY

The BQHD homes include 89 one-and-a-half and two-and-a-half-story brick residential housing units with half-timber detailing in a Tudor revival style built between 1935 and 1937 as a planned community. The units, as well as the district in which they are located, were listed on the NRHP in October 2018. As part of the renovation program considered in the EIS for the 89 Tudor revival style houses, units were assigned to groups according to size (ft^2) and other amenities (number of bedrooms, size of garage). Other government-owned homes in the BQHD include the historic Foulois House constructed in 1874, which is eligible as a contributing element of the Fairfield Air Depot Historic District, and 10 non-historic housing units on Yount Drive built in 1975. At the time the EIS was prepared (2016), only two units (Quarters 1 and Foulois House) in the WPAFB housing inventory met the requirements for K&E personnel. The remaining housing inventory does not meet current Air Force standards, including standards for square footage and/or building layout.

1.2 ALTERNATIVES

Five of the alternatives in the EIS consider continued or initial USAF ownership, with operation and maintenance of some or all housing in the BQHD funded using family housing construction (FCON) funds and other housing operation and maintenance funds (FHO&M), or privatized and leased once restoration and upgrading are complete (Table 1). The five remaining alternatives consider immediate privatization of BQHD housing, in which a suitable private developer would renovate, maintain, or demolish some portion of the inventory when maintaining and renting were no longer financially viable; construct some replacement housing; and manage BQHD housing over a 50-year period (Table 1).

Under continued USAF ownership, some housing units (90 units under Alternatives 3 and 4, and 30 units under Alternatives 1, 2 and 5) would be renovated, while some units (60 under Alternatives 1 and 5) would be upgraded to be comparable with units in the local community, while the 10 Yount homes would be demolished. Under Alternative 4, 60 units would be privatized and leased to a private developer once renovated, and under Alternative 5, 60 upgraded units would be leased by a property manager and sublet to individual tenants.

Under the privatization alternatives, 30 housing units would be renovated by a private developer in Alternatives 6, 7 and 8; 10 units in Alternative 9; and two units in Alternative 10, with the remaining 60 units upgraded to be comparable to units in the local community. The remainder of the BQHD units would be either returned to the USAF after 15 years when no longer financially viable under Alternative 6 (60 units), or demolished under Alternative 9 (60 units), and Alternative 10 (88 units). The 10 Yount units would be demolished after 15 years under each privatization alternative. Under Alternatives 9 and 10, 20 and 28 new units, respectively, would be constructed in Tudor Revival style, replacing housing units demolished on the same land parcels.

Section 111 of the NHPA obliges the Air Force to assume responsibility for the preservation of historic properties which it either owns or over which it has control, and grants that historic properties owned by the Air Force may be leased to any person or organization. However, if the Air Force determines that the lease will adequately insure the preservation of the historic property, not all of the alternatives explicitly include the leasing of all BQHD housing units. Under privatization (Alternatives 6, 7, 8, 9, and 10), under Alternative 4 (privatization on completion of renovation by USAF of 90 units), and under Alternative 5 (leasing by a property manager once renovation of 30 units and upgrading of 60 units is complete), leasing is considered. Alternatives 1, 2, and 3, however, indicate current BQHD housing arrangements for Air Force personnel under continued USAF ownership.

TABLE 1 Description of Alternatives

Alternative Name	Description of Alternative
	USAF Ownership
No Action	Continue with existing operation and maintenance program for 100 units
1	Renovate 30 and upgrade 60 BQHD units, demolish 10 Yount units
2	Renovate 30 BQHD units, demolish 60 BQHD units and 10 Yount units
3	Renovate 90 BQHD units, demolish 10 Yount units
4	Renovate 90 and privatize 60 BQHD units, demolish 10 Yount units
5	Renovate 30 and upgrade 60 BQHD units for lease under Section 111, demolish 10 Yount units
	Privatization
6	Renovate 30 and upgrade 60 BQHD units, return to USAF after 15 years, demolish 10 Yount units after 15 years
7	Renovate 30 and upgrade 60 BQHD units, demolish 60 BQHD units and 10 Yount units after 15 years
8	Renovate 30 and upgrade 60 BQHD units, demolish 10 Yount units after 15 years
9	Renovate 10 and upgrade 60 BQHD units, demolish 20 BQHD units in Year 1, demolish 60 BQHD units and 10 Yount units after 15 years; construct 20 new units
10	Renovate two and upgrade 60 BQHD units, demolish 28 BQHD units in Year 1, demolish 60 BQHD units and 10 Yount units after 15 years; construct 28 new units

Various funding options would be available to developers leasing BQHD houses under the five privatization alternatives, including direct loans; conveyance or leasing of existing property and facilities for purposes of using proceeds to finance the privatization projects; differential lease payments; allowing DOD to pay the difference between the negotiated rent and basic allowance for housing (BAH) for military personnel; and investments in the form of limited partnerships and/or stock or bond ownership. Privatized military family housing elsewhere at WPAFB has been conveyed under a quit claim deed and the underlying land leased to the developer (Parsons, Inc. 2019).

Renovations proposed for each alternative were based on the findings of an Adaptive Reuse and Cost Estimates report (WPAFB 2016), and they were designed to increase the life of the units by a minimum of 25 years. All alternatives except the No Action Alternative require consultation and a Programmatic Agreement with the Ohio Historic Preservation Office and the Advisory Council on Historic Preservation concerning potential impacts to the BQHD and the Foulois House.

Under the No Action Alternative, the Air Force would continue to own and maintain the 100 units for K&E and non-K&E personnel in housing within the BQHD and on Yount Drive.

2 COST-BENEFIT ANALYSIS METHODOLOGY

2.1 OVERVIEW OF COST-BENEFIT ANALYSIS

Cost-benefit analyses are undertaken to provide a rationale for deciding whether a project or policy option is likely to have a net positive impact by aggregating each of the costs and benefits resulting from the project or option. The cost-benefit analysis for BQHD housing disposition options compares the projected costs and benefits of the various alternatives described in the EIS, including the contribution of each alternative to the stated policy goal, the continued housing of K&E Air Force personnel at the required AFI 32-6001 standard, providing Air Force housing under existing and projected WPAFB mission requirements in a cost-effective manner, and satisfying historic preservation obligations under the NHPA.

In general, cost-benefit analysis involves valuing the benefits and costs associated with a facility or policy option in monetary terms, where possible. Depending on the extent of the data available, cost-benefit analyses may rely partially on qualitative data to assess the various costs and benefits. Costs and benefits are often separated into two categories – private and public. Private costs and benefits are those that impact the owner of a project or facility, while public costs and benefits are those that impact society as a whole.

Private costs include costs that would be incurred by USAF for the renovation or demolition of existing BQHD houses, the construction of replacement houses, the maintenance and repair costs for houses that continue in USAF ownership, and the cost of additional travel associated with officer commuting times where officers are required to live off-base. Private benefits include the avoided costs of maintenance and repair of houses that would no longer continue in USAF ownership, and state and federal tax credits that would be available for historic property renovation to offset costs to private developers under privatization. All costs and benefits are expressed in monetary terms to provide an assessment of the value of costs and benefits in the most relevant time periods, and may include contingencies to incorporate uncertainties that may exist over the size of each cost element.

Unlike private costs and benefits, not all public costs and benefits can be quantified. Quantifiable public costs include the regional economic impact of operation and maintenance (O&M) expenditures on economic output (sales) that would be lost with the demolition of housing units in the BQHD, while quantifiable public benefits would be the regional economic impacts of renovation, demolition, and construction of houses in the BQHD. Non-quantifiable public costs include those related to impacts on land use, visual resources, air quality, geology and soils, water resources, ecological resources, environmental justice, noise, transportation, public and occupational health, and waste management. Housing of historical or architectural significance may have value to the public beyond the cost of renovation, or the market value of the restored structures. A public benefit would be the value that can be assigned to artifacts (such as housing) in historic preservation districts if members of the public are willing to pay a premium (known as use value), measured in terms of travel and hotel costs, to visit the district. Also, some members of the public might be willing to pay merely to be able to visit an historic district at some undetermined point in the future (known as existence, or non-use value), whether

or not a visit actually takes place. Although these public benefits may be of significant value, quantifying them is beyond the scope of this project.

Non-quantifiable private benefits include the prestige associated with living in BQHD accommodation for K&E personnel, the operational flexibility afforded the Air Force with the availability of restored, updated housing on-base where changes in WPAFB mission personnel requirements mean expanded demand for housing, while non-quantifiable public benefits include the extent to which the cost of national defense policy goals would be satisfied with the renovation, upgrading, demolition, and new construction of houses in the BQHD for the housing of K&E USAF officers.

Once all data on costs and benefits, both private and public, have been collected, the analysis calculates private and public costs and benefits, and overall net benefits (benefits minus costs) of the 10 action alternatives and the No Action Alternative.

2.2 DATA

Data used to analyze the costs and benefits of the various housing disposition options presented in the EIS came from a number of sources.

Renovation, demolition, and construction cost estimates presented in the EIS come from the Adaptive Reuse and Cost Estimates report (WPAFB 2016), which includes costs associated with the preservation and retention of BQHD buildings; the costs of upgrading buildings to modern standards; a low- and a high-level renovation case for each type of unit; the costs to demolish BQHD housing units; the salvage of historic architectural features; and the cost of replacement modern houses, also with a low- and high-level building cost case. These costs are based on conceptual designs intended to correct deficiencies found in a Facility Condition Assessment (FCA) performed (WPAFB 2014) on the interior and exterior of select units.

For the renovations, emphasis was placed upon preserving the structure of the housing units and extending their useful lives, as well as resolving safety issues (abatement costs of removing asbestos and lead-based paint). Building Information Models were used to verify material and labor quantities and provide accurate floor plans, and estimates of cost used standard published cost estimating data, RS Means Online, and contractors and manufacturers for custom assemblies or locally available material. Standard cost estimating practices (Parametric Cost Engineering System Software [PACES]) were used for estimating replacement housing costs, and commercial pricing was used for custom installations, preservation, architectural salvage costs, and demolition costs (WPAFB 2016).

O&M costs for both continued USAF ownership and privatization were based on extant USAF data provided by the Air Force (WPAFB 2018a) on annual budgetary support for BQHD housing, and from the 2018 Housing Community Profile (WPAFB 2018b), which details renovation, construction, and repair and maintenance costs for BQHD housing while the 100

existing BQHD houses remain in USAF ownership. Costs borne by developers under the privatization alternatives were assumed to be the same as those currently borne by the USAF, and under the USAF alternatives, on a per house basis.

To estimate the value of officer-commuting travel times, where off-base residency is required following the demolition of BQHD units, the analysis used guidance provided in the Housing Requirements and Marketing Analysis (HRMA) (USAF 2005), which requires that off-base housing should be within a market area within 20 miles or accessible with a one-hour commute. These standards stipulate that off-base housing may include homes, apartments, and manufactured housing, although mobile homes are not considered suitable housing. Housing should be no less than a two-bedroom unit and have room patterns, floor areas, and amenities that are consistent within the market area, with a private entrance and at least one full bathroom, and a kitchen for sole use of its occupants. Additionally, housing must be in a suitable location, be affordable (not exceed BAH) and have an adequate number of bedrooms (one bedroom for each dependent). Unlike government-owned housing, off-base housing has no minimum square footage requirements.

Census housing statistics from the 2017 American Community Survey (U.S. Census Bureau 2019) and local housing market data from online sources, Zillow (Zillow.com 2019), Trulia (Trulia.com 2019), and Sperling's BestPlaces (Bestplaces.net 2019) were used to assess the availability and rental costs for single family houses within the locality within approximately one-hour commuting distance from the base.

The level of state and federal support for renovation of BQHD properties in the form of income tax credits for property developers and lessors was assumed to be based on current standards, under which state and federal tax credits are applicable. Leased BQHD units would be eligible for a 20 percent credit at the federal level, and a 25 percent credit at the state level, for the rehabilitation of historic, income-producing buildings that are determined by the Secretary of the Interior, through the National Park Service (NPS), to be "certified historic structures." An eligible applicant would be either the owner of the historic building(s) or a qualified lessee with an executed lease agreement for a term equal to or exceeding 27.5 years for residential rental property (WPAFB 2017).

The state economic impacts of each alternative are the marketplace effects of current operation and maintenance, proposed renovation, upgrades, new construction and demolition of housing, and expenditures associated with off-base and BQHD rental revenues, and developer margins on economic output (sales). These impacts are measured using direct cost estimates for each activity, and regional economic multipliers taken from the *IMPLAN* model (IMPLAN 2019). Multipliers capture the indirect (off-site) effects of on-site construction activities in industries in the Ohio state economy in which BQHD-related spending occurs. Multipliers are derived from *IMPLAN* input-output economic accounts for each industry in the state, and show the flow of commodities to industries from producers and institutional consumers. The accounts also show consumption activities by workers, owners of capital, and imports from outside the state. The *IMPLAN* model contains 528 sectors representing industries in agriculture, mining, construction, manufacturing, wholesale and retail trade, utilities, finance, insurance and real

estate, and consumer and business services. The model also includes information for each sector on employee compensation, proprietary and property income, personal consumption expenditures, federal, state and local expenditures, inventory and capital formation, imports, and exports.

3 COST-BENEFIT ANALYSIS RESULTS

Table 2 details the private and public costs and benefits for the USAF-ownership alternatives, and Table 3 details the private costs and benefit for the privatization alternatives, with net benefit (total benefits minus total costs) provided for the private and public cost and benefits of each alternative. Together, the tables show overall net benefit for each alternative. The No Action Alternative is also included for purposes of a complete comparison of housing disposition options.

3.1 PRIVATE COSTS

The costs of renovation, upgrades, demolition, and new construction under each alternative are presented using high and low estimates provided in the Adaptive Reuse and Cost Estimates report (WPAFB 2016), with additional private and public costs and benefits estimated for both where appropriate. Although expenditures associated with each of these spending activities would occur in the first year under continued USAF ownership of housing the in BQHD, under privatization, spending would be phased, with the financial viability of houses leading to their return to USAF ownership under Alternative 6, and demolition under Alternatives 7, 8, 9 and 10 (in each case, after 15 years). This approach to management of BQHD housing would also affect other costs and benefits components, commuting costs, O&M costs and economic impacts. Where appropriate, costs and benefits are shown for Years 1 through 15, and Years 16 through 50, to illustrate differences in net benefits over time. The number of housing units affected under each alternative is also taken from the ARS.

Building costs, including renovation, upgrades, demolition, and new construction costs, would vary from between $16.7 million to $28.1 million under Alternative 2, where only 30 units are renovated and the remainder demolished, to between $31.5 million and $65.8 million under Alternatives 3 and 4, where 90 housing units are renovated and the 10 Yount units are demolished. Costs for each alternative under USAF ownership would only occur in the Year 1 to Year 15 time period, with all expenditures occurring in the first year. Under privatization, costs would vary from between $13.6 million and $14.2 millon under Alternative 10 in Year 1 to 15, with the renovation of only two units and the construction of 28 units, to between $18.4 million to $29.8 million under Alternatives 6, 7, and 8, with the renovation of 30 units, the upgrading of 60 units, and the demolition of the 10 Yount units. Costs in the Year 16 to Year 50 time period would vary between $7.5 million and $9.8 million, with the demolition of 70, 90, and 98 units under Alternative 7, 9, and 10, respectively.

Analysis of commuting costs assumed that off-base housing would be within 20 miles of WPAFB, or within a one-hour commute during peak traffic, and would be used by officers requiring off-base accommodation in the event of the demolition of BQHD housing. Assuming an average commuting distance of 45 minutes, and an average weighted cost of $50.63 per hour for officer's time based on 2017 pay ranges for the 12 general, nine senior, and four field grade officers, and for one senior NCO and four command chiefs in the K&E personnel profile

TABLE 2 Private and Public Costs and Benefits for the USAF-Ownership Alternatives, Low and High Building Cost Cases (costs in $million)

	Alternative 1			Alternative 2			Alternative 3			Alternative 4			Alternative 5		
	Units	Low	High	Units	Low	High	Units	Low	High	Units	Low	High	Units	Low	High
Private Costs and Benefits															
Private Costs															
Renovation Costs	30	9.1	20.6	30	9.1	20.6	90	31.3	65.5	90	31.3	65.5	30	9.1	20.6
Upgrade Costs	60	9.2	9.2	0	-	-	0	-	-	0	-	-	60	9.2	9.2
Demolition Costs	10	0.2	0.2	70	7.5	7.5	10	0.2	0.2	10	0.2	0.2	10	0.2	0.2
New Housing Construction Costs	0	-	-	0	-	-	0	-	-	0	-	-	0	-	-
Total Building Costs															
Year 1		18.6	30.0		16.7	28.1		31.5	65.8		31.5	65.8		18.6	30.0
Year 15		0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0
Off-Base Commuting Costs															
Year 1 to Year 15		2.8	2.8		19.9	19.9		2.8	2.8		2.8	2.8		2.8	2.8
Year 16 to Year 50		6.6	6.6		46.5	46.5		6.6	6.6		6.6	6.6		6.6	6.6
Off-Base Rental Costs															
Year 1 to Year 15		3.2	3.2		22.1	22.1		3.2	3.2		3.2	3.2		3.2	3.2
Year 16 to Year 50		7.4	7.4		51.5	51.5		7.4	7.4		7.4	7.4		7.4	7.4
Ongoing Annual O&M Costs															
Year 1 to Year 15		10.0	10.0		3.3	3.3		10.0	10.0		10.0	10.0		10.0	10.0
Year 16 to Year 50		23.2	23.2		7.7	7.7		23.2	23.2		23.2	23.2		23.2	23.2
Total Private Costs															
Year 1 to Year 15		34.5	46.0		62.0	73.4		47.5	81.7		47.5	81.7		34.5	46.0
Year 16 to Year 50		37.2	37.2		105.8	105.8		37.2	37.2		37.2	37.2		37.2	37.2
Private Benefits															
Avoided Ongoing Annual O&M Costs															
Year 1 to Year 15		1.1	1.1		7.7	7.7		1.1	1.1		1.1	1.1		1.1	1.1
Year 16 to Year 50		2.6	2.6		18.1	18.1		2.6	2.6		2.6	2.6		2.6	2.6

TABLE 2 (Cont.)

	Alternative 1			Alternative 2			Alternative 3			Alternative 4			Alternative 5		
	Units	Low	High	Units	Low	High	Units	Low	High	Units	Low	High	Units	Low	High
Tax Credits															
State		0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0
Federal		0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0
BQHD Rents															
Year 1 to Year 15		0.0	0.0		0.0	0.0		0.0	0.0		18.9	18.9		18.9	18.9
Year 16 to Year 50		0.0	0.0		0.0	0.0		0.0	0.0		44.1	44.1		44.1	44.1
Developer Margins															
Year 1 to Year 15		0.0	0.0		0.0	0.0		0.0	0.0		0.9	0.9		0.9	0.9
Year 16 to Year 50		0.0	0.0		0.0	0.0		0.0	0.0		2.2	2.2		2.2	2.2
Total Private Benefits															
Year 1 to Year 15		1.1	1.1		7.7	7.7		1.1	1.1		21.0	21.0		21.0	21.0
Year 16 to Year 50		2.6	2.6		18.1	18.1		2.6	2.6		48.9	48.9		48.9	48.9
Public Costs and Benefits															
Public Costs															
Lost Ongoing Annual O&M Spending Impacts															
Year 1 to Year 15		1.1	1.1		7.5	7.5		1.1	1.1		1.1	1.1		1.1	1.1
Year 16 to Year 50		2.5	2.5		17.6	17.6		2.5	2.5		2.5	2.5		2.5	2.5
Total Public Costs															
Year 1 to Year 15		1.1	1.1		7.5	7.5		1.1	1.1		1.1	1.1		1.1	1.1
Year 16 to Year 50		2.5	2.5		17.6	17.6		2.5	2.5		2.5	2.5		2.5	2.5
Public Benefits															
Ongoing Annual O&M Spending Impacts															
Year 1 to Year 15		9.7	9.7		3.2	3.2		9.7	9.7		9.7	9.7		9.7	9.7
Year 16 to Year 50		22.6	22.6		7.5	7.5		22.6	22.6		22.6	22.6		22.6	22.6
Building Spending Impacts															
Renovation		8.9	20.0		8.9	20.0		30.5	63.8		30.5	63.8		8.9	20.0
Upgrades		9.0	9.0		0.0	0.0		0.0	0.0		0.0	0.0		9.0	9.0

TABLE 2 (Cont.)

	Alternative 1			Alternative 2			Alternative 3			Alternative 4			Alternative 5		
	Units	Low	High	Units	Low	High	Units	Low	High	Units	Low	High	Units	Low	High
Demolition															
Year 1 to Year 15		0.2	0.2		7.3	7.3		0.2	0.2		0.2	0.2		0.2	0.2
Year 16 to Year 50		0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0
New Construction		0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0
Rent Impacts															
Year 1 to Year 15		2.8	2.8		19.4	19.4		2.8	2.8		19.4	19.4		19.4	19.4
Year 16 to Year 50		6.5	6.5		45.2	45.2		6.5	6.5		45.2	45.2		45.2	45.2
Developer Margin Impacts															
Year 1 to Year 15		0.0	0.0		0.0	0.0		0.0	0.0		0.1	0.1		0.1	0.1
Year 16 to Year 50		0.0	0.0		0.0	0.0		0.0	0.0		0.3	0.3		0.3	0.3
Total Public Benefits															
Year 1 to Year 15		30.6	41.7		38.8	49.9		43.2	76.5		59.9	93.2		47.3	58.4
Year 16 to Year 50		29.1	29.1		52.7	52.7		29.1	29.1		68.1	68.1		68.1	68.1

TABLE 3 Private and Public Costs and Benefits for the Privatization Alternatives, Low and High Building Cost Cases ($million)

	Alternative 6			Alternative 7			Alternative 8			Alternative 9			Alternative 10		
	Units	Low	High	Units	Low	High	Units	Low	High	Units	Low	High	Units	Low	High
Private Costs and Benefits															
Private Costs															
Renovation Costs	30	9.1	20.6	30	9.1	20.6	30	9.1	20.6	10	2.5	6.3	2	0.5	1.0
Upgrade Costs	60	9.2	9.2	60	9.2	9.2	60	9.2	9.2	60	9.2	9.2	60	9.2	9.2
Demolition Costs	10	0.2	0.2	70	7.5	7.5	10	0.2	0.2	90	10.0	10.0	98	11.1	11.1
New Housing Construction Costs	0	-	-	0	-	-	0	-	-	20	11.5	13.2	28	16.2	18.5
Total Building Costs															
Year 1		18.4	29.8		18.4	29.8		18.4	29.8		14.5	18.3		13.6	14.2
Year 15		0.2	0.2		7.5	7.5		0.2	0.2		9.8	9.8		9.8	9.8
Off-base Commuting Costs															
Year 1 to Year 15		0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0
Year 16 to Year 50		6.6	6.6		46.5	46.5		6.6	6.6		46.5	46.5		46.5	46.5
Off-Base Rental Costs															
Year 1 to Year 15		0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0
Year 16 to Year 50		7.4	7.4		51.5	51.5		7.4	7.4		51.5	51.5		51.5	51.5
Ongoing Annual O&M Costs															
Year 1 to Year 15		10.0	10.0		3.3	3.3		10.0	10.0		1.1	1.1		0.2	0.2
Year 16 to Year 50		23.2	23.2		7.7	7.7		23.2	23.2		7.7	7.7		7.7	7.7
Total Private Costs															
Year 1 to Year 15		28.3	39.8		21.7	33.1		28.3	39.8		15.6	19.4		13.8	14.4
Year 16 to Year 50		37.5	37.5		113.3	113.3		37.5	37.5		115.5	115.5		115.5	115.5
Private Benefits															
Avoided Ongoing Annual O&M Costs															
Year 1 to Year 15		0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0
Year 16 to Year 50		2.6	2.6		18.1	18.1		2.6	2.6		18.1	18.1		18.1	18.1

TABLE 3 (Cont.)

	Alternative 6			Alternative 7			Alternative 8			Alternative 9			Alternative 10		
	Units	Low	High	Units	Low	High	Units	Low	High	Units	Low	High	Units	Low	High
Tax Credits															
State		4.5	7.4		2.7	5.6		4.5	7.4		1.1	2.1		0.6	0.8
Federal		3.6	5.9		2.2	4.5		3.6	5.9		0.9	1.7		0.5	0.6
BQHD Rents															
Year 1 to Year 15		31.5	31.5		31.5	31.5		31.5	31.5		31.5	31.5		31.5	31.5
Year 16 to Year 50		0.0	0.0		22.1	22.1		66.2	66.2		22.1	22.1		22.1	22.1
Developer Margins															
Year 1 to Year 15		1.6	1.6		1.6	1.6		1.6	1.6		1.6	1.6		1.6	1.6
Year 16 to Year 50		0.0	0.0		1.1	1.1		3.3	3.3		1.1	1.1		1.1	1.1
Total Private Benefits															
Year 1 to Year 15		41.3	46.4		38.0	43.1		41.3	46.4		35.1	36.9		34.2	34.5
Year 16 to Year 50		2.6	2.6		41.3	41.3		72.1	72.1		41.3	41.3		41.3	41.3
Public Costs and Benefits															
Public Costs															
Lost Ongoing Annual O&M Spending Impacts															
Year 1 to Year 15		0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0
Year 16 to Year 50		2.5	2.5		17.6	17.6		2.5	2.5		17.6	17.6		17.6	17.6
Total Public Costs															
Year 1 to Year 15		0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0
Year 16 to Year 50		2.5	2.5		17.6	17.6		2.5	2.5		17.6	17.6		17.6	17.6
Public Benefits															
Ongoing Annual O&M Spending Impacts															
Year 1 to Year 15		9.7	9.7		3.2	3.2		9.7	9.7		1.1	1.1		0.2	0.2
Year 16 to Year 50		22.6	22.6		7.5	7.5		22.6	22.6		7.5	7.5		7.5	7.5
Building Spending Impacts															
Renovation		8.9	20.0		8.9	20.0		8.9	20.0		2.4	6.1		0.4	1.0
Upgrades		9.0	9.0		9.0	9.0		9.0	9.0		9.0	9.0		9.0	9.0

TABLE 3 (Cont.)

	Alternative 6			Alternative 7			Alternative 8			Alternative 9			Alternative 10		
	Units	Low	High	Units	Low	High	Units	Low	High	Units	Low	High	Units	Low	High
Demolition															
Year 1 to Year 15		0.0	0.0		0.0	0.0		0.0	0.0		2.2	2.2		3.1	3.1
Year 16 to Year 50		0.2	0.2		7.3	7.3		0.2	0.2		7.5	7.5		7.7	7.7
New Construction		0.0	0.0		0.0	0.0		0.0	0.0		10.0	11.4		14.0	16.0
Rent Impacts															
Year 1 to Year 15		27.7	27.7		27.7	27.7		27.7	27.7		27.7	27.7		27.7	27.7
Year 16 to Year 50		6.5	6.5		64.6	64.6		64.6	64.6		64.6	64.6		64.6	64.6
Developer Margin Impacts															
Year 1 to Year 15		0.2	0.2		0.2	0.2		0.2	0.2		0.2	0.2		0.2	0.2
Year 16 to Year 50		0.0	0.0		0.1	0.1		0.4	0.4		0.1	0.1		0.1	0.1
Total Public Benefits															
Year 1 to Year 15		55.4	66.6		49.0	60.1		55.4	66.6		52.4	57.6		54.5	57.1
Year 16 to Year 50		29.3	29.3		79.6	79.6		87.8	87.8		79.8	79.8		79.9	79.9

(Federalpay.org 2019), commuting costs from Year 1 to Year 15 would range from $2.8 million under Alternatives 1, 3, 4, and 5, to $19.9 million under Alternative 2. With demolition of housing units occurring in Year 16 for the privatization alternatives, commuting costs would range from $6.6 million under Alternatives 6 and 8, to $46.5 million under Alternative 7, 9, and 10 from Year 16 through Year 50. There would be no commuting costs under the No Action Alternative.

Census housing statistics from the 2017 American Community Survey (U.S. Census Bureau 2019) for the three-county region including Clark, Greene, and Montgomery Counties indicate that there would be 26 vacant rental single-unit housing units (houses or apartments) with a monthly rent of between $2,000 and $2,500 per month, which is at the upper limit of the BAH for general officers ($1,713 to $2,004 per month) (MilitaryBenefits.info 2019), and 98 vacant rental single-unit housing units with a monthly rent of between $1,500 and $2,000 per month, which is at the upper limit of the BAH for other officers, senior NCO and command chiefs ($1,158 to $1,989 per month) in the K&E personnel profile. Data from Zillow.com, Trulia.com and Bestplaces.net also indicate the availability of more than 65 two-, three- and four-bedroom single-family houses in Huber Heights and Fairborn alone, well within the one-hour commuting distance requirement, with rents of between $670 and $2,100 per month. Additional single-family rental housing was also available further afield in other townships, also within the commuting requirement.

To estimate rents that would be paid by officers commuting to and from off-base residential locations, mean BAH rates for each K&E officer category were used to calculate an annual average rental payment. Total rents for commuting officers would vary from $3.2 million under Alternatives 1, 3, 4, and 5, to $22.1 million under Alternative 2 for Year 1 to 15, and from $7.4 million under Alternatives 1, 3, 4, 5, 6, and 8, to $51.5 million under Alternatives 2, 7, 9, and 10 for Year 16 to 50.

The costs of operating and maintaining (O&M) BQHD housing has varied considerably over the past 20 years, with large expenditures in some years, and none in others. O&M costs used in the analysis were calculated per house based on the most recent 10 years of historical data provided by USAF (WPAFB 2018a), adjusted for inflation to 2018 dollars using the Consumer Price Index (CPI). It was assumed that existing O&M expenditures would be made per house following privatization, as has been the case over the most recent 10 years under USAF ownership. Using this data as a basis, O&M costs under continued USAF ownership would be between $3.2 million for Alternative 2, with the majority of housing units demolished in Year 1, and $10 million for Alternatives 1, 3, 4, and 5 between Year 1 and Year 15; between Year 16 and Year 50, these costs would be between $7.7 million and $23.2 million. Following privatization, O&M costs would be $11.1 million under each alternative for Year 1 to Year 15; they then would be dependent on the number of housing units remaining after the demolition of housing units in Year 16, varying from $7.7 million with Alternatives 7, 9, and 10 with fewer housing units available, to $23.2 million under Alternatives 6 and 8.

3.2 PRIVATE BENEFITS

Following the demolition of houses, each alternative would benefit from avoided O&M costs, varying from $1.1 million to $7.7 million under USAF ownership in Year 1 through 15, and from $2.6 million to $18.1 million in Year 16 through 50. With privatization, these benefits would vary from $2.6 million to $18.1 million in Year 16 through 50, with the demolition of houses occurring during the second period.

Based on current standards regarding state and federal income tax credits for property developers and lessors in support of the renovation of BQHD properties, leased housing units would be eligible for a 20 percent credit at the federal level, and a 25 percent credit at the state level (Ohio Development Services Agency 2019; U.S. Department of Interior 2019). Given the availability of these benefits to lessees at current levels for the five privatization alternatives, and assuming all credits would be paid between Year 1 and Year 15, credits provided by the state would be between $0.5 million and $1.7 million under Alternatives 9 and 10, with fewer housing units renovated, and between $3.7 million and $6 million under Alternatives 6, 7, and 8, where a larger number of units would be renovated. Similarly, federal tax credits would be between $0.6 million and $2.1 million under Alternatives 9 and 10, and between $2.7 million and $7.4 million under Alternatives 6, 7, and8.

Rental payments would be collected for BQHD housing units under Alternatives 4 and 5, and under the privatization alternatives. As was the case for off-base housing, BQHD rents were estimated using an annual average rental payment based on mean BAH rates for each K&E officer category. Rents would vary from $18.9 million under Alternatives 4 and 5, to $31.5 million for Alternatives 6, 7, 8, 9, and 10 in Year 1 to 15, and from $22.1 million under Alternatives 7, 9, and 10 to $66.2 million under Alternative 8 in Year 16 to 50. Margins property developers would be likely to receive for renting BQHD housing were also calculated based on the K&E officer annual average rental payment, and an assumed margin rate of 5%. On this basis, margins would vary from $0.9 million under Alternatives 4 and 5, to $1.6 million for Alternatives 6, 7, 8, 9, and 10 in Year 1 to 15, and from $1.1 million under Alternatives 7, 9, and 10 to $1.3 million under Alternative 8 in Year 16 to 50. For both BQHD rental and margin rates, it was assumed housing units returned to USAF under Alternative 6 were provided to officers at no charge.

Although Alternative 4 and the privatization alternatives oblige the USAF to lease BQHD housing to a private developer based on the requirements of Section 111 of the NHPA, with any lease fees used to support O&M of historic properties, it is likely that the lease fee would be minimal to allow the developer to reduce operating costs in the interests of preserving the houses as historic properties. In this respect, leases would most likely mirror those used by the USAF in privatization programs elsewhere at WPAFB and on other USAF bases, with housing units conveyed to a developer under a quit claim deed and the underlying land leased for $1 (Parsons 2019).

Developers of privatized military housing may obtain financing through bank loans and bonds for both renovating existing homes and constructing new homes. In addition, the military departments can provide additional financing, and the Air Force generally provides financing

through direct loans to the developers, limited by the Military Housing Privatization Initiative (MHPI) to not more than 33 percent of the value of the investment, or 45 percent if land or facilities are also part of the investment. As the precise source of financing for privatized military housing is not known, and that it is likely it would come from outside Ohio, the costs and benefits of the various financing options are excluded from the analysis.

3.3 PUBLIC COSTS

Reduction in O&M activities with demolition of housing units would mean a reduction in expenditures, reducing spending in the rest of the state economy. To capture these spending impacts, *IMPLAN* multipliers were used in association with cost estimates in one sector of the Ohio economy: Sector 63, Maintenance and Repair Construction of Residential Structures (IMPLAN 2019) . The reduction in O&M spending with the demolition of housing units would lead to the loss of $15.3 million in output with Alternative 2 in Year 1 to Year 15, and $2.2 million with Alternatives 1, 3, 4, and 5, while $5.1 million would be lost in Year 16 to Year 50 with Alternatives 1, 3, 4, 5, 6, and 8, and $35.7 million with Alternatives 2, 9, and 10.

3.4 PUBLIC BENEFITS

Renovation, upgrade, demolition, construction activities, ongoing O&M activities, off-base and BQHD housing rents, and developer margins would result in expenditures flowing into the state economy, creating additional spending elsewhere in the economy. To capture these spending impacts, *IMPLAN* multipliers in four sectors of the Ohio economy—Sector 63, Maintenance and Repair Construction of Residential Structures; Sector 59, Construction of New Single-Family Residential Structures; Sector 468, Services to Buildings; and Personal Consumption Expenditures for the household annual income group $75,000 to $100,000—were used in association with ARS cost estimates and the annual average rental payment based on mean BAH rates for each K&E officer category (IMPLAN 2019).

Renovation would produce between $18.0 million and $40.6 million in output for the low and high building cost cases under Alternatives 1, 2, 5, and 6, and between $61.8 million and $129.3 million under Alternatives 3 and 4. Upgrades would produce $18.2 million in output under Alternatives 1, 5, 6, 7, 8, 9, and 10. Demolition would produce $0.5 million in output under Alternatives 1, 3, 4, and 5, and $14.9 million under Alternative 2 in Year 1 to Year 15, and $0.5 million under Alternatives 6 and 8, $14.9 million under Alternative 7 in Year 16 to 50. Under Alternatives 9 and 10, demolition would occur in both time periods, producing $4.4 million in Year 1 through 15, and $15.3 million in Year 16 to 50 under Alternative 9, and $6.2 million in Year 1 through 15, and $15.6 million in Year 16 to 50 under Alternative 10. New construction would produce between $21.5 million and $24.6 million for the low and high building cost cases under Alternative 9, and between $30.1 million and $34.5 million under Alternative 10.

Continuing O&M activities for the remaining housing units would create $19.7 million in output with Alternatives 1, 3, 4, 5, 6, and 8 in Year 1 to Year 15, and $6.6 million with Alternatives 2, 9, and 10, while in Year 16 to Year 50, $45.9 million would be created with Alternatives 1, 3, 4, 5 ,6, and 8, and $15.3 million with Alternatives 2, 9 and 10.

3.5 NET PRIVATE AND NET PUBLIC BENEFITS

Table 3 and Table 4 sum the private and public net benefits (benefits minus costs) in Table 1 and Table 2 for each alternative for a comparison of each action alternative with the No Action Alternative. Table 3 presents the results for the low renovation and new housing construction cost case; Table 4 presents results for the high building cost case.

With the emphasis on renovation and upgrading of BQHD units under USAF ownership in Year 1 to 15, the private net benefits for Alternatives 1 through 5 during this period are negative. For the privatization alternatives, private net benefits during this period are positive, with tax credits, BQHD rents and developer margins offsetting renovation and upgrading costs, and off-base commuting and rental costs. With the continuation of off-base commuting and renting for Alternatives 1 through 5, and the demolition of units in Year 16 resulting in off-base commuting and rentals for Alternatives 6 through 10, private net benefits are negative for Year 16 to Year 50. With expenditures associated with renovation, upgrades, demolition, new construction, off-base and BQHD rentals and developer margins all producing economic impacts in Ohio, the public net benefits of each alternative are positive in both time periods.

Alternative 2 would have the largest negative private net benefits. The costs of demolition of 70 units and the renovation of only 30 units, and the need for off-base commuting to and from rental housing, produce large private costs in Year 1 to 15 and continuing costs associated with off-base housing through Year 16 to 50. Minor offsetting public benefits of avoided O&M costs on demolished housing units would still mean negative net private benefits. Net public benefits would be lower with Alternative 2 than with some of the other alternatives; economic impacts of demolition expenditures in Year 1 to 15 would be only partially offset by the economic impacts associated with the loss of O&M expenditures, with this benefit continuing in Year 16 to 50.

Because of the emphasis on renovation under Alternatives 3 and 4, these alternatives have relatively large private costs in Year 1 to 15, with smaller costs, primarily associated with ongoing O&M, in Year 16 to Year 50. While there are only the minor benefits of avoided O&M costs on demolished housing units, producing negative net benefits for both alternatives in Year 1 to 15, the benefits of rental revenues and developer and property manager margins under Alternatives 4 and 5 as units are privatized and leased after restoration mean positive net benefits for these alternatives. Although there would be minor public costs with the loss of the economic impacts of O&M expenditures on demolished housing units, with renovation expenditures under both alternatives, and rental revenues and developer and property manager margins under Alternative 4 and Alternative 5, large positive net public benefits come in the form of economic

TABLE 4 Private and Public Net Benefits of Housing Disposition Alternatives, Low Building Costs ($million)

Description of Alternative	Private Net Benefits		Public Net Benefits	
	Year 1 to 15	Year 16 to 50	Year 1 to 15	Year 16 to 50
USAF Ownership				
No Action – Continue with existing operation and maintenance program for 100 units	-11.1	-25.8	10.8	25.1
1 – Renovate 30 and upgrade 60 BQHD units, demolish 10 Yount units	-33.4	-34.7	29.5	26.6
2 – Renovation 30, demolish 60 BQHD and 10 Yount units	-54.2	-87.7	31.3	35.1
3 – Renovate 90 BQHD units, demolish 10 Yount units	-46.4	-34.7	42.1	26.6
4 – Renovate 90 and privatize 60 BQHD units, demolish 10 Yount units	-26.5	11.7	58.8	65.6
5 – Renovate 30 and upgrade 60 BQHD units for lease under Section 111, demolish 10 Yount units	-13.6	11.7	46.2	65.6
Privatization				
6 – Renovate 30 and upgrade 60 BQHD units, return to USAF after 15 years, demolish 10 Yount units after 15 years	12.9	-34.9	55.4	26.8
7 – Renovate 30 and upgrade 60 BQHD units, demolish 60 BQHD units and 10 Yount units after 15 years	16.3	-72.0	49.0	62.0
8 – Renovate 30 and upgrade 60 BQHD units, demolish 10 Yount units after 15 years	12.9	-34.6	55.4	85.3
9 – Renovate 10 and upgrade 60 BQHD units, demolish 20 BQHD units in Year 1, demolish 60 BQHD units and 10 Yount units after 15 years; construct 20 new units	19.6	-74.3	52.4	62.2
10 – Renovate two and upgrade 60 BQHD units, demolish 28 BQHD units in Year 1, demolish 60 BQHD units and 10 Yount units after 15 years; construct 28 new units	20.4	-74.3	54.5	62.3

impacts in Year 1 to 15. Net public benefits are smaller in Year 16 to 50 with ongoing O&M expenditures under Alternative 3, and larger under Alternative 4 with the continued benefit of rental revenues and developer margins.

Alternatives 1 and 5, with their emphasis on renovation and upgrading have lower public costs in Year 1 to 15, and minor public benefits of avoided O&M costs on demolished housing units, and large net public benefits, particularly in Year 1 to 15, with the economic impact of renovation and upgrading expenditures, and ongoing O&M expenditures.

Primarily because demolition, commuting, and off-base renting would occur during Year 16 to Year 50 under the privatization alternatives, private net benefits would be positive during Year 1 to Year 15, and negative between Year 16 and 50. Private costs consist primarily of upgrades, with renovation limited to the 30 K&E units under Alternatives 6, 7, and 8, with 10 units renovated under Alternative 9 and two under Alternative 10. Tax credits, BQHD rents, and developer margins would only partially offset ongoing O&M costs. There would be no demolition, off-base commuting, or off-base rents between Year 1 and 15 under Alternatives 6, 7, and 8, with demolition and new construction costs featuring in Alternatives 9 and 10. During Year 16 to 50, demolition—and the off-base commuting and off-base rents that would follow—would mean larger private costs, especially under Alternatives 7, 9, and 10, despite the private benefits of a reduction in O&M costs.

Each privatization alternative has relatively large net public benefits in both periods, with the economic impact of renovation and upgrading expenditures, and O&M expenditures in Year 1 to 15, and BQHD rents, off-base rents, and developer margins in Year 16 to 50. Lower net public benefits would come under each privatization alternative in Year 16 to 50 with the loss of the economic impacts associated with O&M expenditures. The economic impacts of demolition expenditures under Alternatives 7, 9, and 10, and of new construction expenditures under Alternatives 9 and 10, would be offset by the loss of the economic impacts of O&M expenditures, where public net public benefits would be negative under each of these alternatives.

Although there is no difference in the relative ranking of the alternatives between the low and high building costs cases, there is a difference in the size of the private net benefit associated with each alternative when low and high building cost assumptions for renovation and new construction are considered (Table 5). As all renovation and new construction costs are borne in Year 1, these differences are seen in the private and public net benefits for Year 1 to Year 15, with no differences in the private and public net benefits between the low and high building cases for Year 16 to Year 50.

TABLE 5 Private and Public Net Benefits of Housing Disposition Alternatives, High Building Costs ($million)

Description of Alternative	Private Net Benefits		Public Net Benefits	
	Year 1 to 15	Year 16 to 50	Year 1 to 15	Year 16 to 50
USAF Ownership				
No Action – Continue with existing operation and maintenance program for 100 units	-11.1	-25.8	10.8	25.1
1 – Renovate 30 and upgrade 60 BQHD units, demolish 10 Yount units	-44.9	-34.7	40.6	26.6
2 – Renovate 30 BQHD units, demolish 60 BQHD units and 10 Yount units	-65.7	-87.7	42.4	35.1
3 – Renovate 90 BQHD units, demolish 10 Yount units	-80.6	-34.7	75.4	26.6
4 – Renovate 90 and privatize 60 BQHD units, demolish 10 Yount units	-60.8	11.7	92.1	65.6
5 – Renovate 30 and upgrade 60 BQHD units for lease under Section 111, demolish 10 Yount units	-25.0	11.7	57.3	65.6
Privatization				
6 – Renovate 30 and upgrade 60 BQHD units, return to USAF after 15 years, demolish 10 Yount units after 15 years	6.7	-34.9	66.6	26.8
7 – Renovate 30 and upgrade 60 BQHD units, demolish 60 BQHD units and 10 Yount units after 15 years	10.0	-72.0	60.1	62.0
8 – Renovate 30 and upgrade 60 BQHD units, demolish 10 Yount units after 15 years	6.7	34.6	66.6	85.3
9 – Renovate 10 and upgrade 60 BQHD units, demolish 20 BQHD units in Year 1, demolish 60 BQHD units and 10 Yount units after 15 years; construct 20 new units	17.4	-74.3	57.6	62.2
10 – Renovate 2 and upgrade 60 BQHD units, demolish 28 BQHD units in Year 1, demolish 60 BQHD units and 10 Yount units after 15 years; construct 28 new units	20.1	-74.3	57.1	62.3

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4 ECONOMIC VALUATION OF HISTORIC PROPERTIES

In addition to the costs and benefits of BQHD housing under each alternative, housing of historical or architectural value may have considerable economic value to the public not captured in some cost-benefit analyses. Visitors to historical resources benefit from various educational, visual, recreational experiences, and memories offered by these resources, while others may benefit indirectly from these resources through magazines, films, or through virtual visits on the Internet without actually having visited the resource (Mourato and Mazzanti, 2002). Preservation and maintenance of historical resources also provides the possibility for visitation at some point in the future, providing *option value*. There may also be a desire to conserve cultural resources for future generations, or *existence value.* These are benefits that come from the knowledge that historical resources are being conserved in a certain condition, without any actual visitation, and carry *bequest value*, or the willingness to pay to ensure historic properties are available for future generations. These *non-use values* are thought to be a significant proportion of the total economic value of cultural heritage. The components of total economic value are shown in Figure 1.

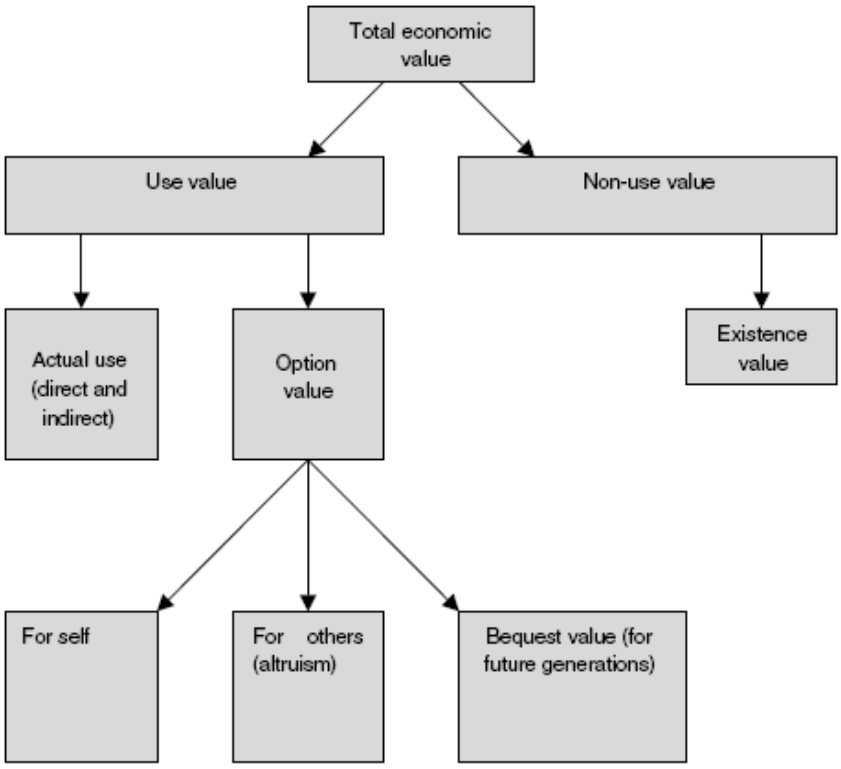

FIGURE 1 Components of Total Economic Value (Source: O'Brien [2010])

A simple way to quantify the value of these resources would be to measure revenue generated by user fees and other charges for public use, and to measure how these vary with changes in the quality of historical resources. However, visitation statistics are often incomplete, and in many cases federal and state agencies do not charge visitors a fee for entrance to historical resources. Where fees are charged, fees may be nominal compared to the value of the visit to users, and they may be lower than ideal so as to not risk compromising visitation numbers.

The essential problem with estimating the demand for the quality of historical resources, including housing in the BQHD, is that these resources are often not market goods; characteristics of the demand for these resources cannot be based on direct observation of buying and selling of services associated with historical resources of a certain quality in the marketplace. Changes in the quality of historic buildings and historic preservation can be measured, however, as changes in economic welfare, or as consumer surplus: the amount of value a consumer of a good or service receives over and above that which would be paid for the good or service. Consumer surplus corresponds to the willingness to pay (WTP) for a benefit, or for the avoidance of a cost, or the willingness to accept compensation for tolerating a cost or forgoing a benefit. In other words, the economic value of the loss or deterioration of the quality of historical resources is measured as the amount of income individuals would be willing to pay to keep consumer surplus at the original level before the loss of, or fall in the quality of, historical resources. Alternatively, it is the amount of income required to move an individual to a new utility level in lieu of achieving that level through an improvement in the quality of historical resources.

There are two general methods, or approaches, for obtaining data on the economic valuation of historical resources, including historic housing (Table 6):

- *Revealed Preference*—the relationship between private goods and the quality of historical resources (in particular, housing) is examined in order to draw inferences about the general demand for the quality of historical resources, using hedonic pricing, travel cost, and avoided maintenance cost methods; and

- *Stated Preference*—individuals are asked to reveal their willingness to pay for improvements in the quality of historical resources in "hypothetical markets" (described by means of a survey) to elicit preferences where there may be no market for a cultural good or service.

TABLE 6 Methods Used to Produce an Economic Valuation of Historic Resources

Method	Used to Measure	Key question to be answered	Advantages	Disadvantages
Revealed Preference Approaches				
Hedonic pricing	The value of living near to, and being able to use, a cultural artifact	What is the relationship between a good or service and real estate prices?	Market (real estate) prices with sophisticated techniques to reveal the values associated with a given good or service Real estate data readily available	Only measured benefits related to property values, which are often only indirectly related to historically related goods and services Does not capture non-use and option values
Travel cost	The willingness to pay for traveling to visit historic resources	What do people value based on the amount of time and money they are willing to spend travelling to consume a good or service?	Market (transportation and lodging) prices used to reveal preferences for a good or service Can be used to value a range of historical goods and services	May undervalue short travel times; some trips may have multiple purposes Does not capture non-use and option values
Avoided maintenance cost	The cost of cleaning, repairing, and restoring a building used as a proxy for the value of its conservation	What value is placed on avoiding historic building damage by measuring conservation costs?	Cost data readily available from government agencies and local authorities	Costs do not measure the benefits derived by society from changes in the quality of historical resource Does not capture non-use and option values
Stated Preference Approach				
Contingent valuation	The willingness to pay to conserve an historic resource in a specific location	How can we capture user and non-user valuations of historic resources for use in cost-benefit analysis?	Well established in environmental economics Provide monetized valuations of historic resources for cost-benefit analyses	Techniques are complex and expensive to apply Results highly dependent on survey design

Sources: Adapted from O'Brien (2010) and Yung et al. (2013).

4.1 REVEALED PREFERENCE APPROACHES

The hedonic price method assumes that the price of a house is partly affected by non-market cultural factors, such as historic zone designation. Other things being equal, the extra price commanded by a house in a historic area would be a measure of the willingness to pay (WTP) for historic zone designation. This method is of partial and limited use in the valuation of cultural heritage, as it is only applicable to cultural heritage elements that are embodied in property prices. It also relies on the unrealistic assumptions of a freely functioning and efficient property market, where individuals have perfect information and mobility.

The travel cost method uses variation in the cost of traveling different distances, and in the number of trips taken over each distance, as a way to represent the demand for historical resources in any given location. The method attempts to relate the cost of accessing all historical sites to the decision to visit specific historical sites. A demand curve can be generated to represent the number of visits to a given site with the associated travel costs, with higher travel costs typically leading to lower levels of visitation, other things being equal. Variations in costs

incurred to visit different places provide "implicit" prices that can be used instead of conventional market prices as the basis for estimating the value of historical sites and changes in their quality.

The avoided maintenance cost method is often used to estimate the economic value of restoration of historical resources as cost information is easier to collect than benefit information. The costs of cleaning, repairing, and restoring a building are taken as proxy for the value of conservation, but these costs do not measure the benefits derived by society from changes in the quality of historical resources.

4.2 STATED PREFERENCE APPROACH

Although revealed preference approaches are useful, their potential use in the estimation of the value attached to cultural sites is limited as they cannot estimate option and non-use values and they cannot evaluate future marginal changes in historical assets. The stated preference approach's contingent valuation (CV) method has been widely used to determine the economic feasibility of public policies for the improvement of environmental quality. Using questionnaires, a random sample of people is asked to express their willingness to pay for a hypothetical change in the level of provision of the good in a hypothetical market where the good in question can be "traded." Respondents are asked to behave as though they were in a real market, and it is assumed that stated willingness to pay amounts are related to respondents' underlying preferences. Unlike revealed preferences, CV is able to capture all types of benefits from a non-market good or service, including non-use values. A CV questionnaire has three interrelated stages. The first stage identifies the good to be valued, constructs the valuation scenario, and elicits the monetary values. The second stage adds questions on attitudes and opinions, knowledge, familiarity and use of the good, demographics, and various other relevant topics. The third stage consists of piloting the draft questionnaire for content, question wording, question format, and overall structure and layout.

4.3 EXAMPLES OF ECONOMIC VALUATION OF HISTORIC BUILDINGS

Even though a growing body of literature has demonstrated that economic value arises from preservation of cultural heritage sites, there are only a few North American examples of revealed preference or stated preference approaches being used to value historic buildings. These are summarized in Table 7.

TABLE 7 Examples of North American Non-market Valuation Studies of Historic Buildings

Author	Subject	Non-market Valuation Method	Willingness to Pay Value
Morey, Rossmann, Chestnut & Ragland (1997)	Slowing the rate of pollution damage to outdoor marble monuments in Washington, D.C.	CVM	$57 or $82.31 depending on the elicitation format
Chambers, Chambers & Whitehead (1998)	Conservation of historic school building	CVM	$6
Whitehead & Finney (2003)	Creation of a historic shipwreck state park	CVM	$32.82 to $34.15 depending on estimated model
King, Charles, Revier & Sable (2004)	Conservation and restoration of local historic landmark (Northern Hotel in Fort Collins)	CVM	$224 or $630 with low or high information, respectively
Poor and Smith (2004)	Visit to historic St. Mary's City, Maryland	TCM	$8 to $19.26
Poor & Snowball (2010)	Conservation of built heritage in university campuses	CVM	0.25% of current average tuition fee
Melstrom (2014)	U.S. National Park Service preserved battlefields	TCM	$8 to $25

Source: Based on Mourato et al. (2014)

There are a few examples of the use of revealed preference methods to estimate economic value of historic resources. A study by Poor and Smith (2004), for example, employed the travel cost method (TCM) to estimate the use value generated for visitors by historic St. Mary's City, Maryland. A questionnaire submitted by 328 visitors established transport costs, the opportunity cost of traveling time and the entrance fee, with a demand function estimated based on travel cost, income, ethnicity and age. The findings indicated that demand was elastic with respect to changes in travel cost, indicating that travel spending was sensitive to distance to the historical resource, while the income elasticity was negative, implying that visitors would seek other historic sites and cultural activities as their income increases. The three-year average visitor consumer surplus measured ranged from approximately $8 to $19.26; for all paid visitors, the average annual benefit estimates ranged from $75,492 to $176,550. In another study, Melstrom (2014) used TCM to estimate the use values associated with U.S. National Park Service preserved battlefields, and indicated that an average individual willingness to pay for a battlefields trip ranged from $8 to $25.

As there is insufficient observed variation in historical or cultural resources to estimate willingness to pay for preservation, stated preference methods have been more popular for evaluation of economic value at North American sites (Hicks and Queen 2016). For example, Morey et al. (2002) undertook studies in Washington, D.C. to determine the value of reducing damage to marble monuments from acid deposition. Using a sample of residents from the Philadelphia and Boston metropolitan areas, the study estimated the total value (combining the value of use and non-use) of the historical good. The results indicated that households were willing to pay between $33 and $69, based on the preservation scenario presented.

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5 DISCUSSION AND CONCLUSIONS

The purpose of the alternative disposition options proposed in the environmental impact statement was to establish a strategy to provide housing in the BQHD for 30 K&E personnel at the required AFI 32-6001 standard, to meet Air Force housing needs under existing and projected WPAFB mission requirements in a cost-effective manner, and to satisfy historic preservation obligations under the NHPA. Analysis of the costs and benefits associated with each alternative has focused on the quantifiable private and public costs and benefits in order to provide a wider basis for choosing a practical housing strategy than was presented in the EIS (Table 8).

Key additional private costs not included in the EIS are: those that relate to commuting that would occur in the event BQHD housing units are demolished and Air Force personnel are required to live outside WPAFB; off-base rents; the annual costs associated with different levels of O&M activities with different levels of provision of BQHD housing; federal and state tax credits; BQHD rents; and property developer margins that would be available under the privatization alternatives. Key public benefits not included in the EIS are: state-level economic impacts resulting from capital expenditures associated with renovation, upgrading, demolition and new construction activities; O&M expenditures of housing units regardless of their disposition; off-base and BQHD rents; and developer margins. With the inclusion of these additional cost-benefit elements, and the systematic comparison of all quantifiable costs and benefits over the life-cycle of the 50-year proposed leasing period, a more comprehensive comparison between the housing disposition alternatives can be made. Table 8 presents a summary of the overall net benefits for each action alternative and the No Action Alternative under the low and high building cost cases (with private and public net benefits summed for both time periods).

TABLE 8 Summary Comparison of Overall Net Benefits of Housing Disposition Alternatives, Low and High Building Cost Cases ($million)

Description of Alternative	Low Building Costs	High Building Costs
USAF Ownership		
No Action – Continue with existing operation and maintenance program for 100 units	-1.0	-1.0
1 – Renovate 30 and upgrade 60 BQHD units, demolish 10 Yount units	-12.1	-12.4
2 – Renovate 30 BQHD units, demolish 60 BQHD units and 10 Yount units	-75.5	-75.8
3 – Renovate 90 BQHD units, demolish 10 Yount units	-12.4	-13.3
4 – Renovate 90 and privatize 60 BQHD units, demolish 10 Yount units	109.5	108.6
5 – Renovate 30 and upgrade 60 BQHD units for lease under Section 111, demolish 10 Yount units	109.9	109.6
Privatization		
6 – Renovate 30 and upgrade 60 BQHD units, return to USAF after 15 years, demolish 10 Yount units after 15 years	60.3	65.1
7 – Renovate 30 and upgrade 60 BQHD units, demolish 60 BQHD units and 10 Yount units after 15 years	55.2	60.0
8 – Renovate 30 and upgrade 60 BQHD units, demolish 10 Yount units after 15 years	188.3	193.1

TABLE 8 (Cont.)

Description of Alternative	Low Building Costs	High Building Costs
9 – Renovate 10 and upgrade 60 BQHD units, demolish 20 BQHD units in Year 1, demolish 60 BQHD units and 10 Yount units after 15 years; construct 20 new units	59.9	63.0
10 – Renovate two and upgrade 60 BQHD units, demolish 28 BQHD units in Year 1, demolish 60 BQHD units and 10 Yount units after 15 years; construct 28 new units	63.0	65.3

The comparison of the overall net benefits associated with the alternatives, for both the low and high building cost cases, shows that Alternative 8 has the largest positive net benefits. The renovation and upgrading of a large number of units means significant expenditures in the state economy, tax credits, and BQHD rents for the developer. The delay in demolition of the 10 Yount units postpones only minor off-base commuting and off-base housing renting (Table 8). Substantial but smaller positive net benefits come with Alternatives 4 and 5, with the renovation and upgrading of a large number of units meaning significant expenditures in the state economy, BQHD rents for the developer with the privatization of upgraded units, and only minor off-base commuting and off-base renting. The remainder of the privatization options—Alternatives 6, 7, 9, and 10—would have similar, positive overall net benefits, with slightly larger net benefits for Alternatives 9 and 10, reflecting the number of units demolished and their replacement with new housing units, and slightly smaller net benefits for Alternatives 6 and 7, reflecting the number of units demolished. Each privatization alternative includes tax credits and BQHD rents for the developer, and—with the exception of Alternative 6—off-base commuting and off-base housing renting in Year 16 to Year 50. With the exception of Alternatives 6 and 8, each privatization alternative features the demolition of 60 upgraded units and the Yount units after 15 years; under Alternative 6, the 60 upgraded units are returned to the USAF after 15 years. It was assumed these units would be provided to Air Force personnel at no cost between Year 16 and Year 50.

For all USAF ownership alternatives except Alternatives 4 and 5, overall net benefits would be negative. Particularly large negative net benefits would come with Alternative 2, under which 70 units would be demolished in Year 1, meaning significant off-base commuting and off-base housing renting. The loss of O&M expenditures would only be partially offset by economic impacts of renovation spending for the remaining 30 K&E units, and by demolition and rental expenditures. Overall net benefits of Alternatives 1 and 3 would be similar, with slightly larger negative overall net benefits with Alternative 3 because of higher restoration costs, and the continuation of O&M expenditures on all 90 restored units. Lower overall negative net benefits would come with the No Action Alternative, in which no renovation would take place and all units would be retained—meaning no off-base commuting or off-base renting—allowing for ongoing maintenance expenditures.

Section 111 of the NHPA obliges the Air Force to assume responsibility for the preservation of historic properties which it either owns or over which it has control, and to lease these properties if a lease would adequately insure the preservation of the historic property. Under the five privatization alternatives, BQHD housing would be leased to a suitable private developer who would renovate BQHD housing with the assistance of federal and state tax credits, while two of the USAF ownership alternatives feature privatized leasing once BQHD

housing is restored by the USAF (Alternative 4) or leasing by a property manager once restoration has been undertaken by the USAF (Alternative 5). Three of the USAF ownership alternatives (Alternatives 1, 2, and 3), however, reflect the continuation of current BQHD housing arrangements.

Although Section 111 leasing would be possible under most of the alternatives, there are issues with the viability of leasing under privatization not addressed either in the EIS or in the cost-benefit analysis. Under privatization, property developers would be expected to arrange financing to cover the cost of restoration, which would be undertaken according to predetermined building standards, with federal and state credits reducing capital costs. It is not known, however, how the cost of financing restoration bank loans would affect O&M costs, and if sufficient renters would be found to cover cost and profit margin. Given the need to cover upfront restoration costs, developer profitability issues may also affect the likelihood of attracting suitable candidate developers. The risks associated with leasing under privatization would be significantly reduced if the restoration of BQHD housing were to be undertaken using USAF funds, before housing units were either leased out to developers (Alternative 4), or rented out through a property manager (Alternative 5). Although the cost of restoration would have to borne by the Air Force, much of the risk of adverse financial viability of BQHD leasing projects after privatization affecting the disposition of BQHD housing would be avoided.

In addition to the net benefits calculated and discussed in this analysis, based on the literature review of economic valuation studies, housing of historical or architectural significance may also have value to the public beyond the cost of renovation, or the market value of the restored structures. Additional value can be assigned to artifacts, such as historic housing, or housing in historic preservation districts, if members of the public are willing to pay a premium (use value), measured in terms of travel and hotel costs, to visit the district. Some members of the public might also be willing to pay merely to be able to visit, or to allow future generations to visit, historic housing at some undetermined point in the future (non-use value), whether or not a visit actually takes place.

Although these public benefits may be of significant value—and quantifying them is beyond the scope of this project—it is likely that including them would not alter the general findings of this analysis. These findings are that the alternatives which produce the largest overall net benefits are those that emphasize renovation and upgrading, and the leasing of a large number of units over a 50-year period under privatization (Alternative 8), and, once restoration is complete, those that allow privatization (Alternative 4) and leasing through a property manager (Alternative 5). These alternatives feature minor off-base commuting and rental costs, higher BQHD rental revenues and developer margins, tax credit benefits for restoration under privatization (Alternative 8), higher operation and maintenance spending, and higher consequent economic impacts. Alternatives which emphasize demolition in the short-term under USAF ownership (especially Alternative 2), minor restoration and operation and maintenance spending and consequent economic impacts, and higher levels of off-base commuting and renting costs, have lower (and negative) overall net benefits. While the absolute impacts of each alternative would change if use and non-use values were to be included in the analysis (use and non-use valuation adding to the net benefits of those alternatives where restoration and upgrading

activities are most important), the relative impacts of the alternatives, and their rankings, would be less likely to change.

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Environmental Science Division
Argonne National Laboratory
9700 South Cass Avenue, Bldg. 240
Lemont, IL 60439-4854

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