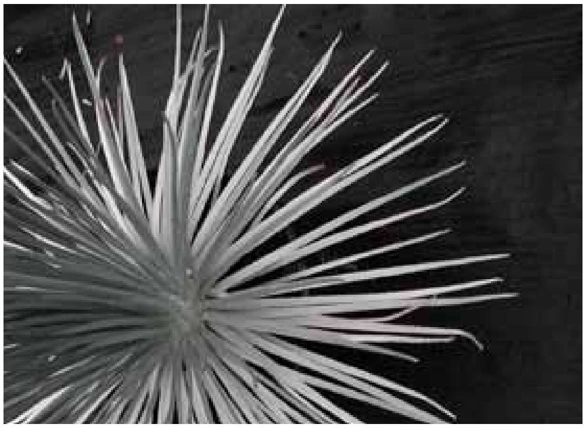
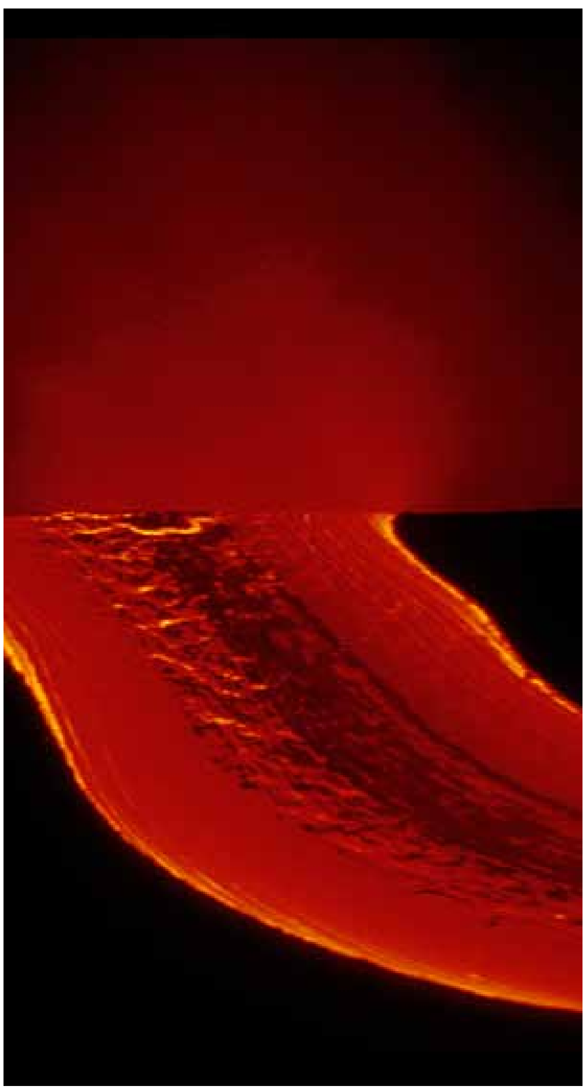



UHERO
THE ECONOMIC RESEARCH ORGANIZATION AT THE UNIVERSITY OF HAWAIʻI

Methodologies to Assess the Value of the Coastal Zone Management (CZM) Special Management Area (SMA) Permit Program

MAY 22, 2013




Methodologies to Assess the Value of the Coastal Zone Management (CZM) Special Management Area (SMA) Permit Program

MAY 22, 2013

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Table of Contents

CZM Acronyms and Abbreviations

ACM – avoided cost method

BTM – benefits transfer method

CBA – cost-benefit analysis

CBM – contingent behavior method

CM – choice modeling

CVM – contingent valuation method

CZM – coastal zone management

DBDC – double-bounded dichotomous choice

ES – ecosystem services

ESM – ecosystem service method

HPM – hedonic pricing method

NOAA – National Oceanic and Atmospheric Administration

SMA – special management area

TCM – travel cost method

WTA – willingness to accept

WTP – willingness to pay

Methodologies to Assess the Value of the Coastal Zone Management (CZM) Special Management Area (SMA) Permit Program

1 Introduction

The Hawaii Coastal Zone Management (CZM) Program and Special Management Area (SMA) permitting system were established to protect coastal areas and manage the public's use of coastal resources. The purpose of CZM is to provide for the effective management, beneficial use, and protection of resources and recreation in the coastal zone in the face of development. While it is clear that healthy coastal resources provide a variety of beneficial ecosystem services (ES), valuing those ES in dollar terms is a challenging exercise. "Ecosystem services are the benefits people obtain from ecosystems. These include provisioning services such as food, water, timber, and fiber; regulating services that affect climate, floods, disease, wastes, and water quality; cultural services that provide recreational, aesthetic, and spiritual benefits; and supporting services such as soil formation, photosynthesis, and nutrient cycling." Millennium Ecosystem Assessment (2005). The purpose of this report is to illustrate a set of methodologies for valuing the important benefits of an ES protected or enhanced by the SMA permit program. It presents discussion of the benefits and limitations of each methodology, particularly as it pertains to the CZM Program.

Given the countless number of ES potentially associated with the coastal zone, a list of key ES was provided to the study team by the Office of Planning. The list includes public access, beach and shoreline protection, marine resources, and scenic and open space. While not an ES, public participation was also identified as an important benefit of the SMA program. The identification of benefits and potential valuation methods are illustrated through case studies that were selected based on the recommendation of participating County planners. The examples were chosen with the intent of providing adequate representation of key coastal ES of interest. The permit examples were taken from each of the counties. One or more SMA permit examples are provided from Hawaii, Kauai, Maui and Oahu (see Table

Table 1. **Overview of case studies**

Island	Site	Key ecosystem service(s) protected/enhanced by the SMA permit process
Hawaii	Puako Bay	Public beach access, marine resources
	Kohaniki Beach Park	Public beach access, scenic amenity, open space, marine resources, cultural value
	Holualoa Bay	Scenic amenity, marine resources, cultural value
Kauai	Kealia and Donkey Beaches	Public beach access, scenic amenity
Maui	Makani Sands	Beach recreation (local), marine resources
	Charley Young Beach	Beach recreation (tourism)
Oahu	Moana Surfrider Hotel	Public beach access, erosion control

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1). The case studies were selected based on their illustration of the methodologies and are not intended to be a representative sample statewide.

Depending on the benefit or ES of interest, there are a variety of established environmental valuation techniques that may be used to ascertain the benefits of a particular permit in monetary terms. The major distinction in methods are whether they are based in information "revealed" in the market (actual actions taken), or in "stated" preferences (for example, through a survey of preferences and willingness-to-pay for specified ES). Within that general distinction, there exist a variety of specific approaches. In this report, six major approaches are considered: contingent valuation, choice modeling, travel cost, hedonic pricing, ecosystem service approach, and benefits transfer. For each case study, one or more valuation technique is recommended based on site visits and discussions with local planners. An appendix provides additional details on how one would implement various techniques in practice, including data requirements and the necessary statistical analysis.

From the small sample of permits reviewed, it is clear that the types of benefits, expected beneficiaries, geographical conditions, and the existing state of ES varies widely within and across islands. Therefore, it would be difficult to recommend an aggregate valuation approach for the SMA program, e.g. wherein a metric like "area of protected coastline" is multiplied by the average expected benefit generated by each acre covered by an SMA permit. However, conducting valuation studies for a few permits covering a variety of ES would likely give a rough idea of the potential magnitude of benefits generated across the State. This information could be used to develop a wider cost-benefit analysis of the merit of the program.

2 Project overview

The CZM Program is a partnership between the National Oceanic and Atmospheric Administration (NOAA) and participating coastal and Great Lakes states, territories, and commonwealths. Established in 1972 as part of the CZM Act, the partnership works to preserve, protect, develop, restore, and enhance the nation's coastal zone resources. The Hawaii CZM Program was approved by the federal government in 1978 and the state in 1977 and is codified under HRS Chapter 205A. The SMA permit, which is now a key component of the Hawaii CZM Program, was established in 1975 with the enactment of the Shoreline Protection Act (Act 176). The SMA permitting system, which is administered by each of the county governments throughout the state, is a tool to ensure that development within the SMA are designed and carried out in compliance with CZM objectives, policies, and SMA guidelines.

The SMA boundary is determined by each respective county to include areas where development should be managed to protect coastal resources. While the definition of "development" within the SMA is quite broad, typical land uses and activities regulated by the SMA program include development of hotels, subdivisions, and commercial areas. Unless determined to have a significant impact in the SMA, agriculture, interior alterations, single family homes, and underground utilities are exempt from the permitting process. If a proposed development has construction valued at $500,000 or less, it is subject to an abbreviated review process and does not require

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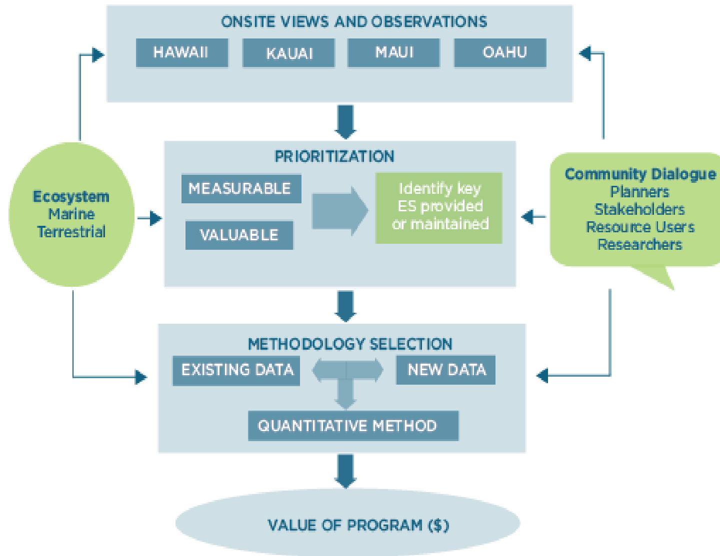
a public hearing. An SMA Use Permit, otherwise known as an SMA Major, is required if the development exceeds $500,000 in value and/or potentially generates substantial adverse environmental and ecological effects. The review process for an SMA Major permit includes a public hearing.

While the SMA permitting system is implemented by each county according to its own ordinances and rules, the Hawaii CZM Program provides oversight and support. The overarching guidelines provided to the counties for processing SMA permits are CZM objectives and policies for the following: recreational resources, historic resources, managing development, coastal ecosystems, public participation, scenic and open space resources, economic uses, coastal hazards, beach protection, and marine resources. The objective of this report is to illustrate a set of methodologies for valuing these important resources, protected by the SMA permit process. The potential application of these environmental valuation techniques is demonstrated through several selected case studies.

The key to developing a methodology for valuing benefits of the SMA permit program is linking actions resulting from the program to value changes in coastal and ocean ES of interest. Because the focus is on the value of the permit itself, and not the wider project or development, the counterfactual is what would likely occur in the absence of the mitigations and conditions attached to the permit (and not an assessment of the project itself, as that is outside the scope and purpose of this study). As outlined in Figure 1, the process begins with onsite interviews and observations at sites where permits were granted. The case studies provide information about the types of ES provided or maintained as a result of the



permit program (through attached mitigations and conditions), and through dialogue with the community and observation of the ecosystem, ES must be prioritized based on both measurability and expected value. The issue of "measurability" is critical, as not all issues can be quantified adequately. Once a list of key ES is constructed, an appropriate valuation technique can be chosen with an understanding of what kinds of economic value that specific methodology is able to account. The selection of methodology should also consider the availability of existing data and the feasibility of collecting new data, which is often necessary given the site-specific nature of valuation techniques. The selected valuation method generally provides a lower bound to the value of the ES or benefit provided by the SMA permit, given that measuring the value of all services is generally not feasible.

The ES of interest, provided to the study team by the Office of Planning, include public access, beach and shoreline protection, marine resources, and scenic and open space. While not an ES, the Office of Planning additionally identified public participation as an important benefit of the SMA permit program.

3 An introduction to environmental valuation[1]

Ecosystems generate flows of goods and services that benefit society. However in many cases, those valuable goods and services are not priced by a market, which begs the question of how to estimate those values, especially given their importance in planning and policy decisions. Quantifying the value of ES first requires a conceptual model grounded in economic theory. If an individual is presented with a potential change in the provision of an ES, he/she may be willing to pay money to ensure that the improvement happens. This willingness to pay (WTP) reflects an individual's value of the improvement in ES.[2]

It is assumed that individuals have a set of preferences over goods and services that are reflexive, complete, transitive, and continuous. Under those assumptions, a utility function exists that is an ordinal representation of preferences. Since utility cannot be directly observed, however, consumer surplus – the money metric of utility – is used to quantify the value of an increase in the level of an ES. Specifically, for a given change in the provision of an ES, the value of the change is estimated as the maximum WTP of the individual to return him/her to the original (pre-change) utility level. Although environmental valuation studies are typically based on the same basic theory of rational choice, there are a variety of quantitative methods available to estimate non-market values. The major distinction in methods are whether they are based in information "revealed" in the market, or in "stated" preferences. The remainder of this section briefly discusses six major approaches: contingent valuation, choice modeling, travel cost, hedonic pricing, ecosystem service approach, and benefits transfer. The first two are stated preference techniques while the others are revealed preference techniques.

1 This section draws heavily on chapter 11 in Hanley et al. (2007).

2 An alternative but (approximately) theoretically equivalent way of looking at the problem is to calculate the minimum compensation an individual is willing to accept (WTA) to forego the increase in the ES. Empirical evidence suggests that there is often a divergence between WTP and WTA measures of value (e.g. List and Shogren, 2002), but for the purposes of this report, consumer surplus is measured by WTP.

3.1 Contingent valuation

The contingent valuation method (CVM) was pioneered by Davis (1963) and has since become the most widely used, albeit also the most controversial of valuation techniques.[3] Most CVM applications can be split into five steps: [1] creating the hypothetical market (creating a survey), [2] obtaining "bids" (administering the survey), [3] estimating WTP (interpreting the responses), [4] aggregating the data, and [5] carrying out validity checks.

Step 1 entails designing a hypothetical scenario wherein ES may be increased due to, for example, the implementation of a new policy. The restoration effort can only proceed, however if funds are generated, which requires some form of payment from users of the resource (and in this case, the survey-taker). Bids are obtained through telephone, in-person, mail, or online surveys. Respondents are typically asked to state their WTP as either a range of values (interval-type data), a single value as an answer to an open-ended question, or a dichotomous choice (yes/no) to a single suggested payment. Some studies also use the double-bounded dichotomous choice (DBDC) method, wherein respondents are asked if they are willing to pay a higher or lower amount than

3 See Bateman et al. (2002) for a comprehensive account of CVM.

the original value suggested depending on whether they answered "yes" or "no" to the first question.

Once all of the survey data is collected, it is straightforward to calculate WTP if respondents provide a dollar amount corresponding to the hypothetical change in ES. For dichotomous choice methods, however, WTP must be estimated. While there are several approaches, the most popular is the "utility difference approach" (Hanemann and Kanninen, 1999), which is applied to the random utility model. After WTP is collected or estimated, the next step involves aggregation, i.e. calculating the total value for the entire population of interest. One recently developed approach involves using a distance-decay function, which relates how far people live from the environmental resource of interest and how much they are WTP to protect or improve it (Hanley et al., 2003). While not always used in CVM studies, several validity checks have recently emerged to roughly assess the credibility of valuation estimates: scope tests, convergent validity, calibration factors, protest rates, and construct validity. WTP estimates additionally assume that the relevant population is educated enough on the survey topic to provide reasonable responses such that it truly reflects a person's preferences and value system.

3.2 Choice modeling

Choice modeling (CM), also sometimes referred to as conjoint analysis, covers a group of stated preference methods that, like CVM, elicit preferences directly from individuals via surveys. Rather than requesting information about WTP for a particular change in an ES, however, CM takes a somewhat different approach to what exactly people are valuing. The choice experiment approach (Louviere and Hensher, 1982) asks respondents to choose between alternative goods with varying attributes. The theoretical framework, as in the CVM dichotomous choice method, follows the random utility approach. A conditional or multinomial logit (statistical) model is then typically used to estimate the probability that a respondent prefers a particular option to any other alternative in the choice set. Once parameters are estimated, a compensating variation welfare measure can be calculated. This is the amount of money that a person would have to be compensated in order to maintain his/her initial level of utility (well-being) after the change in ES. Other commonly used CM methods include contingent ranking, paired comparisons, contingent ratings, and choice experiments.[4]

3.3 Travel cost

The travel cost method (TCM) is a revealed preference approach that uses data of people's actual behavior in markets rather than hypothetical scenarios. However, since observable data only exists for markets that are related to the ES in question, TCM is viewed as an indirect valuation method. TCM was developed in the 1950s (Wood and Trice, 1958; Clawson, 1959) to study the number and distribution of trips people take to outdoor recreational resources (e.g. forests, national parks, and beaches) as a function of the cost of the trip. Several advances have been made since the introduction of TCM, and two models have emerged as frontrunners in the TCM literature: count models and random utility models.

Count models estimate the relationship between the number of visits per period with characteristics of both the recreation site and the in-

4 See Louviere et al. (2000) for a detailed discussion of CM methods.

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dividual. More specifically, they can provide the value of consumer surplus under existing conditions. If interest lies in how the values will change if some of the attributes of the site change (e.g. ES are improved due to conservation efforts), however, random utility modeling is more appropriate. The random utility approach applied to TCM is analogous to that used for CVM and CM, except that the data is based on real behavior and costs rather than hypothetical scenarios. An increase or decrease in utility resulting from a change in site attributes is converted into dollars using the inverse of the marginal utility of income, which in this case is the parameter on the travel cost variable in the regression.

Some recent studies have combined revealed preference approaches with stated preference approaches. The contingent behavior method (CBM), for example, measures intended behavior in some contingent (rather than actual) market. WTP is then estimated by comparing the contingent market data to actual market data from the same individuals. The CBM can be used to examine changes in trip frequency as prices change (Eiswerth et al., 2000) or as environmental quality changes (Hanley et al., 2003). For the purposes of this study, we discuss TCM as a "revealed" preference approach.

3.4 Hedonic pricing

First applied to environmental valuation by Ridker and Henning (1967), the hedonic pricing method (HPM) provides a means for calculating implicit prices of an environmental good or service of interest using actual market data, most often housing prices. HPM typically proceeds in three steps, starting with the estimation of a hedonic price function. If the commodity in question is real estate, then it is necessary to obtain data on housing prices, as well as characteristics expected to affect house values, e.g. number of rooms, size of yard, crime rate, distance from the city center, quality of nearby schools and parks, air quality, noise level, and view. Since the partial derivative with respect to any characteristic gives its implicit price, the implicit (marginal) prices of the ES of interest are determined once the model parameters are estimated. Lastly, welfare benefits of discrete improvements in ES can also be estimated. Under certain conditions, the value of such an improvement is equal to the expected change in property value resulting from the environmental change. Palmquist (2003) provides a comprehensive review of HPM, including a discussion of caveats and limitations.

3.5 Ecosystem service valuation

While most valuation methods focus on individual preferences for changes in the environment, the ecosystem service method (ESM) estimates values for ES via their role as inputs in the production of market-valued goods. For example the value of a mangrove ecosystem, which serves as a breeding ground and nursery for shrimp, can be inferred from the change in surplus to shrimp fishermen resulting from a decline in the area covered by mangroves in the region (Barbier and Strand, 1998). An alternative but related approach is the avoided cost method (ACM), which values ES according to what it would cost to replace them. For example, the recharge of aquifers via upland watersheds could be valued according to what it would cost to obtain water from alternative sources such as treated wastewater or desalinated brackish water (Kaiser and Roumasset, 2002).

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3.6 Benefits transfer

Conducting primary research such as valuation studies can range in cost from hundreds of thousands to millions of dollars and typically take a year or more to complete. A less intensive alternative that relies on secondary data is the benefits transfer method (BTM). It involves taking estimates from a different site and transferring them to the site of interest after making site-specific adjustments (Rozan, 2004). While the BTM is appealing from a budgetary and time standpoint, average transfer error is in the range of 20-40% (Brouwer, 2000; Shrestha and Loomis, 2003). The cost of a "competent" original valuation study is in the range of $200-300K (Allen and Loomis 2008). Benefit transfer is therefore only justifiable if the loss in accuracy is more than offset by the reduction in the cost of analysis.

4 Examples of SMA permits in Hawaii

In this section, we discuss six examples where an SMA permit was obtained and one example of a withdrawn permit application. The case studies were selected by participating county planners, with the instruction that the permits represent successful application of the SMA permit program intent and were completed within the last ten years. The examples were additionally selected with the intent of providing adequate representation of geographical conditions and key coastal ES, as identified by the Office of Planning.

Table 2 provides a summary of the selected case studies. For detailed information obtained from on-site interviews, see Appendix A. Pros, cons, step-by-step instructions, and data requirements for specific valuation techniques are outlined in Appendix B.

Beneficiaries are individuals or groups who obtain benefits from ecosystem goods or services. A single ecosystem service can generate benefits to multiple beneficiaries simultaneously. For example, improved coastal water quality may be valued by both individual recreational beach users, as well as commercial fishing operations. Beneficiaries can also span large spatial scales. Maintaining healthy coral reefs, for example, generates benefits in the immediate area for snorkelers but also holds value for many individuals across the globe who appreciate the existence of endemic coral. Environmental valuation studies attempt to quantify the value of measurable benefits that can be associated with specific beneficiaries.

It should again be noted that it is not within

Table 2. Overview of case studies

Island	Site	Key ecosystem service(s) protected
Hawaii	Puako Bay	Public beach access, marine resources
	Kohaniki Beach Park	Public beach access, scenic amenity, open space, marine resources, cultural value
	Holualoa Bay	Scenic amenity, marine resources, cultural value
Kauai	Kealia and Donkey Beaches	Public beach access, scenic amenity, open space
Maui	Makani Sands	Beach recreation (local), marine resources
	Charley Young Beach	Beach recreation (tourism)
Oahu	Moana Surfrider Hotel	Public beach access, erosion control

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the scope of this report to assess the overall environmental impact or economic costs or benefits of the above proposed projects. The consideration of how one would quantify benefits is solely of those benefits provided by the permit mitigations and conditions, rather than of the project as a whole.

4.1 Makani Sands (Lahaina, Maui)

In March 2011, a SMA emergency permit was requested to repair the seawall fronting the Makani Sands condominium in Lahaina, Maui. The seawall and the concrete slab behind it were largely undermined due to long-term erosion and wave impact, and the makai (ocean-front) face of the seawall contained noticeable structural cracks. The cavity under the slab created imminent danger of collapse, which could have resulted in bodily harm or death. In addition, ocean encroachment following a collapse of the seawall would have caused substantial damage to the foundation of the building.

Prior to the emergency seawall repair, first-flush storm water runoff from the parking area was channeled through a concrete swale directly into the nearshore environment via an 8-inch diameter drainage pipe transecting the existing wall. Although the coastal ecosystem at the site can be described as fairly healthy, continued introduction of contaminants to the ocean would pose a threat to water quality and consequently to all of the organisms that depend on clean water.

4.1.1 Description of the mitigative measures undertaken

Repair of the existing seawall entailed excavating four to six feet below the wall, placing three to five foot diameter boulders under the wall, pressure-grouting the voids between the boulders, installing No. 5 rebar on top of the boulder floor, and pressure-grouting to stabilize the entire structure.

Following a site visit in May 2012, the Maui County Department of Planning staff concluded that the existing drainage system should be improved. The SMA permit was approved in October 2012 subject to the installation of a storm water treatment system. The existing concrete swale was removed and replaced by a 3-chamber treatment system. In addition, a 2' by 2' inlet grate and filter was installed to capture oil, debris, and floatables from runoff entering the infiltration chambers. Not accounting for the inlet filter, removal efficiencies are expected to be 80% for total suspended solids, 49% for phosphorus, 90% for total petroleum hydrocarbons, and 53% for zinc.

4.1.2 Benefits of the SMA permit

Approval of the permit to repair the seawall generated several positive effects in addition to the obvious benefit of preventing serious injury and structural damage. The beach fronting the seawall is used by local families for recreation, which means that repairing the seawall will maintain recreational values. Installation of the storm water treatment system improved water quality by filtering and reducing runoff entering the ocean from the parking area. Maintaining a high quality of water is both beneficial to recreational users and to the coastal ecosystem, including fish, seaweed, and coral.

4.1.3 Recommended valuation methods

The primary added ES provided through the permit is improved water quality. To simplify the problem, we focus on two classes of beneficiaries: recreational users (e.g. local families) and people concerned with the wellbeing of coastal ecosystems (both residents and non-residents).

Residents who use the beach for recreation value the quality of the water directly, given that it is presumably less enjoyable to swim in polluted water.[5] This value could be estimated using stated preference methods, which require obtaining users' WTP for an incremental improvement in coastal water quality through on-site or telephone/mail surveys. Typically, such surveys elicit preferences by asking participants to rank different scenarios (e.g. beaches with different characteristics). Once the data is collected, WTP is obtained directly from the survey results (King, 1995) or estimated using an appropriate quantitative model, e.g. mixed multinomial logit (Beharry-Borg and Scarpa, 2010), conditional logit (Penn et al., 2012), or negative binomial (Rolfe and Gregg, 2012).

The model results will provide an estimate in dollars of how much a typical beach user is willing to pay for a 1% increase in water quality, which may be measured, for example, as cloudiness of the water (indicative of total suspended solids). To determine the total recreational value of the permit, the WTP would need to be multiplied by the total number of users and then by the effect of the storm water system installation relative to the baseline, since the additional filtering is likely to increase water quality by more or less than (i.e. not exactly) 1%.

Since the health of the ecosystem also increases with the quality of water, the value of

5 Health problems caused by contaminated water can also be an issue if the quality of the water falls below a certain threshold. However, this is not likely to be a concern in this particular situation given what is known about the current water quality at the site and the source and magnitude of contaminant flux prior to the seawall repair.

Table 3. Summary of Makani Sands case study

Ecosystem service	Primary Beneficiary Group	Recommended valuation method	Data required
Beach recreation	Beach users	CVM, CM	Beach user survey
Marine resources	Individuals who value existence of marine resources such as coral	BTM	Existing studies

the permit should include existence values for the nearshore ecology, which includes everything from fish and sharks to coral. Although done on a much larger scale, Cesar and van Beukering (2004) estimated that Hawaii's coral reefs in aggregate generate at least $10 billion in present value, or $360 million per annum. Unless the pollution in the parking lot runoff would eventually entirely eliminate the coral in the area, however, even a dollar value scaled down in proportion to the area of coral at the study site would overestimate the marginal effect of the storm water system. Bishop et al. (2011) estimate the value to all U.S. households of increasing protected coral reef areas and restoring five acres of coral reefs per year in Hawaii at roughly $34 billion per year. While their hybrid contingent-valuation/stated-preference method does a better job of capturing the marginal value of coral reef improvement, the accuracy of scaling down the result will depend on what exactly is meant by "restoring" coral reefs as compared to the expected change in reef health resulting from an improvement in water quality at Makani Sands.

4.2 Charley Young Beach (Kihei, Maui)

In March 2012, an SMA permit, shoreline setback, and environmental assessment exemption were approved for a proposed encroachment removal and dune restoration project at Charley Young Beach, which is located along the Kihei

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Signage for the dune restoration area

Beach width has largely increased, generating value for beach recreation

coast. Prior to the project, homeowners fronting the beach park parcel were encroaching on public land via, e.g., landscaping, lighting, beach chairs, barbecue grills, and in one instance, a hot tub. In addition, irrigation of vegetation along the beach boundary created thick barriers that impeded view-planes along the beach.

4.2.1 Description of the mitigative measures undertaken

Mitigative actions were paid for by property owners along the shoreline and proceeded in two steps: (1) removal of encroaching vegetation including trees, bushes, and grass, and (2) dune restoration with indigenous dune vegetation such as pohuehue vines (Ipomea pes-caprae) and akiaki grass (Sporobolus virginicus), as well as installation of sand fencing to promote natural dune growth. Additional improvements included signage noting public access and areas undergoing coastal preservation activities.

4.2.2 Benefits of the SMA permit

Removal of the encroaching objects raises the value of beach recreation both because of the increased beach width and because of the expanded view corridors along the shoreline. Local planners estimated that encroachment removal at least doubled the previous usable beach width. This is especially significant, given the high usage rate of Charley Young Beach; as the photos suggest, many visitors were enjoying the beach on a weekday. Replenishing sand dunes with dune vegetation also reduces erosion and generates a natural barrier against coastal hazards.

4.2.3 Recommended valuation methods

Increasing the beach width through encroachment removal and dune restoration has two effects: (1) users may want to visit the beach more often, and (2) users may experience greater enjoyment during a given beach visit. Users of Charley Young Beach include local residents and visitors from outside of Hawaii. A demand function for beach recreation could be estimated using the travel cost method (TCM) if beach user

Table 4. **Summary of Charley Young Beach case**

Ecosystem service	Primary Beneficiary Group	Recommended valuation method	Data required
Beach recreation	Beach users (locals/tourists)	TCM, CVM	Beach user survey

Before vegetation removal

After vegetation removal

Photos courtesy of Tara Owens, UH Sea Grant, County of Maui Department of Planning

data is available before and after the restoration project.[6] TCM is a revealed preference approach that uses data of people's market behavior, in this case the amount spent to travel to and recreate at Charley Young Beach, to infer the value of an environmental service. If the requisite data are not available for TCM, the value of beach width could be estimated using a stated preference method, which requires collecting survey data on users' responses to hypothetical scenarios, e.g. a wider beach. Whitehead et al. (2008) use a combination of revealed and stated preference data and a Random Effects Poisson specification to estimate the value of a beach day and the value of improved beach width in North Carolina. Pendleton et al. (2012) find that the marginal value depends on the initial beach width; if the beach is already very large, increasing width does not increase value by much if at all. In this case, like most of the beaches in Hawaii's SMA, beach width is relatively narrow, which suggests that the marginal value generated by the project may be sizeable.

4.3 Puako Bay (South Kohala, Hawaii Island)

In January 2012, a SMA use permit was requested to construct retaining walls, driveway access, and water laterals; implement a shoreline access path; and install landscaping on a 6.92 acre property located along the South Kohala coast. The proposed development includes three lots for residences, each approximately two acres in size. Prior to the site improvements, runoff from the property was flowing directly into coastal waters, likely affecting the nearshore ecosystem, including pristine coral reefs, fish, and sea turtles.

6 To isolate the effect of the permit, applying TCM would require a counterfactual.

Before erosion control measures

After erosion control measures

Photos courtesy of Bethany Morrison, County of Hawaii Department of Planning

4.3.1 Description of the mitigative measures undertaken

Mitigative measures fell into three general categories: site improvements, lateral coastal access improvements, and landscape improvements. Erosion control measures included installation of silt fences, sand bags, and a crushed rock ingress/egress, as well as construction of a 1-foot high wall designed to direct on-site generated water toward drainage basins. Runoff mitigation included the construction of an 80-foot wide channel to convey off-site floodwaters, as well as a 1-foot high wall running parallel to the ocean to minimize on-site runoff from directly entering the bay by redirecting it towards two shallow drywells on the lots. Lateral coastal access improvements included a 4-foot wide walking trail that would follow the shoreline within a 10-foot wide public access way corridor, installation of trail signs, and trimming and/or removal of trees along the path. Landscaping improvements, including removal of some existing trees and addition of drought tolerant plant material, were intended to minimize erosion and therefore are not expected to affect beach processes or artificially fix the shoreline.

4.3.2 Benefits of the SMA permit

Approval of the permit in February 2012 to proceed with the various site, access, and landscape improvements generated several positive effects. Erosion and runoff control measures (retention barriers and drywells) reduce discharge of pollutants and nutrients into nearshore waters, which is beneficial to both recreational users of the bay and marine resources comprising the coastal ecosystem. Development of the lateral coastal trail provides access to the previously inaccessible bay. Beneficiaries of improved and maintained public access include participants in boating, fishing, snorkeling, and other coastal recreational activities.

4.3.3 Recommended valuation methods

The benefits of improved water quality could be quantified by implementing stated preference methods using survey data obtained from recreational beach users, combined with a contingent value methodology or benefit transfer approach to approximate the existence value of the marine resources that require clean water to survive, such

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Table 5. **Summary of Puako Bay case study**

Ecosystem service	Primary Beneficiary Group	Recommended valuation method	Data required
Public beach access	Beach users	CVM, CM	Beach user survey
Marine resources	Beach users	CVM, CM	Beach user survey
	Fishermen	ESM	Ecosystem production function, market price of fish
	Individuals who value existence of marine resources such as coral	BTM	Existing studies

as turtles, coral, and fish.[7] If the health of the nearshore ecosystem contributes to fish growth, e.g. by providing a protected habitat or nursery for juveniles, then one could alternatively apply the ecosystem services method (ESM), given that beneficiaries include fishermen. Because values calculated using ESM are based on prices for market-valued goods, in this case fish, applicability is largely dependent on the extent to which the health of the nearshore ecosystem serves as an input to the production of fish. If one can quantify the production function, i.e. relationship between the nearshore ecosystem (input) and harvestable fish (output), then it is possible to determine the avoided cost associated with sediment and erosion control resulting from the SMA permit in terms of the potential effect on fish production and harvest.

There are a variety of valuation methods that can be employed to estimate the WTP for a public beach access point. For example, it can be estimated using a contingent behavior model (Barry et al., 2011), contingent valuation methods (Oh et al., 2008; Dixon et al., 2012), or a combination of revealed and stated preference methods (Whitehead et al., 2010). Each of these valuation techniques require survey data from beach users, but the extent of such data would vary with the method selected. The contingent valuation approach elicits WTP for additional access points by presenting survey participants with hypothetical resource scenarios. The contingent behavior approach also directly asks how behavior (trips to the beach) would change in response to a change in the resource (an additional access point). Hybrid revealed/stated preference methods require information on beach trips taken in the past (e.g. recreational activities undertaken, distance traveled, money spent on travel, trip duration, number of trips to the beach, and household characteristics) in addition to stated preference data based on future trips that would be undertaken under various hypothetical conditions.

4.4 Kohanaiki Beach Park (North Kona, Hawaii Island)

In November 2003, the Planning Commission approved an SMA permit request to develop 500 homes, an 18-hole golf course, golf clubhouse, and related improvements at a property in Kohanaiki, North Kona. Part of the development borders the Kaloko-Honokohau National Historic Park. The beach is a popular destination for camping, surfing, diving, swimming, fishing, and other coastal activities. However, prior to the development, public access was limited to an unpaved path (4WD was necessary to go beyond a certain point).

4.4.1 Description of the mitigative measures undertaken

The SMA permit was approved subject to an extensive list of conditions. To preserve open

7 See section 4.1.3 for a detailed discussion on valuing water quality.

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Signage for the historical Mamalahoa Trail

View of the golf course and clubhouse from the access road

Construction of the comfort station almost complete

Signage for the Anchialine Pool Restoration Project

Kohanaiki is a popular beach camping ground

The beach park is also a popular destination for surfers, fishermen, swimmers and divers space and maintain view-planes, the following conditions were required: the makai (oceanfront)-most row of lots and the those bordering the National Historical Park must consist only of one-story homes with heights not exceeding 30 feet, plantings must be established to shield residences from views from the National Park, no facilities may be developed within 400 feet of the National Park, the view from Queen Kaahumanu Highway toward the sea must be maintained, and 109 acres of the parcel will be donated to public ownership for a coastal park. To improve public access, a mauka (mountain)-makai (ocean) public access road, a lateral public access road, public parking stalls, and public restrooms and showers must be constructed. To protect the culturally important Mamalahoa Trail that traverses the parcel, a 50-foot wide buffer of natural lava must be maintained on the makai (ocean) side of the trail and the trail shall not be breached except by the access road. Lastly, the area is characterized by many anchialine ponds, which are home to native shrimp and insects. To protect those coastal resources, an anchialine pond management plan was developed and implemented including hiring of a pond manager and creating agreed upon buffers around the ponds. A study was submitted that found that the non-potable water for golf course irrigation has no negative effects on the ponds.

4.4.2 Benefits of the SMA permit

The mitigative actions undertaken by the permit applicant improved public beach access, which is valued by recreational beach users; maintained the scenic amenity value provided by the ocean and enjoyed by highway users, property owners in the area, and visitors to the National Park; and ensured more protection of the anchialine ponds, an important nearshore resource.

Table 6. Summary of Kohanaiki Beach Park case

Ecosystem service	Primary Beneficiary Group	Recommended valuation method	Data required
Public beach access	Beach users	CVM, CM	Beach user survey
Scenic amenity and open space	Property owners, visitors to the National	HPM	Real estate data
Marine resources	Individuals who value existence of marine resources such as coral	BTM, CVM	Existing studies, Survey

4.4.3 Recommended valuation methods

As discussed in section 4.3.3, there are a variety of valuation methods that can be used to estimate WTP for public beach access – e.g., contingent behavior models, contingent valuation methods, or a combination of revealed and stated preference methods – all of which require survey data from beach users. The value of improved beach access in terms of a better experience for beachgoers is likely to be large when aggregated across all users, given that the site visit confirmed that this is a heavily used beach.

WTP for scenic amenity has been estimated for many regions around the world. Nearly all studies use the hedonic pricing model, which requires market data for real estate or hotel bookings with some observations characterized as having a view and some observations characterized as not having a view. The quantitative method can vary – e.g. ordered probit (Ambrey and Fleming, 2011), maximum-likelihood Box-Cox (Benson et al., 1998), fixed effects (Fleischer, 2012), OLS (Fraser and Spencer, 1998; Jim and Chen, 2009), or a spatial simultaneous autoregressive lag model (Hindsley et al., 2012) – but all methods aim to estimate the effect on housing or hotel room price of the presence or absence (and sometimes the quality) of the view, while controlling for other factors that can affect prices.

If there were other studies with valuation estimates of anchialine ponds, those values could be used to infer, via benefit transfer, the approximate value of pond protection and management at Kohanaiki. Because the ponds do not generate resources that are priced in a market, valuation would have to be determined using stated preference methods, e.g. CVM. The framework developed in a 2011 study by Bishop et al., which estimates the value to U.S. households of increasing protected coral reef areas, could be used as a starting point if one were to directly estimate the value of the anchialine pools.

4.5 Holualoa Bay (Kona, Hawaii Island)

While most case studies discussed in this report involve benefits generated by successful SMA permit applications, Holualoa Bay serves to illustrate the value of the SMA Program's role as a deterrent to developments when the community perceives there to be detrimental effects. After a series of Land Use Commission hearings over almost five years, developers decided to abort an attempt to construct a four-story, 16-unit condominium on the beachfront parcel currently underlying the Lyman House along Holualoa Bay. The owners applied for an SMA permit but, through the process, the neighborhood strongly opposed the development and the permit was never approved. The community concerns centered around nearby cultural sites and scenic views.

4.5.1 Benefits of the SMA program

Public involvement and the SMA program requirements ultimately prevented developers from moving forward with the condominium project. In addition to reducing scenic amenity due to smaller view corridors both for surfers facing mauka (mountain view) and for residences and businesses looking toward the sea, the plans for the proposed condominium included an underground parking structure that might have generated runoff into underwater springs or directly into the ocean, resulting in nearshore water quality reduction and damage to coral reefs.

While it is not certain that the development of a condominium would largely diminish recreational benefits of the bay – Lyman's is a popular surf break – the cultural value of maintaining the area is additionally considered. The coastal

Site of the proposed 4-story condominium along Holualoa Bay

Konani game board carved into the lava rock

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area is rich in ancient Hawaiian history, including heiau and ancient petroglyphs, e.g. a konani game board carved into the lava rocks fronting the property (photo from site visit).

4.5.2 Recommended valuation methods

The most measurable value of not developing the condominium is the maintenance of existing view corridors. As discussed in section 4.4.3, WTP for scenic amenity has been estimated for many regions around the world, and nearly all studies use some version of the hedonic pricing model, which requires real estate market data. The goal is to estimate the effect on housing of the presence or absence of the view, while controlling for other factors that may affect prices.

As in the Makani Sands case, runoff to the ocean would have reduced both the value of beach recreation and the health of the nearshore ecosystem. Stated preference methods, which require survey data collected from beach users, could be used to estimate the WTP for a marginal change in water quality. The value of maintaining the health of the ecosystem could be approximated using either benefit transfer or a stated preference approach similar to those conducted by Cesar and van Beukering (2004) and Bishop et al. (2011) for coral reefs in Hawaii.

While it is generally difficult to quantify cultural value, especially when the cultural activities or objects in question are not linked in any way to actual market activity, the value of protecting important Hawaiian heritage sites at Holualoa Bay is partially represented by the public effort to oppose the development of the project. Costs incurred include the value of leisure time spent at public hearings and other meetings, costs of legal counsel, and any other costs incurred to educate and increase community involvement. In this particular example, donations to a nonprofit organization helped to support the cause.

Table 7. Summary of Holualoa Bay case study

Ecosystem service	Primary Beneficiary Group	Recommended valuation method	Data required
Scenic amenity and open space	Property and business owners	HPM	Real estate data
Marine resources	Individuals who value existence of marine resources such as coral	BTM, CVM	Existing studies, Survey
	Beach users	CVM, CM	Beach user survey
Cultural value	Cultural practitioners and residents	Cost of public effort to oppose development (as a lower bound)	Time spent, expenditures (e.g. for legal counsel)

4.6 Kealia Beach and Donkey Beach (Kealia, Kauai)

In December 1998, a public hearing was held regarding a proposed 28-lot subdivision along the makai (ocean) side of Kuhio Highway and immediately to the north of Kealia Beach along the east shore of Kauai. Part of the land is situated within the State Conservation District for public use, and the beach area abutting the property is a recreational resource for fishermen, surfers, and beachgoers. Prior to the development, the existing cane haul road that traverses through the property was used for pedestrian and bike access.

4.6.1 Description of the mitigative measures undertaken

The SMA permit was approved in March 1999, subject to the fulfillment of several conditions, including minor grading, clearing, and grubbing; construction of two public parking areas (24 stalls each); provision of a mauka (mountain) -makai (ocean) pedestrian pathway from the north parking area to Donkey Beach; maintenance of view corridors along Homaikawaa and

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Public Beach Path at Kealia-Kai Development

Convenience Center

Kumukumu streams as well as to the ocean, taking into account the need to mitigate the visual impact of the structures from the highway to the shoreline and from existing public views to and along the shoreline; and dedication of 57 acres of the property (one 7-acre parcel and one 50-acre parcel) to the County of Kauai or another government agency for public recreational purposes.

4.6.2 Benefits of the SMA permit

The mitigative actions undertaken by the permit applicant improved public beach access, which is valued by recreational beach users (photos below); maintained the scenic amenity value provided by the ocean and enjoyed by highway users and property owners in the area; and maintained 57 acres of open space for public use, which provides both recreational and scenic amenity values.

Table 8. Summary of Kealia Beach and Donkey Beach case study

Ecosystem service	Primary Beneficiary Group	Recommended valuation method	Data required
Public beach access	Beach users	CVM, CM	Beach user survey
Scenic amenity	Highway users and ocean recreationists	CVM, CM	Resident survey

In this case, the scenic amenities preserved were largely from the highway to the bluff as well as from the ocean to the development area. The scenic amenities include the maintenance of the ironwood trees on the bluff as well as substantial setbacks of the development as to limit its visibility from both the highway and ocean. Shrubbery was provided in strategic locations from the highway as to hide the development but still provide vistas from the highway to the ocean.

4.6.3 Recommended valuation methods

The benefits of providing and maintaining public beach access could be estimated using a variety of quantitative methods, e.g. a contingent behavior model, contingent valuation methods, or a combination of revealed and stated preference methods, each of which would require survey data from beach users.[8] In this particular example, the marginal benefit of the pedestrian pathway may be difficult to quantify, however, inasmuch as the existing cane haul road was already being used for beach access.

Although most WTP for scenic amenities

8 See section 4.3.3 for a detailed discussion on valuing public beach access.

Table 9. **Summary of Moana Surfrider Hotel case study**

Ecosystem service	Primary Beneficiary Group	Recommended valuation	Data required
Public beach access	Beach users	CVM, CM	Visitor survey
Erosion control	Property owners	HPM	Real estate data and beach characteristics

studies, as discussed in section 4.4.3, use some version of the hedonic pricing model, this example is somewhat different because the beneficiaries of the maintained view are not residences but rather motorists and ocean recreationists. As such, it would be appropriate to apply a stated preference method, such as CVM.

4.7 Moana Surfrider Hotel (Waikiki, Oahu)

In July 2010, the City and Council of Honolulu approved applications from Kyo-ya Hotels and Resorts for an SMA permit and Shoreline Setback Variance for the replacement of the Moana Surfrider Diamond Head Tower with a new tower and related improvements, including a retaining wall, swimming pool, deck, stairway, and lateral walkway.

4.7.1 Description of the mitigative measures undertaken

Granting of the SMA permit and SSV were subject to several conditions, including installation of a wider public beach access easement on the southeast end of the property; submission of $50,000 to the City and County for the repair and maintenance of bathrooms, surfboard racks, and surrounding area at Kuhio Beach Park; as well as written documentation that the applicant contributed $500,000 to DLNR for the State's beach replenishment project.

4.7.2 Benefits of the SMA permit

The mitigative actions required by the permit will improve public beach access, which is valued by recreational beach users and will replenish the beach, which is valued by recreational beach users and property owners fronting the beach where replenishment activities occur.

4.7.3 Recommended valuation methods

Valuation methods for improved beach access have been documented in many of the previous examples. The value of increasing beach width to recreational beach users has also been discussed in section 4.1.3. The benefits of erosion control (replenishment), however, are unique to this case study. In a recent study, Gopalakrishnan et al. (2011) implement a hedonic property value model and show that beach width tends to account for a large portion of coastal property value when there is severe erosion and shoreline stabilization via beach replenishment is undertaken. Performing such an analysis requires data on the basic characteristics of the beach and adjacent properties, including real estate prices.

5 Conclusion

The environmental valuation techniques discussed in this report provide a means for estimating the value (i.e. benefits) of a variety of ecosystem services protected or enhanced by the SMA permitting program. While not suited to quantitatively valuing all types of benefits (e.g., cultural importance or educational outreach), these tools are capable of providing a lower-bound dollar value for specific permits granted by the program. The valuation estimates, however, do not capture the costs incurred to protect or enhance the coastal resources of interest. Unlike environmental benefits, which are often difficult to value quantitatively and require primary data collection for analysis, cost data are often relatively straightforward and typically more readily available (e.g. labor, overhead, and administrative costs). Moreover, a benefit to one user group may also be considered a cost to another. The sum of all benefits and costs as a result of the SMA permit should be considered in any wider cost-benefit analysis (CBA), which would aim to assess the full merit of any particular action associated with an SMA permit. This would provide insight into the net benefit of the SMA program. This report highlights the core methodologies that could be used to assess ES, which then serves as an input into a CBA.

Another important point is that environmental valuation techniques are inherently static, i.e. the estimated value of an ecosystem service is associated with a specific snapshot in time. While the present value of the resource could be roughly approximated by summing a single value into the future using an appropriate discount rate, there are many unpredictable factors that will likely alter actual future values. Nevertheless, if the costs of maintaining a permit are low relative to the initial cost associated with the application and approval process and the benefits of the permit exceed the costs for the first year, then the net benefit of the permit is likely to remain positive over time.

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Appendix A. On-site interviews

HAWAII ISLAND SITE VISITS SUMMARY

Date: February 15, 2013

Attendance: Kimberly Burnett (UHERO), Makena Coffman (UHERO), Chris Wada (UHERO), Bethany Morrison (County of Hawaii Planning), Jeff Darrow (County of Hawaii Planning), Maija Cottle (County of Hawaii Planning) and Lucas Mead (County of Hawaii Planning)

The itinerary was put together by Bethany based on prior discussions regarding the types of ecosystem benefits we are planning to highlight in the report. At each of the sites, we asked questions touching on three major topics: (1) what are the benefits being protected or enhanced by the SMA permit, (2) what was the state of the site prior to the issuance of the permit, and (3) what kinds of mitigative actions were taken to protect the ecosystem services of interest? Visiting the sites in person allowed us to understand both the contents of the permit and, in some cases, the extent of the benefits. For example, improving beach recreation through better access and increased beach width is especially beneficial if the beach is heavily used, but the documentation would not provide that type of information.

Site: NELHA (Wawaloli Beach)

Benefit: public access, cultural value, water quality

Information obtained from the site visit: SMA permit resulted in the provision of mauka-makai access to the shoreline, a parking lot, and park facilities (bathroom, benches). Recreational value is probably fairly low, however, compared to other beaches; only 8-10 vehicles stopped at site while we met, and most just went out to look, take pictures, or use the bathroom (not too much recreation). It could be that most visitors were somewhere at NELHA (e.g. the seahorse farm) and then just decided to check out this beach since it was nearby. One of the conditions for the permit was to establish preservation buffers for the culturally significant Mamalahoa Trail. Lastly, NELHA agreed to an offshore water-quality monitoring program. There are no specific criteria however (how often to test, what to test) and the County is not in charge of ensuring that the water meets a certain standard. In any case, it's difficult to track the source of contaminants, especially after large storm events.

Site: Kohanaiki Beach

Benefit: public access, recreation, nearshore resources

Information obtained from the site visit: This is a popular beach used for camping, surfing, diving, swimming, fishing, and other activities. Improved public access include both mauka-makai and lateral pathways, a comfort station (restroom and showers), parking, and a designated camping area with a station to obtain camping permits (not sure if this is permanent). An additional condition (among many) of the SMA permit, which was requested for a golf course and residential development, is the maintenance of some of the anchialine ponds (habitat of native shrimp and some sort of endangered/endemic/protected fly). Seems like the main mitigation is to allow for a buffer between the golf course and the ponds, to minimize runoff into the ponds, and to regularly monitor the ponds. Maintenance will be paid for by the developer. Given the high usage and multiple amenities, this would be a good example.

Site: Old Kona Airport State Recreation Area and Kona Bay Estates

Benefit: recreation, public access

Information obtained from the site visit: These were visited together, although it seemed that the relevant SMA permit was with regard to the Estates, and they just happened to be near the old airport. The airport area included a skate park, community garden, parking (the old runway), restroom facilities and beach access. Nearer to the Estates, there were "private property" signs, although beach access was maintained via a concrete pathway. The pathway continued on top of a wall, which provided lateral access to areas that could otherwise not be reached through the gated community areas.

Site: Honl's Beach Park

Benefit: parking, public access, scenic amenity

Information obtained from the site visit: Owners of the parcel along the beach wanted to develop a condo, but it was blocked. The County did an exchange with the owners to develop elsewhere and turned the area into a beach park. Facilities include bathrooms and 20 parallel parking stalls across the street. Relatedly, developments across the street (private residences) were required to keep a low profile in order to maintain existing view corridors from the nearest highway (Kuakini Hwy). There was moderate recreational activity at the beach, but there are probably better examples if the main issues are access and recreation.

Site: Holualoa Bay
Benefit: public access, public input, cultural value
Information obtained from the site visit: At the first site, we looked at a house that was rebuilt after 50% of it was destroyed by fire. As a condition to rebuild, the owners added public beach access. At the second site, there was an old building (Lyman House) with a large saltwater pool that is in disrepair. The owners applied for an SMA major to put in a condo along the beach but the neighborhood opposed and the permit never made it to hearing. At the sites, there were some items of cultural value such as a konane board carved into the lava and a heiau.

Site: Kona Lagoon and Keauhou Beach Resort
Benefit: cultural value
Information obtained from the site visit: Heiau restoration has been occurring over the past 3-4 years. The CZM program allows restoration of cultural structures without an SMA permit. Although the activity is occurring within the setback area, it's not clear how the SMA permit is actually generating these benefits (restoration could have occurred anyway without the program).

KAUAI SITE VISITS SUMMARY
Date: March 11, 2013
Attendance: Makena Coffman (UHERO), Jody Galinato (County of Kauai Planning), Leslie Milnes (County of Kauai Planning)

Based on the priority areas of ecosystem protection identified by the State Office of Planning, Makena (UHERO) worked with Jody (County of Kauai) to select a variety of potential case studies on Kauai. Jody provided permit information on four potential sites of interest and crafted the site visit itinerary to visit these four locations. For each permit/location, the project team was interested to know (1) what are the benefits being protected or enhanced by the SMA permit, (2) what was the state of the site prior to the issuance of the permit, and (3) what kinds of mitigative actions were taken to protect the ecosystem services of interest.

Site: Kealia Kai and Donkey Beach

Benefit: public beach access, maintenance of view corridors and open space

Information obtained from the site visit: The SMA permit attached to the development at Kealia Kai and Donkey Beach primarily addressed public beach access, parking and a comfort station, as well as maintenance of view corridors. What was critical about visiting the site was to gain understanding of the view corridors that were protected. They were not "typical" view planes from residences, but rather to both strategically hide the development (through shrubbery) from drivers on the road as well as provide pockets of more open areas where the ocean could be viewed from the road. In addition, it included maintenance of the ironwood trees on the bluff, as the community felt that these ironwood trees were part of the areas character and can be seen from both the ocean and the road. Originally the project team had thought this case was best estimated through a hedonic pricing method, but upon visiting the site, realized that this would be inappropriate because it was not residential real estate view corridors, but rather ocean recreationalists and vehicular passengers.

Site: Secret Beach

Example of a withdrawn permit

Information obtained from the site visit: The project team was searching for examples of withdrawn SMA permits, potentially to showcase how the process of having to obtain a permit in and of itself can deter projects with poor environmental outcomes. This project would have established trails through the secret beach area. Although the permit application was withdrawn (possibly due to issues of public beach access), the project team did not feel this was an example of a permit being withdrawn because the project itself was environmentally detrimental. As such, we did not choose to use this example within the report.

Site: Coco Palms Hotel

Benefit: public participation

Information obtained from the site visit: This is a case where the current SMA permit may be revoked, primarily due to public concern that the developer has failed to meet prior deadlines. In the site visit, Makena, Jody and Leslie toured dilapidated grounds and discussed its history, the current development plan, community concerns and what the community envisions for the area, as discussed with county planners in public meetings. From this conversation, it is evident that the decision to revoke the SMA permit is primarily motivated by the public concern and thus the study team thinks this is a good example of the role of public participation in shaping outcomes more aligned with the community's values and vision. Because the decision is ongoing, the study team chose not to include this as an example.

Site: Kukuiula

Benefit: beach nourishment

Information obtained from the site visit: The SMA permit for this development is in regards to a beach nourishment project. From the site visit, the study team learned that the landowner was primarily pursuing the project to improve vistas from the "clubhouse" area to the beach. However, a number of public benefits would occur as a result of the project, including the expansion of the beach, removal of unsafe and ill-placed sea walls, as well as having the beach area given to the county. A canoe club operates out of this beach. Although the study team thought this was a very good example of a successful beach nourishment project, the other site visits and selected cases well covered this topic.

MAUI SITE VISITS SUMMARY

Date: February 14, 2013

Attendance: Chris Wada (UHERO), Jim Buika (County of Maui Planning), Anna Benesovska (County of Maui Planning), Tara Owens (UH Sea Grant)

The itinerary was put together by Jim based on prior discussions regarding the types of ecosystem benefits we are planning to highlight in the report. At each of the sites, we asked questions touching on three major topics: (1) what are the benefits being protected or enhanced by the SMA permit, (2) what was the state of the site prior to the issuance of the permit, and (3) what kinds of mitigative actions were taken to protect the ecosystem services of interest? Visiting the sites in person allowed us to understand both the contents of the permit and, in some cases, the extent of the benefits. For example, improving beach recreation through better access and increased beach width is especially beneficial if the beach is heavily used, but the documentation would not provide that type of information.

Site: Charley Young Beach (Kihei)

Benefit: beach width (recreation)

Information obtained from the site visit: Property owners along shoreline were privatizing state land (landscaping, irrigation, beach chairs, bbqs, lights, etc.) and allowed vegetation to grow tall and thick as a barricade. CZM required them to move everything within the private property line and vegetation (trees, bushes, even naupaka that was too thick due to irrigation) were cut back. Anna estimated that this at least doubled the beach width. Removing the vegetation and replacing with native vines conducive to building sand dunes will also create better protection in the makai direction while improving scenic amenity and view corridors. As the pictures indicate, this beach is very heavily used.

Site: Kamaole Beach III (Kihei)

Benefit: public access

Information obtained from the site visit: This is also a heavily used beach, but they only recently installed access ramps that meet ADA standards. This is one of the very few (maybe only?) beach on Maui with a ramp designed to allow wheelchair access all the way from the parking lot area down to the sand. Anna and Tara believe it is used a lot, and there was in fact a wheelchair parked at the foot of the ramp when we were there. General public access was also improved by adding a wooden boardwalk (?) that like the ramp actually goes over the sand dunes. The old paths that transected the dunes allowed for a wind tunneling effect that slowed the building of natural sand dunes.

Site: Mana Kai Maui Resort (Kihei)

Benefit: beach width (recreation), public access

Information obtained from the site visit: This is a similar story to Charley Young Beach. They requested an SMA permit to redo the bathrooms and the shoreline assessment revealed that a lot of the landscaped area was on State land. Once they removed the naupaka, beach width was increased and views were largely improved (especially for the restaurant on property). They also installed a walkway along the beach. One of the differences though, is that this case involves a resort. Jim said the owner actually told him that after the improvements, business increased dramatically – doing it changed them "from a five star to a ten star resort". In this case we could argue that it was beneficial to both local users (better public access and beach width) and to tourists and the resort owner (beach width, better views).

Site: Keawekapu Beach (Kihei)

Benefit: parking and public access

Information obtained from the site visit: In this area there are a lot of large gated properties, so providing public access here was a pretty big deal. This is one of many possible examples with improved public access, though.

Site: Sugar Beach (Kihei)

Benefit: parking and public access

Information obtained from the site visit: Parking and public access (including ADA – although the ramp did not go all the way to the sand) were constructed. However, as the pictures suggest, there weren't many people on the beach, so this is probably not as good of an example as some of the others.

Appendix B. Pros, cons, step-by-step instructions and data requirements for valuation methods

Table B1. Pros, cons and step-by-step instructions for different valuation methods

Valuation method	Ecosystem service	Pros	Cons	Implementation	Notes
Contingent valuation (CVM)	Public beach access Marine resources Scenic and open space Beach and shoreline protection	• Can be used to estimate both use and non-use values, i.e. it is very flexible	• No consequence for stating (exaggerated) WTP • Most people unfamiliar with placing dollar values on ES • Responses may be more qualitative expressions of the desired outcome, not of actual values • Individuals may be more likely not to respond to an open ended question about WTP • Expensive and time-consuming to design, test and implement survey	1. Specify the problem: determine ES of interest and beneficiaries 2. Survey design: focus groups to develop questions that best reveal people's true WTP for ES 3. Survey implementation: select sample and carry out survey 4. Analyze data using statistical techniques	Sometimes CVM and CM are the only options for estimating non-use values
Choice modeling (CM)	Public beach access Marine resources Scenic and open space Beach and shoreline protection	• Can be used to estimate both use and non-use values • Tradeoffs and qualitative rankings may be easier to consider than dollar values for non-use values • Reduces potential biases that may arise by open-ended WTP survey questions	• Does not directly ask for WTP in dollars but is still based on hypothetical scenarios with no consequences • Increasing the number of attributes may make choices too complicated for some respondents • Because the presented options are a subset of all feasible choices, respondents may be forced to make a choice they otherwise would not make • Data analysis typically more difficult than CVM because WTP is inferred by discrete choices, not stated directly • Translating qualitative rankings to dollar values may increase uncertainty about actual value	1. Specify the problem: determine ES of interest and beneficiaries 2. Survey design: focus groups to develop questions that best reveal people's true WTP for ES 3. Survey implementation: select sample and carry out survey 4. Analyze data using discrete choice techniques to infer WTP from tradeoffs	Especially useful for evaluating policy options where a set of scenarios with different potential outcomes can be compared

Valuation method	Ecosystem service	Pros	Cons	Implementation	Notes
Travel cost (TCM)	Public beach access Beach and shoreline protection (recreation)	• Based on actual behavior related to the ES of interest • Required data is sometimes already available making it relatively inexpensive	• Cannot be used to estimate non-use values • If a trip has more than one purpose, the value may be overestimated • Valuing the cost of travel time (opportunity cost) is difficult • Locals may choose to live near a site they highly value but their travel cost would be low (though they might go more frequently) • Need enough variation in distances traveled to estimate the demand curve • Would need to collect data both before and after the permit mitigation is implemented to establish counterfactual	**Zonal approach** 1. Specify the problem: determine ES of interest and beneficiaries 2. Specify zones around the site (e.g. cities or counties) 3. Collect data on number of visitors from each zone over a period of time (e.g. one year) 4. Calculate average round-trip distance and travel time from each zone 5. Select distance time cost ($/mile) and travel time cost ($/minute) 6. Estimate relationship between visits per capita and travel costs 7. Construct the demand function for trips to the site 8. Estimate total economic benefit of the site by calculating consumer surplus or area under the demand curve	Typically used to value services/sites that are used for recreational purposes Requires a "before" and "after" study to isolate the effect of implemented SMA permit mitigations/conditions Alternatives to the zonal approach include the following: 1. ***Individual approach***: similar to the zonal approach but requires more data collection via surveys on individual characteristics (this may be preferable if there is a large population of residential users) 2. ***Random utility approach***: requires detailed surveys because it presents individuals with choices among alternative sites with different characteristics
Hedonic pricing (HPM)	Beach and shoreline protection (erosion control) Scenic and open space	• Based on actual spending of dollars • Data for property markets are generally reliable • Relatively inexpensive since data is usually publicly available (though sometimes difficult to obtain)	• ES limited to those linked to housing prices • If people are not aware of the link between the ES and their property then it will not be reflected in housing prices • There must be sufficient housing sales transactions to have sufficient data (i.e. will not work in a community that has a high level of long-term residents – though the environmental impact is clearly still evident) • Accurate results requires high-level statistical analysis	1. Specify the problem: determine ES of interest and beneficiaries 2. Collect data on property sales in the region over a period of time (e.g. one year) and the ES of interest 3. Statistically estimate a relationship between property values and property characteristics, including the ES	The environmental amenity should be straightforward to measure or index and related to real estate, e.g. open space provided by a nature reserve

Valuation method	Ecosystem service	Pros	Cons	Implementation	Notes
Ecosystem service method (ESM)	Marine resources	• Straightforward methodology • Relatively low data requirements and often data is readily available	• Limited to resources that are inputs to the production of a market-valued good • Does not include other values related to the ES of interest, e.g. the value to beach recreation and existence values in this case • Quantifying the required scientific relationships (the production function) can be difficult	1. Specify the problem: determine ES of interest and beneficiaries 2. Specify the production function based on scientific data 3. Estimate how the change in the ES of interest affects production of the marketed good 4. Estimate the economic benefits of preventing a decline in the quality of the ES input, i.e. the avoided cost	Unless the production function has already been established by prior studies, ESM will in most cases require collaboration between natural and social scientists
Benefit transfer (BTM)	Marine resources	• Generally the least costly method • Generally relies on existing data • Can usually be completed relatively quickly	• Depends largely on the quality of the initial value estimate • Appropriate studies that target the same ES and have sites with similar characteristics may be difficult to find • Selecting appropriate past studies and making adjustments based on available information are "judgment calls" that must be made by the researcher • High levels of error and uncertainty	1. Specify the problem: determine ES of interest and beneficiaries 2. Find existing studies with comparable ES being valued and similar site and demographic characteristics 3. Adjust the existing value estimates to better reflect the values for the ES of interest	Viewed by some as more of a screening tool to determine if an original valuation study should be conducted

Table B2. Data requirements for different valuation methods

Ecosystem service	Beneficiaries	Valuation method	Required data	Source for data	Method to collect data
Public beach access (to, from, and across)	Beach users (residents and tourists)	Contingent valuation	1. How much people are WTP for a specific improvement in public access 2. Location and characteristics of the site including characteristics of nearby alternative beaches	Random sample of beach users	Survey: in-person, phone, online/e-mail, mail
Beach and shoreline protection (erosion control)	Homeowners	Choice modeling	1. Respondents' choices between different hypothetical erosion control scenarios 2. Location and characteristics of the site	Random sample of homeowners along the beach	Survey: in-person, phone, online/e-mail, mail
Beach and shoreline protection (recreation)	Beach users (residents and tourists)	Travel cost	1. Where beach users are coming from (by zone) 2. How many users visit the beach over a specified period 3. Average round-trip distance and travel time from each zone 4. Distance time and travel time costs in dollars	Existing data on visitor counts and characteristics (e.g. UHERO, HTA, DBEDT); otherwise random sample of beach users	Obtain existing data from relevant agency or survey: in-person, phone, online/e-mail, mail – both before and after implemented mitigations/conditions
Scenic and open space	Homeowners	Hedonic pricing	1. Selling prices and locations of real estate 2. Property characteristics that affect prices (e.g. lot size, number and size of rooms, number of bathrooms) 3. Neighborhood characteristics that affect prices (e.g. property taxes, crime rates, quality of schools, presence of parks, distance to the beach, distance to shopping centers, availability of public transportation) 4. Measure of the ES that affects prices (e.g. distance to a nature preserve or park, availability of an ocean or other view)	Existing data on real estate prices, characteristics, and the ES of interest (e.g. Zillow, County Real Property Tax Division)	Obtain data from relevant agency In some cases the ES data may need to be obtained separately, e.g. using GIS maps

Ecosystem service	Beneficiaries	Valuation method	Required data	Source for data	Method to collect data
Marine resources	Fishermen	Ecosystem services method	1. Quantitative relationship between coral reef health and fish production 2. Quantitative measure of the effect of runoff and erosion control activities on coral reef health 3. Information on fishing behavior at the study site 4. Market price of fish	Existing studies on the production function of interest and the effect of sedimentation on coral; if not available, need to estimate scientific relationship Existing market data for fish (e.g., DLNR Division of Aquatic Resources, Western Pacific Regional Fishery Management Council)	Existing studies available online (e.g. Google Scholar) Obtain primary data to quantify scientific relationship Obtain data on fish market from relevant agency
Marine resources	Beach users and anyone who cares about the existence of those resources	Benefit transfer	1. Value estimates from existing studies 2. Demographic or site characteristics that may be required to adjust transferred estimates	Environmental valuation literature	Many studies are available online (e.g. Google Scholar)

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