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Comments of ENTRIX, Inc. on the Draft Damage Assessment and Restoration Plan for the *Athos I* Oil Spill

1.0 Overview

ENTRIX, Inc. (ENTRIX) appreciates the opportunity to comment on the Draft Damage Assessment and Restoration Plan (DARP) associated with the *Athos I* oil spill that occurred on the Delaware River on November 26, 2004. ENTRIX is submitting these comments because

- It is important that society's scarce economic resources be efficiently allocated when compensating for spill-induced injuries to natural resources;
- The Draft DARP suggests a substantial level of restoration ($25 million) is necessary to compensate for resource injuries related to this spill; and
- The basis for the amount of restoration appears to embody significant deficiencies in logic and/or the absence of scientific rigor.

We understand that the Natural Resource Damage Assessment (NRDA) process inherently involves uncertainties. We further understand that it may be reasonable, in the absence of data, to make simplifying assumptions, use expedited approaches, and/or employ best professional judgment. Such an approach, which we support as a general matter, reduces transaction costs and conserves society's scarce resources. However, even simplified and expedited approaches must meet certain standards of rigor in design and application if the resulting conclusions are to at least approximate the appropriate level of restoration, and hence expense, required.

After careful analysis of the Draft DARP, it appears that certain of the methods and analyses undertaken by the natural resource trustees (Trustees) fail to rise to the required level of rigor. This results in a substantial overestimate of the restoration requirements associated with this spill. While we have not undertaken a complete analysis of the degree of overestimation, our initial analyses suggest that the Draft DARP identifies restoration requirements that generate 2 to 3 times more services than were lost.

Two examples drawn from the detailed comments below illustrate our concerns.

1. In scaling restoration for impacts on shorelines, the Trustees assume a restoration project that converts *Phragmites* marsh to a *Spartina* marsh, where the *Spartina* marsh is judged to provide 10 times more services than the *Phragmites* marsh. Yet, in computing injuries, the Trustees appear to assert that these two marsh types provide the same level of service. Either *Phragmites* marshes are less valuable, or of equal value, but they certainly are not both.
2. In scaling marsh creation to compensate for injuries to ducks and geese, the Trustees assume ducks only eat invertebrates and geese only eat plants. The Trustees first assume wetland created for ducks only produces invertebrates for ducks, and produces no plants for geese to eat, and compute that X acres are needed to compensate for ducks. The Trustees then assume that any wetland created for geese only produces plants, and produces no invertebrates for ducks to eat, and compute that Y aces are needed for geese. The total waterfowl restoration required is then the sum X + Y of these acres. Of course, such areas produce both vegetation and invertebrate biomass. Incorporating this observation into scaling would generate a cost savings of approximately $10 million to society.

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Other similar examples follow. It appears from our review that the Trustees employ a variety of "mix and match" calculations, which are at times inconsistent with a coherent and unified framework for the damage assessment, and at times simply contradictory one another.

We offer these comments in hope of improving the admittedly difficult task of combining science and judgment, with the ultimate aim in providing a fair assessment of appropriate compensation to the public in the form of habitat restoration.

We request that the Draft DARP be revised to address each numbered comment below. We believe such revisions would increase the accuracy and technical defensibility of the assessment. For any comment that does not result in a DARP revision, we request that the administrative record be amended to include a technical explanation supporting the Trustees decision. These requested revisions are inset and in italics in the document below. These explanations will help the public better understand the Trustees methodologies and interpretations and so be able to comment on them.

We also request that the Trustees extend the comment period to 45 days after publication of the revised DARP and provide a complete administrative record, which would include the technical explanations requested below.

2.0 Bird Injuries

ENTRIX has several comments related to the bird injury assessment. Specifically:

- The Trustees fail to examine the net effect of the spill on birds;
- The Trustees appear to err in not accounting for all benefits of marsh production;
- The Trustees' avian assessment framework is inconsistent with economic and ecological theory; and
- Restoration costs are disproportionate to restoration benefits.

2.1 Net Effects of the Spill

Comment 2.2.1: Natural Resource Damage Assessment (NRDA) requires a comparison of natural resource availability and quality with the spill to the natural resource availability and quality that would have existed but for the spill, i.e. under baseline conditions.

There are two spill-related impacts that simultaneously affected bird populations following the Athos I oil spill:

- The oil caused mortality among birds via physical fouling and/or oil ingestion; and
- The spill-related closure of waterfowl hunting areas decreased hunting related mortality among dabbling ducks, diving ducks, and geese.

Each factor must be accounted for when determining the effect of the spill on bird populations and associated damages.

For example, if a spill results in the death of 10 mallard ducks due to fouling and a spill-related closure results in survival of 5 mallards that otherwise would have been harvested by hunters, the net effect of the spill is to (1) reduce the quantity and quality of hunting opportunities and (2) to reduce the mallard population by 5 individuals. Under Oil Pollution Act of 1990 (OPA), restoration should compensate for the

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loss of the recreational hunting opportunities and the injuries (loss of services) associated with the net loss of 5 mallards[1].

Comment 2.1.2: The principle of estimating "net changes" is embedded in the Department of the Interior's "CERCLA Type A Natural Resource Damage Assessment Model for Coastal and Marine Environments (NRDAM/CME)." In describing total injury for a spill that involves both direct mortality due to oiling and a recreational closure the authors note:

> *Some of Y_{CL} [lost harvest due to closure] would be lost due to mortality regardless of closure. As a result, only that portion of losses due to a closure that exceed losses from mortality is added to total losses (French et al. 1996, page I.4-54; emphasis added[2]).*

That is, when estimating total spill-related injury it is necessary to consider the interaction between the effect of oiling/oil ingestion on a resource and the effect of any spill-related area closure.

Comment 2.1.3: The Draft DARP addresses the effect of fouling and oil ingestion on birds but fails to address the effect of the spill-related hunting closure on bird populations. When the effect of the hunting closure is incorporated, our analysis (presented in Appendix A) indicates that waterfowl populations (dabbling ducks, diving ducks, and geese) actually increased as a result of the spill. Hence, after compensating for the loss of hunting-based recreation, no additional compensation is required for spill-related impacts to the waterfowl population itself. Stated another way, failing to account for the spill-related hunting closure results in double counting.

The Draft DARP asserts that restoration actions costing $11.4 million are required to compensate for impacts to waterfowl. But this is based on only one of two spill related effects. When the second factor, a reduction in hunting-related mortality, is incorporated it is clear that the spill resulted in an increase in the waterfowl population of some 3,300 birds relative to baseline conditions. Hence, the Draft DARP overestimates avian restoration requirements by at least $11.4 million.

- *We request that the Trustees respond to the previous three detailed comments by evaluating the net effect of both oiling and spill-related hunting area closures on avian resources. We further request that the Draft DARP, and compensatory restoration requirements reported therein, be revised to reflect the net effect of the spill on avian resources. Absent these revisions, we request a detailed technical justification of the Trustees' decision to omit from their analysis the most significant spill-related avian effect arising from hunting closures.*

Comment 2.1.4: It is also worth noting that the Draft DARP asserts that approximately $530,000 is required to compensate for impacts to 2,561 other, non-waterfowl bird species, over 90% of which are gulls. Clearly, the services provided by the extra 3,300 ducks and geese that existed after the spill will offset at least some portion of the debit associated with mortality among other birds. Indeed, if society prefers the bundle of services gained when there is a small increase in the waterfowl population relative to the bundle of services lost when there is a small decrease in the gull population, the public requires no compensation at all for the spills net impact to bird populations.

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1 OPA allows Trustees, on behalf of the public, to be compensated for spill-related reductions in the provision of environmental services (i.e. natural resource damages). Punitive damages are not available as a component of NRD.

2 French, D., M. Reed, K. Joyko, S. Feng, H. Rines, S. Pavignano, T. Isaji, S. Puckett, A. Keller, F. French III, D. Gifford, J. McCue, G. Brown, E. MacDonald, J. Quirk, S. Natzke, R. Bishop, M. Welsh, M. Phillips and B.S. Ingram. 1996. The CERCLA type A natural resource damage assessment model for coastal and marine environments (NRDAM/CME), Technical Documentation, Vol. I-Model Description. Final report, submitted to the Office of Environmental Policy and Compliance, U.S. Dept. of the Interior, Washington, D.C. April. 1996, Contract No. 14-0001-91-C-11.

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- *We request that the Trustees evaluate whether services associated with 3,300 ducks and geese can compensate for services associated with 2,305 gulls; if so, the Draft DARP should be revised to reflect the credit associated with "excess" duck and geese produced against debits associated with gulls.*

2.2 Trophic Scaling Inconsistencies

Comment 2.2.1: The Trustees rely on a method referred to as trophic scaling to determine the size of the restoration projects that need to be constructed to compensate for avian injuries. This scaling method is illustrated by the example below.

- The Trustees report that over its 50 year lifespan, an acre of created *Spartina* marsh produces 5,241 kg wet weight of invertebrates [3] and more than 2,500,000 kg wet weight of vegetative biomass[4].
- The Trustees also report that each kg of invertebrates consumed supports 0.02 kg of invertivore and each kg of vegetation consumed supports 0.0003 kg of herbivore.
- Hence an acre of newly created marsh would compensate for 105 kg of injured invertivore (estimated as 5,241 kg X 0.02) and 750 kg of herbivore (estimated as 2,500,000 kg X 0.0003).

When estimating the compensatory requirements for dabbling ducks (asserted by the Trustees to be invertivores) the Trustees' scaling acknowledges that 105 kg of new invertivores are supported by the consumption of the newly created invertebrate biomass. However, the Trustees' scaling completely ignores the fact that the newly created marsh also produces vegetation sufficient to support 750 kg of herbivores, including geese.

When this error is corrected, and accepting all other Trustee assumptions, compensatory restoration cost associated with potential bird impacts are reduced from the currently estimated $11.9 million to not more than $1.5 million, all else being equal.

- *We request that the Trustees revise their scaling to include as credit all of the benefits associated with all of the biomass produced in the habitats created via restoration. We request that the Trustees alter their approach in which restoration of the same type (marsh) is independently computed and then added together for species (ducks, and geese) that make use of different components of the same habitat (respectively insects and plants). Absent this revision, we request detailed technical justifications for why the Trustees decided to omit significant productivity components when implementing trophic scaling.*

Comment 2.2.2: It also is noteworthy that the Trustees assume the diet of dabbling ducks (primarily mallards, teal, and black ducks) is exclusively invertebrate. In fact, the actual diet of dabbling ducks is primarily vegetation according to the Birds of North America; in the DARP for the Chalk Point Oil Spill NRDA, it is assumed that dabbling ducks are herbivores. This may appear to be a minor issue, but the Trustee assumption that dabbling ducks are solely invertivores implies approximately $1.4 million in restoration is necessary to offset the reduction in mallard services; whereas if dabbling ducks are assumed to be herbivorous, compensatory requirements would be estimated as approximately $200,000.

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[3] Jones, A.S. and M Donlan. 2008. Athos I Oil Spill Restoration Scaling Paper for Injuries to Birds. See Page 10 available online at http://www.darrp.noaa.gov/northeast/athos/pdf/Athos_Bird_Restoration_Scaling_Final_22Aug2008.pdf.

[4] McCay, D.F., P. Peterson, and M. Donlan. 2002. Restoration scaling of benthic, aquatic, and bird injury to oyster reef and marsh restoration projects. See Page 35 available online at http://www.darrp.noaa.gov/northeast/athos/pdf/French%20McCay%20et%20al%202002.pdf

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- *We request that the dabbling duck scaling reflect actual dabbling duck diets. Absent this revision, we request an explanation of why this apparent upward bias in estimated restoration requirements is introduced into the assessment by departing from diet assumptions used in previous assessments (i.e. Chalk Point).*

2.3 The Bird Damage Framework is Inconsistent with Ecological and Economic Theory

In a damage assessment, determining the amount of restoration needed to compensate for injuries to a population of birds can be thought of as occurring in four steps.

1. *Determine if marginal members of the populations provide, on net, desirable services to society. If yes, proceed to step 2. If no, compensation is not required.*
2. *Identify the population level over time that would have existed had the spill not occurred (i.e. baseline);*
3. *Identify the population level that will exist over time with the spill plus restoration actions; and*
4. *Adjust the size of the restoration project(s) such that the discounted present value population level with spill and restoration is no less than the discounted present value of the population under baseline conditions.*

Steps 2 through 4 are often discussed in terms of debits and credits. When the population with the spill and restoration is less than the baseline population, a debit accrues. When the population with spill and restoration exceeds the baseline population, a credit accrues. When credit, measured in discounted bird years or discounted kilogram years,[5] is equal to the debit (denominated in the same unit), compensation has been achieved.

[5] A bird year is defined as 1 bird existing for 1 year. Bird years are discounted to reflect the economic observation that, all else equal, society prefers bird years today rather than bird years in the future. Similarly, a kilogram year would be one kilogram of bird mass existing for 1 year.

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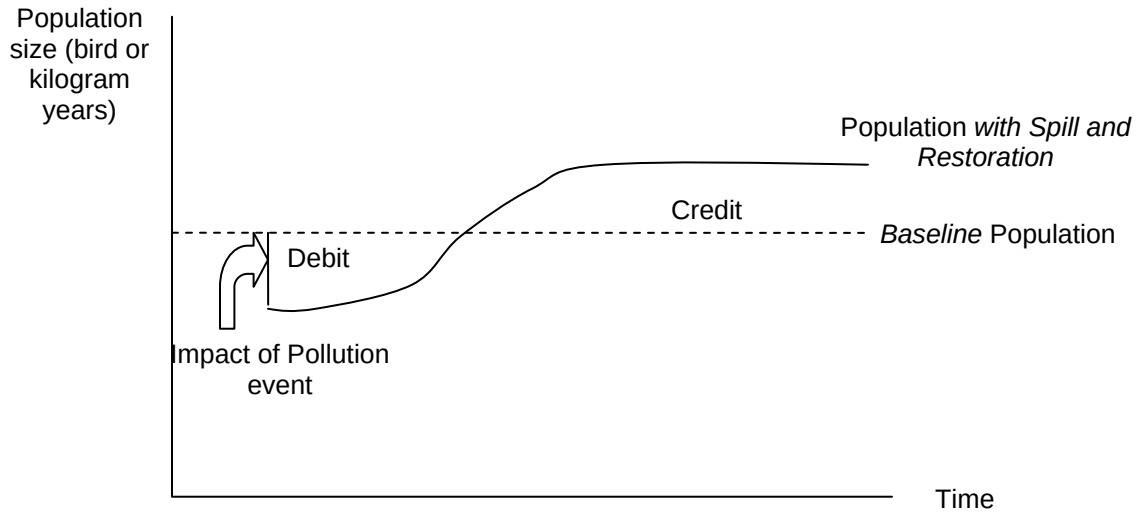

Scaling Illustration

Comment 2.3.1: In some prior incidents, the U.S. Fish and Wildlife Service (USFWS) has taken a rigorous, coherent approach to the analysis (refer to the treatment of egrets, cormorants, loons and pelicans in CDFG & USFWS[6]) in which species life history parameters and biologically limiting factors are combined in ecological models to predict debits and credits. These approaches are scientifically grounded, consistent with OPA guidance[7], and represent best practices.

In contrast, the *Athos I* framework for assessing avian injuries lacks a clearly articulated ecological (or economic) theoretical basis. The result is a piecemeal assessment that cannot be assessed using scientific principles and that contains multiple internal inconsistencies.

Specifically, in evaluating injury, the Trustees assert a loss of biomass associated with the mortality of oiled individuals. Rather than attempting to determine how the population responds to the mortality event (as is recommended by Zafonti and Hampton,[8] whom the Trustees cite) the Trustees simply assume more lost biomass associated with the offspring of the birds that were oiled. Applying the Trustee logic,

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6 California Department of Fish and Game, California State Lands Commission, and United State Fish and Wildlife Service (CDFG & USFWS). 2004. Stuyvesant/Humboldt Coast Oil Spill: Draft Damage Assessment and Restoration Plan. Available at http://www.dfg.ca.gov/ospr/spill/nrda/sutyvesant%20DARP/darp_index.htm

7 NOAA. 1999. Discounting and the Treatment of Uncertainty in Natural Resource Damage Assessment. Technical Paper 99-1. U.S. Department of Commerce, NOAA Damage Assessment and Restoration Program, Washington, D.C. Available at http://www.darrp.noaa.gov/library/pdf/discpdf2.pdf and also NOAA. 2006. Habitat Equivalency Analysis: An Overview. Technical Paper. U.S. Department of Commerce, NOAA Damage Assessment and Restoration Program. March 21, 1995, Revised October 4, 2000 and May 23, 2006. http://www.darrp.noaa.gov/library/pdf/heaoverv.pdf

8 Zafonti M. and S. Hampton. 2005. Lost Bird Years: Quantifying bird injuries in natural resource damage assessments for oil spills. Proceedings of the 2005 International Oil Spill Conference.

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this leads to an infinite injury as more and more future generations of birds are also lost, as there is no mechanism in the Trustee model for the population to eventually recover.[9]

Comment 2.3.2: Apparently recognizing the general illogic associated with such assertion of infinite harm, the Trustees limit injury calculations to include only one generation of foregone fledges. However, the choice to limit injury calculations to one, two, ten, or any other number of generations is essentially arbitrary. This is because the analysis focuses on what individual birds killed by the spill would have done had they not died. In direct contrast, ecological theory tells us that a population recovers, or does not recover, based on the responses of the individuals that did not experience mortality. The response of those individuals to post-spill conditions may result in increased survival and or reproduction; if so, the population will recover to baseline over some time period determined by the ecology of the species. If survival or reproductive rates do not increase, recovery will not occur until and unless effective restoration projects are initiated. In either case, the correct analysis is not to specify a model that implies infinite debit and to arbitrarily truncate that model. Rather, an ecologically-based model that incorporates available biological data and the effect of planned restoration should be used to estimate compensatory requirements.

Comment 2.3.3: Since the Trustee model has no ecological basis the assessment cannot be evaluated by comparison to ecological principles and existing literature. The only way to evaluate the Trustee injury estimates is to conduct a theoretically valid analysis and to compare the results of such an analysis to the Trustee estimates. ENTRIX has conducted a host of such comparisons. Occasionally the Trustee method underestimates injury; this occurs when populations that exist at low levels are injured and restoration is assumed to not be initiated for extended time periods. However, for most species which exist at or around carrying capacity, the simplified method employed by the *Athos I* Trustees overestimates injury by 15 to 35 percent. That translates into $1.7 to $4 million all else equal.

- *We request that the Trustees respond to the previous three comments by implementing a rigorous resource equivalency analysis that uses ecologically grounded models to estimate baseline and with spill and restoration population projections. The Draft DARP and the compensatory requirements reported therein should be revised to reflect the results of the analysis. Should the Trustees choose not to adapt a rigorous approach to REA, we request that the Trustees amend the administrative record by adding:*

  1. *A description of the biologically limiting factors (or lack thereof) that were assumed for each restoration group;*
  2. *A description of the literature they relied on to form their opinions and, for the case of mallard ducks, a detailed explanation of the data that caused them to form an opinion inconsistent with the conclusion stated in the report cited; and*
  3. *Text describing how the selected assumption regarding biologically limiting factors and population demographics were mapped into assumptions regarding forgone generations. This explanation will preferably describe the results of a fully-specified ecological model and demonstrate an equivalence between the restoration requirements associated with the fully specified model and those associated with the Trustees' simplified approach.*

Comment 2.3.4: Moreover, the lack of a coherent theoretical foundation for the Trustee methods tends to result in internal inconsistencies.

[9] Injury, measured in discounted bird or kilogram years, would be infinite if debits from foregone future generations accrue faster than the discount rate; if not the sum need not be infinite, but the same basic illogic persists.

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- In justifying their restoration projects, the Trustees assert that avian populations will expand if they are provided additional resources (food in this case); this is a classical density dependant response. However, in estimating injury, the Trustees assert that they have found little evidence that avian populations are limited by density dependant mechanisms.
- When calculating restoration credits, biomass is accumulated through time and economic discounting is used to reflect society's temporal preferences. In contrast, the Trustees' injury calculations do not include a temporal component. Hence, when comparing debits and credits the Trustees are comparing apples to oranges.
- The Trustees' scaling suggests that avian populations respond selectively to restoration projects. Thus, a wetland created for mallard restoration is assumed to only benefit mallards and a wetland created for geese is assumed to only benefit geese despite the fact that the species share wetland habitats.

We request that the Trustees revise the Draft DARP to be internally consistent with respect to assumptions regarding density dependence. If the provision of food is assumed to increase avian populations, the scaling of injuries associated with those populations should assume density dependant mechanisms (in this case food limitation) facilitate population recovery. If it assumed that populations are not regulated by density dependant mechanisms, then the selected restoration projects should not assume that populations will increase in response to increased food supply. Absent such a revision, we request a detailed technical description of the theory underlying the assertion that populations not limited by density dependant mechanisms will increase when additional habitat is created.

We request that the Trustees revise the Draft DARP to be internally consistent with respect to discounting. Both debits and credits should be discounted. Absent such a revision, we request a detailed technical description of the theory underlying the assertion that society's rate of time preference varies as it related to ecological debits and credits.

2.4 Cost-Effectiveness

The following discussion focuses on three different topics all related cost-effective restoration.

2.4.1 Grossly Disproportionate

Comment 2.4.1.1: OPA allows Trustee agencies to seek compensation on behalf of the public for injuries to natural resources. In general, there is a preference for compensation taking the form of an environmental restoration project that is of sufficient magnitude such that the public experiences no net loss in the provision of environmental services (NOAA 1997). However, economic efficiency is undermined when the cost of a resource restoration project exceeds by a considerable margin the value of the resource so created. This is the basis for the "grossly disproportionate test" articulated in the Ohio decision.[10] Moreover, one of the Trustees' stated criteria for evaluating restoration projects is "cost-effectiveness." If there is a restoration alternative that provides the same benefit as another for less cost, it is preferred, all else equal.

The Draft DARP suggests that necessary compensation exceeds $5,420 per assumed duck and goose mortality.[11] The Trustees' lost use valuation report implies an average consumptive value of a duck or

[10] State of Ohio v. United States Department of Interior, 880 F.2d 432, 441, 459 (D.C. Cir. 1989).

[11] Estimated as $11.4 million in waterfowl compensation to address 2,103 duck and goose mortalities.

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goose is not more than $30.34 per duck or goose.[12] This magnitude of difference between restoration costs and benefits cannot be bridged by appeal to "non-use" (or existence or passive use) values. First, non-use values likely are not relevant at all for marginal changes in sizable populations, such as geese and ducks (as opposed to, say, in an endangered population). Second, a substantial body of economic literature shows that non-use values are of the same order of magnitude as use values; many agencies, such as US EPA, employ a "rule of thumb" developed by Freeman and by Fisher (1993)[13] that non-use values tend to be about one-half of use values. Thus, even if non-use values did exist in association with impacts to individual ducks and geese, they are likely to lie in the $15-$30 range.

Thus, the cost of restoration for these species may be 90 to 180 times the social value produced. The consistency of the Trustee restoration plan with the concept of a grossly disproportionate or cost effectiveness criteria is seriously in doubt and hence so is the premise that implementation of the Trustee restoration plan will actually provide a net benefit to society.

> *We request that the Trustees provide an evaluation of their proposed avian restoration costs with respect to a grossly disproportionate and cost-effectiveness criteria.*

2.4.2 Restoration Screening

Comment 2.4.2.1: Further, given the difference between the restoration costs identified by the Trustees and the actual value of the resource, a more cost-effective restoration option available to the Trustees would be to compensate for any reduction in the waterfowl population via a program that paid hunters to not harvest waterfowl.

Comment 2.4.2.2: Such a program would be entirely analogous to the lobster compensation scheme developed in response to the North Cape oil spill in which lobster fishermen were paid to return lobsters that otherwise would have been harvested to the sea. Thus, the concept has been adopted and proven in a NRD setting. Further, the program would meet all criteria used by Trustees to evaluate restoration and be considerably more cost-effective. The likely cost of compensation would be around $30.00 per duck or goose, plus program administration fees.

Given these considerations, and accepting all other Trustee assumptions regarding potential impacts to waterfowl, necessary compensation would not be $11.4 million as suggested by the Trustees, but would be approximately $158,000 plus fees required to implement such a program.

> *We request that the trustees evaluate a broader suite of potentials restoration projects including the option of compensating hunters for reducing harvests. In doing so we request that the Trustees provide a detailed description of their evaluation of each alternative relative to all restoration criteria including cost.*

2.4.3 A Focus on Services

Comment 2.4.3.1: Finally, we note that the cost-ineffectiveness of the Trustee restoration plan is even more pronounced when noting the Trustee assertion that approximately $4,500 is required to compensate

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[12] The Athos 1 Lost Use Valuation Report identifies the per trip consumer surplus of $44.56. U.S. Fish and Wildlife Service Migratory Bird Harvest Information, 2004: Preliminary Estimates. U.S. Department of the Interior identifies the average harvest rate in DE and NJ as 1.46 ducks per trip. If all consumer surplus is attributed to harvest alone, WTP for a duck or goose is no more than $30.34 per individual.

[13] Freeman, A.M. 1993. Non-use Values in Natural Resource Damage Assessment. In: Valuing Natural Assets. Kopp and Smith Editors.

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for each of the approximately 710 mortalities among non-migratory Canada geese (a nuisance species) [14] and mute swans (an invasive species) [15]. The assertion that compensation is required for a reduction in the abundance of nuisance and invasive species is in conflict with the actions and statements of the state and federal agencies that prepared the Draft DARP. Notably these agencies actively seek to reduce the abundance on both non-migratory Canada geese and mute swans through the use of public funds, while simultaneously asserting that the public requires compensation for any such reduction.

Comment 2.4.3.2: In responding to comments on the Bird and Wildlife Injury Report, NOAA indicates that the Trustees decided to include nuisance and invasive species in the assessment "…regardless of their perceived service value." Since the loss of services provided by natural resources is, in fact, the very thing that necessitates compensation, the decision to conduct an assessment "regardless of services" is inconsistent with agency guidance on damage assessment as well as basic economic principles and methods. If the net services provided by a resource are negative (i.e. they are a public nuisance), no compensation for a reduction of that resource is required; to assert otherwise results in an excessive expenditure of society's scarce resources on restoration.[16]

As such, it is incorrect to assert that the public requires compensation for spill-related reductions to invasive and nuisance species. Correcting this mistake in the Draft DARP would reduce compensatory requirements by $3.2 million all else being equal.

> *We request that the Trustees respond the previous two comments by revising the Draft DARP and the compensatory requirements reported therein to reflect the observation that Trustee agencies are, on behalf of the public, actively seeking to reduce populations of nuisance and invasive species. As such, the public does not appear to require compensation for minor impacts to these populations. Absent such a revision, we request a detailed technical explanation of the apparent divergence between the actions of the Trustee agencies, which are to actively reduce the populations of these invasive and nuisance species, and the Draft DARP's implicit assertion that society desires increased abundance among these species and must be compensated for any marginal decrease in their numbers. We further request that the Trustees acknowledge that services are important in considering restoration, and that when a spill causes an increase in the net level of services provided, such as in the case of mortality to nuisance species, compensation is not required.*

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[14] In a report titled Delaware Estuary Aquatic Nuisance Species of Concern: An E-Mail Survey of Resource Managers (2002) Wakefield and Faulds report the results of an e-mail survey of resource managers working in the Pennsylvania portion of the Delaware Estuary. In that survey, Canada Geese were among the 5 most commonly identified aquatic nuisance animals. In a report titled Management of Canada Geese in Urban Areas (2002), the New Jersey Department of Environmental Protection outlines methods to reduce non-migratory Canada Geese numbers. Plans allowing the lethal management of non-migratory Canada Geese, including the depredation of nests and the lethal removal of adults have been circulated in the State of Delaware (Delaware Advisory Council on Game and Fish 1999) and by USFWS (Notice of intent to prepare an Environmental Impact Statement 1999) for nearly a decade.

[15] In the document Mute Swan Management Plan 2003-2013 the Atlantic Flyway Council outlines a plan to "reduce mute swan populations in the Atlantic flyway to…minimize negative ecological impacts."

[16] In responding to comment regarding the services provided by non-migratory Canada geese the Trustees state that they modified their assessment so that "reproduction foregone was not included" for non-migratory geese. Whether to include production foregone is a biological question, completely divorced from the service value question. Either the public values the services associated with the species and so requires compensation or it does not; either the recovery to baseline occurs or it does not. The two ideas are in no way related.

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3.0 Shoreline Service Reductions

ENTRIX comments on the shoreline assessment address the following issues:

1. Baseline appears to have been specified incorrectly;
2. The restoration scaling includes internal inconsistencies;
3. The assertion of 100% loss of shoreline services is inconsistent with the data; and
4. The Trustees failed to integrate shoreline and wildlife assessments.

3.1 Baseline

Comment 3.1.1: OPA requires that potential spill impacts and restoration activities be evaluated relative to baseline conditions. In this case, baseline is defined to be the services flowing from the shorelines and tributaries impacted by the spill. We note that the spill area was largely an industrialized portion of the Delaware River adjacent to Philadelphia. This area is subject to urban runoff, combined sewer overflows, and analysis suggests that approximately 90% of the poly-aromatic hydrocarbons (PAHs) found in sediments 10 months after the spill were present prior to the incident (*i.e.* PAHs in sediment are part of the baseline conditions).

Keeping that baseline condition in mind, it is troubling that much of the Trustees' *Athos I* methods and assumptions are taken directly from the Chalk Point oil spill assessment, without any adjustment for the vastly different baseline conditions.

Comment 3.1.2: In the Chalk Point assessment the affected marsh was a high quality marsh with little background PAH, few impacts from urbanization, and limited *Phragmites.* Using that high quality marsh as baseline, the Trustees asserted that restored and created marsh sites will eventually provide services equivalent to 80% of the high quality baseline marsh.

Noting that restoration projects related to the Athos spill will generally occur away from the urban influence of Philadelphia and in generally uncontaminated areas, it appears inconsistent for the *Athos I* Draft DARP to similarly assert that habitat restoration identified in the NRDA will achieve 80% of baseline, but in this case 80% a very low quality baseline. Either these are very poor projects, or the Trustees' do not properly account for baseline in the injury assessment.

If the degraded baseline conditions are acknowledged, the asserted shoreline liability would likely be reduced by approximately $1 million, all else being equal.

> *We request that the Trustees respond to the previous two comments by revising the Draft DARP to incorporate the fact that baseline for the Athos spill (the degraded marshes outside Philadelphia), is not the same as baseline for the Chalk Point spill. As such, off-site restoration should achieve more than 80% of degraded baseline services. Absent such a revision, we request that the administrative record be amended to include a detailed technical explanation supporting the assertion that the restoration projects recommended by the Athos Trustees are inferior to those recommended by the Chalk Point Trustees and, as such, will only provide 80% of the degraded baseline service level.*

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3.2 Inconsistency in Restoration Scaling

Comment 3.2.1: In response to comments from the Responsible Party's consultant, the Trustees state that *Phragmites* dominated marshes provide a service level similar to wild rice and *Spartina* marshes (Hoff 2005). This assumption is employed when determining injuries to oiled *Phragmites* marshes. However, when justifying restoration projects, the Trustees state that a degraded *Phragmites* marsh provides 10% of the services of a healthy *Spartina* marsh.

If the Trustees believe *Phragmites* marshes provide service levels similar to *Spartina* or wild rice marshes, then compensatory restoration projects designed to convert *Phragmites* marshes to *Spartina* marshes provide little to no increase in services and should be rejected in the restoration screening process. Alternatively, if the trustees believe *Spartina* provides 10 times more services than does *Phragmites*, then the assumed service reduction associated with impacted *Phragmites* marshes must be adjusted to incorporate the relatively low level of services they were being produced under baseline conditions.

> *We request that Trustees respond to the previous two comments by revising the Draft DARP to acknowledge the following: if the Trustees believe Phragmites marshes provide service levels similar to Spartina or wild rice marshes, then compensatory restoration projects designed to convert Phragmites marshes to Spartina marshes provide little to no net increase in services and should be rejected in the restoration screening process. Alternatively, if the trustees believe Spartina marshes provides 10 times more services than do Phragmites marshes, then the assumed service reduction associated with impacted Phragmites marshes must incorporate the relatively low level of services they were producing under baseline conditions relative to the type and quality of services of the marshes to be restored.*

3.3 Shoreline Service Loss

The Trustees assert that 100% of baseline services were initially lost from areas impacted by heavy or moderate oiling. This assertion cannot be supported when viewed in light of the documents contained in the administrative record. The Shoreline Injury Report: Appendix A lists baseline services provided by shoreline habitats. In addition, scattered throughout the administrative record are Trustee assessments of potential impacts to those resources. For easy reference, we have combined these sources of information into the table below.

Summary of Services and Impacts Described by Trustees

Service	Function described in DARP	Trustee evaluation of impacts
Primary Production	Production of plant material that forms the base of the primary food web and the detrital food web. Much of salt marsh vascular plant production is exported to adjacent habitats as detritus.	The shoreline Injury report states "The spill occurred when the marshes were in senescence (not growing) and it was not possible to discern any significant impacts to marsh vegetation" when it began growing in spring 2005
Habitat for Biota	Marshes serve as physical habitat for organisms including birds, mammals, insects, fish and invertebrates. The type and density of the vegetation is the primary determinant of species use. *Emphasis added*	See Primary production discussion
Food Web Support	Encompasses the entire system including invertebrates that are food for higher trophic levels that may spend limited time in the wetland.	The Trustees assert that oil would have smothered most organisms within the oiled band.

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Summary of Services and Impacts Described by Trustees (continued)		
Service	**Function described in DARP**	**Trustee evaluation of impacts**
Fish and Shellfish Production	Marsh edge and ponds are nursery areas for fish and shellfish. Dense shellfish provide microhabitat for a diverse assemblage of organisms that contribute to productivity and species composition.	In the Final Pre-assessment Data Report measurements of tissue burdens are levels below thresholds of concern.
Sediment shoreline stabilization	Marsh vegetation stabilizes the soil and prevents erosion during normal tides, wave action or storm events	See Primary production discussion
Water Filtration	The physical removal of particles and nutrients from water.	See Primary production discussion
Nutrient Removal Transformation	Nutrients are converted to plant material thereby reducing the occurrence of algal blooms and anoxic conditions in the bay.	See Primary production discussion
Sediment /Toxicant Retention	Sediments and the toxicants bound to them are filtered in wetland rather than being transported to the bay. Wetlands encourage redox reactions that can detoxify many compounds.	See Primary production discussion
Soil Development and biogeochemical cycling	The soil is a living system that converts chemicals from one form to another and supports the growth of higher plants through biogeochemical cycling and the breakdown of detritus.	In Appendix H of the Shoreline Injury Report, A Trustee contractor reports that little substrate penetration occurred. Also, see Primary Production discussion.
Storm Surge Protection	Wetland habitat is a buffer between the bay and other habitats. Vegetation absorbs wave energy and reduces impacts to inland habitat and property.	See Primary production discussion for evidence that vegetation was unaffected.
Slow Runoff from Upland	Marsh surface absorbs runoff from upland, vegetation also slows flow allowing more runoff to be absorbed	See Primary production discussion for evidence that vegetation was unaffected.

Comment 3.3.1: A 100% percent service reduction in light of the observations summarized above implies that the Trustees place zero weight on services, such as primary production, run-off reduction, and flood control, which were reported as having not been affected by the spill. This is unjustified; as reported during the NOAA sponsored workshop on Measures of Ecosystem Function for Habitat Equivalency Analysis[17], these are highly-valued services.

If all services are given equal weight and noting that approximately ¼ of the services provided by shoreline were not impacted, estimates of shoreline-based compensatory restoration may need to be reduced by as much as $3 million all else being equal.

> *We request that the Draft DARP be revised such that assumed shoreline service reductions be revised to more accurately reflect the host of services apparently unaffected by the spill. Absent such a revision, we request a listing of the weights assigned to each service identified, an evaluation of the spill-related impact to each individual marsh service, and a mathematical demonstration confirming the 100% initial reduction of services.*

[17] Coastal Response Research Center. 2008. Measures of Ecosystem Function for Habitat Equivalency Analysis. University of New Hampshire, Durham, NH, 34 pp.

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3.4 Shoreline and Wildlife Assessment Are Not Properly Integrated

The Draft DARP reports that spill-related reductions among the population of dabbling ducks will be compensated for via the production of birds that otherwise would not exist. These birds are to be created by constructing 25 acres of new marsh which, in turn, will cause bird populations to increase. In developing this comment we note that, in addition to supporting these dabbling ducks and providing whatever food they would need to survive, the newly created marsh would provide a variety of services not related to production of ducks, such as flood control and water purification.

Relying on a separate assessment of potential impacts to shoreline habitats, the Draft DARP reports that the quantity and quality of services provided by Delaware marshes, which include flood control and water, were reduced as a result of the spill. To compensate the public for these lost services, the Trustees assert that 38 acres of new marsh need to be created.

Comment 3.4.1: Without commenting on the veracity of the two independent estimates, the Trustees appear to err in assuming these two requirements are strictly additive. Clearly, the 25 acres of marsh created to support an increased dabbling duck population will provide additional services not related to ducks. It would appear that these additional services must offset, to some degree, any potentially spill-related reduction in marsh services. The Trustees provide no accounting of these "extra services" nor do they discuss the degree to which they offset compensatory requirements associated with impacts to marsh services.

The failure to account for these services is particularly troubling in light of the Trustees' reliance on habitat exchange ratios reported in Peterson (in press)[18]. As noted by the Trustees and utilized in their analysis, Peterson asserts that a wetland provides 2.5 times more services than a sand/gravel habitat. What the Trustees do not note is that, according to Peterson, if bird services are considered, a wetland provides 3.1 times more services than a sand/gravel habitat. Thus, it appears that 80% (estimated as 2.5/3.1) of the services flowing from the mallard restoration project are actually wetland services that should be credited against shoreline and aquatic debits.

We recognize that, if a marsh is oiled, there may be injury to all the services, including bird services. So, when restoring for direct shoreline impacts, there may be a "one-to-one" correspondence between injured and restored habitat, with little or nothing "left over" to compensate for other injured resources, such as ducks or aquatic organisms. That is not our point. Rather, the error runs the other way: when building the marsh to offset duck injuries, more than duck services are created, and when this is credited against shoreline injuries, less marsh is needed to address shoreline effects.

We believe that if amended to address all of the services flowing from the mallard and goose restoration projects, the compensatory restoration associated with the shoreline injury would be reduced by approximately $2.2 million, all else being equal.

[18] ENTRIX is not endorsing the use of the Peterson ratios.

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We request that the Trustees revise the Draft DARP to address the apparent overlap between restoration requirements associated with shoreline impacts and those associated with birds and aquatic organisms. Absent such a revision, we request a detailed accounting of all individual services considered in the shoreline Habitat Equivalency Analysis (HEA). That accounting should include:

1. *A listing of all individual services that flow (would flow) from both the impacted and restored marshes and habitats,*
2. *A listing of the relative value assigned to each service and justification for such weights,*
3. *The level of each individual service flowing from the impacted marshes and habitats through time under both baseline and with spill conditions,*
4. *The level of each individual service flowing from the restored habitats under both baseline and with spill conditions, and*
5. *A mathematical demonstration that (1) the level of marsh services provided to the public given the spill and restoration is neither greater than nor less than the baseline level of marsh services and (2) the level of bird services provided to the public given the spill and restoration is neither greater than or less than the baseline level of bird services.*

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Appendix A: Estimating the Net Effect of the Spill on Waterfowl Populations

The Final Report of the Athos I Bird and Wildlife Technical Working Group estimates the effect of physical fouling and oil ingestion on birds. That document asserts that, as a result of fouling and ingestion:

- 605 dabbling ducks died and an additional 611 did not breed in 2005;
- 82 diving ducks died and an additional 26 did not breed in 2005;
- 1,416 herbivores (geese) died and an additional 2,458 did not breed in 2005; and
- 1,205 other birds (over 90% gulls) died and an additional 1,365 did not breed in 2005.

To estimate the effect of the spill-related hunting closure, we reviewed (1) the Trustees' Lost Use Valuation Report[2] and (2) migratory bird harvest information reported in U.S. Fish and Wildlife Service (2005)[19]. The Trustees' lost use valuation report states that 4,700 waterfowl hunting trips did not occur due to the spill. The migratory bird harvest data from U.S. Fish and Wildlife Service (2005) is reported in the Table below.

Migratory bird harvest and trip information			
	Harvest	**Hunter trips**	**Per Trip Harvest**
Delaware Dabbling Duck	42,600.00	32,400.00	1.31
New Jersey Dabbling Duck	66,900.00	42,400.00	1.58
Total/Average	109,500.00	74,800.00	**1.46**
Delaware Diving Ducks	900.00	500.00	1.80
New jersey Diving Ducks	2,900.00	1,800.00	1.61
Total/Average	3,800.00	2,300.00	**1.65**
Delaware Goose	27,000.00	28,700.00	0.94
New Jersey Goose	40,300.00	23,200.00	1.74
Total/Average	67,300.00	51,900.00	**1.30**

Relying on the trip ratios reported in Table 1, we estimate that, among the 4,700 foregone waterfowling trips, 2,850 were likely for dabbling ducks, 99 were likely for diving ducks, and 1,751 were likely for geese. Using the per trip harvest statistics reported in the table above, we estimate that, as a result of spill related area closures:

- 4,161 dabbling ducks were not harvested (2,850 foregone trips x 1.46 dabbling ducks per trip);
- 163 diving ducks were not harvested (99 foregone trips x 1.65 diving ducks per trip); and
- 2,276 geese were not harvested (1,751 foregone trips x 1.3 geese per trip).

To estimate the net effect of the spill on dabbling ducks, note the Trustee assertion that 1,216 dabblers were negatively impacted by the spill (605 dead, 611 surviving but not breeding in 2005) whereas 4,161 dabbling ducks that otherwise would have been harvested via hunters, survived. Thus, the **net** effect of the spill on dabbling ducks was to increase the population by at least 2,945 individuals.

[19] U.S. Fish and Wildlife Service. 2005. Migratory Bird Harvest Information, 2004: Preliminary Estimates. U.S. Department of the Interior, Washington D.C. USA

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To estimate the net effect of the spill on diving ducks, note the Trustee assertion that 108 divers were negatively impacted by the spill (82 dead, 26 surviving but not breeding in 2005) whereas 163 diving ducks that otherwise would have been harvested, survived. Thus, the **net** effect of the spill on diving ducks was to increase the population by at least 55 individuals.

To estimate the net effect of the spill on herbivores (geese), we evaluate two effects. First, 860 individuals that otherwise would not have survived, actually did survive (estimated as 2,276 geese not harvested - 1,416 deaths due to fouling and oiling). Second, the Trustees assert that 2,458 birds did not breed in 2005 due to the spill. To determine the net result of these two effects we use the age structured population model outlined in Section 7.2 of the Final Report of the Athos I Bird and Wildlife Technical Working Group. ENTRIX used this same model to compare a projected baseline population (the baseline projection does not embody any spill effects) to a "with-spill" projection (the with-spill projection increases the number of individuals in the population by 860 individuals in the spring of 2005 but does not allow 2,458 geese that otherwise would have bred to breed in the summer of that year). This exercise suggests that the **net** effect of the spill was to increase the goose population by more than 300 individuals over the course of 2 years.

On net then, the waterfowl population appears to have increased by approximately 3,300 individuals as a result of the spill and the spill-related closure.