Minnesota's Outdoor Heritage Fund: A Process to Define Outcomes and Impacts

Final Report and Work Group Recommendations
July 31, 2017

A project of the Lessard-Sams Outdoor Heritage Council

Process convened by Environmental Initiative

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Executive Summary

Project Goal

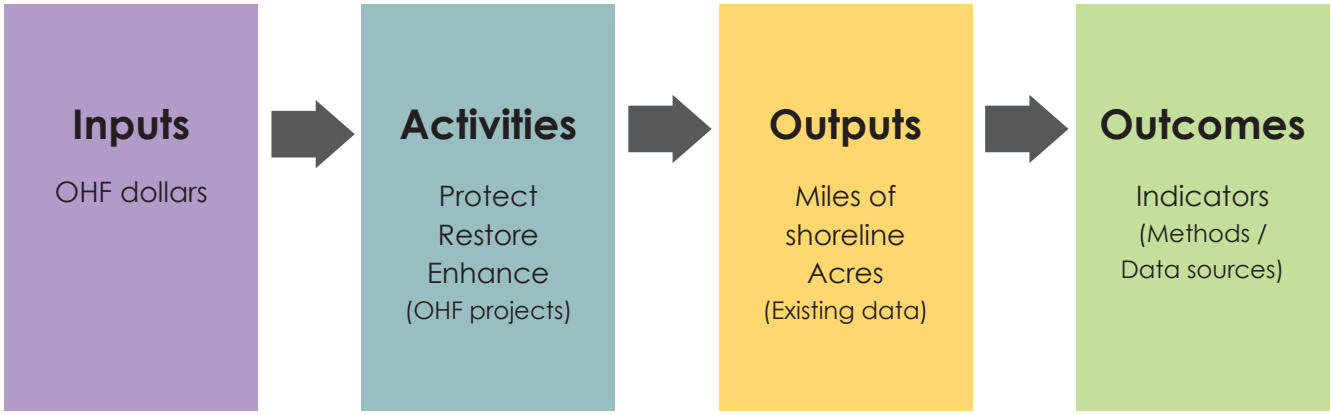
Develop recommended outcome metrics for the Outdoor Heritage Fund (the Fund, OHF), as required by Minnesota State Statute 97A.056, that support the demonstration of public benefit and accountability for the use of public money. Building on prior efforts, these metrics will be used to report the aggregate impact and accomplishments of the Outdoor Heritage Fund.

Process Overview

Between April and July of 2017, Environmental Initiative convened a Work Group of thought leaders, including representatives from state and federal agencies, local governments, and conservation nonprofits, to develop recommended outcome metrics for the Outdoor Heritage Fund. Technical support was provided by Houston Engineering, Inc. staff, several additional state and federal agency staff, and conservation leaders.

Connecting Projects to Outcomes

The recommended outcome metrics tie back to and build upon output reporting by Fund recipients and ultimately help provide accountability to tax payers that the Fund's investments result in public benefit for Minnesotans.



Key Messages / Themes

Consistent with the constitutional directive of the Outdoor Heritage Fund, outcome metrics emphasize primarily providing healthy habitat for Minnesota fish, game, and wildlife species, and outdoor recreation opportunities. Secondarily the outcomes highlight other economic, social, and ecological benefits of the Fund.

This is important work as broad indicators and outcomes that support a long-term vision can provide a more robust and meaningful way of reporting on the Outdoor Heritage Fund's impact.

These outcome statements and supporting indicators build on the work originally completed in 2010 by the Lessard-Sams Outdoor Heritage Council (LSOHC): *A 25-year framework: Minnesota's conservation estate, historic conservation investments and future opportunities*, specifically the results management framework found in Appendix C.

Methods and data sets to measure the indicators are challenging to define, as outcomes accrue over long periods of time and can rarely be tied to single actions or sets of actions.

The recommendations are a starting point for further work that should continue to adapt over time and incorporate the best available science and new or emerging methods of measurement. The Council should seek opportunities to support the development of methods to measure the recommended indicators.

Habitat outcomes and species abundance are influenced by external factors outside of the control of the LSOHC and Fund recipients, and consequently the larger context should be considered and communicated when reporting the Fund's impact.

Different types of reporting will help to communicate the results of the OHF investments to key audiences:

- Aggregate Impact—Cumulative effects of numerous projects that provide greater accountability for the Fund overall.
    - Outcome statements, supporting indicators that demonstrate progress toward the outcomes, and potential methods and data sources to measure the indicators can be used to report the Fund's impact over time.
    - Adapting the message of the Fund's aggregate impact for the five LSOHC planning regions can also help in better relaying the impacts of the OHF to key audiences.
- Case Studies—Examples that showcase local or regional projects or stories and the impacts that can be realized when monies are focused on strategic actions in particular focal areas.

Audience, scale, and context (temporal, geographic, etc.) are imperative to consider when relaying the Fund's impact and deciding when to use case studies in addition to aggregate impact reporting.

Currently available data sources and methods that can be used to report on the aggregate impact of the Fund are limited. Both measured and modeled data that could be used to measure progress toward outcomes have benefits and limitations in their potential uses and applications.

Working with the best information available today, the recommended indicators have potential to meaningfully measure progress toward the stated outcomes. By highlighting these indicators, the LSOHC can focus existing or new work on further developing potential methods and data sources in the future.

Background

Outdoor Heritage Fund (the Fund, OHF) monies are a significant, long-term investment in the future of Minnesota with approximately $80 million available for appropriation by the legislature annually. As directed by the Constitution of the State of Minnesota, funds must only be spent to, "restore, protect, and enhance wetlands, prairies, forests, and habitat for fish, game, and wildlife."

Since 2010, the Lessard-Sams Outdoor Heritage Council (LSOHC) has been consistently measuring several key outputs of the Outdoor Heritage Fund such as acres acquired, miles of shoreline protected, and acres restored. While these output measures are important, stakeholders are highly interested in understanding, in a more comprehensive way, how these important funds are making a difference for Minnesota. The goal of creating outcome metric recommendations through this process was to support the demonstration of public benefit and accountability for the use of public money, rather than to evaluate the success of individual OHF projects. Building on prior efforts, particularly the work completed in 2010 by the LSOHC in *A 25-year framework: Minnesota's conservation estate, historic conservation investments and future opportunities*, these outcome metrics can be used to report on the aggregate impact and accomplishments of the Outdoor Heritage Fund.

Defining outcome metrics for the OHF is not an easy task. The OHF was created to improve habitat used by Minnesota fish, wildlife, and game species. Habitats, and the species that live in them, are influenced by a wide variety of factors. As *A 25-year framework* states, "Long-term outcomes are often the result of efforts of numerous agencies, nonprofit organizations and other entities working together. They are the most susceptible to change due to external social, environmental or political forces" (p. 55). Measuring outcomes as they directly relate to the OHF can be incredibly challenging as there are forces outside the control of the LSOHC that impact what results from projects. Outcomes accrue over long periods of time and can rarely be tied to single actions. Furthermore, habitat outcomes and species abundance are influenced by external factors outside of the control of the LSOHC. In any communications about the impact of the OHF, contextual information will be needed to better describe how the conservation impact of the OHF relates to statewide and regional priorities and trends.

Key Terms and Definitions

Consistent use of certain key terminology is important when assessing and communicating long-term impact. For the purpose of this process, the following terms and definitions were used.

Output

What is produced. Specific products resulting from activities. Outputs can be described as the volume of work achieved (e.g., acres acquired, shore land protected, acres enhanced).

Outcome

What results. Benefits to wildlife, natural resources, and people resulting, directly or indirectly, from outputs. Outcomes typically relate to changes in people (awareness, knowledge, attitudes, skills, behavior, and satisfaction) and changes in natural resources (conditions and quality).

Indicator

A marker of accomplishment or progress. A specific, observable, and measurable accomplishment or change that shows the progress made toward achieving a specific output or outcome. Also sometimes called a measure or metric.

Method

Means to gather information about an indicator or an outcome (e.g., geospatial mapping, biological surveys, modeling).

Data Sources

The specific source of the information (e.g., data models, land cover maps, etc.).

Process Overview

In January 2017, the LSOHC posted a request for proposals to develop outcome metric recommendations and reporting suggestions for the Outdoor Heritage Fund. Similar reports have been developed for other Clean Water, Land, and Legacy Amendment funds such as the Clean Water Fund. In March 2017, Environmental Initiative and its subcontractor Houston Engineering, Inc. were selected to provide facilitation, project management, and technical support services for the Outdoor Heritage Fund outcomes development process.

Environmental Initiative staff designed and facilitated all project meetings, including the meetings of the steering committee and the Work Group. Houston Engineering, Inc. supported the technical input aspect of the process.

Steering Committee

The steering committee was comprised of LSOHC staff, Larry Kramka as a technical advisor from Houston Engineering, and Julie Blackburn as liaison to and representative of the LSOHC. The steering committee provided feedback on the process and provided input and advice for the design of the Work Group meetings and format of the final recommendations.

Work Group

The Work Group was the decision-making body of the process and was tasked with collaboratively defining outcome metrics to recommend to the LSOHC. This Work Group consisted of thought leaders from across sectors, including representatives from state and federal agencies, local governments, and conservation nonprofits. Attachment A lists the Work Group participants and their affiliated organizations. The Work Group held its first meeting in mid-April 2017 and its fifth and final meeting in mid-July 2017. Individual agendas for each of the five Work Group meetings are included in this report as Attachment C. Each Work Group member brought to the process their unique experience with the Outdoor Heritage Fund, other Legacy funds, and their professional expertise related to habitat protection and restoration.

Early in the process, the Work Group agreed to a charter outlining their scope of work and expectations for the consensus decision-making process (included as Attachment B). The Work Group also discussed and defined overarching principles and criteria to be used in evaluating potential outcome metrics.

Overarching Principles

The following overarching principles were used to evaluate the package of outcomes and indicators as a whole.

Simpler is better

General compatibility and connection

Comprehensiveness

Ability to support goals identified in other conservation plans

Efficacy

Geographic context and relevance

Meaningfulness in relation to one or more things that are valued by the "general" public

Criteria for Outcome Metrics

The following criteria were used when crafting the outcome statements and when considering potential methods and data sources individually.

Understandable (translatable)

The ease of communicating the outcome to general audiences, including its ability to be "translated" by experts for communication to the broader public. This criterion related specifically to the outcome language, not the indicators.

Breadth

"Proxy power," or the ability to address multiple issues/interests/values/indicators with a single data source. In other words, the "comprehensiveness" of the method or data source.

Availability of data

This criterion has two components: 1) data must be useable (measureable) now or in the near future (within two years); 2) cost considerations for obtaining the necessary data and/or performing the necessary calculations. The Work Group focused primarily on the usability of the methods and data sources in this phase of the project.

Scientific credibility

The credibility of the data, method, or model necessary to measure progress.

Technical Input

Technical experts were consulted in various fields including ecology and land, water, and wildlife management to gather information on what data currently exist that could be used to measure OHF outcomes, potential application of methods, models, or tools, and additional information that may be required to report on OHF outcomes that is not currently available. Consulted individuals represented the Minnesota Department of Natural Resources, the Board of Water and Soil Resources, the University of Minnesota, The Nature Conservancy, and the U.S. Fish and Wildlife Service (a list of technical experts consulted is included as Attachment F). Some of these technical experts gathered for a half-day meeting in May 2017 to better understand the project and discuss potential methods and data sources to be applied to OHF outcome metrics being considered.

These technical experts were asked to consider currently existing data, methods, and models that could be paired with the outcomes and indicators identified by the Work Group, and to discuss the strengths and weaknesses of different potential methods and data sources. Attachment D lists the Work Group recommended outcomes, indicators, and potential methods and data sources with notes from technical experts on the possible use, limitations, and additional notes related to applying the methods and data sources to the listed indicators.

Using the criteria of availability, breadth, and scientific credibility, Houston Engineering staff rated potential methods and data sources that were under consideration to better inform the Work Group discussions and decisions. Houston Engineering staff also prepared a companion document to provide additional detail on several potential methods and data sources in response to questions raised by the Work Group. This document is included as Attachment G. A list of terms and acronyms relating to the data sources and methods is provided in Attachment E.

Recommended Outcomes, Indicators, and Potential Methods and Data Sources

The Work Group split the task of defining outcome metrics into three components: outcome statements, supporting indicators that demonstrate progress toward the outcomes, and potential methods and data sources to measure the indicators.

These outcome statements and broad indicators are intended to support the vision and measure the long-term results of the OHF. The outcome statements are based on the constitutional language that created the Fund. Specifically, the Work Group defined primary outcomes related to providing healthy habitat for fish, wildlife, and game species, and outdoor recreation opportunities. Given that there are also many benefits to people that result from improved fish, game, and wildlife habitat, the Work Group decided to define a secondary outcome related to the economic, social, and ecological benefits resulting from the Fund. Defining and measuring these benefits as a secondary outcome can help to communicate the additional benefits to society provided by Fund investments in a way that may be more relatable for members of the general public than the primary outcomes. Although the Work Group considers the secondary outcome to be very important

for communicating the impact of the OHF, they did not have time in this process to refine the list of indicators for the secondary outcome as much as they did for the primary outcomes. This further refinement of indicators could occur in the next phase of work.

The recommended indicators demonstrate progress toward the outcomes, such as changes in habitat quality, connectivity, and species diversity. Each indicator is associated with at least one potential method or data source, derived through a range of techniques, from sampling, to mapping, to modeling. Defining methods and data sources to measure the indicators is critical to enable reporting on the outcome metrics, and the Work Group felt that additional technical expertise is needed to evaluate the potential methods and data sources that were identified through this process for their practical application and potential uses. Therefore, the potential methods and data sources should be viewed as a starter list for consideration and refinement in a future phase to further develop OHF outcome reporting.

Attachment D includes notes on several of the potential methods and data sources, as well as a list of additional indicators and potential methods and data sources for future consideration.

The recommended indicators can be used to communicate the aggregate impacts of all OHF funded projects and to evaluate progress toward achieving the desired outcomes of the Fund. These indicators should not be used for prioritization of individual project proposals or evaluation of ongoing projects.

Methods and measures to report on outcomes of the OHF should continue to adapt over time and incorporate the best available science and new or emerging methods of measurement. Working with the best information available today, the recommended indicators have potential to meaningfully measure progress toward the stated outcomes. By highlighting these indicators, the LSOHC can focus existing or new work on further developing potential methods and data sources in the future.

Summary Table for Recommended Outcomes, Indicators, and Potential Methods and Data Sources

Primary Outcomes

Recommended Outcome Statement	Recommended Indicator Potential Methods / Data Sources
Fish Habitat Lakes, rivers, and streams are strategically protected, restored, or enhanced to provide healthy habitat for Minnesota fish species.	**Abundance of selected fish species, representative of Minnesota's diverse aquatic habitats** InVEST data models, DNR surveys **Biodiversity/species diversity** Fish models based on predictor variables, Index of Biological Integrity (IBI) **Connectivity of high-quality habitat for desired species** DNR Watershed Health Assessment Framework
Wildlife / Game Habitat Forests, prairies, and wetlands are strategically protected, restored or enhanced to provide healthy habitat for Minnesota wildlife and game species.	**Changes to high-quality habitat complexes and risk of loss** Land cover maps, InVEST data models **Habitat suitability for forest, grassland or wetland wildlife** Land cover maps, HAPET models **Abundance of selected wildlife, game, and pollinator species, representative of Minnesota's diverse terrestrial habitats** InVEST data models, Site-specific sampling data, Thunderstorm maps **Connectivity of high-quality habitat for desired species** DNR Watershed Health Assessment Framework, Biological survey data
Outdoor Recreation Minnesotans have more opportunities to enjoy fish, wildlife, and game related outdoor recreation.	**Public access to habitat** Public lands mapping, walk-in access acres, conservation holdings maps, National Conservation Easement Database (NCED) **Public access for hunting and fishing** Public lands mapping, walk-in access acres, MN DNR trout stream maps with population map overlay **OHF project sites within a certain radius of population centers** OHF project sites map with population map overlay

Secondary Outcome

Recommended Outcome Statement	Recommended Indicator Potential Methods / Data Sources
Benefits to People Economic, social, and ecological outcomes provide benefits to people that go beyond habitat (fish, game and wildlife) and outdoor recreation.	**Total economic contribution of the OHF to the state and local economy** Dollars spent on 'personnel' and 'contracts' collected through IMPLAN **Other funds leveraged** OHF projects **Participation in outdoor recreation / tourism** InVEST data models, social media based visitation data, ebird **Wellhead protection** Combined mapping to show vulnerable areas and LSOHC sites, DNR Watershed Health Assessment Framework **Soil loss reduction** InVEST sediment delivery ratio model, HSPF, SAMS, SWAT, PTMApp, ELINK **Water quality (nutrient retention and sediment reduction)** InVEST nutrient delivery ratio model, HSPF, SAMS, SWAT, PTMApp, ELINK **Carbon storage and sequestration** InVEST data models, Land change modeling **Water retention and flood storage** Acre feet of storage model

Note: Refer to Attachment E for a full list of terms and acronyms for methods and data sources

Work Group Input on Frequency, Format, and Content of OHF Outcome Reporting

Ways to Communicate OHF Impact

Broad indicators and outcomes that support a long-term vision can provide a more robust and meaningful way of reporting on the Outdoor Heritage Fund's impact. Audience, scale, temporal context, and geographical context are important to consider when communicating about the Fund's impact. The Work Group believes that different types of reporting will help to relay the results of the Outdoor Heritage Fund investments to different key audiences. These include:

- **Aggregate Impact**
  Cumulative effects of numerous projects that provide greater accountability for the Fund overall.

- **Case Studies**
  Examples that showcase local or regional projects or stories and the impacts that can be realized when monies are focused on strategic actions in particular areas of interest.

Aggregate impact reporting and case studies each help to convey the impact of the OHF in a different way, ensuring that the importance of this work reaches and resonates with different audiences. In both cases, the broader conservation context should also be considered and communicated when reporting the Fund's impact, since habitat outcomes and species abundance are influenced by numerous external factors outside of the control of the LSOHC and Fund recipients. This contextual information also provides the background needed to better describe the conservation impact of the OHF and provides narrative that reflects statewide and regional priorities and trends.

Adapting the message of the Fund's impact for each of the five LSOHC planning regions can also help in better relaying the impacts of the OHF to key audiences.

The recommended indicators from this process are intended only to be used only to demonstrate the aggregate impacts of the OHF and are focused on the cumulative effects of all OHF projects, providing greater accountability to the public. Caution should be used when selecting the type of story to communicate the impact of the OHF. Certain indicators may not be appropriate to use for aggregate impact reporting or for site-specific case studies, and it is important to pair the indicator used with its intended purpose and acceptable applications. A list of additional indicators to consider for use in communicating across outcomes or through site-specific case studies is included in Attachment D and should be further developed in a future phase of work.

There are several benefits of using case studies, in addition to aggregate impact reporting, to describe the outcomes and impact of the OHF:

- Reporting through case studies can provide detail to convey the Fund's impact on a specific, local area. This provides a link from the project level to the broader aggregate level, where specific data may be limited or unavailable. Case studies allow for a focused effort on one more project sites that may also aid in developing additional data sources.

- Case studies provide an opportunity to focus on a geographic scope and on outcomes of the Fund that reflect current priorities.

- Case studies can provide a cohesive narrative that connects to all of the outcomes of the Fund, as recommended by the Work Group.

In spite of these beneficial applications, case studies could be misleading about aggregate impacts if extrapolated to other areas, and the LSOHC should therefore use caution when employing case studies to communicate the impact of the OHF. Case studies should be paired with other types of outcome reporting, including contextual information, and the intended interpretation of a case study should always be clearly stated. In particular, wildlife and fish abundance can be especially problematic when used as a measure of success in case study reporting, since actual abundance is unpredictable and project activities can only partially influence potential abundance of wildlife or fish populations.

Two OHF project sites that could make for compelling case studies, if LSOHC were to develop them as such, include:

Lester Lake

The Lester Lake Scientific & Natural Area (SNA) and Aquatic Management Area (AMA) is a cooperative project between the Minnesota Department of Natural Resources' Divisions of Ecological and Water Resources and Fish and Wildlife, the Trust for Public Land, and the Kabekona Lake Foundation. Funded with Clean Water Land and Legacy dedicated sales tax dollars from the Outdoor Heritage Fund, and lottery proceeds from the Environment and Natural Resources Trust Fund, the Area is 440 acres, with 120 acres designated as AMA and 320 acres designated as SNA. It completely surrounds 56-acre Lester Lake, and is located within the Kabekona Lake watershed. Lester Lake SNA and AMA protects aquatic and upland habitat, increases fishing and hunting opportunities, protects an important tributary to Kabekona lake, provides a unique wilderness experience for tourism, and provides many other beneficial outcomes to the local community. These beneficial outcomes will continue in perpetuity, as Lester Lake is under permanent protection as a state SNA/AMA. *(Conservation Partners Legacy (CPL) grant to Trust for Public Land and Kabekona Lake Foundation) (ML 2009, Ch. 172, Art. 1, Sec. 2, Subd. 5(b): Aquatic Management Area Acquisition – Phase 1)* More information can be found in the May – June 2015 *Minnesota Conservation Volunteer* magazine in the article "Cast into the Past."

Sand Hill River

The Sand Hill River stabilization project along a 5-mile stretch between Fertile and Beltrami in western Polk County will reduce sediment, increase soil retention, and improve habitat for fish—including sturgeon that spawn upstream. Four concrete drop structures, paid for in part with funding from the Lessard-Sams Outdoor Heritage Fund and modified by the U.S. Army Corps of Engineers will allow fish passage while maintaining grade-reduction benefits. The project provides numerous beneficial outcomes associated with improved fish habitat, as well as secondary outcomes that provide social, economic, and ecological benefits to people. *(Minnesota Board of Water and Soil Resources Snapshot, July 2017)*

Work Group Input on Outcome Reporting

The Work Group believes the LSOHC should continue its strong focus on annual reporting of outputs resulting from funded projects. Reporting on outcomes will also be important, but should happen less frequently, as outcomes accrue over longer periods of time. Furthermore, certain indicators can be viewed as leading indicators, marking near-term progress toward an intended outcome, while others are lagging indicators that require a longer time span to measure change.

In addition to narrative reporting on project outputs and the outcomes of the Fund's investments, the Work Group believes that visual representations of the OHF's impact (such as GIS maps) will be an important tool for reporting the OHF's impact.

Some Work Group members felt that outcome reporting should only be done every five years, while others felt that every two or three years would be more appropriate. The Work Group suggests that a visual "report card" that describes the aggregate impact outcomes of the Fund in terms consistent with the language and indicators recommended through this process should be developed by the LSOHC and/or state agencies (not by Fund recipients or for individual projects). Like any effective communication tool, any OHF outcomes report should consider the primary audience and be adapted to best suit the needs and interests of that particular audience (e.g., tax payers, legislators, county commissioners, sportsmen and women, etc.). Linking the outcomes attained to the LSOHC planning regions can also make outcome reporting more relevant and relatable by bringing in relevant geographic context.

Conclusion and Next Steps

This process was envisioned as the first phase of a multi-phase effort. Further development of the methods and data sources associated with the recommended indicators is needed. The Work Group believes this work is valuable and should be continued to further evaluate and explore the potential application and limitations of existing or emerging methods and data sources that could be used to communicate the aggregate impact of the Outdoor Heritage Fund. Due to the timing and scheduling constraints of this phase of the project, some invited individuals were not able to participate. As a result, the next phase of work should aim to fill certain gaps in expertise that were not well represented by the Work Group for this process.

The next phase of outcomes development work could potentially be organized around specific technical expertise. Fish habitat, wildlife habitat, and outdoor recreation experts could be called upon to elaborate on the potential applications and limitations of different methods and data sources. Experts in the secondary social, economic, and ecological benefits of the Fund could also be called upon to provide deeper analysis of the indicators and potential applications and limitations of various methods and data sources. Regardless of how the next phase of work is scoped and organized, the Work Group suggests consulting with additional technical experts and peer reviewers to further assess and explore the potential methods and data sources that could be used to measure progress toward the recommended indicators.

Attachment A: Work Group Roster

First Name	Last Name	Organization
Bruce	Albright	Buffalo-Red River Watershed District
Marilyn	Bernhardson	Redwood County Soil & Water Conservation District
Gary	Botzek	Capitol Connections (Minnesota Conservation Federation)
Tom	Cooper	U.S. Fish and Wildlife Service
Mike	Estey	U.S. Fish and Wildlife Service (alternate for Tom Cooper)
Don	Hickman	The Initiative Foundation
Steve	Hobbs	The Conservation Fund
Tabor	Hoek	Minnesota Board of Water and Soil Resources
Andy	Holdsworth	Minnesota Department of Natural Resources
Rich	Johnson	The Nature Conservancy
Eran	Sandquist	Pheasants Forever
Grant	Wilson	Minnesota Department of Natural Resources
Dave	Zumeta	Minnesota Forest Resources Council

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Attachment B: Work Group Charter

Minnesota's Outdoor Heritage Fund: A Process to Define Outcomes and Impacts

Work Group Charter

April 13, 2017

Mission

The Work Group will develop recommended outcome metrics for the Outdoor Heritage Fund (OHF) that support the demonstration of public benefit and accountability for the use of public money. The Work Group will use a consensus process to collaboratively define recommended outcome metrics for approval by the Lessard-Sams Outdoor Heritage Council (LSOHC). Building on prior planning efforts, these metrics will be used to tell the story of the aggregate impact and accomplishments of the OHF.

Scope

Since 2010, the LSOHC has been consistently measuring several key outputs such as dollars spent, acres acquired, and acres restored. While these are important metrics, the LSOHC is highly interested in understanding, in a more comprehensive way, how these important funds are making a difference in Minnesota.

The LSOHC defines outputs and outcomes as follows:

- Output: What is produced. Specific products resulting from activities. Outputs can be described as the volume of work achieved, e.g., acres acquired, shore land protected, acres enhanced.
- Outcome: What results. Benefits to wildlife, natural resources, and people resulting, directly or indirectly, from outputs.

The Work Group is charged by the Council with recommending a selection of outcome metrics that can serve to communicate the accomplishments of the OHF and the importance and value of habitat restoration, protection, and enhancement. These recommended metrics and the accompanying report should:

- Primarily address impacts to fish, game, and wildlife habitat and secondarily capture and quantify associated economic, ecological, and social impacts.
- Be developed to support accountability to the Minnesota Legislature and the public.
- Assist in telling the Outdoor Heritage Fund story.

- Identify gaps in knowledge and methods necessary to measure potential outcomes of interest.
- Drive innovation in methods to evaluate overall outcomes and impact.

The Work Group will also be tasked with providing input on the use, reporting, and communication of outcomes, including reporting frequency, format, outline, methods, reporting responsibilities, etc.

The following are out of scope, and will not be addressed by this Work Group:

- Alternatives to defining outcome metrics as a focus or deliverable for this process; the purpose of this project is to recommend outcomes metrics
- Collecting data and reporting on any of the proposed metrics
- Defining or debating funding priorities
- Recommending specific program evaluation methods
- Defining metrics that cannot be measured or implemented in the next two years (though these can be identified as gaps in knowledge)

End Result and Deliverables

A desired outcome of this process is that the Work Group brings forward a set of recommended outcome metrics to the LSOHC, related to the above scope and consistent with the authoring language of the Clean Water, Land and Legacy Amendment ("…restore, protect, and enhance Minnesota's wetlands, prairies, forests, and habitat for fish, game, and wildlife…"), through a consensus process.

Participant Roles and Decision-making

Work Group members are asked to bring their biggest and brightest thoughts around this issue into group discussions. Work Group members are not asked to represent the official position of their organization or sector. Members agree to volunteer until a set of recommended outcome metrics have been defined through a consensus process. To reach consensus, as defined inside the process:

1. Work Group members need to be able to live with the recommendations.
2. Work Group members need to be able to support the recommendations.
3. Work Group members need to pledge to not undermine the recommendations.

In addition to the Work Group's consensus recommendations, the final process report will include information on recommendations that received majority support, with the difference between consensus recommendations and majority-supported recommendations clearly reflected. It may also include a single minority report or other commentary on potential metrics which were not majority-supported, but about which certain Work Group members feel strongly.

When an issue arises that cannot be easily resolved, Work Group members agree to contact Environmental Initiative staff to discuss their concerns and potential ways to resolve them; see "Communication Mechanisms" section for contact information.

Work Group meetings will be attended by at least one member of the LSOHC, who will act as a liaison between the Council and the Work Group to observe and participate in discussions, as needed, in order to ensure that the process is guided by the needs and vision of the Council. This liaison will not be considered a member of the Work Group for the purpose of consensus decision-making.

Process decisions will be guided by a steering committee comprised of LSOHC staff and the Council liaison to the Work Group, with whom Environmental Initiative will consult prior to Work Group meetings. This group will not dictate the content of the recommendations; rather, the recommendations will be the product of the Work Group.

Timeline and Milestone Dates

This Work Group will meet four times for approximately six hours each between the middle of April and the middle of June.

1. Meeting #1 (*April*):
    a. Present and discuss goal(s)
    b. Introduce and align on process
    c. Discuss and decide on initial list and relative importance of criteria for evaluating outcome measures
    d. Develop initial list of questions/information needed to effectively evaluate possible outcome measures

2. Meeting #2 (*April*):
    a. Finalize evaluation criteria and decision-making process (including a scoring process and how various criteria will be weighted or otherwise utilized)
    b. Develop draft list of outcome measures to evaluate against criteria

3. Meeting #3 (*May*):
    a. Review information on available methods, models, tools, and data and discuss implications for viability and priority of possible outcome measures
    b. Discuss relationship to social, economic, and other ecological outcomes
    c. Complete evaluation of possible outcome measures and align on draft list
    d. Discuss ideas for use, presentation, and communication of measures
    e. Determine what additional information is needed to finalize recommendations

4. Meeting #4 (*June*):
    a. Final selection of recommended outcome measures
    b. Further discussion on possible use, presentation, and communication of measures, including presentation of social, economic, and other ecological outcomes associated with selected outcome measures

Environmental Initiative will report the recommendations of the Work Group to the LSOHC at the end of June.

Supporting Resources

A complementary technical input process will be used to provide information to the Work Group on available data and relevant methods, models, and tools and evaluation of potential outcome measures against defined criteria.

Process to Release Deliverables

Environmental Initiative will produce a report on the outcomes of the process, with content determined by the decisions and discussions of the Work Group. This report will be delivered to the LSOHC and entered into the public record.

Communication Mechanisms

Within Group

Environmental Initiative will inform members of upcoming meetings via email. Environmental Initiative staff is always available by phone or email to take Work Group questions and concerns:

- Meleah Houseknecht (through end of May):
    - Phone: 612.334.3388 ext 8104
    - Email: mhouseknecht@en-in.org
- Ellen Gibson (from beginning of May to project end):
    - Phone: 612.334.3388 ext 8103
    - Email: egibson@en-in.org
- Erin Niehoff (through project duration):
    - Phone: 612.334.3388 ext 8102
    - Email: eniehoff@en-in.org

With LSOHC and Staff

Council members may come to Work Group meetings to hear the discussion and provide input. LSOHC staff will attend Work Group meetings to observe and answer relevant questions.

With Other Interested Parties
While Work Group members are not expected to represent the official position of their organization or sector, they are encouraged to gather and bring forward the input and ideas of their colleagues, peers, and constituents throughout the process. In addition to informal channels for input, the LSOHC may seek opportunities to gather formal input or feedback from interested parties during the development or after the completion of draft recommendations. Formal input from outside parties will not be solicited before the completion of the final recommendations and report without the knowledge and approval of both Work Group members and the LSOHC staff and Council liaison.

With the General Public
Meetings of the Work Group are open to individuals who would like to attend as observers. Work Group members are welcome to bring guests, such as colleagues or board members, to meetings as observers as well, but are asked to notify Environmental Initiative staff of any guests who will be attending for planning purposes.

With the Media
Through the duration of the process, all media inquiries should be directed to Environmental Initiative. Once a final project report has been delivered to the Council, media inquiries should be directed to the LSOHC staff.

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Attachment C: Work Group Meeting Agendas

Minnesota's Outdoor Heritage Fund: A Process to Define Outcomes and Impacts

Work Group Meeting Agenda

Thursday, April 13, 2017
9:30 a.m. – 3:30 p.m.
State Office Building, Room 500N
100 Rev. Dr. Martin Luther King Jr. Blvd
St. Paul, MN 55155

Meeting Objectives

- Establish a common understanding of the goals for this process and a work group charter that includes agreed-upon parameters for the conversation
- Discuss anticipated outcomes and milestones for the process
- Discuss and develop a list of criteria to be used by the group to evaluate potential outcome measures
- Identify key sources of information and/or inspiration to be used and referenced in drafting outcome measures
- Confirm dates for remaining work group meetings

9:00 Light breakfast and networking

9:30 Welcome and introductions
Julie Blackburn, Member, Lessard-Sams Outdoor Heritage Council
Mike Harley, Executive Director, Environmental Initiative

9:45 Outdoor Heritage Fund outcomes development process overview
Meleah Houseknecht, Director, Environmental Policy, Environmental Initiative

- Provide overview of proposed process
- Review meeting agenda and objectives
- Review process timeline

10:00 Discussion of Council and participant goals and expectations

11:00 Break

11:10 Work to date on defining Outdoor Heritage Fund outcomes
Joe Pavelko, Assistant Director, Lessard-Sams Outdoor Heritage Council

11:30 Establish Work Group charter

12:00 Lunch

12:30 Discussion of criteria for evaluating outcome measures

- Availability of data/model
- Understandable to general audiences
- Scientific accuracy
- Ease of obtaining data
- Ease of replication
- Comprehensiveness
- Geography

2:20 Break

2:30 Identify key sources of information/inspiration for drafting outcome measures

3:00 Technical process & meeting
Larry Kramka, Senior Environmental Project Manager, Houston Engineering, Inc.

- Develop initial list of questions/information needed to effectively evaluate possible outcome measures
- Identify initial list of individuals to consult
- Plan for technical meeting

3:25 Wrap-up and next steps
Mike Harley, Executive Director, Environmental Initiative

3:30 Adjourn

Celebrating Environmental INITIATIVE 25 years
Powerful Partnerships, Effective Solutions

Minnesota's Outdoor Heritage Fund: A Process to Define Outcomes and Impacts

Work Group Meeting Agenda

Thursday, April 27, 2017
9:00 a.m. – 3:00 p.m.
Minnesota Valley National Wildlife Refuge
3815 American Boulevard East
Bloomington, MN 55425

Meeting Objectives

- Finalize list of criteria to be used by the group to evaluate potential outcome measures, including any relative weighting or thresholds
- Develop draft list of outcome measures and associated indicators to be evaluated
- Gather additional input into the technical information gathering process and meeting

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8:30 Light breakfast and networking

9:00 Welcome and introductions
Mike Harley, Executive Director, Environmental Initiative

9:15 Outdoor Heritage Fund outcomes development process update
Meleah Houseknecht, Director, Environmental Policy, Environmental Initiative

- Review meeting agenda and objectives
- Review any changes to process timeline
- Formal adoption of charter

9:30 Connecting the Outdoor Heritage Fund's 25-Year Framework to the Need for Long-Term Outcomes
Lessard-Sams Outdoor Heritage Council Staff
Julie Blackburn, Member, Lessard-Sams Outdoor Heritage Council

9:45 Break

10:00 Review, discuss, and finalize criteria and decision matrix for evaluating outcome measures

- Overarching principles
- Criterion descriptions
- Primary vs. secondary

- Outcomes vs. indicators
- Qualitative vs. quantitative use of criteria

11:30 Lunch

12:00 Generate and discuss potential outcome measures and indicators
- Begin with each Work Group member's suggestions

2:00 Break

2:15 Preparing for the technical process & meeting
Larry Kramka, Senior Environmental Project Manager, Houston Engineering, Inc.
- What information is needed to effectively evaluate possible outcome measures?
- Discuss list of individuals to consult
- Review draft agenda for technical meeting
- Discuss high-priority individuals to invite to participate in meeting

2:55 Wrap-up and next steps
Mike Harley, Executive Director, Environmental Initiative

3:00 Adjourn

Celebrating Environmental INITIATIVE 25 years
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Minnesota's Outdoor Heritage Fund: A Process to Define Outcomes and Impacts

Work Group Meeting Agenda

Tuesday, May 23, 2017
9:00 a.m. – 3:00 p.m.
Minnesota Valley National Wildlife Refuge
3815 American Boulevard East
Bloomington, MN 55425

Meeting Objectives

- Discuss target audiences and refine outcomes based on envisioned audiences
- Review progress towards identifying available methods, models, tools, and data and discuss implications for use of different methods
- Determine what additional information is needed to develop recommendations to the Council

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8:30 Light breakfast and networking

9:00 Welcome and introductions
Mike Harley, Executive Director, Environmental Initiative

9:15 Technical information gathering process update
Meleah Houseknecht, Director, Environmental Policy, Environmental Initiative

- Recap of the technical process and who was involved
- High-level overview of what was gathered

9:30 Core audiences and uses of outcomes

- What core audiences are important to reach with the "Outdoor Heritage Fund story" of public benefit and accountability?
- How might the story need to look for each audience?
- What implications might this have for selection and/or prioritization of outcomes and indicators?

10:30 Break

10:45 Progress toward evaluating indicators
Meleah Houseknecht, Director, Environmental Policy, Environmental Initiative

11:00 Review and edit outcome descriptions

- Review draft outcome descriptions
- Modify or redraft as necessary

12:00 Lunch

12:30 Finalize outcome descriptions

- Come to agreement on final outcome descriptions

2:00 Break

2:15 Determine additional information needed to develop recommended indicators and discuss reporting process

- Are there still gaps in the list of potential indicators as it stands now?
- Is there additional information that you feel you will need to make recommendations about indicators to explore further?

2:55 Wrap-up and next steps
Mike Harley, Executive Director, Environmental Initiative

3:00 Adjourn

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Minnesota's Outdoor Heritage Fund: A Process to Define Outcomes and Impacts

Work Group Meeting Agenda

Tuesday, June 13, 2017
8:00 a.m. – 1:30 p.m.
Minnesota Valley National Wildlife Refuge
3815 American Boulevard East
Bloomington, MN 55425

Meeting Objectives

- Review screening process for indicators and measures to consider including in final recommendations
- Identify viable measures to move forward for consideration and measures that could be useful for "top down" storytelling and/or for "case studies" that communicate OHF impact
- Discuss possible use and communication of measures and outcomes, as well as other means to tell the story of the Outdoor Heritage Fund's impacts
- Preview the format for the package of recommended outcomes, indicators and measures

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7:30 Light breakfast and networking

8:00 Welcome and introductions
Mike Harley, Executive Director, Environmental Initiative

8:10 Outdoor Heritage Fund outcomes development process update
Ellen Gibson, Senior Program Director, Environmental Initiative

- Review meeting agenda and objectives
- Plan and date for additional meeting of Work Group: Monday, July 17
- Plan and schedule for final report development and presentation to the LSOHC on July 31

8:30 Screening process for indicators and measures & preview of final report structure
Larry Kramka, Senior Environmental Project Manager, Houston Engineering, Inc.
Ellen Gibson, Senior Program Director, Environmental Initiative

- Orientation to screening process methodology and purpose
- Questions and discussion
- Preview final report structure and sections

8:45 Discuss Indicators and Measures for Healthy Habitat for Fish

- For each set of indicators and measures, objective is to sort measures and indicators into 4 baskets:
    1) Measures that should be advanced for consideration in the final recommendations for use by OHF in reporting impact ("ready to go")
    2) Measures that could be considered in a 2nd tier that are in need of further development
    3) Measures or indicators that are not viable and should be removed from consideration
    4) Indicators or measures that should be moved to "top down" list for use in contextual storytelling
- Identify any additional questions for technical experts related to indicators and measures still up for consideration

9:30 Break

9:45 Discuss Indicators and Measures for Healthy Habitat for Wildlife/Game

10:30 Discuss Indicators and Measures for Opportunities to Enjoy Fish, Wildlife, and Game Related Outdoor Recreation

11:15 Discuss Indicators and Measures for secondary outcomes: benefits to people, economic benefits, improved water quality, carbon sequestration

12:00 Lunch

12:30 Telling the story of the Outdoor Heritage Fund

- Best approaches to reach key audiences?
- Reporting by LSOHC versus other organizations within the conservation community
    - What are organizations currently doing to communicate OHF projects and impacts? What works and what doesn't?
    - What should a report (produced by the LSOHC) include?
    - How should it balance and/or connect aggregate outcomes, case studies, and contextual information (such as state-wide trends)?
- How does OHF outcomes information get distributed and who is involved in telling the story/stories of the OHF?

1:20 Wrap-up and next steps
Mike Harley, Executive Director, Environmental Initiative

- Presenting recommendations to LSOHC on July 31 – nominate 2-3 Work Group members to serve as "spokespeople"

1:30 Adjourn

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Minnesota's Outdoor Heritage Fund: A Process to Define Outcomes and Impacts

Work Group Meeting Agenda

Monday, July 17, 2017
9:00 a.m. – 3:00 p.m.
Minnesota Valley National Wildlife Refuge
3815 American Boulevard East
Bloomington, MN 55425

Meeting Objectives

- Consensus decisions on final package of recommendations: contextual stories, case studies, aggregate impact outcomes, indicators and associated methods and data sources
- Finalize key messages/themes from this process to communicate to LSOHC
- Provide input and advice for next phase of work to further develop outcomes reporting by the LSOHC
- Briefly discuss format, methods and frequency of LSOHC reporting on outcomes
- Finalize plan for presentation of recommendations and final report to LSOHC on July 31

8:30 Light breakfast and networking

9:00 Welcome and introductions
Mike Harley, Executive Director, Environmental Initiative

9:10 Revisit charter, principles, criteria, decision making process, key audiences and expectations around consensus
Mike Harley, Executive Director, Environmental Initiative
Ellen Gibson, Senior Program Director, Environmental Initiative

9:30 Preview of next phase of outcomes development work
Mark Johnson and Joe Pavelko, Lessard-Sams Outdoor Heritage Council

9:45 Brief discussion on types and timeframes for reporting on and communicating Outdoor Heritage Fund impacts
Mike Harley, Executive Director, Environmental Initiative
  - Reporting frequency, format, methods

10:00 Preview final report outline and presentation of final recommendations
Ellen Gibson, Senior Program Director, Environmental Initiative

10:10 Discuss and decide on outcome statements
- Primary and secondary

10:30 Break

10:40 Discuss and decide on contextual story recommendation and indicators
Discuss and decide on methods and data sources for contextual story indicators

11:10 Discuss and decide on case study recommendation and indicators
Discuss and decide on methods and data sources for case study indicators

11:40 Lunch

12:00 Discuss and refine aggregate impact indicators for primary outcomes:
- Healthy habitat for fish
- Healthy habitat for wildlife/game
- Outdoor recreation

12:40 Consensus decision on aggregate impact indicators for primary outcomes

12:50 Discuss and decide on methods and data sources for aggregate impact indicators for primary outcomes

1:20 Discuss and refine aggregate impact indicators for secondary outcomes:
- Benefits to people
- Economic benefits

1:50 Consensus decision on aggregate impact indicators for secondary outcomes

2:00 Discuss and decide on methods and data sources for aggregate impact indicators for secondary outcomes

2:30 Consensus decision on key messages/themes

2:55 Wrap-up and next steps
Mike Harley, Executive Director, Environmental Initiative

3:00 Adjourn

Attachment D: Recommended Indicators, Potential Methods and Data Sources, with Notes

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Primary Outcomes

Fish Habitat

Lakes, rivers, and streams are strategically protected, restored, or enhanced to provide healthy habitat for Minnesota fish species.

Indicator	Method or Data Source	Notes
Abundance of selected fish species, representative of Minnesota's diverse aquatic habitats	InVEST data models, DNR surveys	Would require parameterizing the InVEST model for MN fish species; Need to identify specific species to focus on
Biodiversity / species diversity	Fish models based on predictor variables, Index of Biological Integrity (IBI)	Developed by DNR (for lakes) and MPCA (for streams) as part of IBI research. Would require months/ years of development time to adapt computer code and database structure to tie to OHF project sites.
Connectivity of high-quality habitat for desired species	DNR Watershed Health Assessment Framework	Selected for specific species that would need to be identified

Wildlife / Game Habitat

Forests, prairies, and wetlands are strategically protected, restored, or enhanced to provide healthy habitat for Minnesota wildlife and game species.

Indicator	Method or Data Source	Notes
Changes to high-quality habitat complexes and risk of loss	Land cover maps, InVEST data models	Potential for LCCMR to assist with further development. For InVEST, quality does not explicitly account for connectivity, patch size, mortality, recruitment, or reslience. InVEST model outputs are quality, degradataion, abundance.
Habitat suitability for forest, grassland or wetland wildlife	Land cover maps, HAPET models	Unsure to what degree InVEST indicators (and/or bird habitat suitability) can effectively serve as a proxy for redundancy, habitat quality, buffer around remnant habitat.
Abundance of selected wildlife, game, and pollinator species, representative of Minnesota's diverse terrestrial habitats	InVEST data models, Site-specific sampling data, Thunderstorm maps	Use caution; can be misleading as actual abundance is unpredictable; models predict potential abundance
Connectivity of high-quality habitat for desired species	DNR Watershed Health Assessment Framework, Biological survey data	Wateshed Health Assessment is a primary source and also incorporates biological survey data and patch size as inputs

Outdoor Recreation

Minnesotans have more opportunities to enjoy fish, wildlife, and game related outdoor recreation.

Indicator	Method or Data Source	Notes
Public access to habitat	Public lands mapping, walk-in access acres, conservation holdings maps, National Conservation Easement Database (NCED)	Consider asking private conservation holdings to udpate data to NCED regularly with consistent methodology
Public access for hunting and fishing	Public lands mapping, walk-in access acres, MN DNR trout stream maps with population map overlay	
OHF project sites within a certain radius of population centers	OHF project sites map with population map overlay	

Secondary Outcome

Benefits to People

Economic, social, and ecological outcomes provide benefits to people that go beyond habitat (fish, game, and wildlife) and outdoor recreation.

Indicator	Method or Data Source	Notes
Total economic contribution of the OHF to the state and local economy	Dollars spent on 'personnel' and 'contracts' collected through IMPLAN	IMPLAN only works for state and regional data; local economic impact method and data source TBD
Other funds leveraged	OHF projects	Currently available data
Participation in outdoor recreation / tourism	InVEST data models, social media based visitation data, ebird	Visitation rates from internet photos as a proxy for use. Can be connected to landscape features using linear regression
Wellhead protection	Combined mapping to show vulnerable areas and LSOHC sites, DNR Watershed Health Assessment Framework	DNR Watershed Health Framework includes groundwater contamination susceptibility
Soil loss reduction	InVEST sediment delivery ratio model, HSPF, SAMS, SWAT, PTMApp, ELINK	InVEST sediment delivery ratio outputs soil loss, sediment exported, sediment retained at a watershed scale

Benefits to People *(continued)*

Economic, social, and ecological outcomes provide benefits to people that go beyond habitat (fish, game, and wildlife) and outdoor recreation.

Indicator	Method or Data Source	Notes
Water quality (nutrient retention and sediment reduction)	InVEST nutrient delivery ratio model, HSPF, SAMS, SWAT, PTMApp, ELINK	InVEST nutrient retention model outputs are nutrient export and retention along with value of avoided treatment, calibration recommended
Carbon storage and sequestration	InVEST data models, Land change modeling	InVEST outputs are current/ future carbon storage, carbon sequestration, economic value of carbon sequestered, and confidence intervals
Water retention and flood storage	Acre feet of storage model	Various models exist that would be intensive to set up and execute; or use coarse scale components of water budget with multiple methods, including: STAR, simple water balance, soil organic matter.

Additional Indicators to Consider

(particularly when looking across outcomes or for use in site-specific case studies)

Indicator	Method or Data Source	Notes
In-stream / in-lake habitat protection	Score Your Shore	Could potentially measure via buffer law compliance or via MN DNR Sensitive Lakeshores
Biodiversity / species diversity	IBI scores increasing or holding steady in stream reaches, Aquatic Diversity Index	Aquatic Diversity Index comes from LCCMR Statewide Conservation and Preservation Plan
Habitat quality in lakes / streams	Phosphorous level or turbidity	Measured via secchi disk reading
Shoreline habitat protection	Lakes with fewer than 16 docks per mile of shoreline	
Watershed habitat protection	Watersheds with >75% protection (percentage perennial land cover)	
Forest habitat protection	DNR Forestry maps	

Attachment E: Terms and Acronyms for Methods and Data Sources

eBird: eBird, coordinated by the Cornell Laboratory of Ornithology and the National Audubon Society; provides online data sources for basic information on bird abundance and distribution at a variety of spatial and temporal scales

eLINK: eLINK, developed by the Minnesota Board of Soil and Water Resources; houses reports on statewide conservation efforts around soil water resources

HAPET models: Habitat and Population Evaluation Team models, developed by the U.S. Fish & Wildlife Service; different models have been developed for a number of migratory bird species in the prairie pothole region of Minnesota to assess the impacts of habitat treatments on bird populations

HSPF: Hydrological Simulation Program—Fortran, developed by the U.S. Geological Survey; simulates for extended periods of time the hydrologic, and associated water quality, processes on pervious and impervious land surfaces and in streams

InVEST data models: Integrated Valuation of Environmental Services and Tradeoffs models, developed by the Natural Capital Project (NatCap) which includes University of Minnesota researchers; numerous models around ecosystem services such as habitat quality, pollinator abundance, carbon storage, and more

IBI: Index of Biological Integrity, with specific uses developed by the Minnesota Department of Natural Resources and the Minnesota Pollution Control Agency; measured for fish in lakes, and fish and macroinvertebrates in rivers and streams

Biological integrity is the ability of an aquatic ecosystem to support and maintain a balanced, adaptive community of organisms having a species composition, diversity, and function comparable to that of a natural habitat

IMPLAN: Impact analysis for Planning data and software produced by MIG, Inc. (formerly Minnesota IMPLAN Group, Inc.); can measure output and employment impacts and can be modified to reflect local conditions

NCED: National Conservation Easement Database held by an organization of the same name; currently, the Trust for Public Land is responsible for the public easement data collection and Ducks Unlimited is responsible for the private easement data collection

PTMApp: Prioritize, Target & Measure Application, developed by the International Water Institute, Red River Watershed Management Board, the Minnesota Board of Water and Soil Resources, and Houston Engineering, Inc.; a tool that enables practitioners to build prioritized and targeted implementation scenarios, measure the cost-effectiveness of the scenario for improving water quality, and report the results

SAMS (HSPF–SAM): Scenario Application Manager is a tool developed by MPCA and RESPEC; provides decision makers with a user-friendly approach to explore hypothetical

scenarios that evaluate water quality changes under various conservation practices as well as the associated costs and benefits using existing HSPF models

SWAT: Soil and Water Assessment Tool supported by the USDA Agricultural Research Service; hydrology model at the basin scale used to simulate water and nutrient cycle in areas that are primarily agricultural

Thunderstorm maps: Breeding Pair Accessibility Maps developed by the U.S. Fish & Wildlife Service; produced from long-term 4 square mile survey data to predict potential abundance of nesting breeding pairs of birds

Attachment F: List of Technical Experts Consulted

First Name	Last Name	Organization
Steve	Chaplin	The Nature Conservancy
Jennifer	Corcoran	Minnesota Department of Natural Resources
Mike	Estey	U.S. Fish and Wildlife Service
David	Fulton	University of Minnesota
Tom	Gile	Minnesota Board of Water and Soil Resources
Greg	Hoch	Minnesota Department of Natural Resources
Peter	Jacobson	Minnesota Department of Natural Resources
Drew	Kessler	Houston Engineering, Inc.
Larry	Kramka	Houston Engineering, Inc.
Michael	Larson	Minnesota Department of Natural Resources
Leslie	McInenly	Minnesota Department of Natural Resources
Brian	Nerbonne	Minnesota Department of Natural Resources
Ryan	Noe	University of Minnesota Natural Capital Project

Attachment G: Houston Engineering Compiled Responses to Technical Questions

The following document was created by Drew Kessler at Houston Engineering, Inc. on June 26, 2017 in response to questions posed by the Work Group for the Outdoor Heritage Fund Outcomes Development Process. The document also contains a few additional comments from Brian Nerbonne and Pete Jacobson from the Minnesota Department of Natural Resources.

InVEST Details

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1. Overall abundance of regularly monitored fish species
    a. **Webinar**: https://www.youtube.com/watch?v=MUNMvgEMwco
        i. **Notes –** To date, has been done largely for marine species. It is a single species model. Would require set up in MN for preferred species
    b. **Description** – Wild capture fisheries provide a significant source of protein for human consumption and directly employ nearly 40 million fishers worldwide (FAO 2014). However, poor harvesting practices and habitat loss and degradation can reduce the ability of ecosystems to support healthy, productive fisheries. The InVEST Fisheries Production model produces estimates of harvest volume and economic value of single-species fisheries. The model is an age- or stage-structured population model, and is presented as a generic model that can be adapted to most species and geographies. Inputs to the model include parameters for life history characteristics (e.g., age at maturity, recruitment, migration and natural mortality rates), behavior of the fishery (e.g., fishing pressure), habitat dependencies (e.g., importance and availability of nursery habitat), and, optionally, economic valuation (e.g., price per unit biomass). The model outputs the volume and economic value of harvest within the area(s) designated by the user. It is best to compare outputs from multiple runs of the model, where each run represents different scenarios of habitat extent, environmental conditions and/or fishing pressure. A library of four sample models is provided, which the user can adapt to their own species or region or the user can choose to build a model from scratch.

2. High quality habitat complexes and risk of loss
    a. **Webinar**: https://www.youtube.com/watch?v=8bXF5vFe3fQ (Quality); https://www.youtube.com/watch?v=g2w1V-ir87U&t=42s (Risk; Terrestrial and Aquatic)
        i. **Notes** – Quality does not explicitly account for connectivity, patch size, mortality, recruitment, or resilience. Can be adjusted for using sensitivity analysis. Outputs are quality, degradation, abundance. Risk model does account for missing components of Quality model, but is more complex to develop.
    b. **Description** Biodiversity is intimately linked to the production of ecosystem services. Patterns in biodiversity are inherently spatial, and as such, can be estimated by analyzing maps of land use and land cover (LULC) in conjunction with threats. InVEST models habitat quality and rarity as proxies for biodiversity, ultimately estimating the extent of habitat and vegetation types across a landscape, and their state of degradation. Habitat

quality and rarity are a function of four factors: each threat's relative impact, the relative sensitivity of each habitat type to each threat, the distance between habitats and sources of threats, and the degree to which the land is legally protected. Required inputs include a LULC map, the sensitivity of LULC types to each threat, spatial data on the distribution and intensity of each threat and the location of protected areas. The model assumes that the legal protection of land is effective and that all threats to a landscape are additive.

3. Pollinator abundance
    a. **Webinar:** Could not find one
    b. **Description** - The InVEST pollination model focuses on wild bees as a key animal pollinator. It uses estimates of the availability of nest sites and floral resources and bee flight ranges to derive an index of bee abundance nesting on each cell on a landscape (i.e., pollinator supply). It then uses flight range information to estimate an index of bee abundance visiting each agricultural cell. If desired, the model then calculates a simple index of the value of these bees to agricultural production, and attributes this value back to source cells. The results can be used to optimize agriculture and conservation investments. Required inputs include a current land use and land cover map, land cover attributes, species of pollinators present, and their flight ranges. The model's limitations include exclusion of non-farm habitats that may determine pollinator abundance and of the effects of land parcel size. The model also does not account for managed pollinators and pollinator persistence over time.

4. Sediment Loss Reduction (sediment delivery ratio)
    a. **Webinar**: https://www.youtube.com/watch?v=EQt0sGsFUWw
        i. **Notes** – Outputs soil loss, sediment exported, sediment retained at a watershed scale.
    b. **Description** - The objective of the InVEST sediment delivery model is to map overland sediment generation and delivery to the stream. In a context of global change, such information can be used to study the service of sediment retention in a catchment. This is of particular interest for reservoir management and instream water quality, both of which may be economically valued. The main differences between the InVEST SDR model and the InVEST Sediment retention model found in InVEST v3.0.1 and earlier are: The routing of sediment from a cell to the stream was modified to remove the sensitivity to grid resolution and facilitate the selection of LULC-specific retention coefficient; (Optional) calibration is based on one non-physical parameter that preserves the spatial distribution of sediment sinks and sources, facilitating the interpretation of spatially explicit outputs; the increased flexibility in model structure allows advanced users to represent more complex processes such as gully erosion or instream retention (work is in progress to facilitate the representation of these processes for InVEST users)

5. Water Quality (nutrient retention model)
    a. **Webinar:** https://www.youtube.com/watch?v=8AsQqb4Rl3U
        i. **Notes** – Outputs are nutrient export & retention along with value of avoided treatment. Calibration recommended. Simple representation of nutrient transport dynamics
    b. **Description** The objective of the InVEST nutrient delivery model is to map nutrient sources from watersheds and their transport to the stream. This spatial information can be

used to assess the service of nutrient retention by natural vegetation. The retention service is of particular interest for surface water quality issues and can be valued in economic or social terms (e.g. avoided treatment costs, improved water security through access to clean drinking water). The main differences between the NDR model and the InVEST v3.1 Nutrient retention model are: the routing of nutrient from a pixel to the stream was modified to reduce the sensitivity to grid resolution and facilitate the selection of LULC-specific retention coefficient; it is now possible to calibrate the model based on one (non-physical) parameter; note that calibration preserves the spatial distribution of nutrient sinks and sources, increasing confidence in spatially explicit outputs; the flexible model structure allows advanced users to represent more complex processes such as direct nutrient discharges (for example, tile drainage), or instream retention (work in progress)

6. Carbon sequestration/storage
    a. **Webinar**: https://www.youtube.com/watch?v=M3MD_gHBA2U&t=21s
        i. **Notes** – Outputs are current/future carbon storage, carbon sequestration, economic value of carbon sequestered, and confidence intervals
    b. **Description** Terrestrial ecosystems, which store more carbon than the atmosphere, are vital to influencing carbon dioxide-driven climate change. The InVEST model uses maps of land use and stocks in four carbon pools (aboveground biomass, belowground biomass, soil, dead organic matter) to estimate the amount of carbon currently stored in a landscape or the amount of carbon sequestered over time. Additional data on the market or social value of sequestered carbon and its annual rate of change, and a discount rate can be used in an optional model that estimates the value of this ecosystem service to society. Limitations of the model include an oversimplified carbon cycle, an assumed linear change in carbon sequestration over time, and potentially inaccurate discounting rates.

7. Participation in outdoor recreation/tourism
    a. **Webinar:** https://www.youtube.com/watch?v=6WbjOzVDgWU
        i. **Notes** – Visitation rates from internet photos as a proxy for use. Can be connected to landscape features using linear regression.
    b. **Description** - Recreation and tourism are important components of many national and local economies and they contribute in innumerable ways to quality of life, sense of place, social connection, physical wellbeing, learning, and other intangibles. To quantify the value of natural environments, the InVEST recreation model predicts the spread of person-days of recreation, based on the locations of natural habitats and other features that factor into people's decisions about where to recreate. The tool estimates the contribution of each attribute to visitation rate in a simple linear regression. In the absence of empirical data on visitation, we parameterize the model using a proxy for visitation: geotagged photographs posted to the website Flickr. Using photo-user-day estimates, the model predicts how future changes to natural features will alter visitation rates. The tool outputs maps showing current patterns of recreational use and maps of future patterns of use under alternate scenarios.

Medium Score for Breadth on Measures Associated with Outdoor Recreation

Rules for Breadth score were based upon number of indicators a method was connected to. The matrix was:

- 1 = Low
- 2 to 3 = Med
- 4 > or = High

Recommendation for Discussing Habitat Suitability (bird habitat)

I would recommend Derric Pennington

https://www.worldwildlife.org/experts/derric-pennington

Flood Storage and Water Retention

There are numerous models that could be used to do this including HEC-HMS, XPSWMM, HYDROCAD, SWAT, HSPF, PTMApp. However, each of these would likely be intensive to set up and execute. In the Red River Valley, a STAR method has been developed that is used for structural flood reduction practices (.pdf included) [*available upon request*]. Would likely require some tweaks to make it work across the state.

A simple water annual water balance method (PPT – ET = Excess Water) could likely be formulated to estimate the water retention benefits of different land/use and soil types. ***NOTE – missing from this equation, and certainly of interest with recent attention to soil health, is soil organic matter content which can cause a soil to retain much more water as it increases. The soil health institute (http://soilhealthinstitute.org/) is beginning to gather data that could be used to address soil water retention.

Summary of possibilities:

1. Intensive model (see list above)
2. Coarse scale components of water budget with multiple methods, including;
    a. STAR – Structural practices for flood reduction
    b. Simple Water balance – change in annual ET or Excess Water at coarse scale
    c. Soil Organic Matter – rough estimate of water retained by soil organic matter

Impact on local economy from commercial uses

I'm not sure how this could be done. Most commercial uses would involve private industry and, as such, much of the data and information needed could be privately held. My only thought would be to look at tax

assessment records as a relative proxy for changes in local economies. This would be difficult to connect to OHF projects.

Level of effort to link fish models based upon predictor variables to OHF project sites

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Note – this method was suggested by Brian Nerbonne with MN DNR. I do not know what it is, where it exists, or if it is viable. The text below was provided by Nerbonne…
Developed by DNR (lakes) and PCA (streams) as part of IBI research. Computer code and database structure exist. Not currently an off-the-shelf product. Would require months/years of development time by someone knowledgeable about the data and computer code. Currently presence/absence only; some of the aforementioned month of development could result in models that correlate to abundance.

Note from Pete Jacobson:
We have a lake-based water quality/fish diversity model that could be useful for the water quality habitat component with some modifications (probably need several months to do the modifications). It primarily is for the larger game fish species. Adding shoreline habitat and sensitive non-game species would take longer (at least a year) and is the focus of our Lake IBI program.

Viable methods for in-stream & in-lake habitat

Couldn't dig up much more on this. From what I could dig up, buffer law compliance may be the most feasible alternative.

Some alternative ideas:

- MN DNR Sensitive Lakeshores - http://www.dnr.state.mn.us/eco/sli/index.html
    - Survey of lake plants based upon MN DNR Lake Plant Survey Manual
    - Probably not viable for this purpose
- MN Buffer Law Compliance -
    - State maintains database of compliance. Could be used as a proxy for shoreline protection along public waters
    - Possibly viable for this purpose

Note from Pete Jacobson:
"Phosphorus would be a good measure of the water quality component of fish habitat in lakes (I suspect things are more complicated in streams – Brian will have to comment on that). However, the watershed protection measure also speaks to the water quality component. So, I would recommend using just the watershed protection measure if you really want to simplify things (lakes with 75% of their watershed's protected will likely have low phosphorus concentrations).

For the shoreline habitat protection measure, I would recommend the dock counts per mile of shoreline metric. We have a scientifically defensible threshold for docks (16/mile – see the attached peer-reviewed article that we just published), but not for Score Your Shore (it is simply on a gradient of good to bad). Docks per mile is also more consistent with the DNR Fish Habitat Plan.

The attached article [*available upon request*] also gives more background on the two fundamental types of fish habitat in lakes (1) water quality where watershed condition is a good proxy and (2) physical habitat where shoreline habitat condition is a good proxy. It is useful to view the proposed metrics in these two components.

We have a lake-based water quality/fish diversity model that could be useful for the water quality habitat component with some modifications (probably need several months to do the modifications). It primarily is for the larger game fish species. Adding shoreline habitat and sensitive non-game species would take longer (at least a year) and is the focus of our Lake IBI program."

From Brian Nerbonne:
"I would offer that including phosphorous levels in relation to PCA standards in addition to the % protected threshold might provide more differentiation for some watersheds where point sources such as wastewater treatment or animal agriculture are contributing a disproportionately greater amount of phosphorous than other disturbed land uses. Also, % protected is a measure of whether a lake will maintain good water quality, but the % natural land cover in a watershed is a more direct correlate of what current phosphorous levels are. There are some watersheds with very similar amounts of natural land cover and current lake phosphorous levels, but differ greatly in the % protected. The ones with high % natural land cover but lacking in protection are where DNR has been targeting our protection work. Which measure you choose depends on what exactly you're trying to represent with that metric.
As Pete indicated, phosphorous is not a good measure for streams. Stream habitat is more complicated than in lakes, and is not well represented by a single variable. Values for the % natural land cover are good indicators of instream habitat, although other variables such as the presence of barriers such as dams can significantly degrade the aquatic community that is present. If you are looking for a correlate stream variable that covers riparian habitat, % natural land cover would also be an option."

Land Change Modeling for Carbon

Please see InVEST section on Carbon sequestration. The InVEST model is a simple land use land cover based model for Carbon sequestration. The work group can assume that this model could be used, or a very similar type of model developed.