

Coastal Infrastructure Investment Analysis Framework

Supplementary Materials: Updated Annotated Scoring Guidance with Metrics

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Introduction

This document is one of the supplementary materials referred to in Reynolds et al. (2026). It contains the detailed scoring instructions created as part of the development and testing phase of the *An Evaluation Framework to Inform National Park Service Coastal Infrastructure Investment Decisions*, now referred to as the CIIAF. This guidance incorporates version 3.0 Cultural Resources metrics and other reviewer suggestions (labelled ‘Notes Oct 2025’ in the right-hand column) with the information presented in Appendix 3 of Eaton et al. (2024).

Scoring instructions such as these are a standard part of the decision-analysis process and are developed to guide the project proposers through the process of evaluating their proposed projects using a consistent set of objectives and performance metrics. A spreadsheet-based workbook (Reynolds 2026a, 2026b) was used to collect, organize, and perform initial comparative analyses of the investment concept alternatives for the case studies. Future iterations of this framework will require a mechanism for collecting and organizing the inputs and a calculation tool for comparative analyses. These can be integrated in a spreadsheet format like that provided in the Supplemental Materials (Reynolds 2026a, 2026b) or could be implemented in a tool of the National Park Service’s (NPS) choosing. It is critically important that the scoring instructions and the input tool match. Referring to this report while reviewing or modifying these instructions can illustrate the tight connection between the two.

The *Annotated Scoring Instructions* is presented in Table 1 using a two-column format. The **left column** contains a lightly edited version of the scoring instructions directly provided to the case study participants to guide their evaluation of the proof-of-concept test cases (park-specific investment concepts). The document was updated to remove case-study specific language and generalize the concepts presented. No changes to metrics were implemented, as those updates require further work by the NPS, with the exception that the Cultural Resources-focused metrics shown are version 3.0, the latest update available.

The **right column** notes revisions to the instructions that should be considered for future applications. General advice on useful updates is combined with a detailed discussion of metrics determined difficult to use or problematic for the case study participants. The metrics for the case studies were developed by the teams described in Eaton et al. (2024). For revisions to the metrics, please consult the description and citations provided in the *Starting Points: Proof-of-Concept Products That Can Form the Basis for the Next Steps* section of the Eaton et al. (2024) report and Chapter 3 of Reynolds et al (2026).

Annotated Scoring Instructions

Table 1. Scoring instruction shown alongside needed considerations and revisions.

[The organizing structure and text of the “Scoring Instructions” column of this table was not modified, revised, or comprehensively edited for this report. H1–H5 represents hurricane intensity levels one through five. DA, decision analysis; BRD, Biological Resources Division; e.g., Latin abbreviation meaning “for example”; IC, investment concept; i.e., Latin abbreviation meaning “that is”; IPM, integrated pest management; MMHW, mean monthly high water; N/A, not applicable; NPS, National Park Service; O&M, operations and maintenance; SFIP, Strategic Facilities Investment Planning; SHPO, State Historic Preservation Officers; SLR, sea-level rise; SMART, Simple Multi-Attribute Rating Technique; TCFO, total cost of facility ownership; THPO, Tribal Historic Preservation Officers; USGS, U.S. Geological Survey; %, percent; —, no information provided]

Scoring instructions	Considerations and revisions needed
Introduction	
This manual provides instructions for scoring NPS park-specific Investment Concepts to implement the decision analysis (DA) framework co-developed by NPS and USGS to support ongoing efforts for NPS Strategic Facilities Investment Planning (SFIP) in coastal parks. This framework focuses on the Investment Concept (IC) stage of NPS planning and is intended to complement and/or integrate with SFIP procedure. The intent is for this framework to: - Ensure the broadest range of NPS values are represented - Foster completeness and check for redundancy - Be accessible and useful for all potential users, accommodating various levels of data availability and quality - Identify data gaps or areas of need for parks that lack comprehensive vulnerability assessments The DA framework follows the PROACT decision analysis protocol and includes: - Problem Statement - Objectives hierarchy - Performance metrics (scoring criteria)	The text on the left has been slightly revised from the version provided to the case study participants. Those updates were intended to generalize the text and make it clearer to future applications of the evaluation framework, outside of the context of the “case studies.” The NPS should review this text and update it as necessary. Detailed notes are offered by subsection.

Scoring instructions	Considerations and revisions needed
- Bounding constraints and assumptions - SMART table (Simple Multi-Attribute Rating Technique) The Problem Statement focuses on transparent evaluation and comparison of investment actions for infrastructure assets that may be affected by coastal hazards associated with climate change. The Objectives Hierarchy describes the ultimate goals that Investment Concepts aim to achieve, following the overall structure of the Strategic Facilities Invest Plan (SFIP) Guiding Principles and NPS Servicewide Investment Pillars. Performance metrics identify measurable data that indicate how well the specified objective is being achieved. Bounding constraints and Assumptions are National-level or park-specific considerations for (1) external uncertainty due to climate change (e.g., SLR and cyclone activity), and (2) internal limitations to operational capacity (e.g., budget constraints, electric, requirements from other agencies, such as Departments of Transportation). Finally, the SMART table is an interactive accounting tool that produces quantitative scores for alternative investment concepts under consideration.	
<i>Achieving Objectives</i>	
In developing your Investment Concept(s), we urge you to think rigorously about how the candidate actions you propose to take (i.e., proposed solutions) will mitigate impacts due to coastal hazards and improve outcomes for these overall objectives: Financial, Supporting Park Operations, Contribution to Park Purpose, Resilience to Coastal Hazards	If the top-level objectives of the evaluation framework change (which is unlikely), this section must be revised. Consider including a figure illustrating the objectives hierarchy here.
<i>Developing Park-specific Problem Framing</i>	
Each park has its own enabling legislation or authorized purpose, and assets and supporting infrastructure and facilities within the park support that purpose. Investment concepts are designed to improve or conserve the quality of park assets and infrastructure, and in turn, contribute to the fundamental objectives listed above. These investment concepts can include updating, relocating, or fortifying park assets, facilities, and infrastructure, among other options. In developing your concept(s), please think carefully about (1) the options that are available to you for implementing change, (2) how these changes will impact assets, infrastructure, and other park resources, either improving or degrading them, and (3) what value will ultimately be created, in terms of achieving the fundamental objectives described. This requires first stating the problem that you set out to resolve specifically in terms that pertain to your park, and then asking what options are available to you to implement change. Problem	Park-specific problem framing is an important part of the decision analysis approach. Attention to this element of the process can help the parks articulate the context and reasons for the proposed investment. As the NPS makes decisions and progress on an implementation process for this framework, this section and the section on alternative-investment concepts may need revision to fit with the revised implementation process. For example, the "Scoring Instructions" text here assumes that the park staff are fully responsible for these steps—if a facilitated approach is defined, it should be reflected here.

Scoring instructions	Considerations and revisions needed
statements will vary among parks according to their Purpose and holdings, so it is important to carefully consider and express the problems that your park faces.	NOTE Oct 2025: It is feasible that Next Steps will involve facilitated pilot testing of the framework at various parks. While the pilot process should be facilitated, feedback should be sought on how to expand or clarify this guidance so that, in the long run, it can be applied by a park without facilitation.
<i>Specifying Alternative Investment Concepts</i>	
More than one option is available for solving a given problem. Managers must choose which action plan, or proposed solution, will achieve the highest net value. For each Investment Concept to be considered, include alternative projects that represent distinct proposed solutions to the same problem (or to the same asset or assets contained in the initial Investment Concept). A choice to not invest is also a choice, therefore the first alternative action will be a "No Investment" or status quo option, in which the asset(s) are maintained under their current regime. It is important to consider whether and how a No Investment option may outperform an investment; for example, if high-cost solutions achieve no appreciable increase in value. Beyond the "No Investment" option, you are free to develop as many proposed solutions for each Investment Concept as make sense to consider, one of which should include the option preferred by the park, if a preferred option exists. We urge you to generate options that provide contrasting, yet realistic potential actions available for the asset(s). An example of contrasting projects may include options to relocate, fortify, or protect an asset that is vulnerable to storm surges – this would be a more robust set of options than, say, three projects that vary only a particular design or engineering element such as distance moved inland for relocation. You can also consider a divest option, where the asset is not protected but rather safely taken out of service and not replaced; note that divestment is not the same as a no investment / status quo option. Contrasting options will help highlight potential important tradeoffs such as achieving high value for one objective, but low value for another. A central example is the cost-benefit tradeoff, where an increase in cost expenditure may not necessarily result in a proportional increase in benefit. Since multiple objectives are considered, tradeoffs across alternative Investment options can be complex. We also recognize that parks may be constrained in potential actions that are available to them, and thus we encourage each	If the NPS decides that more guidance is needed or would be helpful to the parks in describing the types of solutions that should be considered, additional guidance should be added to this section. Specific suggestions from the case studies about how to think about and define alternative investment concepts include: (1) Define the "no investment" option more clearly. Is this the same as a "status quo" option (noting that the status quo often involves ongoing maintenance costs, which is a financial investment)? Consider "no new capital investment" as an alternative wording. (2) Descriptions of alternative solutions should include as much detail as is known. For example, a "leasing option" for a park facility could include details on a proposed leasing agreement specifying what types of material should be used in upkeep and maintenance. This facilitates scoring using the metrics that follow. NOTE Oct 2025: A goal of the CRAB working group is to promote development of ICs across the range of adaptation options captured by Resist-Accept-Direct (RAD). The scoring instructions should be modified to reflect and encourage this goal, to the extent possible. Note that

Scoring instructions	Considerations and revisions needed
group to draft a problem statement that could identify such constraints. Each project will then be scored to determine how it is expected to perform in relation to the objectives.	classifying a specific IC to a specific RAD bin requires clarity on the motivation management intent (the IC itself is insufficient to determine R vs A vs D; see Schuurman et al. (2025). Consider including brief examples of each class of adaptation action.
Detailed Scoring Instructions for Investment Concepts and Potential Solutions	
Overview	
Quantifying scores for outcomes All investment concepts and potential solutions are intended to increase the value of assets and infrastructure in the park and therefore can be evaluated in terms of how they are expected to improve outcomes for NPS fundamental objectives. However, actions taken to upgrade assets and improve asset longevity may have both positive and negative impacts on the various objectives, such as increasing visitor access and degrading natural ecological processes. We want you to think critically about how you can quantify these outcomes. To help you with this step, try to break the problem into these two categories: Expected change in value due to degradation without action Expected change in value due to the management intervention (i.e., Investment) These together add up to determine the final score of the outcome: Future state = Current state + change in state where change in state = degradation without action + effects of the management intervention Note that the change in state can be either positive or negative. The user must think critically on how to define the current state and magnitude of change within the context of their park and particular decision context.	"Introduction to scoring investment concepts" Review for clarity; no specific revisions suggested.

Scoring instructions	Considerations and revisions needed
Scoring scales for each objective are organized to reflect either the future end state (final outcome) or net change relative to current condition (delta). Scoring instructions for each objective indicate which of these is used. Types of performance metrics Two types of performance metrics are used in the set of questions below. Natural scales are used for values that can be directly measured or estimated, such as asset lifetime or costs of the investment. Most of the metrics are defined by constructed scales, which are categorical scales that are tailored for this specific decision context. The constructed scales define categories of performance, with clear definitions for each category. When scoring an investment concept or alternative solution using these metrics, assign the category that most closely describes the expected outcome of implementing the solution.	
Scoring Mechanics Create a separate workbook for each IC, by copying the generic workbook and saving it with an unambiguous title. Within each workbook there are four tabs, one for each top-level objective (Financial, Park Operations, Contribution to Park Purpose, and Resilience to Coastal Hazards) that each contain a series of questions. You will enter the scores for each question in the IC-specific SMART table (Excel workbook).	Replace this “scoring mechanics” section with instructions on how to use whatever electronic scoring tool the NPS develops or adapts to accompany these instructions and capture the evaluations. For the case studies, a spreadsheet was used (Reynolds 2026 a, Reynolds 2026b). Review and revise text associated with each metric as necessary to reflect whatever scoring tool is being used (references are to <i>workbooks</i> and <i>worksheets</i> and <i>tabs</i> in an Excel spreadsheet). As detailed in sections below, many suggestions for clarifications and revisions to the performance metrics were identified during the case studies. The “Needs for Further Framework Development” section of Eaton et al. (2024) highlights revising the framework, including the metrics, as a next step for the NPS. Metric revision should include the input of subject matter experts, park staff, and other NPS personnel and would benefit from advice and guidance from someone with decision-science expertise.

Scoring instructions		Considerations and revisions needed
Metrics		
Financial For each proposed solution you are considering, please provide the following estimates on the "Financial" tab of the draft scoring workbook. Note that at the investment concept stage you are not expected to have a comprehensive or detailed estimate of costs, so constructed scales defining a range of potential costs have been developed and you can answer by choosing a range from drop-down menus within the Excel worksheet. If you have more detailed cost estimates, you have the option to provide those directly. You are asked to answer seven questions about the financial implications of each proposed solution (each alternative investment concept being evaluated)		The financial metrics capture most, if not all, of the elements of <i>total cost of facility ownership</i> (TCFO) but are not summarized using that value. Some case study participants suggested TCFO as the financial metric but not everyone agreed. It was also noted that <i>deferred maintenance costs</i> are not called out specifically in this set of metrics. It is not clear how that metric would or should affect the value of proposed investments, but this could be revisited. Specific suggestions for revisions arising from the case studies and discussions are summarized below.
F1: What is the projected remaining service lifetime of the asset(s) that are the focus of the investment concept? Different potential solutions may extend (or not extend) the service lifetime of the target assets by different amounts. For example, under a <i>divest</i> option, there is likely to be no service life remaining, while under a <i>rebuild</i> option the remaining service life should be the design life of the new structure (e.g., perhaps 50 years for a new building). This factor will be reported directly and used to understand the full extent of the annual cost commitment being made.		F1. Clarify what is meant by <i>service lifetime</i>. For example, is it measured as time to collapse of the building, time to loss of any benefit to park, or something else? If a structure no longer serves its original function but serves a different function, what does service lifetime mean? For example, consider that a building that can no longer be used may still have historical or educational value.
Score (drop-down selection)	Description	
N/A	Use only for <i>blank column</i> / unspecified potential solutions	
< 1 year	This might be the case for a <i>divest</i> option	
1-5 years	—	
6-10 years	—	
10-20 years	—	

Scoring instructions		Considerations and revisions needed
20-30 years	—	
30-50 years	—	
> 50 years	This might be the case for new-build options	
F2: What are the total capital costs to implement the solution? Include the full direct and indirect costs of the investment concept, including any “secondary costs” that are required to achieve the objectives of the investment. For example, if the potential solution is to replace a building, the total costs should include the construction costs for the building and for all infrastructure required to use the building, such as the costs for road and parking upgrades, etc. Cost ranges provided are the same ranges defined in the IC Workbook.		N/A
Score (drop-down selection)	Description	
N/A	Used only for potential solutions that have not been specified (i.e., blank columns)	
< \$2M	Although this framework is intended to be used to evaluate capital investments of greater than \$2M, some potential solutions (especially a status quo option) may have lower cost	
\$2M - \$5M	—	
\$5M - \$10M	—	
\$10M - \$20M	—	
\$20M - \$50M	—	
\$50M - \$100M	—	
\$100M-plus	—	

Scoring instructions	Considerations and revisions needed
F3: What are the annual O&M costs required to operate and maintain the asset/investment? Under each potential solution being evaluated, consider the annual Operations and Maintenance (O&M) costs that will be required to maintain the assets that are the target of the investment in serviceable condition. For any solution that involves removing an asset (e.g., a <i>divest</i> option), these costs should be zero. Following the model of IC Workbook, a default estimate of 2% of the capital cost is automatically calculated from your F2 answer. If you prefer to provide your own estimate of the annual O&M cost, you can enter those costs in the row under the default estimate.	F3. Clarify the distinction between capital costs (F2) and operation and maintenance costs (F3). Is the 2 percent assumption appropriate? Some considered it unrealistically low, leading to a deferred maintenance backlog.
F4: Financial Risk We ask two questions related to the ability of the park to sustain the investment requested in the potential solution. You will need to consult the NPS Risk Report, part of the park Scorecard for your park to answer these questions. What is the most recent financial Risk Rating for the park (Ok, Caution, or Danger)? Considering changes to annual costs associated with the potential solution, will any of the components of the Risk Rating change? Will there be sufficient change to affect the overall financial risk rating? What do you anticipate the new Risk Rating to be?	F4. Not all participants were familiar with this metric; some thought TCFO would be a better measure of financial risk but acknowledged that this may not resonate with the Bureau Internal Review Board (B-IRB). Is the financial risk rating sufficiently sensitive to investments at the level being evaluated using this tool? Note that several of the case studies indicated investments would change their risk rating so it does appear to be sensitive.
F5: Cost mitigation Two types of cost mitigation are considered: (a) external funding to support the initial and/or operating costs of the investment (e.g., through partnerships), and (b) the potential to raise new revenues with or for the asset(s) after the investments are made. At the investment concept stage, it is expected that significant uncertainty will exist about both potential sources of cost mitigation. If the park has funding in hand from external sources, or concrete written agreements that specify the amount of new revenue the assets, after investment, will generate, those numbers can be provided directly in the spreadsheet. When those estimates are not available, please use the dropdown menu to provide a level of confidence that these new funding sources will contribute significantly (e.g., more than 25% of the costs) to the capital or operating costs of the potential solution.	F5. Consideration of this attribute could help participants identify additional investment proposals, or modifications of existing proposals, to include a focus on attracting external funding. The NPS could consider this when developing the implementation process and guidance for future iterations. May need to refine this metric to clarify <i>framing of sustained cost mitigation</i> (as in beyond the initial investment) as coming from investments that generate revenue. This revenue could be internally generated (for example, user fees) or could come from outside entities (partners who contribute sustained financial resources to sustain an asset)

Scoring instructions		Considerations and revisions needed
Score (drop-down selection)	Description	
N/A	No cost mitigation is anticipated	
Almost certain (>90%)	High confidence that funding will be provided. Select this option if there is funding already allocated by an external partner for this potential solution, and agreements are in place with the park to transfer funds and/or to provide the revenue stream if the solution is implemented.	
Likely (50%-90%)	You think it is more likely than not that external funding or revenues to support the investment will be available. This may be the case if external partners and avenues for funding have been identified and made robust commitments expected to weather expected annual volatility in budgets.	
Unlikely (10%-50%)	There are identified potential partners and avenues for obtaining external funding or revenue generation to support the potential solution, but no steps have been taken to explore those opportunities.	
Very unlikely (<10%)	Partners have not been identified; revenue generation is highly uncertain.	

Scoring instructions		Considerations and revisions needed
Supporting Park Operations Two objectives are considered in evaluating how an investment concept and potential solutions affect park operations: (1) how the potential solution affects the ability to deliver core park functions, and (2) how the potential solution affects the workforce. Answer the following questions using “Support Park Operations” tab on the Excel worksheet provided.		-
Core Functions O1. Are the assets addressed by the proposed solution, and/or the functions those assets support, considered critical to the ability operate the park? (Yes/No) If yes, answer questions O2 and O3; if No, continue to the Workforce questions (O4-O6).		O1: Consider whether this is clear enough for parks to answer. Case study participants could answer the question, but they had support from the development team. Some structures may not be operational assets but could provide a core park function, such as visitor and cultural value. Consider additional clarifying text.
O2. Criticality to operations This question is intended to reflect how critical the asset(s) targeted by the investment concept are to the ability to operate the park, by asking you to think about what effect losing the asset entirely would have. This is hypothetical – it does not imply that a “no investment” option is assumed to be equivalent to losing the asset. Question O2 asks specifically about the ability of the park to deliver the potentially affected critical functions under each proposed solution. For this question (O2), consider the asset(s) addressed by the proposed solution, and the functions those assets support. If the asset(s) were lost / no longer available for use, what would the impact be on park Operations? Use the drop-down menu in the spreadsheet to indicate the type of impact loss of the asset would have. The following options are available:		O2: It was unclear to some participants how to answer this question if the asset that is the target of the investment is not currently functional. Consider revisions to clarify that the metric can be used to describe how the park has adapted to loss of the asset, as well as the hypothetical framing of how they would adapt to future loss.
Score (drop-down selection)	Description	
Park closure	The asset and its functions are so essential to the operation of the park that if they were lost / no longer available, the	

Scoring instructions		Considerations and revisions needed
	park would have to close (until the functions could be restored). Examples: primary utility service to the park; access road to a park with a single entrance, water treatment facilities that supply drinking water to visitors and employees or process wastewater.	
Partial closure	The asset and its functions are essential to the operations of at least part of the park, such that if they were lost parts of the park would have to be closed and would no longer be available for their core mission(s). Examples: access roads or bridges to significant park visitor attractions; fire suppression or other life safety systems required to operate a visitation center.	
Major operational change	The park could continue to operate if the asset(s) and their functions were lost, but doing so would require such a significant change in park operations that the ability of the park to carry out its mission would be largely diminished. Examples: the only parking lot available to a key visitor attraction, without which visitors would have to be transported by shuttle bus service to see the attraction, employee housing for remote parks with few to no alternative housing sites.	
Modest operational change	With modest changes the park could continue to operate and carry out its Mission even if the asset(s) and/or their functions were lost. Examples: Waste transfer stations, partial closure of a heavily trafficked road, secondary or satellite visitor centers.	

Scoring instructions		Considerations and revisions needed
	The park could continue to operate if the asset(s) and their functions were lost,	
Small/negligible effect	Loss of the asset(s) and their functions would be an inconvenience but with small changes park operations would be able to continue with negligible effect on the park's mission. Examples: Parking lots or roads associated with minor visitor attractions, bathrooms in lightly used areas, campgrounds.	
O3. Condition and ability to deliver core functions For this question, you are asked to think about each of the potential solutions being evaluated and consider how well the asset(s) would be able to deliver their critical functions assuming the solution was implemented. Assuming the project alternative being evaluated is funded and completed, how well can the critical functions identified in question O2 be carried out? Use the drop-down menu in the spreadsheet to indicate the effect of the solution. The following options are available:		O3: Clarify that this metric is asking the evaluators to compare the outcome—assuming the project is implemented—to a hypothetical, fully functioning asset. In the case studies, some participants wanted to interpret this as performance relative to the status quo. Some participants noted that the investment outcomes were uncertain, and they, therefore, had difficulty assigning a score. Further consideration and discussion of how to address this metric is needed.
Score (drop-down selection)	Description	
Optimal performance	The critical functions required will be carried out in the most efficient and effective way	
Reduced efficiency/effectiveness	The critical functions will be fully carried out, but with reduced efficiency and/or effectiveness compared to the ideal or optimal performance.	
Diminished but adequate	Critical functions will be adequate but diminished to the degree that they are not providing their full service.	

Scoring instructions		Considerations and revisions needed
Loss of asset/function	The ability to use the asset and deliver its critical core functions will be lost	
Workforce The following three questions relate to how each proposed solution will affect the park's workforce. Here you are asked for a simple comparison of safety, working conditions, and living conditions of the current status to the future status assuming each proposed solution is implemented. Drop-down menus are provided for each question.		Changing <i>employee</i> to <i>worker</i> for these descriptions and metrics is recommended. Add clarifying language specifying that <i>worker</i> includes volunteers as well as employees. Some participants had difficulty thinking about the several workforce metrics separately from the first two metrics. Adding detail to the instructions to provide context for the scorers may be beneficial. Metrics like these that are defined around changes from the status quo tend to be easy for evaluators to use, but it is difficult for managers to assign value functions and weights to them. Consider developing alternative metrics with levels defined by an absolute level of performance instead of a change.
O4. Employee safety For this question, consider only the safety of employees that are or could be affected by changes to the asset(s) that are the target of the investment concepts, and the functions that those assets support. If they have no relevance to employee safety, answer "N/A" to the question below. If they can or do affect employee safety, for each potential solution, consider how employee safety will change in the future, relative to their safety today, if the solution is implemented. Use the drop-down menu in the Excel sheet, which has the following options:		—
Score (drop-down selection)	Description	
N/A	Employee safety is not related to or affected by the assets that are targeted for investment, or by the functions they support	

Scoring instructions		Considerations and revisions needed
Decrease / degrade*	Employee safety in the future will be reduced or degraded under the potential solution being considered. Examples might include a <i>no investment</i> or status quo solution to a worker-affecting asset that is in poor and degrading condition	
No change	Employee safety in the future will be about the same as it is currently	
Improve	The potential solution directly or indirectly reduces existing risks to employee safety.	
* If employee safety will be negatively affected under any potential solution, you are asked to describe the safety risks and how employee safety will be negatively impacted.		
O5. Effect on employee working conditions For this question, consider only employee working conditions that are or could be affected by changes to the asset(s) that are the target of the investment concepts, and the functions that those assets support. If they have no relevance to employee working conditions, answer N/A to the question below. If they can or do affect working conditions, for each potential solution, consider how employee working conditions will change in the future, relative to those conditions today, if the solution is implemented. Use the drop-down menu in the Excel sheet, which has the following options:		
Score (drop-down selection)	Description	O5: The NPS should consider whether <i>working conditions</i> could be expanded to explicitly include impacts to mental health for staff who are seeing assets degrade. Case study participants brought up frustration, despair, and negative effects on employee morale.
N/A	Assets targeted by the investment concept, and the functions they support, are not related to employee working conditions	
Decrease / degrade	Employee working conditions in the future will be reduced or degraded under the potential solution being considered.	

Scoring instructions		Considerations and revisions needed
	Examples might include a <i>no investment</i> or status quo solution to a worker-affecting asset that is in poor and degrading condition	
No change	Employee working conditions in the future will be about the same they are currently	
Improve	The potential solution directly or indirectly improves employee working conditions	
Contribution to Park Purpose Cultural Resources The objectives for this section follow guidance from the Cultural Resources, Partnerships, and Science (CRPS) Directorate and reflect input from the full development team and later review and revision by CRPS personnel (FY2025). All but the last objective focus on impacts on integrity or condition of impacted cultural resources. For ease of implementation, separate objectives focus on Historic Properties (including historic structures, archeological resources, and cultural landscapes), Museum Collections, and Ethnographic Resources. Scoring metrics focus on direct impacts from implementing the IC on the integrity and on the condition of the impacted cultural resource(s). NPS 28 Cultural Resource Management Guidelines (NPS 1998) distinguishes these as: “[t]he condition of a resource is defined in terms of deterioration; integrity is defined in terms of correspondence with associations in the past. Condition is a matter of rot and rust; integrity is a matter of age and authenticity.”		This section was revised Oct 2025 to reflect the version 3.0 Objectives and Performance Metrics developed by CRPS during FY2025. During pilot testing, seek to gauge the need for expanding the instructions to provide more detailed text distinguishing Integrity versus Condition.
Historic Properties		Note Oct 2025: During pilot testing, (a) track how often evaluators encounter difficulty in scoring these metrics

Commented [1]: The revisions in this section need to be reviewed (and improved/ revised) by CRPS experts, ideally Jenny Parker, and others (Amanda Babson?).

Commented [2]: Jenny or others => is it beneficial to add some language HERE clarifying the distinction between integrity and condition? Would that help park personnel interpret and apply the scoring guidance?

Commented [PJ3R2]: I think as you have it with the short description works.

Scoring instructions		Considerations and revisions needed
These metrics refer to the Cultural Resource values that pertain to Historic Properties, including historic structures, archeological resources, and cultural landscapes. These may contrast to engineering properties related to <i>Resilience to Coastal Hazards</i>. For example, an asset could be moved from its historic grounds to a safer location, reducing the cultural value associated with the historic Location and Setting, but increasing the expected longevity of the asset. Metrics CR1 and CR2 should be answered by considering all historic properties in the IC's impact area, including, for example, archeological resources like former foundations and cultural landscapes. If this leads to a variety of resources and mix of potential impacts, score based on the most negative impact.		because of the occurrence of multiple resources with varying IC impacts; (b) when that arises, seek to discuss and resolve a path forward regarding summarization of impacts – does the group think it best to report the worse impact? The median impact? Etc. Ultimately, seek to develop adequate compromise language and metric definitions that enable evaluators to achieve the intent of the underlying objectives while remaining feasible to answer without undue effort.
CR1. Minimize loss of Integrity of Historic Properties How will the direct impacts of implementing the IC affect the current integrity of historic properties?		CR1: Notes from case study participants that may be relevant to revisions: Is it necessary (and if so, how) to capture differences between assets listed in a park's enabling legislation and those identified as a nationally significant resource? The metrics do not attempt to distinguish between # of resources impacted as it was felt that to do so would make the performance metric too complex.
Score (drop-down selection)	Description	
Loss of Significance	Integrity will be diminished to the point where significance is lost	
Some impact	Some aspect of integrity will be greatly reduced but not to the point where significance is lost	
No Impact	No aspect of integrity will be lost or diminished	
Unknown	Cannot be evaluated due to lack of necessary information (either regarding resource or impact of IC)	
N/A	Not applicable because no known HPs in impact area of IC	
CR2. Maintain or improve Condition of Historic Properties		Note Oct 2025: During pilot testing, note if there is confusion (requiring further clarification to prevent in the future)

Scoring instructions		Considerations and revisions needed
How will the direct impacts of implementing the Investment Concept affect the overall condition of historic properties (HP)?		between <i>condition</i> as applied to CRs in these PMs and <i>material condition</i> as used in <i>Resilience to Coastal Hazard</i> PMs. Material condition in those PMs is intended to strictly refer to a structure's ability to withstand storms.
Score (drop-down selection)	Description	
Loss of HP(s)	HP will be demolished or destroyed	
Degraded	Condition of HP will be degraded	
Maintained	HP will be maintained in their current condition	
Improved	Condition of HP will be improved	
Unknown	Cannot be evaluated due to lack of necessary information (either regarding resource or impact of IC)	
N/A	Not applicable because no known HPs in impact area of IC	
Museum Collections These metrics refer to the Cultural Resource values that pertain to Museum Collections. In most cases, this refers specifically to the holdings in the Museum Collections, not the facility housing those holdings. If there are no museum collections in the impact area of the IC, score CR3 and CR4 as N/A and move to CR5.		-
CR3. Minimize loss of Integrity of Museum Collections How will the direct impacts of implementing the Investment Concept affect the current integrity of museum collections?		-
Score (drop-down selection)	Description	
Loss of Significance	Integrity will be diminished to the point where significance of collection or items is lost	

Commented [4]: Jenny P or others need to review and revise this language. Also, do you want to distinguish impacts on an holding/artefact vrs the whole collection?

Commented [PJ5R4]: I think this is one that may need to wait for iterative change after testing. The issue is that most of the time - not always - museum collections are held in a non-historic building. We really are mostly concerned with the objects inside. A few items may be located outside as objects within a park (e.g., cannons). So this text is intended to focus the answers on the collections themselves. Impacts to the facility housing them could affect the condition - but it's the impacts to the resources, not to the facility we're most interested in.

Scoring instructions		Considerations and revisions needed
Some impact	Some aspect of integrity will be greatly reduced but not to the point where significance is lost	
No Impact	No aspect of integrity will be lost or diminished	
Unknown	Cannot be evaluated due to lack of necessary information (either regarding the resource or impact of IC)	
N/A	Not applicable because no known museum collections in impact area of IC	
CR4. Maintain or improve Condition of Museum Collections		-
How will the direct impacts of implementing the Investment Concept affect the overall condition of museum collections?		
Score (drop-down selection)	Description	
Loss of Collection(s)	Museum Collection(s) will be lost or destroyed	
Degraded	Condition of collection(s) will be degraded	
Maintained	Museum collection(s) will be maintained in their current condition	
Improved	Condition of museum collections will be improved	
Unknown	Cannot be evaluated due to lack of necessary information (either regarding the resource or impact of IC)	
N/A	Not applicable because no known museum collections in impact area of IC	
Ethnographic Resources		Notes Oct 2025: As a component of pilot testing, seek a more expansive, but still brief, clarification of what counts as an Ethnographic Resource (for those not trained in this

Scoring instructions		Considerations and revisions needed
These metrics refer to the Cultural Resource values that pertain to Ethnographic Resources. If there are no ethnographic resources in the impact area of the IC, score CR5 and CR6 'N/A' and move to CR7.		topic) or whom to collaborate with in evaluating CR5 and CR6.
CR5. Minimize loss of Integrity of Ethnographic Resources How will the direct impacts of implementing the Investment Concept affect the current integrity of ethnographic resources?		-
Score (drop-down selection)	Description	
Loss of Resource(s)	Ethnographic Resource(s) will be lost or destroyed	
Loss of Significance	Integrity will be diminished to the point where significance of ethnographic resource(s) is lost	
Some impact	Some aspect of integrity will be greatly reduced but not to the point where significance is lost	
No Impact	No aspect of integrity will be lost or diminished	
Unknown	Cannot be evaluated due to lack of necessary information (either regarding the resource or impact of IC)	
N/A	Not applicable because no known ethnographic resources in impact area of IC	
CR6. Maintain or improve condition of ethnographic resources How will the direct impacts of implementing the Investment Concept affect the overall condition of ethnographic resources?		-
Score (drop-down selection)	Description	

Commented [PJ6]: Why did we lose the 'Lost or destroyed' option here?

Commented [JR7R6]: oversight.

Scoring instructions		Considerations and revisions needed
Degraded	Condition of ethnographic resource(s) will be degraded	
Maintained	Ethnographic resource(s) will be maintained in their current condition	
Improved	Condition of ethnographic resources will be improved	
Unknown	Cannot be evaluated due to lack of necessary information (either regarding the resource or impact of IC)	
N/A	Not applicable because no known ethnographic resources in impact area of IC	
Understanding of potential impacts [This metric refers to the Cultural Resource value of learning from and engaging those with relationships with the cultural resources potentially impacted by the Investment Concept – Tribes, traditionally associated communities, and relevant stakeholders.] The intention of the scoring is balance comprehensiveness with being operational, given the potential complexity of multiple consulted parties and multiple potential impacts.		-
CR7. Maximize understanding of potential impacts on integrity and condition Have Tribes, traditionally associated communities, and relevant stakeholders agreed with the assessment of potential impacts in CR1 through CR6?		Notes Oct 2025: As part of pilot testing, seek to gain insight into the complexities that arise in implementing this metric and if pilot study evaluators raise the need for additional levels of distinction (some parties agreed with some portions of the assessment but not all the assessment, etc.). Ideally, this would be addressed in conjunction with development of 'pilot study' value functions. Ultimately, the metric only needs to distinguish levels that the group feels should have distinct outcomes in the value function.
Score (drop-down selection)	Description	
Agreed (formal)	Agreed in formal consultation process	
Agreed (informal)	Agreed informally	
Some parties Agreed	Some consulted parties agreed with the assessment, others disagreed	
Agreed with parts	Consulted parties agreed only with parts of assessment	

Commented [8]: This needs review/revision by relevant CRPS personnel (Jenny P?).

Commented [PJ9R8]: I think it's fine for now (where we are in this process.) May be updated after testing.

Scoring instructions		Considerations and revisions needed
Disagreed (informal)	Disagreed informally	
Disagreed (formal)	Disagreed in formal consultation process	
In Discussion	Discussions underway	
Discuss if selected	IC or proposal have not been shared externally but should be if selected	
N/A	IC or proposal does not warrant discussion externally	
Natural Resource Values Natural Resource objectives follow recent guidance from NPS Biological Resources Division (BRD), which lays out the following four sub-objectives:		The NPS Natural Resource Stewardship and Science (NRSS) Directorate has stated that they would like to review and revise these metrics. Several of these metrics (especially NR4) were not familiar to those doing the scoring, and several clarifications were suggested. It is recommended that the NRSS team take the lead in revising these metrics and that they work with park representatives to ensure that the metrics can be implemented at the park level, as well as being meaningful for decision making. See the <i>Starting Points: Proof-of-Concept Products That Can Form the Basis for the Next Steps</i> section of Eaton et al (2024) for advice on metric development.
NR1. Restore Imperiled Systems Facility investment decisions may negatively or positively impact ecosystems through facility expansion, hardening, or relocation, or through incorporating nature-based alternatives in the engineering plans. Additional measures may be taken such as restoration of sites that are no longer occupied by infrastructure. For evaluating Investment Concepts and their proposed		NR1: Notes from case study participants that may be relevant to revisions—

Scoring instructions		Considerations and revisions needed
solutions, the metric below asks about the effect (direct or indirect) that a solution has on reestablishing disrupted ecological processes, building resilience and improving function in ecological systems in the park that are currently in a highly degraded, imperiled condition, or are trending in that direction with climate change. The scale below represents the net degree to which the proposed solution is predicted to change the imperiled system relative to its current status.		There is uncertainty about the outcomes of any investment or infrastructure project on an ecosystem (meaning positive or negative impacts), making scoring challenging. Timing considerations can be important (for example, the impacts of removing an asset versus delayed ecosystem benefit and what might replace the current infrastructure or asset).
Score (drop-down selection)	Description	
N/A	The assets targeted by the Investment Concept and the proposed solutions are not related to any imperiled ecological systems in the park.	
Major Improve	Imperiled ecosystems restored to functional levels. If possible, restored to pre-disturbance condition through restoration, protections to prevent further degradation included if relevant (e.g., reserve status, visitor attenuation), or assets or human interactions that damage Imperiled system are relocated or removed.	
Improve	Some ecosystem functions restored. Protections for Imperiled system included in IC if relevant.	
No Change	No change in status of Imperiled ecosystem and adjacent areas.	
Degrade	Additional degradation is predicted for the imperiled ecosystem degraded after proposed solution is implemented. The proposed solution increases negative impacts on Imperiled ecosystem or expands footprint of existing asset(s) and/or supporting infrastructure, increasing the extent of impact on imperiled systems.	
Failed	Ecosystem function is predicted to be lost. Substantial disturbance or elimination of Imperiled ecosystem after Investment Concept is implemented. Heavy construction of	

Scoring instructions		Considerations and revisions needed
	asset(s) and/or supporting infrastructure within or adjacent to Imperiled system.	
NR2. Stewardship of Priority taxa. For each Investment Concept being considered, this metric refers to the outcomes for priority taxa following implementation of the investment. Priority taxa are designated at the park level and may include species protected through state or federal legislation (e.g., Endangered Species Act), those included in park-enabling legislation, species that are deemed culturally important by stakeholders, or keystone species and others that have a strong effect on structuring and regulating ecosystem function. For each proposed solution, describe the predicted effect on priority taxa resulting from the action.		NR2: Clarifications are requested on what qualifies as a priority taxa.
Score (drop-down selection)	Description	
N/A	The assets targeted by the investment concept and potential solutions do not affect any priority taxa.	
Excellent	Optimal stewardship of priority taxa on all levels. Substantial improvement of outcomes for priority taxa that were previously in decline within the park. Design and location of assets and infrastructure facilitate biological processes of priority taxa.	
Good	Successful ongoing stewardship of priority taxa. Improvement of conditions for one or more priority taxa within the park that were previously in decline. Some implementation of infrastructure that supports biological processes of priority taxa.	
Fair	One or more priority taxa are adversely impacted, but population dynamics are generally stable.	

Scoring instructions		Considerations and revisions needed
Poor	Substantial decline. All or nearly all priority taxa are adversely impacted. Population dynamics unstable, populations in decline.	
Failed	Stewardship failed. Populations of all or nearly all priority taxa are failed or in severe decline approaching failure.	
NR3. Ecological function on NPS Working Lands Working lands refer to private lands within NPS boundaries, or federal lands leased out to private enterprises, that are used for economic production with shared goals for conservation and land stewardship. Maintaining ecological function on these lands is important to the NPS mission. This metric describes whether conservation goals for NPS Working Lands will be met following implementation of a Proposed Investment concept. Ecological function refers to abiotic (e.g., hydrology, oceans, atmosphere) and biotic (fish, wildlife, vegetation) processes that interact as complex adaptive system. Examples of ecological processes include nutrient cycling, sediment deposition/accretion, and migration. ICs that improve the management, conservation, resilience, and restoration of NPS Working Lands using sound science and integrated pest management (IPM) principles receive a higher rating than those that do not.		NR3: Refinement is needed regarding the definition of "working lands" and an appropriate and clear link between the NPS working lands and ecological function.
Score (drop-down selection)	Description	
N/A	The asset that is targeted by the investment concept and the proposed solutions does not impact any working lands	
Excellent	Proposed Investment Concept results in high ecological function of landscape, including restoration of lost ecological function incurred through working practices. Smart designs that facilitate ecosystem function are implemented. Negative impacts on ecological function are offset, or assets and infrastructure are relocated, replaced with better options, or removed from operation. Biodiversity at optimal levels.	
Good	Ecosystem processes are functioning at stable levels. Some transient loss of function, able to be recovered. Partial	

Scoring instructions		Considerations and revisions needed
	restoration of losses in ecological function due to working practices. Biodiversity is stable or increasing.	
Fair	Ecosystem processes are functioning at acceptable levels, some processes are lost. Ecosystem dynamics trending toward unstable. Biodiversity is in decline.	
Poor	Substantial degradation of ecological function of a landscape. Unstable ecosystem dynamics. Natural processes are compromised, disrupted, or halted. Low biodiversity.	
Failed	Complete degradation of ecological function of the landscape to the extent that natural processes are severely compromised or disrupted, and ecosystem function is lost. Biodiversity is lost.	
NR4. One Health Challenges This objective addresses the Center for Disease Control's One Health initiative, which is a "collaborative, multisectoral, and transdisciplinary approach" focused on achieving optimal health outcomes while "recognizing the interconnection between people, animals, plants, and their shared environment" (CDC 2022). The scale used here is tentative and represents the overall expected health condition for a park after investment action is taken. Tentative scoring options are:		NR4: There was a significant misunderstanding of the concepts and definition of this metric. Suggestions involved including more general statements than specific statements like <i>transient wildlife disease</i> , which would help improve understanding. Including examples may be useful.
Score (drop-down selection)	Description	
N/A	The asset that is targeted by the investment concept and the proposed solutions does not impact One Health objectives	
Optimal	Stable overall health condition. Interactions between wildlife, humans, and ecosystems positively support recovery from transient wildlife disease.	

Scoring instructions		Considerations and revisions needed
Good	Ecosystem condition stable, transient to moderate instances of wildlife disease. Human interactions generally positive.	
Fair	Ecosystem condition stable, moderate wildlife disease, some negative human interactions, one or more populations in decline.	
Poor	Ecosystem condition unstable, some taxa impacted by chronic disease, exacerbated by negative human interactions, multiple populations in decline	
Severe	Ecosystem condition failed or failure is imminent, several taxa impacted by chronic disease, multiple wildlife populations collapsed, chronic negative human interactions	
Visitor Experience This objective is divided into four subobjectives: Use and Access, Park Aesthetics, Visitor Safety, and Education and Interpretation. Use and Access generally refer to social and leisure activities, while Education and Interpretation refer to learning about Park history and cultural heritage.		Suggest a <i>no change</i> or <i>N/A</i> option for all Visitor Experience metrics.
V1. Use & Access This subobjective represents visitor interactions with park assets and landscapes and is further divided into three categories to give parks some flexibility in scoring.		The V1 <i>Use and Access</i> metrics are all defined in terms of change from the status quo. In general, change metrics are relatively easy for those providing the estimates and scores to use but are less easy to assign value functions for (see the “Starting Points: Proof-of-Concept Products That Can Form the Basis for the Next Steps” section of Eaton et al. (2024)). The NPS Park Planning, Facilities, and Lands Directorate should consider whether these metrics can be restated in absolute rather than relative terms.

Scoring instructions		Considerations and revisions needed
V1a. Recreation This metric refers to recreation activities such as hiking, boating, wildlife viewing, hunting, and fishing. The scoring scale represents the relative change in visitors to the park engaging in these activities after an Investment Concept's proposed solution is implemented.		V1a. Suggestions and questions from case study participants included— Should the definition of <i>recreation</i> be broadened to include nontraditional forms of recreation, including attraction based on cultural or existence value.
Score (drop-down selection)	Description	
Major increase	Substantial increase in visitors over several recreation sectors. New recreation opportunities created.	
Increase	Some increase in visitors over one or more sectors (>10% annual)	
No change	About the same number of visitors before and after implementation of IC	
Decrease	Some decrease in visitors over one or more sectors (>10% annual). Some closing of park facilities.	
Major decrease	Substantial decrease in visitors over several recreation sectors. May include substantial closing of park facilities.	
V1b. Community groups This metric refers to community groups using parks for social activities. These activities may involve recreation, but the focus here is on community-building and sense of place. Some examples include bird watching groups, social hiking or kayaking groups, wilderness search and rescue enthusiasts.		V1b. Participants discussed a possible need for an additional metric related to the importance of the resource to community stakeholders, regardless of visitation or any other visitor values.
Score (drop-down selection)	Description	
Substantial	Substantial increase in community involvement in parks. Several new community groups formed. Strong sense of community.	

Scoring instructions		Considerations and revisions needed
Several	Increase in community group activity over one or more sectors. One or two new community groups formed.	
Some	Some increase in community group activity over one or more sectors.	
None	Substantial loss of community involvement in parks. Loss of community support. Sense of community is lost.	
V1c. Underrepresented communities This metric refers to groups or communities that suffer or have suffered past institutional discrimination in the United States and/or marginalization in society (Emory University). The focus here is on community-building developed through visitation to parks, including addressing barriers to access. For this metric, consider how an IC is expected to change visitation to the park by underrepresented community groups.		V1c: Participants expressed concerns about how to use this metric if park visitors are primarily from minority or under-represented communities; they are under-represented nationally but not in the park.
Score (drop-down selection)	Description	
Substantial	Substantial increase in community involvement in Parks. Several new community groups formed. Strong sense of community.	
Several	Increase in community group activity over one or more sectors. One or two new community groups formed.	
Some	Some increase in community group activity over one or more sectors.	
None	Substantial loss of community involvement in Parks. Loss of community support. Sense of community is lost.	
V2. Park Aesthetics This metric identifies how the appearance or attractiveness of parks may change with implementation of ICs. Aesthetics refers to how the park is generally perceived by visitors and		V2: This was a difficult metric for participants to score objectively or consistently. Participants had a difficult time separating their own sentiments from their estimates of the public's appreciation of aesthetics (meaning the average

Scoring instructions		Considerations and revisions needed
others interacting with parks and thus represents the value they receive by a well-maintained park. This metric is not a measure of personal preference, since individuals may like or dislike aspects of the park regardless of their condition. The scoring scale for this metric represents relative change from current conditions, insofar as the IC will impact park aesthetics.		park visitor). This metric requires additional thought and refinement, perhaps to reflect some standardization of the representative visitor.
Score (drop-down selection)	Description	
Substantial improve	Facilities and infrastructure are functioning well with optimal outward appearance. Natural areas are functioning at pristine or near-pristine levels.	
Improve	Facilities and infrastructure have improved function and appearance. Some improvement in natural areas.	
No change	Future conditions are the same as current conditions	
Degrade	Some reduction in facilities and infrastructure function and appearance. Some degradation of natural areas.	
Substantial degrade	Facilities and infrastructure are outdated, unpleasant, or altogether failing. Natural areas are in heavily degraded condition.	
V3. Visitor Safety This metric refers to whether a change in visitor safety could result after implementation of an IC, and whether the park will meet all safety compliance regulations. We urge you to consider whether an IC could result in reduction or increase of accidents, or addition or removal of critical life-saving facilities. The scoring scale is a simple binary: Compliant or Not Compliant.		V3. Recommend revisiting some of the wording of this metric, such as <i>compliant</i>, to clarify meanings.
V4. Education & Interpretation This metric describes the visitor experience of learning about park history, cultural heritage, natural ecology, socioeconomic context, and other educational opportunities, and thus represents the educational value that a park provides for its visitors. The scoring scale given here represents an overall change in education opportunities following implementation of an IC.		V4. No recommendations are made here, although participants identified this metric as a useful prompt for thinking about ways to add value to their alternative solutions. For example, include interpretation actions into a proposed solution that had not considered such activities.

Scoring instructions		Considerations and revisions needed
This score can be informed by a number of supporting criteria, including addition or loss of educational programs, classes, workshops, interpretive material, or interpretive moments. Each park should consider which criteria are most appropriate for describing their Park purpose, given limitation in data availability. Some suggestions for supporting metrics include number of students or commercial groups, participation rates in interpretive programs, and percentage of park visitors that use the target asset or area.		
Score (drop-down selection)	Description	
Substantial increase	Educational programming of parks functioning at highest level. Multiple programs, opportunities, and updated educational facilities. High visitation to education programs or interpretive areas. History and social context of multiple communities represented.	
Increase	Some increase in of education opportunities. Some upgrade of education facilities. Some increase in visitation and/or participation in education programs	
No change	Future opportunities same as current opportunities	
Decrease	Some loss of education opportunities, degradation of education facilities, loss of visitation and/or participation in education programs.	
Substantial decrease	Substantial loss of education opportunities OR Failure to meet objective of providing educational opportunities for park visitors	

Resilience to Coastal Hazards

For each potential solution that you are considering, please evaluate and predict asset outcomes with respect to the coastal hazards-related variables described below, and record your estimates on the “Resilience to Coastal Hazards” tab of the draft scoring worksheet. Constructed scales defining a range of potential conditions, exposure, sensitivity, and landscape context have been developed to assist you with this evaluation, and are defined on the “Resilience Value Functions” tab. Note that at the Investment Concept stage, you may not necessarily have comprehensive or detailed estimates of asset condition, current and future exposure, or details of landscape condition or context in which the asset in question is located. However, some parks may have these data already available through tailored Vulnerability Assessments (Peek et al., 2022). If so, feel free to use these to inform your dropdown selections. For example, in the WCU model, metrics are summarized on a 4-point scale, and you can adapt these to the scales listed below. This module may need to be refined in the future to better accommodate this translation, or to accept other data sources or analyses. For this analysis, you are asked to answer seven questions about your predictions on asset performance given various hazard vulnerabilities that are expected to be mediated by the proposed solutions of each alternative investment concept being evaluated.

This portion should be reviewed and updated by subject matter experts with expertise in oceanography, geology, and engineering.

There were general and conflicting concerns about metrics associated with “Resilience” attributes; they were described by some as too complicated and detailed and by others as not containing sufficient detail. Further NPS consideration is needed.

Some participants expressed concerns that these metrics were too focused on issues related to the East-Coast and that additional discussion and refinement would be necessary to make them more applicable for West Coast parks.

Please see the section at the end of this appendix for a more detailed discussion of the input received on these metrics and potential alternative structures that may be useful to the NPS staff who are revising these metrics.

Notes from case study participants that may be relevant to revisions—

Clarify the meaning and differences between *resilient* and *resistant*. For example, if something is renovated to current code, is it automatically scored as resistant? Are nature-based solutions inherently more resilient?

Clarify *major event* as used in the *good condition* description.

Clarify use of the term *condition*. For example, does, or how does, condition map to the Facility Management Software System (FMSS) condition index?

How should consideration be given to the stated lifetime of the asset after investment when thinking about condition?

Scoring instructions		Considerations and revisions needed
		If an asset is removed as part of a solution, how should it be scored against this metric? Should there be an N/A category?
R1: What is the overall condition of the asset? This question refers to an overall assessment of the physical condition of all components of the structure or asset, rather than any one component or system of the asset. Consider the overall ability of the asset to remain in place and withstand coastal exposures or degrade and fail. For example, if the shingles on a building are in a poor state, but the rest of the structure is in good condition, you might choose the overall condition of the building as “fair”. Note that this question is not mutually exclusive from the next one in R2 but focus here on overall condition.		—
Score (drop-down selection)	Description	
Resilient	Asset is or will be in a condition to rapidly resume its intended purpose following a minor storm, shock, or event.	
Resistant	Asset fortified with materials specifically designed to withstand a storm, shock, or event.	
Good	Condition allows it to serve intended function now and into the future, barring major events.	
Fair	Asset could serve intended function only with minor maintenance or upgrades.	
Poor	Asset will be unable to serve intended function without significant maintenance or upgrades.	
Failed	Asset is no longer able to serve intended function and will require significant maintenance or upgrades to restore function.	
R2: What is the condition of the most susceptible component material of the asset?		

Scoring instructions		Considerations and revisions needed
This question differs from R1 in that it addresses the physical condition of a particular element, component, system, material, etc., rather than the overall or gestalt condition of the asset. Considering the given investment concept proposed, what will the physical condition be of the most susceptible material or component of the asset following implementation of the action? For a “no invest” decision, this question refers to the current state of the most susceptible component. For any other active investment, what is the expected future condition of the most susceptible material or element once the solution has been implemented?		R2. Some participants requested clarification on the differences between R1 and R2 metrics.
Score (drop-down selection)	Description	
Resilient	Asset is or will be in a condition to rapidly resume its intended purpose following a minor storm, shock, or event	
Resistant	Asset is or will be fortified with materials specifically designed to withstand a storm, shock, or event.	
Good	Condition allows it to serve intended function now and into the future, barring major events.	
Fair	Asset could serve intended function only with minor maintenance or upgrades.	
Poor	Asset will be unable to serve intended function without significant maintenance or upgrades.	
Failed	Asset is no longer able to serve intended function and will require significant maintenance or upgrades to restore function.	
R3: What is the final anticipated storm surge exposure of the asset, based on the adaptation action proposed and on current mean monthly high water (MMHW)? Storm surge exposure refers to inundation (flooding) of assets and property through increase in sea surface height from tropical cyclone activity and associated oceanographic processes. Inundation is determined by comparing the elevation of the asset to expected sea surface elevations for different tiers of cyclone activity (minor, major, and extreme storms). Sea surface		R3. More detailed discussion of potential revisions to this metric are included below. Other relevant participant comments included— This and other resilience metrics should be easy to score if a vulnerability assessment has been done. Otherwise, there

Scoring instructions	Considerations and revisions needed
elevation is also determined by long-term sea level rise (SLR) and astronomic tides. Thus, total estimated surge is calculated as the change in sea surface height due to storm surge added to the change due to sea level rise, measured from a reference elevation for mean tide level (not supplied, open to user interpretation). Surge inundation heights are represented as different tiers of hurricane intensity: minor H1-H2 (0-4 feet), major H3-4 (4-9 feet), and extreme H5 (9-20 feet). An asset with elevation above 20 feet has no storm surge exposure, while those below 20 feet fall within one of these tiers. For example, an asset with an elevation of 7 feet is exposed to both major and extreme hurricanes. For ease of calculation, SLR is considered here as an adjustment to the final elevation of the asset after the Investment Concept has been implemented. The user selects an SLR scenario based on their preferred time horizon and Shared Socioeconomic Pathways (SSP), and the expected change in sea surface height due to SLR is then subtracted from the final asset elevation, giving an SLR-adjusted elevation that is then compared to the surge elevation categories above. We also assume that protective engineering can be built to reduce storm surge exposure and is designed to target different levels of hurricane intensity, following the scale of the inundation tiers defined above. For example, minor engineering is expected to reduce impacts of minor hurricanes (0-4 feet), while major engineering targets major hurricanes (4-9 feet). Users are asked to: (1) estimate the final elevation of the asset based on the proposed adaptation action and current mean tide level (e.g., MMHW), (2) select the SLR scenario(s) that they would like to evaluate, and (3) select any additional protective engineering that is proposed for the given solution. The spreadsheet then calculates the future SLR-adjusted elevation of the asset, the inundation category that the asset falls within, and the overall storm inundation exposure level (none, low, medium, high, extreme).	may be more informative local information about sea-level rise (SLR) predictions, in which case users can supply available values for these metrics and document the source of the estimates (for example, if specific data of SLR projections are available, the user can enter the range of feet associated with any category, regardless of year or emission scenario). The asset-design lifetime for an IC solution could be used to determine the time horizon for selecting a subset of SLR scenarios (for example, which projections better match the asset lifetime horizon). Consider whether protective engineering can be included as part of a design solution rather than something exogenous (for example, a sea wall) to the asset or proposed solution. Standardize and clarify the definition of <i>asset elevation</i> (for example, ground elevation versus first finished floor, and others). Note that a first finished floor could be a basement. For solutions that elevate a structure, increased wind exposure should be considered a possible consequence. Careful consideration should be given to the role and exposure of supporting infrastructure. The need to include such relationships in the IC should be clearly indicated. How should a proposal for demolishing or removing an asset (such as an N/A option) be scored?
R4: What is the level of exposure of the asset to riverine flooding, conditioned on the proposed solution? This metric refers to exposure of the asset to terrestrial river flooding through freshwater flood pulse events, as distinguished from oceanographic-based inundation. Flood exposure is based on the location of the asset within established flood zones as identified by existing FEMA flood	R4. Recent National Oceanic and Atmospheric Administration (NOAA) flood maps should be available for all coastal areas. Notes Oct 2025: As part of pilot testing, expand this guidance to incorporate more recent information sources

Scoring instructions		Considerations and revisions needed
maps, or other data sources. This can also include special considerations for topography and distance to streams and other waterways which could further inform flood exposure. The metric is organized around annual probability of flooding (all floods, 40-, 100- & 500-year floodplains) but also includes the ability to consider the surrounding geomorphic context and/or aspects of the asset itself that would allow freshwater flooding to be mitigated (e.g., a building's ground-floor elevation putting it out of reach of a 500-year flood).		identified in the Natural Hazards Handbook and protocol (e.g., SHIRA tools).
R5: What level of wind exposure is the asset subjected to, conditioned on the proposed solution? In addition to storm surge inundation, hurricane-force winds also impact assets and property both immediately at the coast and farther inland. Exposure to wind impacts and expected damage resulting from these should be considered for any assets that are potentially exposed to hurricanes or other high-level wind events. Wind damage can also be significant depending on the asset's orientation or setting (e.g., located on cliffs, among dynamic coastal dunes). To inform your selection for this metric, consider the type of materials used on the asset and the specific landscape setting (e.g., sheltered, exposed) proposed for the IC, along with your estimation of the future outcome of the asset. Will exposure to high winds result in significant loss of or damage to the structure, or a possible outright loss of the asset? Are building materials specially engineered to withstand high winds?		R5. Additional examples in the description are suggested to clarify, for example, that <i>Highly Resistant</i> and <i>Resistant</i> are more likely outcomes of restoration projects, because regardless of the condition or materials, no physical asset comes out of an H2 storm unscathed. H1 storms cause damage to roofing and siding. An N/A option is needed for a removal alternative.
Score (drop-down selection)	Description	
Highly resistant	Asset able to withstand > 130 mph sustained winds (H4 and higher)	
Resistant	Asset able to withstand up to 130 mph sustained winds (up to H3)	
Minor exposure	Asset damage expected to occur for sustained winds > 96 mph (H2 and higher)	
Major exposure	Asset damage expected to occur for sustained winds > 39 mph (TS and higher)	

Scoring instructions		Considerations and revisions needed
R6: Regarding the context of the surrounding landscape, how stable is the local geomorphology? This is a broad metric that can accommodate consideration of many factors that may characterize the landscape context in which the asset is located. Evaluation of shoreline change dynamics, coastal dunes, rates of land subsidence and erosion, or other such factors can be used to determine the degree of geomorphic stability of the physical context in which the asset is situated. Various data sources may be available to assist with the evaluation of a 4-point constructed scale (e.g., NPS shoreline buffers, USGS Coastal Change Hazards portal, https://marine.usgs.gov/coastalchangehazardsportal/).		R6. Clarify the description to convey that it refers to local geomorphology and not the physical park asset itself. Generally, this score would be the same across all potential solutions, except under a <i>relocate</i> option or if a management action taken by the park or by others changes geomorphology, as with beach nourishment or a seawall. Notes Oct 2025: As part of pilot testing, expand scoring guidance for R6 to include mention, for NER, of the Coastal Change Likelihood products (https://www.sciencebase.gov/catalog/item/61781c1bd34e4c6b7fe2a425). Confirm if it is being expanded to SER. If so, expand the guidance language appropriately.
Score (drop-down selection)	Description	
Resilient	Asset is or will be in a condition to rapidly resume its intended purpose following a minor storm, shock, or event.	
Resistant	Asset fortified with materials specifically designed to withstand a storm, shock, or event.	
Good	Condition allows it to serve intended function now and into the future, barring major events.	
Fair	Asset could serve intended function only with minor maintenance or upgrades.	
Poor	Asset will be unable to serve intended function without significant maintenance or upgrades.	
Failed	Asset is no longer able to serve intended function and will require significant maintenance or upgrades to restore function.	

Scoring instructions		Considerations and revisions needed
R7: In what condition is any related infrastructure that the target asset is dependent upon? This metric refers to the condition of any infrastructure or system that provides support to, or allows the intended functioning of, the target asset. Such infrastructure could include roads, electrical, water or sewage lines, ferry terminals or docks, associated structures that contribute to the significance or functioning of the target asset (e.g., transfer stations, storage), etc. The condition of the related infrastructure should only change from a “no investment” strategy if upgrades or modifications to this associated infrastructure are included in alternative solutions, or the condition is predicted to worsen over the lifespan of the target asset’s proposed lifespan.		R7. See the note on R1 about clarifying the distinction between resilient and resistant. Certain actions require further thought on the intent and description of this metric (for example, is supporting infrastructure relevant under an asset-removal solution? Should evaluators consider all aspects of supporting infrastructure, or just the most vulnerable element?). Does the metric need to capture how the degree of vulnerability of supporting infrastructure affects the target assets or could this issue be addressed in the details of the proposed IC solution?
Score (drop-down selection)	Description	
Resilient	Asset is or will be in a condition to rapidly resume its intended purpose following a minor storm, shock, or event.	
Resistant	Asset fortified with materials specifically designed to withstand a storm, shock, or event.	
Good	Condition allows it to serve intended function now and into the future, barring major events.	
Fair	Asset could serve intended function only with minor maintenance or upgrades.	
Poor	Asset will be unable to serve intended function without significant maintenance or upgrades.	
Failed	Asset is no longer able to serve intended function and will require significant maintenance or upgrades to restore function.	

Additional Considerations for Future Metric Revisions

The current *Resilience to Coastal Hazards* metrics rely on information in the coastal facilities vulnerability assessments developed under the protocol of Peek et al. (2022)¹. It is recommended that the NPS revisit and revise the *Resilience to Coastal Hazards* metrics to include consultation with subject matter experts in oceanography, geology, and engineering. General and conflicting concerns were raised during the case studies suggesting that metrics associated with several of these attributes are either too complicated or detailed or, alternatively, do not contain sufficient detail. Further NPS consideration is needed. As another potential starting point for those revisions, several alternative metrics, listed below, are added to those developed and tested in the case studies that are intended to address some of the issues that arose in the proof-of-concept.

Storm surge exposure

Modify to allow parks to define park- or asset-specific surge heights corresponding to predefined levels of impact.

This metric (R3 in Table 1) refers to inundation due to oceanographic processes and is distinguished from inundation due to terrestrial riverine processes. The storm surge exposure metric developed for the case studies that is shown in the scoring instructions followed the general methodology of the National Oceanic and Atmospheric Administration (NOAA) National Hurricane Center and Pacific Hurricane Center's Sea, Lake, and Overland Surges from Hurricanes (SLOSH) model ([SLOSH Display Program \(SDP\) | U.S. Climate Resilience Toolkit](#)) and ([National Storm Surge Risk Maps - Version 4 \(text\)](#)). The methodology of the SLOSH model is to identify, for any given area, exposure to different intensity levels of storm surge due to different intensities of hurricane. The SLOSH model computes exposure for all five hurricane classes (H1–H5). The scoring instructions and metrics simplified this to three generic “levels”: Minor, Major, and Extreme, which were intended to correspond with the hurricane classes (Minor = H1–H2; Major = H3–H4; Extreme = H5). In the example Excel spreadsheet provided in Reynolds 2026a and Reynolds 2026b, the maximum sea-surface surge height for each level is defined in cells J100–102 of the *Resilience Value Functions* tab. It is important to note that the SLOSH model calculates storm-surge heights as a Maximum Envelope of Water (MEOW) based on thousands of model simulations.

During the case study trials, users commented that surge-height levels defined for each category (Minor, Major, Extreme) can vary among parks due to local and regional geography and landscape context and in cases where the relocation of an asset is being considered. Furthermore, the types of storms and storm-surge exposure for parks on the Pacific coast differ from the Atlantic and Gulf of Mexico coasts, specifically with regard to tsunamis and El Niño-Southern Oscillation (ENSO) related weather. Addressing these comments requires that parks be allowed to define park- or asset-specific surge heights that correspond to predefined levels of impact. A suggested way to accomplish this is described here.

Commented [KN10]: Do these metrics align with information parks can access from the Coastal CCVAs completed or being done for all coastal units? Would make sense that these link. If not, should this be a suggestion?

Commented [SF11]: File not found.

After the case study work, the USGS participants involved in the development of this framework consulted with subject matter experts in oceanography and geology about methods for calculating inundation heights. The MEOW approach used by the NOAA SLOSH model relies on intensive modeling; surge heights are derived from multiple stochastic storm simulations with site-specific landscape details. A more flexible approach is to express heights as total water level (TWL) during a storm event, which is the vertical sum of astronomical tide, storm surge, wave setup and wave runup, plus any additional factors that may influence the water level at the coast (such as seasonal variability, coastal trapped waves, and other conditions). This TWL approach allows estimation based on empirical observations and empirically derived models developed specifically for the location of interest (Stockdon et al., 2006). Sallenger (2000) used this approach to define four levels of coastal storm flooding hazards, which were later refined by Leaman et al. (2021) for coastal barrier islands: swash, collision, overwash, and inundation (see figure 4 in Leaman et al. (2021), shown here as Figure 15).

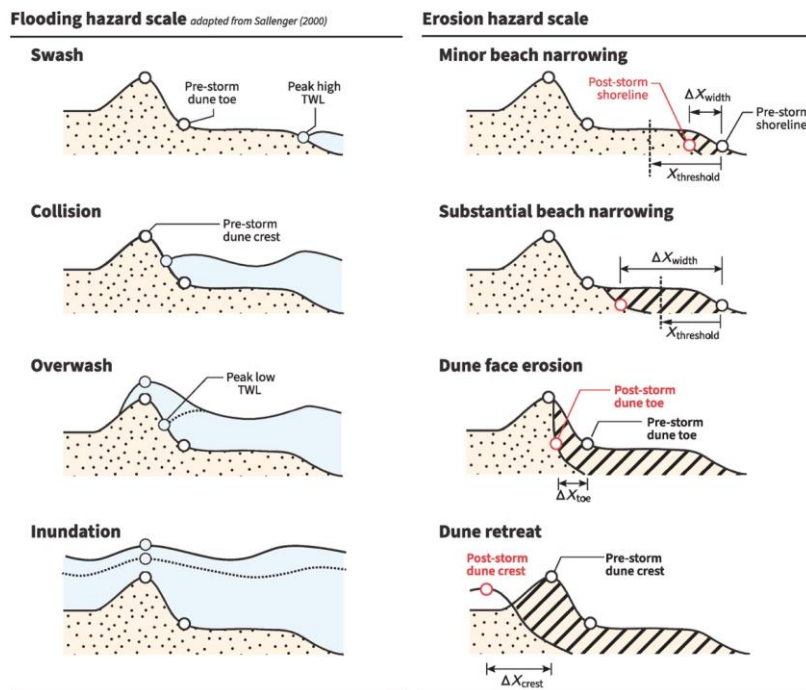


Figure 15. Images depicting coastal flooding hazard scale (left) and beach erosion hazard scale (right) from Leaman et al. (2021).

It is recommended that the NPS consider this approach because it places an emphasis on the local geomorphic conditions of the landscape (as in beach slope and width, dune height and width, and wave setup and runup) and the potential for geomorphic features to become overtopped at different

levels of storm-surge height, thereby exposing assets to flooding. The main advantage of this approach is that it provides more details on the landscape setting, which allows the user to better visualize and identify which zone the asset falls within for each proposed solution when compared to a hurricane-intensity class rating or the generic classes used in the case studies (Minor, Major, Extreme). Since this approach uses TWL, it can be informed by empirical observations and model predictions. The disadvantage of this approach is that it was developed for coastal barrier islands with beach and dune systems and has not been applied to areas with a different geology (for example, rocky intertidal). However, it is feasible that the classification zones described by Leaman et al. (2021) could be adapted to these types of areas if sufficient subject matter expertise and scientific review are applied.

A potential way to implement this change is shown in Table 2. Require each park proposing an investment to identify the TWL that would result in each of the four categories of storm surge, allowing the metric to capture park-specific characteristics. The evaluator can be asked to consider important factors that characterize the local oceanographic regime, such as topographic and bathymetric features, shoreline elevation gradients, local wave-energy regime, wave setup or runup, distance from shoreline, and other factors.

Table 2. Example of local specification of total water level (TWL) as related to class of hurricane or flooding

Level and descriptor	Maximum inundation height ^A (TWL, in ft)	Description
I. Swash	1	Lowest height level of coastal storm flooding hazard, occurs when peak high TWL is confined to low elevations such as beach or marshes. Does not reach upland.
II. Collision	4	Second height level of flooding hazard, peak high TWL impacts dunes or rocky supratidal areas, may result in substantial post-storm beach narrowing.
III. Overwash	9	Dune crest or rocky supratidal are intermittently overtopped, resulting in loss of flood protection. Flooding hazards may also be exacerbated during long-duration events or if inadequate drainage is provided.
IV. Inundation	20	Highest and most severe level of coastal storm flooding hazard for the open coast. Dune crest or rocky shoreline are constantly submerged. Entire coastal communities potentially subjected to flooding.

V. No exposure	>20 ft	Asset is located at an elevation above any potential inundation.
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^A The maximum inundation height should be specified by park staff—numbers in the second column are adjusted by the user during implementation of the decision analysis framework. The areas in gray give definitions and descriptions for each category. These can be revised during development but should be broad enough to apply globally to all ICs being considered. For that reason, descriptions and categories would be locked for users when the framework is implemented (but not the maximum inundation height column). TWL, total water level; ft, feet.

Riverine Flood Exposure

Create a clearly constructed scale with improved instructions on how to evaluate investment concepts using this metric

This metric (R4 in Table 1) refers to inundation due to terrestrial riverine processes and is distinguished from inundation due to oceanographic processes, which is captured in the R3 metric. The reasons for this distinction are that terrestrial flooding can be independent of or lag storm surge during a given storm event because of the track that the storm follows and its residence time in the area (for example, Hurricane Harvey in 2017 and Hurricane Florence in 2018) and different mitigation methods may be necessary to address riverine flooding. The metric is organized around the emergency management approach to estimating annual probabilities of flooding at different levels of flood intensity (such as 100-year and 500-year floodplains). During the case study evaluations, participants were asked to identify the flood plain for the asset, but the metric categories were not well-defined.

A clearly constructed scale based on Federal Emergency Management Agency (FEMA) Flood Zone Designations (<https://www.fema.gov/glossary/flood-zones>; https://efotg.sc.egov.usda.gov/references/public/NM/FEMA_FLD_HAZ_guide.pdf) could be created, and an example of this is shown in Table 3. This approach has a few potentially confusing issues. First, FEMA does not distinguish between terrestrial- and oceanographic-based flood sources, so the estimation of this metric requires careful reasoning and interpretation from the indicated FEMA status to the scale developed here. Second, the FEMA categories are resolved to a fine level of detail that distinguishes between properties where data on flood depths and base-flood elevations are both known (e.g., zone AO) and unknown (e.g., zones A, A99), and where there is temporary uncertainty in the impacts (e.g., AR). For the purposes of this report, these FEMA classifications must be simplified. The following constructed scale (in Table 9) for *R4. Riverine Flood Hazard* addresses the issues described. The FEMA codes are given as examples, but, ultimately, the best judgement of the evaluator is required to determine the appropriate level of exposure.

Table 3. Example of constructed scale for Riverine Flood Exposure referenced to Federal Emergency Management Agency Flood Zone Designations. The left column gives drop-down categories that are selected by the user during evaluation of the proposed IC. The right column gives definitions and descriptions for each category of the scale to aid the user in selection. Definitions and descriptions can be revised during development but should be broad enough to apply globally to all investment concepts being considered. For that reason, descriptions and categories would be locked for users when the framework is implemented. FEMA, Federal Emergency Management Agency; N/A, not applicable.

Drop-down selection	Description
500-year floodplain	Area of minimal flood hazard. Examples include FEMA designations, (C) and (X), 500-year floodplain
100 to 500-year floodplain	Area with an annual 0.2 percent (or 1 in 500) chance of flooding. This zone is also used to designate base floodplains of lesser hazards, such as areas protected by levees from 100-year flood, or shallow flooding areas with average depths of less than one foot or drainage areas less than 1 square mile.
100-year shallow	Areas with a 1 percent annual chance of shallow flooding that would have minor impacts to the asset. Examples include (AH) shallow flooding in the form of a pond, with an average depth ranging from 1 to 3 feet; (AO) river or stream flood hazard areas and areas with a 1 percent or greater chance of shallow flooding each year, usually in the form of sheet flow, with an average depth ranging from 1 to 3 feet; (AR) areas with a temporarily increased flood risk due to the building or restoration of a flood control system (such as a levee or a dam); (A99); areas protected by a Federal flood control system where construction has reached specified legal requirements, although depths and base flood elevations are unknown.
100-year extensive	Areas with a 1 percent annual chance of extensive flooding that could broadly and severely impact the asset.
1 to 100-year floodplain	Areas with > 1 percent change of extensive flooding.
N/A	No significant source of riverine flooding.

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