

Appendix 1. Instructions for Using the Sea Level Rise Impact Assessment Tool



FLOODING ACROSS A STREET DURING A KING TIDE. PHOTO BY OREGON KING TIDES PROJECT, 2020.

The vulnerability of assets exposed to sea level rise will vary because of location, physical characteristics, services provided, and other factors. To help users organize their thoughts, OCMP staff prepared the Sea Level Rise Impact Assessment Tool (Assessment Tool), a set of Excel worksheets programmed to provide a structured approach to evaluating the vulnerability of exposed assets. The term “asset,” as used in the Assessment Tool, is expansive and includes buildings, infrastructure, neighborhoods, parks, natural areas, social spaces, cultural features, etc.

The Assessment Tool workbook contains 11 worksheets. Worksheets that begin with the numbers 1 – 9 are used for the SLR vulnerability analysis and reporting. The worksheet labeled “Instructions” provides basic information about how to use the numbered worksheets. The “Data Dictionary” worksheet contains the variables used in the numbered worksheets.

Data Dictionary

The “Data Dictionary” worksheet drives programming, contents of dropdown menus, and scoring values in the numbered worksheets. Most users will not need to change the elements in the Data Dictionary. The following paragraph briefly describes how the numbered worksheets use the Data Dictionary, for the benefit of users familiar with Excel programming.

Changing the words and scoring values in the Data Dictionary changes what is included in the drop-down menus on the numbered worksheets. Color blocks around the Data Dictionary sets indicate that the same-color set is a named range. The named ranges are linked to their applicable worksheet and are used in worksheet formulas. If users change the name of the named ranges from the Excel ribbon menu, the formulas that use the named range will change automatically on the numbered worksheets. Note that the name range titles included as text above each color block in the Data Dictionary is a user aid; changing it does not alter the named range within the Excel program. Adding rows to the named ranges will cause the new rows to be included in the drop-down menu linked to the named range.

A Note About the Formulas: This workbook uses a formula introduced called XLOOKUP that was introduced by Excel in 2019. Previous versions of Excel will not recognize this formula. Contact OCMP staff if you are using a version of Excel that is incompatible with XLOOKUP.

Report any bugs in workbook programming to OCMP staff.

Identifying Exposed Assets

Start the analysis with the worksheet labeled “1. Exposure.” This worksheet allows users to type in assets that are located within or near the Sea Level Rise Exposure Area shown on the companion Geographical Information System, **Sea Level Rise Impact Explorer**: www.coastalatlantia.net/sealevelriseplanning/. There is no limit to the number of assets that can be added. Assets included in the “1. Exposure” worksheet will be copied to all subsequent worksheets.

The “1. Exposure” worksheet presents users with drop-down menus to further describe the “asset category,” “primary threat,” and “primary service area”. Users may change the contents or number of these attributes by modifying the appropriate table in the Data Dictionary. A free form comment area is provided on the “1. Exposure” worksheet to allow users to report the source of the information added, and any comments.

The “1. Exposure” worksheet is the first of six worksheets to apply a vulnerability score. These scores will be summed at the end of the analysis to establish an asset’s vulnerability to sea level rise impacts.

Scores: The Assessment Tool calculates a vulnerability score for each asset included in the analysis based on scoring in six categories. The categories are:

- degree of exposure,
- level of potential harm posed to people if the asset is damaged by events associated with sea level rise,
- characteristics of people who use the asset,
- the asset’s ability to withstand physical damage,
- how prepared owners or operators are to cope with damage,
- how important the asset is to community functioning.

Scores from each step are summed across each exposed asset to produce a ranked list, labeled very high to low priority, for further analysis (Figure A). Users don’t need to remember which score values apply within the worksheet. Score values are populated into the worksheet automatically after users select a description from a drop-down menu.

Although set forth as a mathematical equation, the vulnerability assessment is, in fact, subjective. OCOMP advises that communities who undertake this vulnerability assessment spend time defining what each part of the assessment equation means and what score is appropriate. The process is meant to be completed in conversation with groups of people within the government enterprise or organization, affected populations, and the entire community. Even with this upfront work, participants may not always agree on what score should be assigned. A facilitated process may be needed to work through the exercise. Provision is made in the Assessment Tool to easily change default scores.

The sea level rise vulnerability score is calculated using the following equation:

Vulnerability Score for Each Evaluated Asset = Exposure Score + Risk Class Score + Users’ Score + Sensitivity to Damage Score + Coping Capacity Score + Social Weighting Score

Exposure scores are determined using the Sea Level Rise Planning Area. Scores range from 0 (no exposure) to 4 (asset exposed to seawater inundation due to SLR, oceanfront wave action, and coastal erosion).

- 0 = not exposed directly to SLR or its effects
- 1 = not directly exposed, but surrounded by areas affected by sea level rise
- 2 = affected by one SLR effect
- 3 = affected by two sea level rise effects
- 4 = affected by three sea level rise effects

Risk Class refers to consequences to people should the asset be damaged or fail. Scores range from 1 to 4 and are based on American Society of Civil Engineers (ASCE) Risk Classifications:

- 1 = Category I: Buildings, structures, or services that represent a low hazard to human life, or cause minor inconvenience, in the event of failure.
- 2 = Category II: Buildings, structures, and services except those listed in Risk Categories I, III, and IV.

3 = Category III: Buildings, structures, or services that represent a substantial hazard to human life, or will cause major inconvenience, in the event of failure.

4 = Category IV: Buildings, structures, or services designated as critical, essential, or lifelines.

Users refers to the demographic profile of the asset's primary users. Scores range from 1 to 3 and reflect the degree to which users are underserved by the community/society by virtue of poverty, physical or mental health illness, limited mobility, discrimination or marginalization, or age (very young or elderly). Each community will need to define what they mean by well-served and underserved using demographic data or lived experience.

1 = Asset is primarily used by well-served populations

2 = Asset is used by both well-served and underserved populations

3 = Asset is primarily used by underserved populations

Sensitivity to Damage refers to the asset's ability to function after being exposed to the consequences of SLR. Scores range from 0 to 3.

0 = Not affected by exposure

1 = May suffer minor harm but can maintain functionality

2 = May sustain harm such that repairs are necessary before it can resume full functionality

3 = May become severely harmed or destroyed and cannot resume normal function until repaired or replaced

Coping Capacity refers to how prepared the asset (or its management) is to cope with SLR. Preparedness can include physical coping mechanisms such as structure hardening or building elevation, to non-physical coping mechanisms such as contingency or evacuation plans. Scores reflect the degree of preparedness and range from 0 to 3. (Note that the scoring for this element is reversed from other elements, with low scores indicating higher coping capacity. This was done to make the vulnerability calculation easier. The spreadsheet is programmed to reflect this.)

0 = Well prepared; response plans are up-to-date and exercised regularly. Facilities are designed and maintained to withstand anticipated effects of SLR.

1 = Partially prepared; response plans have been made but may not be up-to-date or are not exercised regularly. Asset is designed and maintained to address some, but not all, of the anticipated effects of SLR.

2 = Challenged: Response plan is vague or out-of-date. Asset was not designed or is not maintained to handle anticipated effects of SLR, but some preparations have been made to safeguard sensitive records or equipment.

3 = Unprepared to handle the anticipated effects of SLR.

Social Weighting refers to the value of the asset to community functioning, economy, cultural identity, or sense of place. Scores range from 1 – 3.

1 = Duplicative. Service or function is readily available elsewhere within the community.

2 = Important, but substitute service or function is available within a reasonable distance from affected area.

3 = Very important to retain in the community, no substitutions available within a reasonable distance.

A value of 100 is assigned in the Assessment Tool when there is not enough information to score an element. Because scores assigned to assets are summed, scores in the hundreds indicate that more research is needed to properly assess vulnerability.

Each scoring worksheet provides space to add information about the source of the information recorded and comments. Users are encouraged to use these areas of the worksheet.

Reports: Figure A shows how the scores are reported on the worksheet named “6. Summary.” *Resist the temptation to sort this worksheet by vulnerability score.* Doing so breaks the connection between the asset and its Vulnerability score. OCMP programmers are aware of this issue and will resolve it in future updates.

Some communities may wish to change how the elements are weighted. The default is that all elements are weighted equally. Users can change the weighting factors on the “6.Summary” worksheet, as shown in the green shaded area. Be aware that changing the weighting may require a change in how the scores are color-coded, using conditional formatting, on following worksheets.

FIGURE A. EXAMPLE VULNERABILITY ASSESSMENT SCORING SUMMATION

Weighting Factor	1	1	1	1	1	
Formula Used >>>	xlookup	xlookup	xlookup	xlookup	xlookup	calculated
Exposed Asset	Exposure Score	Risk Classification Score	User Score	Damage Potential Score	Coping Capacity Score	Vulnerability
EXAMPLE: Seabranh Hospital	1	3	2	0	0	6
EXAMPLE: GoNow Clinic	2	2	3	1	2	10
EXAMPLE: Helping Hand Assisted Living	2	3	3	3	3	14
EXAMPLE: OUCH Physical Therapy Center	3	2	2	0	2	9
EXAMPLE: Pediatric Health Services	2	3	2	1	2	10
EXAMPLE: Omni Mental Health Services	1	3	3	2	3	12
EXAMPLE: Drop In Sports Medicine	3	2	2	1	2	10
EXAMPLE: Culvert on Seabranh Drive	1	1	2	0	0	4
EXAMPLE: Culvert on Marine Drive	3	2	2	2	2	11
EXAMPLE: Culvert on Oceanview Road	2	2	2	1	1	8
EXAMPLE: Seaview Hotel and Convention Center	2	2	1	1	2	8
EXAMPLE: Oceanview subdivision	0	100	100	100	100	400
EXAMPLE: Hat Rock Overlook	4	1	2	2	100	109

After scores are summed, users evaluate how important the asset is to community functioning on the worksheet named “7. Community Importance.” *Resist the temptation to sort this worksheet by Vulnerability score.* Doing so breaks the connection between the asset and its vulnerability score. OCMP programmers are aware of this issue and will resolve it in future updates.

Once this is accomplished, the program assigns a color to the total score to indicate which assets might be a high priority for further evaluation. The assignment of colors is accomplished using Excel’s conditional formatting feature. Users’ can modify the conditional formatting categories by changing how scores are binned by following the instructions found in the Data Dictionary worksheet. Users will need to change the conditional formatting categories if the default of equal weighting was changed on the previous worksheet.

FIGURE B: SCREENSHOT OF SUMMARY WORKSHEET

Exposed Asset	Vulnerability	7. Community Importance	Community Importance Score	Total Vulnerability	Priority
EXAMPLE: Seabbranch Hospital	6	Very important to retain in community	3	9	Medium
EXAMPLE: GoNow Clinic	10	Services available elsewhere in community	1	11	Medium
EXAMPLE: Helping Hand Assisted Living	14	Very important to retain in community	3	17	Very High
EXAMPLE: OUCH Physical Therapy Cente	9	Services available elsewhere in community	1	10	Medium
EXAMPLE: Pediatric Health Services	10	Services available elsewhere in community	1	11	Medium
EXAMPLE: Omni Mental Health Services	12	Alternatives exist within a reasonable distance	2	14	High
EXAMPLE: Drop In Sports Medicine	10	Very important to retain in community	3	13	High
EXAMPLE: Culvert on Seabbranch Drive	4	Alternatives exist within a reasonable distance	2	6	Low
EXAMPLE: Culvert on Marine Drive	11	Very important to retain in community	3	14	High
EXAMPLE: Culvert on Oceanview Road	8	Services available elsewhere in community	1	9	Medium
EXAMPLE: Seaview Hotel and Conventio	8	Very important to retain in community	3	11	Medium
EXAMPLE: Oceanview subdivision	400	Very important to retain in community	3	403	Data Gap
EXAMPLE: Hat Rock Overlook	109	Blank	100	209	Data Gap

The worksheet named “8. Report” concatenates all comments made on previous worksheets along with presenting final Vulnerability scores. Again, do not try to sort this worksheet.

FIGURE C: SCREENSHOT OF SUMMARY WORKSHEET

Exposed Asset	Total Vulnerability	7. Community Importance	Community Importance Score	Total Vulnerability	Priority
EXAMPLE: Seabbranch Hospital	9	Critical facility	Hospital is designed to withstand 500-yr flood events	Hospital is prepared for flood events, culvert could be upsize	Only hospital in or near the community
EXAMPLE: GoNow Clinic	11	Day use only	Serves region	Newer building built to current flood standards	Some preparation
EXAMPLE: Helping Hand Assisted Living	17	Residential facility	Elderly population, people with mobility	Older building constructed before flood standards	Difficult to quickly relocate residents
EXAMPLE: OUCH Physical Therapy Center	10	Day use only	Serves region	Newer building, elevated 2+ feet above current flood standards	Some preparation
EXAMPLE: Pediatric Health Services	11	Day use only	Serves region	Newer building built to current flood standards	Some preparation
EXAMPLE: Omni Mental Health Services	14	Residential facility	Special needs	Older building constructed before flood standards	Difficult to quickly relocate residents
EXAMPLE: Drop In Sports Medicine	13	Day use only	School sports check-ups/sports injury tre	Newer building constructed to current flood standards	Some preparation
EXAMPLE: Culvert on Seabbranch Drive	6	Short detour available	Hospital users	Culvert is less than 5 years old and sized for 100-year storm	Easy to repair, but could be upsize to 500-yr event
EXAMPLE: Culvert on Marine Drive	14	Medium detour needed	Johnson's Mobile Home Park	Culvert is old, rusted out and in a difficult to repair area	May need bridge, in a landslide area
EXAMPLE: Culvert on Oceanview Road	9	Medium detour needed	Residential/Vacation Homes	Culvert is undamaged but easy to replace with a larger one	May need to upsize
EXAMPLE: Seaview Hotel and Convention Center	11	Economic driver in region	Meeting space	Meeting rooms would need to be refurbished if flooded	May need to abandon meeting rooms on ground floor
EXAMPLE: Oceanview subdivision	403	May include vacation renta	Need to investigate demographics		Ingress/egress may be an issue
EXAMPLE: Hat Rock Overlook	209				

The last worksheet in the workbook (9. PT_Summary) displays assets in order of vulnerability score.















FIGURE D: EXAMPLE OF VULNERABILITY RANKING

Vulnerability Ranking	Exposed Asset	Total Vulnerability
Data Gap	EXAMPLE: Oceanview subdivision	403
Data Gap	EXAMPLE: Hat Rock Overlook	209
Very High	EXAMPLE: Helping Hand Assisted Living	17
High	EXAMPLE: Culvert on Marine Drive	14
High	EXAMPLE: Omni Mental Health Services	14
High	EXAMPLE: Drop In Sports Medicine	13
Medium	EXAMPLE: Seaview Hotel and Convention Center	11
Medium	EXAMPLE: GoNow Clinic	11
Medium	EXAMPLE: Pediatric Health Services	10
Medium	EXAMPLE: OUCH Physical Therapy Center	10
Medium	EXAMPLE: Seabbranch Hospital	9
Medium	EXAMPLE: Culvert on Oceanview Road	9
Low	EXAMPLE: Culvert on Seabbranch Drive	6

Two summary reports are created within the workbook. The tab labelled “Report” concatenates, or gathers up, all of the comments that were entered into previous worksheets. This report provides users with information that may be helpful when selecting adaptation responses.

The tab labelled “9. PT_Summary” provides a list of assets ranked from highest to lowest vulnerability. Note that assets showing scores at or above 100 indicate that information is unknown or missing for that asset on previous scoring worksheets.

FIGURE D: SCREEN SHOT OF PT_SUMMARY WORKSHEET

Vulnerability Ranking	Exposed Asset		Total Vulnerability
Data Gap	EXAMPLE: Oceanview subdivision		403
Data Gap	EXAMPLE: Hat Rock Overlook		209
Very High	EXAMPLE: Helping Hand Assisted Living		17
High	EXAMPLE: Culvert on Marine Drive		14
High	EXAMPLE: Omni Mental Health Services		14
High	EXAMPLE: Drop In Sports Medicine		13
Medium	EXAMPLE: Seaview Hotel and Convention Center		11
Medium	EXAMPLE: GoNow Clinic		11
Medium	EXAMPLE: Pediatric Health Services		10
Medium	EXAMPLE: OUCH Physical Therapy Center		10
Medium	EXAMPLE: Seabranh Hospital		9
Medium	EXAMPLE: Culvert on Oceanview Road		9
Low	EXAMPLE: Culvert on Seabranh Drive		6