

# Western Australia Coastal Resilience Mapping & Decision Support Tool

Training Manual Version 2.0



*A project funded by The Alcoa Foundation*



## **Western Australia Coastal Resilience Tool**

### **Training Manual, Version 2.0**

The Western Australia *Coastal Resilience* online mapping and decision support tool for visualizing and assessing regional coastal hazards risk and exploring potential habitat restoration projects can be found at [maps.coastalresilience.org/Australia](https://maps.coastalresilience.org/Australia). The draft tool has been developed as part of the “*Revitalising the Peel Harvey Estuary*” project initiated in late 2017 by The Nature Conservancy with support from The Alcoa Foundation and local project partners. The project was developed to address the growing threats of urban development, fisheries decline and climate change on the long-term health and resilience of the Peel-Harvey Estuary.

The first two years of the project (2018-2019) will identify opportunities for ecosystem restoration and protection through restoration feasibility and risk assessments, Conservation Action Planning and development of interactive, online decision-support tools known as *Coastal Resilience*. These activities will help identify, prioritise and plan for future, restorative in-water activities proposed to commence in 2020.

Coastal Resilience is a decision support tool that incorporates the best available science and local data to enable communities to visualize the risks imposed by sea-level rise and storm surge on the people, economy, and coastal habitats of the Peel-Harvey region and identify nature-based solutions for enhancing resilience and reducing risks where possible.

This training manual for the Coastal Resilience tool provides Exercises & Skills to practice real-world problem solving. Hints & Tips for using the tool and a glossary of terms are also included. The tool contains web mapping applications, or "apps." Each one is intended to address a specific coastal issue to inform conservation, mitigation, and/or adaptation planning. These tools, trainings and activities were shared with stakeholders in the Peel Harvey estuary in March 2019 and revised based on feedback received at the workshop.

Please read the [Legal Disclosure](#) carefully for more information about the proper use of the Coastal Resilience tool.

Please contact us with your questions and input: [cgillies@tnc.org](mailto:cgillies@tnc.org)

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## **Hints and Tips**

1. The *Coastal Resilience* tool is web-based. Make sure your internet connection is working before use.
2. The *Coastal Resilience* tool can be used in most internet browsers, including Chrome, Internet Explorer, Firefox, and Safari. However, be sure your browser is up-to-date to avoid issues.
3. It is a good practice to reboot your device before using the tool to ensure that you have sufficient memory available to use it.
4. It may be helpful to periodically refresh the browser window (refresh button or F5 key) in which you are viewing the *Coastal Resilience* tool in order to prevent errors from occurring. Keep in mind that refreshing will return the *Coastal Resilience* tool to its starting condition.
5. If the *Coastal Resilience* tool really seems to be stuck, try clearing the local cache in your browser by pressing Control + F5 (you may want to press this several times to fully clear the system). On an Apple machine press Command + R. You can also close the browsing window or tab and open it again to fully refresh the site.
6. Another option to avoid issues caused by web browser history is to open the *Coastal Resilience* tool in a window which does not retain cookies or other browsing data. This is known by different names in different web browsers. For example:
  - Chrome: incognito window
  - Internet Explorer: InPrivate Browsing
  - Firefox and Safari: private browsing window
7. The *Coastal Resilience* tool is optimized to work on desktops and laptops, and may experience issues when open in a tablet or hand-held devices. Additionally, the *Coastal Resilience* tool map viewer may seem crowded when viewed on a laptop.
8. If a background map layer does not load (grey screen displayed), try choosing another layer or changing the zoom level. Some layers do not appear when zoomed in extensively.
9. For a quick run-down on the functions of the tool click on “Tour” at the bottom left corner of the screen – this will point to the different elements of the tool and give a short explanation of them.
10. When you open an app the icon changes color and appears like an app on your phone. When done using the app you can either use the close (‘x’) button in the upper right hand corner to remove it from being active, and remove its data from the map, or the minimize (‘\_’) button to have it remain active and, therefore, keep data on the map. You can have multiple apps open – minimizing the apps helps maximize how much of the map is shown.

11. Likewise, the Map Legend can be minimized ('\_'). To show the legend again, click on the plus button ('+') on the right side of the Map Legend header. The legend can also be dragged to a different location.
12. App data displays in the order in which you access it. For example, if you open the Risk Explorer app first, then the Restoration Explorer app, Risk data will be layered on top. For this reason, we recommend opening the Regional Planning app last if you wish to use it.
13. Clicking on data that appears on the map will open an Identify window showing the attributes of the data layer at that point. If the Identify box is too big and goes off the map then pan the map (click and hold mouse down, then drag) until you see the entire window. Note that the Identify window does not move.
14. You can also hold the Shift key down and click and hold the mouse to draw a box for zooming into a particular area. This may allow you to zoom to a level that is between those used by the zoom in and zoom out buttons.
15. Remember that the *Coastal Resilience* tool is a work in progress! If you find obvious errors, feel free to report them to [cgillies@tnc.org](mailto:cgillies@tnc.org).

**Thank you very much for using the *Coastal Resilience* tool!**

**If you have any feedback, please submit it to [cgillies@tnc.org](mailto:cgillies@tnc.org)**

# Western Australia Coastal Resilience Tool

## Exercises and Skills



### Part One: Basic Navigation

#### Exercise A. Getting there

- Start by going to the Western Australia Coastal Resilience project website:  
<https://coastalresilience.org/project/western-australia/>
  - Scroll down the page to learn more about the Coastal Resilience work going on in the region.
  - In the upper right-hand corner of the header banner, click **Mapping Portal** to launch the Coastal Resilience mapping tool (or enter URL: <http://maps.coastalresilience.org/>).
- Click on **Australia**, then scroll down and click on **Western Australia** or click on the pin on the map of **Western Australia**. Scroll through the text and click on the **Open Map** button to open the mapping tool.

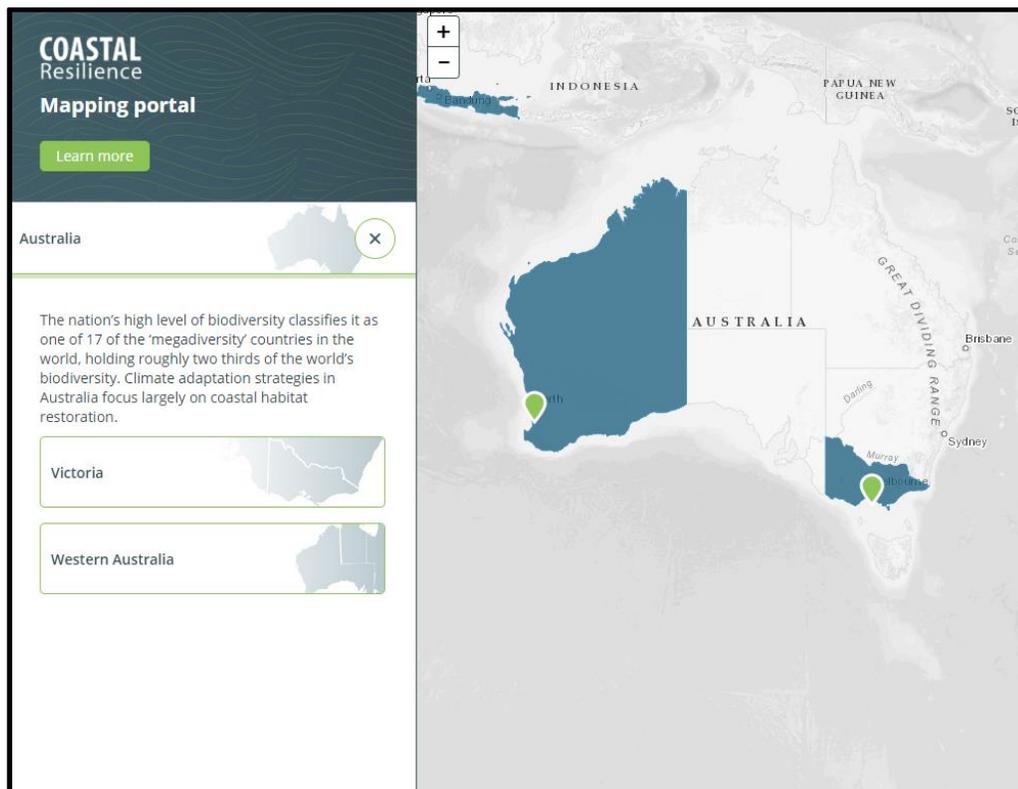


Figure 1. Accessing the Australia map at <https://maps.coastalresilience.org/>

## Exercise B. Basic orientation to framework and apps

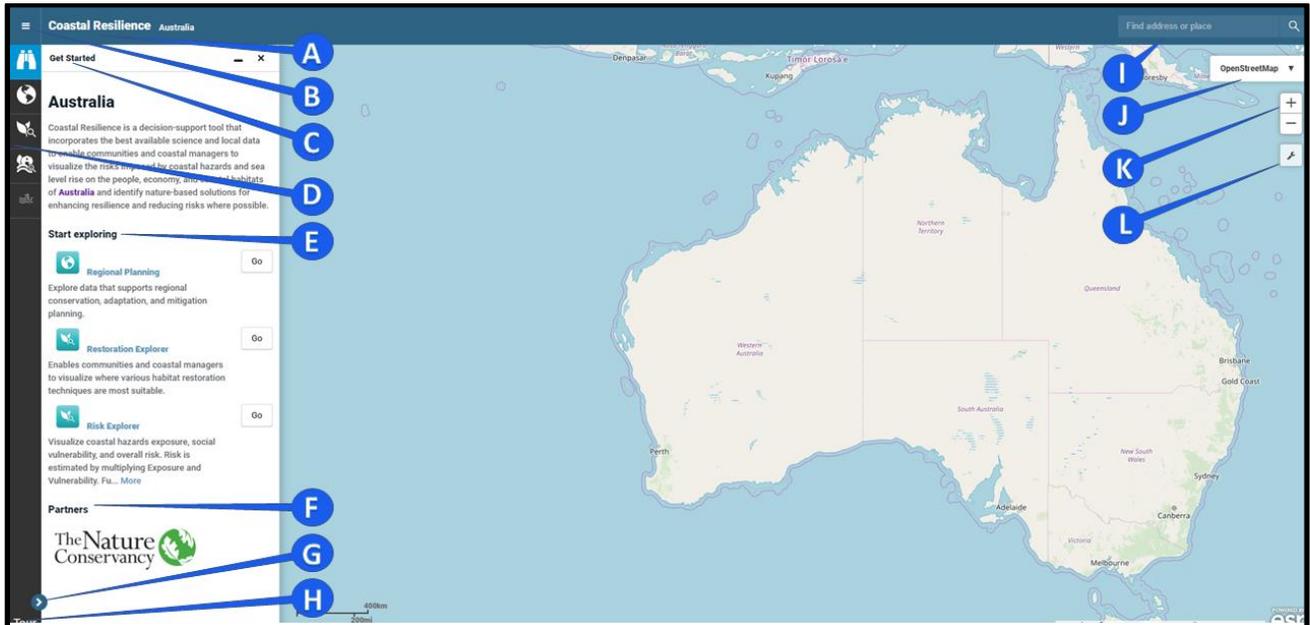


Figure 2. Orientation to the framework

- A. Clicking on **Coastal Resilience** will open a dropdown menu with links to The Nature Conservancy's home site, a legal disclosure, and other Coastal Resilience tool regions.
- B. This is a hamburger menu for exploring external links outside of the mapping tool.
- C. **Get Started**: This is the start menu that provides an introduction to the mapping application, specific links to apps in the left sidebar, and also partner and collaborator logos. Each item below the heading **Start exploring** contains a web mapping application, or "app."
- D. These are the Coastal Resilience tool apps. They are intended to address a specific coastal issue to inform conservation, mitigation, and/or adaptation planning. Click on a symbol to open an app. You can have multiple apps running at the same time when you use the minimize " \_ " option for an active app. Minimize (the icon will stay blue) and open other apps to view additional data and information. Minimize will leave data on the map, but close the app interface. If you do not minimize, apps and their data remain active until the "x" is clicked either in the app window or next to the app name on the left sidebar (the "x" is only present in the sidebar when the sidebar is expanded and more than one app is open). Use the close "x" to remove data from the map.
- E. These are quick links to the Coastal Resilience tool apps. Click on **Go** to open an app.
- F. Under **Partners** you can find organizations that partnered with The Nature Conservancy for the development of the Coastal Resilience tool.
- G. This arrow collapses and expands the app names to allow for a larger map area.
- H. Click **Tour** for an introduction to the map interface. Click on each number for feature information and close this window when finished.
- I. Go to the **Find address or place** search window in the top right corner of the map to find and zoom to a particular area on the map:
  - a. Start typing in your point of interest and you will get a list of available selections from a global address database.

[maps.coastalresilience.org/Australia](https://maps.coastalresilience.org/Australia)

- b. Choose the correct location from the dropdown menu.
  - c. Close the search window by clicking on the **X** icon.
- J. Click **Topographic** in upper right hand corner and select the **Imagery** basemap option. Note that other base maps are available here as well.
- K. Click the **plus sign [+]** button to zoom in and the **minus sign [-]** button to zoom out. Note that you can hold down the Shift key and left-click to draw a zoom box.
- L. This button opens the **Tools** dropdown menu. It includes the following options:
  - a. The **Measure** option allows you to measure a distance. Select the tool, then click on a point on the map. You can create several segments; when you are done you need to double-click to display the measurement. You can also measure an area by clicking on the first point again when finished creating a shape. Click the **Clear** button to close this tool.
  - b. **Zoom to Extent** will zoom to the full extent of the Eastern Shore of Virginia.
  - c. **Create Map** allows you to print the current extent and selected layers or save the map as an Adobe Portable Document Format (PDF).
  - d. Click on **Save & Share** to generate a link to the current map which can be copied and shared with colleagues.

## Apps in the Toolbox



### Regional Planning

The Regional Planning app includes supporting infrastructure, ecological, socioeconomic, and other data important for resilience, adaptation, and restoration planning. These layers may be used in combination with the other apps to identify and assess vulnerability and potential solutions for specific locations and resources.



### Restoration Explorer

The Restoration Explorer enables communities and coastal managers to visualize where various habitat restoration techniques are most suitable. This app is intended to help planners and coastal managers identify where habitat restoration could be most effective and help guide investments, permitting, and implementation at a regional scale.



### Risk Explorer

The Risk Explorer app allows users to visualize coastal hazards exposure, social vulnerability, and overall risk. Risk is estimated by multiplying Exposure and Vulnerability. Future risk can also be explored under various sea level rise scenarios. The Risk Explorer helps identify solutions and prioritize sites where habitat management and restoration may most reduce risk.



## Part Two: Risk Explorer

### Assessing Exposure and Vulnerability to Estimate Risk

#### *How to use the Tool: Assessing Risk*

- Click on the **Risk Explorer** app on the left or the **Go** button for the app in the **Get Started** menu.
- The default view is the combined **Final Risk Map** which is derived by multiplying Vulnerability by Exposure.
  - Future Risk due to rising sea levels can be explored visually by using the slider bar at the bottom of the interface to adjust the water level.
  - Sliding the **Water Rise** slider button adjusts the Final Risk Map to account for the selected amount of sea level rise.
- Exposure and Vulnerability can also be viewed separately by selecting how you would like to view the results. The Exposure map can also be adjusted to reflect sea level rise by using the **Water Rise** slider.
- Each of the variables used to create these maps can also be viewed individually by clicking on “Show Individual Risk Variables”
  - Click on **View Ranking Thresholds** for more information about how each variable was calculated and mapped. Click on **Hide Ranking Thresholds** to hide this additional information.
  - The Coastal Flood Risk is the only individual variable that can be adjusted to reflect future sea level rise.
- Opacity (or transparency) of the layers in this app can be adjusted by using the Opacity slider.

#### Exercise A. Characterizing the Exposure of a point of interest in the Peel-Harvey

★ **Exercise A Scenario:** *Much of the land around the Peel-Harvey estuary is low lying and you would like to consider how flooding is likely to affect nature reserves that you manage. What is the current level of exposure of the Austin Bay Nature Reserve? What about for coastal flood risk in particular? How is the level of coastal flood risk likely to change in the future?*

- Select the **Risk Explorer** app and its **Show only combined Exposure** option. Go to the **Find address or place** search window on the top right corner of the screen and type **Austin Bay Nature Reserve** and hit **Enter** or click the search result that comes up, then click the **X** to close the search result window.
  - Zoom in or out to adjust extent by clicking on the **plus sign [+]** or the **minus sign [-]** on the upper left or by using the mouse wheel.

- **Pan:** hold the left mouse button down and move the mouse in the direction you want to pan.
- Feel free to change the background from **Topographic** to **Imagery** if you find it helps to navigate.
- Navigate to the Austin Bay Nature Reserve.
  - Explore the overall exposure of the Nature Reserve and the areas just inland from the reserve.
  - Select various individual risk variables (erosion, runoff, coastal flooding, etc) and explore how they vary across the reserve.
  - Adjust **Opacity** as necessary to visualize exposure.
  - Select the **Coastal Flooding Risk** layer and explore how the exposure changes with various levels of sea level rise.
  - Leave the Risk Explorer open and open the Regional planning app by clicking the Globe icon on the left-hand menu. Navigate to Western Australia -> Vulnerability -> Roads and explore how flood risk is likely to impact the area inland from the reserve and if any roads exist that may be barriers to habitat migration.

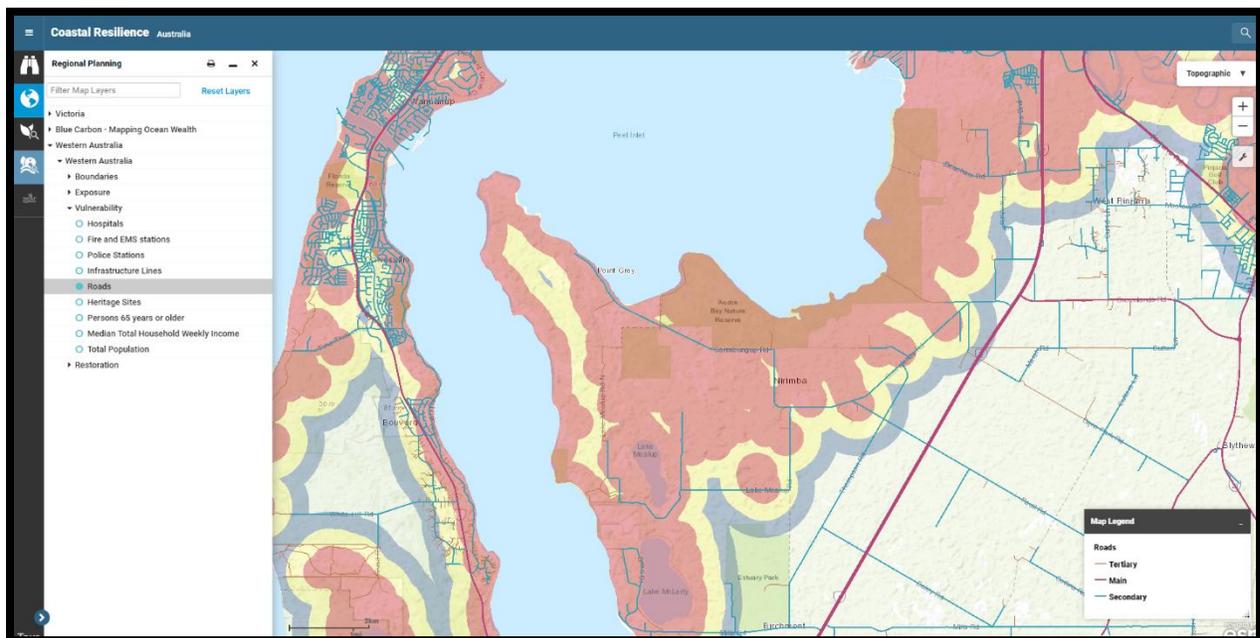


Figure 3: Screenshot of how the Coastal Resilience tool might look during exercise 2.



## Part Three: Save and Share

### Easily share a live bookmark of your scenario maps

- Save and Share is a live bookmark that saves the zoom extent, basemap, and all selections you made within all open apps
- Once shared with someone, they can begin working where you leave off and send you an updated bookmark.

#### Exercise A. Creating your own Save and Share Bookmark

★ **Exercise A Scenario:** *You would like to create an interactive map for a conservation partner that is unfamiliar with how to use GIS. You would like for them to be able to explore future sea level rise impacts on the protected areas around the Peel Harvey.*

- Click on the wrench icon on the right under the zoom in/out buttons, select Save and Share, and copy the permalink into an email or message to a colleague.



**Tool Feedback:** We developed the beta version of the Risk Explorer for use in the Conservation Action Planning Process as well as to support future resilience planning processes in the Peel Harvey region. Please let us know how the scale, data sources and visualizations could be adapted or improved to improve their usability.

# Western Australia Coastal Resilience Tool

## Exercises and Skills



### Part Four: Restoration Explorer App

#### Identifying and Planning for Habitat Restoration

##### ***How to use the Tool: Restoration Explorer: Wetlands and Blue Mussels***

- Click on the **Restoration Explorer** app on the left or the **Go** button for the app in the **Get Started** menu. The app shows areas that are suitable for wetland and mussel restoration using available data.
- From the dropdown menu, select a Habitat type for consideration, *Wetlands* or *Blue Mussels*. The default view is the combined **Final Suitability Map** which is derived by adding the scores for each of the individual suitability indicators.
  - For *Wetlands*, the future **Restoration Suitability** associated with rising sea levels can be explored visually by using the slider bar at the bottom of the interface to adjust the water level.
  - Sliding the **Water Rise** slider button adjusts the Final Suitability Map to account for the selected amount of sea level rise.
- Each of the variables used to create the Suitability Map can also be viewed individually by clicking on **“Select a suitability variable to view”**.
  - Click on **View Ranking Thresholds** for more information about how each variable was calculated and mapped. Click on **Hide Ranking Thresholds** to hide this additional information.
  - The Potential to accommodate coastal flooding is the only individual variable that can be adjusted to reflect future sea level rise.
- Opacity (or transparency) of the layers in this app can be adjusted by using the Opacity slider.
- The **Blue Mussel Restoration Explorer** operates in a similar fashion.
  - The default view is the combined **Final Suitability Map** for *Blue Mussels* which is derived by adding the scores for each of the individual suitability indicators.
    - You can toggle between **Wet** and **Dry** Seasons to explore how seasonal rainfall affects site suitability for *Blue Mussel* restoration.
- Each of the variables used to create the Suitability Map can also be viewed individually by clicking on **“Show information on individual suitability variables”**.
  - Click on **View Ranking Thresholds** for more information about how each variable was calculated and mapped. Click on **Hide Ranking Thresholds** to hide this additional information.

## Exercise A. Prioritizing Wetland Restoration Projects at a regional scale

★ **Exercise A Scenario:** Sea level rise will likely impact coastal wetlands by inundating existing wetlands. How is this likely to affect restoration planning in the Peel-Harvey? Where can wetland restoration be used to increase resilience of the system under future sea level rise scenarios? Are there zoning or marine regulations that might impact where we choose to do restoration projects?

- Select the **Restoration Explorer** app and its **Show final suitability** option.
  - Zoom in or out to adjust extent to by clicking on the **plus sign [+]** or the **minus sign [-]** on the upper left or by using the mouse wheel.
  - **Pan:** hold the left mouse button down and move the mouse in the direction you want to pan.
  - Feel free to change the background from **Topographic** to **Imagery** if you find it helps to navigate.
- Zoom to an extent that show the shoreline of the Peel-Harvey estuary.
  - Explore the overall Wetland Restoration Suitability of Peel-Harvey estuary coastline and the areas that are just upland from the foreshore.
  - Select various individual suitability variables (soil waterlog potential, wetland proximity, protected lands proximity, potential to reduce runoff, potential to accommodate coastal flooding) and explore how they vary across the estuary.
  - Adjust **Opacity** as necessary to visualize exposure.
  - Select the **Potential to Accommodate Coastal Flooding** layer and explore how this changes with various levels of sea level rise.
- Now let's consider how navigation restrictions might impact restoration site suitability.
  - Leave the Restoration Explorer open and open the Regional planning app by clicking the Globe icon on the left-hand menu.
  - Navigate to Western Australia -> Restoration -> Navigable Water Regulations and explore how navigation regulations might impact the feasibility of doing restoration in suitable areas.

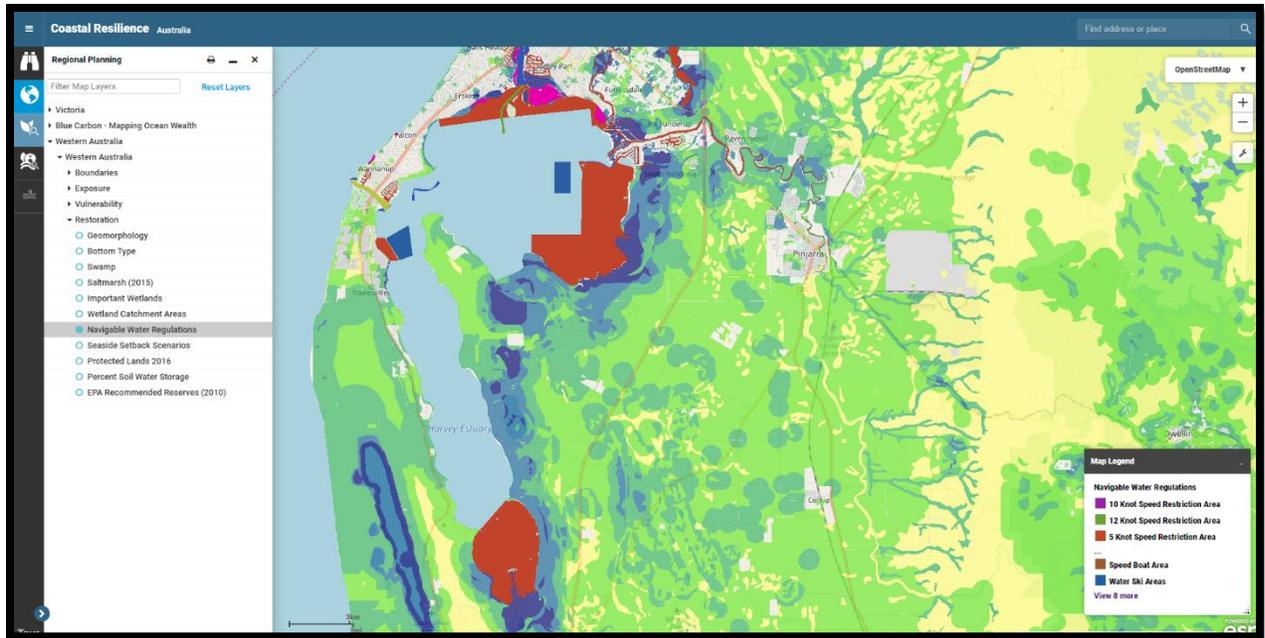


Figure 4. Screenshot of the overlays for one of the scenarios in Exercise A.

## Exercise B: Using the Restoration Explorer in combination with the Risk Explorer

★ **Exercise B Scenario:** Wetlands help stabilize shorelines and can provide shoreline stabilization benefits even in the face of sea level rise.

On your own, use the Restoration Explorer and Risk Explorer to identify a location that is suitable for wetland restoration in a location that is likely persist in the future. Create a shareable map of your location.

Next, use the Restoration Explorer to determine if it would be suitable to site a Blue Mussel restoration project adjacent to the wetland restoration project.



## Part Five: Technical Skills and Implementation

### Technical Skills Completed

- Ability to assess risk (exposure and vulnerability) to specific places or infrastructure due to a range of flooding scenarios based on sea level rise scenarios.
- Ability to identify areas that are currently undeveloped dry land but that could become salt marsh under future sea-level rise scenarios.
- Ability to identify areas suitable for wetland and/or blue mussel restoration and consider factors that limit project feasibility.
- Ability to identify areas where nature-based approaches such as wetland restoration can be used to reduce risk.

### Implementation:

- You can now use the Risk Explorer app to help guide stakeholder workshops or conversations around community socio-economic vulnerability to permanent inundation among a range of projected sea-level rise scenarios.
- You can now create a meaningful map that can help clearly communicate to decision-makers and stakeholders that the impacts of sea-level rise on storm surge are not uniform and vary based on place. For example, SLR may have a greater impact on areas which have a larger tidal range.
- You can now use the Restoration Explorer app to help guide planning processes around using coastal restoration to help make your community more resilient.
- You can use the “Save and Share” feature to work collaboratively with colleagues to get input on an analysis or create a map to help make the case for a project proposal.



**Tool Feedback:** We developed the beta versions of the Risk and Restoration Explorers for use in the Conservation Action Planning Process as well as to support future resilience planning processes in the Peel Harvey region. Please let us know how the scale, data sources and visualizations could be adapted or improved to improve their usability.