Build Accessible Web Apps with ArcGIS Maps SDK for JavaScript and Calcite Design System

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2024 ESRI DEVELOPER SUMMIT

Agenda

Build accessible web apps

- Introduction to accessibility
- Web Content Accessibility Guidelines (WCAG)
- Accessibility with Maps SDK for JS and Calcite
- Build accessibility into mapping apps
- Tools and Resources

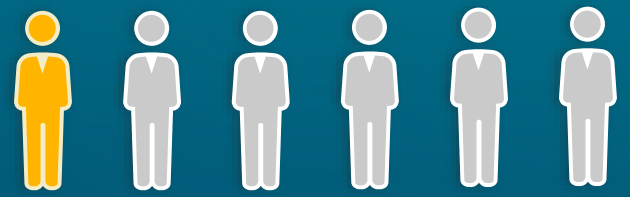
Introduction to accessibility

Kelly Hutchins

Who are we designing for?

Quick facts on accessibility

- 12.7% of Americans have a disability [1]
- 47.1% of Americans over 75 years of age have a disability [1]
- 1.3. billion people worldwide experience a significant disability [2]



1 in 6 people

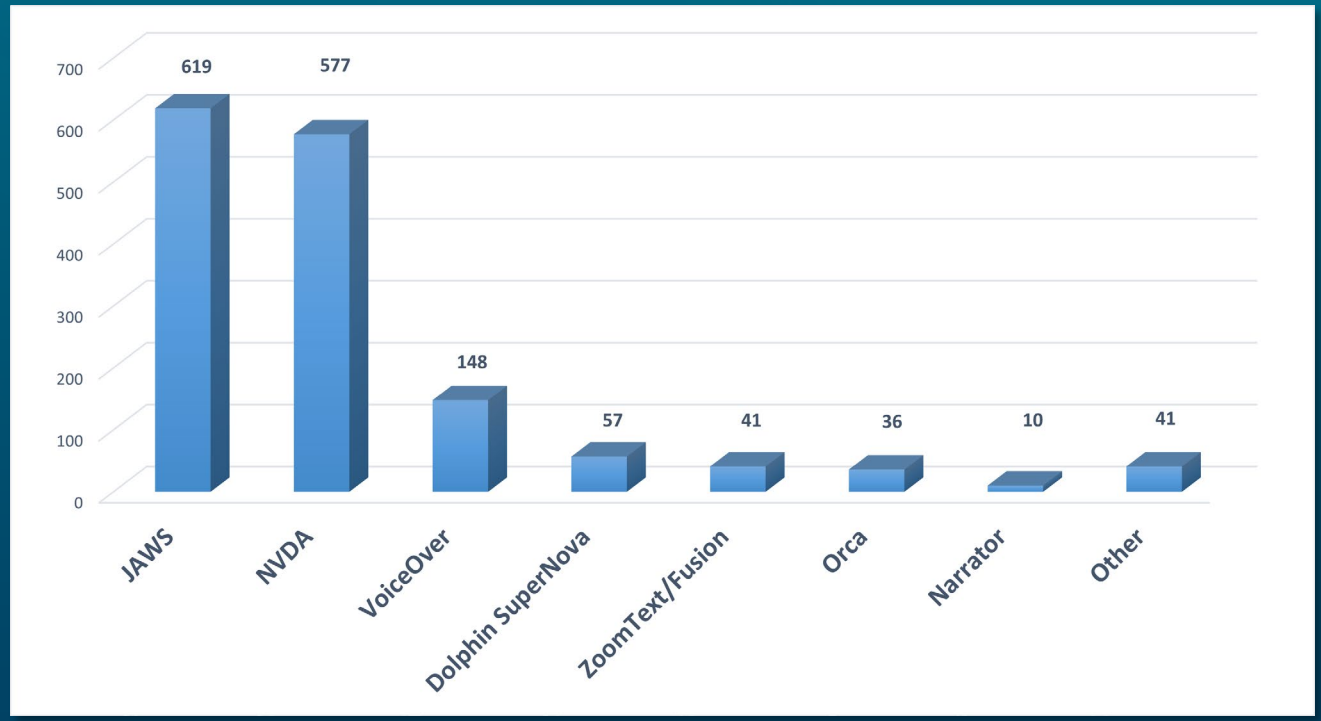
[1] 2021 American Community Survey

[2] World Health Organization

Screen readers

WebAIM's 2024 survey results

- JAWS is the primary desktop screen reader, but NVDA is a close second.
- Chrome is the most used browser for screen readers.
- Nearly 72% of screen reader users rated their internet proficiency as advanced.

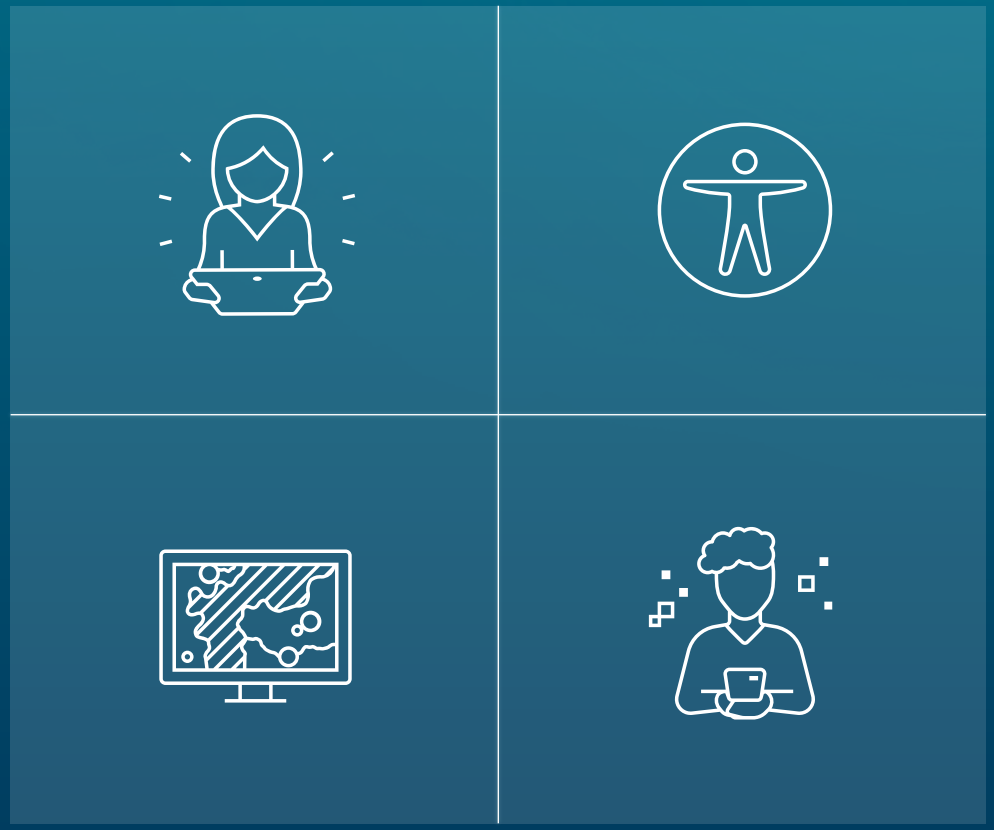


Source: WebAIM Screen Reader User Survey #10 Results

Benefits to the web

Make an impact with accessibility

- Reach a broader audience
- Reduce the risk of legal implications
- Develop an innovative mindset
- Improve reputation
- Reduce load times



Web Content Accessibility Guidelines (WCAG)

Kitty Hurley

Web standards

Web Content Accessibility Guidelines (WCAG) 2.2

- Success Criterion
  1. **P**erceivable
  2. **O**perable
  3. **U**nderstandable
  4. **R**obust
- Levels
  - **A**: Basic
  - **AA**: Desirable (Many organizations)
  - **AAA**: Comprehensive

WCAG examples

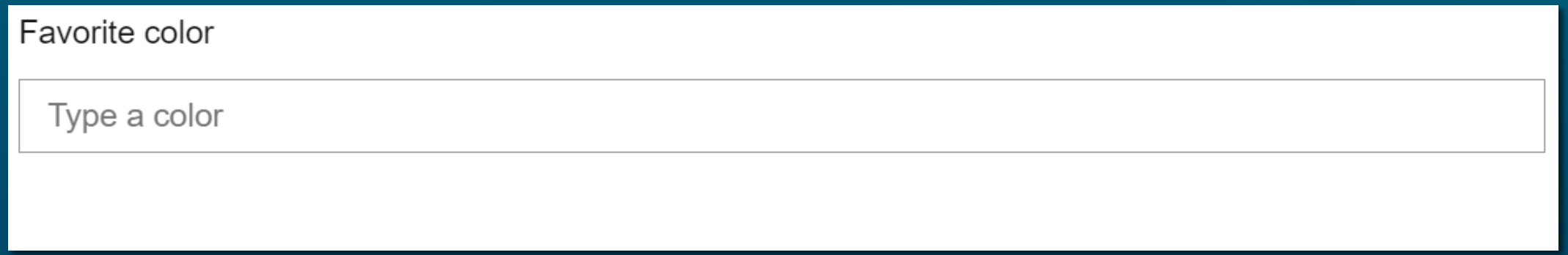
Levels and their meaning

Level	Success Criterion	Description
A	1.4.1: Use of Color	Color is not used as the only visual means of conveying information, indicating an action, prompting a response, or distinguishing a visual element.
AA	1.4.3: Contrast (Minimum)	The visual presentation of text and images of text has a contrast ratio of at least 4.5 to 1.
AAA	1.4.6: Contrast (Enhanced)	The visual presentation of text and images of text has a contrast ratio of at least 7 to 1.

1.4.1: Use of Color

Level A

Color is not used as the only means of conveying information, indicating an action, prompting a response, or distinguishing a visual element.



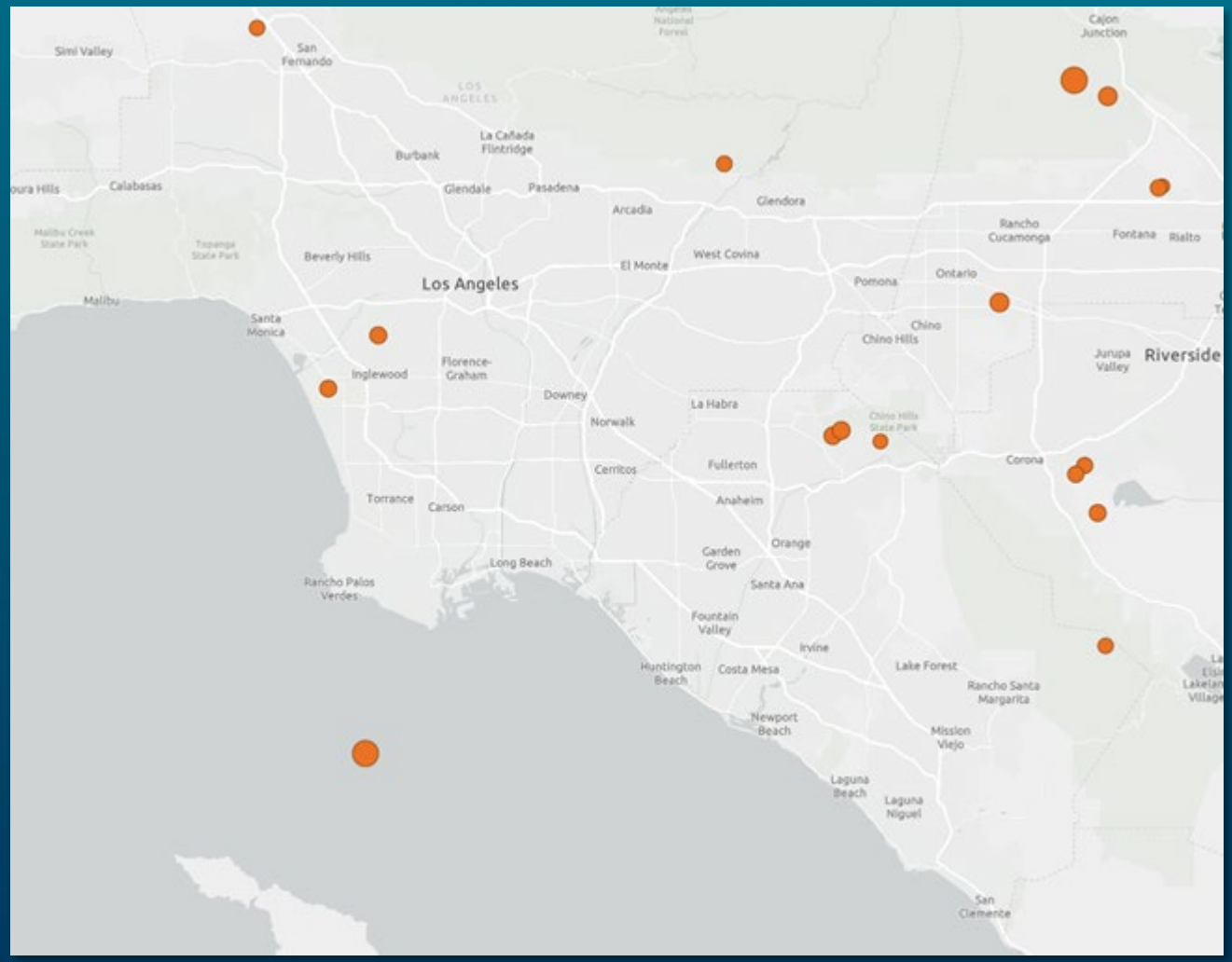
1.4.3: Contrast (Minimum)

Level AA

The visual presentation of text and images of text has a contrast ratio of at least 4.5 to 1.

Map contrast ranges:

- 4.65 to 1
- 6.11 to 1



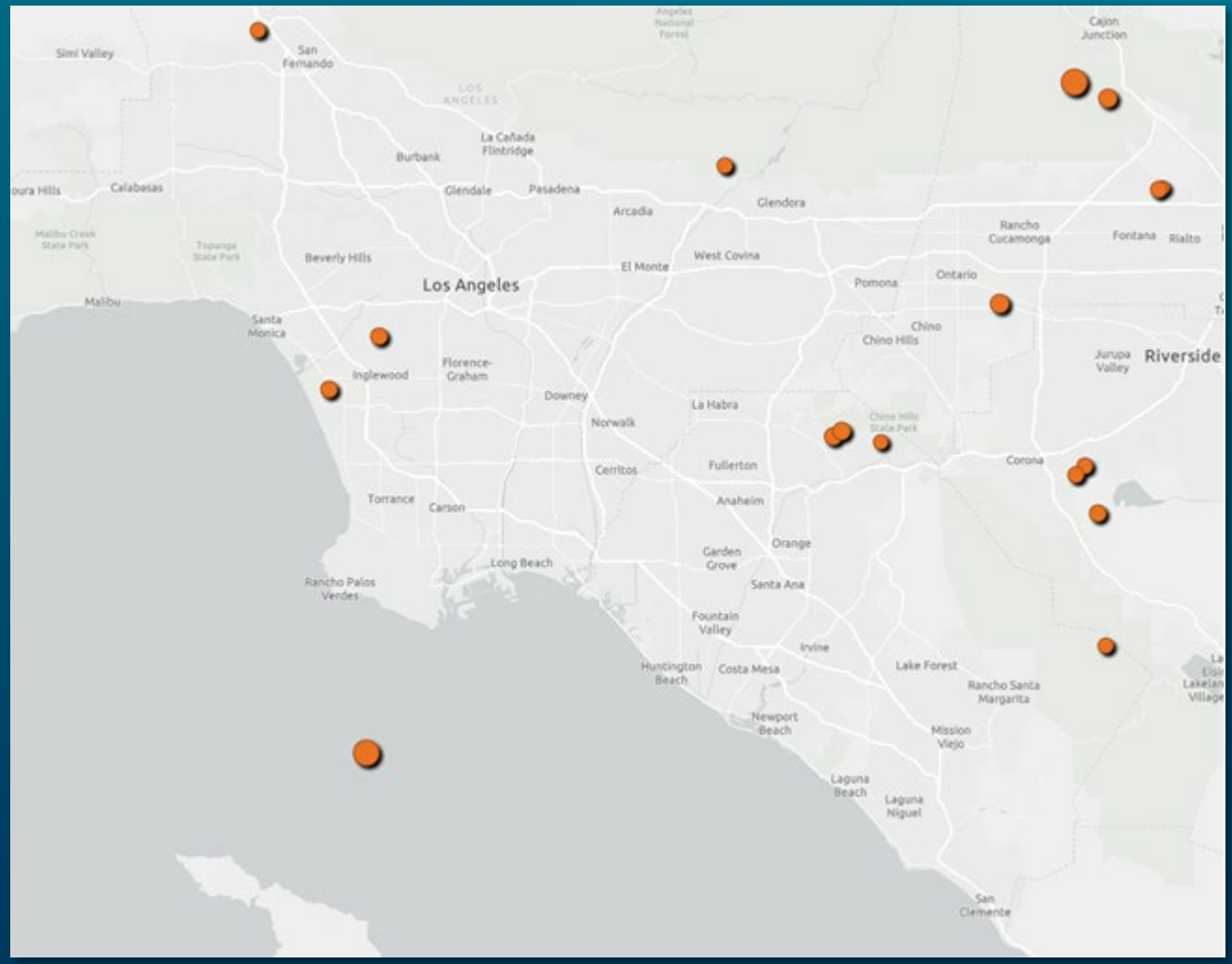
1.4.6: Contrast (Enhanced)

Level AAA

The visual presentation of text and images of text has a contrast ratio of at least 7 to 1.

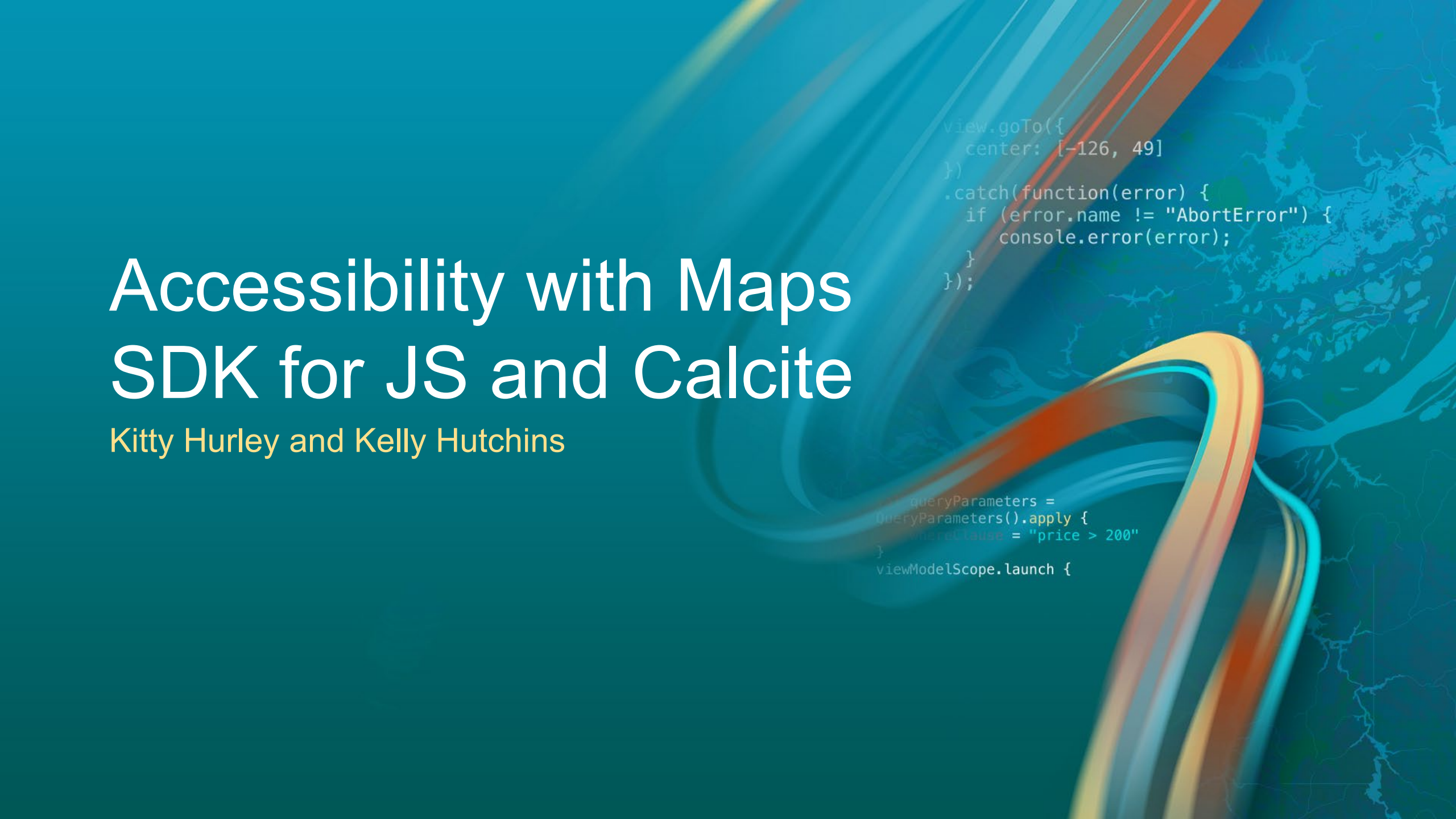
Map contrast ranges:

- 13.92 to 1
- 18.26 to 1



Accessibility with Maps SDK for JS and Calcite

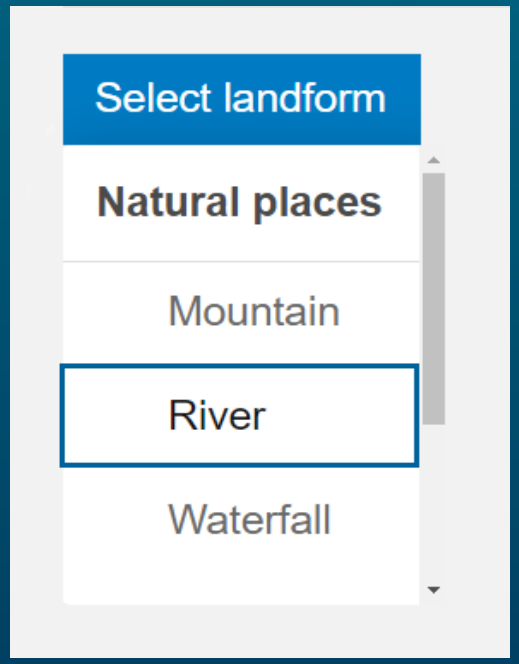
Kitty Hurley and Kelly Hutchins

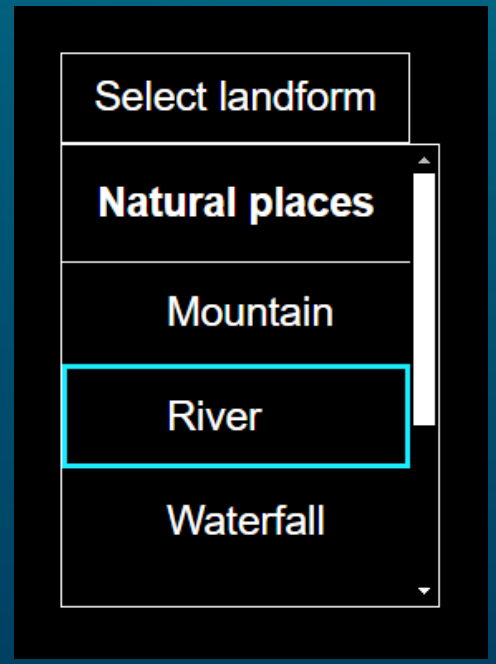


Calcite accessibility

Accessibility features with Calcite

- Reduced motion support
- High contrast
- Keyboard navigation
- Live regions

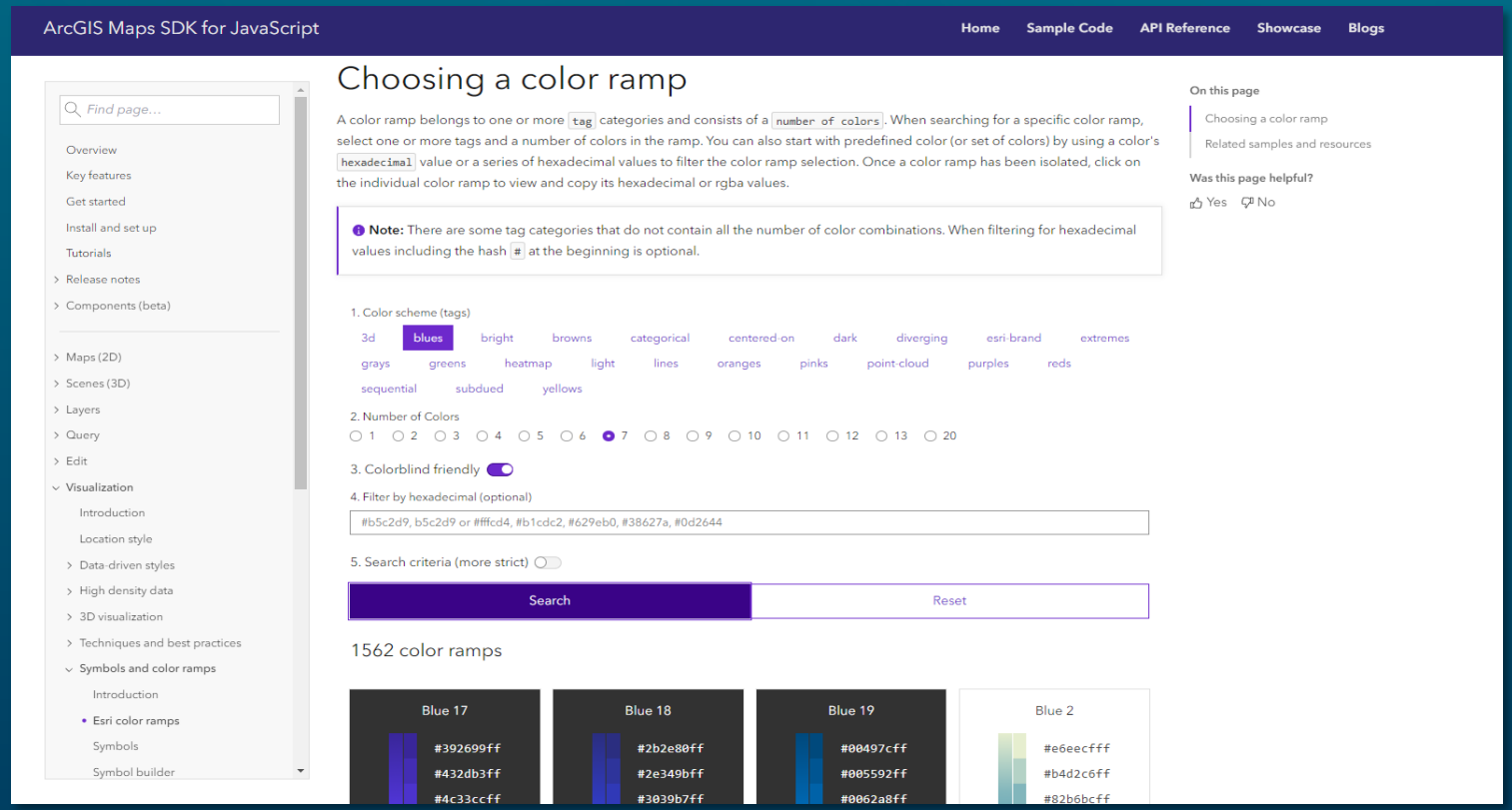




Maps SDK for JS accessibility

Accessibility features with Maps SDK for JS

- Colorblind friendly color ramps
- MapView and SceneView keyboard navigation
- Color contrast theme support
- Popup focus
- Widget
  - Roles and built on Calcite



MapView keyboard navigation

2D maps

Key	MapView Behavior
Arrow keys	Nudge the map to the left, right, up or down.
N	Adjust the map to point north.
A	Rotate the map counterclockwise.
D	Rotate the map clockwise.
+	Incrementally zoom in from the center of the map.
-	Incrementally zoom out from the center of map.

SceneView keyboard navigation

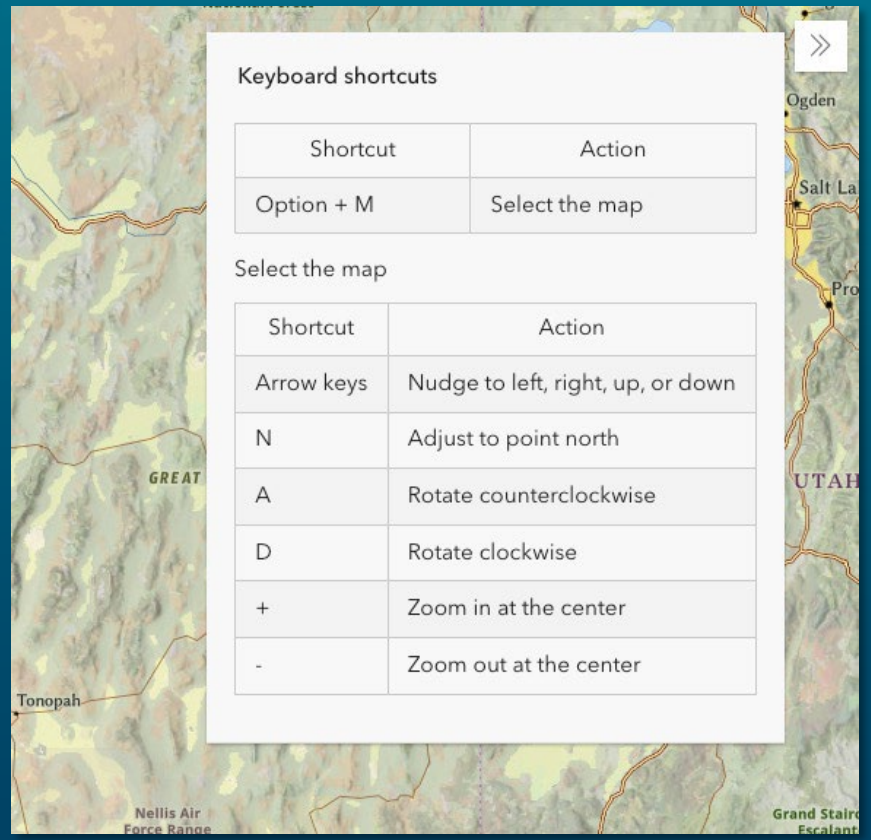
3D maps

Key	SceneView Behavior
Arrow keys	Nudge the view to the left, right, up or down.
P	Adjust the camera to perpendicular of the data in the view.
N	Adjust the view to point north.
W	Tilt the camera up.
A	Rotate the camera counterclockwise.
S	Tilt the camera down.
D	Rotate the camera clockwise.
J	In a global scene, move down – closer to the view.
U	In a global scene, move up – higher from the view.
+	Incrementally zoom in from the center of the map.
-	Incrementally zoom out from the center of map.

Keyboard Navigation Component

2D and 3D

- Web component
  - Use in your own apps
- https://github.com/Esri/instant-apps-components



Build accessibility into mapping apps

Kitty Hurley and Kelly Hutchins

Descriptions

Set an aria-describedby to your map

- aria-describedby identifies the element, or elements used to describe its purpose.
- Use to provide a descriptive label for your UI

```
<div id="viewDiv"></div>
<p id="map-description" class="sr-only"></p>

<script>
  const map = new WebMap({
    portalItem: {
      id: "f2e9b762544945f390ca4ac3671cfa72"
    }
  });

  const view = new MapView({
    map,
    container: "viewDiv"
  });

  view.when(() => {
    document.querySelector("#map-description").innerText = map.portalItem.snippet;
    view.container.setAttribute("aria-describedby", "map-description");
    const rootNode = document.getElementsByClassName("esri-view-surface");
    for (let i = 0; i < rootNode.length; i++) {
      rootNode[i].setAttribute("aria-describedby", "map-description");
    }
  });
</script>
```

Live regions

Dynamic content updates

- Live regions provide dynamic context as an app's state changes, such as when your map has loaded
- Live regions can be set to "off" (default), "polite", or "assertive"
  - Assertive should only be used for time-sensitive or crucial notifications

```
<body aria-describedby="map-loaded">
  <div id="mapView"></div>
  <p id="map-loaded" aria-live="polite"></p>
</body>
```

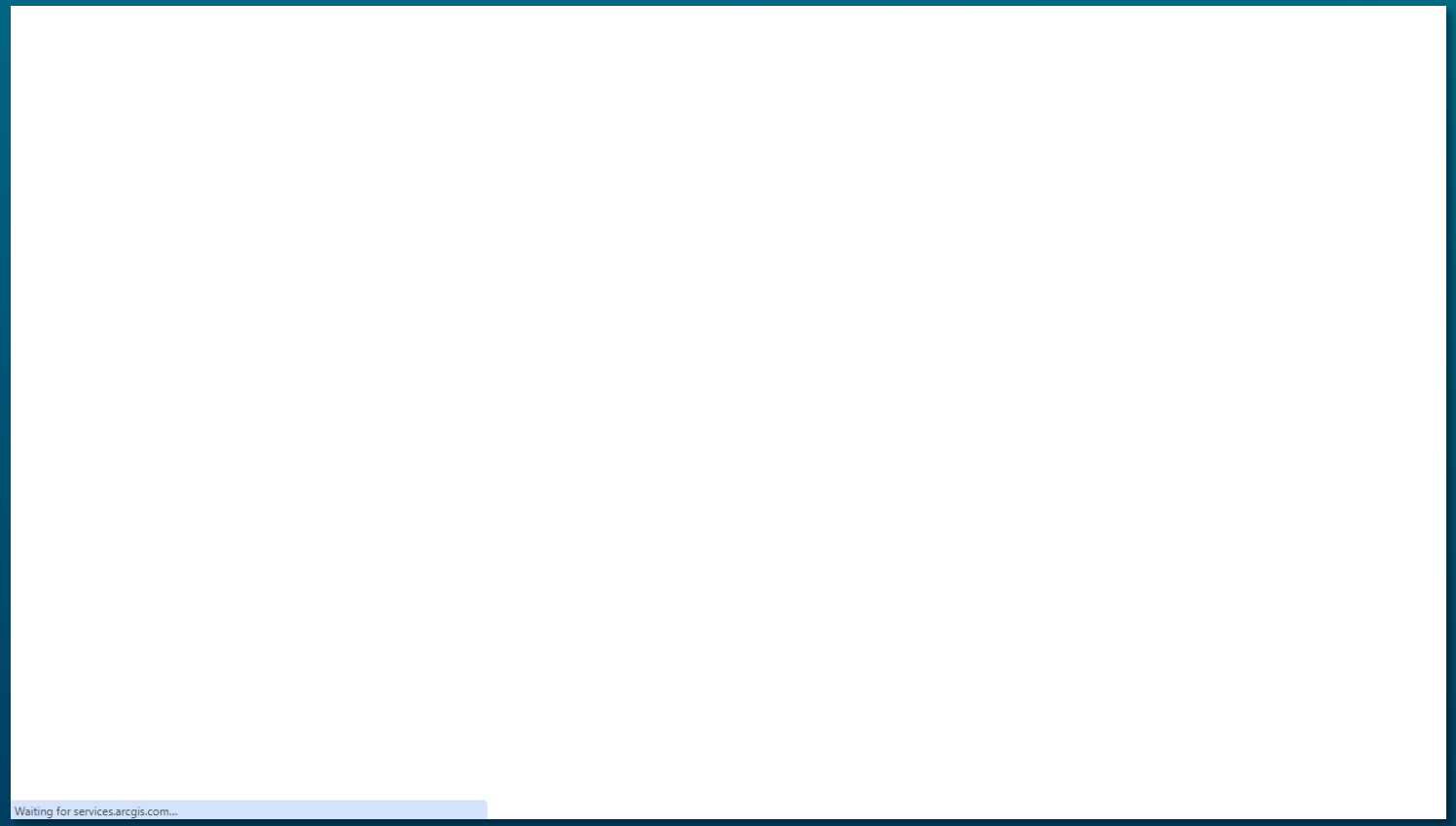
Description and Live region

Code sample

```
<div id="viewDiv"></div>
<p id="map-loaded" class="sr-only" aria-live="polite"></p>
<p id="map-description" class="sr-only"></p>

<script>
  const map = new WebMap({
    portalItem: {
      id: "f2e9b762544945f390ca4ac3671cfa72"
    }
  });

  const view = new MapView({
    map,
    container: "viewDiv"
  });

  view.when(() => {
    document.querySelector("#map-description").innerText = map.portalItem.snippet;
    document.querySelector("#map-loaded").innerText = `${map.portalItem.title} map has loaded.`;
    view.container.setAttribute("aria-describedby", "map-description");
    const rootNode = document.getElementsByClassName("esri-view-surface");
    for (let i = 0; i < rootNode.length; i++) {
      rootNode[i].setAttribute("aria-describedby", "map-description");
    }
  });
</script>
```

Description and Live region demo

Demo with JAWS transcript



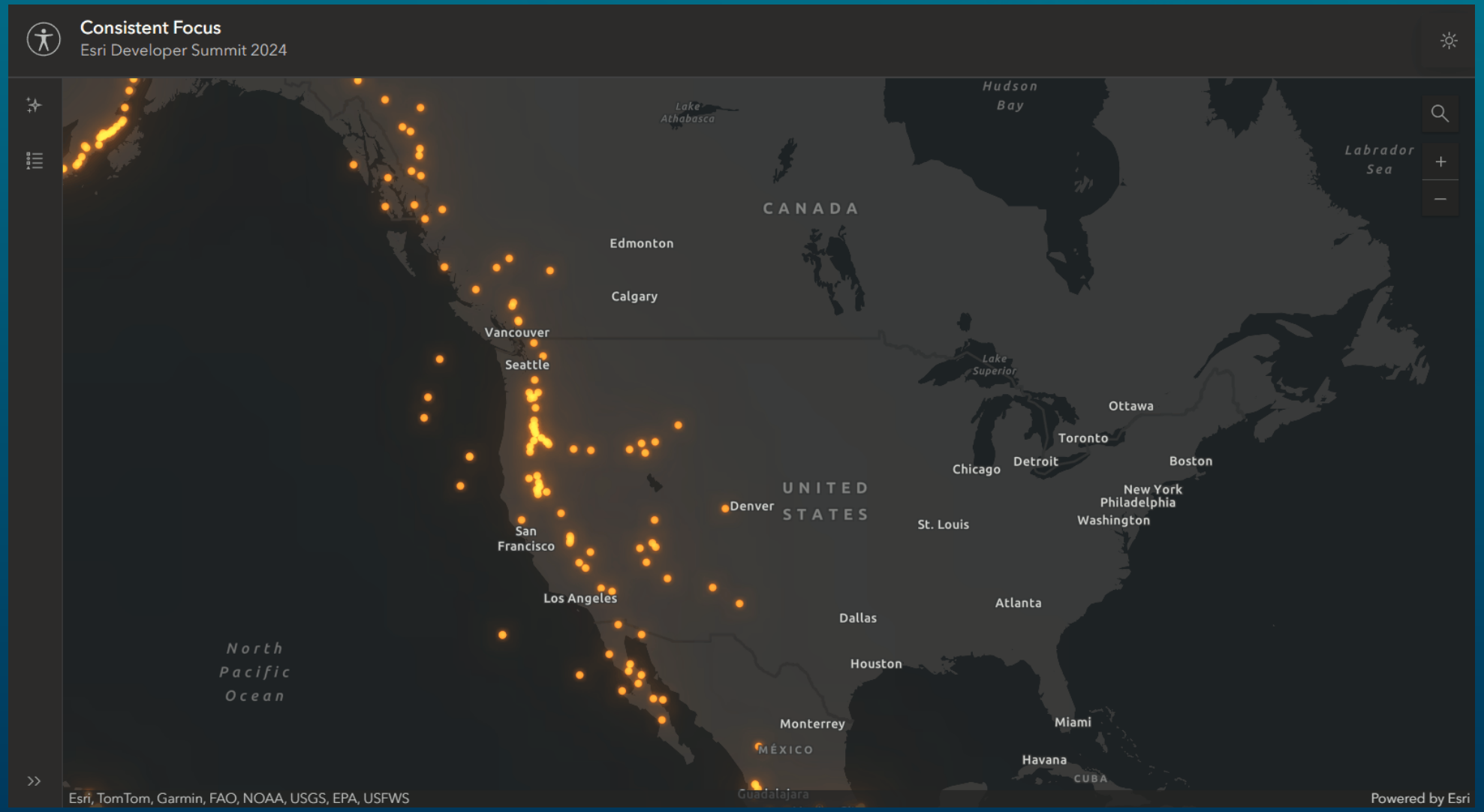
- Map Description and Live Regions
- Accidental Deaths map has loaded. Map description
- Toggle mode toggle button. To toggle the state press spacebar.
- The map summarizes the count, and rates, of accidental deaths in each state.

Consistent focus

Sequential navigation through an app

- Navigate an app sequentially to preserve meaning and operability
  - Mobility impairments, Cognitive impairments, such as ADHD
- Ensure the visual presentation has a contrast ratio of 3 to 1

Consistent focus demo



Consistent focus with Calcite code

Calcite action bar and panel focus

```
// Active action
const handleActionBarClick = ({ target }) => {
  if (target.tagName !== "CALCITE-ACTION") {
    return;
  }

  if (activeWidget) {
    activeActionEl = document.querySelector(`[data-action-
id=${activeWidget}]`).removeAttribute("active");
    activePanelEl = document.querySelector(`[data-panel-id=${activeWidget}]`).closed = true;
  }

  const nextWidget = target.dataset.actionId;
  if (nextWidget !== activeWidget) {
    document.querySelector(`[data-action-id=${nextWidget}]`).active = true;
    document.querySelector(`[data-panel-id=${nextWidget}]`).closed = false;
    activeWidget = nextWidget;
    document.querySelector(`[data-panel-id=${nextWidget}]`).setFocus();
  } else {
    activeWidget = null;
  }
};

actionBarEl.addEventListener("click", handleActionBarClick);

// Panel interaction
const panelEls = document.querySelectorAll("calcite-panel");
  for (let i = 0; i < panelEls.length; i++) {
  panelEls[i].addEventListener("calcitePanelClose", () => {
    document.querySelector(`[data-action-id=${activeWidget}]`).closed = true;
    document.querySelector(`[data-action-id=${activeWidget}]`).active = false;
    document.querySelector(`[data-action-id=${activeWidget}]`).setFocus();
    activeWidget = null;
  });
}
```

Consistent focus with Map widgets code

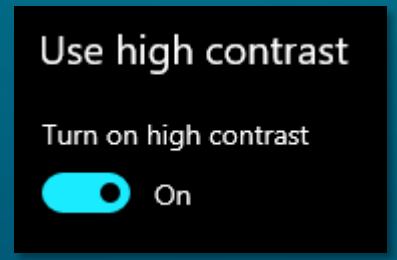
Map widget focus

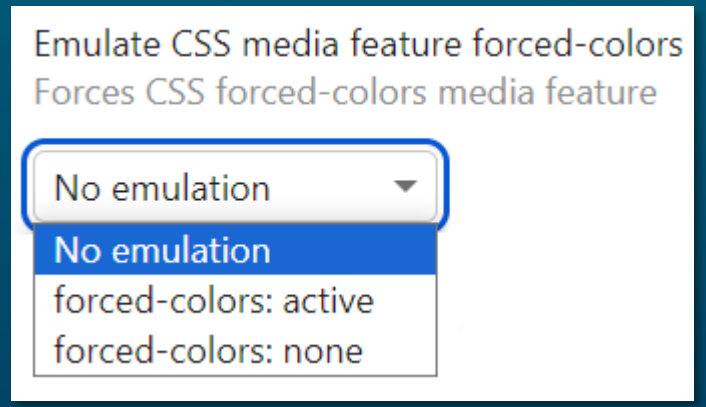
```
// Handle search/popup focus
const searchEl = document.querySelector("arcgis-search");
let abortController;

searchEl.addEventListener("searchComplete", onSearchComplete);

async function onSearchComplete() {
  const reactiveUtils = await $arcgis.import("esri/core/reactiveUtils");

  abortController?.abort();
  const { signal } = (abortController = new AbortController());
  const view = mapEl.view;

  // When the popup is visible set focus on it.
  await reactiveUtils.whenOnce(() => view.popup.visible, signal);
  view.popup.focus();

  // And when the popup is closed move the focus back to the search wiget.
  await reactiveUtils.whenOnce(() => !view.popup.visible, signal);
  searchEl.focusSearch();

}
```

High contrast

Adapt screen to distinguish elements

- Allows the user to increase contrast of elements on their screen to more easily read text and distinguish between different elements.
  - Visual impairments, such as color blindless or low vision
- Enabling forced-colors
  - Operating system setting
  - Browser tools
    - Chrome





High contrast demo

Dynamically change the basemap and layer

High contrast code

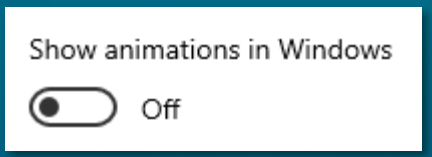
forced-colors CSS media feature

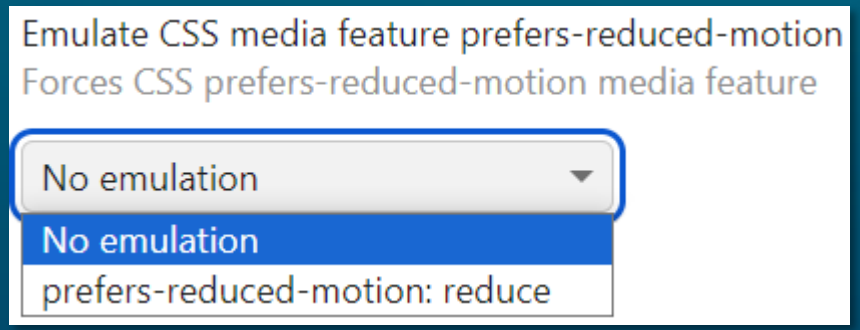
```
// High contrast support with basemap and layer effects
const contrastMedia = matchMedia("(forced-colors: active)");
function checkContrastMedia() {
  if (mode == "dark") {
    mapEl.basemap = contrastMedia.matches ? highContrastDarkBasemap : "dark-gray-vector";
    contrastMedia.matches ? earthquakeLayer.effect = "bloom(1.5, 0.5px, 0.1)" : earthquakeLayer.effect =
"bloom(0, 0px, 0)";
  } else {
    mapEl.basemap = contrastMedia.matches ? highContrastLightBasemap : "gray-vector";
    contrastMedia.matches ? earthquakeLayer.effect = "drop-shadow(3px, 1px, 3px)" :
earthquakeLayer.effect = "drop-shadow(0px, 0px, 0px)";
  }
}

// Event listeners on map load and high contrast media query
mapEl.addEventListener("arcgisViewChange", checkContrastMedia);
contrastMedia.addListener(checkContrastMedia);
```

Animations and reduced motion

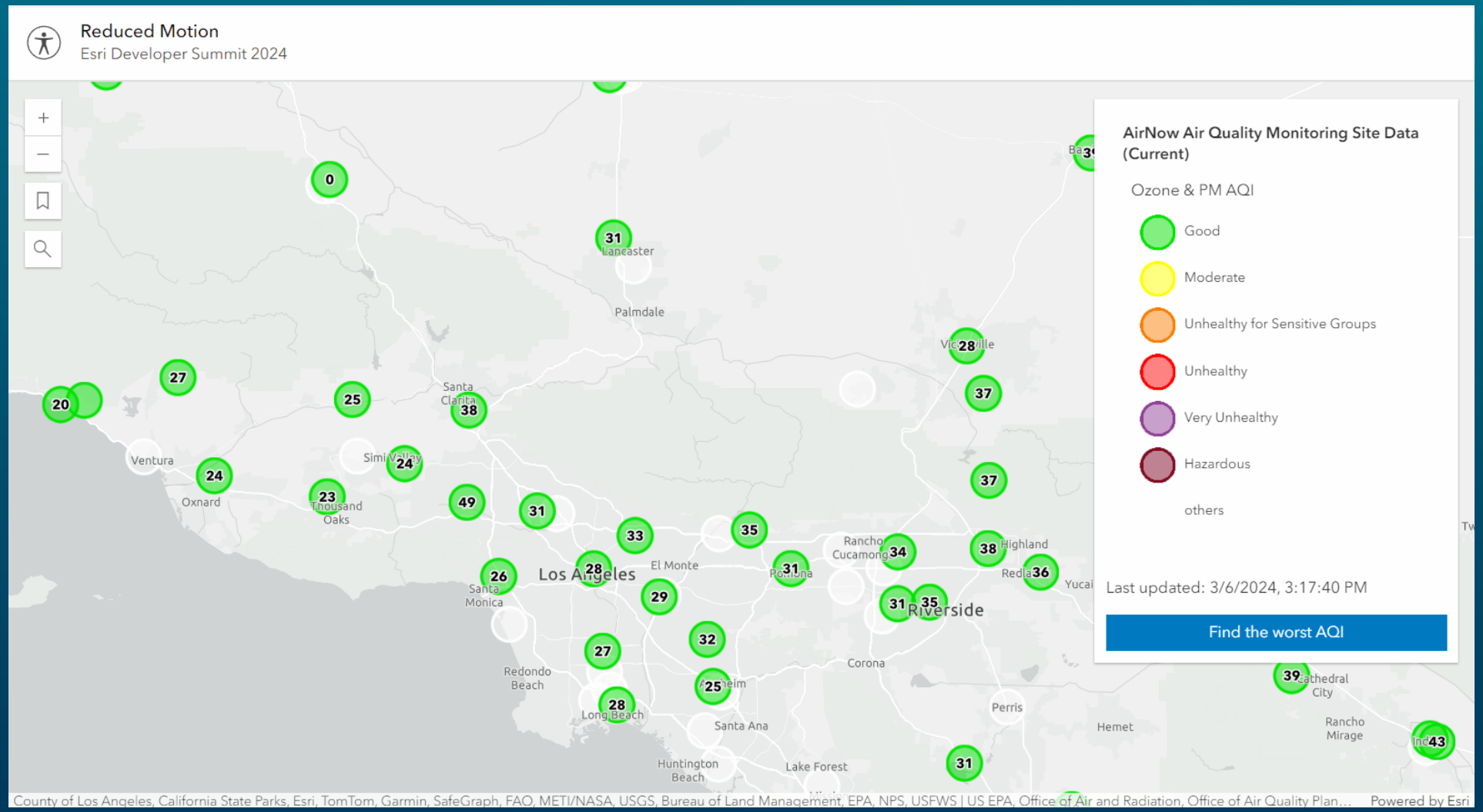
prefers-reduced-motion

- Removes, reduces, or replaces motion-based animation
  - Vestibular motion, such as inner ear movement from the head controlling balance
- Enabling prefers-reduced-motion
  - Operating system setting
  - Browser tools
    - Chrome





Animations and reduced motion demo



GoToOverride

Modify the goTo function to account for reduced animation

```
function overrideGoToOptions(view, goToParams) {

  const { target, options } = goToParams;

  return view.goTo(target, {
    ...options,
    animate: !isReduced(),
  });

}
```

```
const view = new MapView({
  container: "viewDiv",
  map,
  popup: {
    goToOverride: overrideGoToOptions
  },
  center: [-117.87, 34.31],
  zoom: 8,
  constraints: {
    minScale: 9000000
  }
});
```

```
view.ui.add(new Expand({
  view,
  group: "left",
  content: new Bookmarks({
    view,
    visibleElements: {
      thumbnail: false
    },
  goToOverride: overrideGoToOptions })
}), "top-left");
```

```
view.ui.add(new Expand({
  view,
  group: "left",
  content: new Search({
    view,
    goToOverride: overrideGoToOptions
  })
}), "top-left");
```

Check if reduced motion matches

matchMedia prefers-reduced-motion

```
function isReduced() {
  return window.matchMedia('(prefers-reduced-motion: reduce)').matches;
}
```

```
if (worst) view.goTo(worst, {
  animate: !isReduced()
});
```

```
// Only play the animation if AQI is greater than 151 and user does not have reduced motion
expression: `$feature.OZONEPM_AQI_SORT >= 151 && !${isReduced()}`
```

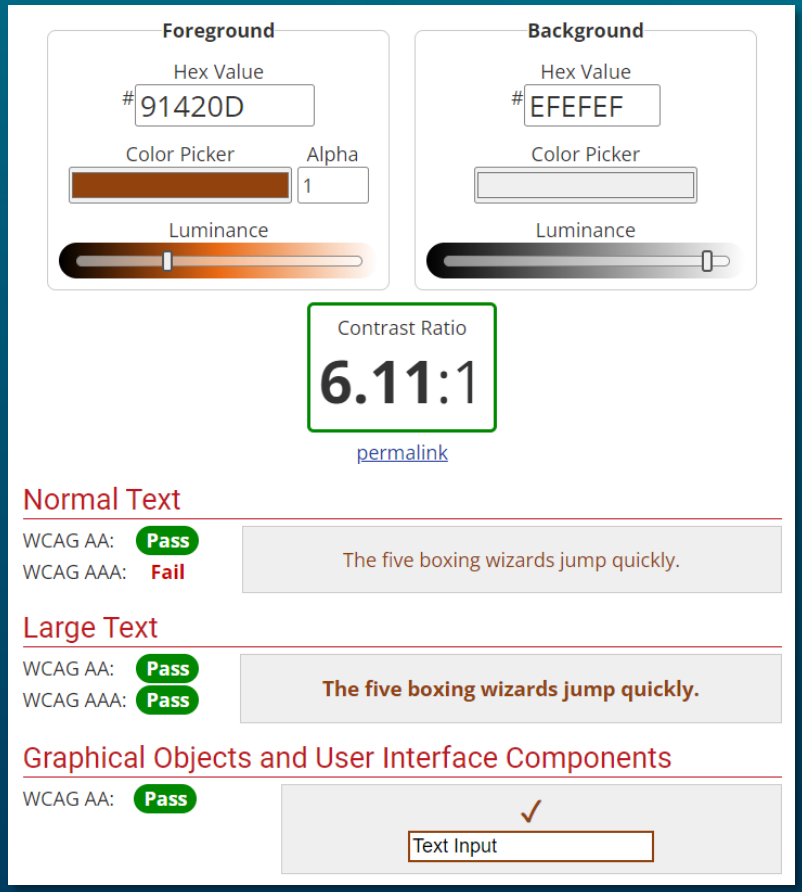
Tools and Resources

Kitty Hurley and Kelly Hutchins

Accessibility tools

Lean into accessibility

- Color Contrast Checker by WebAIM
- Contrast Grid by Eightshapes
- Browser extensions
  - Colorblindly
  - Axe by Deque
  - WAVE by WebAIM
  - Accessibility Insights by Microsoft
  - Accessibility Checker by Silktide



More accessibility tools

Lean into accessibility

- Browser accessibility features
  - Chrome
  - Firefox
- MagentaA11y
- Dev specific introduction to accessibility

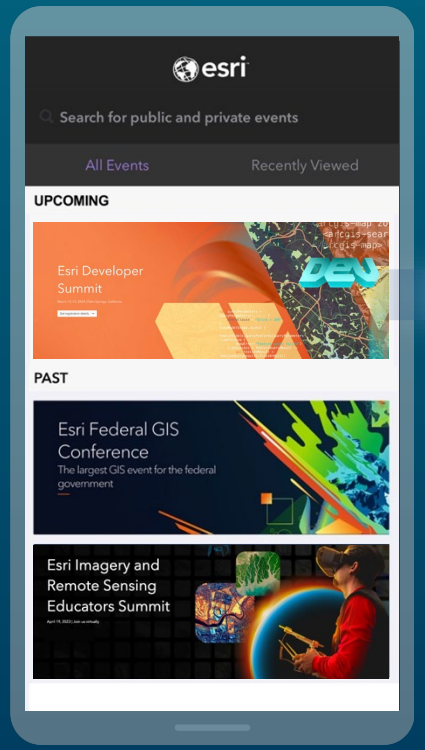
Accessibility resources

Exploring accessibility further

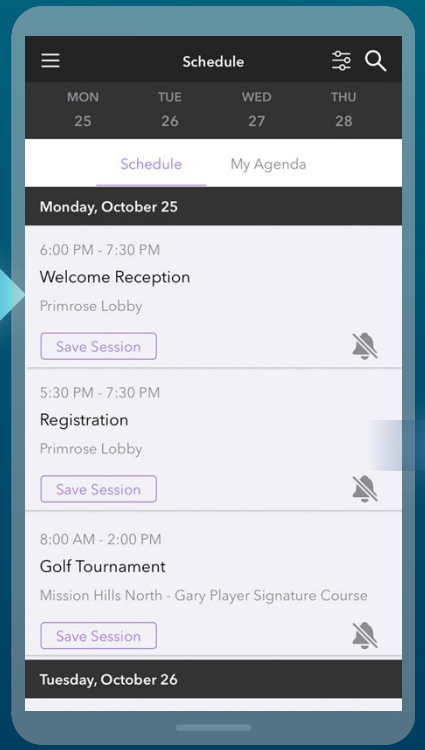
- GitHub demos and code: https://esriurl.com/a11y-ds-2024
- Resources and tools: https://esriurl.com/a11y-resources
- Community: https://esriurl.com/a11y-community
- Developer guides
  - https://esriurl.com/js-a11y
  - https://esriurl.com/calcite-a11y

Please Share Your Feedback in the App

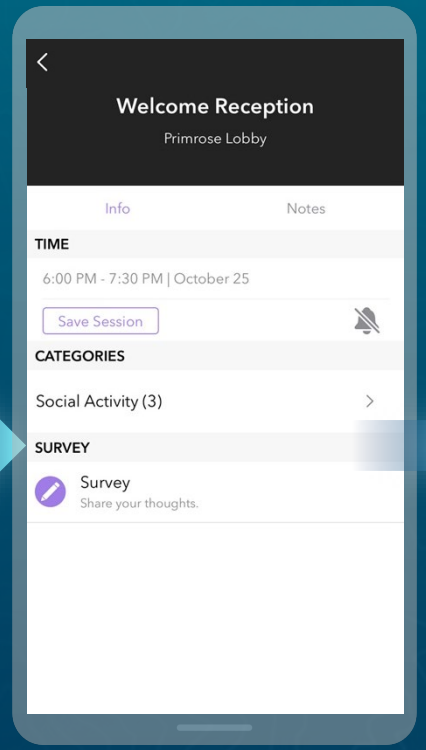
Download the Esri Events app and find your event



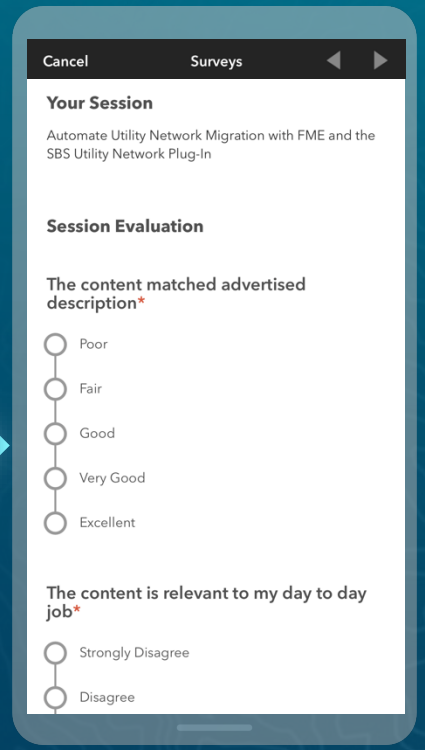
Select the session you attended



Scroll down to "Survey"



Log in to access the survey



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