Map Accessibility

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Map Accessibility Agenda

I. Digital Accessibility 101
II. Cartographic Best Practices
III. Static Map Accessibility
IV. Interactive Map Accessibility
V. Resources

Digital Accessibility 101

- **Accessible design** is a design process that considers the needs of people with disabilities.
- **Think about accessibility from the start** in the design phase. Avoids rework (saving time and $$$).
- **Creating accessible information shouldn't be an exception** to the rule, it should be there when people need it and not by request.

Minnesota Standards and Expectations

- **Section 508** of the U.S. Rehabilitation Act
- **Web Content Accessibility Guidelines (WCAG) 2.0**, level A and AA
- Supplementing the standard are statutes on **public records** (363A.42) and **continuing education** (363A.43)

Cartographic Best Practices

Low Vision and Color Vision Deficiency

- Beyond cartographic design standards, we also include design that assists those with **Low Vision** and/or **Color Vision Deficiency**.

Color is tricky!

Ask yourself some questions before you start:

- Choose colors based on **information hierarchy**.
- Basemap information should be muted back by use of transparency or muted colors. **Contrast** is important!
- **Is the map being printed?** CMYK (ink) vs. RGB (onscreen)

Accessible Color Schemes

The MN Map Design Guide has color scheme resources to help

Sample Accessible Color Schemes

Qualitative Data

Jewel Tones

This color palette is vivid and bright, containing rich color tones that resemble gemstones. These colors have a high level of saturation and are very distinctive and dynamic.

Color	CMYK	RGB	HEX
	0, 100, 70, 20	196, 16, 57	#C41039
	0, 18, 100, 0	255, 207, 1	#FFCF01
	100, 0, 0, 35	0, 125, 172	#007DAC
	64, 100, 0, 0	122, 42, 144	#7A2A90
	65, 10, 100, 0	104, 173, 69	#68AD45
	0, 0, 0, 60	128, 130, 133	#808285
	0, 80, 100, 7	224, 84, 32	#E05420
	100, 100, 100, 100	0, 0, 0	#000000

Muted

Muted colors are lower in saturation and have a soft quality. This color palette is opposite the more vibrant "Jewel Tones" and "Brights" palette and is useful when you want to create a "quiet" feeling.

Color	CMYK	RGB	HEX
	40, 30, 15, 0	160, 133, 169	#A085A9
	3, 27, 88, 0	243, 188, 59	#F3BC3B
	22, 0, 0, 5	183, 220, 239	#B7DCEF
	0, 0, 0, 50	147, 149, 152	#939598
	35, 30, 60, 0	174, 165, 122	#AEA57A
	0, 32, 38, 50	146, 109, 90	#926D5A
	0, 9, 15, 3	245, 224, 205	#F5E0CD
	2, 9, 50, 0	251, 225, 147	#FBE193

Earth Tones

This color palette is rich in tans and browns and reflects the natural colors found in soil, trees and rocks. These colors create a warm feeling and are closely aligned with nature.

Color	CMYK	RGB	HEX
	37, 18, 87, 6	162, 170, 73	#A2AA49
	3, 7, 24, 11	221, 209, 180	#DDD1B4
	30, 0, 0, 60	86, 116, 131	#567483
	41, 6, 53, 50	89, 117, 87	#597557
	0, 33, 100, 35	186, 134, 13	#BA860D
	3, 75, 100, 35	164, 69, 18	#A44512
	2, 9, 40, 0	230, 227, 166	#FAE3A6
	40, 70, 100, 60	83, 47, 9	#532F09

Brights

This palette is vibrant, colorful and fresh – a great choice when you need a color scheme that conveys energy.

Color	CMYK	RGB	HEX
	0, 0, 100, 0	255, 242, 0	#FFF200
	0, 40, 100, 0	250, 166, 26	#FAA61A
	0, 100, 100, 0	237, 29, 36	#ED1D24
	50, 0, 0, 0	109, 207, 246	#6DCFF6
	100, 100, 0, 20	38, 36, 123	#26247B
	30, 100, 0, 0	180, 30, 142	#B41E8E
	85, 10, 90, 15	0, 142, 77	#008E4D
	100, 100, 100, 100	0, 0, 0	#000000

Optimized for Color Blindness

This color palette was designed for those with and without color blindness to reasonably identify colors, demonstrated in Nature's Points of View: Color blindness written by Bang Wong.

Color	CMYK	RGB	HEX
	100, 100, 100, 100	0, 0, 0	#000000
	0, 50, 100, 0	230, 159, 0	#E69F00
	80, 0, 0, 0	86, 180, 233	#56B4E9
	97, 0, 75, 0	0, 158, 115	#009E73
	10, 5, 90, 0	240, 228, 66	#ECDE38
	100, 50, 0, 0	0, 114, 178	#0072BC
	0, 80, 100, 0	213, 94, 0	#F15A22
	10, 70, 0, 0	204, 121, 167	#DA6FAB

Minnesota Brand Colors

Cartographers may want to create maps that use the State of Minnesota's brand colors. This palette can help to build a strong color relationship between maps and state websites and design pieces in which they might appear. This palette is not required for cartographic use.

Color	CMYK	RGB	HEX
	0, 19, 79, 0	255, 200, 69	#FFC845
	0, 4, 27, 0	245, 225, 164	#F5E1A4
	38, 4, 0, 0	155, 203, 235	#9BCBEB
	100, 60, 10, 53	0, 56, 101	#003865
	65, 0, 100, 0	120, 190, 33	#78BE21
	24, 4, 8, 13	164, 188, 194	#A4BCC2
	100, 0, 20, 0	0, 142, 170	#008EAA
	0, 78, 83, 55	141, 63, 43	#8D3F2B

ColorBrewer[1] Orange-Red

Color	CMYK	RGB	HEX
	0, 20, 40, 0	253, 204, 138	#FDCC8A
	0, 45, 55, 0	252, 141, 89	#FC8D59
	10, 70, 70, 0	227, 74, 51	#E34A33
	30, 100, 100, 0	179, 0, 0	#B30000

Diverging Data

Colorblind Safe & Print Friendly

ColorBrewer[1] Red-Yellow-Blue, 6-Color

Color	CMYK	RGB	HEX
	15, 80, 75, 0	215, 48, 39	#D73027
	0, 45, 55, 0	252, 141, 89	#FC8D59
	0, 12, 40, 0	254, 224, 144	#FEE090
	12, 0, 0, 0	224, 243, 248	#E0F3F8
	43, 11, 0, 0	145, 191, 219	#91BFDB
	75, 37, 0, 0	69, 117, 180	#4575B4

ColorBrewer[1] Red-Blue, 6-Color

Color	CMYK	RGB	HEX
	30, 90, 70, 0	178, 24, 43	#B2182B
	5, 45, 50, 0	239, 138, 98	#EF8A62
	0, 14, 16, 0	253, 219, 199	#FDDBC7
	18, 4, 0, 0	209, 229, 240	#D1E5F0
	60, 15, 0, 0	103, 169, 207	#67A9CF
	90, 40, 0, 0	33, 102, 172	#2166AC

ColorBrewer[1] Brown-Blue-Green, 6-Color

Color	CMYK	RGB	HEX
	45, 60, 100, 0	140, 81, 10	#8C510A
	15, 25, 55, 0	216, 179, 101	#D8B365
	3, 8, 20, 0	246, 232, 195	#F6E8C3
	22, 0, 6, 0	199, 234, 229	#C7EAE5
	65, 5, 23, 0	90, 180, 172	#5AB4AC
	100, 30, 60, 0	1, 102, 94	#01665E

ColorBrewer[1] Purple-Green

Color	CMYK	RGB	HEX
	55, 80, 10, 0	118, 42, 131	#762A83
	31, 38, 0, 0	175, 141, 195	#AF8DC3
	9, 14, 0, 0	231, 212, 232	#E7D4E8
	15, 0, 15, 0	217, 240, 211	#D9F0D3
	50, 5, 50, 0	127, 191, 123	#7FBF7B
	90, 20, 90, 0	27, 120, 55	#1B7837

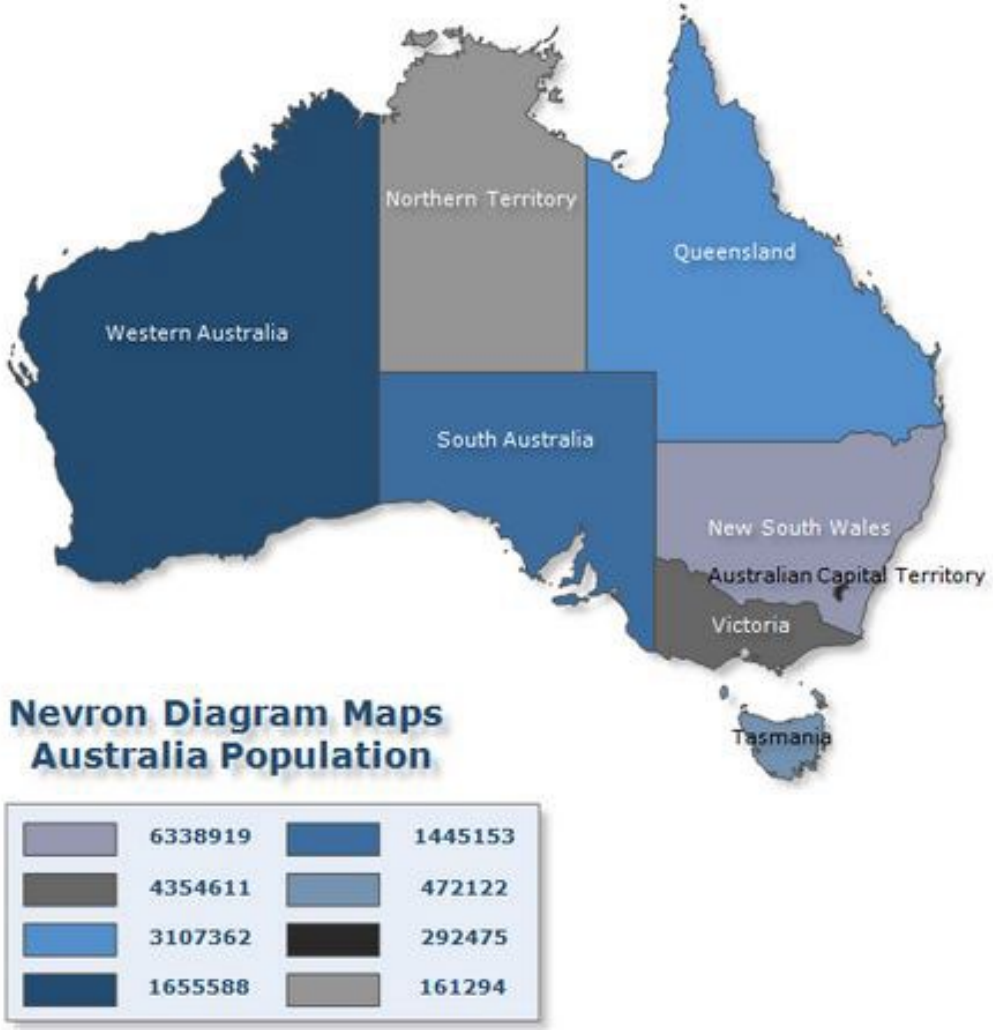
Tell a Story

A map should tell a story.

Sea Monster Off the coast of Venezuela – David Rumsey, 1587

Map Considerations

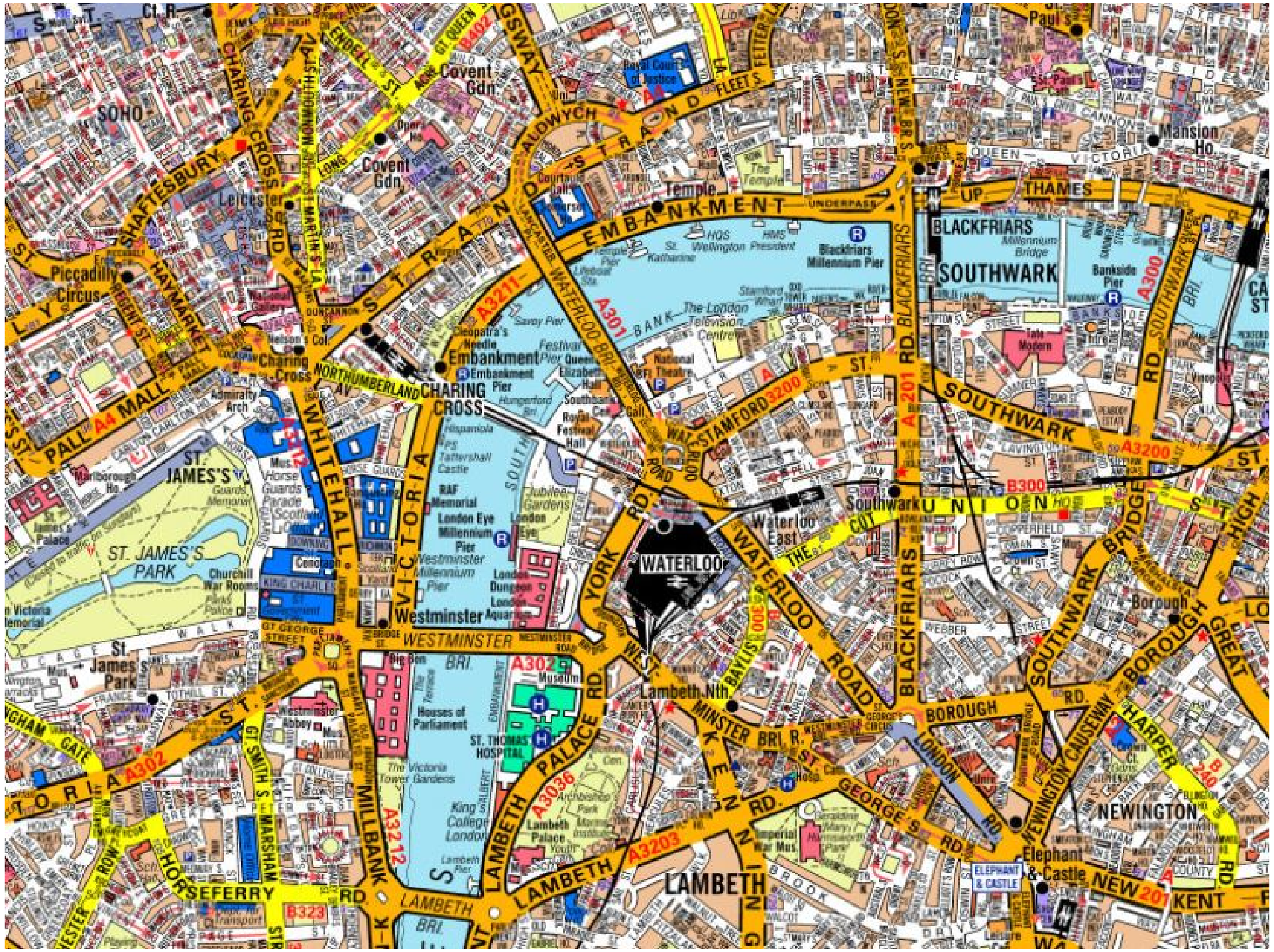
- What is the **purpose** of the map?
- Is a map really needed?
- Can the information be portrayed with a **table** and/or **graph**?



Map source: www.sutori.com

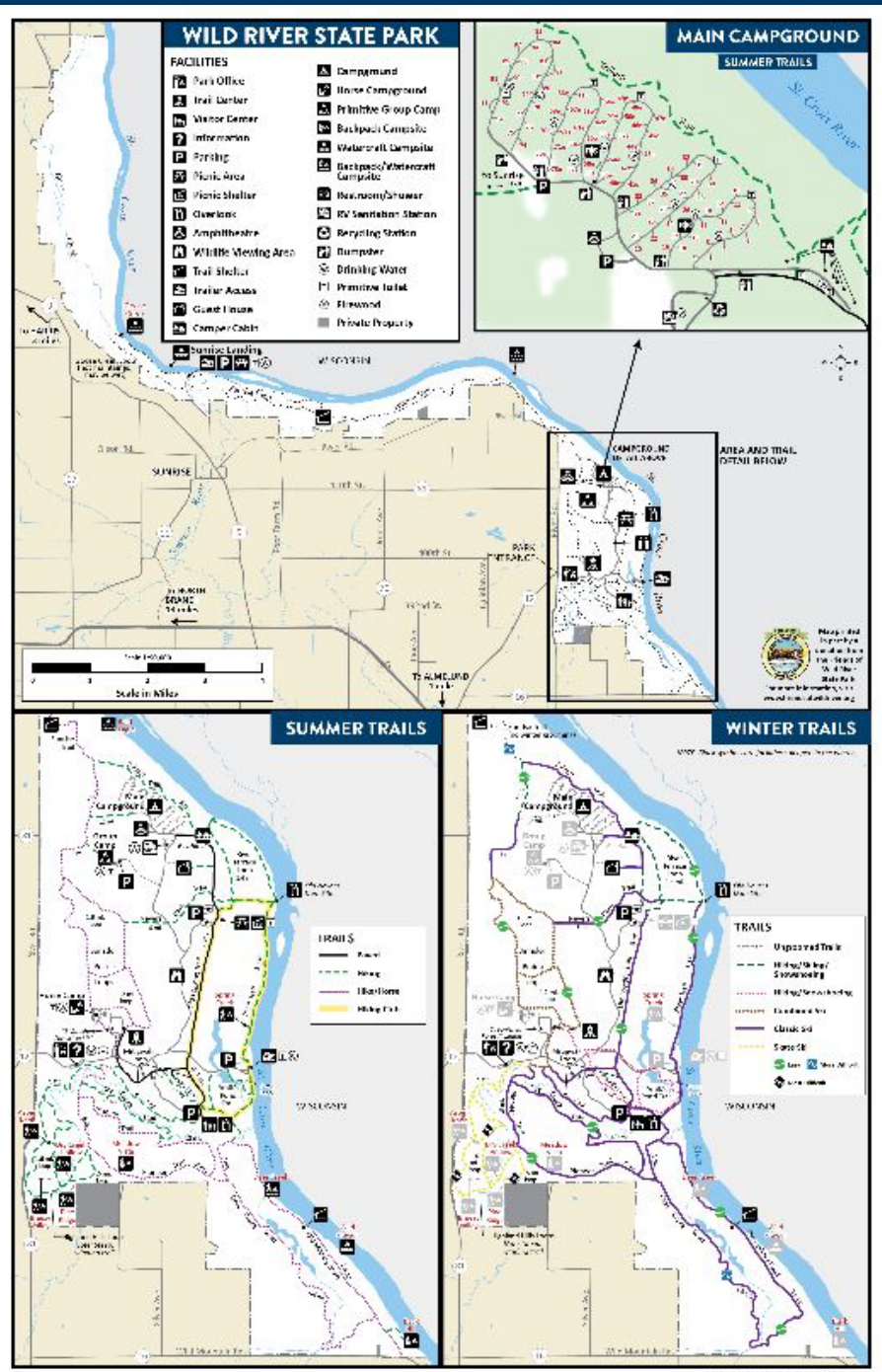
Too Much Information

- Don’t get lost in the weeds.
- Too much information can **confuse your reader.**



Map source: Map of London roads, A to Z Maps

Map Size and Scale



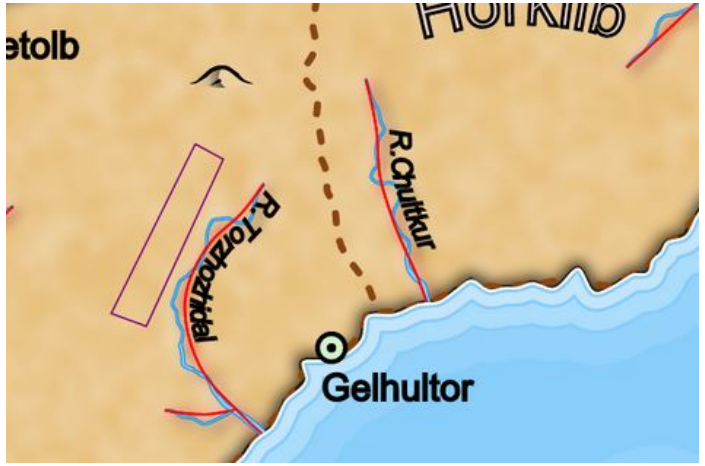
Wild River State Park 11 x 17 map example:

- Large park area (scale 1:74,500)
- Seasonal activities (summer trails/winter trails) almost same physical size as full park overview (scale 1:29,550)

Font Recommendations

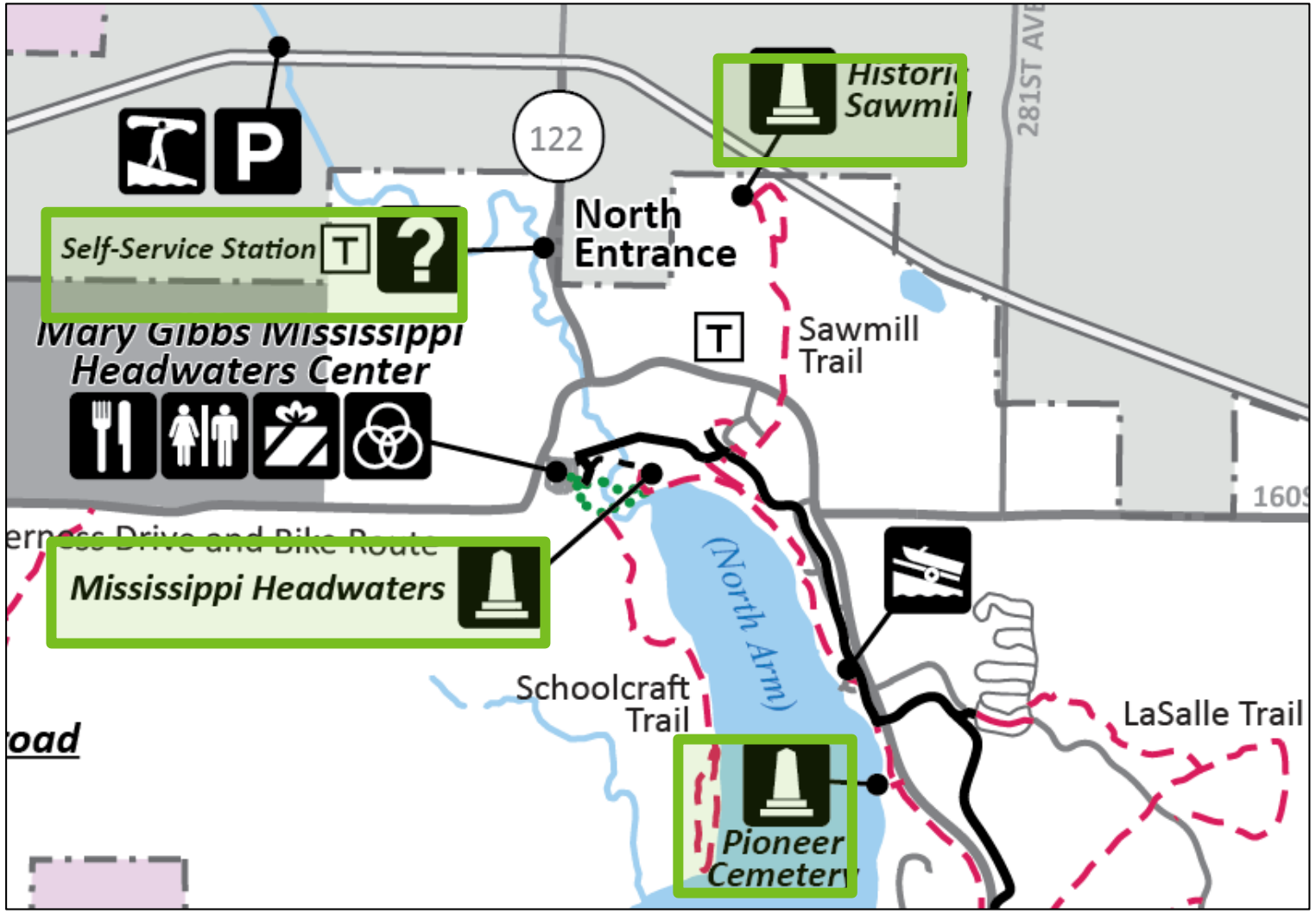
Some considerations for **good design and accessibility** that can make your map easier to read:

- In print **ideal size is 8-10 point**.
- **Do not** use underlined text.
- **Do not** overlap labels.
- **Do not** place labels upside down.
- **Do not** use shadow text.



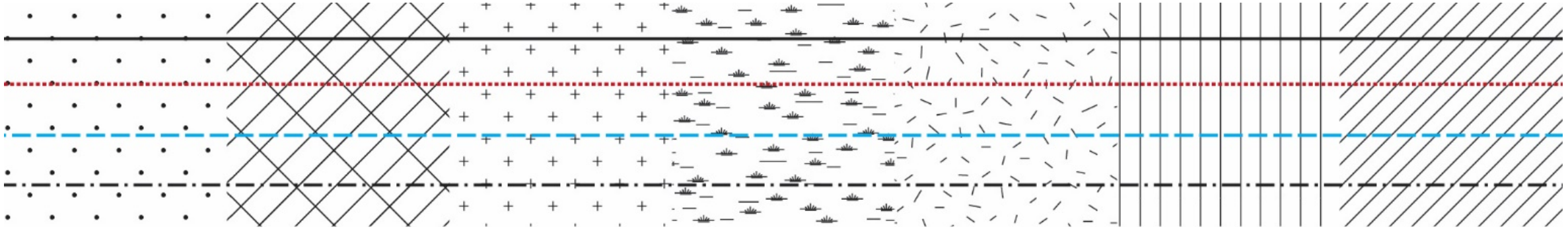
Map Symbols with Labels

If the symbol doesn't intuitively represent the feature then we can **add text**, or a **map label** to the object to **provide context**.



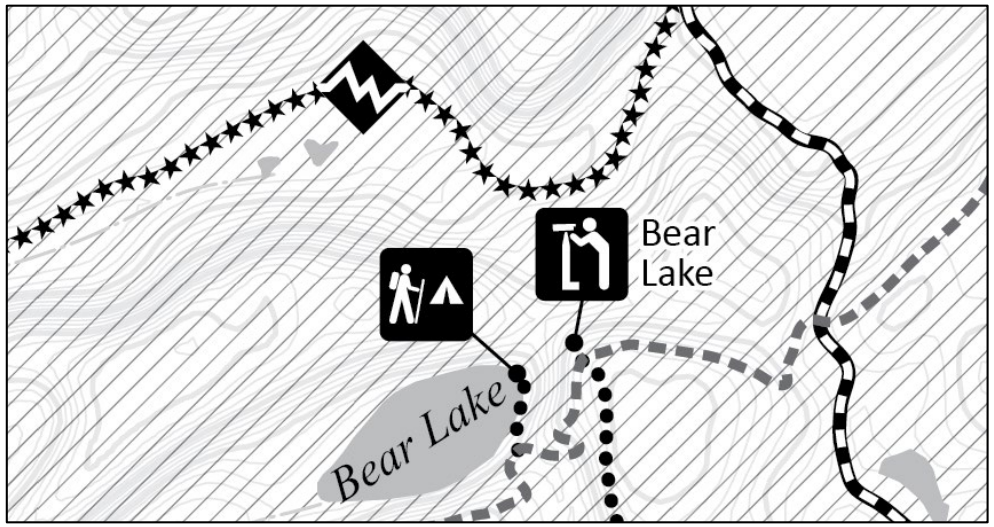
Patterns

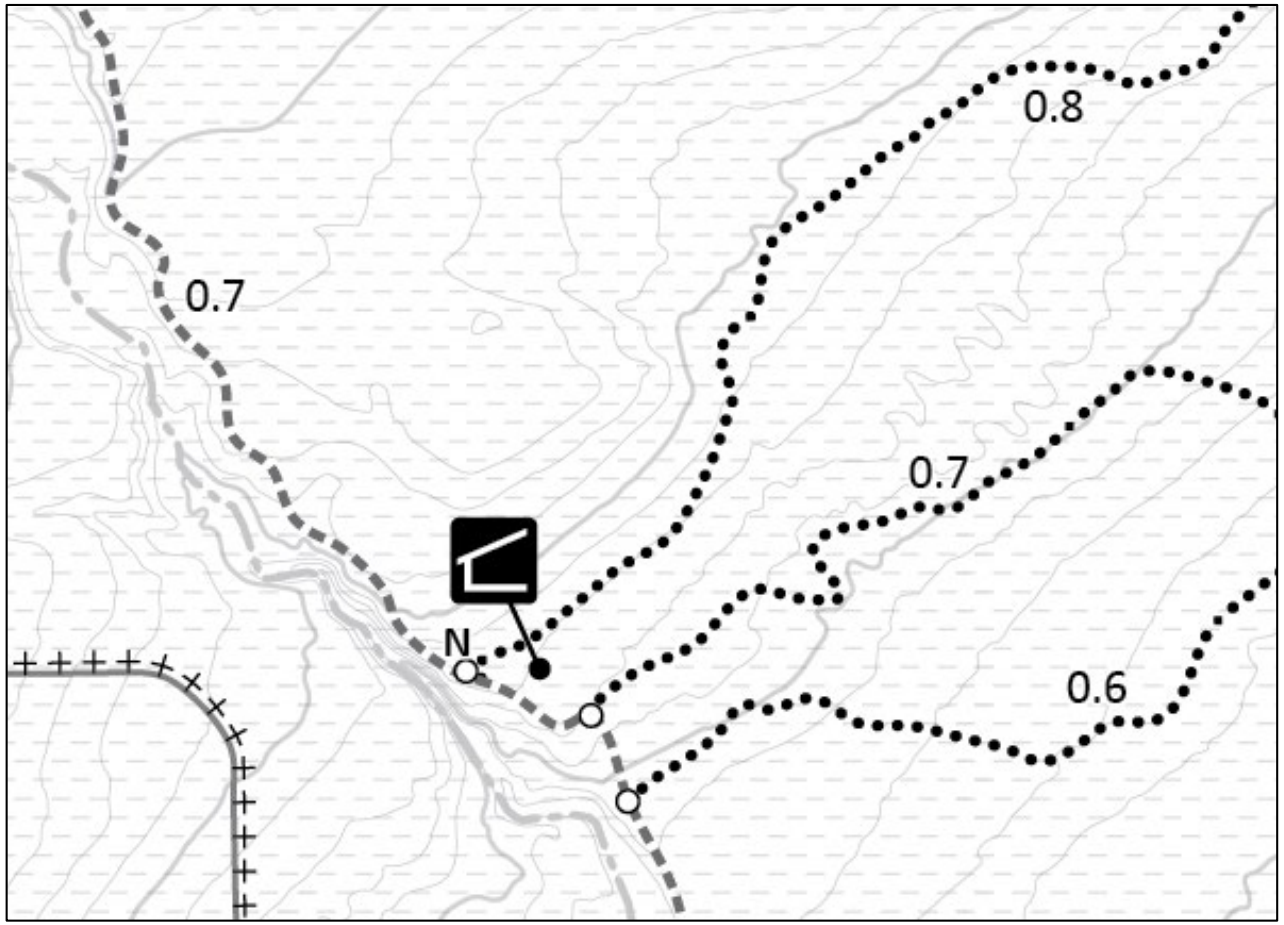
- **Limit use of patterns to 1 to 2 non-hierarchal pieces**. Patterns are very distracting and difficult to distinguish with elements on top of them.
- Ensure the pattern is placed below the primary map information in the order list.
- Try adding a transparency to the pattern to avoid overwhelming the viewer.
- **Never** put dashed/dotted lines on top of opaque patterns!



Patterns (Continued)

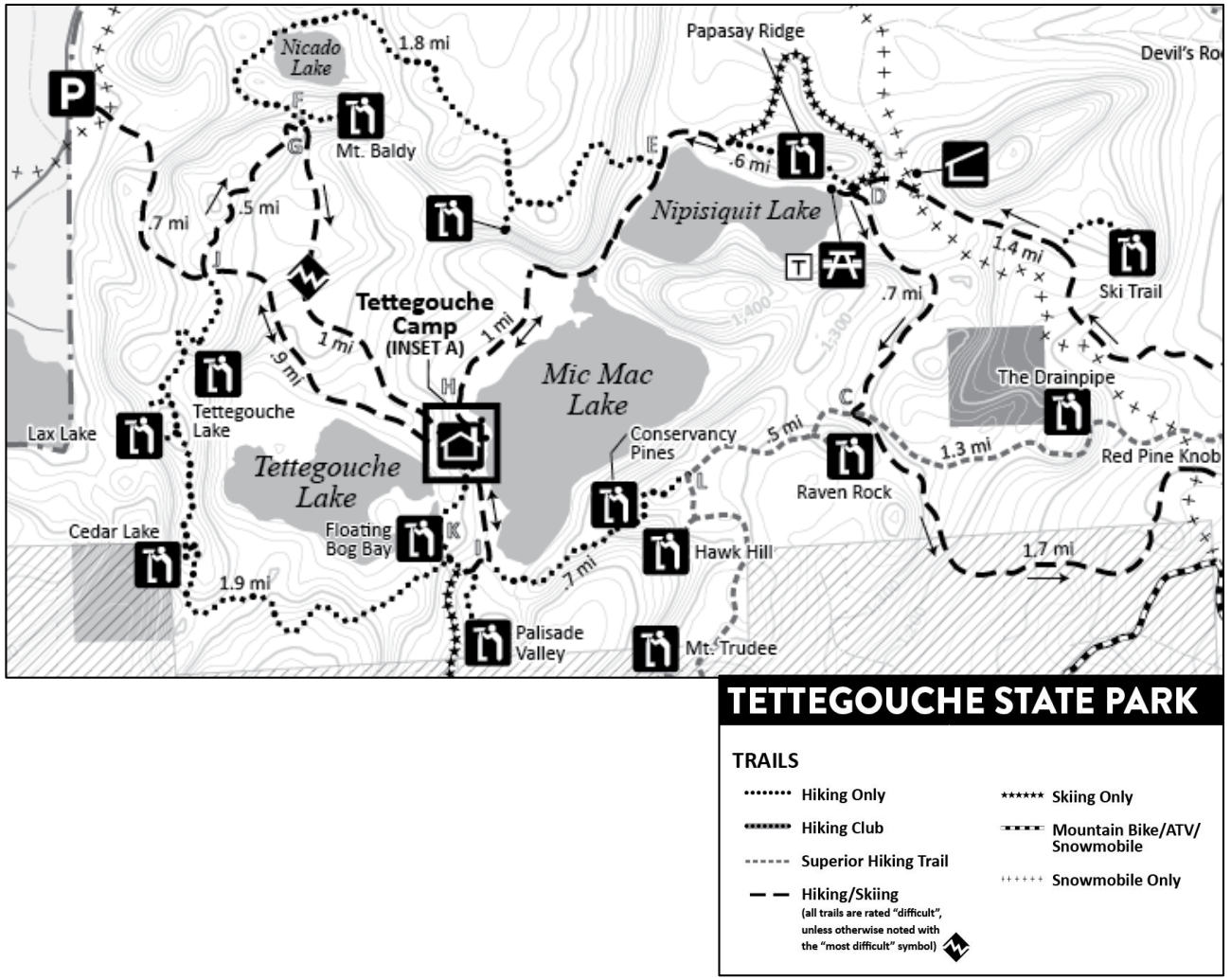
Subtle, or transparent patterns are effective in designating a large area, while still providing enough contrast to separate from other features.





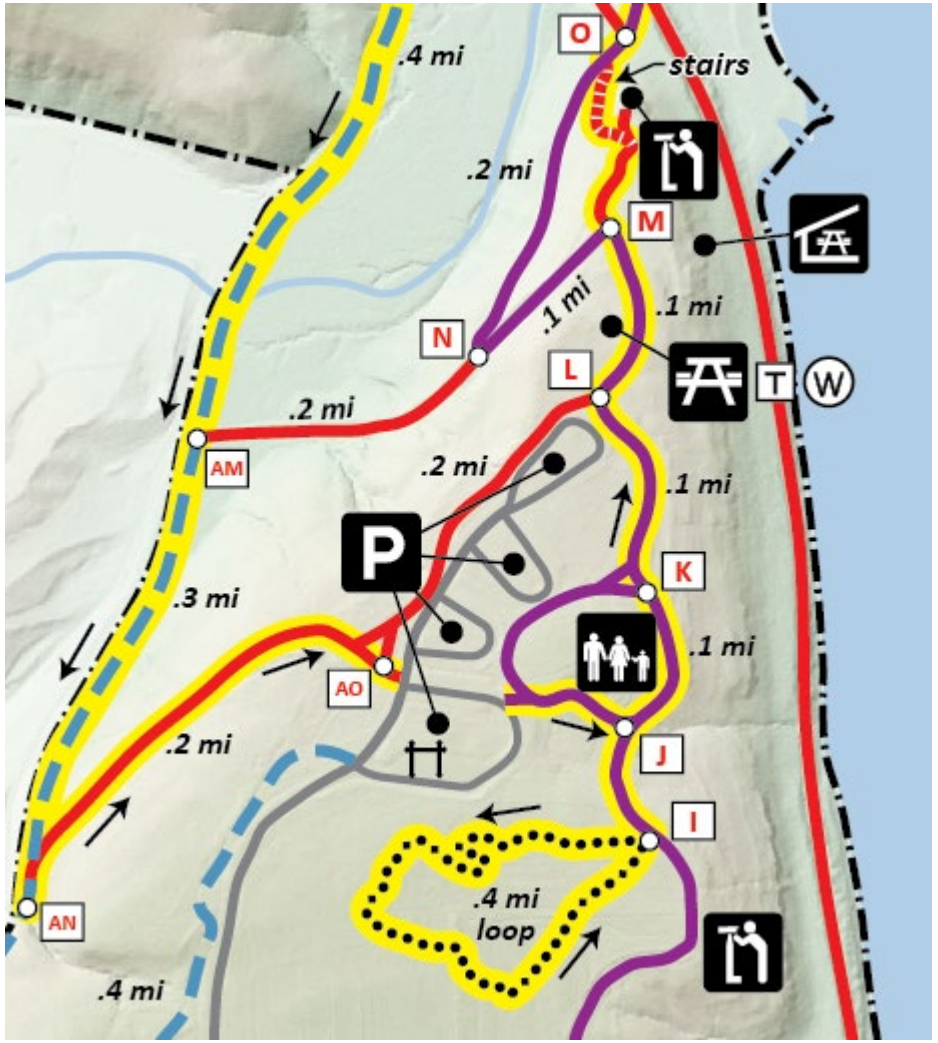
Line Styles

- Be creative! Lines styles should be **distinguishable**.
- Aim for no more than **6-7 style types** for hierarchal information lines.
- This map pushes the boundaries!



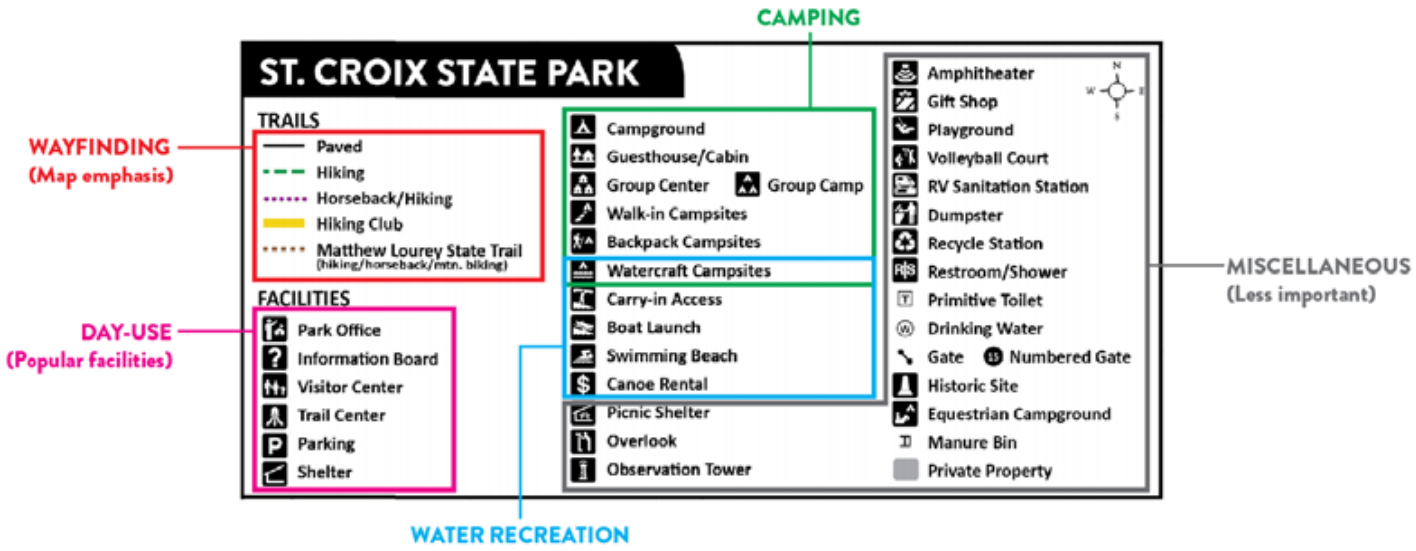
Colored Line Styles

- If you can produce a map in color, your options open greatly. Focus on **high contrast colors**.
- This map features a mixture of color and line patterns, allowing for higher map readability.



Map Legend

- All symbols should be represented in the legend.
- Legend symbols should be the same size as the map symbol.
- Larger legends can group items by category and symbol type.



Parting Cartographic Thoughts

- **Balance map items** on the page.
- **White space is okay**! Less clutter is an easier to read map.
- **Important Accessibility Information**
  - Web
  - PDF
  - Word or print via InDesign

Static Map Accessibility

Static Map Examples

Four Examples:

1. Map with description & data
2. Map with description
3. Map with links
4. Map linking to website (with additional description)

6th C BC map of the world
Source: https://commons.wikimedia.org/wiki/File:Baylonianmaps.JPG

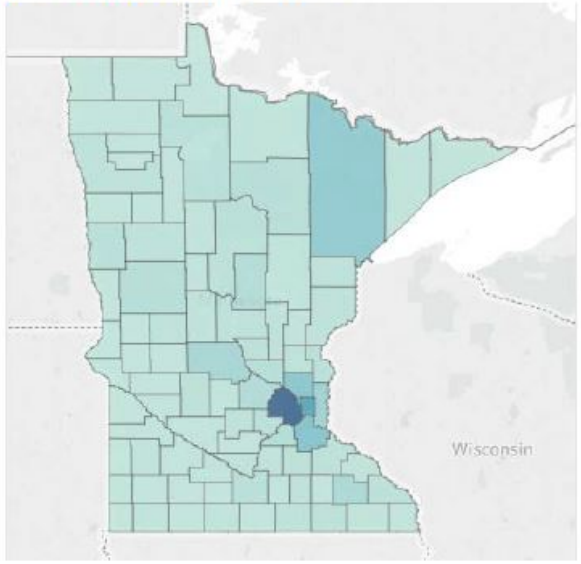
1. Map with description & data

Geographic Differences in Disabilities

Across Minnesota's 87 counties, the percentage of the population with a disability varies from 6.1% in Carver County (lowest) to 18.3% in Aitkin County (highest).[3] Because disability is strongly associated with aging, counties with higher percentages of older adults have higher percentages of residents reporting disabilities. In addition to Aitkin, the rural counties of Koochiching, Wadena, Clearwater, Traverse, Big Stone, and Cass all have an estimated disability prevalence of 16% or more of the civilian, noninstitutionalized population. However, because these counties are not very populous, fewer than 15,000 total persons with disabilities live in these seven counties in total. More than seven times as many persons with disabilities—about 110,100—live in Hennepin County alone, the county with the largest number. Unsurprisingly, other highly populated counties are also home to large numbers of persons with disabilities, including Ramsey (about 58,000 people), Dakota (33,400), Anoka (30,900), St. Louis (27,500), Washington (19,700), Stearns (15,200), and Olmsted (12,500). All other counties in Minnesota have fewer than 10,000 persons with disabilities apiece residing there.

MAP 1

Number of People With Disabilities by County, 2010–2014



APPENDIX

TABLE 3

Number and Percent of People With Disabilities, by County, Minnesota, 2010-2014

Counties in Minnesota	People with a disability (Highest to lowest)	People with a disability, Margin of error (+/-)	Percent with a disability	Percent with a disability, Margin of error (+/-)
Hennepin	110,150	2,160	9.4%	0.2%
Ramsey	57,990	1,400	11.2%	0.3%
Dakota	33,380	1,020	8.3%	0.3%
Anoka	30,940	1,120	9.3%	0.3%
St. Louis	27,480	830	13.9%	0.4%
Washington	19,740	860	8.2%	0.4%
Stearns	15,230	700	10.1%	0.5%
Olmsted	12,500	650	8.6%	0.4%
Wright	9,440	660	7.5%	0.5%
Scott	8,990	570	6.7%	0.4%
Crow Wing	8,910	410	14.3%	0.6%
Sherburne	7,570	760	8.6%	0.9%
Otter Tail	7,550	390	13.3%	0.7%
Itasca	6,990	450	15.7%	1.0%
Clay	6,160	560	10.3%	0.9%
Chisago	5,930	480	11.3%	0.9%
Blue Earth	5,880	400	9.2%	0.6%
Carver	5,770	450	6.1%	0.5%
Beltrami	5,450	450	12.2%	1.0%
Winona	5,310	350	10.4%	0.7%
Rice	5,210	390	8.4%	0.6%
Kandiyohi	4,890	350	11.7%	0.8%
Mower	4,890	370	12.6%	0.9%
Benton	4,830	360	12.5%	0.9%
Goodhue	4,740	340	10.4%	0.7%
Cass	4,530	220	16.0%	0.8%
Isanti	4,370	390	11.5%	1.0%

2. Map with description

Pollution sensitivity of near-surface materials

Methods

The sensitivity to pollution of near-surface materials is an estimate of the time it takes for water to infiltrate the land surface, travel through the unsaturated zone, and reach the water table, which is assumed to be 10 feet below land surface. The first 3 feet is assumed to be soil and the next 7 feet (3–10 feet) is assumed to be surficial geological material. If there is no soil data, the transmission rate is based on 10 feet of the surficial geologic unit.

The transmission rate of a soil or surficial geologic unit will vary depending on the texture. In general, coarse-grained materials have faster transmission rates than fine-grained materials. The two primary inputs used to estimate transmission rate are the hydrologic soil group and the surficial geologic matrix texture. Attributes of both are used to estimate the time of travel (Table 1) (USDA-NRCS, 2011; Part A, Plate 4). Further details are available in *Methods to estimate near-surface pollution sensitivity* (DNR, 2016b).

The time of travel through the near-surface s
from hours to approximately a year.

- Areas with a relatively short travel time (ho
are rated high sensitivity (Figure 18).
- Areas with a longer travel time (weeks to a
low or very low.

Results

High sensitivity conditions dominate the c
19) since the most common surficial materia
is sand and gravel. Moderate sensitivity is
common category where sandy loam till exists
A large area of mostly moderate sensitivity ex
south of Zimmerman through most of the
limits. Smaller areas of mostly moderate se
north of Becker and along the northern borde
One area of mostly low sensitivity exists at th
northern county border west of Princeton.

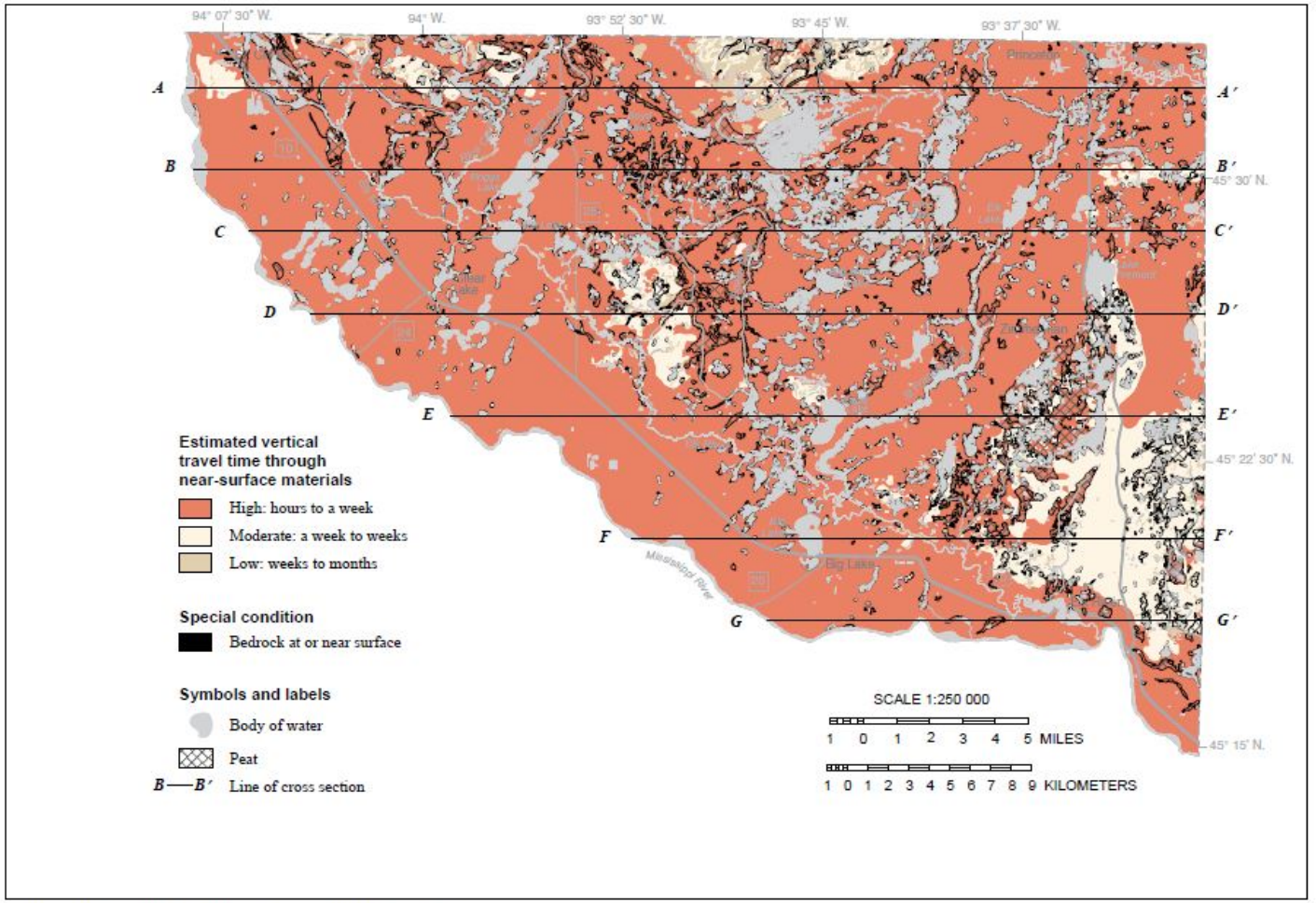
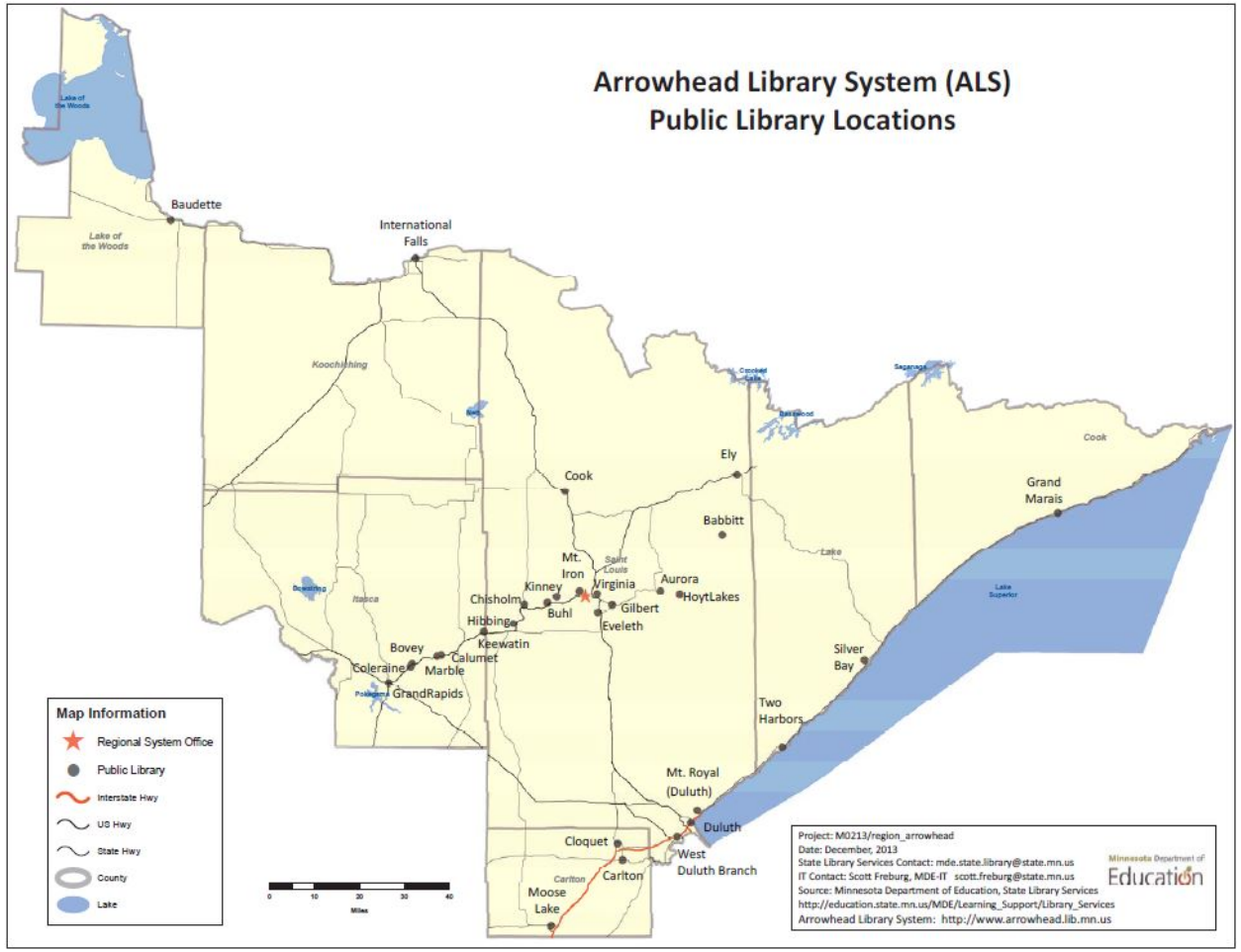


Figure 19. Pollution sensitivity of near-surface materials

This pollution sensitivity model assumes a 10-foot-deep water table and vertical travel of possible pollutants through unsaturated, near-surface materials. Map modified from Adams, 2016b.

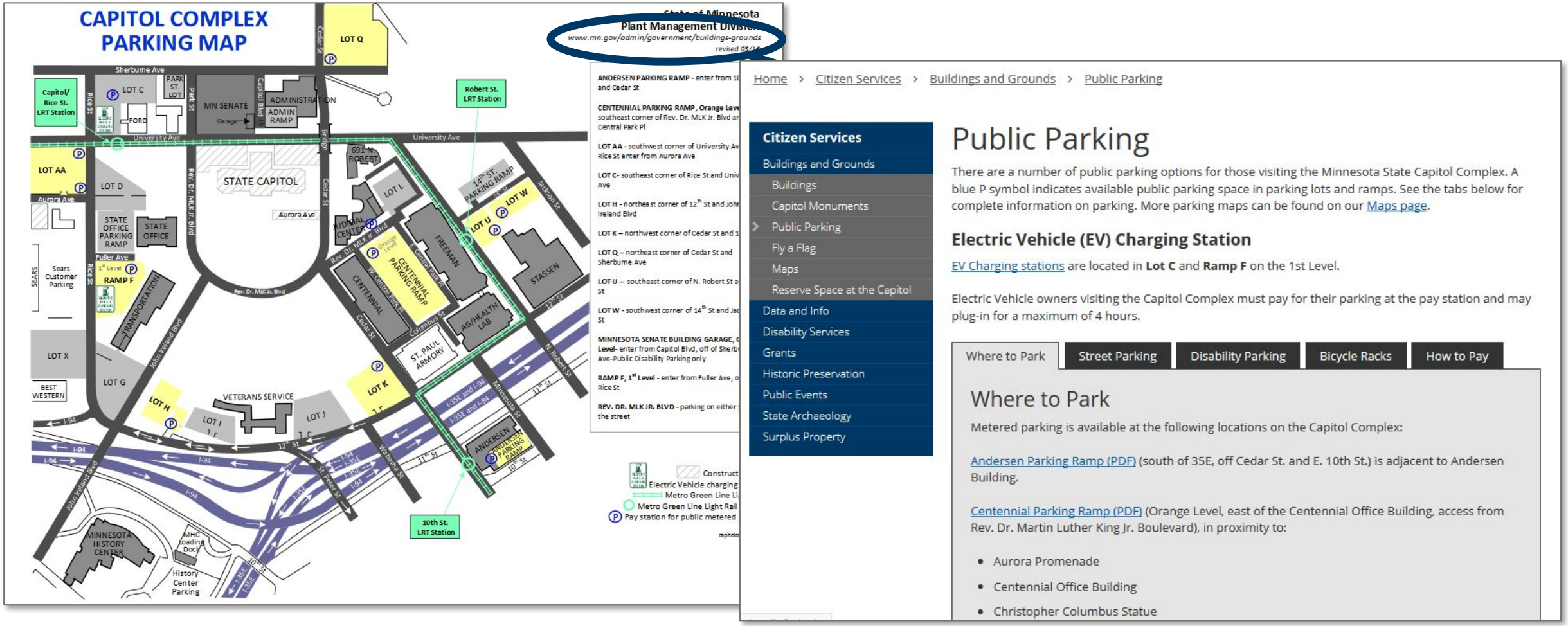
3. Map with links



Public Libraries within Arrowhead Library System

- Arrowhead Library System
- Aurora
- Babbitt
- Baudette
- Bovey
- Buhl
- Calumet
- Carlton
- Chisholm
- Cloquet
- Coleraine
- Cook
- Duluth
- Ely
- Eveleth
- Gilbert
- Grand Marais
- Grand Rapids
- Hibbing
- Hoyt Lakes
- International Falls
- Keewatin
- Kinney
- Marble
- Moose Lake
- Mt. Iron
- Mt. Royal (Duluth)
- Silver Bay
- Two Harbors
- Virginia
- West Duluth Branch

4. Map linking to website



Interactive Map Accessibility

Interactive Map Accessibility Solutions

Top Five

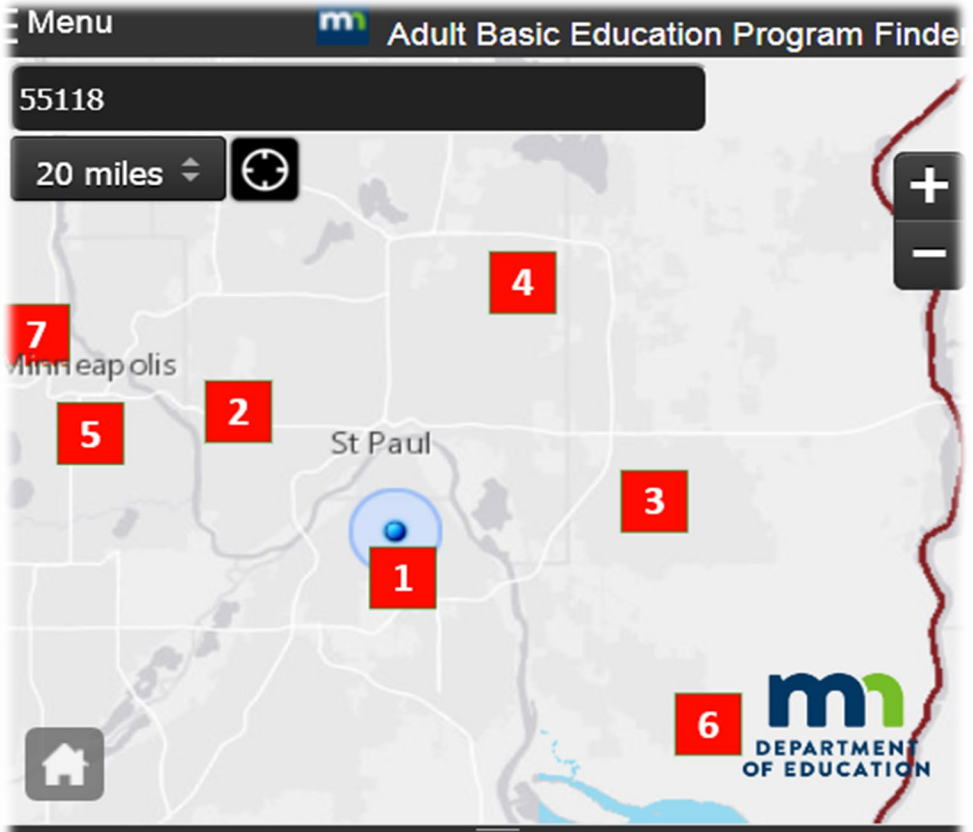
1. Focus on the map's intent/purpose
2. Don't rely on color alone
3. Consider the reading order
4. Consider text layout
5. Recognize technological constraints

1. Focus on the map's intent/purpose

- Focus on the map's purpose.
- Start with the foundational cartographic principles.
- Provide controls where possible that don't rely on map interaction.

Map Intent/Purpose Example

- **Present the data.** Most maps have an accompany set of tabular data. It can be helpful to present that data as an alternative to viewing the map.

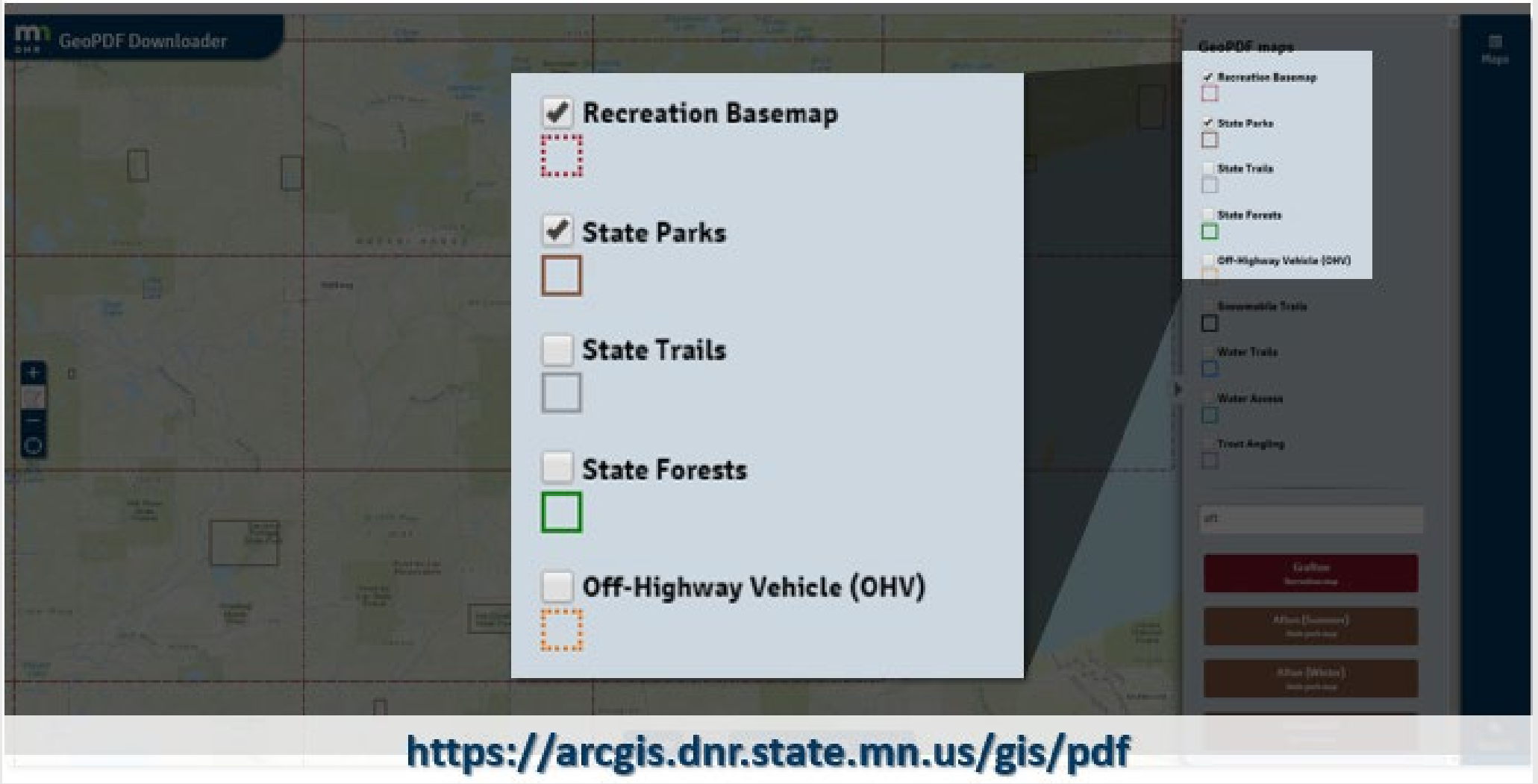


ID	Work Force Center	Miles
1	Dakota County North	2.01
2	Ramsey County-St. Paul	8.31
3	Washington County Woodbury	10.43
4	Ramsey County-North St. Paul	11.96

2. Don’t rely on color alone

- Provide good color contrast.
- Color cannot be the only way information is conveyed.
- Underline links.
- Use shapes and/or texture.

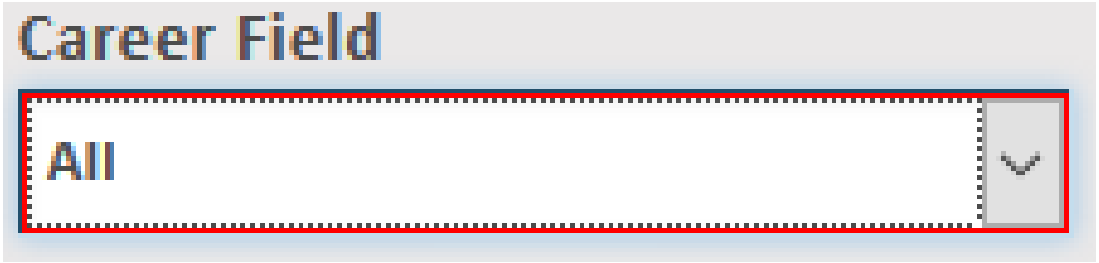
Color + Texture Example



Color + Texture Example, continued

3. Consider the reading order

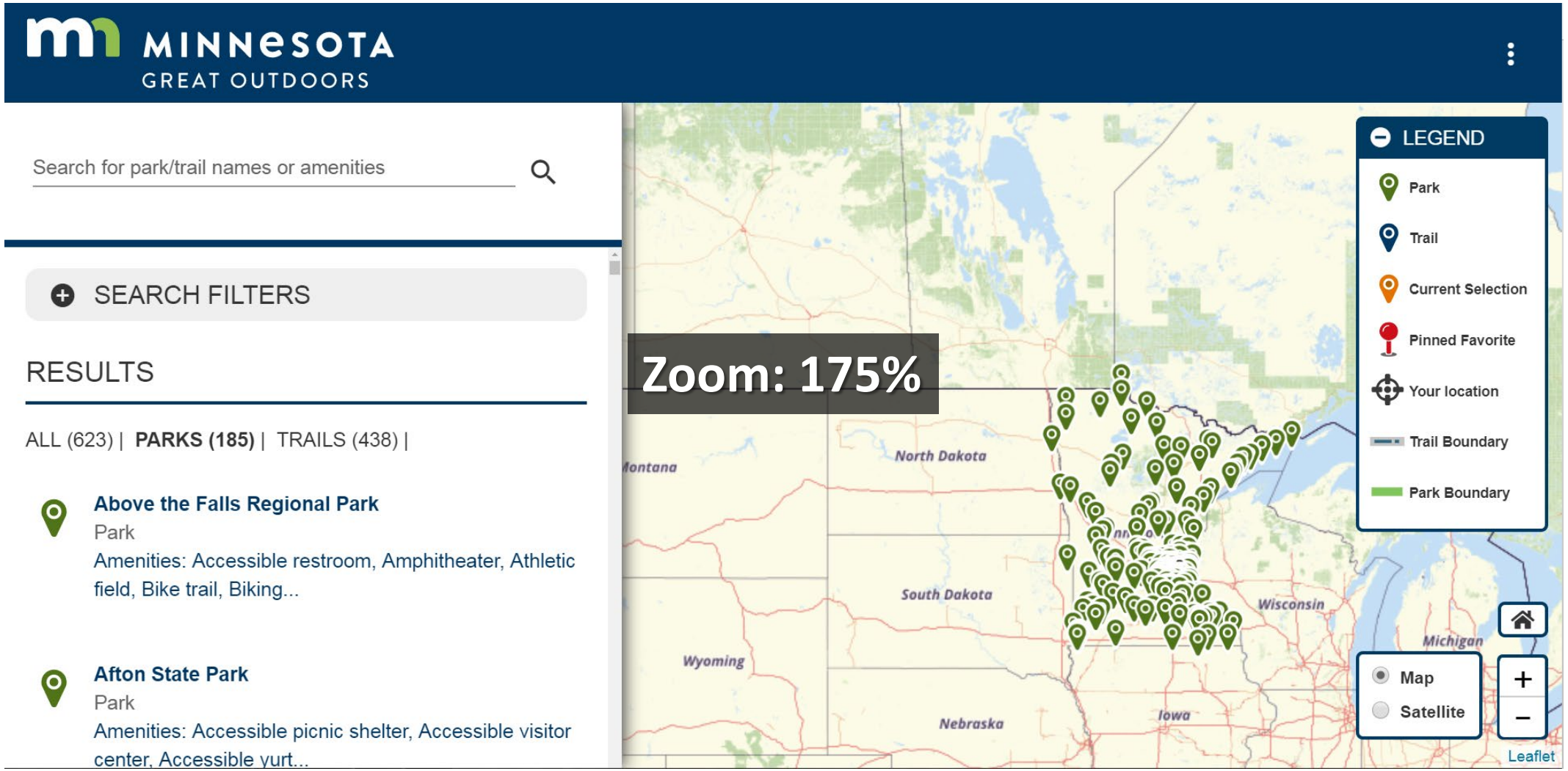
- The visual hierarchy should match the keyboard order.
- Ensure elements can be accessed via the keyboard.
- Use Focus Indicators (CSS) to highlight keyboard focus.



4. Consider text and layout

- Keep simplicity in mind.
- Use clear semantics and remember line length.
- Use a minimum of 12-pt font
- Use true text (HTML text)
- Refrain from using ALL CAPS.

Text Layout Example, continued



5. Recognize technological constraints

- Research assistive technologies.
- Research mapping libraries.
- Use accessibility tools.
- Use people and conduct a usability study.

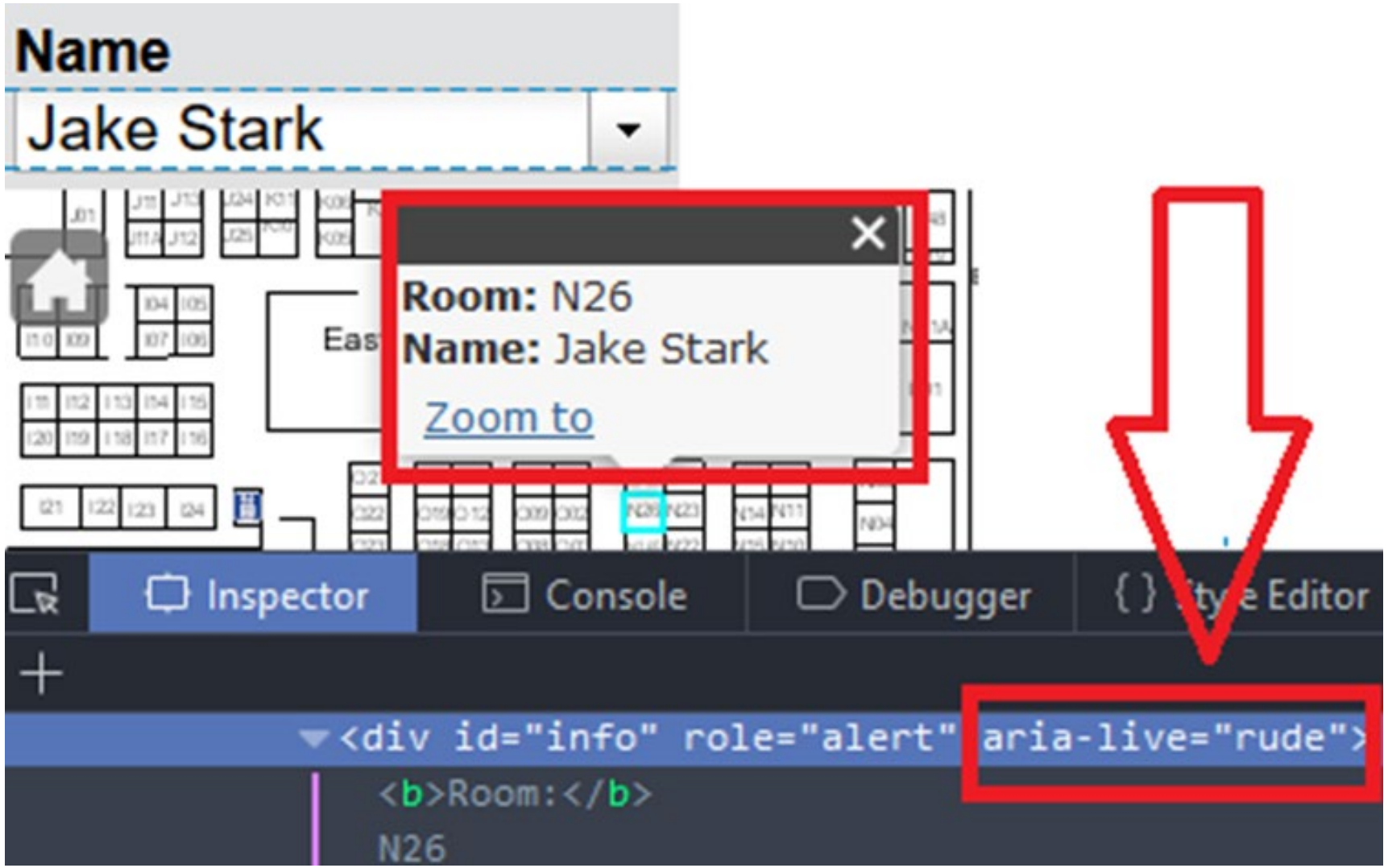
ARIA – Accessible Rich Internet Applications

- **ARIA is a set of attributes** to help enhance the semantics of a web site or web application to help screen readers make sense of certain things that **are** not native to HTML.

First Rule of ARIA: Don’t use ARIA

- **Use Semantic HTML elements** in place of an ARIA attribute wherever possible.
- **Should be used only** to fill in gaps for screen reader users.

aria-live Example



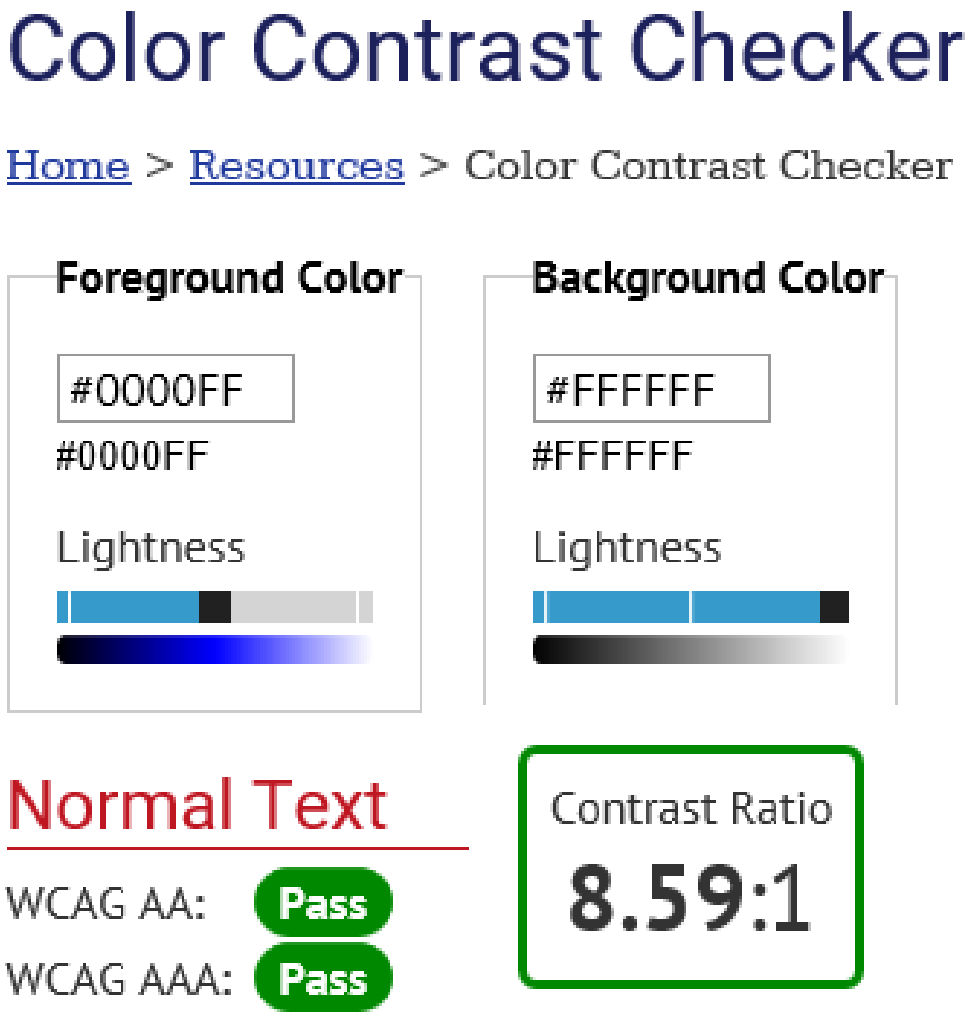
Resources

Color

- WebAIM Color Contrast Checker (website)
- Colour Contrast Analyser (software)

Google Chrome extensions

- aXe (also Firefox)
- WAVE
- Colorblinding



Questions?

Presenters

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