

Salem’s Environmentally Significant Lands: Findings and Recommendations

by

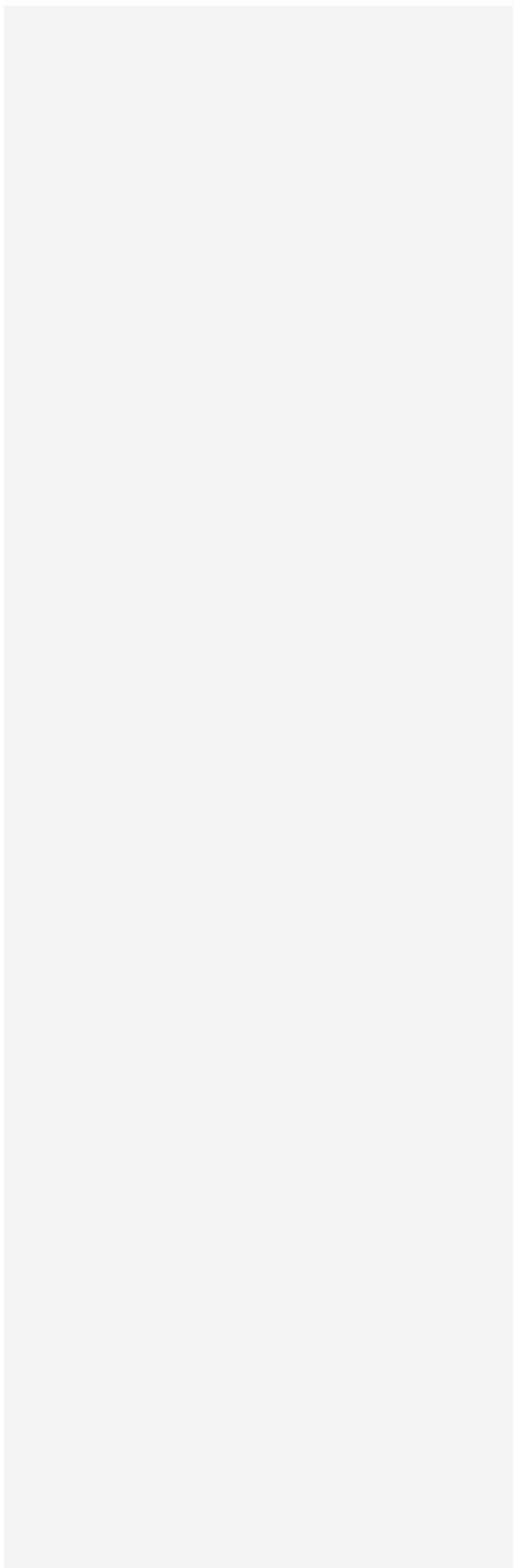
The Streams and Wetlands Subcommittee of the Salem Planning Commission:
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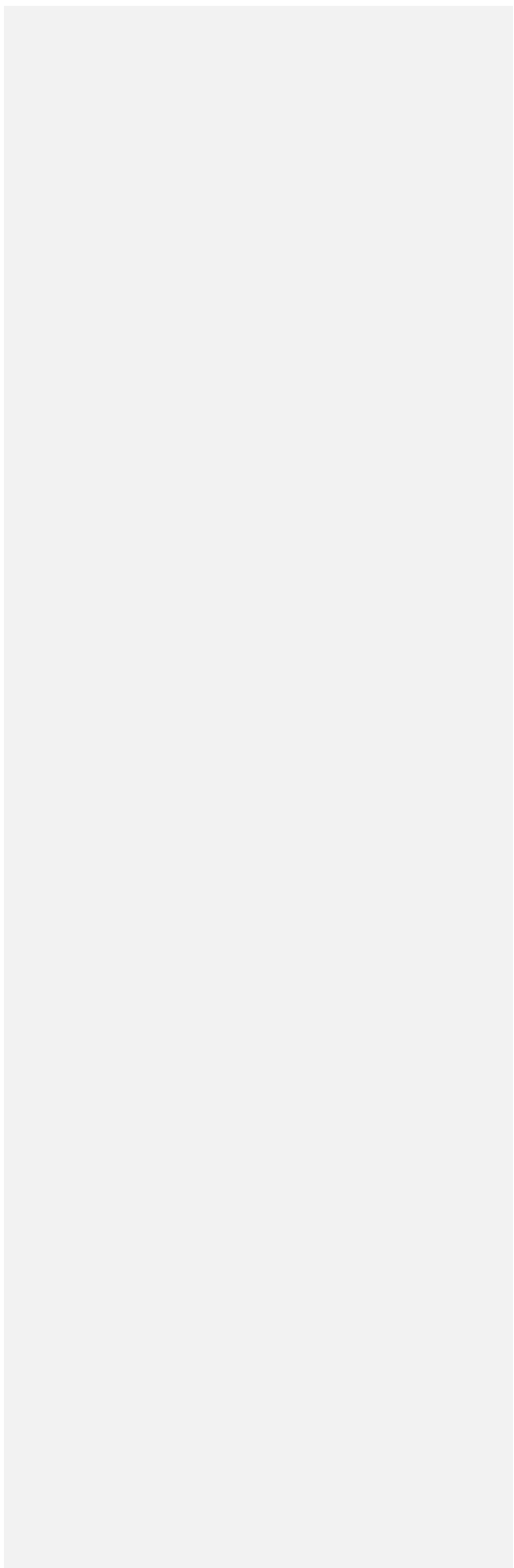
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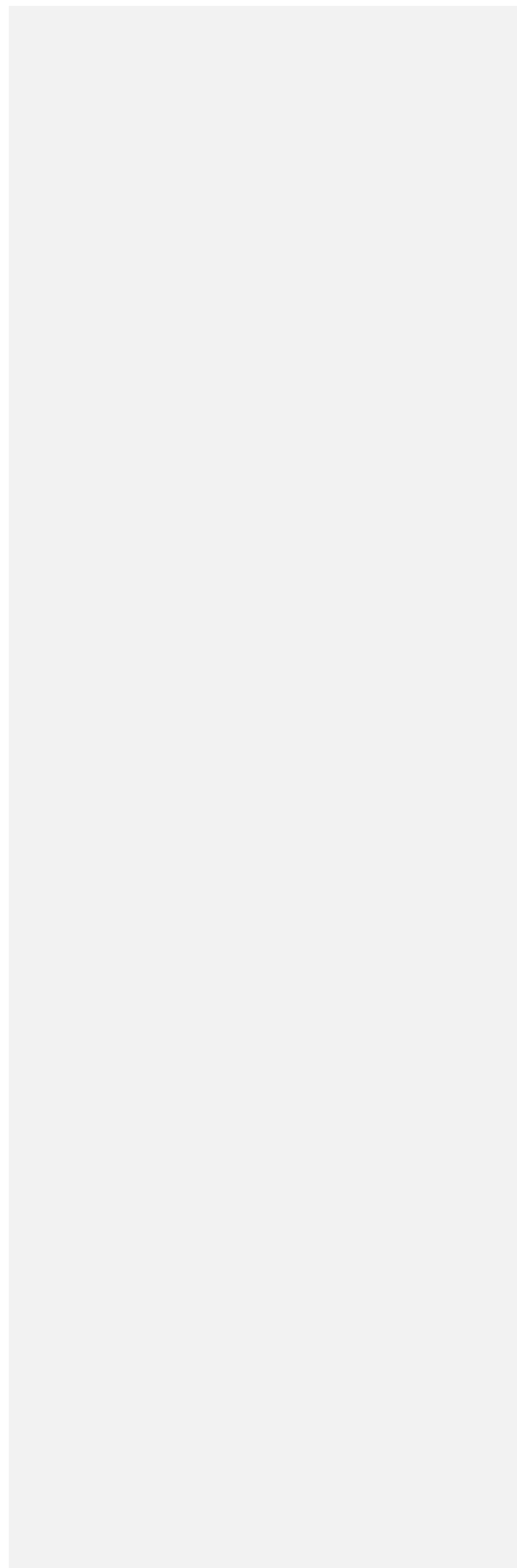
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01. INTRODUCTION

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02. FACTS AND FINDINGS

A. Ecosystem Services and Climate Change

1. Surface water (rivers, streams, lakes, ponds, and wetlands) and undeveloped land provide important ecosystem services that support human health, longevity, and resilience to stress and disaster. Vegetated buffers around riparian areas and wetlands are critical for filtering pollutants, stabilizing soils, mitigating stormwater, and providing groundwater recharge.
2. Higher rates of biodiversity generally yield higher functioning ecosystem services.
3. Salem residents can expect higher average temperatures, more prolonged periods of drought, more frequent heat waves, increased winter flooding, increased invasive species pressure, and new diseases as a result of climate change. Maintaining and restoring natural systems helps buffer these impacts.
4. Healthy ecosystems, an extensive tree canopy, and green infrastructure reduce the impact of climate change on urban communities including but not limited to mitigating heat and flooding, storing and filtering water, improving air quality, and providing access to nature.

B. Rivers

1. Rivers mean the Willamette River.
2. The Willamette River provides a wide range of ecosystem services to Salem residents, including but not limited to: stormwater conveyance, effluent conveyance, temperature regulation, groundwater recharge, fire risk mitigation, and -recreational, cultural, and educational opportunities.
3. The Willamette River has a five mile reach that runs through Salem with a volume that ranges considerably but has been 32,000 and 36,000 cubic feet per second (CFS) recently.
4. The Willamette River is designated by the Oregon Department of Lands as essential salmonid habitat and supports Winter Steelhead and Spring Chinook salmon.

C. Streams

1. Stream means a flowing body of water that typically follows a channel or bed. Streams may be perennial, seasonal, or intermittent. Streams include fish-bearing ditches.
2. Streams provide important ecosystem services, including stormwater management, groundwater recharge, climate moderation, fire risk mitigation, and recreational, cultural, and educational opportunities.
3. Salem has approximately 91 miles of open stream.
4. Streams running through Salem are significantly degraded. Salem's urban streams are characterized by: altered hydrology, increased water temperatures, simplified channel morphology, hardened banks, turbidity, and contamination.

5. Salem streams are a vital component of Salem's stormwater management system.
6. Although permitted, the City's stormwater system still creates significant challenges for natural streams. Thousands of outfall pipes discharge into local waterways. Even when stormwater is filtered, the unnaturally rapid, concentrated flows delivered through these pipes contribute to streambank instability, erosion, and sedimentation, degrading habitat quality and stream function.

D. Riparian Buffer

1. Riparian Buffer means a segment of land that runs alongside a body of surface water (rivers, streams, lakes, or ponds) or wetland and has specific dimensions established by ordinance or statute.
2. Riparian buffers provide several important ecosystem services, including, pollution mitigation, wildlife habitat, temperature mitigation, climate regulation, biochemical processing, fire risk mitigation, and recreation and cultural services.
3. The city has approximately 1,350 acres of land that are within 50' feet of a stream bank (excluding piped stream segments).
4. The City has not established a riparian buffer for Salem streams.
5. The City's failure to establish riparian buffers for City streams is inconsistent with State Land Use Planning Goal 5, which calls for 50 feet riparian buffers on streams with flow rates lower than 1,000 cubic feet per second.

E. Wetlands

1. Wetland means an area that is inundated or saturated by surface water or ground water at a frequency and duration sufficient to support, and that under normal circumstances does support, a prevalence of vegetation typically adapted for life in saturated soil conditions.
2. Wetlands provide important ecosystem services, including: stormwater management, groundwater recharge, temperature moderation, wildlife habitat, fire risk mitigation, and recreational, cultural, and educational opportunities.
3. Several Salem **listed species** depend on wetlands at some point in their life cycle, including:
4. The City of Salem does not protect wetlands beyond the requirements set by the State of Oregon.
5. The City of Salem has not adopted a local wetland inventory per Oregon Land Planning Goal 5.
6. The City of Salem maintains **X** amount of constructed wetlands.

F. Floodplains

1. Floodplain means an area that has a one percent (1%) annual chance of flooding.
2. Floodplains provide a range of ecosystem services, including stormwater conveyance and storage, habitat for native species, groundwater recharge, and water quality management.
3. The City of Salem permits floodplain development pursuant to Federal Emergency Management Agency (FEMA) regulations.
4. Floodplains are vital to the health of anadromous fish because they provide important habitat during the freshwater phase of the anadromous life cycle.
5. Development in the floodplain increases the risk and severity of flooding, poses a threat to human health and safety, and contributes pollutants to streams and rivers.

G. Open Spaces

1. Open spaces means land that is not developed for residential or economic uses (other than farmland), that contains minimal amounts of impervious surfaces, and that has few or no structures.
2. The City owns and manages 2,335 acres of parkland distributed across 90 parks. Ten parks are classified as natural areas and total 1,391 acres. Minto-Brown Island Park accounts for 1,216 acres (87%) of natural area.
3. Open space is an Oregon Goal 5 resource, which Goal 5 defines as “parks, forests, wildlife preserves, nature reservations or sanctuaries, and public or private golf courses.”

H. Wildlife Habitat

1. Wildlife habitat means an area upon which native flora and fauna depend in order to meet their requirements for food, water, shelter, and reproduction.
2. The Oregon Department of Lands have designated the Willamette River, Mill Creek, and portions of Glenn Creek, Gibson Creek, Pringle Creek, and the Lower Pudding River as Essential Salmonid Habitat (ESH).
3. Salem has not designated any land as wildlife habitat.

I. Lakes

1. Lake means a large body of water surrounded by land. A lake is larger and/or deeper than a pond. A lake may be constructed.
2. Salem's lakes, while constructed, provide important ecosystem services, including; stormwater management, temperature moderation, groundwater recharge, biochemical cycling, and recreation.
3. Salem has X lakes.

4. Salem's lakes are a result of gravel mining.
5. Lake Wirth is stocked by the Oregon Department of Fish and Wildlife.
6. Salem's lakes provide habitat for migratory birds and a number of species listed as key conservation species by the Oregon Department of Fish and Wildlife.

J. Ponds

1. Pond means a small body of surface water that is less than 12 acres wide, less than 16 feet deep, and has less than 30 percent cover of emergent vegetation. Ponds have different geochemical profiles than lakes, streams, or wetlands and serve different ecological functions.

K. Oregon White Oak Groves

1. Oregon white oak groves mean a contiguous stand of Oregon White Oak (*Quercus garryana*) of any shape that equals or exceeds one-quarter acre and that provides an Oregon white oak canopy coverage of at least fifty-percent over that same space.

L. Regulatory Environment

1. The City must comply with the provisions of the Clean Water Act through its National Pollutant Discharge Elimination System permit, regulating stormwater discharge into Salem's streams.
2. City programs or projects that receive federal funds must comply with the Endangered Species Act.
3. The Army Corp of Engineers (Corps) has jurisdiction over the waters of the United States, which includes the Willamette River and its tributaries.
4. The State of Oregon has co-jurisdiction over waters of Oregon.
5. The City has co-jurisdiction of rivers and streams within its boundaries and may promulgate regulations so long as they do not conflict with federal or state regulations.
6. The State of Oregon has primary jurisdiction over wetlands. The State requires a permit and associated mitigation to develop within a wetland. Cities may regulate wetlands so long as municipal regulations do not conflict with state regulations.
7. The City is subject to the Migratory Bird Treaty Act (MBTA), which prohibits the take (killing, capture, or harassment) of migratory birds, their active nests, and eggs. The MBTA applies broadly across City projects involving vegetation management, tree removal, construction, utility maintenance, airport operations, and other disturbance-related work.
8. The City is subject to the Bald and Gold Eagle Protection Act (BGEPA), which prohibits disturbance, take, or destruction of eagles, their nests, and their eggs without a permit from the U.S. Fish and Wildlife Service. Because Salem supports multiple active bald eagle nesting

Commented [1]: This is more complicated than it sounds if you consider canopy overlap with Douglas fir and other species.

Commented [MS2R1]: Agreed. The definition needs some work.

territories, the City must ensure that its operations, facilities, and public events avoid disturbing nesting eagles and comply with federal eagle management guidelines.

M. City Policies & Practices

1. The City's natural resource policies and programs have historically been driven by the desire to comply with state and federal regulatory requirements.
2. The City operates a comprehensive flood monitoring and drainage system maintenance program, which includes routine inspection of streams, culverts, drainage channels, and known problem sites to identify obstructions and flood hazards before they escalate.
3. The City has an effective program to manage drinking water and monitor storm water quality.
4. The City requires a permit to remove native vegetation in riparian areas, to remove an Oregon white oak with a diameter at breast height (DBH) of 20 inches or more, and any other species of tree with a DBH of 30 inches or more.
5. The City has a robust Urban Forestry Program.
6. The City has an aggressive program to manage Emerald Ash Borer (EAB)
7. The City actively monitors bald eagle nests on and near City-owned properties and manages its operations to avoid disturbance.
8. In 2023, the City adopted an Integrated Pest Management (IPM) Policy (APP 3.23) to provide clear requirements and guidance for pesticide use.
9. The City owns and manages 2,335 acres of parkland distributed across 90 parks.
10. Ten parks are classified as natural areas and total 1,391 acres. Minto-Brown Island Park accounts for 1,216 acres (87%) of natural area.

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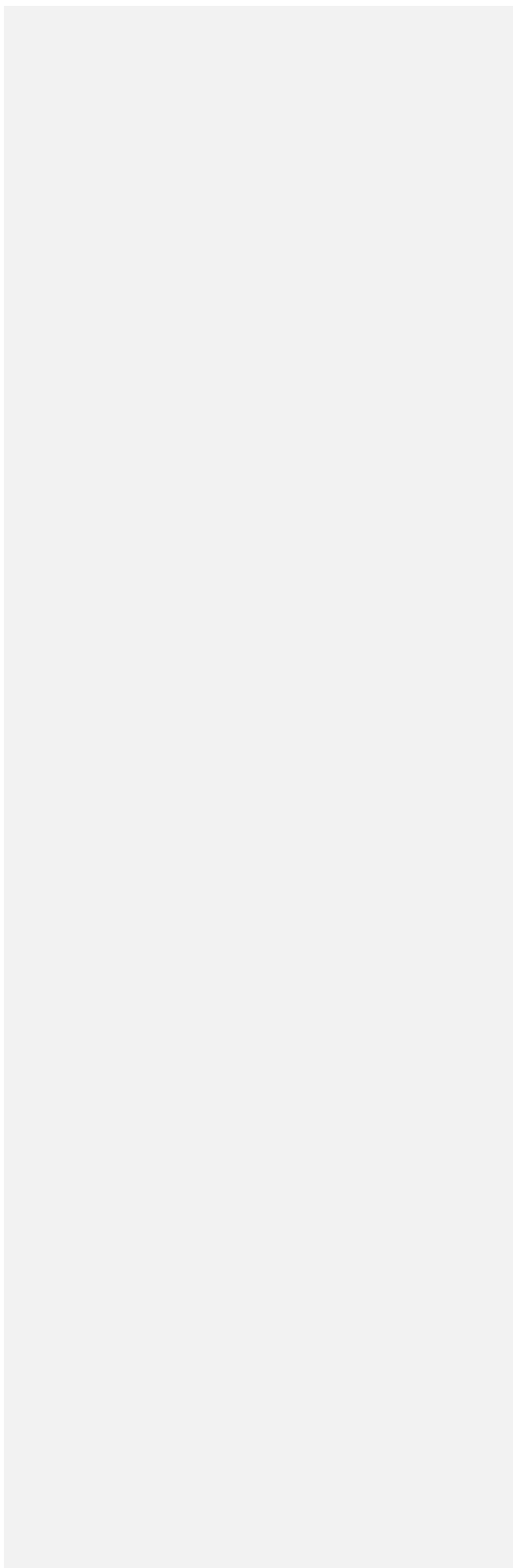
03. RECOMMENDATIONS

1. Align Salem natural resource policies with Oregon Land Use Goal 5 and the Oregon Conservation Strategy.
2. Update the Natural Resources section of Salem's Comprehensive Plan to better
3. Enact an environmentally significant lands ordinance.
4. Manage environmentally significant lands for ecosystem services and natural habitat.
5. Conserve environmentally significant lands through easements, deed restrictions, and other legal mechanisms.
6. Develop rehabilitation and management plans for each class of environmentally significant lands.
7. Make better use of GIS capabilities to track and report on natural resource management. Consider producing public-facing maps where appropriate.
8. Improve cross-departmental planning and coordination among staff that set policy and manage natural resources.

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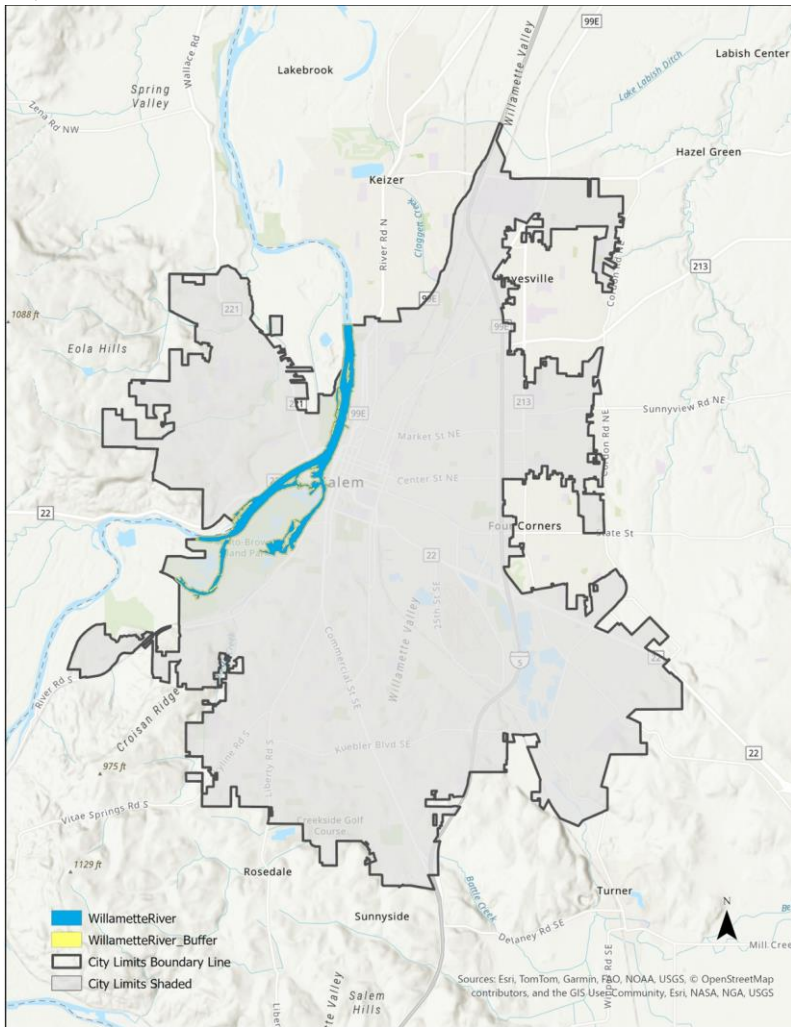
04. CONCLUSION

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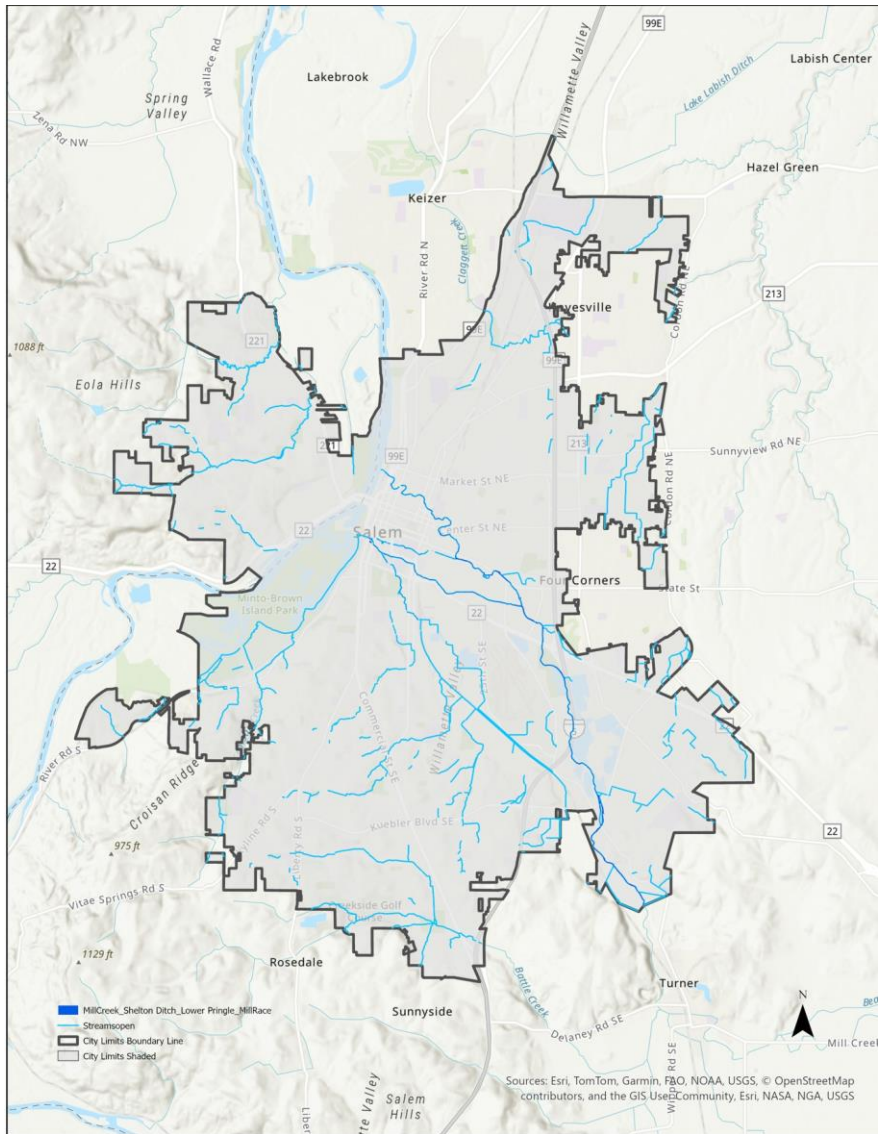
05. MAPS

Map 01. The Willamette River



GIS Analysis by Jennifer Mongolo and Michael Slater.

Map 02. Salem's Urban Streams

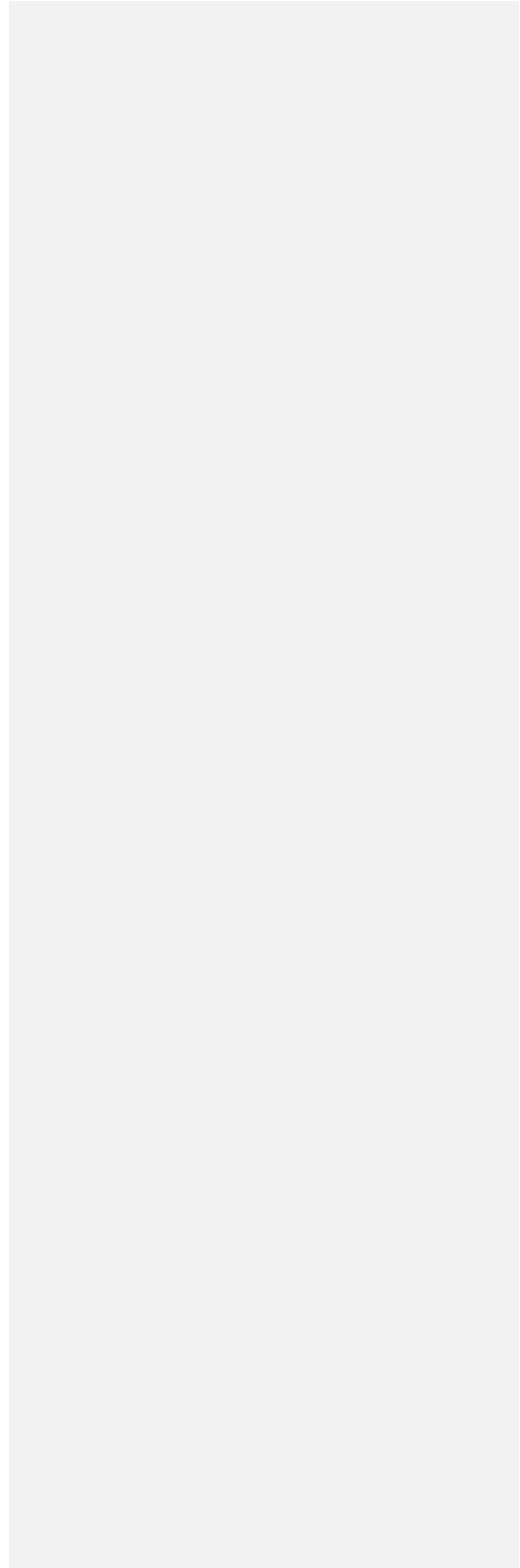


GIS Analysis by Jennifer Mongolo and Michael Slater.

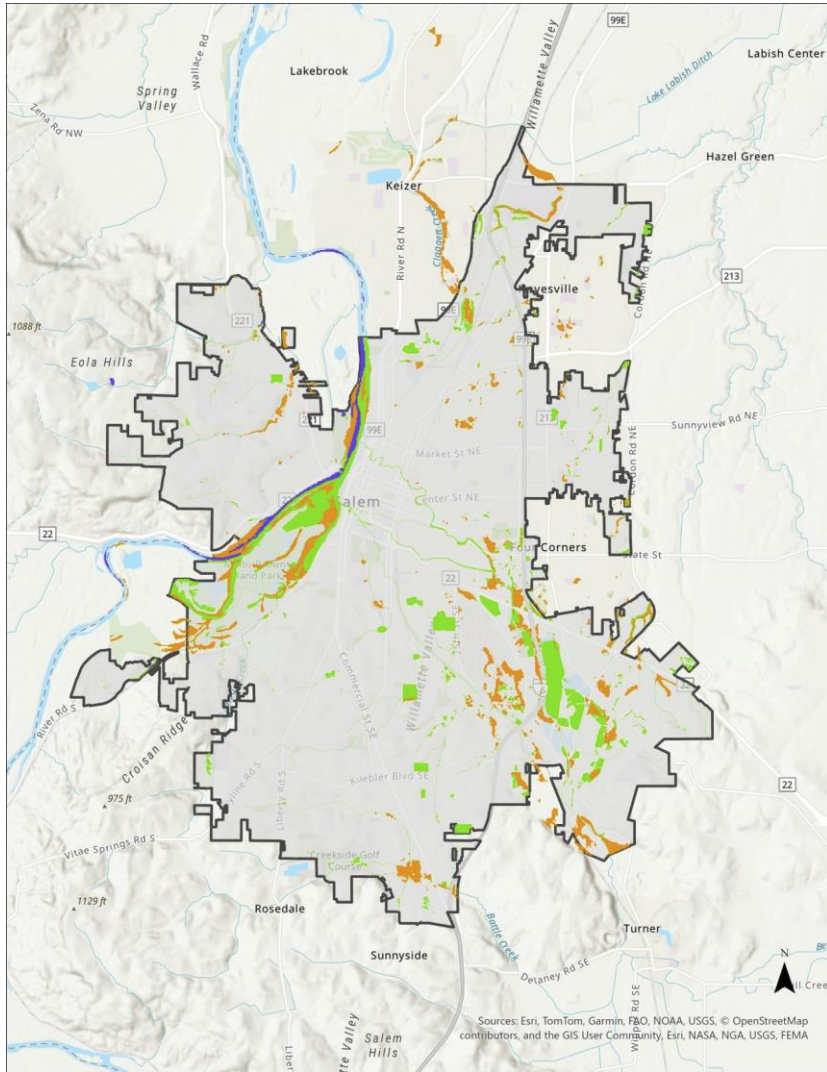
Map 03. Riparian Buffers (50')

05. Maps

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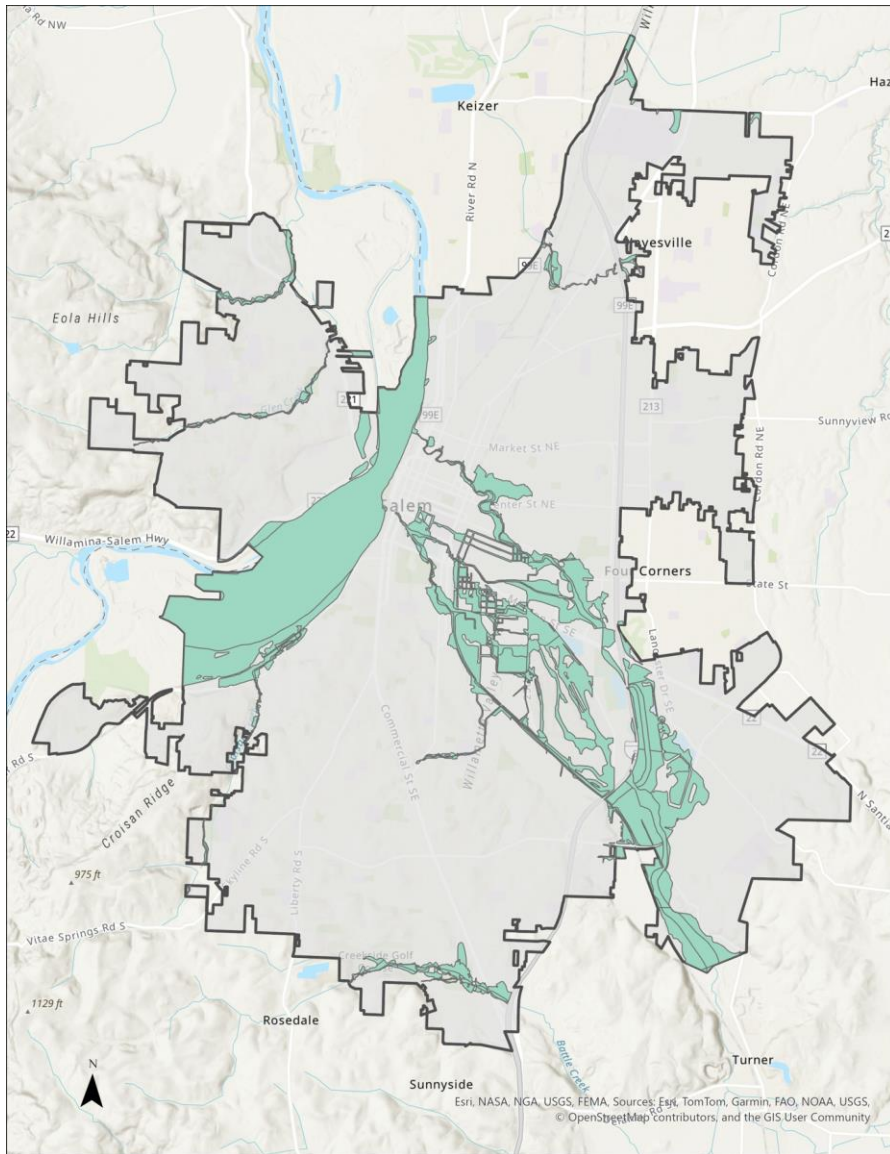


Map 04. Wetlands



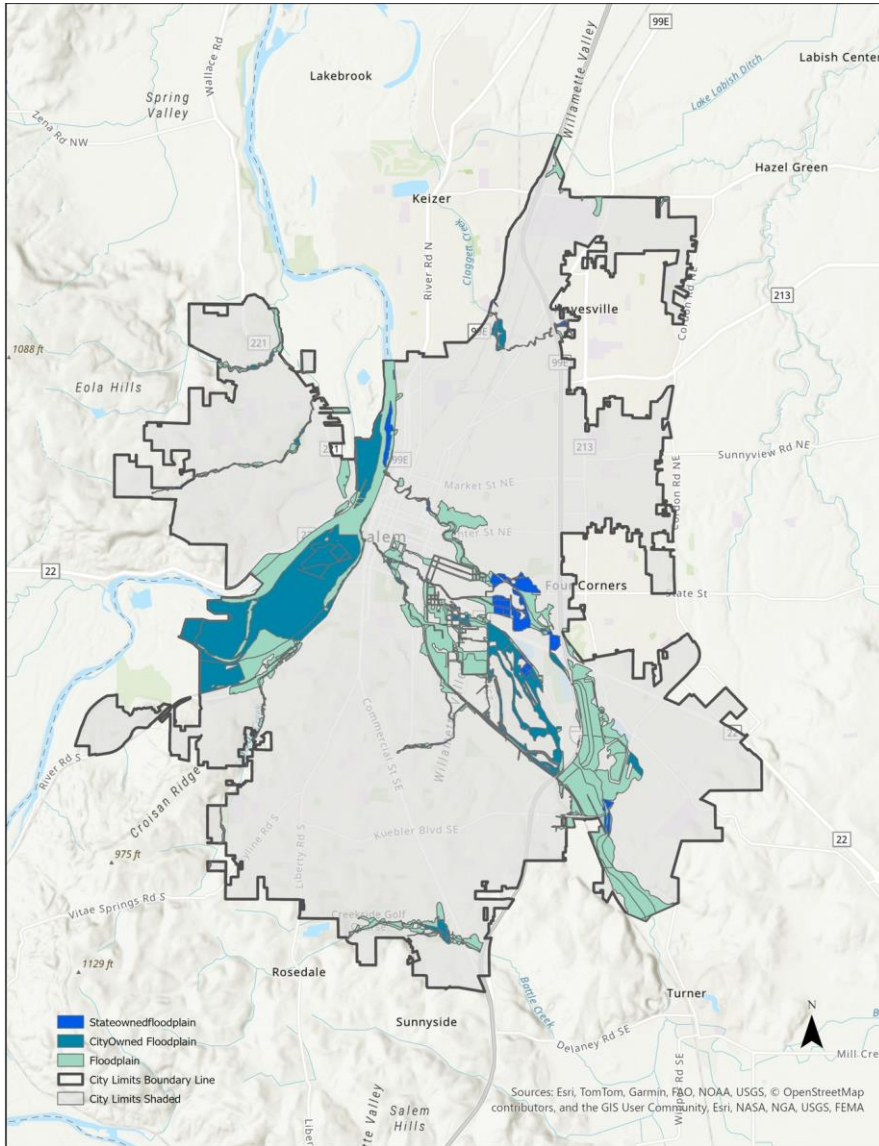
GIS Analysis by Jennifer Mongolo and Michael Slater.

Map 05. Floodplain



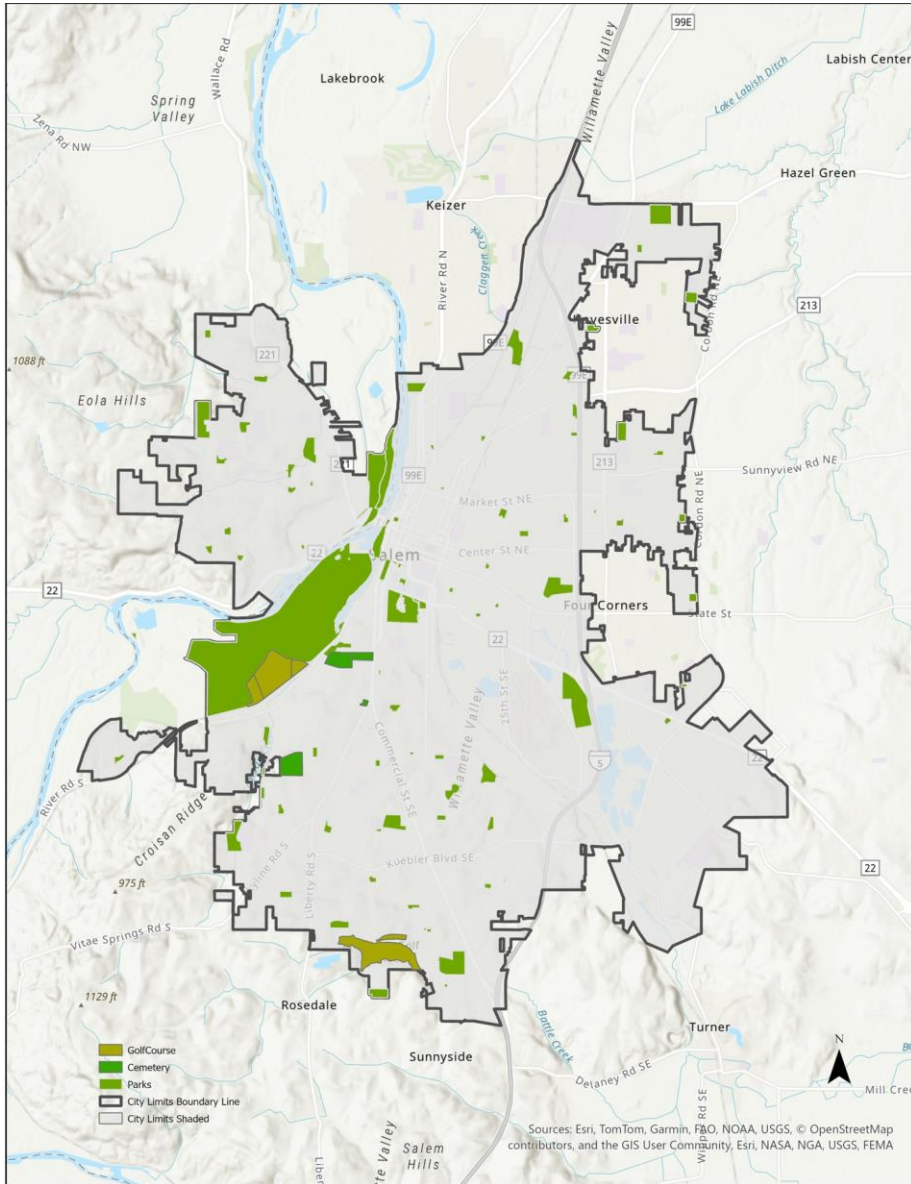
GIS Analysis by Jennifer Mongolo and Michael Slater.

Map 06. City and State Floodplain Ownership



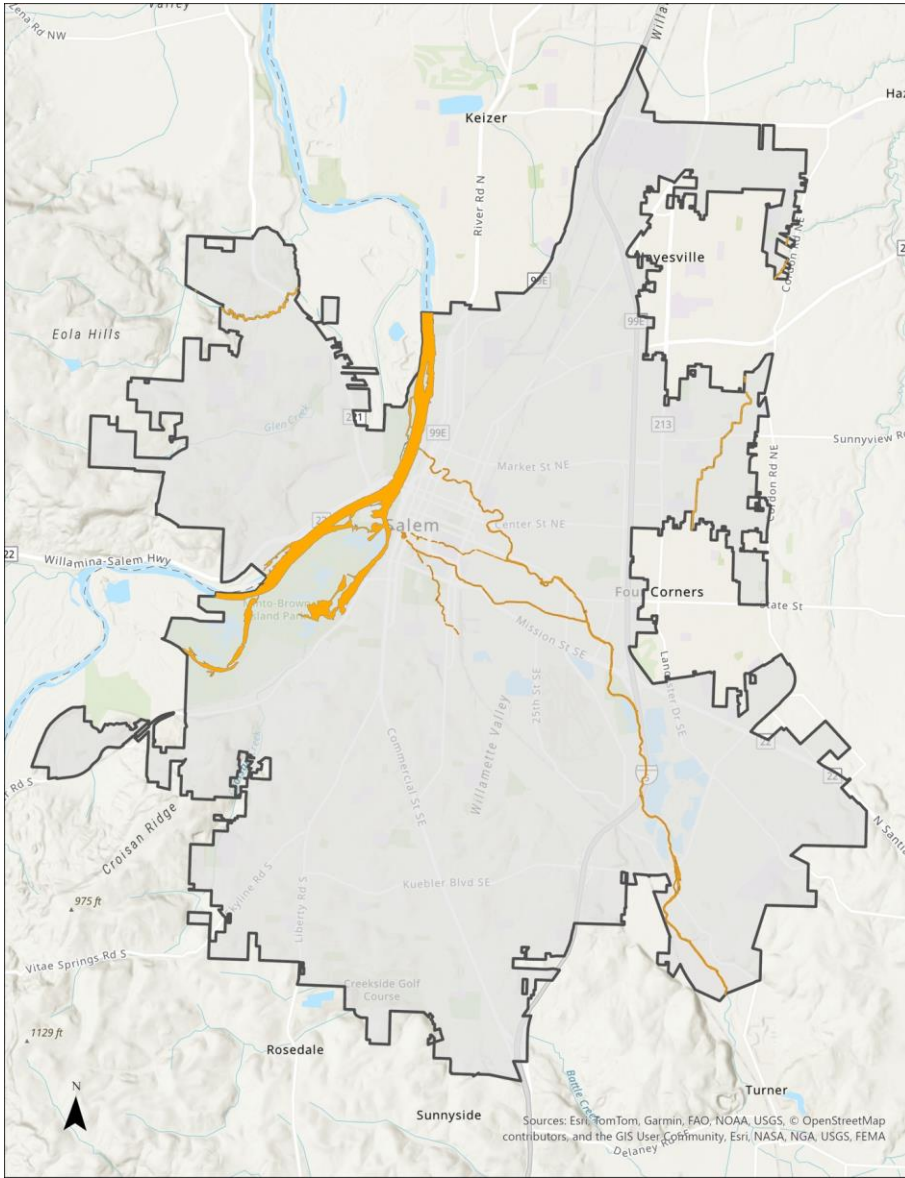
GIS Analysis by Jennifer Mongolo and Michael Slater.

07. Open Space



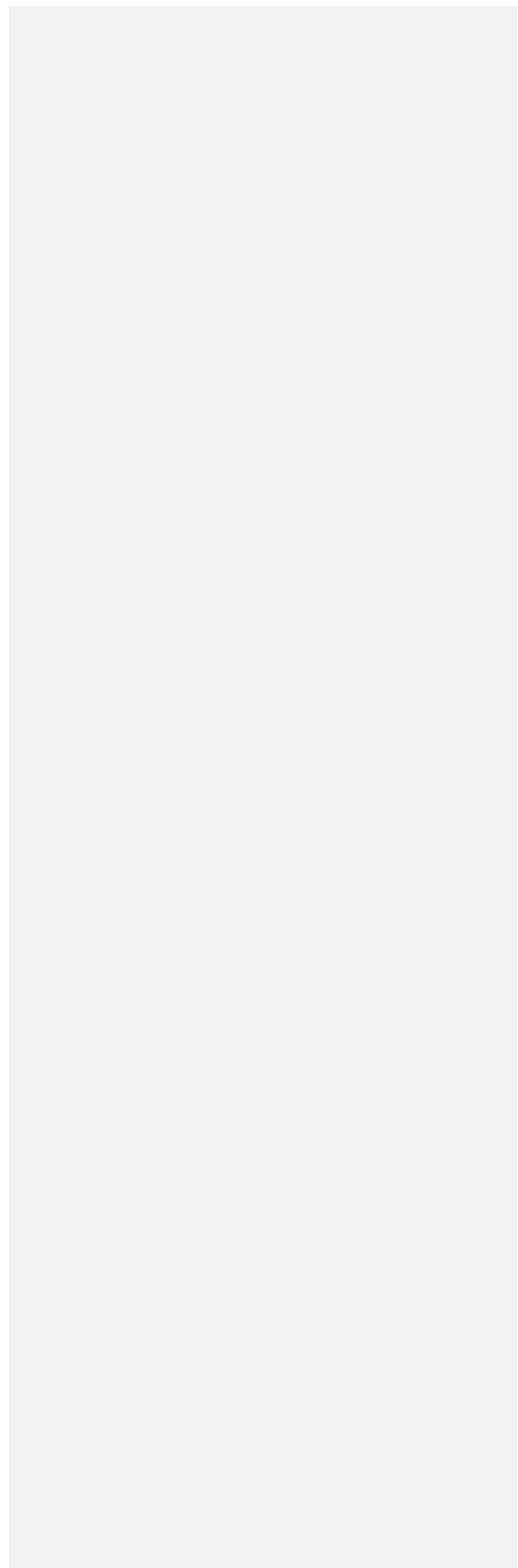
GIS Analysis by Jennifer Mongolo and Michael Slater.

Map 08. Wildlife Habitat

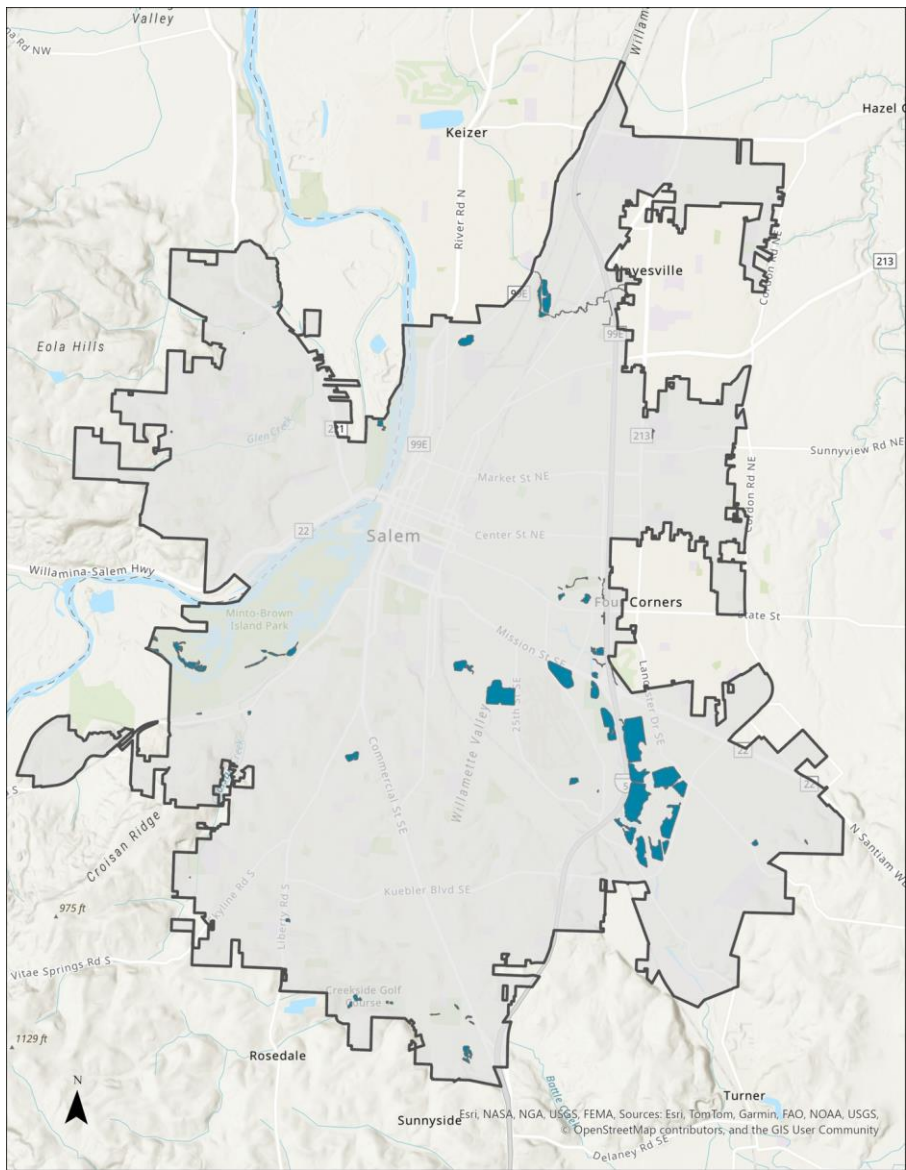


GIS Analysis by Jennifer Mongolo and Michael Slater.
Map 09. Oak Woodlands

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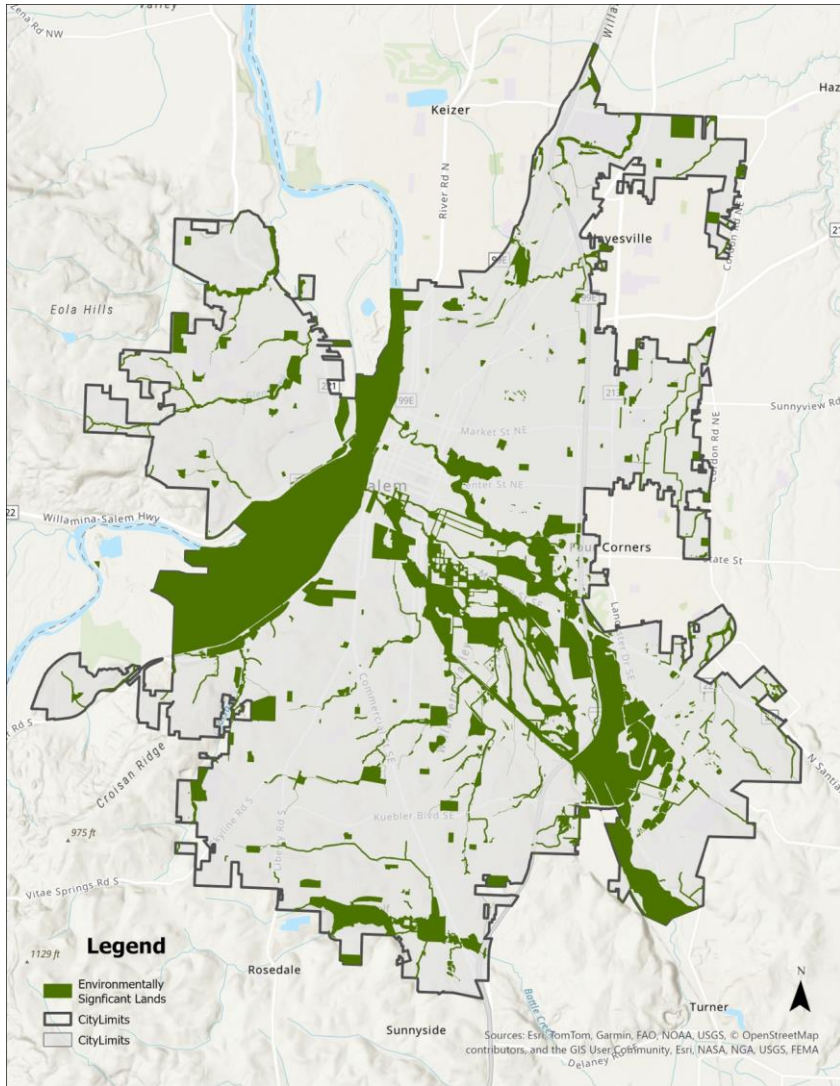


Map 10. Lakes and Ponds



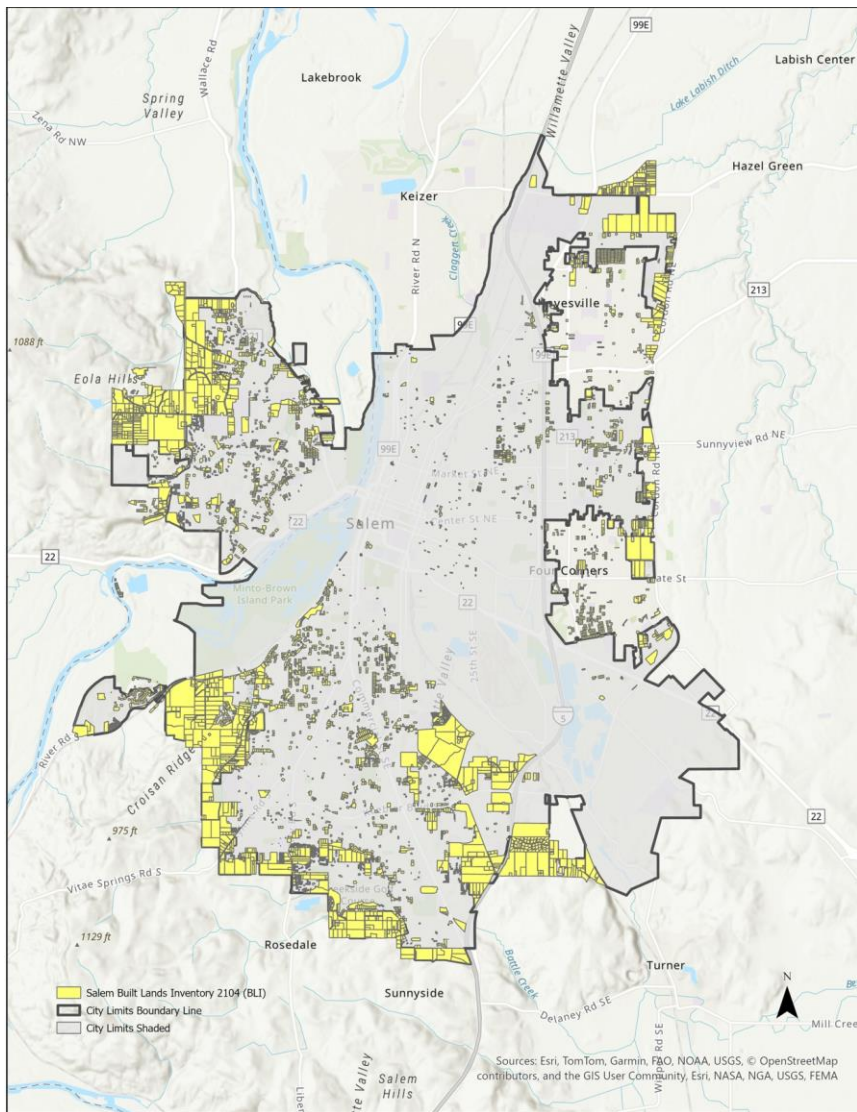
GIS Analysis by Jennifer Mongolo and Michael Slater.

Map 11: Environmentally Significant Lands



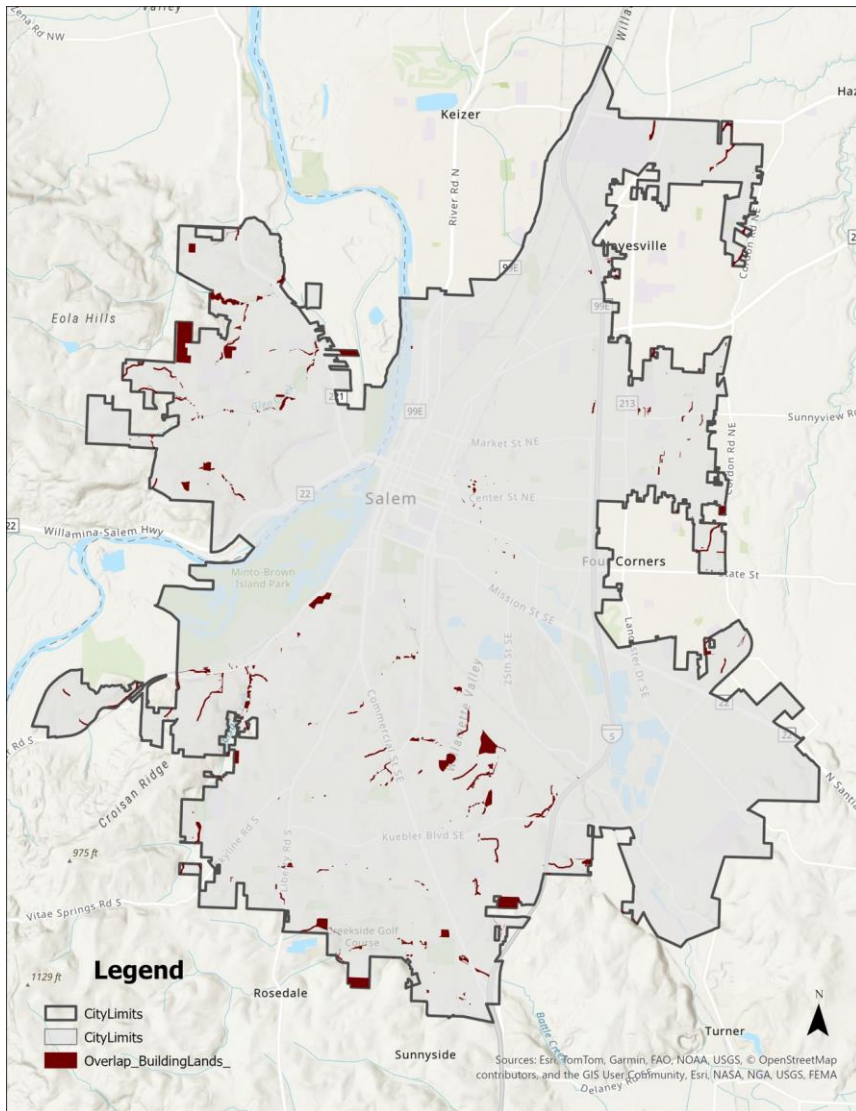
GIS Analysis by Jennifer Mongolo and Michael Slater.

Map 12. Buildable Lands Inventory



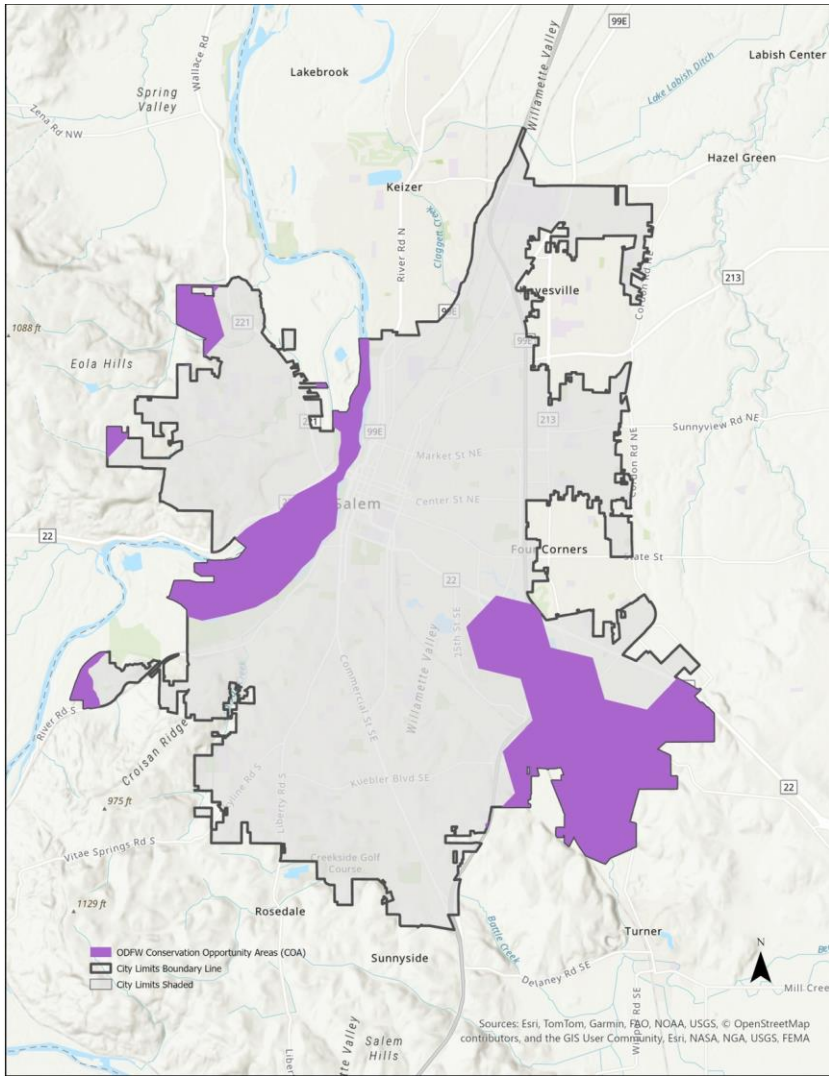
GIS Analysis by Jennifer Mongolo and Michael Slater.

Map 13. Overlap Between BLI and ESL.



GIS Analysis by Jennifer Mongolo and Michael Slater.

Map 14. Conservation Opportunity Areas

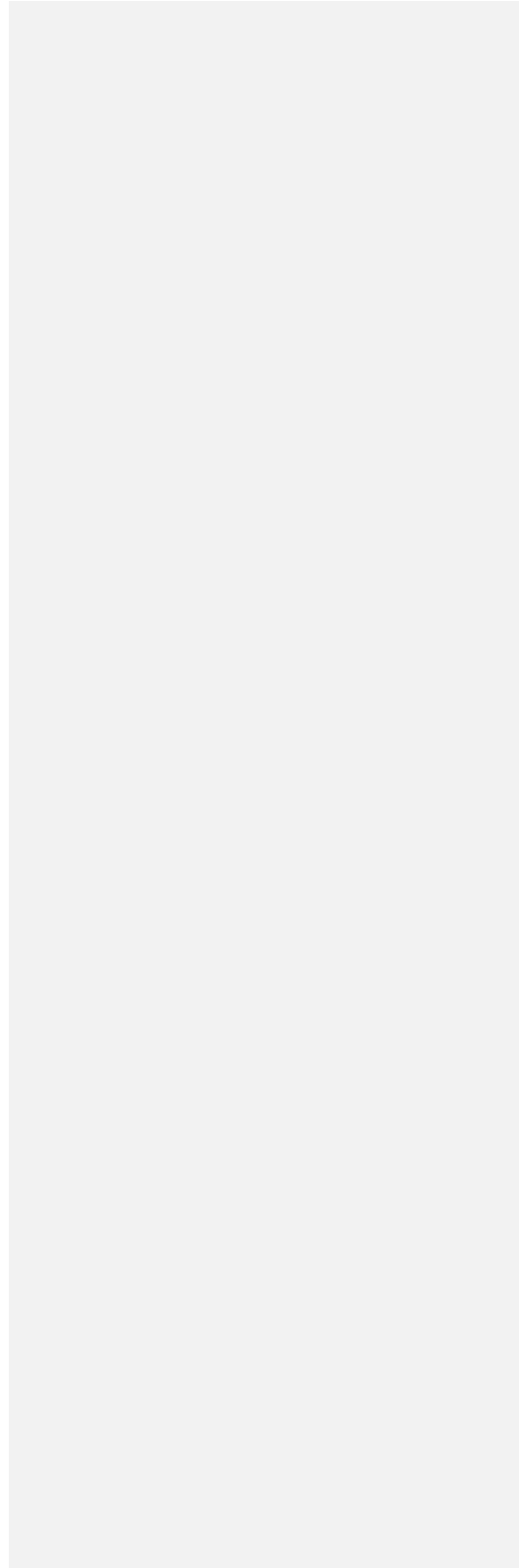


GIS Analysis by Jennifer Mongolo and Michael Slater.

Map 15.

05. Maps

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06. REFERENCES

Case Law

Dolan v. City of Tigard, 512 U.S. 374 (1994).

Nollan v. California Coastal Comm'n, 483 U.S. 825 (1987).

Northwest Environmental Defense Center v. Federal Emergency Management Agency (3:23-cv-01335).

GIS Files

City of Salem. (2020). Watersheds of Salem. DataSalem.

<https://data.cityofsalem.net/maps/d4be24770bd445aba718307deff7f792/about>

City of Salem. (2025). City Limits. DataSalem.

https://data.cityofsalem.net/datasets/e20578821f8c4fb88c692dd032f994be_1/explore?location=44.770509%2C-123.109596%2C8.91

City of Salem. UGB. DataSalem.

https://data.cityofsalem.net/datasets/c09a88d3dc9b4ee1b1ee2b75e2638713_0/explore?location=44.943467%2C-123.031833%2C11.58

City of Salem. Public Wetlands. DataSalem.

https://data.cityofsalem.net/datasets/8aea1e1053fd4fedb7ceb8f9e8d5b38d_0/explore?location=44.940791%2C-123.015489%2C13.13

City of Salem. (2025). Public Stormwater Quality Facilities.

https://data.cityofsalem.net/datasets/8b81d3c07cd64f36a2f7fdc5262949b9_0/explore?location=44.977597%2C-122.971498%2C9.99

GIS Examples

Portland Environmental Services. (N.D.). Watershed Restoration and Monitoring.

<https://pdx.maps.arcgis.com/apps/webappviewer/index.html?id=807ed51bb0314f9cbd31815c73ff9b6e>

Government Documents and Reports

City of Oslo. (2025). Oslo European green capital report. <https://circabc.europa.eu/ui/group/c6e126de-5b8c-4cd7-8d36-a1978a2a63de/library/11d6aa81-fd92-4372-ba51-1476da51355e/details>

City of Salem. (2022). Our Salem: Salem area comprehensive plan. Salem, OR.

City of Salem. (2013, May) Comprehensive parks master plan update. Salem, OR.

<https://www.cityofsalem.net/home/showpublisheddocument/5144/637798386490270000>

City of Salem. (2022, February). Salem Climate Action Plan.

<https://www.cityofsalem.net/home/showpublisheddocument/16431/637931486310570000>

NOAA. (2016, April). Biological Opinion on the Implementation of the National Flood Insurance Program in the State of Oregon. US Department of Commerce.

<https://www.fisheries.noaa.gov/s3//2022-01/2016-04-14-fema-nfip-nwr-2011-3197.pdf>

NOAA. (2016). Oregon Floodplains: Working to Conserve Pacific Salmon & Local Communities. NOAA Fisheries, West Coast Region. US Department of Commerce. <https://media.fisheries.noaa.gov/2022-02/oregon-fema-biop-factsheet-2016.pdf>

05. Maps

Oregon Department of Environmental Quality. (2021, September). Individual permit: National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer Systems Phase (MS4) I Individual Permit. State of Oregon. <https://www.cityofsalem.net/home/showpublisheddocument/21295/638366835831970000>

Salem Public Works Department. (2022). TMDL implementation plan for the City of Salem. City of Salem. <https://www.cityofsalem.net/home/showpublisheddocument/734/638028226960700000>

Salem Public Works Department. (2025). 2025 Annual water quality report: Drinking water quality data from 2024. City of Salem. <https://www.cityofsalem.net/home/showpublisheddocument/27182/638864438912570000>

Salem Public Works Department. (2020, October). Stormwater master plan. City of Salem. <https://www.cityofsalem.net/home/showpublisheddocument/5168/637798392359400000>

Salem Public Works Department. (2025) TMDL annual report 2024-2025. City of Salem. <https://www.cityofsalem.net/home/showpublisheddocument/28346/638981129715330000>

Salem Public Works Department. (2022, September). Surface water and stormwater monitoring plan. National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System. City of Salem.

Salem Public Works Department. (2023, October). Annual Report FY 2022-2023. National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer Systems permit. City of Salem. <https://www.cityofsalem.net/home/showpublisheddocument/21239/638404893336430000>

Journal Articles

Alberti, Marina. (2005, April). The effects of urban patterns on ecosystem function. *International Regional Science Review* 28(2), 168-192.

Andreucci, M.B., et al. (2021) Exploring challenges and opportunities of biophilic urban design: evidence from research and experimentation. *Sustainability* 13 (4323). <https://doi.org/10.3390/su13084323>

Angold, P.G., et al. (2006). Biodiversity in Urban Habitat Patches. *Science of the Total Environment*, 360 (1-3), 196–204.

Aronson, M., et al. (2017). Biodiversity in the city: key challenges for urban green space management. *Frontiers in Ecology and the Environment*, 15(4), 189–196. doi:10.1002/fee.1480

Beatley, T. (2000). Preserving biodiversity. *Journal of the American Planning Association*, 66(1), 5-20. DOI: 10.1080/01944360008976080

Beninde, J., et al. (2015). Biodiversity in cities needs space: a meta-analysis of factors determining intra-urban biodiversity variation. *Ecology Letters*, 18, 581–592.

Blackwell, M.S.A., & Pilgrim, E. (2011). Ecosystem services delivered by small-scale wetlands. *Hydrological Sciences Journal*, 56(8), 1467-1484. DOI:10.1080/02626667.2011.630317

Botkin, D.B. & Beveridge, C.E. (1997). Cities as environments. *Urban Ecosystem*, 1, 3-19.

Bush, J. & Doyon, A. (2019). Building urban resilience with nature-based solutions: How can urban planning contribute? *Cities*, 95. doi.org/10.1016/j.cities.2019.102483.

Calapez, A.R., et al. (2023). Unveiling relationships between ecosystem services and aquatic communities in urban streams. *Ecological Indicators*, 153. doi.org/10.1016/j.ecolind.2023.110433.

Costanza, J.K., & Terando, A.J. (2019). Landscape connectivity planning for adaptation to future climate and land-use change. *Current Landscape Ecology Report* 4, 1–13. doi.org/10.1007/s40823-019-0035-2

- Coutts, C., & Hahn, M. (2015). Green infrastructure, ecosystem services, and human health. *International Journal of Environmental Research and Public Health*, 12(8), 9768-9798. doi.org/10.3390/ijerph120809768
- Dearborn, D.C., & Kark, S. (2009). Motivations for conserving urban biodiversity. *Conservation Biology*, 24(2), 432–440. DOI: 10.1111/j.1523-1739.2009.01328.x
- Díaz, S. & Malhi, Y. (2022) Biodiversity: concepts, patterns, trends, and perspectives. *Annual Review of Environment and Resource*, 47, 31–63. doi.org/10.1146/annurev-enviro-120120-054300
- Eikaas, I.-L., Roussel, H., Thorén, A.-K. H., & Dramstad, W. E. (2023). Applying landscape ecology in local planning, Some experiences. *International Journal of Environmental Research and Public Health*, 20(4), 3410. <https://doi.org/10.3390/ijerph20043410>
- Faeth, S.H., C. Bang and S. Saari. 2011. Urban biodiversity: Patterns and mechanisms. *Annals of the New York Academy of Sciences*, 1223, 69-81. doi: 10.1111/j.1749-6632.2010.05925.x,
- Ferreira, V., et al. (2023). Ecosystem services provided by small streams: an overview. *Hydrobiologia* 850, 2501–2535. <https://doi.org/10.1007/s10750-022-05095-1>
- Filazzola A, Shrestha N, MacIvor JS. (2019). The contribution of constructed green infrastructure to urban biodiversity: A synthesis and meta-analysis. *Journal of Applied Ecology*, 56: 2131–2143. <https://doi.org/10.1111/1365-2664.13475>
- Flitcroft, R., et al. (2023). Science to support conservation action in a large river system: The Willamette River, Oregon, USA. *Water Biology and Security*, 2(4). <https://doi.org/10.1016/j.watbs.2023.100203>
- Groffman, P.M., Bain, D.J., Band, L.E., Belt, K.T., Brush, G.S., Grove, J.M., Pouyat, R.V., Yesilonis, I.C. and Zipperer, W.C. (2003). Down by the riverside: Urban riparian ecology. *Frontiers in Ecology and the Environment*, 1, 315–321. [https://doi.org/10.1890/1540-9295\(2003\)001\[0315:DBTRUR\]2.0.CO;2](https://doi.org/10.1890/1540-9295(2003)001[0315:DBTRUR]2.0.CO;2)
- Haaland, C., & Konijnendijk van den Bosch, C. (2015). Challenges and strategies for urban green-space planning in cities undergoing densification: A review. *Urban Forestry & Urban Greening*, 14(4), 760-771. <https://doi.org/10.1016/j.ufug.2015.07.009>.
- Hall, D.M., et al. (2017). The city as a refuge for insect pollinators. *Conservation Biology*, 31, 24–29. <https://doi.org/10.1111/cobi.12840>
- Haase, D. (2015). Reflections about blue ecosystem services in cities. *Sustainability of Water Quality and Ecology*, 5, 77-83. <https://doi.org/10.1016/j.swaqe.2015.02.003>.
- Hersperger, A.M., Grădinaru, S.R., Pierrri Daunt, A.B. et al. (2021) Landscape ecological concepts in planning: Review of recent developments. *Landscape Ecology* 36, 2329–2345. <https://doi.org/10.1007/s10980-021-01193-y>
- Ignatieva, M., et al. (2011). Planning and design of ecological networks in urban areas. *Landscape and Ecologic Engineering*, 7, 17–25. <https://doi.org/10.1007/s11355-010-0143-y>
- Ives, C.D., Lentini, P.E., Threlfall, C.G., Ikin, K., Shanahan, D.F., Garrard, G.E., Bekessy, S.A., Fuller, R.A., Mumaw, L., Rayner, L., Rowe, R., Valentine, L.E. and Kendal, D. (2016). The importance of cities for threatened species. *Global Ecology and Biogeography*, 25: 117-126. <https://doi.org/10.1111/geb.12404>
- Jennings, V., et al. (2019). Friend or foe? an overview of the services and disservices from urban green spaces. In: *Urban green spaces*. Springer Briefs in Geography. Springer, Cham. https://doi.org/10.1007/978-3-030-10469-6_2
- Jones, K.B., Zurlini, G., Kienast, F. et al. (2013). Informing landscape planning and design for sustaining ecosystem services from existing spatial patterns and knowledge. *Landscape Ecology*, 28, 1175–1192. <https://doi.org/10.1007/s10980-012-9794-4>

- Kardan, O., Gozdyra, P., Mistic, B. et al. (2015). Neighborhood greenspace and health in a large urban center. *Scientific Reports*, 11610. <https://doi.org/10.1038/srep11610>
- Jack D. Kartez & Molly P. Casto (2008). Information Into action: Biodiversity data outreach and municipal land conservation, *Journal of the American Planning Association*, 74(4), 467-480, <https://doi.org/10.1080/01944360802378096>
- Kenney, Melissa A., Peter R. Wilcock, Benjamin F. Hobbs, Nicholas E. Flores, and Daniela C. Martínez, 2012. Is Urban Stream Restoration Worth It? *Journal of the American Water Resources Association*, 48(3) 603-615. <https://doi.org/10.1111/j.1752-1688.2011.00635.x>
- Klaus, V. & Kiehl, K. (2021). A conceptual framework for urban ecological restoration and rehabilitation. *Basic and Applied Ecology*, 52, 82-94. <https://doi.org/10.1016/j.baae.2021.02.010>.
- Lafortezza, R., et al. (2018). Nature-based solutions for resilient landscapes and cities. *Environmental Research*, Volume 165,431-441, <https://doi.org/10.1016/j.envres.2017.11.038>.
- Lee, T. S., et al. (2022). A framework to identify priority wetland habitats and movement corridors for urban amphibian conservation. *Ecological Solutions and Evidence*, 3. <https://doi.org/10.1002/2688-8319.12139>
- Leitão, A. & Ahern, J. (2002). Applying landscape ecological concepts and metrics in sustainable landscape planning, *Landscape and Urban Planning*, 59(2), 65-93. [https://doi.org/10.1016/S0169-2046\(02\)00005-1](https://doi.org/10.1016/S0169-2046(02)00005-1).
- Martin, G. K., O'Dell, K., Kinney, P. L., Pescador-Jimenez, M., Rojas-Rueda, D., Canales, R., & Anenberg, S. C. (2024). Tracking progress toward urban nature targets using landcover and vegetation indices: A global study for the 96 C40 Cities. *GeoHealth*, 8, e2023GH000996 <https://doi.org/10.1029/2023GH000996>
- Meli P, et al. (2014). Restoration Enhances Wetland Biodiversity and Ecosystem Service Supply, but Results Are Context-Dependent: A meta-analysis. *PLoS ONE* 9(4), e93507. <https://doi.org/10.1371/journal.pone.0093507>
- Orta-Ortiz, M.S., & Geneletti, D. (2022). What variables matter when designing nature-based solutions for stormwater management? A review of impacts on ecosystem services. *Environmental Impact Assessment Review*, 95. <https://doi.org/10.1016/j.eiar.2022.106802>.
- Pickett, S.T.A., et al. (2001). Urban ecological systems: Linking terrestrial ecological, physical, and socioeconomic components of metropolitan areas. *Annual Review of Ecology and Systematics*, 32, 127-157. <https://doi.org/10.1146/annurev.ecolsys.32.081501.114012>
- Planchuelo, G. et al. (2019). Untangling the role of urban ecosystems as habitats for endangered plant species. *Landscape and Urban Planning*, 189, 320-334. <https://doi.org/10.1016/j.landurbplan.2019.05.007>.
- Pulliam, H.R., & Johnson, B.R. (2002) Ecology's new paradigm: What does it offer designers and planners? In Bart R. Johnson and Kristina Hill (Eds.), *Ecology and Design: Frameworks for Learning* (pp 51-88). Island Press.
- Ranta, E., et al. (2021). Urban stream assessment system (UsAs): An integrative tool to assess biodiversity, ecosystem functions and services. *Ecological Indicators*, 121. <https://doi.org/10.1016/j.ecolind.2020.106980>.
- Riley, A. (2016). *Restoring neighborhood streams: planning, design, and construction*. Island Press. <https://doi.org/10.5822/978-1-61091-741-4>.
- Rojas-Rueda D., et al. (2019). Green spaces and mortality: a systematic review and meta-analysis of cohort studies. *Lancet Planetary Health*, 11, e469 - e477. [https://doi.org/10.1016/S2542-5196\(19\)30215-3](https://doi.org/10.1016/S2542-5196(19)30215-3)

Schueler, T. (1995). The importance of imperviousness. *Watershed Protection Techniques*, 1(3).

Spirn, A.W. (2014). Ecological urbanism: A framework for the design of resilient Cities (2014). In Ndubisi, F.O. (ed), *The Ecological Design and Planning Reader*. Island Press.
https://doi.org/10.5822/978-1-61091-491-8_50

Stokes, D., et al. (2009). Local land-use planning to conserve biodiversity: Planners' perspectives on what works. *Conservation Biology*, 24(2), 450–460.
<https://doi.org/10.1111/j.1523-1739.2009.01356.x>

Trammell, E. & Carter, Sarah & Haby, Travis & Taylor, Jason. (2018). Evidence and Opportunities for Integrating Landscape Ecology into Natural Resource Planning across multiple-use landscapes. *Current Landscape Ecology Reports*, 3. <https://doi.org/10.1007/s40823-018-0029-5>.

Wu, J. (2014) Urban ecology and sustainability: The state-of-the-science and future directions. *Landscape and Urban Planning*, 125, 209-221.
<https://doi.org/10.1016/j.landurbplan.2014.01.018>.

Textbooks

Turner, M. & Gardner, R. (2015). *Landscape ecology in theory and practice: pattern and process*. Springer.
<https://doi.org/10.1007/978-1-4939-2794-4>

Statutes, Rules, and Ordinances

OAR 660-015-0000(1)

OAR Chapter 660, Division 23: Procedures and requirements for complying with Goal 5.

SRC Title I, Chapter 1: General Provisions

SRC Title I, Chapter 6: Planning Commission

SRC title X, Chapter 400: Use Classifications

SRC Title X, Chapter 600: Willamette Greenway

SRC Title X, Chapter 601: Floodplain Overlay Zone

SRC Title X, Chapter 800: General Development Standards

SRC Title X, Chapter 808: Preservation of Trees and Vegetation

SRC Title X, Chapter 809: Wetlands

Web Pages

City of Salem. (N.D.) Streams and Wetlands. <https://www.cityofsalem.net/community/natural-environment-climate/environmental-planning-management/streams-wetlands>

City of Salem. (N.D.) Benefits of Riparian Areas.
<https://www.cityofsalem.net/community/natural-environment-climate/environmental-planning-management/streams-wetlands/benefits-of-riparian-areas>

City of Salem. (N.D.) Benefits of Wetlands.

<https://www.cityofsalem.net/community/natural-environment-climate/environmental-planning-management/streams-wetlands/benefits-of-wetlands>

City of Salem. (N.D.) Salem's Plan to Cool Stream Temperatures.
<https://www.cityofsalem.net/community/natural-environment-climate/environmental-planning-management/streams-wetlands/salem-s-plan-to-cool-stream-temperatures>

City of Salem. (N.D.). Stream Cleaning Program. <https://www.cityofsalem.net/community/natural-environment-climate/environmental-planning-management/streams-wetlands/keep-salem-s-streams-clean/stream-cleaning-program>

City of Salem. (N.D.). Coexisting with Beavers. <https://www.cityofsalem.net/community/natural-environment-climate/environmental-planning-management/coexisting-with-beavers-in-salem>

City of Salem. (N.D.). Stormwater Filtration Facilities for Cleaner Water
<https://www.cityofsalem.net/community/natural-environment-climate/clean-streams-clear-choices-initiative/stormwater-filtration-facilities-for-cleaner-water>

City of Salem. (N.D.). Emerald Ash Borer.
<https://www.cityofsalem.net/community/natural-environment-climate/trees-and-plants/emerald-ash-borer>

City of Salem. (N.D.). General Floodplain Information.
<https://www.cityofsalem.net/community/safety/flooding/floodplain-information>

Oregon Department of Land Conservation and Development. (N.D.) Goal 1: Citizen Involvement.
<https://www.oregon.gov/lcd/op/pages/goal-1.aspx>

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