



IMPLEMENTATION

5



To support the implementation of recommended actions, the following sections discuss **action prioritization, implementation considerations, and funding opportunities.**

5.1 Action Prioritization

5.1.1 Action Prioritization Methodology

The following criteria have been considered in the action prioritization process:

- Contribution to flood/drought risk reduction
- Environmental benefits
- Economic benefits
- Social benefits
- Capital costs
- Non-capital costs
- Funding availability/alignment & available resources
- Ease of implementation
- County autonomy for implementation
- Low-carbon resilience.

Each criterion was assigned a weighting from 1 – 3 according to input from stakeholders as well as input from Strathcona County staff. Weighting reflects alignment with the County’s strategic priorities and interests of residents and other stakeholders, as communicated in the stakeholder engagement surveys. A scale from 0-3 was used to score each action, as shown in Table 5-1. Criteria evaluation was based on an order of magnitude assessment (i.e. low, moderate, high). This approach was taken as many of the actions are at a conceptual level. A more detailed assessment of benefits, costs, and risks should be undertaken as



actions are further developed in the implementation stage. Prioritization criteria may also need to be revisited if strategic priorities shift. Community needs may change over time, and stakeholder feedback could influence priorities in the future.

In order to prioritize actions, an overall score was calculated for each action. The methodology to calculate scores was to develop a score for each criterion by multiplying the weighting (1-3) and score (0-3) for each criterion. The sum of all criteria scores for each action resulted in a total score for prioritization. Priority rankings within each vision are included in Table 5-2. These rankings indicate action scoring from highest to lowest within each vision. In addition, overall priority levels were assigned based on set thresholds for scores ranging from very low to very high priority. The overall priority scores indicate how the priority of each action compares to all other actions. Overall priority levels for all actions are also included in Table 5 2.

Table 5-1 Prioritization Criteria

Criteria	Weighting	0	1	2	3
Contribution to flood/drought risk reduction	3	No impact on flood/drought risk	Minor risk reduction	Moderate risk reduction	Considerable risk reduction/elimination of risk
Environmental benefits	3	Does not provide environmental benefits	Provides noticeable short-term or localized benefit	Provides short to moderate term benefits	Provides long-term, wide-spread benefit
Economic benefits	2	Does not provide economic benefits	Provides noticeable short-term or localized benefit	Provides short to moderate term benefits	Provides significant and /or long-term benefits
Social benefits	2	Does not provide social benefits	Provides noticeable short-term or localized benefit	Provides short to moderate term benefits	Provides significant and /or long-term benefits
Capital cost	1	High capital cost (>1M)	Moderate capital cost (75K - 1M)	Low capital cost (<75K)	Minimal capital cost (<10K)
Non-capital costs	1	Significant increase to non-capital costs	Moderate increase to non-capital costs	Low increase to non-capital costs	Reduction in overall non-capital costs

Criteria	Weighting	0	1	2	3
Funding alignment & available resources	2	No alignment with available funding and/or available resources	Could apply for funding in partnership	Portion of work eligible for funding and/or can be covered by available resources	Alignment with existing funding program and/or available resources
Ease of Implementation (constructability/regulatory approval/community support)	1	High risk/uncertainty with implementation	Moderate risk/uncertainty with implementation	Low risk/uncertainty with implementation	Minimal risk/uncertainty with implementation
Autonomy	1	No portion of action could be implemented without stakeholder partnership/	High level of stakeholder partnership/collaboration	Some stakeholder partnership/collaboration	County in full control of action
Low-carbon resilience	1	GHG intensive option	Low/Moderate GHG emissions	Minimal or no GHG emissions	Action provides a carbon sink

5.1.2 Action Prioritization Results

The following table includes the results of the action prioritization. As described in the previous section, action prioritization is presented both as a ranking of actions within each vision as well as an overall priority level. The full prioritization matrix is included in Appendix B.

Table 5 -2 Action Priority Level

Vision	Supporting Actions	Priority Ranking Within Vision	Overall Priority Level
Vision 1: Healthy Ecosystem	V1.1 Conserve/restore vegetated buffer	4	Medium
	V1.2 Conserve/restore natural water retention features	3	High
	V1.3 Implement erosion and sediment control measures	5	Low
	V1.4 Implement co-existence with wildlife strategies	1	Very High
	V1.5 Ensure aquatic connectivity	2	High
	V1.6 Prevent livestock from accessing creek	6	Low
Vision 2: Integrated Watershed Management	V2.1 Conserve and restore wetlands	3	High
	V2.2 Develop land buyback and/or compensation programs	2	High
	V2.3 Maintain ecological function in Upper Assessment Reach	1	Very High
	V2.4 Protect and enhance drainage ways	4	Medium
Vision 3: Resilient Infrastructure	V3.1 Replace undersized infrastructure	3	High
	V3.2 Elevate roads along with crossing upgrades	5	Low
	V3.3 Update the allowable stormwater discharge rate for new developments	4	Medium
	V3.4 Incorporate flood construction level requirements in the LUB	2	Very High
	V3.5 Include climate change considerations in infrastructure and development standards/policy	1	Very High
Vision 4: Proactive Management	V4.1 Implement a debris management program	2	Medium
	V4.2 Expand asset management program	3	Medium
	V4.3 Proactive creek inspections and monitoring	4	Low
	V4.4 Landowner education and partnership for private property clean up	1	Medium

Vision	Supporting Actions	Priority Ranking Within Vision	Overall Priority Level
Vision 5: Flood and Drought Preparedness	V5.1 Develop flood response plan and training	3	Low
	V5.2 Develop flood forecast, monitoring, and warning system	3	Low
	V5.3 Develop a drought mitigation plan	2	Medium
	V5.4 Increase public understanding of flood prevention and drought mitigation, property protection and emergency response	2	Medium
	V5.5 Incentivize property level flood protection	1	High
	V5.6 Investigate availability of flood insurance for landowners	4	Very Low
Vision 6: Educated, Engaged, and Empowered Public	V6.1 Implement public outreach programs	3	Low
	V6.2 Implement pilot programs to showcase nature-based solutions	1	Medium
	V6.3 Implement citizen science initiatives	3	Low
	V6.4 Indigenous relations	2	Medium

5.2 Implementation Considerations

Priority levels presented in the previous section are intended to inform action implementation and sequencing. However, it is important to note that when implementing the Resiliency Action Plan, actions from all six visions should be pursued and priority levels within each vision should be considered in conjunction with overall priority level. For example, although the actions within Vision 6: Educated, Engaged, and Empowered Public rated as low and medium priority overall, actions within this vision are crucial as they enable actions within the other visions. The lower ratings for these actions is attributed to the fact that they do not directly correlate to risk reduction or the realization of benefits. However, without stakeholder support, there may be risks to public acceptability for the implementation of other actions, especially those that require collaboration and partnership with stakeholders.

The time required for implementation should also be a consideration for action planning and implementation. The majority of recommended actions require ongoing investment and/or require annual, reoccurring actions. Project based actions may be completed over multiple years due to budget availability. Policy and planning based actions typically require an up-front investment of time and resources, with some follow up action related to enforcement, education, and review/revisions. The following table presents timelines considerations for all actions.

Table 5 -3 Timeline Considerations

Vision	Supporting Actions	Timeline Considerations
Vision 1: Healthy Ecosystem	V1.1 Conserve/restore vegetated buffer	Projects can be prioritized based on risk level and opportunity, and completed over multiple years
	V1.2 Conserve/restore natural water retention features	Projects can be prioritized based on risk level and opportunity, and completed over multiple years
	V1.3 Implement erosion and sediment control measures	Projects can be prioritized based on risk level, and completed over multiple years
	V1.4 Implement co-existence with wildlife strategies	Ongoing, likely requiring annual action
	V1.5 Ensure aquatic connectivity	Projects can be prioritized based on risk level and completed over multiple years. Should be a consideration with the implementation of Action V3.1
	V1.6 Prevent livestock from accessing creek	Ongoing, likely requiring annual action
Vision 2: Integrated Watershed Management	V2.1 Conserve and restore wetlands	Ongoing action
	V2.2 Develop land buyback and/or compensation programs	Ongoing action required to manage program
	V2.3 Maintain ecological function in Upper Assessment Reach	Ongoing action
	V2.4 Protect and enhance drainage ways	Ongoing action

Vision	Supporting Actions	Timeline Considerations
Vision 3: Resilient Infrastructure	V3.1 Replace undersized infrastructure	Projects can be prioritized based on risk level, and completed over multiple years
	V3.2 Elevate roads along with crossing upgrades	Projects can be prioritized based on risk level, and completed over multiple years
	V3.3 Update the allowable stormwater discharge rate for new developments	Short-term action, with some follow-up actions required (i.e. enforcement, education, review/revisions)
	V3.4 Incorporate flood construction level requirements in the LUB	Short-term action, with some follow-up actions required (i.e. enforcement, education, review/revisions)
	V3.5 Include climate change considerations in infrastructure and development standards/policy	Short-term action, with some follow-up actions required (i.e. enforcement, education, review/revisions)
Vision 4: Proactive Management	V4.1 Implement a debris management program	Annual action
	V4.2 Expand asset management program	Initial investment in program development, with ongoing action required
	V4.3 Proactive creek inspections and monitoring	Annual action
	V4.4 Landowner education and partnership for private property clean up	Ongoing/annual
Vision 5: Flood and Drought Preparedness	V5.1 Develop flood response plan and training	Initial investment in plan development, with ongoing action required for training and plan review/revision
	V5.2 Develop flood forecast, monitoring, and warning system	Initial investment in program development, with ongoing action required
	V5.3 Develop a drought mitigation plan	Initial investment in plan development, with ongoing action required for plan review/revision
	V5.4 Increase public understanding of flood prevention and drought mitigation, property protection and emergency response	Ongoing action
	V5.5 Incentivize property level flood protection	Ongoing action, depends on scope/duration of incentive program
	V5.6 Investigate availability of flood insurance for landowners	Short-term action, outreach with landowners may be ongoing
Vision 6: Educated, Engaged, and Empowered Public	V6.1 Implement public outreach programs	Ongoing action
	V6.2 Implement pilot programs to showcase nature-based solutions	Timeline depends on scope of pilot programs
	V6.3 Implement citizen science initiatives	Timeline depends on scope of citizen science initiatives
	V6.4 Indigenous relations	Ongoing action

5.3 Funding Opportunities

There are several current funding opportunities that are aligned with recommended actions. A list of current funding opportunities is provided below for reference, however, funding programs and funding availability will continue to change. This list is provided as a starting point, but further investigation related to applicability will be required to align funding with specific actions. There are some programs in the following list which are not currently accepting applications, however, these have been included so they can be monitored to determine if additional funding may be made available under these programs in the future.

5.3.1 Federal Funding Programs

2 Billion Trees Program

Natural Resources Canada

The 2 Billions Trees Program is a part of the Nature Smart Climate Solutions Fund which is focused on planting trees to capture carbon, enhance biodiversity, and support human well-being.

Eligible participants: Provinces, territories, Indigenous organizations, third party organization (for and not-for profit)

Available funding: \$3.19 billion, over ten years

Application information: Current round of funding deadline is February 2022, however intention is for ongoing application process, more details on Call for Proposal process to be made available in April 2022

Potential alignment: Vision 1: Healthy Ecosystem

Canadian Community-Building Fund

Infrastructure Canada

The Canadian Community-Building Fund supports projects including public transit, wastewater infrastructure, drinking water, solid waste management, community energy systems, local roads and bridges, capacity-building, highways,



local and regional airports, short-line rail, short-sea shipping, disaster mitigation, broadband and connectivity, brownfield redevelopment, culture, tourism, sport, recreation, and fire halls.

Eligible participants: Provinces and territories. Provinces and territories can flow this funding to municipalities.

Available funding: \$255 - \$266 Million per year to be allocated among communities in Alberta

Application information: Applications online through GTF Online system

Potential alignment: Vision 1: Healthy Ecosystem & Vision 3: Resilient Infrastructure

Disaster Mitigation and Adaptation Fund

Infrastructure Canada

The Disaster Mitigation and Adaptation Fund is a merit-based contribution program intended to support public infrastructure projects designed to mitigate current and future climate-related risk and disasters triggered by climate change. Eligible projects include new construction of public infrastructure and/or modification or reinforcement of existing public infrastructure. This can include natural infrastructure that prevents, mitigates, or protects against the impacts of climate change, disasters triggered by natural hazards, and extreme weather.

Eligible participants: Provinces, territories, municipalities, regional government, public sector bodies established or under provincial or territorial statutes, a Canadian public or not-for-profit institution (working with one of the aforementioned bodies), and eligible Indigenous applicants.

Available funding: \$1 Million to \$20 Million for small scale projects, and \$20 Million + for large scale projects, maximum federal contribution is 40% for municipalities

Application information: Next application deadline is July 2022

Potential alignment: Vision 3: Resilient Infrastructure



Eco Action Community Funding Program

Environment and Climate Change Canada

The Eco Action Community Funding program is targeted at programs which have positive environmental outcomes. The current (2022/2023) funding priority is freshwater and is focused on projects which contribute to the improvement of the quality of freshwater through the diversion and reduction of harmful substances and/or restore and protect freshwater ecosystem health.

Eligible participants: Non-profit and non-government organizations (environmental groups, community groups, youth and senior groups, community-based associations, service clubs, and Indigenous organizations). Government groups are eligible to apply if they are partners with a non-profit or non-governmental group.

Available funding: \$25,000 - \$100,000 per project, 50% of total project value must come from sources other than Government of Canada

Application information: Applications for 2022-23 are closed

Potential alignment: Vision 1: Healthy Ecosystem

Environmental Damages Fund

Environment and Climate Change Canada

The Environmental Damages Fund directs funds from fines, court order, and voluntary payments to environmental restoration and conservation projects within Canada. Projects are selected based on the following priorities: restoration, environmental quality improvement, research and development, and education and awareness.

Eligible participants: non-governmental organizations, universities and academic institutions, Indigenous organizations, provincial, territorial and municipal governments

Available funding: Variable

Application information: applications accepted via Grants and Contributions Enterprise Management System (GCEMS)



Potential alignment: Vision 1: Healthy Ecosystem & Vision 6: Education, Engaged, and Empowered Public

National Disaster Mitigation Program

Public Safety Canada

The National Disaster Mitigation Program offers funding for flood mapping, mitigation planning, risk assessments, and investments in non-structural and small-scale structural mitigation projects with a focus on reducing significant and reoccurring flood risk.

Eligible participants: Provincial and territorial governments. Provincial and territorial governments may collaborate with and redistribute funding to eligible entities such as municipal or other local governments, public sector bodies, private sector bodies, Indigenous band councils, international non-government organizations or any combination of these entities.

Available funding: \$20,000,000 available for the 2021-2022 fiscal year. Funding amounts vary annually based on federal budget.

Application information: Availability of additional funding for future fiscal years has not yet been communicated.

Potential alignment: Vision 3: Resilient Infrastructure

Nature Smart Climate Solutions

Environmental and Climate Change Canada (ECCC)

The portion of the Nature Smart Climate Solutions Fund administered by ECCC is a ten-year fund focused on reducing greenhouse gas emissions using natural climate solutions which also support human well-being and biodiversity. This fund is intended to support projects which focus on conserving, restoring, and enhancing wetlands, peatlands and grasslands to store and capture carbon. The 2021 application process included three streams:

- place-based actions stream (focused on restoration projects and enhanced land management activities and/or projects that prevent GHG emissions from degradation/loss of carbon-rich habitat);



- sector-based policy stream (focused on advancing policies, programs, and tools to support nature-based solutions); and
- reverse auction pilot stream (piloting a reverse auction for agricultural land to reduce GHG emissions or increase carbon sequestration)

Eligible participants: Provinces, territories, Indigenous organizations, governments and groups, municipal and local governments, not-for-profit organizations, academic institutions, Canadian individuals, domestic or international for-profit organizations, local organizations.

Available funding: \$631 Million, over ten years

Application information: Applications for the 2021 program were due in January 2022, details on subsequent applications have not yet been released

Potential alignment:

- Place-based actions stream: Vision 1: Healthy Ecosystem
- Sector-based policy stream: Vision 2: Integrated Watershed Management
- Reverse auction pilot stream: Vision 2: Integrated Watershed Management

5.3.2 Provincial Funding Programs

Alberta Community Resilience Program

Government of Alberta

The Alberta Community Resilience Program (ACRP) is a multi-year grant program supporting the development of long-term resilience to flood and drought events, while supporting integrated planning and healthy, functioning watersheds. The ACRP provides grants for the design and construction of projects that protect critical infrastructure from flooding and drought and help to ensure public safety is protected.

Eligible participants: Municipalities, First Nations, Metis settlements, improvement districts, and special areas

Available funding: 90% of funding for eligible engineering and construction costs up to \$3 Million and 70% of costs in excess of \$3 Million

Application information: Program is no longer accepting applications.

Potential alignment: Vision 2: Integrated Watershed Management & Vision 3: Resilient Infrastructure

Investing in Canada Infrastructure Program-Green Infrastructure Stream
Infrastructure Canada and Government of Alberta

The green infrastructure stream supports green infrastructure projects with outcomes across climate change mitigation, adaptation, resilience and disaster mitigation, and environmental quality.

Eligible participants: Provinces, territories, municipalities, not-for profit projects, Indigenous groups, private sector projects.

Available funding: 40% of project costs for municipal groups

Application information: The program is not accepting applicants at this time.

Potential alignment: Vision 1: Healthy Ecosystem

Municipal Stimulus Program
Government of Alberta

Municipal Stimulus Program funding is allocated for projects to sustain and create local jobs, enhance provincial competitiveness and productivity, position communities to participate in future economic growth, and reduce municipal red tape to promote job-creating private sector investment. Municipalities will be required to commit to taking concrete actions to reduce red tape and encourage private sector investment.

Eligible participants: Municipalities and Metis Settlements.

Available funding: \$50,000 minimum funding, \$500 million total available

Application information: Program is now closed to new applications.

Potential alignment: Vision 3: Resilient Infrastructure



Municipal Sustainability Initiative

Government of Alberta

The Municipal Sustainability Initiative funds capital projects including roads, bridges, public transit vehicles or facilities, emergency services facilities or equipment, water and wastewater systems, solid waste management facilities or equipment, regional and community airport facilities or equipment, and other municipal buildings such as recreation and sports facilities, libraries, public works buildings, and cultural and community centres. Operating projects including capacity building activities that improve efficiency or effectiveness, municipal services, planning activities, and assistance to non-profit organizations.

Eligible participants: Municipalities

Available funding: Funding is allocated based on municipal status with \$722 million available per year between 2021 and 2023, funding amounts are allocated to municipalities throughout Alberta

Application information: ongoing applications

Potential alignment: Vision 3: Resilient Infrastructure & Vision 4: Proactive Management

Watercourse Crossing Remediation Grant Program

Alberta Environment and Parks (AEP)

The Watercourse Crossing Remediation Grant Program was created in 2021 to support municipalities in the remediation and reclamation of roadway crossings which are impacting fish habitation through erosion, excessive sedimentation, and/or fragmentation of fish habitat.

Eligible participants: Municipalities

Available funding: \$8.5 million in total, funding granted annually between 2021 and 2024

Application information: This funding is granted annually. 2021 applications were due in October 2021. Details on upcoming application deadlines not yet available.

Potential alignment: Vision 1: Healthy Ecosystem & Vision 3: Resilient Infrastructure



Watershed Resiliency and Restoration Program

Alberta Environment and Parks (AEP)

The Watershed Resiliency and Restoration Program focuses on projects that will advance flood and drought resiliency in priority areas, restore, and enhance ecological connectivity and function in critical areas, and increase knowledge, awareness, and tools that enhance watershed resiliency.

Eligible participants: Municipalities, non-governmental organizations, Indigenous communities, incorporated watershed groups, drainage/irrigation districts, and any other group registered under the provincial Societies Act.

Available funding: funding granted annually

Application information: This funding is granted annually. 2021-22 applications were due in November 2021.

Potential alignment: Vision 1: Healthy Ecosystem

Wetland Replacement Program

Alberta Environment and Parks (AEP)

The Wetland Replacement Program aims to re-establish wetlands in partnership with Albertans by providing resources for collaborative restoration projects across the province. Wetland replacement includes both wetland restoration and wetland construction. Strathcona County is already actively engaged in this program and has been identified as a high priority area for wetland replacement by AEP. Strathcona County has initiated an internal Wetland Replacement Program Committee to identify potential wetland replacement projects.

Eligible participants: Municipalities

Available funding: ongoing funding

Application information: Strathcona County is already engaged in a partnership with AEP to take part in this program. As per Strathcona County's internal processes, projects will be brought to Council for approval prior to submission of proposals to AEP.

Potential alignment: Vision 1: Healthy Ecosystem



5.3.3 Non-government Funding Programs

Alberta Ecotrust Environmental Grant Program

Alberta Ecotrust

Alberta Ecotrust has a grant program to support environmental projects throughout Alberta. This program is currently under review and details on the refreshed program will be released later in 2022.

Eligible participants: Alberta environmental non-government organizations, First Nations

Available funding: Information not yet released

Application information: Application details to be released in Summer 2022

Potential alignment: Vision 1: Healthy Ecosystem & Vision 2: Integrated Watershed Management

Community Conservation Action Program

Wildlife Habitat Canada (WHC)

WHC's Community Conservation Action Program supports small organizations in making conservation achievements within their community through projects that connect Canadians with nature, engage in conservation, or provide educational conservation programming.

Eligible participants: Small Canadian Organizations; research, academic, and educational institutions, Indigenous organizations, local organizations.

Available funding: Maximum request of \$10,000. A 1:1 matching contribution is required; Canadian federal funding cannot be included in matching funds.

Application information: Annual applications, 2022-2023 grant year has closed

Potential alignment: Vision 6: Educated, Engaged, and Empowered Public



Green Municipal Fund

Federation of Canadian Municipalities

The Green Municipal fund focuses on projects that are green initiatives with a preference given to pilot projects prior to main projects.

Eligible participants: Municipalities

Available funding: Funding is separated into regular and high-ranking projects. Regular projects are eligible for low-interest loans of up to \$5 Million and a grant worth up to 15% of the loan. High-ranking projects are eligible for low-interest loans of up to \$10 Million and a grant worth up to 15% of the loan. This program will cover up to 80% of eligible costs.

Application information: Ongoing applications, subject to funding availability

Potential alignment: Vision 1: Healthy Ecosystem & Vision 6: Educated, Engaged, and Empowered Public

Habitat Conservation Stamp Initiative

Wildlife Habitat Canada (WHC)

WHC's Habitat Conservation category of the Habitat Conservation Stamp Initiative supports projects that address the North American Waterfowl Management Plan priorities to increase/maintain waterfowl populations, conserve wetland habitat, and increase engagement in habitat conservation.

Eligible participants: Provincial, territorial, municipal, and local governments, Canadian residents, not-for-profit organizations, for-profit organizations, Indigenous organizations, and local organizations.

Available funding: A 1:1 matching contribution is required; Canadian federal funding cannot be included in matching funds.

Application information: annual applications, 2022-2023 grant year has closed

Potential alignment: Vision 1: Healthy Ecosystem



Municipal Asset Management Program

Federation of Canadian Municipalities

The Municipal Asset Management Program provides Canadian municipalities with funding to conduct asset management assessments, develop asset management plans, policies, and strategies, conduct asset-related data collection and reporting, provide asset management training and organization development, and transfer knowledge around asset management.

Eligible participants: Canadian municipal governments or municipal partners applying in association with a municipal government (municipal owned corporations, region/provincial/territorial governments delivering municipal services, Indigenous communities, and not-for profit organizations that focus on municipal services).

Available funding: 80% of total eligible project costs to a maximum of \$50,000 for individual applications.

Application information: no deadline to apply, but grants are subject to fund availability. Municipalities may apply for a second-time if application includes asset management knowledge sharing component.

Potential alignment: Vision 4: Proactive Management

Watershed Stewardship Grants

Land Stewardship Centre

The Watershed Stewardship Grants are provided to support collaborative, community-based stewardship efforts consistent with the principles, goals, and outcomes of Alberta's Water for Life Strategy.

Eligible participants: Alberta-based, community-oriented, and volunteer-based partnerships that actively engage in environmental stewardship of their watershed. Municipal governments and government agencies are not eligible to apply directly for this grant. They may, however, serve as the partnering legal entity for a group that does not have legal status.

Available funding: \$20,000 per year

Application information: 2022 applications were due February 14, 2022, details for future funding applications not yet available

Potential alignment: Vision 6: Educated, Engaged, and Empowered Public





ACKNOWLEDGMENTS

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The County would like to acknowledge and share our appreciation for all of the residents, stakeholders, and Indigenous groups who participated in this project.

We are proud to share that the Astotin Creek Resiliency Study was awarded the Consulting Engineers of Alberta 2022 Environmental Award of Excellence. (Appendix C).





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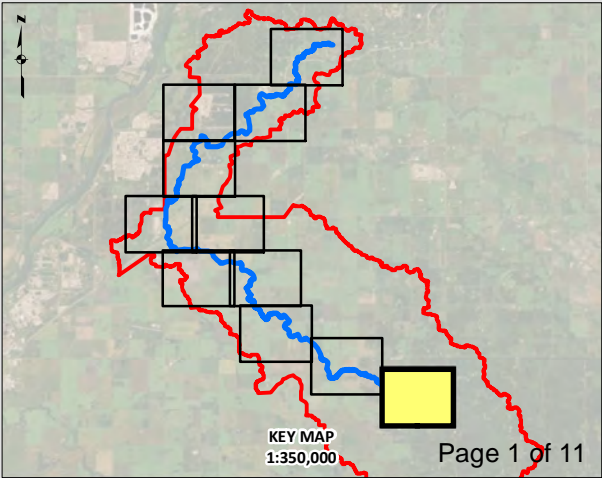
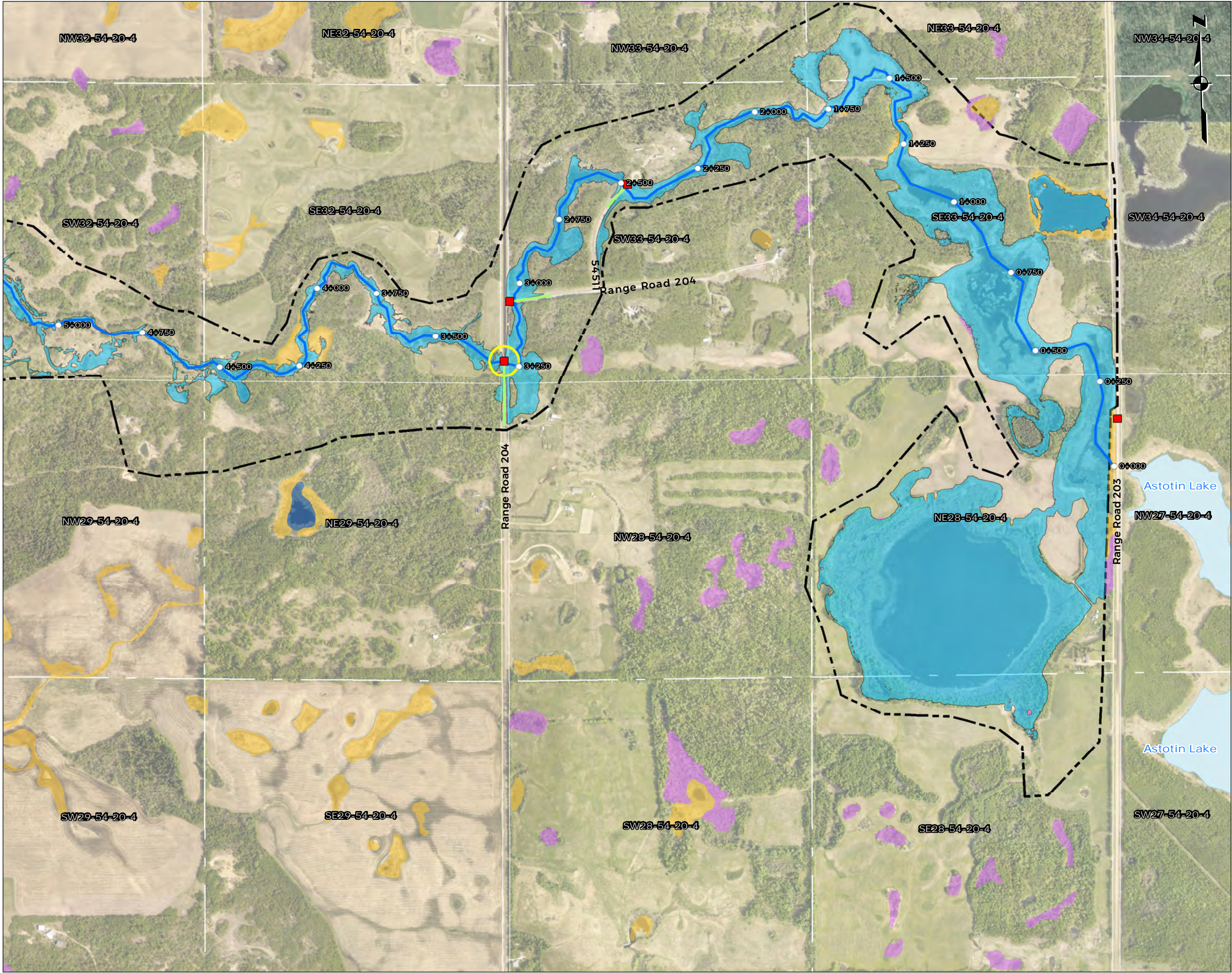




UNDERSIZED CROSSINGS

A





Legend

- Station Marker
- Structures
- Undersized Crossings
- Overtopped Roads
- Astotin Creek
- Astotin Watershed
- Hydraulic Model Boundaries
- 100 Year Flood Inundation
- Marsh
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Astotin Creek Resiliency Study

Appendix A: 100-Year Flood Inundation Map with Locations of Undersized Crossings and Overtopped Roads

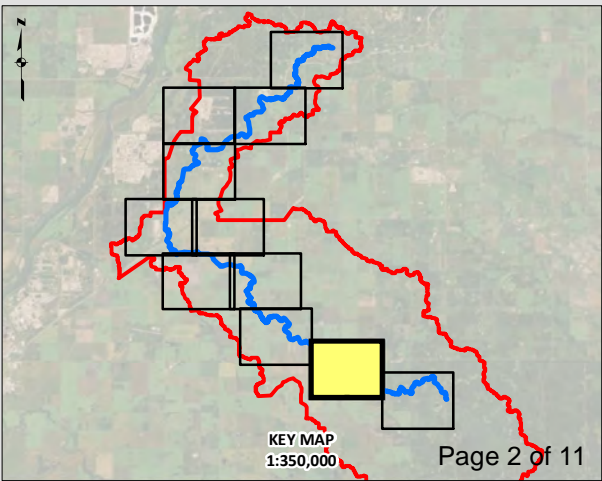
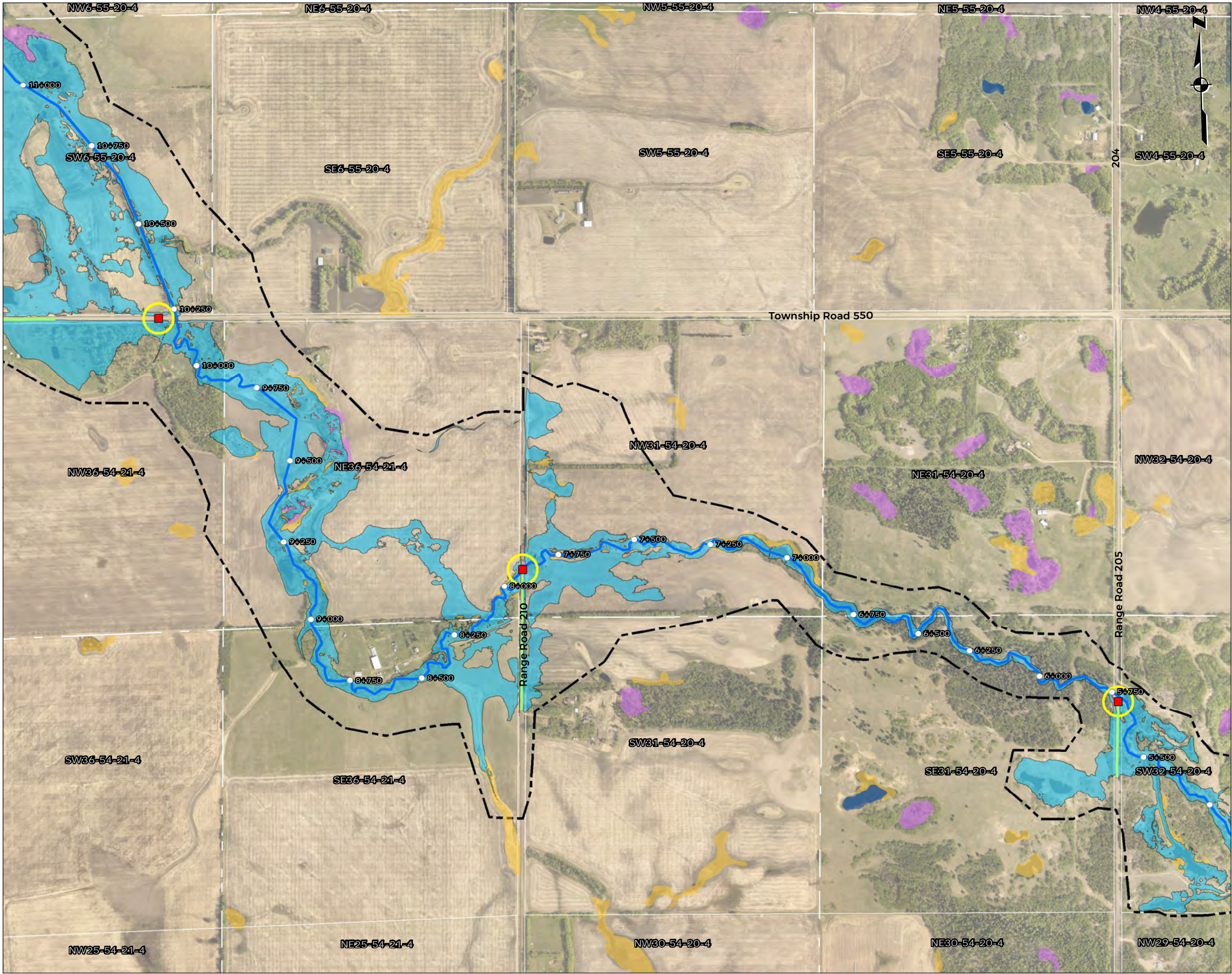
Astotin Creek
Alberta

Scale: 1:10,000



Report By: AH WSP Job #: 211-03754-00
Drawn by: JH Date: August 9, 2021
Reviewed By: AH Office: Edmonton

Notes: Data provided by Altalis; Natural Resource Canada; ESRI



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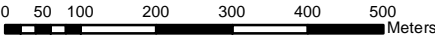
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**Astotin Creek
Alberta**

Scale: 1:10,000

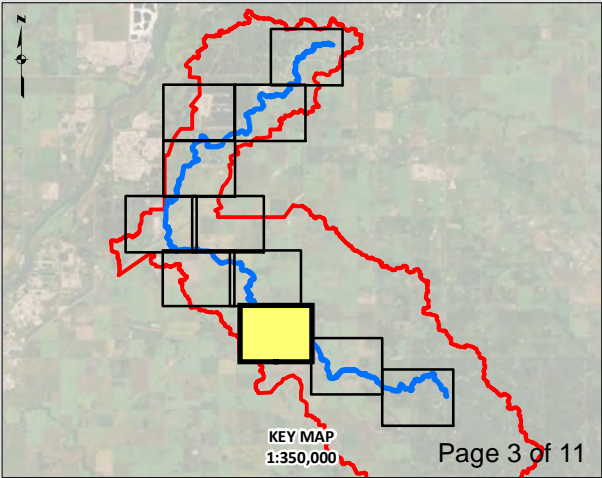
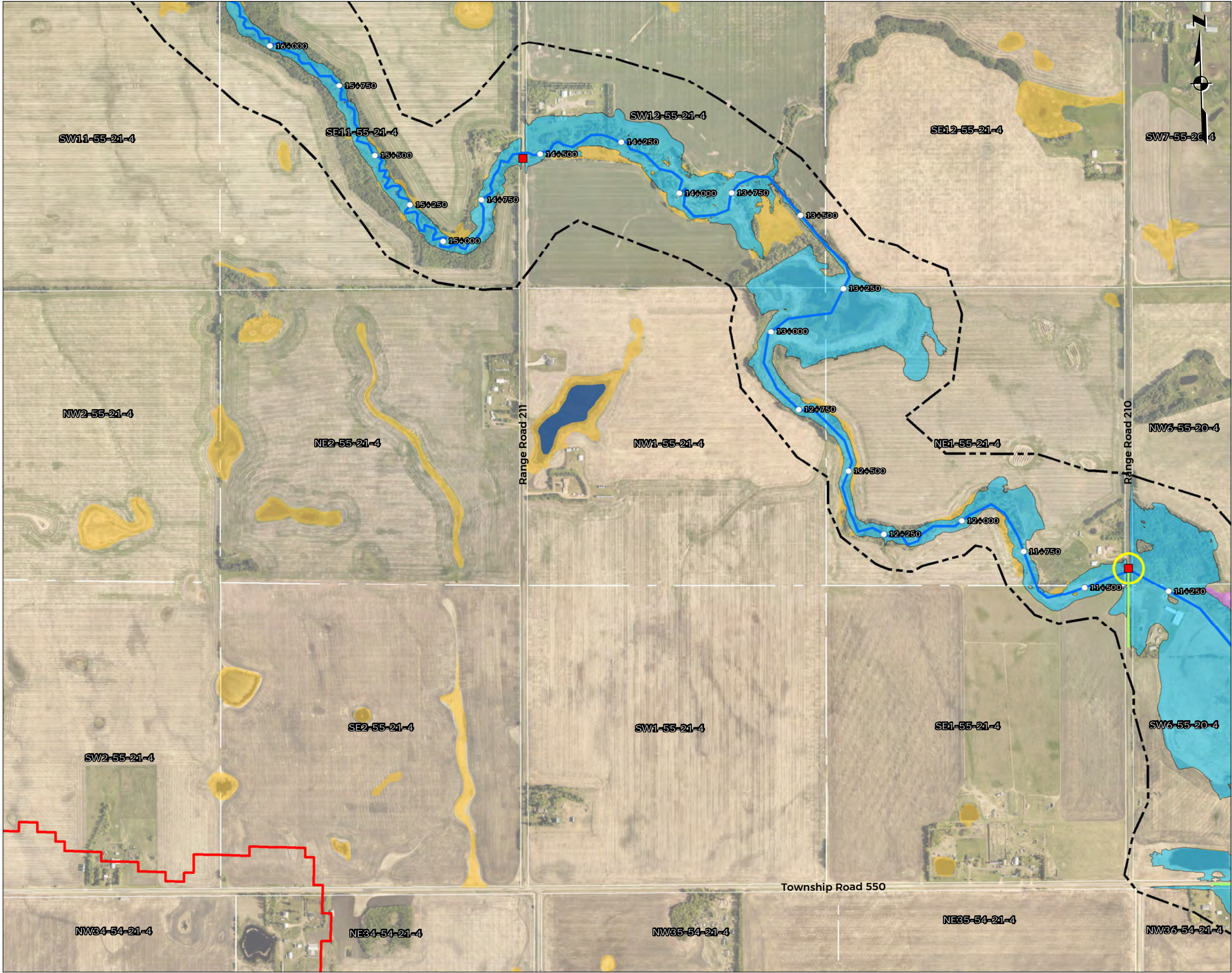


Universal Transverse Mercator (Zone 12)
North American Datum (1983)



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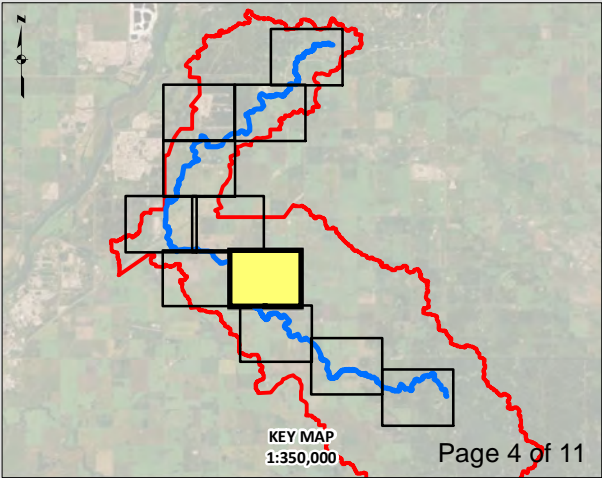
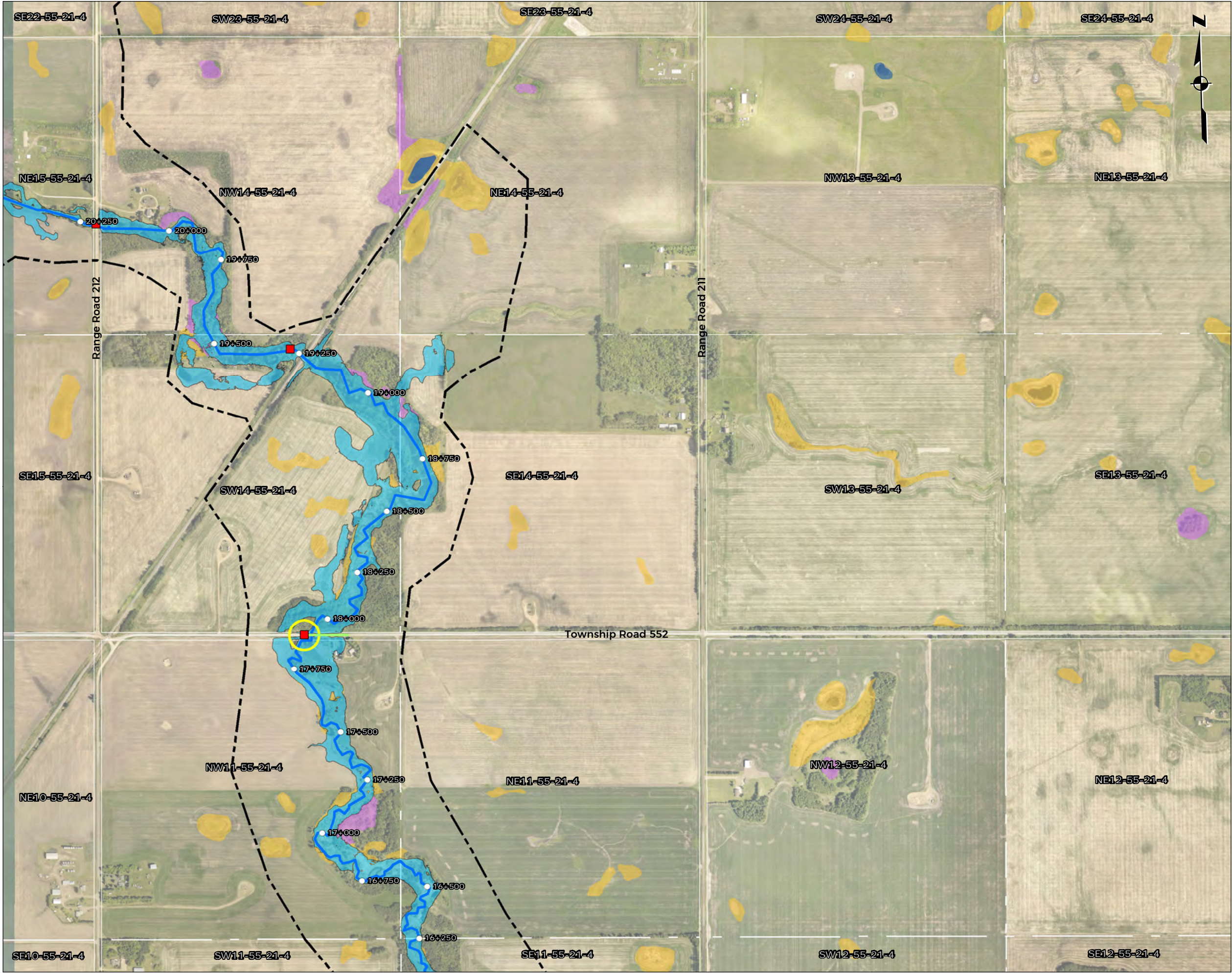
0 50 100 200 300 400 500 Meters

Universal Transverse Mercator (Zone 12)
North American Datum (1983)

wsp

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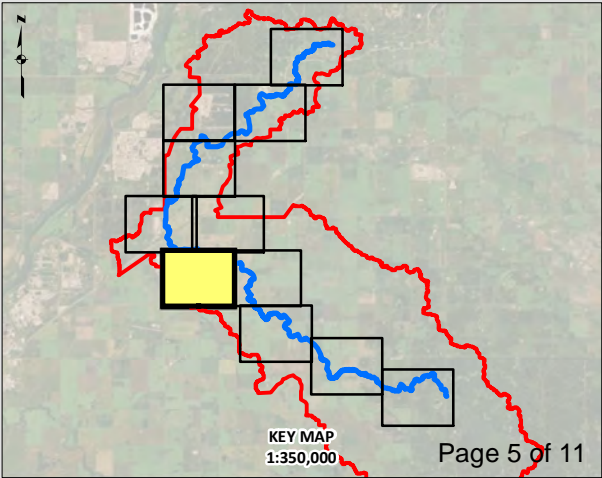
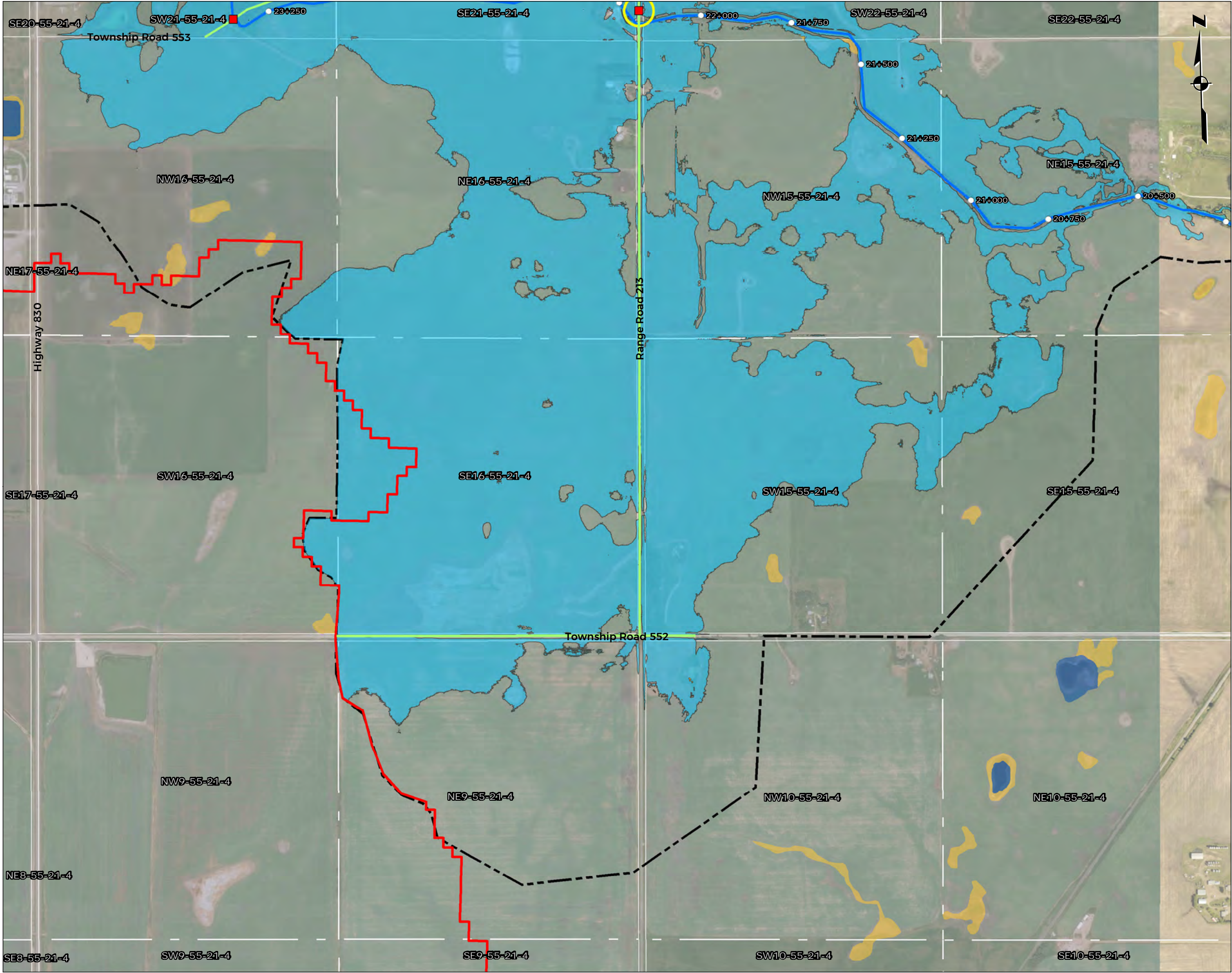
**Astotin Creek
Alberta**

Scale: 1:10,000



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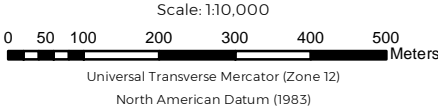
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Astotin Creek Resiliency Study

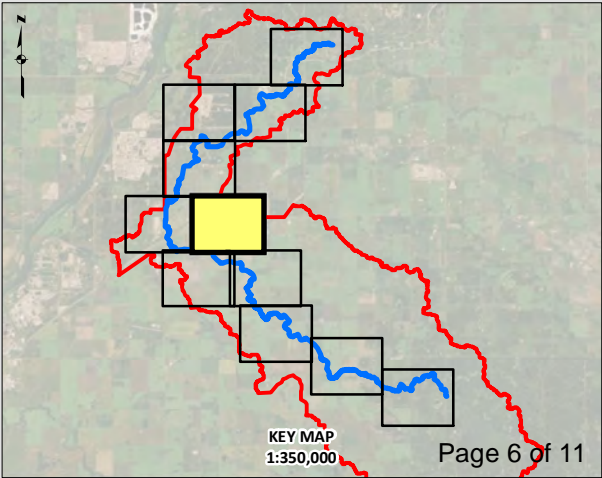
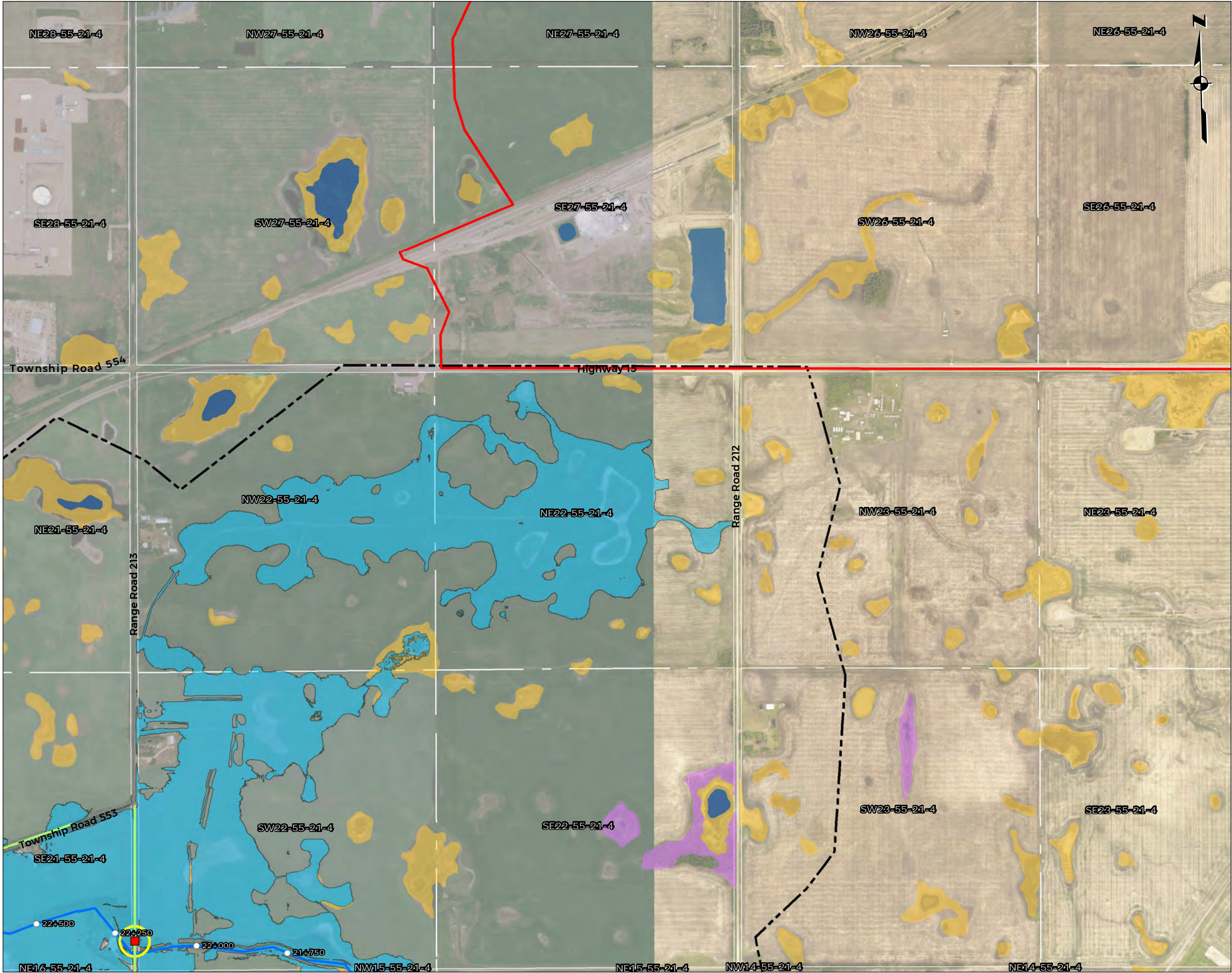
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**Astotin Creek
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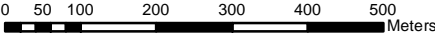
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**Astotin Creek
Alberta**

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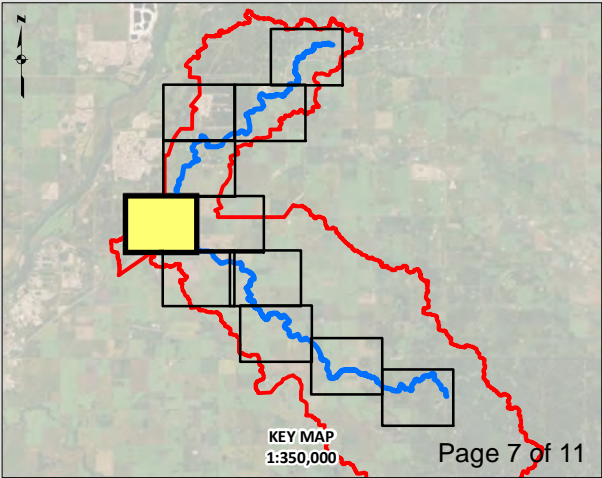
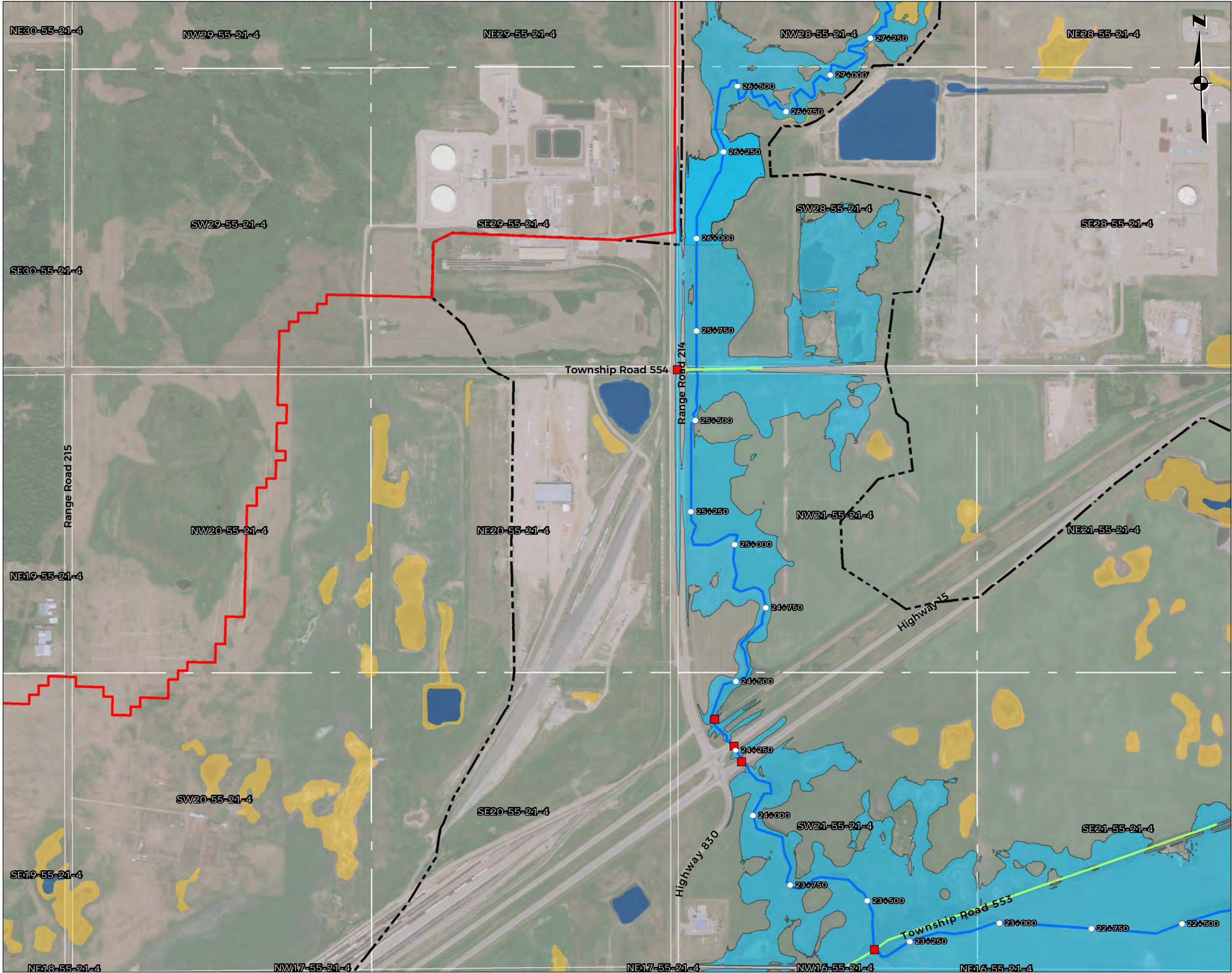


Universal Transverse Mercator (Zone 12)
North American Datum (1983)



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**Astotin Creek
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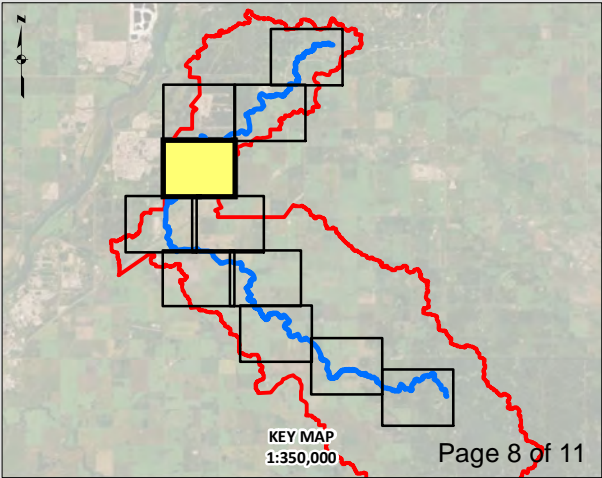
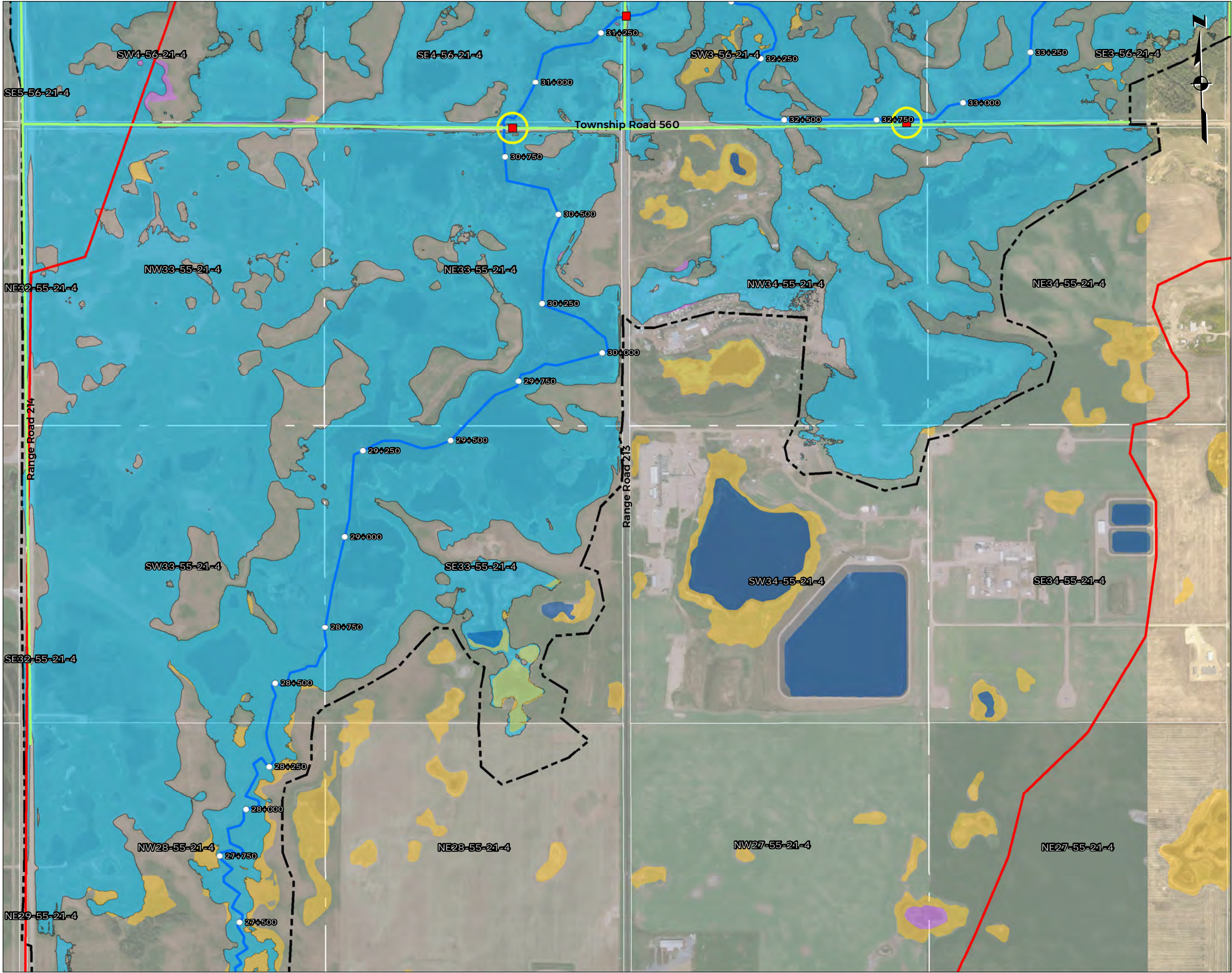
0 50 100 200 300 400 500 Meters

Universal Transverse Mercator (Zone 12)
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wsp

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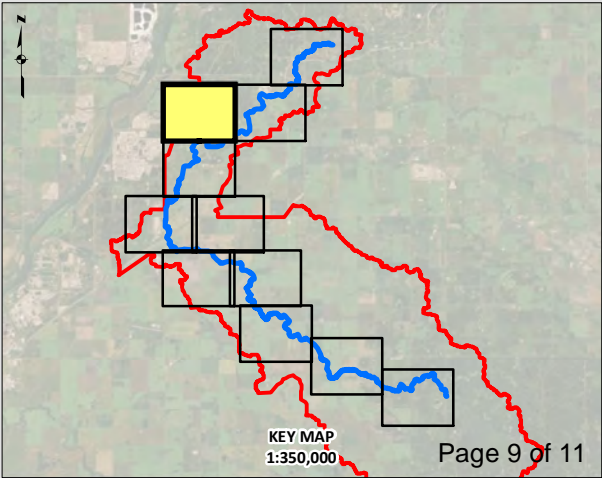
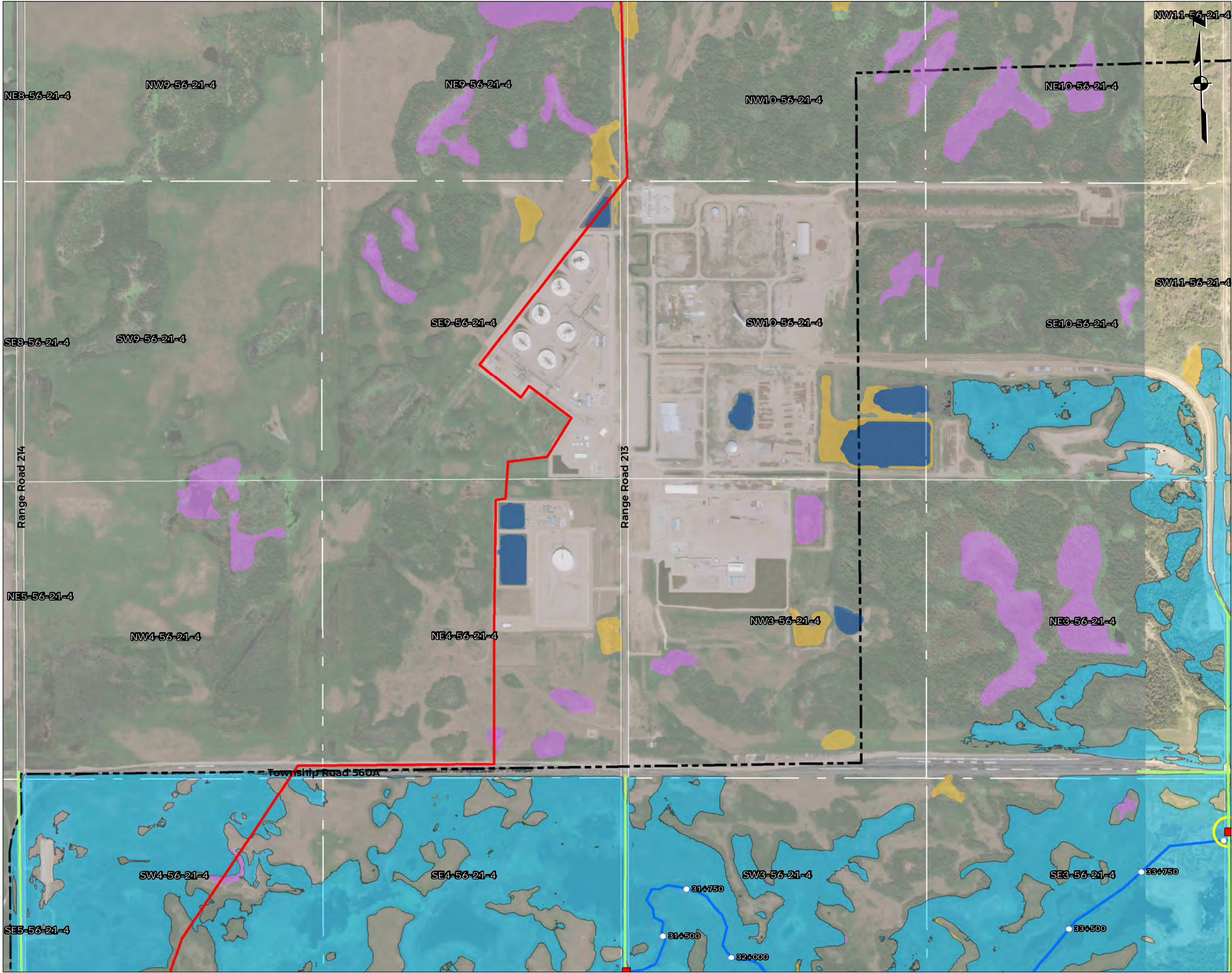
**Astotin Creek
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Scale: 1:10,000



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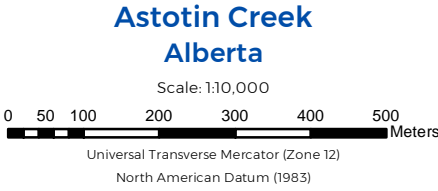
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Astotin Creek Resiliency Study

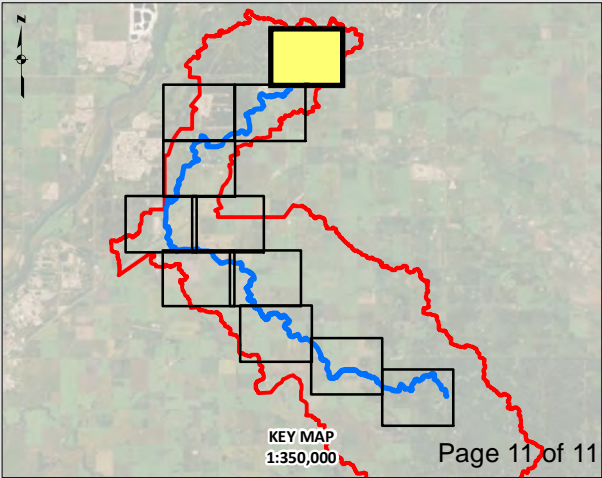
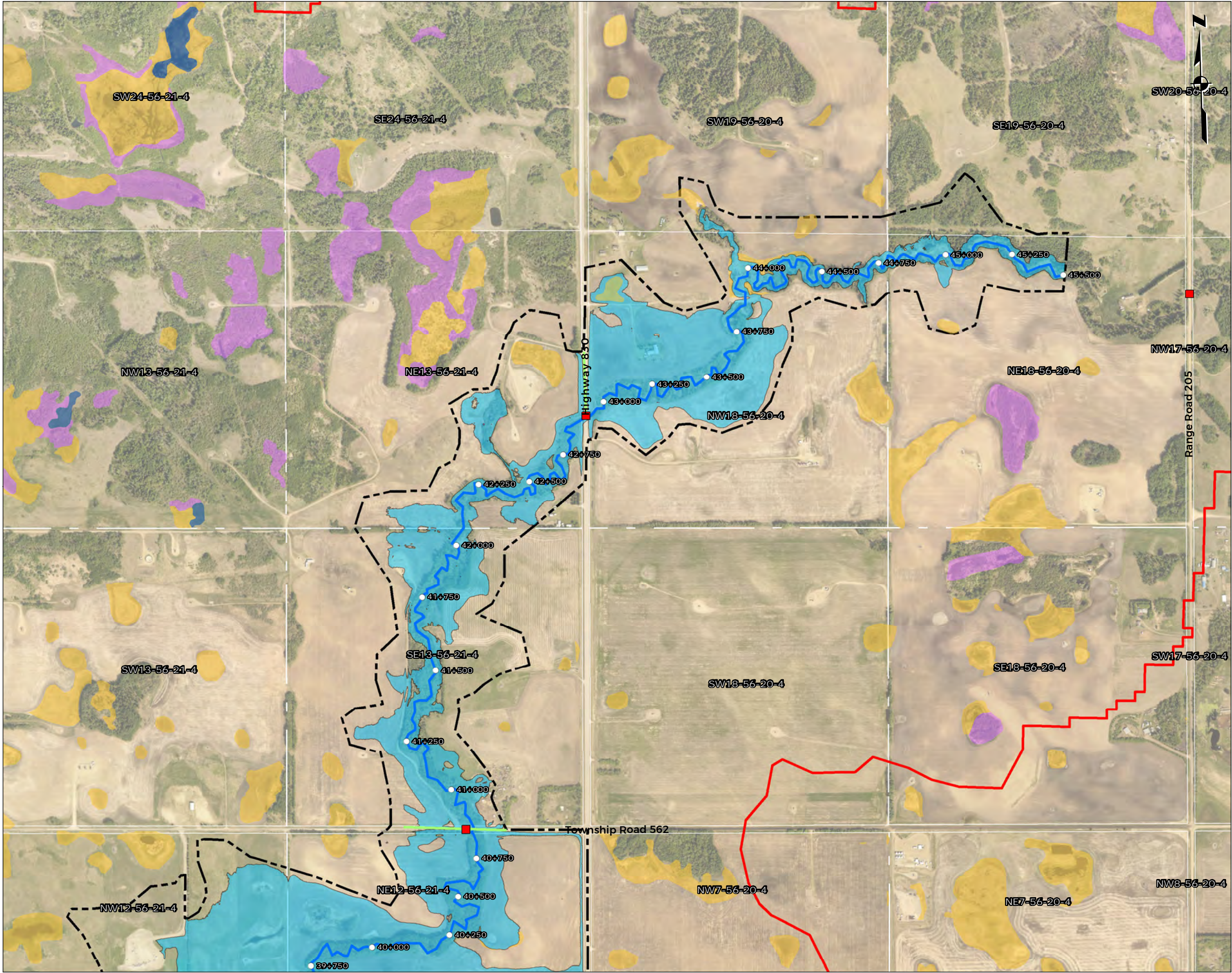
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Report By: AH
Drawn by: JH
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**Astotin Creek
Alberta**

Scale: 1:10,000

0 50 100 200 300 400 500 Meters

Universal Transverse Mercator (Zone 12)
North American Datum (1983)



Report By: AH

Drawn by: JH

Reviewed By: AH

WSP Job #: 211-03754-00

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ACTION PRIORITIZATION MATRIX

B



Vision	Actions	Prioritization Criteria																												Action Prioritization														
		Contribution to flood/drought risk reduction				Environmental benefits				Economic benefits				Social benefits				Capital cost				Non-capital costs				Funding alignment & available resources				Ease of Implementation				Autonomy				Low-carbon resilience				Overall Priority Score	Priority ranking within vision	Overall Priority Level Based on Overall Priority Scores: Very Low: <25 Low: 25 - 29 Medium: 30-35 High: 36 - 40 Very High: >40
		Criteria Weight: 3		3		Criteria Weight: 3		3		Criteria Weight: 2		2		Criteria Weight: 2		2		Criteria Weight: 1		1		Criteria Weight: 1		1		Criteria Weight: 2		2		Criteria Weight: 1		1		Criteria Weight: 1		1								
		Score	Rationale	Weighted Score	Score	Rationale	Weighted Score	Score	Rationale	Weighted Score	Score	Rationale	Weighted Score	Score	Rationale	Weighted Score	Score	Rationale	Weighted Score	Score	Rationale	Weighted Score	Score	Rationale	Weighted Score	Score	Rationale	Weighted Score	Score	Rationale	Weighted Score	Score	Rationale	Weighted Score										
Vision 1: Healthy Ecosystem	V1.1 Conserve/restore vegetated buffer	2	Reduces evapotranspiration	6	3	Water quality protection, habitat/biodiversity enhancement	9	1	Prevents bank erosion and water quality issues, reducing need for other mitigation measures (i.e. erosion control measures)	2	2	Aesthetic improvements, increased amenity value to property	4	2	Revegetation costs	2	2	Can be supported through existing County programs / staff	2	2	Existing County programs, but also other funding options	4	1	Increasing / replacing missing buffers may be challenging in ag lands	1	2	Will require landowner support	2	3	Revegetation results in carbon sink	3	35	4	Medium										
	V1.2 Conserve/restore natural water retention features	3	Adds to water storage & attenuates flood	9	2	Natural water retention features aid in local water cycles	6	2	Adds to water storage and attenuates flood, reducing risk of flood damage and associated costs	4	2	Aesthetic improvements, increased amenity value to property, reduced risk of damage to property	4	2	Moderate to low capital cost for restoration projects, however depends on scale of project	2	2	Long-term reduction in flood risk is a benefit (may lead to reduced non-capital costs), short-term cost for programming support	2	2	Can be through Wetland Replacement Program, or other grants	4	1	Will require willing landowners	1	1	Will require willing landowners	1	3	Wetland storage sites result in carbon sink	3	36	3	High										
	V1.3 Implement erosion and sediment control measures	1	Reduces the risk of culvert blockage	3	3	Bank protection reduces risk of erosion/sediment release	9	1	Reduces downstream sediment risk and localized bank erosion	2	2	Aesthetic improvements, increased amenity value to property	4	2	Low capital cost for each location	2	2	Can be supported through existing County programs / staff	2	1	Can be through environmental grants	2	1	Will require willing landowners	1	1	Will require willing landowners	1	3	Revegetation/ stable banks result in carbon sink	3	29	5	Low										
	V1.4 Implement co-existence with wildlife strategies	3	Beaver dams can attenuate floods, hold water in drought	9	3	Beaver pond biodiversity and habitat adds to regional biodiversity/ eco-function	9	2	Water availability and biodiversity (pollinators) can provide economic benefits	4	2	Aesthetic improvements, reduced risk of damage to property	4	3	No costs for retention of beaver ponds	3	2	Reduction in non-capital costs	2	2	Potential for grant funding & partnerships for resources	4	1	Beavers are divisive, with split support. Need landowner cooperation	1	2	Need landowner cooperation	2	3	Maintaining beaver ponds provides a carbon sink in pond soils and vegetation	3	41	1	Very High										
	V1.5 Ensure aquatic connectivity	2	Co-benefits of better flow resulting in flood risk reduction	6	3	Improved connection improves habitat	9	2	Co-benefit of better flow contributing to flood risk reduction, reduced risk of damage from flooding	4	2	Improved flow reduces risk of damage to property	4	2	Individual culvert replacements are moderate to low cost, and included in County programs	2	2	For culvert replacements, assuming O&M already integrated into budget	2	2	Potential for grant funding & partnerships for resources	4	3	Full landowner support likely	3	3	Fits with County transportation O&M program	3	1	Low/moderate GHG emissions	1	38	2	High										
	V1.6 Prevent livestock from accessing creek	0	Improvements limited to water quality	0	3	Results in reduced nutrient load/sediment release	9	1	Replacement water access and fencing costs involved, but better riparian management can help sustain water flow	2	1	Creek water quality (and quantity) can improve with restricted access, connection between environmental and community/social well-being	2	3	Fencing, alternative watering equipment costs	3	2	Uprake could be aided by County outreach support, leading to a low non-capital cost	2	2	Potential for grant funding & partnerships for resources	4	1	Will require willing landowners	1	1	Will require willing landowners	1	2	Improved riparian edge can store more carbon in vegetation	2	26	6	Low										
Vision 2: Integrated watershed management	V2.1 Conserve and restore wetlands	3	Adds to water storage & attenuates flood	9	3	Water quality protection, habitat/biodiversity enhancement	9	1	Prevents bank erosion and water quality issues, leading to cost savings (i.e. reduced need for erosion control measures)	2	2	Aesthetic improvements, increased amenity value to property	4	2	Low capital cost for restoration projects, however depends on scale of project	2	2	Long-term reduction in flood risk is a benefit (may lead to reduced non-capital costs), short-term cost for programming support, existing program	2	2	Potential funding with watershed protection grants	4	1	Will require willing landowners	1	1	Will require willing landowners	1	3	Wetland storage sites results in carbon sink	3	37	3	High										
	V2.2 Develop land buyback and/or compensation programs	3	Remove assets at risk from the floodplain	9	3	Land buybacks can be restored to enhance biodiversity	9	2	Reduces property damage overtime, however, may require a larger initial investment. Economic benefits for landowners from compensation (localized benefit)	4	3	Flood risk reduction, compensation provides secured revenue to farmers during large flood events, reduces stress of flood events for landowners	6	1	Land buy-back can be extensive, depending on the area. Compensation would be significantly lower cost	1	1	Minor increase in non-capital cost. Would require internal capacity building and possibly new staff	1	2	Potential funding	4	1	Significant risk with implementation if land owners are not on board	1	1	Fully dependent on stakeholder partnership, County would still need to be involved	1	3	Carbon sink if the lands are reclaimed.	3	39	2	High										
	V2.3 Maintain ecological function in Upper Assessment Reach	3	Retained wide riparian buffer reduces run-off speed, aids in flood attenuation	9	3	Reduced speed of run-off, reduces sediment and contaminant introduction, aids bank stability	9	3	Retained wide riparian buffer reduces run-off speed, aids in flood attenuation and reduces risk of flood damage and associated costs	6	2	Aesthetic improvements, increased amenity value to property	4	3	No capital cost	3	3	Low non-capital cost, enforcement of policy required, flood mapping will enhance existing policy	3	3	Aligned with existing land use policy	6	3	Some landowner challenge with development limitation possible	3	3	Building landowner support would aid in compliance	3	3	Retaining riparian buffer provides a carbon sink	3	49	1	Very High										
	V2.4 Protect and enhance drainage ways	2	Small drainage ways can collect flows / moderate overland flows	6	3	Reduced speed of run-off, reduces sediment and contaminant introduction, aids bank stability. Could increase water storage.	9	2	Retaining existing drainage ways helps reduce flood intensity, but also retains localized soil moisture, benefiting agricultural land use and reducing risk of flood costs	4	1	Aesthetic improvements possible	2	3	Range of costs: lower cost for drainage enhancement to no cost for conservation/protection	3	2	Low non capital cost, enforcement of policy required and/or support for enhancement projects	2	2	Potential funding with watershed protection grants & partnership opportunities	4	1	Significant risk - large shift in land mgmt. practice	1	1	Fully dependent on landowner cooperation	1	3	Retaining riparian buffer provides a carbon sink	3	35	4	Medium										
Vision 3: Resilient Infrastructure	V3.1 Replace undersized infrastructure	3	Significant flood risk reduction	9	3	Replacement can improve aquatic connectivity and ecosystem health	9	2	Contributes to community risk reduction	4	1	Indirect benefit, contributes to risk reduction	2	1	50 - 100 k for culvert replacements, 100 - 500 k for bridge replacements	1	2	For infrastructure replacements, assuming O&M already integrated into budget	2	3	Alignment with multiple funding programs. Aligned with existing capital planning/replacement and O&M	6	2	Routine work, in-water work may require additional regulatory approval	2	3	County in full control of action	3	1	Low/moderate GHG emissions	1	39	3	High										
	V3.2 Elevate roads along with crossing upgrades	1	Reduces flood risk for roads, but could increase upstream flood risk by forcing all the flow through culverts/bridges	3	0	No environmental benefits	0	2	Reduces flood damages to infrastructures but can increase flood levels upstream	4	3	Would reduce congestion during flood events, benefits for emergency response	6	1	Moderate capital cost	1	2	Non-capital cost similar to current conditions.	2	2	Alignment with multiple funding programs.	4	3	Routine work	3	3	County in full control of action	3	1	Low/moderate GHG emissions	1	27	5	Low										
	V3.3 Update the allowable stormwater discharge rate for new developments	1	Would contribute to reduced risk for new developments, but would not significantly impact risk on a watershed scale	3	2	Maintaining existing flow regime	6	1	Protects downstream landowners from increased flood risk	2	1	Reduced risk of property damage for downstream landowners	2	3	No capital cost	3	2	No increase in non-capital costs, minimal cost related to policy changes	2	3	Work to be completed internally	6	3	Minimal barriers to implementation	3	3	County in full control of action	3	2	No GHG emissions	2	32	4	Medium										
	V3.4 Incorporate flood construction level requirements in the LUB	3	Reduces flood risk for new developments	9	1	Reduces collateral pollution due to flooded buildings	3	3	Reduces flood damage and associated costs	6	3	Improves flood preparedness and reduces flood risk	6	3	No capital cost to update bylaws. Extra capital cost to raise structures above FCL. Variable cost based on lot elevation but still cheaper than flood damages	3	2	Low non-capital costs related to policy updates, education, and enforcement	2	3	Work to be completed internally	6	2	Low risk. Current bylaw already hold requirements regarding constructions in flood fringe.	2	2	County has full control of its bylaws, but some consultation might be required.	2	2	No GHG emissions	2	41	2	Very High										
	V3.5 Include climate change considerations in infrastructure and development standards/policy	3	Reduces flood risk.	9	1	Reduces collateral pollution due to flooded buildings	3	3	Reduces flood damage and associated costs	6	3	Improves flood preparedness and reduces flood risk	6	2	Slight increase in capital cost due to more stringent design criteria	2	2	Low non-capital costs related to policy updates, education, and enforcement	2	3	Work to be completed internally	6	3	Minimal risk with implementation	3	3	County owns the infrastructure	3	2	No GHG emissions	2	42	1	Very High										

Vision	Actions	Prioritization Criteria																										Action Prioritization						
		Contribution to flood/drought risk reduction			Environmental benefits			Economic benefits			Social benefits			Capital cost			Non-capital costs			Funding alignment & available resources			Ease of Implementation			Autonomy			Low-carbon resilience			Overall Priority Score	Priority ranking within vision	Overall Priority Level Based on Overall Priority Scores: Very Low: <25 Low: 25 - 29 Medium: 30-35 High: 36 - 40 Very High: >40
		Criteria Weight: 3		Score	Criteria Weight: 3		Score	Criteria Weight: 2		Score	Criteria Weight: 2		Score	Criteria Weight: 1		Score	Criteria Weight: 1		Score	Criteria Weight: 2		Score	Criteria Weight: 1		Score	Criteria Weight: 1		Score	Criteria Weight: 1					
		Rationale	Weighted Score		Rationale	Weighted Score		Rationale	Weighted Score		Rationale	Weighted Score		Rationale	Weighted Score		Rationale	Weighted Score		Rationale	Weighted Score		Rationale	Weighted Score		Rationale	Weighted Score		Rationale	Weighted Score	Rationale			
Vision 4: Proactive Management	V4.1 Implement a debris management program	2	Increase creek's conveyance capacity (assumed action taken throughout watershed)	6	1	Reduces collateral pollution due to flooded buildings. Depends on type, severity, and location of debris	3	2	Reduces flood damage and associated costs	4	3	Improves flood preparedness and reduces flood risk	6	3	No capital cost	3	1	Moderate annual cost, depends on extent of debris removal required	1	2	Work to be completed internally	4	3	Minimal risk with implementation, however landowner cooperation likely required for access	3	2	Land access would need to be granted	2	2	Minimal GHG emissions	2	34	2	Medium
	V4.2 Expand asset management program	1	Well maintained/managed infrastructure less likely to fail in a flood event contributing to risk reduction	3	1	Prevention of flood/erosion risk associated with infrastructure failure	3	2	Regular maintenance can increase service life of infrastructure	4	2	Well maintained infrastructure will continue to provide required level of service to residents	4	3	Although asset management program may lead to capital spending, this is not directly associated with asset management program	3	2	Moderate increase in non-capital costs to expand and continue asset management program. Costs will likely be higher in the short term while program is developed, and less over time as program becomes operational	2	2	Possible funding alignment, assuming expansion of existing asset management program using internal resources	4	3	Minimal risk with implementation, expansion of existing program	3	3	County is in full control of action	3	2	Minimal GHG emissions	2	31	3	Medium
	V4.3 Proactive creek inspections and monitoring	1	Improved flood preparedness contributes to reduced risk consequence	3	1	Prevention of flood/erosion risk associated with infrastructure failure	3	1	Improve emergency preparedness can reduce flood costs/damage	2	2	Improves flood preparedness	4	3	No capital cost	3	2	Low increase in non-capital cost	2	2	Work to be completed internally	4	3	Minimal risk with implementation, however landowner cooperation likely required for access	3	2	Land access would need to be granted	2	2	Minimal GHG emissions	2	28	4	Low
	V4.4 Landowner education and partnership for private property clean up	2	Increase creek's conveyance capacity (assumed landowner participation across watershed which would contribute to overall risk reduction)	6	1	Reduces collateral pollution due to flooded buildings.	3	2	Reduces flood damage and associated costs	4	3	Improves flood preparedness and reduces flood risk	6	3	No capital cost	3	2	Minimal non-capital costs related to support and education for landowners	2	3	Internal costs	6	2	Minimal risk with implementation, however success will depend on landowner buy-in and participation	2	1	Fully dependent on stakeholder collaboration	1	2	Minimal GHG emissions	2	35	1	Medium
Vision 5: Emergency Preparedness	V5.1 Develop flood response plan and training	2	Improve flood preparedness and response helps to reduce risk consequence	6	0	No environmental benefits	0	2	Improve flood response and reduces damages	4	2	Reduced risk and improved overall flood response, contributes to improved public safety	4	3	No capital cost	3	2	Low increase in non-capital cost (less than \$50k)	2	2	Potential funding, internal resources	4	3	Minimal risk with implementation	3	1	High level of partnership required for a coordinated response	1	2	No GHG emissions	2	29	3	Low
	V5.2 Develop flood forecast, monitoring, and warning system	2	Improve flood preparedness and response helps to reduce risk consequence	6	0	No environmental benefits	0	2	Improve flood response and reduces damages	4	2	Reduced risk and improved overall flood response, contributes to improved public safety	4	2	Less than \$75k for an hydrometric station	2	2	Low increase in non-capital cost (less than \$50k)	2	2	Potential funding, internal resources	4	3	Minimal risk with implementation	3	2	Land access might be required for hydrometric station installation.	2	2	Minimal GHG emissions	2	29	3	Low
	V5.3 Develop a drought mitigation plan	2	Improve drought preparedness helps to reduce risk consequence	6	1	Drought preparedness likely to incorporate improved water retention	3	2	Helps to reduce financial impacts of drought	4	2	Improves drought preparedness	4	3	No capital cost	3	2	Low non-capital costs	2	2	May be eligible for funding to support plan development, some internal County resources could also support	4	3	Minimal barriers to implementation	3	3	County is in full control of action	3	2	No GHG emissions	2	34	2	Medium
	V5.4 Increase public understanding of flood prevention and drought mitigation, property protection and emergency response	2	Increases preparedness and reduced risk consequence as residents will have been engaged in development of risk/response plans	6	0	No environmental benefits	0	2	Residents understanding and preparing for flood/drought can help to reduce damages	4	3	Increase in residents' understanding of risks and increases buy in for mitigation measures to reduce risk to public safety and property damage	6	3	No capital cost	3	2	Low non-capital costs	2	3	Anticipated to be covered whiling existing County resources	6	3	Minimal barriers to implementation	3	2	County can initiate action, however, participation of citizens is required	2	2	Minimal GHG emissions	2	34	2	Medium
	V5.5 Incentivize property level flood protection	3	Decreased property flood risk	9	2	Reduces collateral pollution due to flooded buildings	6	3	Reduces flood damage and associated costs	6	3	Improves public safety	6	2	Low capital cost to County to provide incentive. Moderate capital cost to landowners.	2	2	Low non-capital costs	2	1	Possible funding through partnership applications	2	2	Minimal risk with implementation, however success will depend on landowner buy-in and participation	2	1	County can implement incentive program, however action implementation is dependent on property owners	1	2	Minimal GHG emissions	2	38	1	High
	V5.6 Investigate availability of flood insurance for landowners	0	No direct impact on risk reduction	0	0	No environmental benefits	0	2	Sharing of flood damage cost between policy owners. Reduce risk to property value.	4	1	Localized benefits for homeowners with insurance. Increased awareness of insurance availability and options.	2	3	No capital cost.	3	2	Minimal cost to county to provide information to landowners. Possibility of increased insurance premiums for land owners.	2	0	No funding available.	0	1	Insurance availability uncertain.	1	1	County can provide support and information, but action is dependent on property owners	1	2	No GHG emissions	2	15	4	Very Low
Vision 6: Educated, engaged, and empowered public	V6.1 Implement public outreach programs	0	No direct impact on risk reduction	0	1	Increased environmental awareness	3	1	Increased risk awareness contributes to support for mitigation to reduce damages	2	3	Strengthen community connections, foster support for resilience initiatives	6	3	No capital costs associated with action	3	2	Low non-capital costs, cost would be incurred over time	2	3	Funding programs available (community conservation action program), also in alignment with internal operating budget	6	3	Minimal barriers to implementation	3	2	County in full control of action, although there may be additional benefits to partnership	2	2	Minimal GHG emissions	2	29	3	Low
	V6.2 Implement pilot programs to showcase nature-based solutions	1	Localized flood reduction via pilot	3	2	Localized environmental benefit	6	1	Localized property risk reduction or community damages	2	2	Localized benefit, depends on communication of project	4	3	Majority of pilot projects will be less than \$10K	3	2	Low non-capital costs, cost would be incurred over time	2	3	Funding programs available (EcoAction, NatureSmart, Watershed Stewardship Grant)	6	2	Perceived risk from up and downstream landowners. Assumption: need one pilot landowner to agree	2	2	Likely need at least one landowner for access	2	2	Minimal/no GHG emissions in most cases, some could be GHG sinks	2	32	1	Medium
	V6.3 Implement citizen science initiatives	0	No direct impact on risk reduction	0	1	Increased environmental awareness and availability of data to monitor/improve environmental outcomes	3	1	Indirect economic benefit as County will know more about private and public lands	2	3	Strengthen community connections, foster support for resilience initiatives, build science and data capacity	6	3	No capital costs associated with action	3	2	Low non-capital costs, cost would be incurred over time	2	3	Funding programs available (community conservation action program), also in alignment with internal operating budget	6	3	Minimal barriers to implementation	3	2	Success depends on engagement of citizens	2	2	Minimal/no GHG emissions	2	29	3	Low
	V6.4 Indigenous relations	0	No direct impact on risk reduction	0	1	Increased environmental awareness and understanding of different perspectives for environmental management	3	2	Improved relations fosters improved future discussions/collaboration around creek management and consultation	4	3	Both County and Indigenous communities stand to benefit from improved relations. Opportunity to align with implementation of Vision 1.	6	3	No capital costs associated with action	3	2	Low non-capital costs	2	3	Improves access to additional grants and programs	6	2	Low risk, largely perceived. County is already active in ongoing Indigenous Relations programs	2	2	County can initiate actions, but collaboration/involvement from Indigenous communities is required for success	2	2	Minimal GHG emissions	2	30	2	Medium



PROJECT RECOGNITION

C



2022
SHOWCASE
- AWARDS -

AWARD OF
EXCELLENCE
-
ENVIRONMENTAL



ASTOTIN CREEK RESILIENCY STUDY

AWARD OF EXCELLENCE
Environmental

FIRM: WSP

CLIENT/OWNER: STRATHCONA COUNTY

LOCATION: STRATHCONA COUNTY, ALBERTA

SUB CONSULTANTS: UNIVERSITY OF ALBERTA,
INNOTECH

Multiple severe floods in Astotin Creek over the past decade triggered the need for an interdisciplinary study to develop a Watershed Resiliency Action Plan. WSP's study balanced environment, engagement, and engineering to create a healthy watershed. The analysis incorporated vegetation, soils, wildlife, fish and aquatic habitat, surface and groundwater studies, climate analysis, innovative eDNA and modeling techniques plus extensive public engagement. This robust assessment will lead to a holistic resiliency action plan with a focus on nature-based solutions. The goal is a community supported plan which enables both residents and Mother Nature to thrive. Study partners: University of Alberta and InnoTech

JUDGES' COMMENTS

The Astotin watershed study creates practical tangible recommendations for managing the watershed, that were founded on community support and feedback.

Figure C-1: Astotin Creek Award Announcement (Consulting Engineers of Alberta, Alberta Innovators Magazine, Spring 2022 issue, page 48)