Environmental Impact Assessment Report for 199 St NW Road Widening at Wedgewood Creek within 5-52-25-W4M and 6-52-25-W4M, Edmonton, Alberta

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Stantec Quality Management Program

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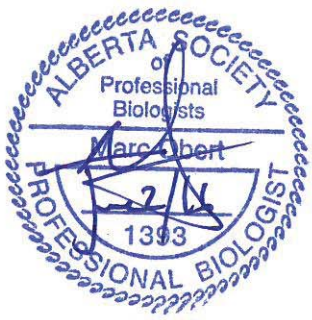

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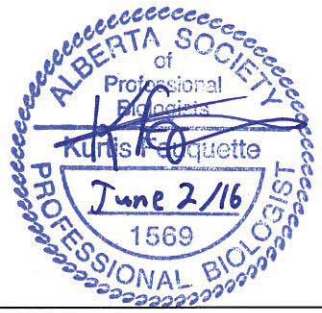

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1.0 INTRODUCTION

Stantec Consulting Ltd. (Stantec) has been retained by Riverview Owners Group (the Client) to provide environmental and regulatory support for the 199 Street NW Widening Project at Wedgewood Creek within the north portion of the Riverview Neighbourhood 1 (the Project).

The purpose of this document is to evaluate the potential biophysical and socio-economic effects associated with the construction, operation, and maintenance of the Project. Because the Project occurs within the North Saskatchewan River Valley Redevelopment Plan Area, the City of Edmonton Bylaw 7188 requires an environmental impact assessment for the Project.

1.1 SITE DESCRIPTION

The Project intersects the North Saskatchewan River Valley Area Redevelopment Plan Area as defined by the City of Edmonton Bylaw 7188 (bylaw area)(City of Edmonton 2012). The Project is located where 199 Street NW bisects an unnamed ravine approximately 250 meters (m) south of 35 Avenue NW, within 5-52-25 W4M and 6-52-25-W4M. (Figure 1-1, Appendix A). Wedgewood Creek flows through the ravine, and herein, the unnamed ravine is referred to as the Wedgewood Ravine. To the east of 199 Street NW, the Wedgewood Ravine connects to the North Saskatchewan River (NSR) Valley. The Wedgewood Ravine is a major ecological feature that provides both habitat for many wildlife species and important corridors and linkages to adjacent agricultural areas, wetlands, natural areas, and environmentally sensitive areas identified in the *Environmental Network Report for the Riverview Neighborhoods* (Stantec 2015a). To the west of 199 Street NW, the Wedgewood Ravine continues upstream to the southwest. Beaver activity is evident in Wedgewood Creek, at the existing watercourse crossing and both upstream and downstream of the Project.

1.2 PROJECT BACKGROUND

This roadway project is being undertaken as a requirement of the development of the Riverview Neighborhood. This new neighborhood will generate a substantial amount of traffic volume, which the current road network cannot support. The existing 199 Street NW from south of 35 Avenue NW to north of 23 Avenue NW is a narrow two lane rural road with no channelization (i.e. no left or right turning lanes), rural drainage systems, and overhead power structures. The road currently crosses Wedgewood Creek. Flow of the creek is maintained via a long structural plate culvert in very poor condition. According to the approved Area Structure Plan and subsequent neighborhood planning, this creek/ road intersection inhibits wildlife movement.

In support of the neighborhood planning process, the City Administration (CA) required that a concept plan and associated report be completed for the portion of 199 Street NW identified.

The concept plan was compiled by CIMA+ (2015, Appendix B) and was approved by Facility and Capital Planning in early 2015.

During the concept planning process, extensive dialogue was undertaken with CA regarding wildlife and the need to enhance the current 199 Street NW/Wedgewood Crossing portion of the roadway. Applicable correspondence with CA and supporting information is included in Appendix H and J of the appended concept plan package (Appendix B). Through the concept review process, various design options were considered (refer to Section 3.0 for details). The final approved concept included a large terrestrial wildlife passage structure and a culvert crossing for the creek flows (aquatic culvert).

Using the Concept Plan as a base, the preliminary plan and detailed design phases expanded upon the configuration approved in the concept plan and evaluated in greater detail the design elements associated with improving wildlife passage, grading, underground utilities, road and sidewalk, and landscape design required for the Project.

The following environmental impact assessment (EIA) report has been updated to reflect the first submission detailed design (December 2015), comments received from CA to date, and concerns presented by CA throughout the concept, preliminary, and detailed design review process.

1.3 DOCUMENT ORGANIZATION

This environmental impact assessment is organized into seven sections, as follows:

- **Section 1.0: Introduction** – introduces the rationale for conducting an environmental impact assessment, Project setting, and document organization
- **Section 2.0: Project Description** – describes the overall Project, Project activities for the construction and operation phases, and Project timelines
- **Section 3.0: Project Alternatives and Engineering Details** – summarizes project rationale, alternatives, and details
- **Section 4.0: Scope of the Assessment** – outlines how the scope of the environmental impact assessment was determined, including descriptions of the following:
  - regulatory and policy setting,
  - influence of consultation on issues identification,
  - valued component selection,
  - assessment boundaries,
  - potential Project interactions with valued components,
  - residual effects characterization criteria
- **Sections 6.0, and 7.0: Existing Conditions** – describes desktop and field survey methods used to describe existing conditions, and existing conditions for each environmental element
- **Section 8.0: Effects Assessment** – this section evaluates the residual effects of the Project on valued components, as follows:

  - identifies potential environmental effects and effect pathways
  - outlines the results of desktop and field surveys
  - references specific mitigation measures
  - characterizes the residual effects of the Project.

- **Section 9.0: Recommendations –** this section summarizes any additional general recommendations or best management practices that should be considered in support of the Project

Supporting appendices are included.

2.0 PROJECT DESCRIPTION

The existing 199 Street NW between 23 Avenue NW and 35 Avenue NW is a narrow two lane rural road. The existing condition of 199 Street NW cannot accommodate the projected traffic volumes anticipated for Riverview Neighborhoods 1, 2 and 3. Based on the recommendations from the Transportation Impact Assessment (Bunt & Associates 2014) and the approved concept plan (CIMA+ 2015) (Appendix B), 199 Street NW will ultimately be a 4-lane divided arterial roadway with channelization requirements. The ultimate cross section includes a 37 m (minimum) wide right-of-way , with surface infrastructure including a 3 m shared use path on the west side, a 1.5 m concrete walkway/3 m shared use path on the east side, landscaping and street lighting. The concept phase also included the evaluation of options for the wildlife passage within the Wedgewood ravine. These options are discussed in Section 3.0.

Within the Wedgewood Creek area, the Project will involve the construction of the first 2 lanes (of the ultimate 4 lanes), including required channelization at 35 Avenue NW and Woodbend Wynd, the 3 m shared use path, the pre-grading of the remainder of the right-of-way, and the landscape restoration for all disturbed surfaces. This construction will also incorporate the deep utility construction of a temporary sanitary forcemain, water transmission main, and storm sewer main. There are also several shallow utilities that will need to be installed: ATCO gas, Telus / Shaw / Bell, power and street lighting. These will be aligned within the Wedgewood Creek footprint and throughout the extent of the roadway project, that covers the area from south of 35 Avenue NW to 23 Avenue NW (approximately 1,600 m of roadway construction).

The Project also requires the construction of a wildlife passage system to accommodate terrestrial wildlife and the reconstruction of a hydraulic crossing to address the creek flow and fish/amphibian passage. Although the road is only being constructed to the first two lanes, the terrestrial wildlife passage system (large wildlife passage structure and mid-slope culvert) and aquatic culvert are being installed to the ultimate cross section. This limits the amount of future disruption to the Wedgewood Creek area when the ultimate roadway is built.

Staging and laydown areas will be located 19 m outside of the bylaw area, 94 m from Wedgewood Creek, west of 199 Street NW, as shown on the 199 Street Staging and Construction Laydown Area figure, Appendix C.

Details regarding the proposed Project design are provided in Section 3.0 and Appendix C.

2.1 PROJECT ACTIVITIES

The following sections summarize the activities required to successfully compete, operate, and maintain the various components of the proposed Project.

2.1.1 Construction

Construction through the Wedgewood Creek crossing will consist of the following: removal of the existing 199 Street roadway embankments and existing culvert, culvert upgrade, embankment and wildlife crossing installation, underground deep and shallow utility installation, final road construction, and landscape restoration. These items have been separated into three key phases of construction in the following sections.

2.1.2 Site Preparation and Culvert Installation

This section provides details on the site preparation and culvert installation portion of the Project.

Dewatering and creek isolation:

- Dewatering: Wedgewood Creek will be temporarily dammed at the upstream construction limit using Aqua-Barrier or equivalent, a water-inflated dam. The construction zone will be left to dry and a second Aqua-Barrier dam will be placed at the downstream construction limit isolating the construction zone. This is summarized further in Sections 2.2.1, 2.2.2, and 2.2.3 in the Erosion and Sediment Control (ESC) plan for the 199 Street NW Wedgewood Creek crossing (Stantec 2015g, Appendix D) and detailed in Drawings C015-001 and C015-003 (Appendix C)
- Water diversion channel: A water diversion channel will be established south of the proposed culvert to maintain the flows during the aquatic culvert replacement, as shown in drawing C015-003 (Appendix C). This temporary channel will be lined to allow Wedgewood Creek to flow along the channel without infiltration or leakage
- Terrestrial ESC measures: Execute the ESC plan (Appendix D) and install the appropriate ESC measures. Refer to Drawings C015-001 and C015-003 (Appendix C) for details. Prior to work initiating, ESC measures must be in place. These must be monitored and repaired, as necessary
- Blockage is located immediately upstream of the existing culvert. This will need to be removed. As such, the water behind the blockage will be drained along the diversion channel to a level which will allow for its removal. A second small beaver dam was observed on April 27, 2015 approximately 30 m downstream of the existing culvert outlet. This beaver dam will likely have to be removed to accommodate the new culvert. Since this beaver dam is small and does not cause a large ponding area, it will be breached to gradually drain any ponding water. Once the isolation measures are installed upstream, the dam will be removed

For specific ESC details refer to the applicable sections within the ESC plan (Stantec 2015g, Appendix D)

Road, embankment and aquatic culvert removal:

- Vegetation clearing and grubbing: the area outlined as the project footprint (Drawing C007-001, Appendix C) will be required to be cleared of all trees (if present), shrub and other vegetative material
- Topsoil stripping: the topsoil in this area will be removed and stockpiled on lands outside the bylaw area. Refer to Figure: 199 Street Staging and Construction Laydown Area, Appendix C) for the location of the staging/laydown area
- Removal of existing road base: the asphalt surface will be removed. The granular base (if present) will then be removed and stockpiled on lands well outside the Wedgewood Creek ravine system
- Removal of road embankment: Embankment cuts will be undertaken in localized areas in preparation of culvert removal and replacement. Based on the suitability of the embankment material removed, it will either be stockpiled within the staging/laydown area or hauled offsite.
- Removal of existing aquatic culvert: The existing aquatic culvert will be removed and discarded

Culvert installation and removal of isolation system:

- The proposed upgraded culvert will be installed according to Drawings C105-012 and S002-002, Appendix C, and backfilled, per City of Edmonton specification and with recommendations from the geotechnical documentation (Hoggan. 2014 and 2015)
- The creek bed and any disturbed areas will be restored in accordance to the detailed landscaping plan (Drawings L001-002 through 0112A and L001-015 through 017, Appendix C) as soon as possible to mitigate exposed soil and reduce the possibility of erosion and sedimentation concerns
- Following restoration, the temporary dams will be removed and Wedgewood Creek will be allowed to flow through the upgraded culvert and along its original course. Refer to Section 2.2.2 of the ESC plan (Stantec 2015g, Appendix D) for details

2.1.3 Road, Utility, and Terrestrial Passage Construction

Foundation construction:

- Compost berms will be installed above the inlet and outlet of the culvert, providing aquatic passage for Wedgewood Creek as detailed in Section 2.2.2 of the ESC Plan (Stantec 2015g, Appendix D) and shown in Drawing C015-001, C015-002 and C015-003 (Appendix C). The compost berms will act as retention dykes and a slow filtration system so as to isolate the construction zone from the creek
- Backfill for the new embankment will continue to allow for the installation of piles as shown on Drawing S001-005, Appendix C to support the cast-in-place concrete abutments that support the large wildlife passage structure

Underground deep utilities and mid-slope culvert construction:

- The temporary 400mm sanitary forcemain will be installed inside a steel casing as shown on Drawing C105-006, Appendix C above the aquatic passage and below the mid-slope culvert and MSE walls after the piles are installed and as backfill continues
- Installation and backfill of the storm sewer mains, treatment, and connection to the existing Edgemont outfall will occur as shown on Drawing C105-006, Appendix C and according to City of Edmonton specification. The mid-slope culvert will be installed according to Drawing S002-001, Appendix C at the same time as the storm sewers

Large wildlife passage structure and watermain construction:

- Once underground construction has been completed, the cast-in-place abutments and MSE walls will be constructed according to Drawings S001-006 to S001-008, and S001-014 to S001-017, Appendix C. Once constructed, backfill will be placed and compacted behind and around the MSE walls gradually to bring up the level of the embankment as well as the earth abutments
- The large wildlife passage structure will include a bridge superstructure (girders) placed on top of the abutments. The superstructure consists of precast concrete girders placed side by side to form the bridge deck as shown on Drawings S001-009 and S001-010, Appendix C. The girders are topped by a concrete deck slab poured on top along with the barriers at the edges of the bridge as shown on Drawings S001-011 and S001-012, Appendix C
- Installation of the 600 mm watermain will occur on the bridge girder along the west side of the crossing structure according to supplier shop drawings

Concrete work, road construction, and shallow utilities:

- Construction of the road structure (curb and gutter, pavement, and guard rail): the subgrade embankment will be prepared and granular material placed. The concrete work is then completed for curbs. The asphalt structure is then completed. The guardrail will then be installed, posts augured, and the rail hung
- Shallow utility installation: the power distribution, Telus/Shaw/Bell, gas lines, and street lighting will be installed in standard alignments at standard depths (these utilities, with the exception of ATCO gas, will be aligned within the bridge girders, within the boulevard, or in a separate duct structure to be determined by EPCOR). The ATCO gas line will be installed via directional drill under the aquatic culvert
- Asphalt path construction and boulevard grading: final grading of the west boulevard will be completed and the asphalt path installed to City of Edmonton standards
- Revegetation: The landscape materials will be installed after the construction of the asphalt path. This will follow the detailed landscaping plan (Drawings L001-007 through 0112A and L001-015 through 017, Appendix C), which includes specific components designed to enhance wildlife movement through the terrestrial wildlife passage system and the aquatic passage. Refer to the listed drawings, Section 3.6, and the *199 Street Wildlife Crossing*

Restoration Brief (MMM Group Ltd./WSP 2016, Appendix D) for a detailed summary of the native plantings selected, their location, and purpose

2.1.4 Operations and Maintenance

During the proponent's maintenance period (prior to final acceptance certification), the operation and maintenance activities include the following:

Aquatic culvert maintenance:

- Monitoring of the aquatic culvert will occur on a regular basis, and also after major flood events, to identify if any maintenance such as removal of debris or installation of additional bank protection is required to ensure the full hydraulic capacity is maintained. These inspections shall also monitor the structural component of the culvert and identify any deficiencies. Refer to the Hydrotechnical Summary Report (Stantec 2015d , Appendix D) and addendum (Stantec 2016a, Appendix D) for suggested maintenance schedule

Road drainage:

- The road drainage system shall be inspected on a regular basis for cleaning and maintenance

Terrestrial wildlife Passage system Maintenance:

- The terrestrial wildlife passage system (large wildlife passage structure and mid-slope culvert) and associated infrastructure shall be inspected on a regular basis to identify if any maintenance concerns are present such as garbage accumulation, fence integrity, or vegetation health at the entrance of the terrestrial wildlife passages. These inspections shall also monitor the structural component of the infrastructure and substrate and identify any deficiencies. As noted in the Hydrotechnical Summary Report addendum (2016a, Appendix D), flood levels during the design (1:100 year) and check (1:200 year) floods will not rise above the bottom of the wildlife passages therefore maintenance is not expected after these events

2.1 CONSTRUCTION SCHEDULE

Construction of the Project is scheduled to begin in summer 2016, pending regulatory approval, and is expected to be 14 months in duration. Details regarding the tentative schedule are summarized in Sections 2.2.1 through 2.2.3 of the ESC Plan (Stantec 2015g, Appendix D)

3.0 PROJECT ALTERNATIVES AND ENGINEERING DETAILS

Due to the complexity of the proposed Project, project alternative assessment was a large part of the overall design process.

As part of the concept planning process, Terrace Engineering Ltd. (2014) completed a Conceptual Bridge Planning Report for the Wedgewood Creek crossing at 199 Street NW (Terrace 2014, Appendix B). The planning report includes an analysis of large wildlife passage options for this location, and considers cost comparisons. Three options were analyzed:

1. A multi-span bridge across the entire ravine,
2. An oversized culvert suitable for wildlife passage in addition to stream flows,
3. A culvert sized for the stream flow with a separate shorter bridge structure crossing for wildlife passage.

Option 1 was ruled out due to the bridge length that would result from the high fill heights and current road skew in relation to the creek alignment. The geotechnical stability of the valley at the location of the crossing may also limit the design of the head slope and/or retaining walls required for a bridge. Lastly, the Erosion Study for Wedgewood Creek at Edmonton (Golder 2012) recommended a culvert type structure that could provide flow attenuation and sedimentation retention, which would not be achieved by a bridge.

Option 2 was ruled out because of cost and practicality. For this location, a 150 m long, 45 m wide, and 5 m high culvert would be required to meet the site and design constraints. However, the fill needed to install the culvert would minimize wildlife use (Stantec 2014c). The use of retaining walls to shorten the opening was considered. However, due to geotechnical stability concerns and cost, retaining walls were not feasible. Given the 45 m width of the required structure across the approximately 140 m wide ravine, similar concerns for the full spanning bridge described above would apply to this option. The substantially larger cross section of the culvert would allow more flow through the crossing, limiting flow attenuation, and could increase the erosion concerns downstream of 199 Street NW. This will also change the existing flow dynamic of Wedgewood Creek at 199 Street NW.

Option 3 was selected as the most suitable option. The aquatic culvert could be aligned to the skew of Wedgewood Creek and the large terrestrial wildlife passage structure would be built higher up on the slope roughly perpendicular to the road alignment to limit the wildlife passage length (Stantec 2014d). The second concept plan (CIMA 2015) increased the width of the large terrestrial crossing from 6 m to 14 m to accommodate this alternative and skewed the structure 25° from perpendicular to improve wildlife sight lines (Table 3-1 below)(Stantec 2014e).

Refer to Appendix J of 199 Street Concept Plan Report (CIMA 2015), Appendix B for further details.

During the preliminary planning process, the option selected and included in the approved concept plan was expanded upon and specific evaluations for components of the terrestrial wildlife passage system, the aquatic culvert, and road drainage was undertaken.

The following sections summarize the design alternatives evaluated and final Project components approved in the evaluation for Option 3 (CIMA+ 2015), which include:

- large wildlife passage structure
- mid-slope culvert for small and medium terrestrial species
- Aquatic culvert
- Road drainage
- Utilities
- Landscaping

3.1 LARGE WIDLIFE PASSAGE STRUCTURE

The target ecological design groups (EDGs) for this large wildlife passage structure are Large Terrestrial, Medium Terrestrial, and Small Terrestrial wildlife species, including white-tailed deer (*Odocoileus virginianus*), coyote (*Canis latrans),* snowshoe hare (*Lepus americanus)* and various microtine species (voles, shrews and mice)(Stantec 2014c).

Given the proposed use of the large wildlife passage structure, several design-related elements have been evaluated to determine an optimum functioning structure based on site and engineering constraints.

The following sub sections summarize the alternatives evaluated for the large wildlife passage structure location, design, the open median width.

3.1.1 Location

In relation to the other design components, the final location of the large wildlife passage structure will be north of the aquatic culvert as shown on Drawings C006-001, C103-006, and S002-001, Appendix C. This location is considered the most optimum in light of the numerous site and engineering constraints.

Throughout the design process, the design team reviewed moving the passage structure south. However, this was considered unfeasible to due to the following constraints:

- Given the optimum alignment of the aquatic culvert (refer to Section 3.3), we consider the location of the aquatic culvert a constant and the other structures were strategically located in relation to this. If moved south, the terrestrial passage would need to be aligned parallel to the aquatic culvert to ensure the piles and abutments do not conflict with it. For example, because the piles will be driven to a depth of 25 m to support the bridge abutments (Drawing S001-005, Appendix C), the footings cannot straddle the aquatic

culvert. Therefore the orientation required would increase the length of the large wildlife passage structure and reduce the openness ratio below 2.0 (City of Edmonton 2010). Furthermore, the angle of the large wildlife passage structure would be approximately 50°, therefore this would hinder line of sight through the passage. A location south of the current location would also place the large wildlife passage structure in a more upslope position. This would negatively affect the approach on the east side. Given the steep conditions on this side, sloping the area to the requested 5H: 1V would not be technically feasible.

- Given the bottom of the retaining walls (mechanically stabilized earth (MSE – approximately 674.5 m bottom elevation as per Drawing S001-001 (Appendix C)), the pipe diameter with insulation and steel casing, and the invert of the existing storm outfall (673.35 m as per Drawing C105-012 (Appendix C), moving the large wildlife passage structure south would create a conflict with any storm sewer attempting to tie into the existing infrastructure (refer to Section 3.4). Therefore, a separate storm outfall would be required for the road drainage south of Wedgewood ravine, expanding the disturbance footprint within the Wedgewood Creek Ravine system.
- The height (Drawings C200-002, S001-001, and S001-003, Appendix C) of the proposed large wildlife passage structure must be considered while reviewing the overall footprint of the roadway crossing section. The low point of the roadway is approximately mid-span of Wedgewood Creek ravine. To minimize the overall footprint of the roadway crossing and to use as much of the existing embankment as possible, the terrestrial passage was located in this area. This adheres very closely to the existing road profile and minimizes the sloping required into the existing terrain. If the passage was shifted south, the road gains in elevation and would result in a larger footprint due to the sloping required to safely match the surrounding terrain.

3.1.2 Design

The large wildlife passage structure is located approximately 5 m below the roadway as shown on Drawings S001-001 and S001-003 (Appendix C), near the natural travel area for deer at the top of Wedgewood Ravine that was observed during the field assessment (Stantec 2014e).

The dimensions for the large wildlife passage structure have been evaluated to provide an adequate opening. Clevenger and Huijser's (2011) general guidelines recommend a width of >12 m and height of >4 m for large mammal underpasses. The dimensions of the new open-span crossing structure are 13.8 m wide and 4.65 m high (Table 3-1, Drawings C200-002 and S001-001, Appendix C), well above Clevenger and Huijser's (2011) recommendations. These dimensions allow for an openness ratio of approximately 2.0 (City of Edmonton 2010).

An openness ratio greater than 1.5 (City of Edmonton 2010) is achieved by spanning pre-cast concrete girders (Drawing S001-009, Appendix C) across cast-in-place concrete abutments (Drawing S001-006, Appendix C), and MSE walls. The abutments will be supported on steel piles spaced at 2.1 m (Drawing S001-005, Appendix C). The girders and a pre-cast concrete bridge deck (Drawing S001-011, Appendix C) will provide cover for the opening.

In Utah, analyses of the effectiveness of wildlife crossing structures confirm they should be designed to be as short as possible. Schwender (2013) found that passage length outperformed all other parameters, and culvert width and length together were the best predictors of successful mule deer passage. As well, Cramer (2012) felt that when considering the metrics of wildlife crossing design, length was the most important factor, followed by width, and height was the least important consideration. Based on this analysis, Cramer (2012) recommended keeping wildlife underpasses under 37 m long. Therefore, wing-walls have been placed at either end of the large wildlife passage structure (Drawings S001-014 and S001-015, Appendix C) to minimize the length and help guide animals to the entrances, as shown on Drawing C006-001, Appendix C. This provides a final estimated length of the large terrestrial structure to be 32.3 m. Refer to Table 3-1 for a summary of the structural dimensions of the large wildlife passage structure from initial concept, through to detailed design.

Table 3-1 199 Street NW– Wedgewood Ravine: Large Wildlife Passage Structure Design and Structural Dimensions

Stage	Date	Dimensions of the Large Terrestrial Crossing Structure			Comments	Reference
		Width (m)	Height (m)	Length (m)		
Initial Concept	April 2014	6.0	4.00	65.0	Open-bottom aquatic passage following creek alignment	CIMA 2015 Stantec 2014c
1st Concept Plan	August 2014	6.0	4.50	28.6	Non- large wildlife passage structure just below grade	CIMA 2015 Stantec 2014d
2nd Concept Plan	November 2014	14.0	4.50	30.9	large wildlife passage structure width increases to 14 m, 25° skew increases length	CIMA 2015 Stantec 2014e
2nd Preliminary Plan	July 2015	14.0	4.5	32.3	Narrower median and 15° skew reduces length of large wildlife passage structure, wildlife path evaluated	Stantec 2015e
3rd Preliminary Plan	September 2015	14.0	4.65	32.3	Narrower median and 15° skew reduces length of large wildlife passage structure	Stantec 2015e Stantec 2015f
1st Detailed Design	December 2015	13.8	4.65	32.3	Slight reduction of width of large wildlife passage structure reflecting design details	Stantec 2015g

During the design process, the skew angle was reviewed and revised from the proposed concept. During, preliminary planning (Stantec 2015e), the skew angle was adjusted from the proposed 25 degrees (°) in the concept plan to 15°. The 15° skew angle allows the use of prefabricated girders and moves the western approach further from the rip-rap associated with

the existing Edgemont storm outfall. It also resulted in a shorter overall length of the large wildlife passage structure (32.3 meters, Table 3-1 above).

Due to the change in skew angle, a review of sight lines through the large wildlife passage structure was also undertaken. It was determined that there will be no change between the 15° skew compared to the 25° skew (Sight-lines associated with the 15° degree skew, Appendix D). For animals at the east entrance looking west, they will be able to see approximately 30 to 40 m of habitat beyond the west exit of the structure. For animals at the west entrance looking east, they can see approximately 30 to 60 more of habitat beyond the east exit of the structure. Therefore, the 15° design was considered to provide sufficient clear view (sight lines) on the other side of the large wildlife passage structure to encourage through passage of larger terrestrial EDG (e.g., deer) in the vicinity of Wedgewood Creek.

The final design of the large wildlife passage structure also include 3 m wide wildlife paths to facilitate north-south wildlife movement along the fill slopes on either side of the roadway (Drawings C006-001 and L001-008, Appendix C). These paths were part of the conceptual design (Stantec 2014e) and preliminary design (Stantec 2015e) and are independent of the east-west slope grading on the approaches into and out of the large wildlife passage structure. The paths will be compacted soil and seeded. Landscaping treatments of the paths have been detailed in the Wildlife Crossing Restoration Brief (Landscaping Brief, MMM Group Ltd. /WSP 2016).

Similar wildlife paths have been used successfully on the Trans-Canada Highway east of Golden, British Columbia to facilitate wildlife (deer, elk and bighorn sheep) approaches to crossing structures (Bill Harper, pers. comm.). The Washington State Department of Transport includes pathways in the “Passage Enhancement Toolbox” as a way to improve the permeability of crossing structures for terrestrial wildlife (Kintsch and Cramer 2011).

3.1.3 Open Median Width

We evaluated a number of median width options to enhance the large wildlife passage structure; however, due to the following constraints, the final median width will be 1.0 m (Drawings C200-002 and S001-001, Appendix C).

Originally, the approved concept plan (Appendix B) showed a 4.5m boulevard; however, this cross-section did not account for any motorist safety measures associated with a bridge crossing structure. Once the jersey barriers and shy distance between the edge of driving lane and the barriers were accounted for, the actual clear median distance will only be 1.0 m as shown in our approved preliminary engineering plan.

These safety measures are all shown within City of Edmonton roadway details as well as the Transportation Association of Canada (TAC) manuals. Although an increase of the median will allow more light, Clevenger and Huisjer (2011) recommend that a shorter structure, with less daytime light and lower noise levels, will be more effective than passage systems with large

open medians. This recommendation is based primarily on structure length and traffic noise levels (Clevenger and Huisjer 2011).

Therefore the current design with a 14m^2 median is considered a good compromise for providing ample natural lighting in the structure, while keeping traffic noise to a minimum.

3.2 MID-SLOPE CULVERT

The main target EDG for the mid-slope culvert is Small Terrestrial wildlife species including various microtine species (voles, shrews and mice). However, Medium Terrestrial wildlife species, such as snowshoe hare, least weasel (*Mustela nivalis*), coyote, and red fox (*Vulpes vulpes*) may also use the structure (Stantec 2014c).

The following subsections detail the mid-slope culvert review undertaken and the selected design.

3.2.1 Mid-slope Culvert Review

The approved concept design initially provided the passage requirements for the Small Terrestrial, Amphibian, and Aquatic Species EDGs in a modified drainage culvert that included a 'shelf' (Stantec 2014c). During the detailed evaluation of the aquatic passage, this was considered unfeasible due to the high levels of beaver activity in the area. For example, the construction of a shelf along the culvert length (regardless of the size of the culvert), with ramps at either end to allow small terrestrial animal access would cause an increased accumulation of debris at the culvert inlet (Stantec 2015d).

In response to City Administration concerns regarding the mid-slope culvert, a mid-slope passage options review titled *199 Street NW/Wedgewood Creek EIA Comment Response Support (GB15-10) - Small Terrestrial Wildlife Passage Options* (Stantec 2016b, Appendix D) was generated and submitted for City review and comment on April 20, 2016. The framework used in the document generated the following mid-slope culvert options:

- Different sizes of culverts (1 m diameter corrugated steel pipe (CSP), 1.2 x 1.8 m concrete box, bottomless arch)
- Different geographic locations (both north and south of the open span large terrestrial wildlife passage)
- Different elevations (same elevation as the large terrestrial passage versus closer to creek level where there is likely more small mammal activities)
- No mid slope passage

From these criterions, eight options were generated and compared. However, only four were considered the best at maintaining permeability for small mammals. The four options included:

- 1 m CSP aligned mid slope
- 1.2 x 1.8 m concrete box aligned mid slope

- 1 m CSP near Wedgewood Creek
- 1.2 x 1.8 m concrete box near Wedgewood Creek

Based on the mid-slope passage review (Stantec 2016b), only the top two options listed ensured that the bottom of the mid slope culvert would be above the design flood water level (i.e. 1:100 year) and the check flood water level (i.e. 1:200 year) (refer to Section 3.3 for additional details). After City review of the submitted information, the 1.0 m CSP culvert mid-slope option was accepted.

3.2.2 Selected Mid-slope Culvert Design

The mid-slope culvert will be a 1.0 m CSP located approximately 1.6 m above the 1:100 year design flood level and 0.9 m above the 1:200 year check flood level elevations as shown on Figure No. SK-2 of the Hydrotechnical Summary Report (Stantec 2015d , Appendix D) and report addendum (Stantec 2016a, Appendix D). The mid-slope culvert design includes a west invert elevation of 674.64 m and an east invert elevation of 675.15 m, which is specified on Drawings C105-012 and S002-001 (Appendix C). The mid-slope culvert will be installed at a 26° skew with the roadway centerline. It is located approximately 5.3 m above the 3.0 m diameter Wedgewood Creek aquatic culvert at the roadway centerline and 7.0 m below the top of the 199 Street NW roadway.

Specifications for vegetation plantings to provide security cover and achieve other habitat restoration objectives associated with the mid-slope culvert have been developed and are summarized in Section 3.6.

3.3 AQUATIC CULVERT

The target EDGs for the aquatic culvert are Amphibians and Aquatic Species, including wood frog (*Lithobates sylvaticus*), boreal chorus frog (*Pseudacris maculata*), brook stickleback (*Culaea inconstans*) and fathead minnow (*Pimephales promelas*)(Ecoventure 2013; Stantec 2014c).

As discussed in Section 3.0, the configuration of the passages recommended in the Conceptual Bridge Planning Report (Terrace 2014, Appendix B), and approved in the concept plan, proposes an aquatic culvert sized for the stream flow with a separate shorter bridge structure crossing for terrestrial passage. The Erosion Study for Wedgewood Creek at Edmonton, (Golder 2012) recommended the support of beaver activity and maintaining a culvert structure at the 215 Street NW, 199 Street NW, and 184 Street NW road crossings to help with flow attenuation and sediment retention. The existing 1.8 m diameter by 68.6 m long closed bottom structural plate corrugated steel pipe (SPCSP) culvert is in poor condition therefore aquatic culvert replacement is required. Originally, the approved concept plan proposed replacement of the existing culvert with a 2.4 m diameter by 150.0 m long closed bottom SPCSP culvert. During the preliminary and detailed engineering phases, the options for the aquatic culvert replacement were further evaluated. The following options were considered (Stantec 2015d and Stantec 2016a, Appendix D):

- A 3.0 m diameter closed bottom corrugated steel pipe (CSP) culvert
- A 3.05 m diameter closed bottom SPCSP pipe
- A 3.0 m wide by 2.4 m rise closed concrete box culvert
- A 3.99 m diameter closed bottom SPCSP culvert
- A 6.0 m wide by 3.0 m high by 117.5 m deep open bottom corrugated steel arch culvert

Due to its larger cross section, conflict with other utilities, wing wall design, and geotechnical constraints, the open bottom arch culvert was deemed unfeasible for this application. The box culvert in this application would flow full, which is less favorable, as the culvert should accommodate the design flood (1:100 year) with some freeboard to accommodate debris passage. The other options considered are adequate from a hydraulic perspective. However, given the Alberta Transportation design guidelines, effective drainage area contributing flow to the Wedgwood Creek crossing at 199 Street NW, the design flow and flood elevation (1:100 year), the existing conditions, the existing velocity of the natural channel downstream of 199 Street NW, required velocity for fish passage, and engineering experience and judgment, the 3.0 m closed bottom CSP culvert was recommended (Stantec 2015d and Stantec 2016a) and formed the foundation of the aquatic cuvlert presented in Drawings C105-012 and S002-002, Appendix C. Also refer to the details provided in the Hydrotechnical Summary Report (Stantec 2015d, Appendix D) and addendum (Stantec 2016a, Appendix D.

Although the 2.4 m diameter aquatic culvert was considered initially in the concept plan, the proposed 3.0 m aquatic passage (Drawings C105-012 and S002-002, Appendix C) will provide adequate hydraulic capacity for the design flood (1:100 year) with a freeboard of approximately 0.20 m to assist in accommodating debris passage (Stantec 2015d). Mean velocities in the natural channel and culvert outlet are similar. Therefore, the 3.0 m diameter culvert should not scour or erode the downstream channel.

In events larger than the design storm events, flow will be slightly attenuated as the 3.0 m aquatic culvert will flow full as shown on Figure SK-2 provided in the Hydrotechnical report and addendums (Stantec 2015d and 2016a, Appendix D). In a 1:200 year check flood event, the flood elevation would be approximately 2.1 m below the bottom of the large terrestrial passage and approximately 0.9 m below the mid slope terrestrial passage at the upstream end. Therefore, both the large and mid-slope terrestrial passages will remain dry during these events.

During the review phase, ice jamming and snow melt were also considered in the design of the 3.0 m diameter aquatic culvert. Due to the width and flow characteristics of the creek in the winter months, ice build-up thickness would be small. It was anticipated that there would be limited icing around the outfall structure and that flows through the aquatic culvert would not be effected. Snow melt in the drainage basin area was factored into the design flow calculations, which contributed to the sizing of the aquatic culvert.

The proposed aquatic culvert will be imbedded 0.75 m into the creek bed to provide a natural substrate at the bottom of the culvert. Class 2 boulders are proposed at 10 m intervals (Drawing

S002-002, Appendix C) to hold the substrate in place. The proposed aquatic culvert has been designed to reproduce, as much as possible, the natural hydraulic conditions of Wedgewood Creek, in order to provide flow velocities and minimum depths that permit upstream movement of aquatic species during low flow conditions. The design of the aquatic culvert has thus been optimized by aligning the structure along the existing stream bed at a 48° skew with the roadway centerline, as shown on Drawing S002-001, Appendix C. Although the length of the aquatic culvert has increased slightly from the preliminary design to the detailed design (117 m to 122 m), it is still shorter than the initial conceptual design (150 m). The aquatic culvert has an upstream invert elevation of 670.0 m and a downstream invert elevation of 668.70 m, as indicated on Drawings C105-012 and S002-002, Appendix C. Any re-alignments or reorientations to shorten the aquatic culvert will be a move away from the assessed optimum alignment (Stantec 2016a).

Concrete end treatments, and rock rip rap placed on non-woven geotextile filter fabric, will be placed on either end of the aquatic culvert as shown on Drawing S002-002 (Appendix C) to tie into the creek bed and provide adequate long term erosion protection. Above the 1:5 year flood elevation, willow whips will be installed to provide additional erosion support and cover to replace some of the native vegetation that was lost. All additional disturbed areas will be restored using native materials as shown on the landscape drawings (Appendix C) and detailed in the Wildlife Crossing Restoration Brief (Landscaping Brief, MMM Group Ltd. /WSP 2016).

Since the aquatic culvert is designed to provide fish passage (Stantec 2015d), it will adequately address passage requirement for amphibians (Stantec 2015f, Appendix D). Kintsch and Cramer (2011) classify this type of passage as a "Class 1 Small Underpass", with the potential to provide passage for the target EDGs, Amphibians and Aquatic Species. This type of structure is considered to be appropriate to provide passage for small aquatic animals (City of Edmonton 2010; Clevenger and Huijser 2011; Phillips et al. 2012).

3.4 ROAD DRAINAGE

A review of the drainage requirements was conducted by Stantec (2015b, Appendix D) to determine the most practical option for treating and discharging collected storm water within the Project. The post-development flows will exceed the pre-development flows indicating that some form of attenuation or storage will be required. The following options were reviewed:

- Use proposed storm water management infrastructure within Riverview
- Use of a newly constructed or an existing outfall (i.e. Edgemont 199 Street NW outfall)

Based on a review of the current Riverview Neighborhood Design Report (MMM Group 2016), it was found that rerouting road drainage south into one of storm water management facilities within Riverview was not feasible due to proposed and existing grade lines for 199 Street NW. Therefore, the use of the newly constructed Edgemont 199 Street NW outfall located at the

northwest quadrant of the terrestrial wildlife passage system or the construction of a new outfall were the options evaluated.

Three alternatives utilizing a local outfall or new outfall were considered. These included:

- A direct connection of the Riverview 199 Street NW drainage into the existing Edgemont 199 Street NW storm sewer and Stormcepter/manhole
- Storage and controlled discharge from the Riverview 199 Street NW drainage into either the existing Edgemont storm outfall pipe or a new separate outfall
- Connection to the newly constructed Edgemont outfall with a major overflow route

The direct connection to the Edgemont 199 Street NW storm sewers was not considered feasible due to the proposed elevation grade lines for the wildlife crossing (Drawing S001-001, Appendix C) and the existing Edgemont sewer inverts (the storm sewer would need to cross the wildlife crossing under the MSE wall, which would make connection to the existing sewers impossible). It was also determined that the existing Stormcepter and sewer pipe did not have sufficient capacity to adequately convey the major flows from the Riverview 199 Street NW drainage. In addition, the storage and controlled discharge alternative was also not considered feasible due to the infrastructure requirements (large diameter storage pipe and separate storm outfall) and operation/maintenance costs.

The recommended option (Appendix C), utilizes the excess capacity in the existing storm outfall coupled with a major drainage overflow route over either side of the 199 Street NW roadway embankments at Wedgewood Creek for major rainfall events, where the flows exceed the available outfall pipe capacity. The proposed 199 Street NW storm sewers will connect to a Stormceptor (Drawings C005-001 and C105-012, Appendix C), which will provide a form of treatment for the roadway drainage. From this structure, treated stormwater will be transported to the existing Edgemont outfall via a perched manhole. Major drainage will culminate at the low point of 199 Street NW at Wedgewood Creek and enter the storm system, or in larger events overflow into Wedgewood Creek through swales protected by adequate erosion and sediment control measures (Drawing C015-003, Appendix C). It must be noted that the overflow is only required for a short duration during the 100 Year 4 hour, and 1978 rainfall events. During these events, the flow over the embankment and into Wedgewood Creek will not exceed the pre-development flow into Wedgewood Creek.

The drainage swales included in the detailed engineering drawings have been aligned from the low point in the roadway, along the top of the MSE wall structures, and will discharge away from the terrestrial wildlife structures. For adequate erosion protection upstream of the wildlife path, and for protection of the roadway slope and embankment, concrete pillows will be used within the overflow channels. Wildlife friendly materials, such as compost socks, will be installed at the interface of the overflow channels and the wildlife path, as well as across the width of the wildlife path, to control erosion (as shown on Drawing C015-003, Appendix C).

For all rainfall events with the exception of the 1978 rainfall, the velocity within the outfall remains 1.01 m/s as initially designed. For the 1978 rainfall, the velocity increases to1.35 m/s. However, it is deemed that the increased outflow velocity can adequately be handled by the existing rip rap apron.

This alternative will discharge the first flush and the minor storm through a Stormceptor into the existing outfall pipe. Any major flows exceeding the capacity of the connection/outflow will then spill over the top of the roadway embankment via a suitably reinforced spillway into the adjoining creek.

Runoff can be treated in three ways for water quality before entering the Wedgewood Creek. The Stormceptor will filter out the majority of the pollutants before runoff flows to the outfall. However, the catch basin sumps offer a form of retention, which allows sediments and other pollutants to settle at the bottom of the catch basin. In addition, ponding at the sag location in the road at Wedgewood Creek will allow some sediment to settle along the curb and gutters before either entering the storm system or overflowing into the creek.

The drainage brief - *Riverview 199 Street NW Drainage System at Wedgewood Creek Report* (Stantec 2015b, Appendix D) was submitted to the City's Drainage department for review in March 2015 and verbal acceptance had been received prior to proceeding to detailed design.

3.5 OTHER UTILITIES

The location of the utilities crossing Wedgewood ravine along 199 Street NW have been set based on site constraints, wildlife use considerations, and input from the CA. The utilities within the Project area include the water transmission main, the temporary sanitary forcemain, and the shallow utilities, all of which are required to service the Riverview Neighborhoods south of Wedgewood Creek.

Through discussions with EPCOR Water (EPCOR) and City Transportation, it was collectively agreed that the water transmission main be aligned on the bridge girder along the west edge of the large terrestrial crossing structure without encroaching upon the cross sectional opening of the structure (Drawings C200-002 and S001-006, Appendix C). Initially, directional drilling the water transmission main under the aquatic passage was reviewed; however this option was deemed unfeasible due to operation and maintenance concerns put forth by EPCOR.

The temporary sanitary forcemain is proposed under the large terrestrial crossing structure, and over the aquatic passage (Drawings C105-006 and C105-012, Appendix C). The temporary sanitary forcemain will be installed in a steel casing to ensure no disturbance within the project footprint occurs, should maintenance be required.

Shallow utilities will be located within the large wildlife passage structure girders, within the boulevard, or in a separate duct structure to be determined by EPCOR, to prevent any interaction with wildlife or wildlife use of the various passage structures proposed. For example,

the street lighting required along 199 Street NW within the project footprint will be located approximately 40 m north and south of the large terrestrial passage structure to limit the amount of light within the Wedgewood ravine, while providing adequate lighting for traffic and pedestrian safety (Drawing C105-006, Appendix C).It is important to note that the proposed improvements do not conflict or encroach upon the existing storm outfall northwest of the roadway crossing. This is clearly shown on Drawings C105-006, C105-012, and S001-002, Appendix C.

3.6 LANDSCAPE DETAILS

Although the structures proposed will facilitate movement, the key to an effective passage system is integrating the structures into the existing landscape. Therefore, detailed restoration/landscaping plans were developed to revegetate the area and enhance the passages proposed. Refer to Drawings L001-007 through 0112A and L001-015 through 017, (Appendix C) and the Landscaping Brief (MMM Group Ltd. /WSP, 2016, Appendix D) for landscaping details.

4.0 SCOPE OF THE ASSESSMENT

The purpose of this document is to evaluate the potential biophysical impacts associated with the construction, operation and maintenance of the Project. This environmental impact assessment (EIA) was prepared to meet the City of Edmonton's requirements under Bylaw 7188 (City of Edmonton 2012).

The scope of the EIA (as discussed with the CA) is to identify the potential environmental effects to the physical and biological environment resulting from project activities and components through construction and operation activities for the road upgrade. This is achieved by the following:

- Describing the regulatory and policy setting of the assessment
- Issues scoping through consultation with the relevant authorities at the City of Edmonton
- Describing the potential environmental effects on the physical and biological environment from the construction and operation of the upgraded road and associated design elements
- Characterizing the anticipated residual effects (effects that remain after mitigation is implemented)
- Evaluating the feasibility of mitigating or preventing adverse environmental effects, and to predict the residual effects (if any) after mitigation
- Developing a mitigation plan to prevent significant adverse effects to the environment

4.1.1 Regulatory and Policy Setting

Various federal, provincial and municipal acts, regulations or bylaws were considered in the scoping of issues, selection of environmental elements and valued components (VCs).

Table 4-1 lists the legislations and policies that provide the regulatory and policy setting for this assessment. It describes the direct influence of the regulatory and policy setting on the assessment.

Table 4-1 Regulatory and Policy Setting

Name of Legislation or Policy	Influence on the Scope of the Assessment
Federal	
Canadian Environmental Protection Act	Pollution, toxic substances, waste management
Fisheries Act	Water Quality as a VC, Fish and Fish Habitat as a VC
Migratory Birds Convention Act	Breeding Birds as a VC
Navigation Protection Act	Issues scoping: not applicable
Species At Risk Act	Species of Management Concern as a wildlife VC; rare plants as a VC if present

Provincial	
Environmental Protection and Enhancement Act	Issues scoping. This Project is out of scope for EPEA
Historical Resources Act	Archaeology and Historic Resources as a VC
Public Lands Act	Permit requirement for instream works
Occupation Health and Safety Act	Issues scoping. Human Health and safety as a VC.
Water Act	Issues scoping regarding instream works at Wedgewood Creek. ESC measures. The act applies to work in around Alberta waterbodies
Weed Control Act	Introduction of weeds as a potential effect for vegetation VCs
Wildlife Act	Species of management concern as a VCs.
Municipal	
City of Edmonton North Saskatchewan River Valley Area Redevelopment Plan (Bylaw 7188)	Impetus and scope for EIA
City of Edmonton Community Standards Bylaw (Bylaw 14600)	Issues scoping related to construction noise
Corporate Tree Management Policy (Policy C456A)	Influences Project design and mitigation measures for vegetation VCs.
Bylaw 15100: The Way We Grow, Municipal Development Plan (City of Edmonton 2010a)	Issues scoping related to strategic growth and development
The Way We Green, City of Edmonton Environmental Strategic Plan (City of Edmonton 2011b)	Issues scoping related to environmental reserves, environmental connectivity, and wetland sustainability
The Way We Live, Edmonton's People Plan (City of Edmonton 2010b)	Issues scoping related to environmental standards and planning
City Policy C542: Top of Bank (City of Edmonton 2010d)	Issues scoping related to geotechnical assessments
Bylaw 16200: Drainage Bylaw (City of Edmonton 2014)	Issues scoping related to grading and alteration of surface drainage, release of matter into watercourses
City of Edmonton ESC Guidelines and Field Manual	Issues scoping related to ESC measures

4.1.1.1 Historical Resources

A Historic Resources application was submitted to Alberta Culture and Tourism (ACT) on March 31, 2015, to request *Historical Resources Act* (*HRA*) approval/requirements. Upon review, ACT issued conditional *HRA* approval on June 8, 2015, with the conditions outlined in the Schedule "B" (*HRA* requirements project file number 4715-15-0017-001). The conditions require completion of a targeted Historic Resources Impact Assessment (HRIA) for palaeontological resources. The HRIA is to be carried out after construction has been initiated and vegetation cover has been removed, but prior to any extensive landscaping. A longer term monitoring program may also be required based on the extent to which construction activities will affect bedrock. The HRIA will be conducted by a professional palaeontological under a "Permit to Excavate Palaeontological Resources (Mitigative)" issued by the Royal Tyrrell Museum of Palaeontology.

4.1.2 Influence of Consultation on Issues Identification and the Assessment Process

Scoping meetings were held on December 16, 2014 and February 15 and 26, 2015 with CA to discuss Project activities and issues scoping associated with the proposed Project. During the meetings, it was agreed that the proposed Project will require an EIA and City council approval in accordance with Bylaw 7188 (City of Edmonton 2012) and pursuant to the Guide to Environmental Review Requirements on the North Saskatchewan River Valley and Ravine System (City of Edmonton 2000).

Table 4-2 details the issues discussed at the initial scoping meetings and indicates how or where this document addresses the issues/requests.

Table 4-2 Consultation's Influence on the Environmental Impact Assessment

City of Edmonton Comments or Concerns Regarding the Environmental Impacts Assessment of the Project	Influence on the Scope of the Assessment
Fall rare plant sweep within project footprint will be required.	A fall rare plant sweep was conducted in Fall 2015; the information collected has been incorporated into Section 5.2.1 and 8.6.
Site specific geotechnical information –geotechnical work will be required to support the design and will need to be presented in the EIA.	A site specific geotechnical assessment was completed by Hoggan (2015), and is appended to the ESC Plan located in Appendix D.
Drainage concerns regarding road runoff (additional inputs, pre-treatment options, existing infrastructure use, new structures, etc.) were flagged by CA.	Site drainage considerations are addressed in Stantec (2015b, Appendix D), and have been incorporated into Sections 3.4 and 8.4.
The treatments provided as part of the west side of the proposed road upgrade will be a focus point. Specifically: – Design synergies with existing outfall and issues with geotech noted previously	The existing stormwater outfall and its intersections with the Project has been addressed in Stantec (2015b, Appendix D), and in the geotechnical report (Hoggan 2015, Appendix D).
Wildlife passage: – Want comments provided as part of concept planning addressed – Small mammal and amphibian passage – Proposed trail interaction with the terrestrial wildlife passage system and its effectiveness – Fencing required to encourage wildlife passage use	The specific comments provided by CA were considered in the design of the approved preliminary concept and detailed design package (Appendix C). Responses to the comments have been provided under separate cover.
Piping for water main and interim sanitary needs to be considered	See Section 2.0 and 3.0 for details.
Planning requires notification and will look for an update to any existing plans if plan changes must be undertaken.	Ongoing correspondence has been underway with the CA.
An Initial Project Review (IPR) will be required for geotech program	An IPR was completed and submitted under separate cover. This report was approved prior to commencing the geotechnical program.

Since the initial submission of the EIA, additional comments have been received and replied to.

4.1.2.1 Public Consultation

An open house was held in Feb 2014 (refer to Appendix L of the CIMA+ Concept Plan Brief, Appendix B for details) followed by mailouts in Dec 2015. Additional consultation has been held with Leduc County, Enoch and the Sierra Club. The Project team and proponent will continue to work with stakeholders as the Project moves forward to respond to any concerns as they arise.

4.1.3 Potential Project Interactions and Potential Environmental Effects

VCs are defined as "the environmental elements of an ecosystem that is identified as having scientific, social, cultural, economic, historical, archaeological, or aesthetic importance" (CEAA 2006). VCs for the proposed Project were selected with the objective of scoping the effects assessment to the Project interactions that are of interest to the regulatory authority, the public, and the scientific community. The selection criterion for VCs includes consideration of legislative or policy drivers, presence in the Project vicinity, and likelihood of interactions with the Project.

Stantec has identified nine environmental elements, and associated VCs that may be affected by The Project. Potential interactions are identified in Table 4-3 to scope the assessment.

Table 4-3 Potential Interactions between the Project Activities and Environmental Elements

Project Activities	Description	Environmental Elements								
		Air Quality and Noise	Geology / Geomorphology	Hydrology	Fish and Fish Habitat	Vegetation	Wildlife	Historical Resources	Public and Worker Health and Safety	Aesthetics
Construction										
Site Preparation										
Site preparation	• Install preliminary ESC measures • Vegetation clearing and brushing • Stripping and storing topsoil • Staging areas, temporary laydown areas	✓	✓	✓	✓	✓	✓	✓	✓	✓

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Project Activities	Description	Environmental Elements								
		Air Quality and Noise	Geology / Geomorphology	Hydrology	Fish and Fish Habitat	Vegetation	Wildlife	Historical Resources	Public and Worker Health and Safety	Aesthetics
Road Removal	• Removal of existing road base, including asphalt surface and granular base if present • Removal of existing road embankment, material	✓	✓	✓	✓		✓	✓	✓	✓
Instream Works										
Drawdown and isolate Wedgewood Creek and remove beaver dam at culvert entrance	• Draw down ponded water to install isolation • Install weir structure • Continue dewatering program within isolation to remove water Instream construction work (debris/dam removal and culvert replacement)	✓	✓	✓	✓		✓		✓	✓
Replace existing aquatic culvert	• Excavate soils • Remove existing aquatic culvert • Store or haul away soil material depending on suitability • Install new aquatic culvert and backfill	✓	✓	✓	✓		✓		✓	✓
Terrestrial and Aquatic Passage Structures, Utilities Installation, and Road Construction										
Install storm sewer main	• Install sewer main • Connect to existing Edgemont outfall • Concrete work	✓	✓	✓			✓		✓	

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Project Activities	Description	Environmental Elements								
		Air Quality and Noise	Geology / Geomorphology	Hydrology	Fish and Fish Habitat	Vegetation	Wildlife	Historical Resources	Public and Worker Health and Safety	Aesthetics
Install terrestrial wildlife passage system	• Install wildlife passages structures (includes pilings) • Install wing walls • Backfill and grading • Install overland swale	✓	✓	✓			✓	✓	✓	✓
Install watermain and sanitary forcemain	• Install watermain on bridge abutments and sanitary forcemain between culvert and bottom of wildlife passage	✓	✓	✓			✓	✓	✓	✓
Construct road structure	• Includes curb/gutter, pavement, and guardrail • Prepare subgrade embankment, place granular material • Concrete work for curbs • Lay asphalt on roadway • Install guardrail (auger posts, and hang rail)	✓	✓	✓			✓		✓	✓
Shallow utility installation	• Power, phone, gas line, and street lights installation • Utilities installation	✓	✓	✓	✓		✓	✓	✓	
Grading, Re-vegetation, and Path Construction										
Asphalt path construction and boulevard grading	• Lay asphalt • Boulevard grading	✓	✓	✓			✓		✓	
Landscaping	• Landscaping materials are installed after the construction phase is complete • Replace topsoil, seed, native plant trees and shrubs • Construct wildlife passage fencing • Construct wildlife paths	✓	✓	✓	✓	✓	✓		✓	✓

Project Activities	Description	Environmental Elements								
		Air Quality and Noise	Geology / Geomorphology	Hydrology	Fish and Fish Habitat	Vegetation	Wildlife	Historical Resources	Public and Worker Health and Safety	Aesthetics
Operation and Maintenance										
Water crossing operation and maintenance	• Removing debris from culvert grate			✓	✓		✓			
Terrestrial wildlife passage system and wildlife fence maintenance	• Wildlife structure maintenance • Fencing and path repairs					✓	✓			
NOTES: "✓" = Potential interactions that might cause an effect.										

The assessment of potential Project interactions detailed in Table 4-3 indicates that all the identified environmental elements will be brought forward into the assessment. Archaeological and historical resources have been addressed through the legislated provincial process, and will not be further discussed here.

Table 4-4 details the VCs and the potential effects of the Project on each environmental element.

Table 4-4 Environmental Elements and Valued Components Potentially Affected by the Proposed Project

Environmental Element	Valued Component	Potential Environmental Effects
Air Quality / Noise	• Dust, Machine Emissions Greenhouse Gas • Auditory setting	• Change in Air Quality. Reduced air quality due to dust, vehicle or machine exhaust. • Change in Auditory Setting. Potential effects to human health related to nuisance noise
Geology/Geomorphology	• Slope Stability	• Change to Slope Stability
Water Quality	• Water Quality	• Change to Water Quality
Hydrology	• Site drainage • Instream flows and channel morphology	• Change to Site Drainage • Change to Instream Flow and Channel Morphology
Fish and Fish Habitat	• Fish • Fish Habitat	• Change to Habitat • Change to Mortality Risk

Environmental Element	Valued Component	Potential Environmental Effects
Vegetation	• Ecological Communities • Rare Plants and Rare Plant Communities	• Windthrow • Change in Species Diversity • Introduction of weeds
Wildlife	• Species of Management Concern • Mammals • Breeding birds • Amphibians	• Change to Habitat • Change to Movement • Change to Mortality Risk
Public and Contractor Health Safety	• Human Health and Safety	• Increased risk of human injury or mortality associated with the movements of large machinery and equipment and excavated areas
Aesthetics	• Landscape and Visual Setting	• Alteration of viewscape (construction crossing; loss of native vegetation)

4.1.4 Boundaries

The following sections describe the spatial and administrative boundaries of the assessment.

4.1.4.1 Spatial Boundaries

The spatial boundaries are the geographic extent within which the potential environmental and health effects of the Project are assessed (Figure 3-1, Appendix A). These include the project footprint for consideration of direct physical effects within the area of disturbance; the local assessment area (LAA) for consideration of localized and direct Project effects on selected environmental elements; and the regional assessment area (RAA), which provides a broader context for determining the extent of Project-related effects.

Project Footprint: The project footprint is the area that will be directly disturbed by construction and operation activities. This includes the portion of the Project that occurs within the Bylaw 7188 area.

Local Assessment Area (LAA): The LAA is the area within which adverse effects from construction and operation of the Project are reasonably expected to occur and can be described. The LAA includes the extent of field studies conducted in support of this assessment.

Regional Assessment Area (RAA): The RAA is used for some environmental elements to assess adverse Project effects within a broader context; for the purposes of this assessment the Riverview Neighborhood Structure Plan boundaries are spatial extent of the RAA because this is the relevant boundary of studies previously conducted in the area. Cumulative effects

assessment is outside the scope of this assessment. In this assessment, a RAA is included to provide a biophysical and socio-economic context for the Project, and to guide the characterization of residual effects.

Figure 3-1 (Appendix A) illustrates the extent of the various boundaries noted.

4.1.4.2 Administrative Boundaries

The project footprint intersects a Key Wildlife and Biodiversity Zone (KWBZ) (Figure 4-1). KWBZs are defined by Environment and Sustainable Resource Development, now Alberta Environment and Parks (AEP) as wildlife management areas for the protection of key ungulate winter range and areas of high potential biodiversity.

The NSR valley is an Environmentally Significant Area (ESA). ESAs within Alberta are important for promoting the long-term maintenance and conservation of natural features or processes (Fiera 2009). They are areas that contain rare or unique elements in the province or include elements that may require special management consideration due to their conservation needs. ESAs are assigned significance rankings based on seven criteria. Rankings are as follows based on importance: Provincial, National, and International (Fiera 2009). ESAs do not represent government policy and are not necessarily areas that require legal protection, but instead, their identification on the landscape is intended to be an information tool to inform land use planning and policy at local, regional and provincial levels.

The Project affects the Wedgewood Ravine, which is terrestrially and aquatically connected to ESA 690. This ESA is 139,728.5 ha and represents the NSRV and adjacent lands across Alberta. It has a significance ranking of “National” because of the presence of wildlife habitat, large natural areas, riparian habitat, and 65 elements of concern.

4.1.5 Residual Environmental Effects Description

The residual effects of the proposed Project are qualitatively characterized based on magnitude, spatial extent, duration, and likelihood of occurrence (Noble, 2006). General definitions of magnitude, spatial extent, duration, and likelihood are provided in Table 4-5.

Table 4-5 Residual Effect Characterization Definitions

Parameter	Definition
Magnitude	Negligible-no measurable effect to valued component Low– see Table 4-6 for definition for each environmental element assessed Moderate – see Table 4-6 for definition for each environmental element assessed High – see Table 4-6 for definition for each environmental element assessed
Spatial Extent	Project footprint – direct environmental effect is only measurable within the confines of the project footprint Local – direct environmental effect is measurable within Local Assessment Area Regional – direct environmental effect is measurable within of the Regional Assessment Area
Duration	Short – direct environmental effect is measurable for 1-5 years Medium – direct environmental effect is measurable for 6-15 years Long – direct environmental effect is measurable for 16+ years
Likelihood of Occurrence	Low – there is less than 25% chance of the environmental effect occurring Moderate – there is between 25 to 74% chance of the environmental effect occurring High – there is >75% chance of the environmental effect occurring

Magnitude definitions are provided for each environmental element in Table 4-6.

Table 4-6 Magnitude Definitions

Environmental Element	Definition
Air Quality / Noise	Low- measurable change to baseline air quality and auditory setting but within baseline variation Moderate– measurable change above baseline variation but less than high magnitude High – measurable change baseline air quality and auditory setting, such that adverse effects to human health are anticipated
Geology / Geomorphology	Low- measurable change to slope stability and water quality but within baseline variation Moderate- measurable change to slope stability and water quality above baseline but less than high High- measurable change to slope stability and water quality such that adverse effects to Wedgewood Creek and associated ravine system are anticipated
Hydrology	Low – measurable change to surface water flow patterns, water volume, or water quality but within baseline variation Moderate – measurable change above baseline variation water flow patterns, water volume, or water quality, but less than high High – measurable change to surface water flow, water volume, or water quality, such that adverse effects to Wedgewood Creek are anticipated
Water Quality	Low – minimal decrease in water quality during/post-construction Moderate – partial decrease in water quality during/post-construction High – substantial decrease in water quality during/post-construction

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Environmental Element	Definition
Fish and Fish Habitat	Low- measurable change to fish and fish habitat but within natural variation Moderate-measurable change to fish and fish habitat, but less than high High-measurable change to fish and fish habitat, such that adverse changes to species diversity, habitat use and habitat quality are anticipated
Vegetation	Low – the distribution and abundance of native plant communities, rare plants, or rare ecological communities are not reduced in the LAA beyond natural variation Moderate – the distribution and abundance of native plant communities, rare plants, or rare ecological communities are reduced, but not lost, in the LAA High – the distribution and abundance of native plant communities, rare plants, or rare ecological communities are completely removed from the LAA
Wildlife	Low – measurable change to wildlife habitat, wildlife movements, or mortality risk Moderate– measurable change, but less than high magnitude to wildlife habitat, wildlife movements, or mortality risk High – measurable change to wildlife habitat, wildlife movement, or mortality risk such that adverse changes to species diversity, wildlife movement corridors, and mortality risk are anticipated.
Worker and Public Safety and Trail Use	Low – measurable change to worker and public safety during construction, with risk of injury being low Moderate – partial threat to public safety during construction, with risk of injury being moderate High – substantial threat to public safety during construction, with risk of injury being high
Aesthetics	Low – minor loss or alteration to key elements/features/characteristics of view, and/or may not be uncharacteristic of the broader area Moderate – partial loss or alteration to key elements/features/characteristics of view, and/or may be somewhat uncharacteristic of the broader area High – total loss or alteration to key elements/features/characteristics of view, and/or totally uncharacteristic of the broader area

Residual effects will be characterized according to these definitions.

5.0 DESKTOP AND FIELD STUDY METHODS

The following section describes the general environmental features and conditions within the local and regional setting for the Project based on a desktop review and field data collection. Desktop review and data collection methods are described, followed by characterization of the biophysical components as required by the City of Edmonton Bylaw 7188.

5.1 DESKTOP REVIEW

Stantec reviewed the following reports as part of the desktop review:

- *199 Street Concept Planning Report: 23 Ave to 35 Ave, Draft 2 Submission* (CIMA 2015, Appendix B)
- *Environmental Noise Impact Assessment for the Riverview Developments in Southwest Edmonton* (ACI 2014, Appendix B)
- *Conceptual Bridge Planning Report: Wedgewood Creek Crossing on 199 St NW in City of Edmonton* (Terrace 2014), Appendix B)
- *Environmental Overview Report for Riverview Neighborhoods 1,2, and 3, Edmonton, Alberta* (Stantec 2014a)
- *Ecological Network Report: Riverview, Edmonton, Alberta* (Ecoventure 2013a)
- *Phase II Ecological Network Report for Riverview Neighborhoods 1,2, and 3, Edmonton, Alberta* (Stantec 2015a)
- *Environmental Screening Report: Edgemont Storm Water Management System, Edmonton AB* (Ecoventure 2013b)
- *Wedgewood Creek Road Crossing 199 St: Fish Habitat Assessment 05-52-25-W4M* (Stantec 2014b,Appendix D)
- *Wildlife Passage Design Recommendations-199 Street Widening Project Within the Riverview Neighborhood* (Stantec 2014c, Appendix B)
- *Erosion Study for Wedgewood Creek at Edmonton* (Golder 2012)
- *Slope Stability Assessment: Wedgewood Creek Proposed Neighbourhoods 1-3, Approximately 199 St and 23 Avenue NW, Edmonton, Alberta*. (Hoggan 2014)
- *Geotechnical Investigation: Proposed 199 St Upgrades, Underground Utilities, Deep Fill Culvert and Wildlife Crossing, 35 Ave to Woodbend Wynd NW, Edmonton, Alberta* (Hoggan 2015,Appendix D)
- *Riverview 199 Street Drainage System at Wedgewood Creek* (Stantec 2015b,Appendix D)
- *Wedgewood Creek Crossing at 19 Street NE 6-52-25-W4 and NW 5-52-25-W4, Edmonton AB – Hydrotechnical Summary Report* (Stantec 2015d, Appendix D)
- *199 Street NW Culvert Crossing at Wedgewood Creek. Prepared for Riverview Heights Estates Ltd. c/o Qualico Communities.* (Stantec Consulting Ltd. 2016a.)
- *Erosion and Sediment Control Report 199 Street Wedgewood Creek Crossing – North of Woodbend Wynd, South of 35 Avenue* (Stantec Consulting Ltd. 2015g, Appendix D)

The following databases were queried in support of desktop data collection:

- A search within the Alberta Conservation Information Management System (ACIMS) dataset (ESRD 2015a) for known occurrences of rare plants, plant communities and arthropods
- A search within the Fish and Wildlife Management Information System (FWMIS) Internet Mapping Tool (ESRD 2015b)

A historical air photo review was also conducted (see Appendix G for photos reviewed).

5.1.1 Geology, Hydrogeology and Site Drainage

Multiple investigations have been conducted within the RAA, LAA, and project footprint, which characterize existing conditions with respect to geology, landform, soils, hydrogeology, and site drainage. These investigations were in support of various initiatives in the area and data collection methods are outlined within the following documents (chronological order):

- *Erosion Study for Wedgewood Creek at Edmonton* (Golder 2012)
- *Geotechnical Investigation: Edgemont Subdivision Stage 1, Proposed Storm Outfall 199 St and 35 Ave Wedgewood Creek Slope, Edmonton, AB*. (J.R. Paine and Associates Ltd. 2013, Appendix B)
- *Slope Stability Assessment: Wedgewood Creek Proposed Neighbourhoods 1-3, Approximately 199 St and 23 Avenue NW, Edmonton, Alberta*. (Hoggan 2014)
- *Geotechnical Investigation: Proposed 199 St Upgrades, Underground Utilities, Deep Fill Culvert and Wildlife Crossing, 35 Ave to Woodbend Wynd NW, Edmonton, Alberta* (Hoggan 2015,Appendix D)
- *Riverview 199 Street Drainage System at Wedgewood Creek* (Stantec 2015b, Appendix D)
- *Wedgewood Creek Crossing at 19 Street NE 6-52-25-W4 and NW 5-52-25-W4, Edmonton AB – Hydrotechnical Summary Report* (Stantec 2015d, Appendix D)

5.2 FIELD STUDIES

Field studies are described below.

5.2.1 Rare Plant and Rare Ecological Communities

Prior to field data collection, historical rare plant and rare ecological community records from the ACIMS were searched (ESRD 2015a). Additionally, a list of rare plant species that have the potential to be found in the project footprint was compiled from *Rare Vascular Plants of Alberta* (Kershaw et al. 2001). Habitat information for each rare plant species was researched to determine which species have the highest potential of being located within the project footprint and provide surveyors with a better understanding of the characteristics and habitats of rare plants that could be found. ACIMS tracking and watch lists were printed for reference in the field.

Targeted rare plant survey areas were pre-selected before field work and marked on field maps as a starting point for the rare plant surveys. These locations were selected in areas with high potential to support rare plants (e.g., transitional or ecotonal areas and extremes of moisture regime) across a wide variety of pre-mapped upland and wetland land units (Stantec 2015a) Actual rare plant survey locations were determined during field surveys (Figures 5-1 and 5-2, Appendix A).

Rare plant surveys within the RAA, focused on vascular plants and bryophytes, were completed in the RAA on July 6 to 8, 2013 and September 3 to 5, 2013 to capture a range of flowering and seeding periods (Figures 5-1 and 5-2, Appendix A). A spring rare plant survey was undertaken within the project footprint June 19, 2014. A fall rare plant survey was conducted on August 14, 2015.

At each pre-selected survey area, a random meander walk within the plant community was completed. A comprehensive species list was compiled at each site until no new species were found. Species requiring further examination or confirmation were collected, with the exception of plants where seed heads or flowers required for identification to species level were unavailable or where plant populations were small (i.e., no more than one in 50, Alberta Native Plant Council 2006). Detailed vegetation information (tree, shrub, and understory species) were collected at rare plant survey sites throughout the project footprint and each site was classified to the appropriate upland ecosite phase or wetland class. All field sites were geo-referenced using GPS (UTM coordinates).

For bryophytes, all microhabitat types present at a site were examined for species. Sampling of bryophytes by microhabitat is the recommended protocol of the *Alberta Biodiversity Monitoring Protocol* (AMBI 2014). Species that can be identified on the basis of macroscopic features were noted. Species that require microscopic examination for accurate species identification were collected. As collections are required to define almost all rare bryophyte species, determination of population size and extent was not possible.

5.2.1.1 Weed Identification

Regulated species (*noxious* and *prohibited noxious*) listed under the *Weed Control Act* (S.A. 2008, c. W-5.1) were documented wherever vegetation surveys were done and included in the plant species list created for the rare plant site characterization surveys.

5.2.2 Winter Snow Track Survey

The winter snow-tracking survey was conducted according to standard data collection methods and protocols developed for Alberta and British Columbia (Government of Alberta 2013; D'Eon et al. 2006). The survey consisted of two 2.1 km long transects along the east and west side of the current alignment of 199 Street NW, within the RAA but to the south of the LAA (Figure 5-1, Appendix A). An appendix to the CIMA+ (2015) report included in Appendix B details the methods of the snow track survey.

5.2.3 Breeding Bird Survey

A modified fixed-radius point count sampling survey procedure (Bibby et al. 1993) was used to document bird species diversity and abundance, and habitat associations in the RAA and LAA (Figures 5-1 and 5-2, Appendix A). Surveys were preceded by two minutes of silence to minimize any disturbance caused by the arrival of observers.

Surveys consisted of a five minute period where all birds heard vocalizing, or observed within 100 m of the point, were recorded. A five minute survey period was used because it has been shown that shorter survey times are more efficient; they maximize coverage of a study area, they minimize the introduction of bias due to the movement of birds into and out of the survey area and they record almost as many species as longer surveys (Lynch 1995, Shiu and Lee 2003). Surveys were conducted when wind speeds were below 20km/h (i.e. Beaufort 3), or during periods of strong rain as these conditions tend to decrease bird activity and hinder the ability of observers to effectively detect birds. Listening stations were spaced at least 300 m apart to prevent double counting of birds.

Incidental observations of birds detected outside the 100 m point count radius during the survey were also recorded and were included in the species list of birds observed. The species list was includes observations from all survey points and incidental observations.

5.2.4 Amphibian Survey

The amphibian survey was conducted in accordance with standard protocols (Government of Alberta 2013) in the RAA and LAA (Figures 5-1 and 5-2, Appendix A).The amphibian survey consisted of a two minute period of silence to reduce disturbance impacts associated with the arrival of observers followed by a five minute listening period where all amphibian species detected were recorded. The amphibian survey was conducted at wind speeds below 20km/h (i.e., Beaufort 3) and conditions not exceeding a light rain to optimize the ability of observers to effectively hear all amphibians vocalizing.

Incidental wildlife species encountered during the amphibian survey were also recorded.

5.2.5 Fish Habitat Assessment

A fish habitat assessment was conducted in the LAA in accordance with standard protocols outlined in the Department of Fisheries and Oceans self-assessment process (DFO 2014), and *Code of Practice for Watercourse Crossings made under the Water Act and the Water (Ministerial) Regulation* (Alta Reg 205/1998) (Figure 5-2, Appendix A). See Appendix D for survey methods.

6.0 EXISTING CONDITIONS: BIOPHYSICAL

The following sections summarize biophysical and socio-economic conditions of the assessment areas. Where appropriate, the text refers the reader to supporting documents.

6.1 HISTORICAL SITE CONDITIONS

Selected aerial photographs were reviewed dating from 1950 – 2012. Aerial photographs were obtained from Alberta Environment and Sustainable Resource Development Air Photo Distribution Office (1950–2001), and from the City of Edmonton (2007–2012) (See Appendix E). Review of the aerial photographs indicates that the project footprint has consisted of a ravine and road that is surrounded by agricultural land since 1950.

Hoggan (2015) also conducted an air photo analysis as part of the geotechnical report for the Project (Appendix E). Hoggan's analysis is as follows:

> *Several sets of aerial photography taken between 1924 and 2014, covering the subject site and surrounding areas, were obtained from the City of Edmonton Mapping Department, the Alberta Sustainable Resource Development Library and Google Earth. The photos were reviewed to identify any signs of disturbances within the site.*
>
> *The photo coverage obtained is summarized as follows:*

Table 6-1 Air photo Coverage for the Project (from Hoggan 2015; Appendix E)

Year	Catalogue No.	Photo No.	Scale
2004 – 2014	Google Earth	---------	Approximately 1:5000
2001	ED 2001-01	138 and 139	Approximately 1:20000
1993	AS 4383	208 and 209	Approximately 1:20000
1974	AS 1313	220	Approximately 1:12000
1962	AS 818	15	Approximately 1:31680
1949	AS 136	58 and 59	Approximately 1:40000
1924	C.ARS	35	Oblique

> *In1924, 199 th Street did not cross the WWC at its existing location. It crossed the WWC to the west of its current crossing location. The road ends at 35th Avenue and then heads south roughly 160 meters west of the existing location and winds through the WWC. The road then follows its current alignment approximately 300 meters south of WWC. Little to no development with the exception of two farm houses was noted along the 199th Street to the south and north of the WWC. In 1949, road*

followed the same pattern and no observable changes to the road were noted. In the 1962 Air Photo, 199th Street appears to follow its current alignment and crosses WWC at its current crossing location. In the 1974 Air Photo, the road appears to be wider and appears to have been paved. Woodbend Wynd along with the subdivision development appears to the southeast of the WWC and 199th Street intersection. Several farm residences are noted to the north of WWC on the east and west sides of 199th Street. In the Air photos from 1993 Photos to the summer of 2014, no changes to the current road alignment from that of the 1974 Photo was noted. In the summer of 2014, 199th Street appears to have been removed due to the construction of underground utilities from 35th Avenue to the north edge of the WWC. Development of the Edgemont Subdivision is noted in the 2012 photos on Google Earth. It should be noted that the failure noted in the 1990 Thurber Report could not be seen in any of the observed Air Photos. No slope stability concerns with the side slopes of 199th Street at the WWC were noted on the observed photos.

6.2 GEOLOGY

Hoggan (2014) describes the geology of the general area, as follows:

The geology of the site starts with the deposition of the bedrock soils in shallow seas present during the Cretaceous period. Clayey sandstone, shale, and bentonitic mudstones were formed at the bottom of these seas and are termed the Horseshoe Canyon Formation (Khc) of the Edmonton Group. For the Wedgewood Creek site, bedrock was not encountered in the testholes as is therefore not a factor at this site.

Long after the bedrock formation, but before the ice age, a river flowed through the Edmonton area which also had several significant tributaries. Deep granular deposits termed Saskatchewan sands and gravels were formed in this river. This river was not the North Saskatchewan River as this flowed after the ice age came and went.

The next major geologic event was the several advances of large ice sheets across most of North America. These large ice sheets plowed along the bedrock, then deposited a mixture of clay, silt and sand during their retreat, termed glacial clay till. A large lake formed over much of Edmonton near the end of the ice retreat. This lake deposited clay and silt soils, termed Lake Edmonton deposits. Aeolian deposits are present north of the site but no such soils were encountered in the site testholes.

The North Saskatchewan River flowed through central Edmonton after the glaciers retreated and Lake Edmonton had emptied, initially downcutting its valley into the lacustrine clays and glacial clay tills. Approximately 6500 years ago, the River bottom hit the harder bedrock soils and started migrating laterally. It was during the down cutting of the River that its tributaries formed downcutting their own valleys. Wedgewood Creek is one of these tributaries to the North Saskatchewan River.

6.3 LANDFORM, SOILS AND HYDROGEOLOGY

The RAA consists of gently rolling hills with undulating depressional land near the river (Bowser *et al.* 1962). The RAA consists of Malmo Silty Clay Loam (Bowser *et al.* 1962). The soil along the NSR within the RAA consisted of Alluvium and Unclassified soils on rough broken land adjacent to the RAA (Bowser *et al.* 1962). Due to agricultural and residential development present throughout the RAA, the majority of the soils are considered to be disturbed soils. Table 6-2 summarizes soils that could be present in the RAA.

Table 6-2 General Soil Information for the Riverview 1, 2 and 3 NSP area

Soils	Description
Malmo Silty Clay Loam	Eluviated Black developed on lacustrine material
Unclassified	Unclassified soils on rough broken land adjacent to stream courses

Hoggan completed a geotechnical investigation for project footprint in April 2015. In general, the soils encountered consisted of surficial asphalt and gravel, underlain by a clay fill to depths in the range of 2.0 and 11.4 meters below ground surface (BGS). Below the clay fill in the testholes drilled north and south of the creek area, native lacustrine clays were encountered. The clays were typically moist and high plastic and transitioned into a very moist to wet and medium plastic, very silty clay or a low plastic clayey silt. These lower silts were typically saturated and sensitive. The clays and silts were encountered to depths between 10.2 and 14.0 meters BGS. In one of the testholes, sand was encountered below the clay fill to a depth of approximately 8.8 meters BGSW. The sand was typically moist above the ground water table and wet below. The final soil encountered in the testholes was a silty, sandy clay till. The clay till was typically moist, medium plastic, stiff to hard in consistency and featured traces of coal, oxides, pebbles and the occasional sand lens. It should be noted that bedrock soils were not encountered in the testholes drilled to a depth of approximately 26.7 meters BGS. Refer to Drawing S001-004, Appendix C for a cross section of the boreholes drilled.

The Hydrogeology of the Southwest Segment of Edmonton Area, Alberta (Ceroici 1978) was reviewed to characterize the hydrogeology of the RAA. Bedrock under the RAA is in the Wapiti Formation (Kwt) and consists of sandstone, mudstone, bentonite, and coal beds (Ceroici 1978).

Groundwater information was derived from Hoggan's (2015) Geotechnical Investigation (for further details refer to Appendix A of the ESC Plan, Appendix D). Hoggan (2015) characterized groundwater in the LAA as follows:

> *The groundwater table within the study area was generally moderate to low throughout the project area. The water table varied between 3.8 and 8.2 meters BGS. Three sets of water table readings were taken, with the results shown in the table below.*

Table 6-3 Groundwater Table Readings: Proposed 199 Street Upgrades (Meters Below Ground Surface) (Hoggan 2015)

Testhole	Elevation	Conditions At Testhole Completion	12 to 13 Day 30-Mar-15	21 to 22 Day 8-Apr-15	27 to 28 Day 14-Apr-15	Watertable Elevation
2015-01	683.04	5.2 m water, 5.2 m slough	5.73	5.60	5.65	677.39
2015-02	681.05	8.5 m water, 4.3 m slough	3.75	3.75	3.80	677.25
2015-03	680.88	16.3 m water, 2.6 m slough	9.21	7.82	7.79	673.09
2015-04	682.37	No water, No slough	5.85	5.75	5.85	676.52
2015-05	687.17	4.3 m water, No slough	8.09	8.16	8.09	679.08

It should be noted that water table levels may fluctuate on a seasonal or yearly basis with the highest readings obtained in the spring or after periods of heavy rainfall. The above readings would be near the average seasonal levels.

The water level in Testhole 2015-02 indicated that the groundwater level is in the clay fill zone. This seemed peculiar. The standpipe was pumped from the water and the water level readings were further observed to be at the same level. Therefore, in order to confirm this reading, a second testhole was drilled next to Testhole 2015-02 in order to isolate the watertable within the sand. The watertable reading in the second testhole indicated a ground water level reading of approximately 5.6 meters BGS, within the native sand layer. Given that the higher groundwater level reading of 3.8 meters BGS has more of an adverse effect on the development, the higher reading was used in all of our analysis.

6.3.1 Erosion Potential

The erosion study conducted by Golder Associates (Golder, 2012) found that erosion along Wedgewood Creek was relatively minor and caused by natural erosion or poor slope erosion management around infrastructure, that erosion did not appear to be increasing, and that immediate erosion controls were not required, but monitoring of select areas was recommended. The study further indicated that upstream of 199 Street NW where the creek bed overlies clay and silt deposits, slopes are more sensitive to erosion, specifically toe slope erosion could potentially result in more pronounced failures. This study also found that existing culvert crossings of the creek (at 215 Street NW, 199 Street NW, and 184 Street NW) provides some benefits related to flow attenuation and sediment retention; however, the associated road embankments were at risk of overtopping during extreme flood events and were at risk of failure. Golder Associates recommended additional work to determine whether these culverts should be upgraded.

The erosion study indicated that future development of the Edgemont and Riverview neighborhoods and associated stormwater management of these neighborhoods were considered to have the potential to change the hydrological, sediment and erosional regimes in

the Wedgewood Creek watershed. An increase in mean annual and peak flows of 11% from historical conditions and 18% from existing watershed conditions were predicted. No increases to tributary flood discharge were anticipated at the Riverview development under the existing stormwater management plan.

Golder (2012) also reported that changes to the erosion patterns and the geomorphology of Wedgewood Creek were not expected to be substantial, natural erosion was expected to continue, and no widespread erosion of the channel bed, banks or hillslopes was expected with the increased flood discharges predicted.

The report highlighted the role of the resident beaver population on the existing Wedgewood Creek morphology in flood attenuation and natural erosion control, and recommended that new development within the creek valley and associated ravines be limited, that flow to the ravine systems be maintained, and that ecological connectivity within the watershed be maintained to encourage young beaver dispersal.

The Project specific ESC Plan (Stantec 2015g, Appendix D) found that the site erodibity rating was medium and the erosion potential was considered to be moderate.

6.3.2 Site Drainage

The existing 199 Street NW drainage area to Wedgewood Creek has been evaluated and summarized in *Riverview 199 Street Drainage System at Wedgewood Creek* (Stantec 2015b, Appendix D). Pre-development drainage for the 199 Street NW Road upgrade area is detailed in Table 6-4.

Table 6-4 Existing 199 Street Drainage at Wedgewood Creek (adapted from Stantec 2015b)

Street Drainage Metrics	Values
Drainage Area	4.35 ha
Overland Flow Length	350.00 m
Average Slope	4.43%
Runoff Coefficient	0.269 - 5 year
	0.314 - 100 year
Time of Concentration (Kirpich's Formula)	5.88 min
5 Year Intensity	90.38 mm/h
100 Year Intensity	172.41 mm/h
5 Year Runoff	0.297 m^3/s
100 Year Runoff	0.655 m^3/s

6.3.3 Creek Hydrology

The Golder Erosion Study (Golder 2012) noted that the gross drainage area of Wedgewood Creek is approximately 170 km^2 with an effective drainage area of 147 km^2. Most of the drainage area is located beyond the City of Edmonton limits. Based on the Hydrotechnical Summary Report (Stantec 2015d, Appendix D), the effective drainage area at the 199 Street NW/Wedgewood Creek Crossing location, the effective drainage area was determined to be 56 km^2. The report also noted that the watercourse in the vicinity of 199 Street NW is heavily regulated by beaver activity. In review of the design floods, the report notes that the high beaver activity, the current undersized culvert located beneath 199 Street NW, and lack of maintenance of this existing culvert has resulting in ponding of water upstream of the crossing. This ponding has produced channel widths (top and bottom) wider than what would be naturally occurring. Due to this ponding, Golder (2012) recommended that a culvert remain beneath 199 Street NW.

Based on the evaluation of design flows the Hydrotechnical Summary Report (Stantec 2015d , Appendix D) and report addendum (Stantec 2016a, Appendix D) recommended that the design and check discharge parameters related to the new culvert consider the following:

- *The Q_{Design} flood was estimated to be 14 m3/s with a depth of flow of 1.3 m and a main channel average velocity of 2.4 m/s*
- *Based on Alberta Transportation (AT) guidelines Q_{fish} passage was estimated to be 1.4 m3/s with a depth of flow of 0.5 m and a main channel average velocity of 1.2 m/s.*
- *Based on Alberta Transportation (AT) Basin Runoff Potential Method, the estimated flow of 30.8 m3/s with a depth of flow of 1.8 m and a main channel average velocity of 2.6 m/s was utilized as Q_{Check1} flood*
- *Based on Golder Associates Ltd work (December 2012 report), the maximum instantaneous discharge of 61.8 m3/s with a depth of flow of 2.3 m in main channel and a main channel average velocity of 2.8 m/s was utilized as Q_{Check2} flood*

A small naturally dammed tributary leading into Wedgewood Creek is located east of the existing Edgemont outfall (outside the Project Footprint). A trickle of flow was noted from this feature during the various field investigations conducted. It is assumed this feature collects local pre-development runoff from the Edgemont neighbourhood.

6.4 FISH AND FISH HABITAT

The following subsections are derived from the *Wedgewood Creek Road Crossing 199 St: Fish Habitat Assessment 05-52-25-W4M* (Stantec 2014b, Appendix D). For figures and photos please refer to this appended report.

6.4.1 Restricted Activity Period

Restricted Activity Periods (RAPs) are implemented to protect sensitive life stages of fish that may be present in the watercourses (ESRD 2012a). RAPs are important for protecting a fishery where

there is uncertainty about the conditions at the site, the fish that might be present at the work location, or the potential impacts of the work. Under the advice of a Qualified Aquatic Environmental Specialist (QAES), works may occur within the RAP if potential impacts to the aquatic environment are mitigated.

Wedgewood Creek is an Unmapped Watercourse that flows into a Class C coded watercourse. Although the watercourse class designation can be inherited from the downstream coded watercourse, in this case, the RAP is adopted from the closest tributary (Whitemud Creek - April 16 to June 30) as per clause 10(5)(b) of the *Code of Practice for Outfall Structures on Water Bodies (*Stantec 2014b,Appendix D) .

6.4.2 Fish Presence

A FWMIS search was conducted on October 2, 2014 (Stantec 2014b). Historical records show that two forage fish species have been recorded within the Project area (ESRD 2014) (Table 6-5). The FWMIS search included 5 km search area of Wedgewood Creek at the proposed Project location.

Table 6-5 Fish species present in Wedgewood Creek 1 km upstream of the Project area and 4 km downstream to the North Saskatchewan River.

Species		Conservation Status			
Scientific Name	**Common Name**	**Alberta Wild Species Rank[1]**	**Alberta *Wildlife Act*[2]**	**COSEWIC[3]**	**SARA[3]**
Forage Fish					
Culaea inconstans	brook stickleback	Secure	N/A	N/A	N/A
Pimpephales promelus	fathead minnow	Secure	N/A	N/A	N/A

Notes:
[1] ESRD (2011)
[2] Wildlife Act Wildlife Regulation (1997)
[3] Government of Canada (2014)

6.4.3 Species of Management Concern

No fish species known to occur in the vicinity of the Project are provincially or federally listed (ESRD 2011, *Wildlife Act* [1997]; Government of Canada 2014).

6.4.4 Fish Habitat Assessment

Wedgewood Creek originates southwest of Edmonton and flows through agriculture lands discharging into the North Saskatchewan River. This creek is impacted extensively by beaver activity creating water impoundments throughout the LAA.

A fish and fish habitat assessment (FHA, Stantec 2014b, Appendix D) was conducted on Wedgewood Creek by qualified aquatic environmental specialists (QAES) on October 8, 2014 (Figure 5-2). At the time of the visit, low flow conditions were present and weather conditions were favorable (i.e., clear skies, no precipitation).

The FHA report noted that the overall fish habitat in Wedgewood Creek was rated as "moderate" based on habitat characteristics and the fish species known to occur in the area (Stantec 2014b, Appendix D).

The existing crossing is a 1.8 m diameter culvert and 62.8 m in length (Terrace 2014, Appendix B). Water depth in the culvert was shallow and the water velocity was slow. According to the FHA report (Stantec 2014b, Appendix D), it appears that small-bodied fish could swim through the culvert with minimal woody debris, aquatic vegetation and fines observed. The report also noted that the culvert does not appear to be a fish barrier at the outlet. However, it did note that a beaver dam may impede passage 2 m upstream of the inlet. From the field information gathered, high flows in the spring could be constricted in the culvert and the velocity could impede upstream migration. Low flows in the late fall could reduce water depths in the culvert, making it impassable (Stantec 2014b, Appendix D).

Stantec (2014b) rated forage fish habitat in assessed reaches of the creek as "good" with suitable areas of aquatic vegetation providing spawning habitats for the fish species known to occur in the area. Woody debris, water depth, and aquatic vegetation appeared to provide good cover and habitat for rearing and overwintering. Overwintering habitat is present in beaver impounded water typically > 1.2 m deep.

The report also noted that coarse and sport fish habitat was rated as "poor" with limited areas of spawning substrate such as gravels, cobbles, and aquatic vegetation. Lower oxygen levels downstream of the crossing in beaver impoundments did not appear to provide suitable rearing or overwintering habitat (Stantec 2014b, Appendix D).

Barriers to fish passage were observed along the creek and migration potential was considered "poor" for all fish species. Beaver dams were present along Wedgewood Creek including the existing crossing immediately upstream of the culvert. The beaver dams appeared to provide temporary barriers and create deep pool habitats compared to a free flowing creek. Stantec (2014b) noted that this would allow habitat for selected forage fish species, but will not be suitable for coarse or sportfish species.

6.4.4.1 Fish Presence

During the FHA survey (Stantec 2014b), backpack electrofishing was conducted for a total of 304 seconds, within a 60 m long section between Transects 1 and 3 (Figure 5-2, Appendix A). Brook stickleback, and finescale dace were the only species captured during this event (Table 6-6).

Table 6-6 Fish Species Captured in Wedgewood Creek, October 8, 2014 (Stantec 2014b)

Gear	Fish Sampling Data		
	Species	Count	Size Range (mm)
Backpack Electofisher	brook stickleback	5	45 - 57
	finescale dace	1	76
NOTE: See Stantec 2014b, Appendix D for detailed fish capture results.			

6.5 VEGETATION

Within the LAA, six sites were surveyed to characterize the ecosite and to identify rare plants (Figure 5-2, Appendix A). All plant species occurring within the project footprint were documented. A list of all plant species identified is located in Appendix F.

The south facing slope east of the existing 199 Street NW road way was classified as Upland Land Class. The area was steep and showed some signs of bare soil, instability and curved tree bases. It was dominated by red osier dogwood (*Cornus sericea* ssp. *sericea*), choke cherry (*Prunus virginiana*), high-bush cranberry (*Viburnum opulus*) and quaking aspen (*Populus tremuloides*) and white birch (*Betula paypyrifera*). The herb layer was dominated by smooth brome (*Bromus inermis*) and hay sedge (*Carex siccata*).

A small wooded area was present to the west of the 199 Street NW (Upland Land Class). The plant species assemblage was typical of an Aspen Parkland community. The lower half of the slope showed evidence of subsidence due to the excessive removal of trees by the beavers in the area. Overall, the area was dominated by aspen with an understory of saskatoon (*Amelanchier alnifolia*), buckbrush (*Symphoricarpos occidentalis*), high-bush cranberry and choke cherry. The herb layer was dominated by hay sedge, smooth brome and northern bedstraw (*Galium boreale*).

The Wedgewood Ravine to east of the 199 Street NW (Riparian Land Class) consisted of steep upper slopes with evidence of subsidence. The slope had a concave shape and showed evidence of rilling and gullying. The area was dominated by Mixed Wood Woodland vegetation. The overstory was dominated by aspen and white birch with scattered balsam poplar (*Populus balsamifera*) and white spruce (*Picea glauca*). The understory was dominated by a thick shrub layer consisting of wild rose (*Rosa acicularis*), twining honeysuckle (*Lonicera dioica*), Canada buffaloberry (*Sherpherdia canadensis*), wild red raspberry (*Rubus idaeus*) and northern gooseberry (*Ribes oxacanthoides*). The herb layer was dominated by common horsetail (*Equisetum arvense*), smooth brome, Kentucky bluegrass (*Poa pratensis*), and trace amounts of wild strawberry (*Fragaria virginiana*) and showy aster (*Eurybia conspicua*).

The area on the north and west side of 199 Street NW (Disturbed Land Class) was under construction and was partially graded, but showed a species composition similar to the area to the east. Figure 6-1 (Appendix A) and Table 6-7 detail the vegetation communities of the project footprint.

Table 6-7 Vegetation Communities in the Project Footprint

Vegetation Community	Area (ha)
Upland Land Class	0.55
Riparian Land Class	0.63
Settled Land Class	0.22
Disturbed Land Class	0.58
Total	1.98

6.5.1.1 Rare Plants

Before field work within the LAA and project footprint was conducted, a search of historical rare plant and rare ecological community occurrences within the Wedgewood Creek and nearby North Saskatchewan River Valley was completed by searching the ACIMS database. Although there were no historical occurrences within Wedgewood creek, five rare vascular plant and four rare non-vascular plant occurrences within the North Saskatchewan River Valley were noted. Refer to Table 6-8 for a list of rare plant species identified from the ACIMS data review.

In addition to the ACIMS occurrences noted, nine rare plant detections were recorded during field studies occurring within the RAA in 2013 (Stantec 2015a). However, none were within the LAA or project footprint.

Table 6-8 ACMIS Database Review: Rare Plant Occurrences and Location

Scientific Name	Common Name	ACIMS Rank	Tracked/ Watched	Form
Bryum uliginosum	moss	S1S2	Tracked	Moss
Carex vulpinoidea	fox sedge	S3	Tracked	Graminoid
Didymodon tophaceus	blunt-leaved hair moss	S2S3	Tracked	Moss
Doellingeria umbellata var. *pubens*	flat-topped white aster	S3	Tracked	Forb
Entodon schleicheri	Schleicher's silk moss	S2S3	Tracked	Moss
Gratiola neglecta	clammy hedge-hyssop	S3	Tracked	Forb
Najas flexilis	slender naiad	S3	Tracked	Graminoid
Osmorhiza longistylis	smooth sweet cicely	S3	Tracked	Forb
Rhodobryum ontariense	Ontario Rhodobryum moss	S1S2	Tracked	Moss

No rare plants or rare ecological communities were observed within the project footprint during the rare plant field program conducted in support of this Project.

6.5.1.2 Weed Species

No *prohibited* noxious weeds were identified during any of the rare plant surveys. However, Canada thistle (*Circium arvense*) and perennial sow-thistle (*Sonchus arvensis*), both *noxious* weeds listed in the *Alberta Weed Control Regulation* (Weed Control Regulation. Alta. Reg. 19/2010) were observed during the August 2015 rare plant survey. Canada thistle was observed within the shrubland located in the northeast and perennial sow-thistle was observed within the Aspen Parkland area within the southwest portion of the project footprint. Both were observed in low densities.

6.6 WILDLIFE

The project footprint occurs within Wedgewood Ravine. It has been identified as a biodiversity core area (Stantec 2015a) and a critical wildlife linkage to the NSR valley (Ecoventure 2013). The project footprint also intersects a KWBZ and provides habitat connectivity for wildlife species to the NSRV ESA, which is a feature of national significance.

6.6.1 Restricted Activity Periods

There is restricted activity periods related to construction activities and wildlife in the project footprint, they are detailed below.

6.6.1.1 Breeding Bird Restricted Activity Period

Virtually all birds (including their nests and eggs) are protected either by the *Migratory Bird Convention Act* and its Regulations and the Alberta *Wildlife Act*. To reduce risk of incidental take, which includes direct and indirect mortality of nesting birds, nestlings, and eggs, is to avoid activities that could result in incidental take (e.g., vegetation clearing and grubbing) and which overlap with the breeding period of migratory birds. Environment Canada provides information on the "general nesting periods" for migratory birds for Canada. The nesting periods vary depending on nesting zone and habitat type (i.e., forest, open, wetlands), and because the project footprint lies at an intersection of all three habitat types the primary nesting period extends from April 26 to August 15. It should also be noted that some bird species such as owls and hawks nest earlier in the year, and their nests are also protected.

6.6.1.2 Key Wildlife and Biodiversity Zone Restricted Activity Period (KWBZ RAP)

Guidelines for industrial activity within KWBZs relate to winter ungulate habitat and areas with higher biodiversity potential and are outlined in the Recommended Land Use Guidelines for Key Wildlife and Biodiversity Zones (ESRD 2015c). It is recommended that no activity occur from January 15 to April 30 within the KWBZ. There are circumstances where exceptions to the KWBZ RAP are possible, these are determined in consultation with provincial regulators.

6.6.2 Species of Management Concern

For the purpose of this assessment, species of management concern includes species ranked by ESRD (*Sensitive, May be at Risk, Threatened, Endangered*) or listed by the Committee on the Status of Endangered Wildlife in Canada or the Species at Risk Act (*Special Concern, Threatened, Endangered*).

A query of the FWMIS database, yielded two occurrence records of species of management concern within a 2 km radius of the Project: least flycatcher (*Empidonax minimus*)and sora (*Porzana carolina*) (Appendix F). Both species were observed in the RAA and LAA during field studies. The general status rank of the least flycatcher and sora is *Sensitive*, which indicates that these species are "not at risk of extinction or extirpation but may require special attention or protection to prevent it from becoming at risk" (Government of Alberta 2011). Neither least flycatcher nor sora has had status ranks or schedules assigned by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) or the *Species at Risk Act*.

Least flycatcher population numbers have been declining in Alberta and surrounding jurisdictions, it is thought that declines may be related to habitat changes on wintering range (Government of Alberta 2011). The sora population has experienced large (>50%) declines in Alberta and all surrounding jurisdictions since 1994; the loss of wetland habitat is the likely driver of population decline (Government of Alberta 2011).

Barn swallow, least flycatcher, pileated woodpecker and sora are species of management concern identified during field surveys (Table 6-9).

Barn swallows have a general status rank of *Sensitive* in Alberta, and are considered a common species that is declining in Alberta and all surrounding jurisdictions. The probable cause of the decline is not understood. Barn swallow is ranked by COSEWIC as a *Threatened* species, but has no status or schedule under the Species at Risk Act. Barn swallow presence in the project footprint is possible for foraging activities, but barn swallow nesting habitat is unlikely occur within the project footprint. Rather, barn swallow nesting locations are more likely to occur on nearby housing structures and barns.

Pileated woodpeckers also have a general status rank of *Sensitive* in Alberta. This species requires mature to old-growth trees for nesting. Some threats to populations have been identified, presumably as a result of habitat change related to human developments. It is possible that habitat change related to Project site preparation activities could result in reductions in nesting or breeding habitat for this species.

6.6.3 Mammals

Six species of wintering mammals were detected in and near the RAA during snow track surveys in March 2014 (see Figure 5-1, Appendix A): white-tailed deer (*Odocoileus virginianus*), coyote (*Canis latrans*), red fox (*Vulpes vulpes*), least weasel (*Mustela nivalis*), snowshoe hare (*Lepus*

americanus), and red squirrel (*Tamiasciurus hudsonicus*) (See Stantec 2014c (Appendix B) for further details).

It is assumed that data collection on wildlife movements in the RAA (to the south of the project footprint) would also be relevant at the Wedgewood Ravine location. Deer tracks were detected mostly to the east of 199 Street (n=48, or 62%), especially where the transect was closer to the NSRV. Coyote track detections were nearly equal on east and west sides of 199 Street, with slightly higher track detections on the west side (n=22, 54%). Snowshoe hare detections were recorded in higher numbers on the west side of 199 Street (n=46, 63%). It could be hypothesized from this data that deer and snowshoe hare are less likely to cross 199 Street than coyotes, but it would require further study to state definitively.

Incidental observations in the RAA during summer breeding bird surveys included multiple records of moose (*Alces alces*), and porcupine (*Erethzion dorsatum*). It is anticipated that the RAA is used by other mammal species not listed here.

Beaver activity is evident in and around the project footprint and beyond. Golder (2012) identified 44 active beaver dams, 37 breached beaver dams and 17 debris jams along Wedgewood Creek.

6.6.4 Birds

According to EPEC Consulting Western Ltd. (1981), it is believed that approximately 150 species of birds inhabit the North Saskatchewan River Valley and its ravine system. The Edmonton Christmas Bird Count 2013, conducted by members of the public, recorded observations of 26,566 birds and 46 species around Edmonton (Edmonton Christmas Bird Count 2014).

The majority of bird species within the ravine system seem to have a strong preference for the mixedwood habitats associated with ravines, while deciduous habitats are widely used by wintering birds with perhaps a preference for aspen poplar/saskatoon/dogwood community types (Strong and MacCallum 1984).

A breeding bird survey was conducted in 28 locations within the RAA on July 2 to 4 2013, from sunrise until 10:00 hr. during the peak breeding period for migratory songbirds. An additional survey was conducted on June 10, 2014 at one location within the LAA, and four other sites within the RAA. Table 6-9 lists bird species detected in the RAA and LAA.

Table 6-9 List of Bird Species Detected During the Breeding Bird Survey in RAA

Common Name	Scientific Name
Alder flycatcher	***Empidonax alnorum***
American crow	***Corvus brachyrhynchos***
American goldfinch	***Spinus tristis***
American robin	***Turdus migratorius***
Barn swallow*	*Hirundo rustica*
Black-billed magpie	*Pica hudsonia*
Black-capped chickadee	***Poecile atricapillus***
Clay-colored sparrow	***Spizella pallida***
Cedar waxwing	*Bombycilla cedrorum*
Chipping sparrow	***Spizella passerine***
Downy woodpecker	*Picoides pubescens*
Franklin's gull	*Leucophaeus pipixcan*
Gadwall	*Anas strepera*
House wren	***Troglodytes aedon***
Leconte's sparrow	*Ammodramus leconteii*
Least flycatcher*	***Empidonax minimus***
Lincoln's sparrow	*Melospiza lincolnii*
Mallard	*Anas platyrhynchos*
Northern flicker	*Colaptes auratus*
Pileated woodpecker*	***Dryocopus pileatus***
Red-breasted nuthatch	*Sitta canadensis*
Red-eyed vireo	***Vireo olivaceus***
Red-tailed hawk	*Buteo jamaicensis*
Red-winged blackbird	*Agelaius phoeniceus*
Savannah sparrow	*Passerculus sandwichensis*
Sora*	*Porzana carolina*
Song sparrow	***Melospiza melodia***
Tree swallow	***Tachycineta bicolor***
Western wood pewee	***Contopus sordidulus***
White-throated sparrow	*Zonotrichia albicollis*
Yellow warbler	***Setophaga petechia***
Total Species = 31	
Species of management concern = 4	
NOTE: * ESRD 2013 *sensitive* Species in bold were detected in the LAA during the June 2014 survey.	

6.6.5 Amphibians

Amphibian surveys were conducted in the RAA on May 26th and 27th, 2013, at 14 locations within the RAA, and on June 11 and 12, 2014 in the LAA. Boreal chorus frog (*Pseudacris maculata*) was the only amphibian species detected in RAA, including within the project footprint. Boreal chorus frogs are not a listed or ranked species, provincially or federally. Nonetheless, amphibian species in general are considered VCs because of scientific and regulator concerns related to observed localized population declines, and habitat changes including the loss of wetland habitat.

7.0 EXISTING CONDITIONS: SOCIO-ECONOMIC ELEMENTS

The following sections provide a description of land use, existing developments, coal shafts and pipelines, railways and transportation and utility corridors, and archeological resources within and adjacent to the LAA.

7.1.1 Land Use and Existing Development

The Wedgewood Ravine a natural feature within a matrix of agricultural lands. A review of the select aerial photographs indicates that Wedgewood Ravine has been surrounded by agricultural land from 1950 to the present (Appendix E).

Currently a farm, and a residential area are present on the east side of 199 Street NW, adjacent to the Wedgewood Ravine (Figure 7-1, Appendix A). In addition, an Altalink powerline is present south of the LAA. Multiple abandoned well heads, wells, and reclamation certificate sites are present in the RAA to the southeast of the project footprint (Figure 7-1, Appendix A). None of these features are anticipated to interact with Project activities (Section 2.1).

8.0 ENVIRONMENTAL EFFECTS ASSESSMENT

The following sections are the assessment of effects, mitigation and residual effects on VCs. The VCs that were evaluated are:

- Air quality and noise
- Geology and geomorphology
- Hydrology
- Water quality
- Fish and fish habitat
- Vegetation
- Wildlife
- Public and worker health and safety
- Aesthetics

Potential effects and effect pathways are described, followed by mitigations, and residual effects characterizations.

8.1 AIR QUALITY AND NOISE

The following sub-sections are the environmental effects assessment related to air quality and noise.

8.1.1 Potential Environmental Effects and Effects Pathways

The potential effects are change in air quality and change in auditory setting.

Change in Air Quality

Potential effects of the Project activities on the air quality of the LAA are anticipated to be related to increased dust associated with the excavation activities and increased engine exhaust associated with construction traffic and heavy machinery required for site preparation, instream works, crossing and utilities installation, grading, and landscaping. Dust can become airborne when soil is exposed or left uncovered, and adversely affect farm and residential area residents through deposition on property and vehicles, and it can also adversely affect vegetation and water quality through deposition proximate to the project footprint.

Change in Auditory Setting

Project implementation will result in increased levels of noise in the LAA throughout the construction phase. Increased noise levels will occur as a result of construction traffic and heavy equipment use. It is anticipated that increased noise resulting from Project activities could affect the residents of the farm and the residential area directly proximate to the project footprint

(Figure 7-1, Appendix A). Construction noise could also adversely affect wildlife through various pathways (See Section 8.7 below).

ACI (2014) conducted a noise impact assessment for the proposed Riverview Developments, which encompasses the RAA (Appendix B). The focus of this report was noise projections from the projected traffic on the future neighborhoods. This assessment included primarily design considerations to mitigate traffic noise.

8.1.2 Mitigation Measures

Change in Air Quality

Mitigation measures that will be employed to address effects associated with air quality include:

- Maintain forests and trees where possible by reducing the project footprint in treed areas, and abiding by the City of Edmonton's Corporate Tree Management Policy C456A. In an urban environment trees play an important role in filtering pollutants from the air and removing carbon
- Limit excessive on-site idling of heavy equipment and construction related-vehicles. Reduce construction related traffic by carpooling or other efforts to limit the number of trips to the site
- Develop and implement dust control management plan during construction, including provisions for storage pile management, and hauled material management.

Change in Auditory Setting

Mitigation measures that will be employed to address effects associated with noise include:

- All work should be limited to normal working hours in accordance with City of Edmonton Community Standards Bylaw 14600
- Reasonable efforts should be made to minimize noise disturbance at all times
- Machinery and equipment will be kept in good working order, with limited idling
- Noise abatement

8.1.3 Residual Environmental Effect Characterizations

Residual effects of the construction and operation of the Project on air quality and noise are anticipated to be low magnitude adverse effects. The spatial extent of the effect is local, and the residual effects are largely limited to the construction phase of the Project.

8.2 GEOLOGY/GEOMORPHOLOGY

The following sub-sections are the Project effects assessment related to geology/geomorphology.

8.2.1 Potential Environmental Effects and Effect Pathways

Construction activities that involve excavation and regrading (refer to Drawings C007-001, C103-005, and C103-006 Appendix C) could adversely affect slope stability during the construction period and into operations. Hoggan (2015) discusses existing soil conditions in the project footprint and the implications of these on construction methods. It is understood that the proposed design and future construction activities will follow the specifications described in the geotechnical reports (Hoggan 2014 and 2015).

8.2.2 Mitigation Measures

Slope stability mitigations and construction specifications for the installation of the terrestrial wildlife passage system are listed in detail in Hoggan (2015) (Appendix A of the ESC Plan, Appendix D) and will be implemented in Project execution. The recommendation list include specific mitigations/recommendations regarding open excavation required for underground utility installation, including: backfill materials, groundwater infiltration and dewatering, trenching cutback angles, trench widths, spill piles, pipe bedding and trench backfill procedures, watermain thrust blocks, trench and backfill compaction.

There are also specific mitigations/recommendations regarding trenchless utility installation, including considerations of soils, frac-out potentials, and best management practices.

Surface utility installation considerations regarding the activities such as: road construction, embankment construction, mid-slope culvert installation, aquatic culvert installation, large wildlife passage structure foundation, cast-in-place piles, driven piles, shallow foundations (wing walls), and lateral load recommendations are also described in the Hoggan (2015) report.

8.2.3 Residual Environmental Effect Characterization

With the implementation of mitigations and construction methods outlined and recommended in Hoggan 2015(Appendix D) the change to the slope configuration and ultimately slope stability is anticipated to be a low magnitude adverse effect. The spatial extent of the effect is local, of low-likelihood, and the residual effects would be limited to the construction phase of the Project.

8.3 WATER QUALITY

The following sub-sections are the Project effects assessment related to water quality.

8.3.1 Potential Effects and Effect Pathways

The primary environmental effects to water quality that may occur as a result of construction of the Project are:

- Increases in suspended sediment levels into Wedgewood Creek and the small unnamed tributary from runoff from construction activity
- Discharge of large volumes of sediment laden water as a result of blockage removal, creek isolation, and culvert replacement
- Introduction of deleterious substances from construction equipment during construction of the terrestrial wildlife passage system, aquatic culvert, and utilities installation into the LAA
- Introductions of deleterious substances from exposed areas within the project footprint between construction seasons
- Road run off introductions to Wedgewood Creek without proper pre-treatment during construction and operations

Water quality with respect to fish habitat is also discussed below in Section 8.5.

8.3.2 Mitigation Measures

Change to Water Quality

- Implement site drainage plan (Stantec 2015b, Appendix D) summarized in Section 3.4 and detailed in Drawings C005-001, C008-001, C105-006, and C200-006 (Appendix C).
- ESC measures will be required during all phases of construction (including overwintering between construction seasons). This will reduce soil displacement with the use of silt fences, erosion control blankets and other selected ESC control measures. The recommendations set out in the ESC plan (Stantec 2015g, Appendix D) will be executed. Details regarding the site specific ESC measures are summarized in in Section 3.0 of the ESC Plan and detailed in Drawings C015-001and C015-003 (Appendix C)
- Install stream isolation measures, detailed in Drawings C015-001 and C015-003 (Appendix C) and summarized in Sections 2.2.1 and 2.2.2 of the ESC Plan (Stantec 2015g, Appendix D) to isolate the instream working area from the rest of Wedgewood Creek while allowing the creek to flow along a protected temporary diversion channel
- Any pumping of water will occur mechanically through a silt bag to an adjacent vegetated area east of the crossing before allowed to enter Wedgewood Creek
- A QAES will be retained to conduct regular sediment monitoring during instream activities to ensure that adverse effects are avoided or minimized
- If any ESC or containment measures fail and sediment laden runoff water enters Wedgewood Creek, the proper authorities (AEP) will be notified immediately of a release. In

addition, provincial and municipal authorities will be notified, as necessary. The contractor will be required to determine where the deficiencies in ESC measures occurred and to repair these deficiencies immediately. All disturbed areas will be re-vegetated as part of the ESC measures and final reclamation plan

- Install riprap to form permanent erosion protection (Drawings C015-001, C015-003, S001-002, S002-001, and S002-003 Appendix C)
- Revegetate the project footprint in accordance to the detail landscaping plan (Drawings L001-002 through 0112A and L001-015 through 017, Appendix C) as soon as possible to mitigate exposed soil and reduce the possibility of erosion and sedimentation concerns
- Maintain a proper maintenance and cleaning schedule for the existing Stormcepter, which will be treating the majority of road runoff prior to discharge to Wedgewood Creek

8.3.3 Residual Environmental Effect Characterization

With the implementation and monitoring of the various ESC measures prior to and throughout the Project construction phase; and an appropriate City maintenance /cleaning schedule of Stormcepter, there is a low likelihood of the introduction of sediments and deleterious substances into Wedgewood Creek from construction and subsequent operation related processes. The magnitude of the residual effect is low, the duration would be short term (mostly limited to the construction period), and the spatial extent of the affected area would be mostly within the LAA.

8.4 HYDROLOGY

The following sub-sections are the Project effects assessment related to hydrology.

8.4.1 Potential Effects and Effect Pathways

Potential Project effects to hydrology at the site are related to changes to site drainage, changes to instream flows, and local channel morphology.

Change to Site Drainage

Changes to site drainage as a result of increasing the area of impermeable surface and reconfiguring the slopes and loss of vegetation associated with the Project are anticipated prior to the implementation of the site drainage plan, which includes storm water storage, oil and grit separation, and discharge through the existing Edgemont outfall (Drawings C005-001, C008-001, C105-006, and C200-006 Appendix C). Increased sedimentation in Wedgewood Creek may occur in extreme high flow events (i.e. 1978 event) where the capacity of the outfall structure is exceeded and water flows over the roadway down the swales (Drawing C015-003, Appendix C) and into Wedgewood Creek, but this is not expected to be materially different than baseline conditions.

During the construction phase, unmanaged local drainage during construction could exasperate any uncontrolled erosion or sedimentation associated with the construction of the various components of the Project.

Change to Instream Flows and Local Channel Morphology

Changes to the instream flow regime and local channel morphology are two of the potential effects the Project activities may have on hydrology in the LAA. The effect pathways associated with changes to instream flow and channel morphology are related to the placement and sizing of the new culvert as a replacement of the existing culvert, removing the debris currently blocking the existing culvert entrance, overall instream construction, placement of bank armoring materials (riprap), changing the form of the existing slopes within the project footprint temporarily cutting off the creek's ability to flow during construction, ice jamming, and interactions with the existing Edgemont outfall.

The replacement of the existing aquatic culvert with a larger culvert is anticipated to decrease flow velocity and erosion, and the removal of the current blockage and old culvert is anticipated to restore the watercourse to its natural regime channel characteristics within, and downstream of, the project footprint. However, the removal of the blockage without an appropriate dewatering plan and installation of the larger culvert without proper isolation may release large amounts of sediment laden water that has been pooling upstream of the crossing over a short time period. This may cause damage to the upstream and downstream portions of the Wedgewood Creek channel. In addition, Wedgewood Creek is a flowing water body so flow will be maintained during construction using a temporary flow bypass plan.

If not considered, future flows from the Edgemont outfall could erode the constructed bank on the north side of the replaced culvert ultimately leading to culvert exposure and damage. In addition, if ice flow exists, ice jamming could affect flows through the aquatic structure.

8.4.2 Mitigations

Change to Site Drainage

- Implement site drainage plan (Stantec 2015b, Appendix D) summarized in Section 3.4 and detailed in Drawings C005-001, C008-001, C105-006, and C200-006 (Appendix C)
- Execute the ESC plan summarized in Sections 2.2.1, 2.2.2 and 2.2.3 (Stantec 2015g, Appendix D) and install and monitor the appropriate ESC measures summarized in Section 3.0 of the ESC Plan (Stantec 215g, Appendix D) and detailed in Drawings C015-001 and C015-003 (Appendix C) to manage any concentrated overland flow that may be anticipated throughout the Project
- Install stream isolation measures, detailed in Drawings C015-001 and C015-003 (Appendix C) and in Sections 2.2.1 and 2.2.2 of the ESC Plan (Stantec 2015g, Appendix D) to isolate the instream working area from the rest of Wedgewood Creek while allowing the creek to flow along a lined diversion channel

- Erosion control blankets and compost berms will be installed above bed and shore of Wedgewood Creek to contain erosion and sedimentation within the construction area. Summarized in 2.2.3 and 3.2.2 of the ESC Plan (Stantec 2015g, Appendix D)
- The construction staging and laydown area will be located away from the bylaw area as shown in Figure: 199 Street Staging and Construction Laydown Area (Appendix C). An earthen berm will surround the staging and laydown area to ensure sediment and / or other contaminants do not affect the surroundings. A silt fence will be installed at the top-of-bank as a final protection measure
- Revegetate the project footprint in accordance to the detail landscaping plan (Drawings L001-002 through 0112A and L001-015 through 017, Appendix C) as soon as possible to mitigate exposed soil and reduce the possibility of erosion and sedimentation concerns
- If landscaping cannot be competed in the same season as construction, the interim ESC measures summarized in Sections 2.2.1.3 and 2.2.3.3 of the ESC Plan (Stantec 2015g, Appendix D) and detailed in Drawings C015-001 and C015-003 (Appendix C) will be followed

Change to Instream Flow and Channel Morphology

- The aquatic culvert orientation, size, location, target flow volumes related to culvert size, required length, embedding depth, and substrate material are all mitigation measures that have been incorporated into the design in order to reduce the current and long term effects to the instream flow regime and general creek morphology (Refer to Drawings C105-012, S002-001, and S002-002 Appendix C for details).
- Ice flow conditions are not anticipated for this creek. If icing occurs, we anticipate it would be limited to the area around the outfall structure. In the event of icing, creek flows through the culvert will not be affected.
- Design has incorporated the recommendations and mitigation measures detailed in the geotechnical report (Hoggan report 2015, Appendix D)
- Implement the dewatering and isolation program detailed in Section 2.2.1 and 2.2.2 of the ESC Plan (Stantec 2015g, Appendix D) in order to gradually drawdown the beaver impounded water upstream of the terrestrial wildlife passage system to a level that will allow the installation of appropriate isolation (Refer to Drawings C015-001 and C015-003 Appendix C) and the work require to replace the aquatic culvert (Detailed in Section 2.21 of the ESC Plan (Stantec 2015g, Appendix D)). This will minimize any accelerated erosion of the upstream and downstream channel
- Continue the dewatering program within the isolation area to allow for the removal of the debris and the replacement of the aquatic culvert (Detailed in Section 2.2.1 of the ESC Plan (Stantec 2015g, Appendix D)
- Install a water diversion channel as detailed in Section 2.2.1.1 of the ESC Plan (Detailed in Section 2.2.1 of the ESC Plan (Stantec 2015g, Appendix D)
- Undertake the aquatic culvert replacement in a timely fashion to remove the water diversion and isolation and return the creek to its natural flow regime
- Implement and monitor all required ESC measures detailed in the Project specific ESC plan (Stantec 2015g, Appendix D)

- Rip rap will be installed below the original high water mark to prevent slope disturbance and armor the lower banks of Wedgewood Creek (Drawings C015-001, C015-003, S001-002, S002-001, and S002-003 Appendix C). Appropriate sized rock will be installed along the west side (604 m^2 area) of the road from the existing Edgemont outfall around the aquatic culvert and on the bank to the south to provide long term erosion from the discharging stormwater through the Edgemont outfall and the natural flow regime of Wedgewood Creek. Additional riprap (192 m^2 area) will be placed around the outlet of the aquatic culvert

8.4.3 Residual Environmental Effect Characterization

Change to site drainage

Given that the implementation of the site drainage plan will route water from the roadway into the outfall structure, the residual effects of discharge from the outfall structure discussed in Ecoventure (2013b) Environmental Screening Report for the existing outfall are also applicable to the Project. They noted that:

> *Once constructed, the stormwater management system is expected to reduce the level of sediment reaching the receiving area. The primary negative impact that may occur post-development is a possible increase in suspended sediments during high flow events. This may be limited to rare extreme flow events, but would be expected to occur at some point. The receiving water in the creek already has significant turbidity caused by suspended sediment because it receives unregulated runoff flow from adjacent agricultural fields. This was observed during the site visit wherein surface runoff from the field upgradient drains directly into the Wedgewood Creek ravine. The total volume of runoff after the ground thaws is moderated by rapid infiltration into to sandy surface soils, but initial spring runoff on top of frozen ground is significant. The storm water management system proposed will moderate overland flow by providing some level of flood storage capacity on the top before overflow occurs and is expected to provide a long term positive impact on water quality. Whereas surface runoff already goes into the ravine and the quality of the receiving water is not pristine to start with, no adverse water quality impacts on the receiving water or the North Saskatchewan River system are anticipated, with any impacts being confined to the receiving area. Where flows are low and the stormwater design provides for substantial retention and settling capacity, the suspended solids and turbidity loading is expected to be similar or less post development with runoff being directed directly into the creek and at less frequent intervals.*

With the inclusion of the proposed ESC measures summarized in Section 3.0 of the ESC Plan (Stantec 215g, Appendix D) and detailed in Drawings C015-001 and C015-003 (Appendix C) to prevent deleterious substance introductions, the residual effect related to Project induced erosion and overall site drainage is anticipated to be a moderate magnitude effect, which is limited to the local area, and long in duration. The likelihood of occurrence is low, as the only

potential for adverse effects are expected to be limited to an extremely rare storm event. However, these will be managed along vegetated swales and is not expected to be materially different than baseline conditions.

Change to instream flow and channel morphology

With the implementation of the noted mitigation measures and the integration of the recommendations from the various technical documents conducted in support of the Project there still may be a possibility for an effect of the revised flow (blockage removed and larger culvert) on the channel morphology. However, in accordance to the Golder report (2012) the overall stability of the creek's sediment regime is not expected to be affected as the culvert will still act as a restricting factor in events larger than the design flood. The design of the replacement aquatic culvert noted in Section 3.3 above was executed so that the velocities do not exceed the velocity and capacity of the natural channel downstream of 199 Street NW.

The effects related to instream flow and channel morphology is expected to be moderate in magnitude. Residual effects associated with the Project are long in duration and local in spatial extent, as downstream effects would be reduced by the retention of a culvert structure verses open system and the presence of additional beaver dams located along Wedgewood prior to the confluence with the North Saskatchewan River. The likelihood of the residual effect occurring is high, as instream flow will change with blockage removal and new culvert installation. However, this would be a return to natural flow conditions, which would have been present prior to any of the beaver related influences on creek flow.

8.5 FISH AND FISH HABITAT

The following sub-sections are the Project effects assessment related to fish and fish habitat.

8.5.1 Potential Environmental Effects and Effect Pathways

Potential effects to fish and fish habitat are through Project-related change in habitat and change in mortality risk.

Change in habitat

Habitat change during construction includes the following potential pathways:

- Direct habitat alteration through physical channel modifications during the construction of crossing structures and changes to instream flow regimes
- Change in water quality due to ground disturbance required during the construction phase. The effect pathway is reduced water quality related to increased sedimentation and erosion. Change in water quality could also occur during the operation phase where rain storm events resulting in overland flows and the discharge of water directly into Wedgewood Creek from the road structure

Change in Morality Risk

The following list details potential effects pathways related to change in mortality risk for fish as a result of Project activities.

- Change in mortality risk associated with instream works (isolation measures, dewatering program and bypass system) of the directional drilling (frac out). Increased mortality risk related to the potential introduction of leachates from instream concrete work into fish habitat
- Deleterious substances (suspended sediments) levels increased during Project related work
- Stream flow disruption within the channel during construction
- Fish entrapment in the isolation or bypass area
- Fish entrainment on water pumps.
- Mortality of fish

An increase in suspended sediment in Wedgewood Creek due to erosion and sediment release from the project footprint can directly or indirectly affect fish mortality risk. Fine sediments have a long-term effect on fish habitat when they settle out on the substrate, filling in interstitial spaces and smothering spawning beds (Grant et al. 1986). The infill of the channel bed reduces the capacity of the waterway to accept greater flows, thus increasing susceptibility to flooding. Fine sediments can increase fish mortality risk by causing inflammation of the gill membranes or by adhering to mucous on the gill and providing a substrate for bacterial gill infections (Lynch et al. 1977).

Sedimentation and turbidity can indirectly affect fish by reducing primary productivity, destroying the habitat of fish food organisms, increasing the drift rate of benthic organisms (Lynch et al. 1977), and reducing the abundance of benthic organisms (Culp and Davies 1983).

8.5.2 Mitigations

Change in habitat

- The aquatic culvert will be imbedded 0.75 m into the creek bed to provide a natural substrate at the bottom of the culvert. It has been designed to reproduce, as much as possible, the natural hydraulic conditions of Wedgewood Creek, in order to provide flow velocities and minimum depths that permit upstream movement of aquatic species during low flow conditions. Details listed in Drawings C105-012, S002-001, and S002-002 (Appendix C).
- A QAES will be retained to develop a program to monitor for adverse effects and recommend mitigation measures as they arise
- The ESC measures outlined in the ESC Plan (Stantec 2015g, Appendix D) should be implemented during all phases of construction. This will reduce soil displacement and deleterious substance introductions to Wedgewood Creek

- If any ESC or containment measures fail and sediment laden runoff water enters Wedgewood Creek, the proper authorities AEP will be notified immediately of a release. In addition, provincial and municipal authorities will be notified as necessary. The contractor will be required to determine where the deficiencies in ESC measures occurred and to repair these deficiencies immediately
- Revegetate the project footprint in accordance to the detail landscaping plan (Drawings L001-002 through 0112A and L001-015 through 017, Appendix C) and as summarized in the Landscaping Brief (MMM Group Ltd./WSP 2016, Appendix D)

Change in mortality risk

- Construction timing will take into consideration the identified the RAP for Wedgewood Creek
- Install a water diversion channel as detailed in Section 2.2.1.1 of the ESC Plan (Detailed in Section 2.21 of the ESC Plan (Stantec 2015g, Appendix D)) in order to allow continuous flow through the project footprint and unfettered fish passage during the replacement of the existing aquatic culvert
- A QAES will be retained to oversee the installation of all in stream isolation the construction of the bypass system, to conduct the required fish salvage and to monitor the directional drilling, as required
- Instream works and directional drilling will be conducted according to best management practices and in accordance with the appropriate provincial and federal legislative requirements
- Personnel are required to notify and report if serious harm to fish and/ or a deleterious substance deposit occurs in the water body (DFO 2013)
- Machinery required to perform work shall be serviced and maintained within a designated staging/laydown area to prevent the leaking of fuels, lubricants, and hydraulic fluids. All maintenance work and refueling shall be performed within the staging/laydown area. Every precaution will be taken to avoid/contain spills during maintenance and refueling of this equipment
- The ESC measures outlined in the ESC Plan (Stantec 2015g, Appendix D) and detailed in Drawings C015-001 and C015-003 (Appendix C) will be implemented during all phases of construction. This will reduce soil displacement and deleterious substance introductions to Wedgewood Creek which could lead to fish mortality
- If any ESC or containment measures fail and sediment laden runoff water enters Wedgewood Creek, the proper authorities at AEP will be notified immediately. In addition, provincial and municipal authorities will be notified as necessary. The contractor will be required to determine where the deficiencies in ESC measures occurred and to repair these deficiencies immediately

8.5.3 Residual Environmental Effect Characterization

The residual effects of the activities associated with Project construction and operation are anticipated to be of low magnitude, limited to the LAA, and short in duration. The likelihood of

occurrence is expected to be low given the small scale of excavation within the project footprint.

8.6 VEGETATION

The following sub-sections are the Project effects assessment related to vegetation.

8.6.1 Potential Environmental Effects and Effect Pathways

The potential effects to vegetation that may occur as a result of construction and operation of the Project are:

Windthrow

Removal of tree cover during construction has the potential to compromise forest stands structurally, and may allow for windthrow (blow down of remaining trees along newly exposed edges of the stand) and the introduction of edge effects. The proposed construction will require the removal of tall aspen and balsam poplar trees. These species can be susceptible to windthrow due to a high incidence of heart-rot typical of these trees. As well, trees that develop within a forest stand are not as structurally sound as trees that develop along the forest edge, and a gap in the forest canopy can result in the blow down of a number of individuals.

Change in Species Diversity and Plant Community Distribution

Project activities will result in the direct loss of native species and alteration of species composition within the LAA. Site preparation activities including vegetation clearing (1.98 ha of total area, 1.17 ha of native vegetation) and grubbing, soil stripping, soil compaction, and tree removal are anticipated to change the diversity of native species occurring in the LAA, and potentially introduce weed species that were not present at baseline or expand the weeds that are currently present in low densities. Soil stripping, the removal of trees and shrubs will result in a direct loss of native species in some areas and will potentially cause a species composition shift within the LAA resulting from edge effects associated with increased light availability, decreased humidity, and increased ease of access for people, wildlife, and introduced plant species.

Post construction, beavers may affect species diversity, by damaging or delaying the establishment of proposed plantings resulting in reduced effectiveness of the proposed landscape plan.

Introduction of Weeds

Construction and operation of the Project could result in an ingression of new non-native species into the LAA or expand the observed populations noted. Non-native species are opportunistic and could invade the project footprint after soil stripping has taken place and if unclean machinery is used to undertake construction activities.

8.6.2 Mitigation Measures

Measures to reduce Project-related effects include the following:

Windthrow

- If windthrow occurs, suitable native tree species should be planted to compensate for lost trees
- Measures should be taken to ensure construction equipment do not unintentionally come into contact with trees. These measures include the installation of hi-vis temporary fencing (e.g. snow fencing) to clearly demark the clearing boundary of the project footprint

Change in Species Diversity and Plant Community Distribution

- Vegetation clearing will be reduced whenever practical
- To reduce edge effects on treed areas remaining after vegetation clearing and to limit changes to plant community composition, the landscaping plan (Appendix C) should be implemented immediately after the completion of construction.
- Re-vegetation activities will include the re-establishment of native vegetation resembling pre-development plant communities. The landscape plan (Drawings L001-007 through 0112A and L001-015 through 017, Appendix C) includes a palate of native plantings of various heights that will mimic the current community and stratification. Refer to Section 3.6 and the Landscaping Brief (MMM Group Ltd./WSP 2016, Appendix D) for details
- Tree and shrub plantings will be protected with wire mesh to deter beaver damage and removal
- The ESC measures outlined in the ESC Plan (Stantec 2015g, Appendix D) will be implemented prior to Project execution and will be monitored throughout the duration of Project construction. All ESC measure recommendations (detailed in Section 3.0 of the ESC Plan (Stantec 2015b, Appendix D) will be installed prior to construction to reduce the duration of exposed soils and loss of topsoil due to erosion
- Soil salvage and storage – topsoil will be stored separately from subsoil within the staging and laydown area above the TOB (Figure: 199 Street Staging and Construction Laydown Area, Appendix C.) to maintain soil nutrients and preserve the native seed bank
- Construction activities will be limited in wet soils whenever possible, to reduce soil compaction, erosion and sedimentation
- Soils should be de-compacted before revegetation occurs

- Physical barriers and/or signage should be installed at the entrance to the project footprint to notify the public of restoration activities, and to discourage people from travelling through the area while vegetation is re-establishing
- Routine monitoring programs (including watering schedule) should be considered to evaluate re-vegetation success

Introduction of Weeds

- A weed control plan should be developed in accordance to the number, density and species of weeds observed, as required
- Construction machinery will be cleaned prior to entering the project footprint to reduce the potential establishment or spread of existing weed species into the LAA
- Mechanical weed control will be employed to control continued establishment and spread of weed populations, especially on exposed soil, during construction and re-vegetation of the project footprint. Herbicides will not be used as a method to control weeds in the project footprint

8.6.3 Residual Environmental Effect Characterization

Residual effects to vegetation are described below.

Windthrow

Project activities related to windthrow can be mitigated through the implementation of mitigation measures noted. Therefore, the effect of windthrow is anticipated to be a low magnitude effect. The spatial extent should be limited to the local area. The duration of the effect is medium, as the total effect on perimeter trees can take time to manifest. The likelihood of a Project-related effect occurring is moderate, as there are multiple avenues that can lead to windthrow occurring.

Change in Species Diversity and Plant Community Distribution

There will be permanent and measurable change in species diversity through the loss of native vegetation through site preparation activities and the proposed Project infrastructure. The effect is considered a moderate magnitude effect, because although there will be loss of native vegetation, rare plants and communities are not anticipated to be affected. The spatial extent of the effect should be limited to the project footprint, which is already affected by the construction of the Edgemont outfall (0.58 ha) and manicured areas (0.22 ha). The remaining area is small (1.17 ha) and will be revegetated. The duration of the effect is long, as vegetation regeneration will take 16 years or more to replace existing mature vegetation. The likelihood of a Project-related effect occurring is high, because it is known that vegetation loss will occur as a result of the proposed Project.

Introduction of Weeds

Project activities related to earthworks are anticipated to increase the risk of an ingression of weeds or expansion of existing populations. The implementation of the re-vegetation plan and the appropriate ESC measures will aid in decreasing this effect. During and post construction monitoring of ESC measures and vegetation establishment will mitigate the loss of species diversity and will decrease weed ingression, as such, a low magnitude residual effect is anticipated.

The residual effect related to the introduction of weeds is anticipated to be a low magnitude effect. The spatial extent of the effect is local, as the residual effects should be limited to the LAA. If new weeds are introduced or expand from existing populations within the project footprint, despite the implementation of mitigations, it is possible that weeds could spread into the LAA. The duration of the effect, if it occurs, is anticipated to be long, but the introduction of weeds is considered to be of low likelihood given mitigation implementation.

8.7 WILDLIFE

The following sub-sections are the Project effects assessment related to wildlife.

8.7.1 Potential Environmental Effects and Effect Pathways

The potential effects to wildlife that may occur as a result of construction and operation of the Project are discussed below. Species of management concern and birds are grouped together because all of the species of management concern identified in the desktop and field data collection were birds.

Change in Habitat

Species of Management Concern and Birds

Site preparation activities including vegetation clearing and grubbing are anticipated to change habitats available to species of management concern occurring in the LAA. The removal of trees and shrubs could result in the direct loss of potential nesting and foraging habitat for least flycatcher, pileated woodpecker, and other forest birds. Similarly for sora and other wetland-associated birds, changes to instream flows associated with the installation of a larger aquatic culvert could reduce potential nesting habitat due to the change from a steady state wetland-type habitat to a habitat more characteristic of a lentic system. There are no direct habitat effects anticipated for barn swallow as a result of Project activities.

Indirect habitat change resulting from sensory disturbance associated with construction activities could potentially adversely affect habitat selection, for example species of management concern, and birds in general, may temporarily avoid active construction areas.

Mammals

Site preparation activities such as vegetation clearing and grubbing will change habitat for mammal VCs in the project footprint. There will be temporary loss of foraging habitat that will persist throughout the construction period. Indirect habitat change as a result of sensory disturbance and increased human presence may affect the use of habitat in the LAA, where mammals avoid habitats proximate to active construction sites. This is also anticipated to be temporary and limited to the construction period.

Beaver presence and evidence of beaver activity is well-documented within the Wedgewood Creek watercourse. As previously noted, beaver activity during the revegetation of the project footprint could result in damage or destruction to plantings, which could prolong the period of habitat change for species that use forested habitats to meet life requisites.

Amphibians

Change in habitat for amphibians in the project footprint will include change to terrestrial habitats as a result of site preparation and other construction activities, and also potential change to breeding habitat associated with the impounded area upstream of the 199 Street NW crossing. As with habitat changes mentioned with respect to wetland birds, changes to instream flows (potentially transitioning from the wetland-type habitat to a more dynamic stream-type habitat) could reduce the availability of suitable breeding habitat within the LAA. Boreal chorus frogs prefer to breed in non-flowing water. Further, potential changes to sedimentation and erosion associated with construction activity could decrease breeding habitat suitability, and potentially breeding success.

Change in Wildlife Movements

Species of Management Concern and Birds

The construction and operation phases of the Project are not anticipated to affect the movements of species of management concern or other birds in the LAA. Birds are highly mobile and are anticipated to move freely through the LAA and beyond throughout the construction and operation phases of the Project.

Mammals

Improving wildlife passage opportunities at Wedgewood Creek is an important facet of the Project rationale (Section 3.0). The proposed terrestrial wildlife passage system at this location (refer to Sections 3.1, 3.2 and 3.3 for a summary of the passages proposed) will improve terrestrial connectivity for wildlife within an important movement corridor, the Wedgewood Ravine. It is anticipated that after Project construction is complete, the Project will result in a positive effect to wildlife movements through improved terrestrial wildlife habitat connections relative to

baseline conditions for large, medium, and small mammals and amphibians (see Appendix B), and reduced mortality risk due to vehicle collisions.

During the construction phase it is likely that mammals will change their movement patterns to avoid the project footprint, particularly during daylight when active construction is occurring. This potential effect may be less pronounced at night, when construction activities have ceased for the day.

There is potential for asphalt pedestrian and the Edgemont outfall construction access road path users to influence wildlife use of the crossing structure. Peak user time of the pedestrian path is anticipate to be mostly confined to daytime and early evening whereas several wildlife species occurring in the LAA are mostly active at dusk, dawn, or during the night. For instance, the peak activity window of songbirds occurs around sunrise and sunset, ungulates are typically more active at dusk and dawn, and small mammals and nocturnal raptors are more active at night. These separated activity windows should reduce any potential barrier effect on wildlife caused by human disturbance during construction and operation. As well, the asphalt pedestrian path is deliberately separated from the 3 m wide wildlife path (Drawing L001-008 and -009, Appendix C) both physically and with the use of screen vegetation (refer to the Landscaping Brief (MMM Group Ltd. /WSP 2016, Appendix D) for details) to reduce the potential for pedestrians to use the wildlife paths and limit sensory disturbance to wildlife.

Landscaping materials will be installed at the Edgemont outfall access path entrance into the project footprint to physically deter public use. In addition, appropriate signage and additional fencing along 35 Avenue NW will be installed to further protect and educate the public from accidental use. Refer to Drawings L001-002 through 0112A and L001-015 through 017, Appendix C for additional details.

Amphibians

Amphibians require movements between aquatic and upland habitats to meet their life requisites for breeding, foraging, and overwintering. Boreal chorus frogs and wood frogs are present in the project footprint, and their movements in the project footprint are potentially negatively affected by construction activities including vegetation clearing, and other construction activities that result in exposed soils. However, a net benefit will result post construction as amphibians will now be able to move freely beneath 199 Street NW through the aquatic and mid-slope culverts.

Change in Mortality Risk

Species of Management Concern and Birds

Depending on the timing of the works, site preparation activities such as vegetation clearing and grubbing could result the increased risk of direct mortality of forest-dwelling birds, including species of management concern, in the project footprint. Increased mortality risk, in this case,

would be related to the potential for vegetation clearing activities to destroy active nests. Instream works that require the drawdown and dewatering of water pooled on the west side of 199 Street could potentially affect the mortality risk of birds using that pool for nesting, including species of management concern, such as sora.

Increased risk of indirect mortality related to sensory disturbance (increased vigilance, stress responses, increased flushing rates) via heavy equipment use and increased human presence in the project footprint has potential to affect bird nesting activities within the LAA, but outside the project footprint. Depending on timing of the Project activities, bird species nesting in the LAA could be initiating their nests while active construction is occurring. It may be that individuals initiating nests under these circumstances would be demonstrating a tolerance for sensory disturbance and therefore less likely to be negatively affected. It is also possible that nesting birds in the LAA could be negatively affected by sensory disturbance such that nest success is decreased.

Mammals

The project footprint occurs within a KWBZ, and vegetation clearing required to construct the Project is anticipated to alter the availability of thermal cover and forage for overwintering ungulates. Overwintering habitat is a life requisite for deer that may be present. As such, the removal of thermal cover and forage from overwintering habitat could potentially increase mortality risk for deer.

Small, medium, and large mammals could also incur increased mortality risk as a result of collisions with heavy equipment in the project footprint, and construction related traffic.

Other potential sources of increased mortality risk for mammals are related to excavation activities. For example, it is possible that excavating could disturb or destroy den sites for foxes or other smaller mammals.

Project activities during the construction and operations phases of the Project could also require the removal of individual beavers from the LAA. Beaver removal activities would directly increase beaver mortality risk in the LAA.

In the operation phase, the presence of the wildlife crossing structures are anticipated to result in a potential positive effect (i.e. reduction) in wildlife mortality risk, for small, medium, and large-sized mammal guilds due to reduced vehicular collisions. Re-vegetation in the project footprint (refer to Drawings L001-002 through 0112A and L001-015 through 017, Appendix C) will potentially provide thermal and forage opportunities for large mammals such that adverse effects would only occur over the period of regeneration.

Amphibians

The potential for increased mortality risk for amphibians would be related to vehicle-collision mortality with Project equipment, and the potential for instream work activities (de-watering) to destroy amphibian egg masses. Further, ruts or other depressions created in the project footprint could potentially fill with water and be used by boreal chorus frogs to lay egg masses. If the ruts dry out or are disturbed before the tadpoles emerge as juveniles, then it would represent forgone breeding effort and increased mortality due to Project activities.

8.7.2 Mitigation Measures

The following text lists mitigations by potential effect.

Change in Habitat

- Minimize native vegetation removal: previously disturbed areas should be used where ever possible, avoid clearing vegetated areas for storage/spill piles or other temporary use areas
- Pre-clearing wildlife surveys will be completed to identify habitat features that require mitigation
- Snow fencing will be installed at the clearing boundary of the project footprint, or other methods to demarcate the footprint boundary. The clearing of timber, stumps, brush, or any other vegetation outside footprint boundaries will be prohibited
- Contamination of wildlife habitat will be avoided by implementing spill control measures and the Spill Contingency Plan. Adhere to clean-up and remediation standards. Spills should be reported to the 24-Hour Alberta Environmental Hotline at 1-800-222-6514 and other applicable agencies. The City of Edmonton reporting requirements will be followed when reporting spills
- Construction activities associated with the Project should be restricted to specific hours as per the City of Edmonton's Community Standards Bylaw 14600
- Noise abatement measures will be implemented, where applicable
- Native materials (trees, shrubs, forb and grasses) have been used in the landscaping plan (detailed in Drawings L001-007 through 0112A and L001-015 through 017, Appendix C), to help replace lost vegetation from the cleared areas and promote wildlife passage (Refer to the Landscaping Brief (MMM Group Ltd./WSP 2016, Appendix D) for details)

Change in Wildlife Movements

- Construct wildlife passage structures as detailed in Section 3.0
- Reduce the extent of vegetation clearing and duration of construction activities to the extent possible
- Where feasible, the time between trenching and backfill operations will be reduced to minimize hazards to wildlife and facilitate free movement
- Open trenches will be monitored for trapped wildlife and the Construction Manager will be informed if trapped wildlife is observed

- Install native plantings, landscaping materials and fencing pursuant the Landscaping Brief (MMM Group Ltd./WSP 2016, Appendix D) to promote greater use of the wildlife structures and minimize human interactions (Detailed in Drawings L001-007 through 0112A and L001-015 through 017, Appendix C)
- Wildlife crossing and wildlife fence maintenance requirements to be assessed annually, and where necessary maintenance activities will be implemented by City of Edmonton

In addition, the following has also been included (refer to Drawings L001-007 through 0112A and L001-015 through 017, Appendix C for details):

- The animal pathways will be vegetated with a native seed mix appropriate for the creek valley system so that animals have a soft and familiar terrain to travel and to negate any erosion concerns. In addition, biodegradable erosion control matting shall hold the soil and seed in place until vegetation is established. Over time its degradation will add additional organics to the soil and growing plant material
- Drainage swales to capture surface runoff from 199 Street NW also drain into the creek valley. To avoid conflicts with the wildlife pathways and overland drainage, cobbles will be placed upslope of the animal pathways to slow and disperse runoff captured by the swale systems. By avoiding cobble/riprap placement on the animal pathways, their movement is encouraged with one continuous grassed surface along the pathway. Rather than providing a rocked surface through the pathway, which is known to provide a barrier to animal movement, wet conditions from overland flows are more favorable. With the erosion matting in place until vegetation establishment, overland flows should be slowed and dissipated as they move over the vegetated surface
- Qualico Communities is already proceeding with interpretive and way-finding signage in the Riverview/Balsam Woods communities. Due to the important habitat value provided by Wedgewood Creek and the associated valley system as a wildlife corridor and habitat refuge, signage will also be located within the project footprint. The signage proposed would be a combination of educational and warning signage to help aid in deterring the public from disturbing the area

In a winter site visit (January 21, 2016)with City of Edmonton Urban Ecology and Drainage Departments, members of the design team, and CA officials, concerns with an existing access to the creek basin from 34th Avenue NW were identified. While it is not a maintained access (previously temporary construction access for the Edgemont outfall) its continual use by local residents could have negative effects on the proposed Project. In addition, it may entice wildlife into developed areas along Edgemont Boulevard/35 Avenue NW, where they could come into conflict with traffic and people. To reduce these impacts and address the concerns brought forward by CA officials, the following will also be undertaken (Drawings L001-007 through 0112A and L001-015 through 017, Appendix C):

- Expanding the restoration limit of the wildlife passage system to include additional native plantings in the Wedgewood Creek floodplain at the lower slope of the previous Edgemont outfall construction access
- Strategically place large boulders and harvested felled trees from within clearing limits of the project footprint to add to an undisturbed aesthetic and the appearance of a more difficult egress in order to make it less appealing to local residents
- Selective placement of additional wildlife fence to help deter wildlife from making their way up this pathway and also to deter the public from accessing the wildlife passage area

Change in Mortality Risk

- Construction will not be conducted during the KWBZ restricted activity period (January 15 to April 30), where possible
- Where feasible, clearing activities will be avoided during the restricted activity period (RAP) for migratory birds (April 26 to August 16). If warranted, additional RAPs will be described by a Professional Biologist
- If clearing and brushing activities cannot be avoided during the migratory bird RAP, conduct a nest clearing survey to identify active nests and reduce the risk of Project-related incidental take
- Avoid dewatering during amphibian breeding period (May through August) if tadpoles or egg masses are present
- Implement bird and bat passage mitigations detailed in the landscape plan (Appendix C)
- If beaver removal is required, appropriate city officials will be contacted for animal removal

8.7.3 Residual Environmental Effect Characterization

The residual adverse effects on wildlife due to the Project are low and of a moderate magnitude effect. There will be measurable changes to habitat, wildlife movements, and mortality risk primarily related to Project construction activities and during the maturation phase of the proposed landscaping plantings.

Given the small size of the Project in relation to the extent of Wedgwood Creek, and the improvements to wildlife passage, and instream flows expected during the operations phase, the Project will confer some positive effects to some affected wildlife guilds. For example, the effect on wildlife movements is positive in the operations phase of the Project, particularly for large- and medium-sized mammals because the wildlife crossing structures and associated landscaping proposed will promote a safe movement corridor for species using the Wedgewood Ravine to meet their life requisites. This positive effect on wildlife movements is anticipated to extend beyond the LAA. For example, ungulates are capable of moving over large areas and they are likely to travel relatively large distances and utilize the large terrestrial passage structure.

Low magnitude effects to habitat in the LAA are anticipated as a result of Project construction activities, and to a lesser extent Project operations. Habitat effects, including sensory

disturbance and human interactions, are anticipated to be limited to the LAA, and long in duration (i.e. the time required for mature forest to regenerate and wildlife to habituate to human presence), and of high-likelihood.

Project activities are anticipated to increase the risk of wildlife mortality during the construction period. Mortality risk will be reduced by implementing mitigations such as restricted activity periods for migratory birds, and the KWBZ. A pre-clearing survey to detect potential den sites could reduce mortality risk for medium –sized mammals such as red fox. Mortality risk during the operations phase is anticipated to result primarily from vehicle collisions with wildlife, but the terrestrial passage system, wildlife fencing, combined with landscaping mitigations designed to reduce bird collisions and enhance the wildlife use of the site, should reduce this risk to levels lower than baseline, with a positive direction residual effect.

8.8 PUBLIC AND WORKER SAFETY

The following sub-sections are the Project effects assessment related to public and worker safety.

8.8.1 Potential Environmental Effects and Effect Pathways

The potential effects to public and worker safety are anticipated occur as a result of Project construction activities, through unsafe interactions with an active construction site. For example, potential interactions with physical hazards related to heavy equipment operation, construction-related traffic, or open excavations could cause physical harm to members of the public or workers.

8.8.2 Mitigation Measures

Mitigations measures to reduce residual effects to human safety are as follows:

- A comprehensive health and safety plan outlining the hazards and controls should be created to ensure consistency among different contractors should be developed and implemented
- Construction contractors will be required to develop and implement a Project-specific health and safety plan. The plan will include provisions for hazard identification, safe work practices, communications planning, and emergency response
- A comprehensive hazard assessment of each aspect of the Project construction activities should be conducted to ensure all hazards are identified and controlled
- Workers will be instructed to stop work if unsafe circumstances are encountered
- Personal protective equipment appropriate to the task and hazards identified should be worn by all people on site
- Measures to exclude the general public from entering the construction site should be developed and implemented
- Activities located across slopes should be monitored and designed to engineered specifications to maintain slope stability

- Workers should not feed or harass wildlife
- Waste products should be stored in secure containers and transported to appropriate facilities during construction
- Wildlife-resistant garbage bins should be installed along trails
- Construction activities during times of elevated fire hazard ratings should be minimized, and all vehicles should be equipped with basic firefighting equipment
- During construction, access to the site will be limited to those directly involved in the development, and those with training regarding the dangers of working near large machinery and adjacent to excavated areas
- Road closures will be implemented during the construction phase
- Install appropriate safety measures such as curb ramps (C200-003, Appendix C), left and right lane separation (C200-004, Appendix C), (hand rails (Drawings C200-003 and S001-012, Appendix C) safety rails (S001-017, S001-018, and S001-019, Appendix C) grating covers (S001-019, Appendix C) to prevent harm to the public utilizing the road and the crossing

8.8.3 Residual Environmental Effect Characterization

After the implementation of mitigations, the residual effect of Project construction activities on members of public and workers is a low-magnitude effect. Adverse effects to public and worker safety are not anticipated due to the development and implementation of the Project-specific health and safety plan and the safety details worked into the overall design. The spatial extent of the effect is the project footprint, and the duration is short as it is limited to the duration of construction activities. With the implementation of the noted mitigations, the likelihood is low.

8.9 AESTHETICS

The following sub-sections are the Project effects assessment related to aesthetics.

8.9.1 Potential Environmental Effects and Effect Pathways

All construction activities associated with the Project will result in changes to the visual setting within the LAA during construction, between construction seasons and post-construction during re-vegetation. Native vegetation removal will occur in the project footprint, and cleared areas will be re-vegetated after the crossing structures are installed and the road construction is complete. Heavy machinery and earthworks will occur over a period of approximately 21 months, and during this time the visual setting may be adversely affected for local residents or commuters. The presence of the crossing structures and associated design elements will change the visual setting at the 199 Street NW/Wedgewood Creek crossing in the long term. Whether or not the presence of the crossing structures or associated design elements will be considered an adverse or positive effect to the visual setting is subjective, and is ultimately the opinion of the viewer.

8.9.2 Mitigation Measures

Mitigation measures to reduce adverse effects to the aesthetics of the project footprint are:

- Reduce the extent of vegetation clearing and duration of construction activities to the extent possible
- Execute the detailed re-vegetation plan (detailed in Drawings L001-007 through 0112A and L001-015 through 017, Appendix C) as soon as possible

8.9.3 Residual Environmental Effect Characterization

Adverse effects to aesthetics associated with Project construction will be limited to the construction phase of the Project (i.e. short duration). The spatial extent of the effect is the project footprint. The implementation of the landscaping and re-vegetation plan (Appendix C) will reduce the residual effect to low magnitude. The likelihood of an effect is high.

9.0 RECOMMENDATIONS

All mitigation measures detailed within Section 8.0, the recommendations within the various technical supporting documentation, and detailed in the design package should be followed. In addition, the following should be considered:

- Ensure that all provincial, federal and municipal legislative requirements have been met, that contractors have read all approvals, and that copies of all approvals are present on site during construction
- A mitigation plan to manage for the potential impacts that beaver activity could have on the Project should be developed by the contractor prior to construction
- A frac out plan should be developed for the gas line directional drill
- An environmental construction and operations plan should be developed by the contractor, due to the complexity of this Project

10.0 LIMITATIONS AND QUALIFICATIONS

In conducting the investigation and rendering our conclusions, Stantec gives the benefit of its best judgment based on its experience and in accordance with generally accepted professional standards for this type of investigation. This report was submitted with the best information to date and on the information provided. The conclusions made within this report are a professional opinion, not a certification of the assessment area's environmental condition, no other warranty, expressed or implied is made. This report has been prepared for the exclusive use of the Client for the purposes of assessing the residual effects of the Project. Any use which any third party makes of this report, or any reliance on or decisions to be made on it, are the responsibility of such third parties. Stantec accepts no responsibility for damages, if any, suffered by any other third party as a result of decisions made or actions based on this report. Our conclusions are limited by the following:

- All field work conducted by Stantec were completed during the dates and times specified, conditions may vary outside that time
- All baseline information from third party sources were completed during the dates and times specified in those reports. The data used has only been summarized; no augmentations, enhancements or manipulations have been undertaken within this report
- The information contained within this report is based on the information provided to date by various agencies and the design drawings available at the time of report preparation
- Should the drawings be amended in the future, revisions to the report may be required
- The investigation was limited to those parameters specifically outlined in this report

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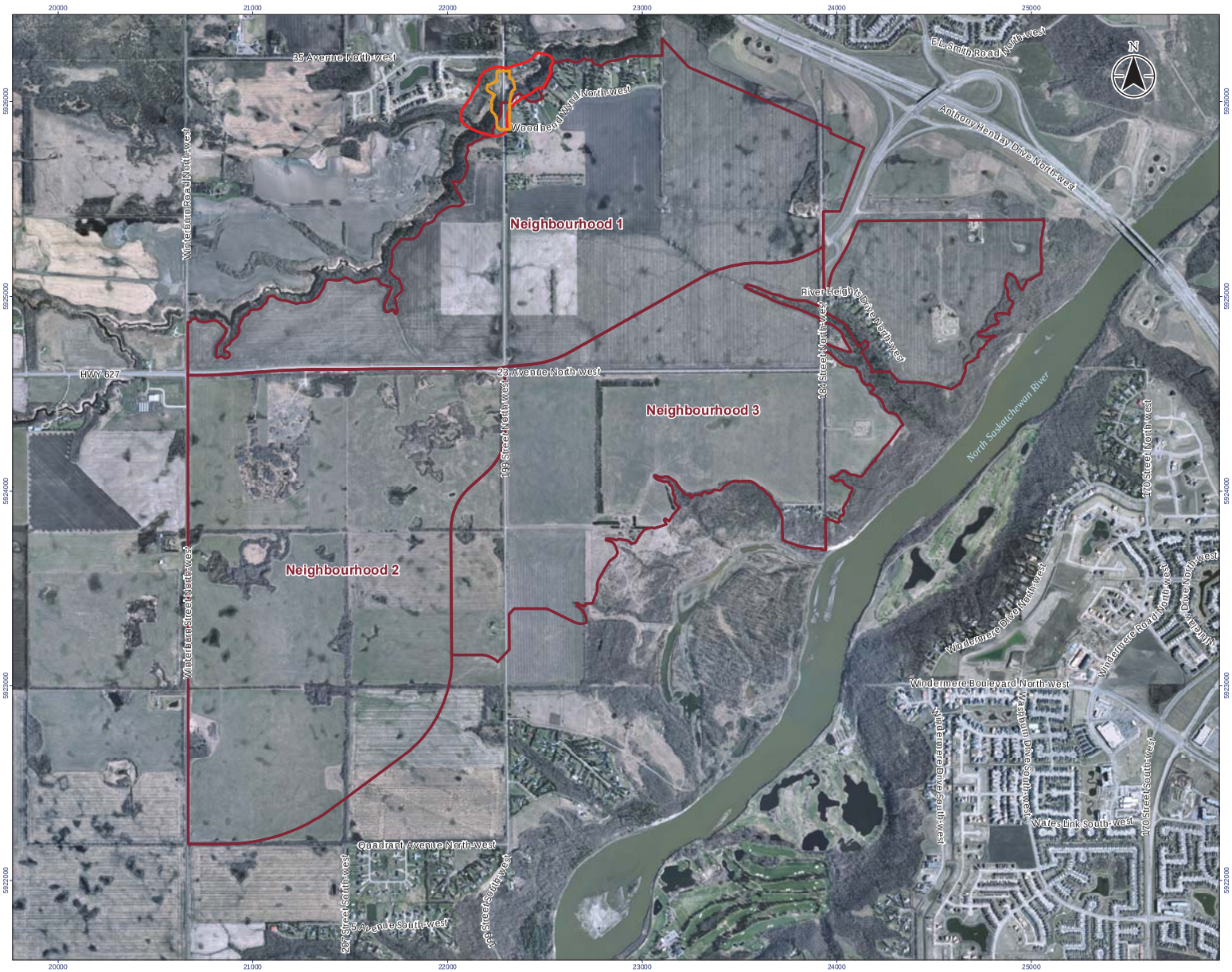
APPENDIX A
FIGURES



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- Project Footprint
- Local Assessment Area (LAA)
- Regional Assessment Area (RAA)
- Quarter Section

0 400 800 metres

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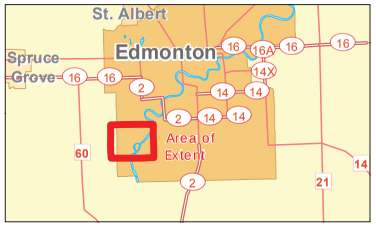
Notes

1. Coordinate System: NAD 1983 3TM 114
2. Base features: Geogratis, ©Department of Natural Resources Canada, All rights reserved.
3. Imagery: City of Edmonton Transportation, 2014



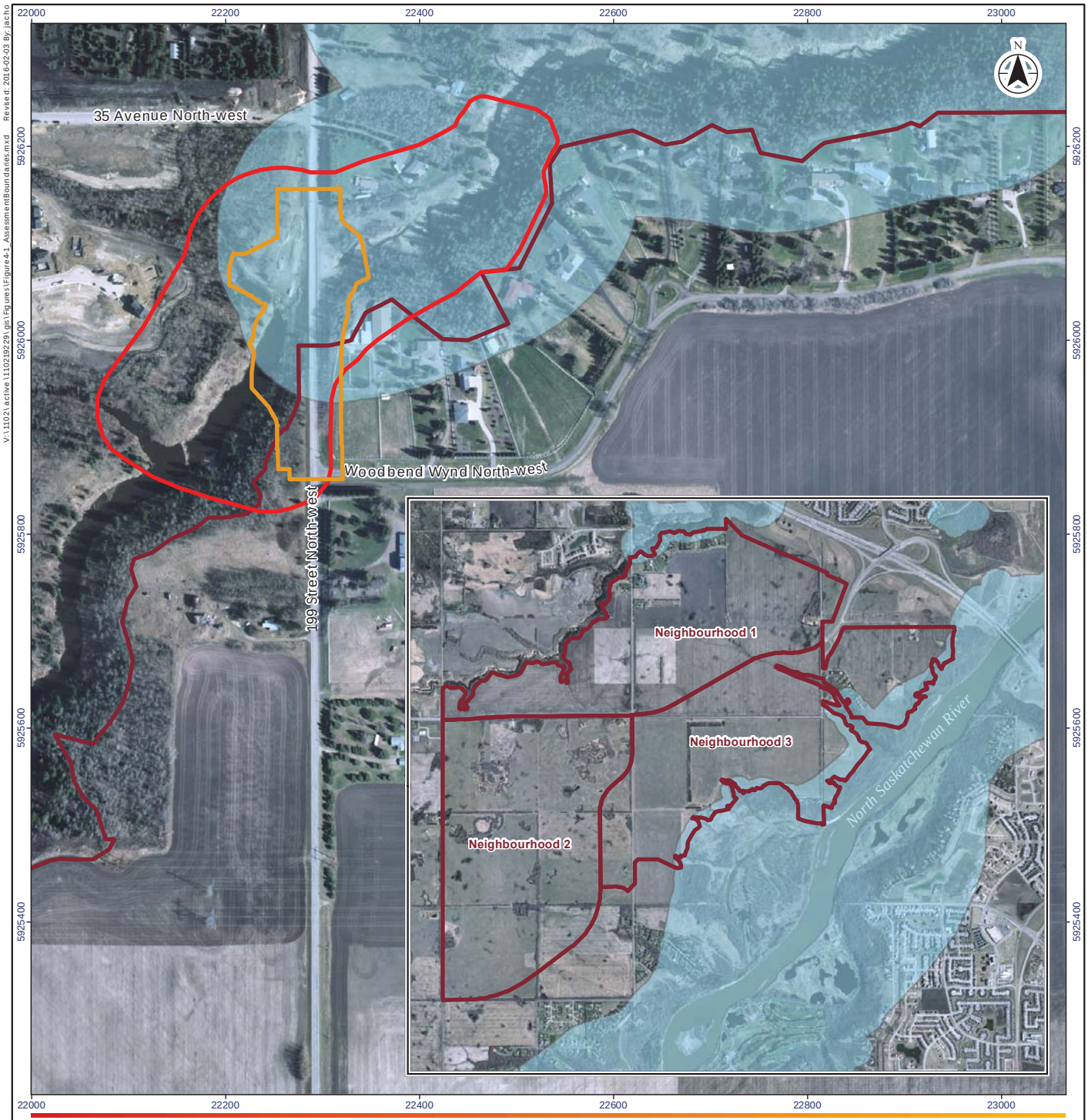
Project Location
NE¼ 06-052-25 W4M
NW¼ 05-052-25 W4M
Edmonton, Alberta

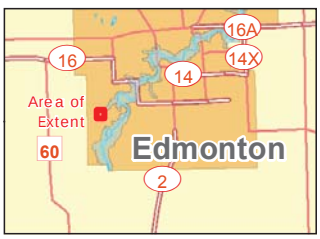
1102-19229
Prepared by MK on 2015-04-29
Review by JC on 2015-04-29

Client/Project
Riverview Owners Group
199 Street Road Widening at Wedgewood Creek

Figure No.
1-1

Title
Site Location Plan





- Project Footprint
- Local Assessment Area (LAA)
- Regional Assessment Area (RAA)
- Key Wildlife and Biodiversity Zone (KWBZ)

0 100 200 metres

1:6,000 (at original document size of 8.5x11)

Stantec

Notes

1. Coordinate System: NAD 1983 3TM 114
2. Base features: Geogratis, ©Department of Natural Resources Canada, All rights reserved.
3. Imagery: City of Edmonton Transportation, 2014
4. Key Wildlife and Biodiversity Zones: Alberta Environment and Sustainable Resource Development, Government of Alberta, Edmonton, Alberta, 2010

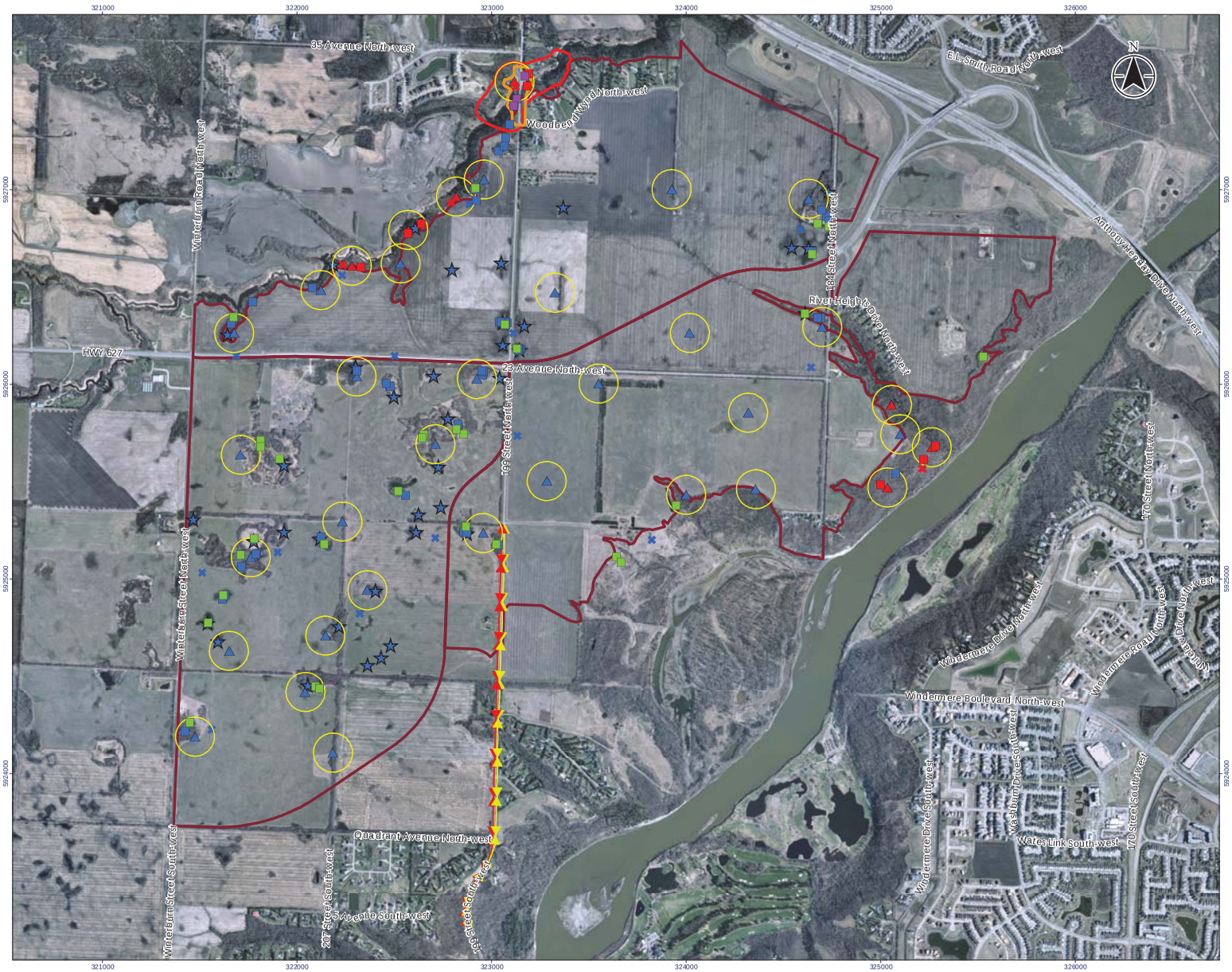
Project Location
NE¼ 06-052-25 W4M
NW¼ 05-052-25 W4M
Edmonton, Alberta

1102-19229
Prepared by MK on 2015-04-29
Review by JC on 2015-04-29

Client/Project
Riverview Owners Group
199 Street Road Widening at Wedgewood Creek

Figure No.
4-1

Title
Assessment Boundaries



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- Bird Survey Site (2014)
- Bird Survey Site (2013)
- Amphibian Survey Site (2014)
- Amphibian Survey Site (2013)
- Boreal Chorus Frog Observation (2013)
- Rare Plant Survey Site (August 2015)
- Rare Plant Survey Site (June 2014)
- Rare Plant Survey Site (Fall 2013)
- Rare Plant Survey Site (Spring 2013)

Snow-tracking Survey (2013)

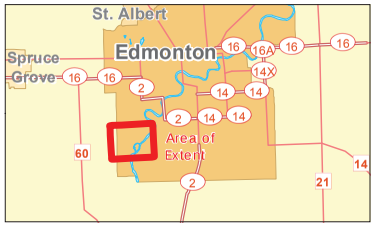
- Transect Segment East
- Transect Segment West
- Project Footprint
- Local Assessment Area (LAA)
- Regional Assessment Area (RAA)
- 100 m Bird Detection Radius

0 400 800 metres

1:20,000 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 UTM Zone 12N
2. Base features: Geogratis, ©Department of Natural Resources Canada, All rights reserved.
3. Imagery: City of Edmonton Transportation, 2014



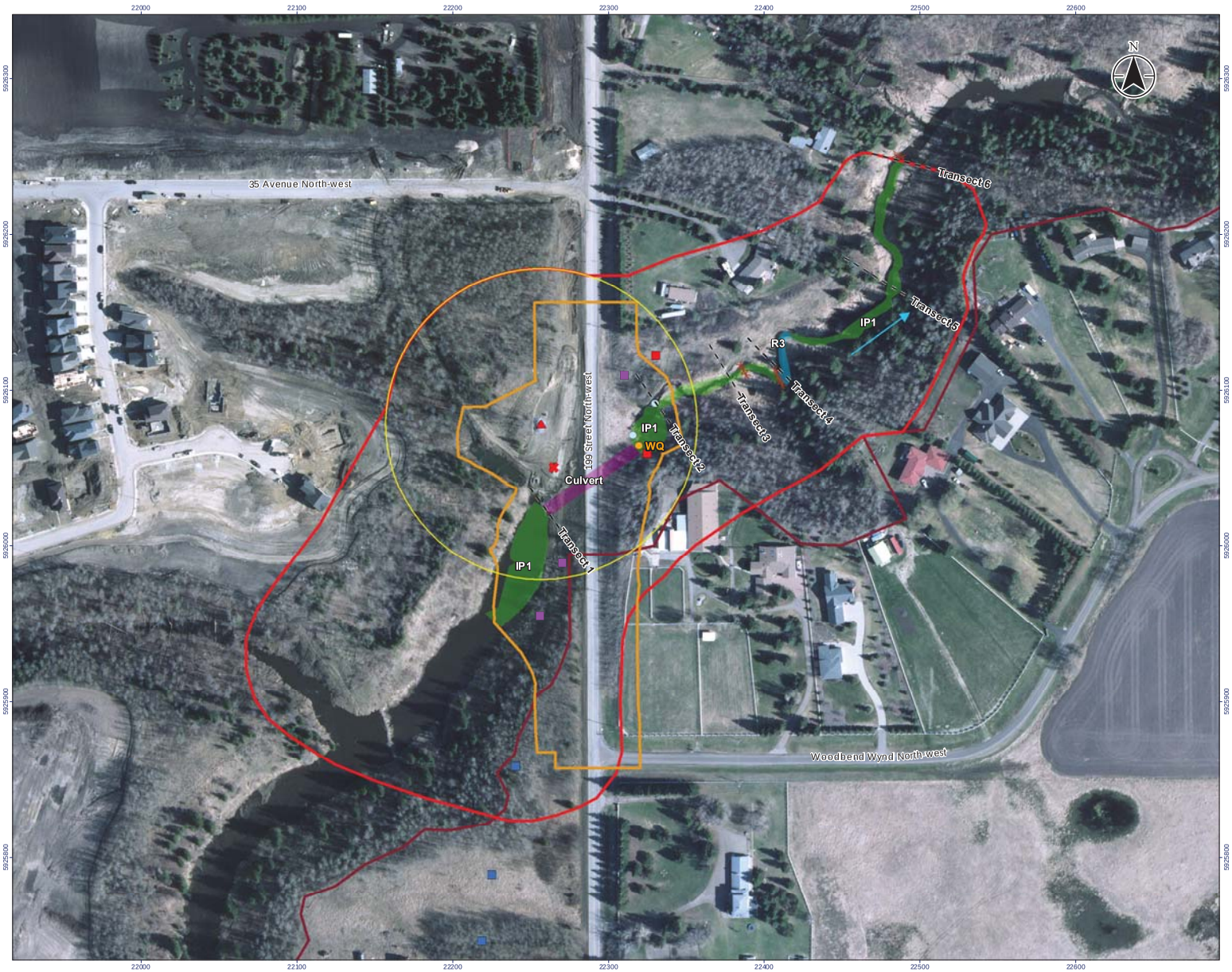
Project Location
NE¼ 06-052-25 W4M
NW¼ 05-052-25 W4M
Edmonton, Alberta

1102-19229
Prepared by MK on 2015-04-29
Review by JC on 2015-04-29

Client/Project
Riverview Owners Group
199 Street Road Widening at Wedgewood Creek

Figure No.
5-1

Title
Biophysical Field Survey Locations in RAA



Stantec

- Electrofishing Site
- Water Quality Sample Site
- Bird Survey Site (June 2014)
- Amphibian Survey Site (June 2014)
- Rare Plant Survey Site (August 2015)
- Rare Plant Survey Site (June 2014)
- Rare Plant Survey Site (Spring 2013)
- Beaver Dam
- Flow Direction
- Transect
- Project Footprint
- Local Assessment Area (LAA)
- Regional Assessment Area (RAA)
- 100 m Bird Detection Radius

Habitat Unit*

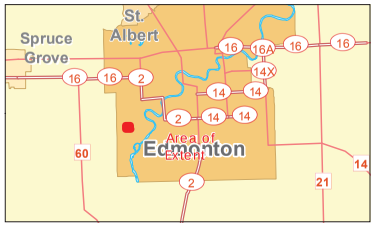
- Impoundment (IP1)
- Culvert
- Run (R3)

0 50 100 metres

1:2,500 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 3TM 114
2. Base features: Geogratis, ©Department of Natural Resources Canada, All rights reserved.
3. Imagery: City of Edmonton Transportation, 2014



Project Location
NE¼ 06-052-25 W4M
NW¼ 05-052-25 W4M
Edmonton, Alberta

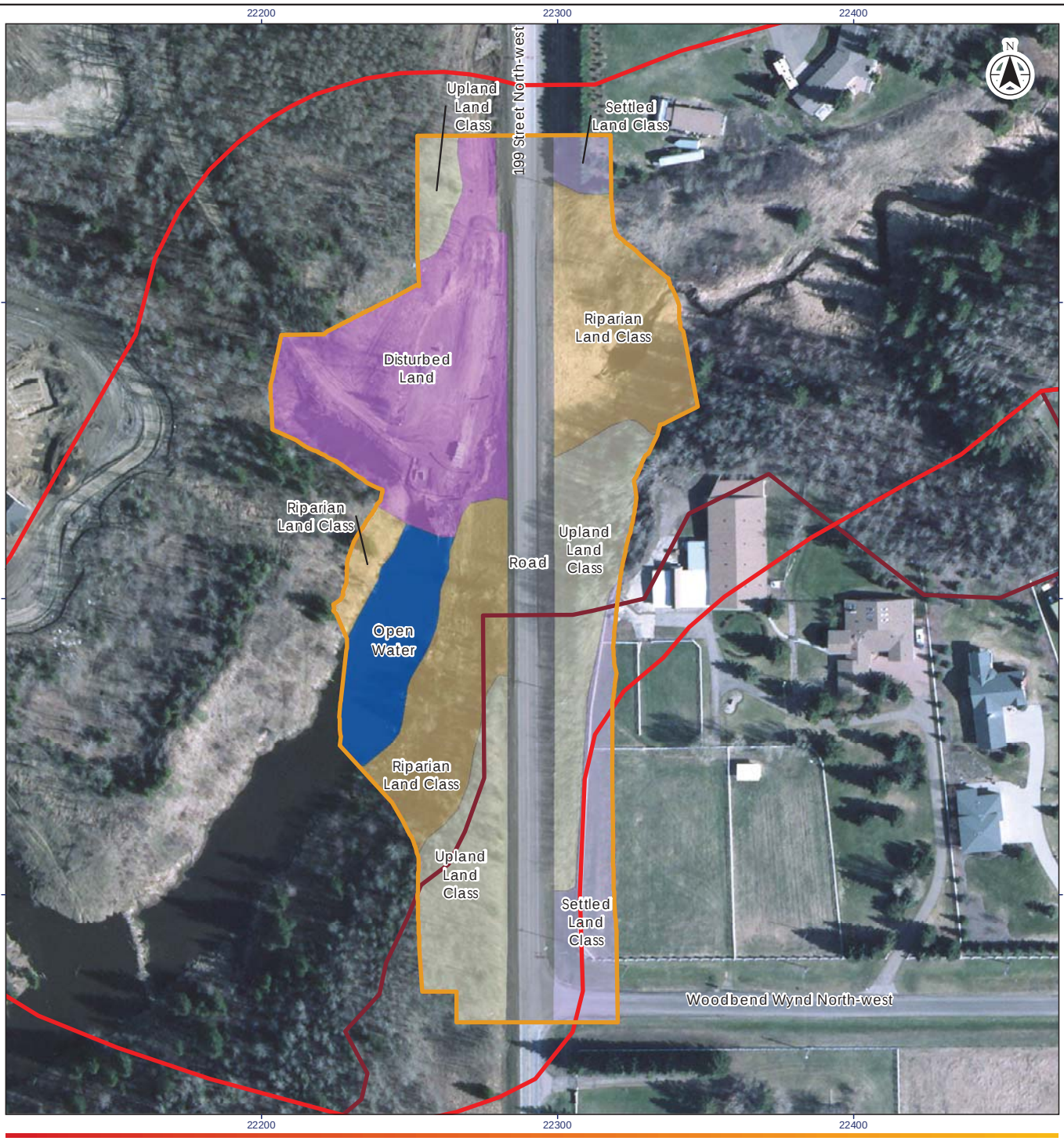
1102-19229
Prepared by MK on 2015-04-29
Review by JC on 2015-04-29

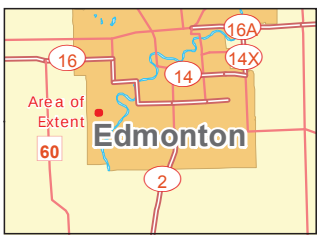
Client/Project
Riverview Owners Group
199 Street Road Widening at Wedgewood Creek

Figure No.
5-2

Title
Biophysical Field Survey Locations in LAA

J:\1102\active\1102019229\gis\figures\figure5-2_BiophysicalFieldSurveyLocs_LAA.mxd Revised: 2015-05-15 By: jkchin





Project Footprint
Local Assessment Area (LAA)
Regional Assessment Area (RAA)

Land Class
- Disturbed Land
- Open Water
- Riparian
- Road
- Settled
- Upland

0 20 40 60 metres

1:2,000 (at original document size of 8.5x11)

Notes
1. Coordinate System: NAD 1983 3TM 114
2. Base features: Geogratis, ©Department of Natural Resources Canada, All rights reserved.
3. Imagery: City of Edmonton Transportation, 2014

Stantec

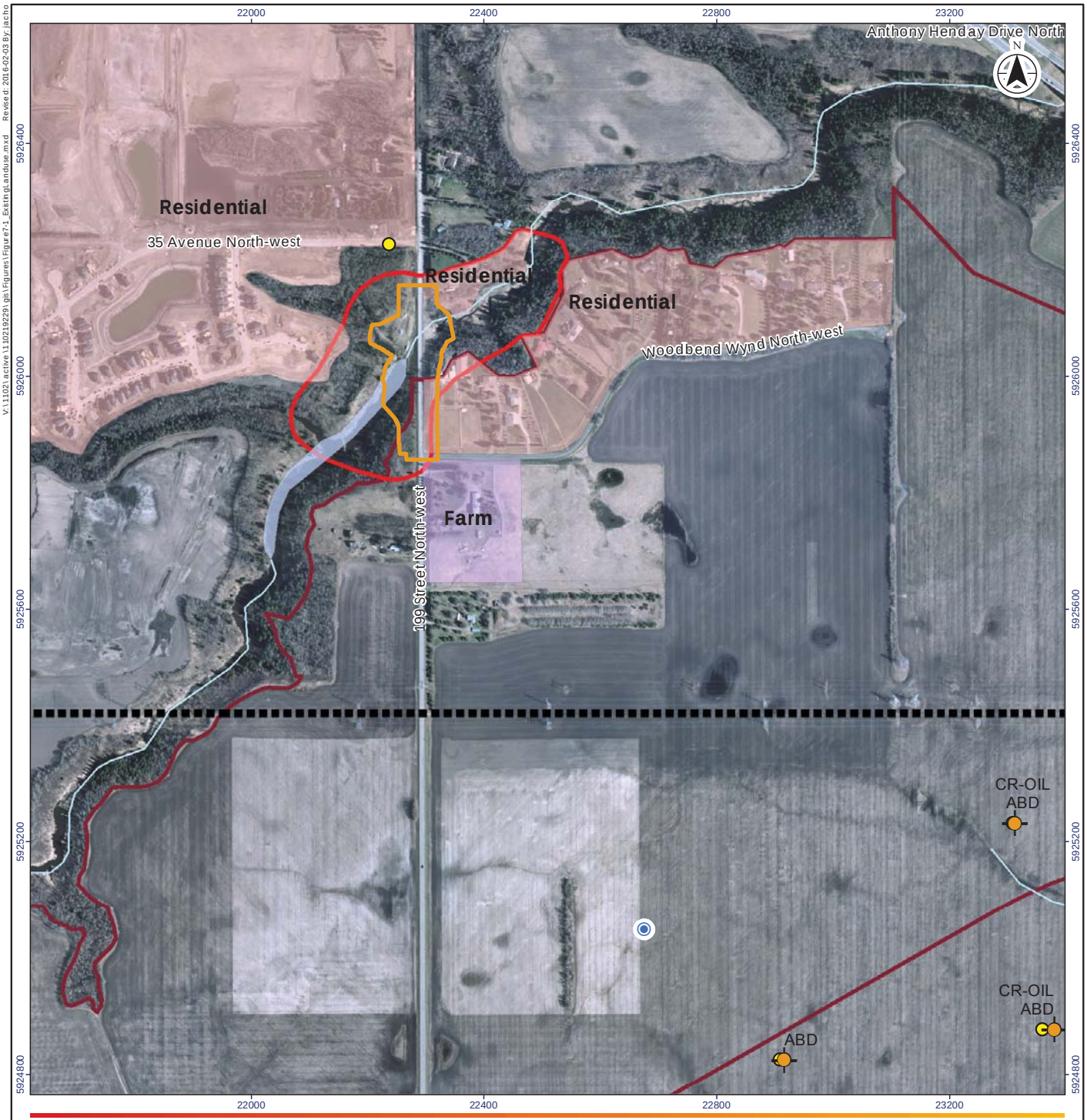
Project Location
NE¼ 06-052-25 W4M
NW¼ 05-052-25 W4M
Edmonton, Alberta

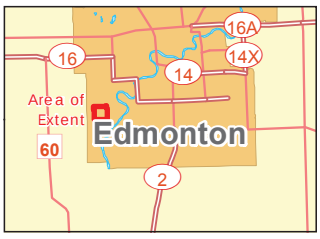
1102-19229
Prepared by MK on 2015-04-29
Review by JC on 2015-04-29

Client/Project
Riverview Owners Group
199 St Road Widening at Wedgewood Creek

Figure No.
6-1

Title
Vegetation Communities





- Abandoned Wellhead
- Well
- Reclamation Certificate Site (ESAR)
- Power Line Altalink
- Watercourse
- Project Footprint
- Local Assessment Area (LAA)
- Regional Assessment Area (RAA)

ESAR - Environmental Site Assessment Repository
EUB - Energy and Utilities Board

Land Use
- Farm
- Residential
- Waterbody

0 100 200 300 metres
1:10,000 (at original document size of 8.5x11)

Notes
1. Coordinate System: NAD 1983 3TM 114
2. Base features: Geogratis, ©Department of Natural Resources Canada, All rights reserved., Allberta Environment and Parks
3. Imagery: City of Edmonton Transportation, 2014

Stantec

Project Location
NE¼ 06-052-25 W4M
NW¼ 05-052-25 W4M
Edmonton, Alberta

1102-19229
Prepared by MK on 2015-04-29
Review by JC on 2015-04-29

Client/Project
Riverview Owners Group
199 Street Road Widening at Wedgewood Creek

Figure No.
7-1

Title
Existing Landuse

APPENDIX B
199 STREET NW CONCEPT PLAN BRIEF

Riverview Ownership Group

199 Street Concept Planning Report

23 Avenue NW to 35 Avenue NW

Final Submission

February 2015

E00540A

CIMA+

Partners in excellence

Riverview Ownership Group

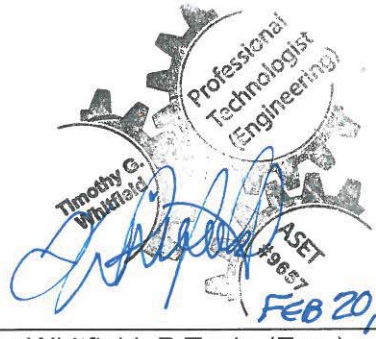
199 Street Concept Planning Report

23 Avenue NW to 35 Avenue NW
Final Submission

Project No. E00540A

Prepared by : FEB 20, 2015

Glen Campbell, P.Eng.



Verified by : FEB 20, 2015

Tim Whitfield, P.Tech. (Eng.)

CIMA+
4th Floor, 10235 – 101 Street
Edmonton, AB T5J 3G1

February 2015

E00540A

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E00540A

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Appendix I Environmental Noise Impact Assessment
Appendix J Conceptual Bridge Planning Report & Additional Communications
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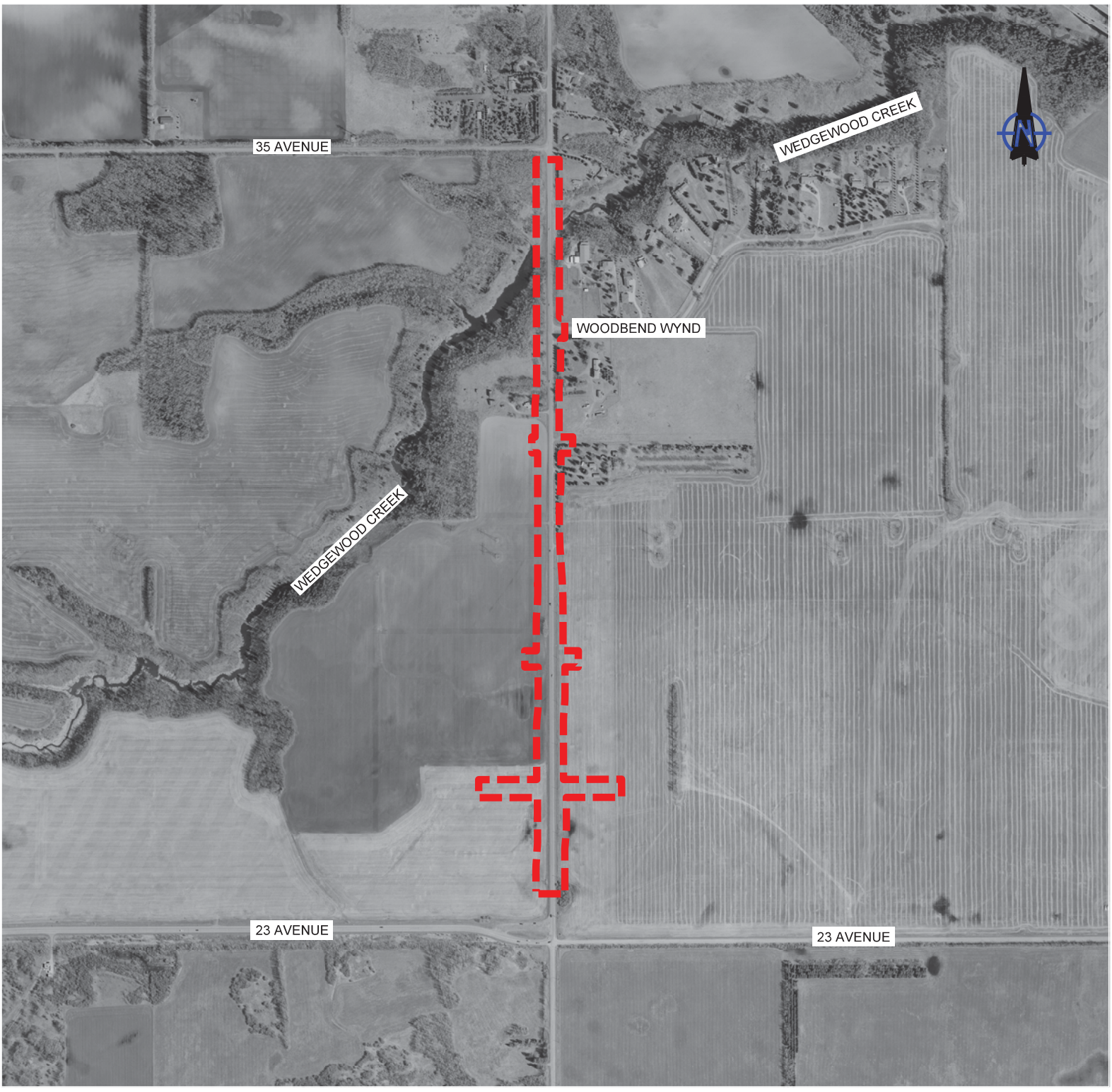
1. Introduction and Overview

The Riverview Ownership Group retained CIMA+ to develop a concept plan along 199 Street between 23 Avenue and 35 Avenue to support their current development plans for the Riverview Neighbourhood 1 area. The concept plan drawing set has been included in **Appendix A**.

Concept plans for 23 Avenue are currently being developed by the City of Edmonton's planning group. The concept plan north of 35 Avenue was completed by Stantec and approved by the City of Edmonton. These existing plans include a four land divided arterial cross section along 199 Street as shown in **Appendix B**. CIMA+ has worked with the City of Edmonton's Transportation Planning Branch in developing this concept plan.

The study corridor included in this concept plan is bounded to the south by 23 Avenue and to the north by 35 Avenue as shown in *Figure 1*. A copy of the development concept has been included as *Figure 2*. Within the study corridor, there are two new proposed collector roadway intersections, one new proposed commercial intersection, the existing Woodbend Wynd intersection and the Wedgewood Creek ravine crossing. The total length of the project is approximately 1.6 km.

This report summarizes the design process on the development of the Arterial Roadway Conceptual Plan for 199 Street between 23 Avenue and 35 Avenue.



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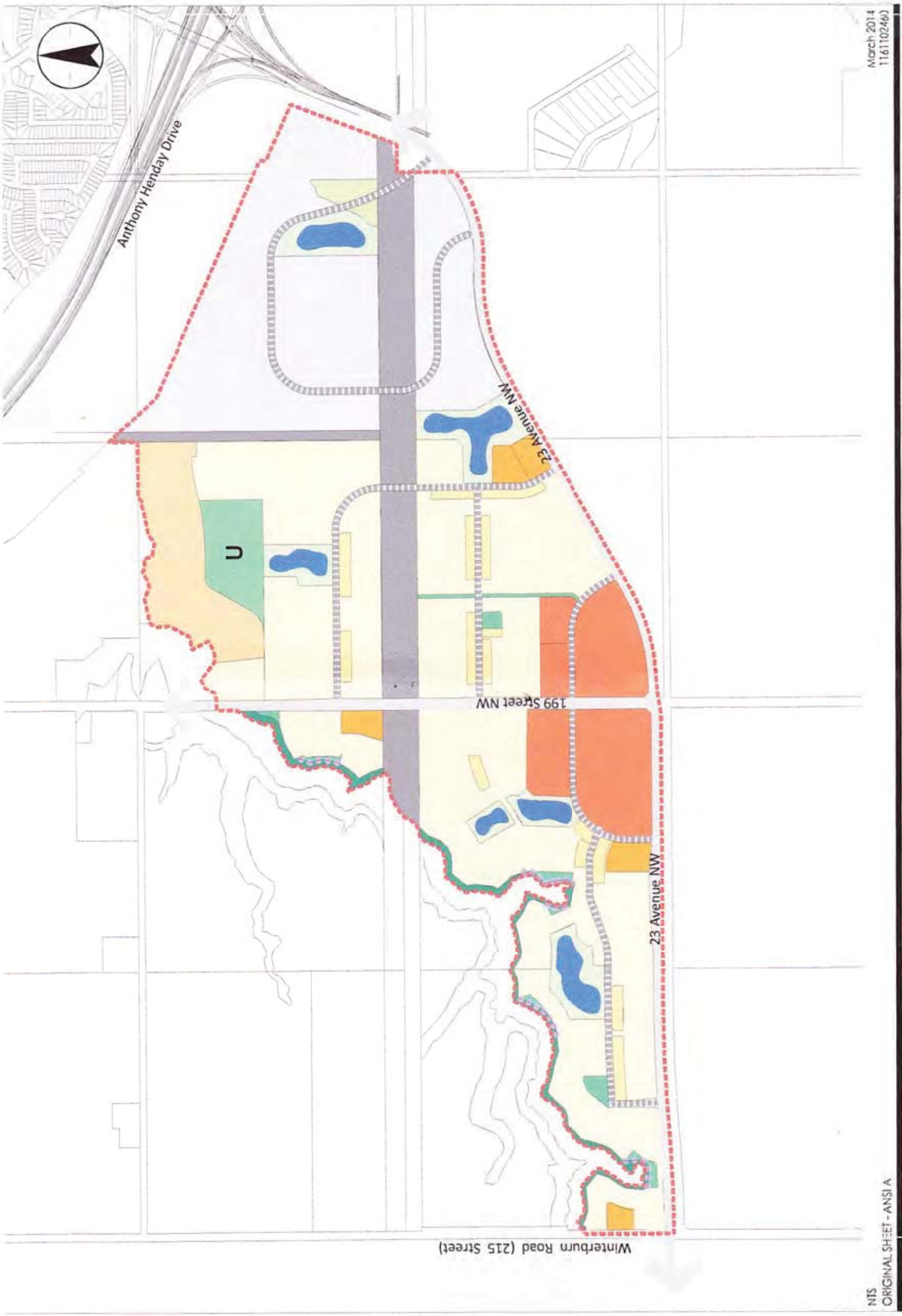
199 STREET
35th AVENUE TO 23rd AVENUE

STUDY LIMITS

Figure 1.0



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199 STREET
35th AVENUE TO 23rd AVENUE

DEVELOPMENT CONCEPT PLAN

Figure 2.0

2. Project Evaluation

2.1 Conditions

2.1.1 Land Ownership

Land owners surrounding the concept plan area are summarised in *Table 1* below.

Table 1 – Land Ownership

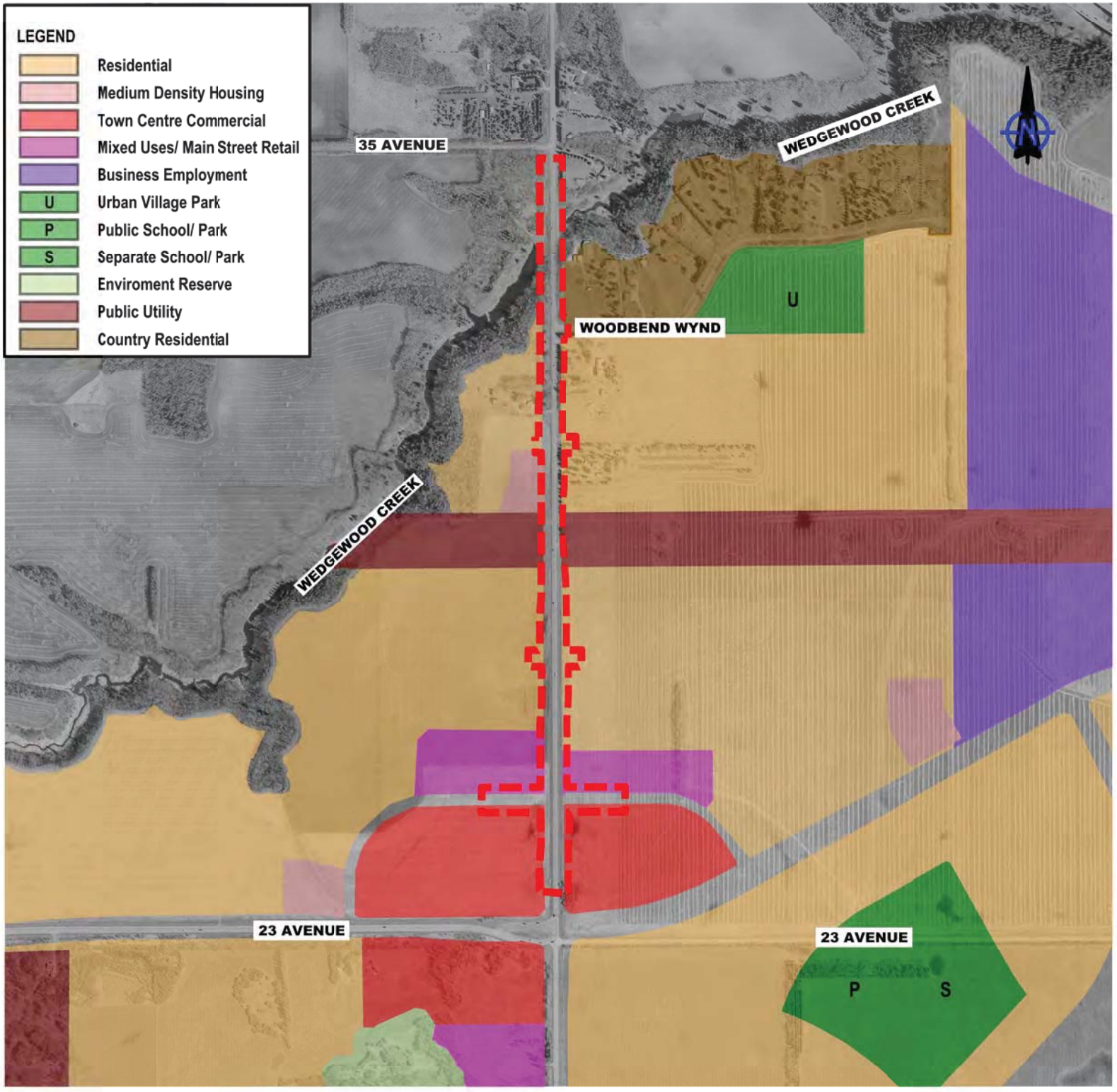
Legal Description	Landowner
NW 5-52-25-4 Plan 716TR, Block 19	Melcor Developments Ltd.
SE 6-52-25-4	Altalink Management Ltd.
SW 5-52-25-4 Plan 822 1585	Altalink Management Ltd.
NW 1-52-25-4 N 4-25-52-2 N 3-52-25-4 NE 5-52-25-4 NE 6-52-25-4 Plan 1225KS; RW; 52	Altalink Management Ltd.
NE 6-52-25-4 Plan 1225KS Plan 1067RS Plan 1068RS Plan 1124680	Walton International Group Inc.
NW 5-52-25-4 Plan 5629RS, Block C	Terry and Lynn Szott
NE 6-52-25-4 Plan 132 0806, Block 17, Lot 66ER	The City of Edmonton
NE 6-52-25-4 Plane 132 0806, Block 17, Lot 67MR	The City of Edmonton
SE 6-52-25-4	Riverview Heights Estates Ltd.
SW 5-52-25-4	Riverview Land Company Ltd.
NW 5-52-25-4 Plan 802 1161, Block 1, Lot 1A	Gerard Jean Paul and Helga Siglinda Levasseur

Legal Description	Landowner
NW 5-52-25-4 Plan 5629RS, Block R2	The City of Edmonton
NW 5-52-25-4 Plan 4862NY, Block A	Melcor Developments Ltd.
NW 5-52-25-4 Plan 5476NY, Block B	Kate Marienne Lueders

2.1.2 Existing and Proposed Land Use

The existing lands along the 199 Street corridor are currently primarily rural in nature and used for agricultural activities. There are three existing Altalink transmission lines crossing 199 Street that are located in the Public Utility lands. There are existing country residential lots adjacent to 199 Street on the Woodbend Wynd roadway. The proposed land use surrounding the 199 Street corridor are zoned Residential, Town Center Commercial, Mixed Use, Existing Country Residential and Public Utility, as shown in *Figure 3*.

Further out from the immediate study area zoning includes: Main Street Retail, Business Employment, Urban Village Parks, Public School/Park, Separate School/Park, and Environmental Reserve.



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199 STREET
35th AVENUE TO 23rd AVENUE

PROPOSED ZONING AND LAND USE

Figure 3.0

2.1.3 Traffic Volumes

Existing traffic volumes from 2011 as shown in Riverview Area Structure Plan Traffic Impact Assessment (April 2013) indicate that the approximately Average Annual Weekday Traffic volumes on 199 Street are 5,600.

2.1.4 Geometrics, Turning Movements, and Traffic Control

The existing alignment of 199 Street is a straight line from north to south following the existing grid road system. The vertical grade along 199 Street is almost level from 23 Avenue to a high point approximately 1000 m north, and at this point there is a significant grade change into the Wedgewood Creek ravine of approximately 4%, followed by a short vertical curve through the ravine and then another 4% grade out of the ravine.

There is stop control for all directions at 23 Avenue, and also at Woodbend Wynd and 35 Avenue in the west and eastbound directions, respectively.

Within the City limits, 199 Street is an 8.0 m wide roadway complete with a rural cross section and an asphalt surface. Shallow ditches exist on both sides and it is centred in a 30 m right-of-way. The posted speed throughout the 199 Street corridor is 80 km/hr.

There is no existing turning movement data available at this time other than what is shown in the Riverview Area Structure TIA. The degree of movements at each of the existing intersection locations will need to be retained to provide the current level of service at these intersections.

2.1.5 Operation

The capacity of the existing two lane configuration along 199 Street will become insufficient to accommodate projected traffic volumes. Currently the traffic along 199 Street is represented by trips between Parkland County and the City of Edmonton. As the adjacent lands along 199 Street develop, there will be a need to increase the capacity of this arterial roadway. The current two land rural cross section will be widened to a four-lane urban cross section with turning lanes as required.

There is a yellow advisory speed reduction sign (55 km/h) for the northbound traffic just after Woodbend Wynd and before the 35 Avenue intersection. This is most likely attributed to the existing limited site distance for vehicles turning left onto 199 Street from 35 Avenue. We anticipate this will be mitigated with the development of 199 Street.

Within the study area, there are three existing intersections that will be maintained, there are seven existing property access points that will be closed or relocated, and there are three proposed new intersections. As shown in *Figure 4*, these include:

Existing Intersections:

i) 199 Street and 35 Avenue – Stop condition on the east direction;

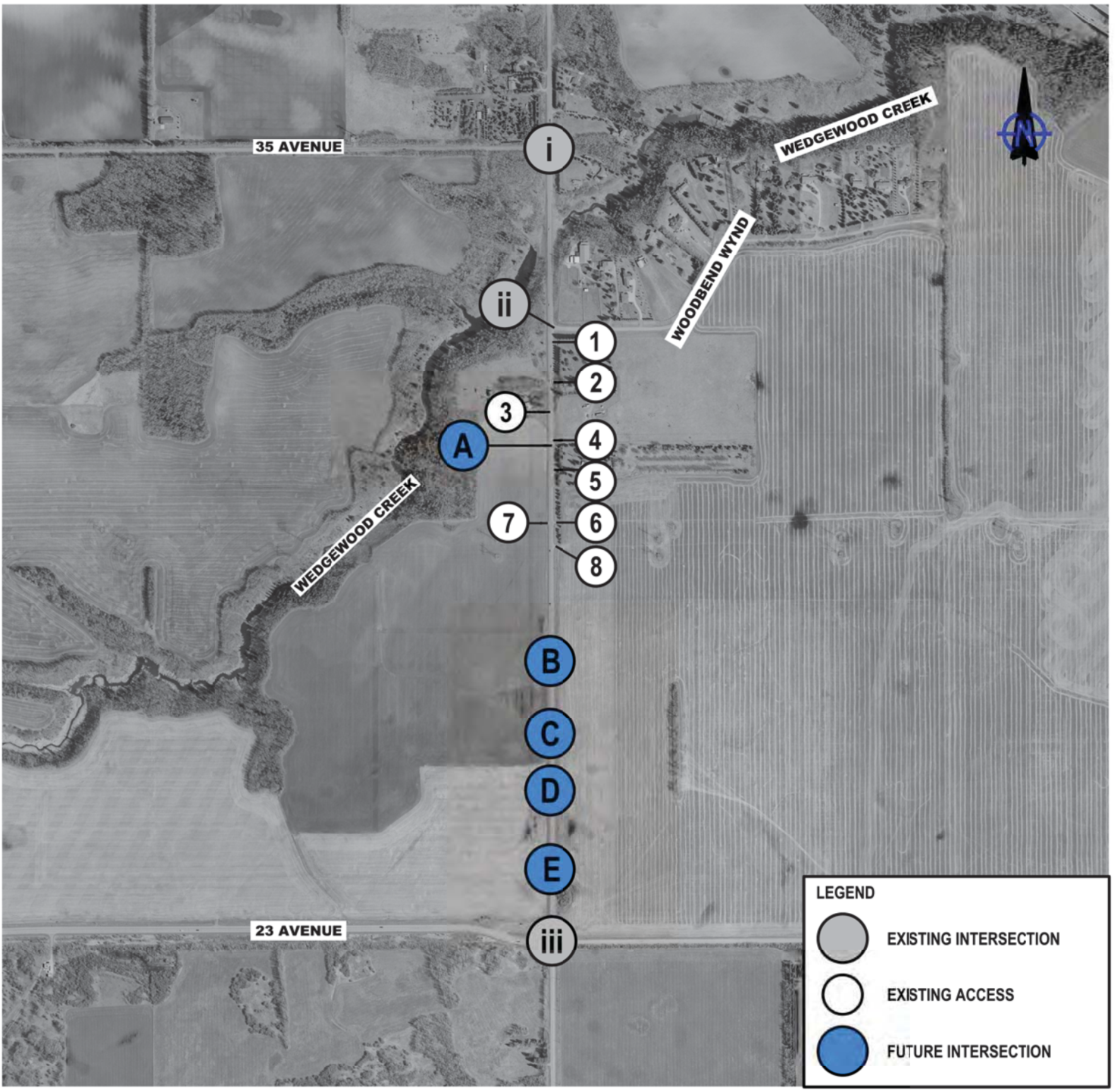
ii) 199 Street and Woodbend Wynd – Stop condition (to be retained) on the west direction; and
iii) 199 Street and 23 Avenue – Four-way stop condition on all directions.

Future Intersections:

A) 199 Street and 27 Avenue – Collector all-direction intersection;
B) 199 Street and 25 Avenue – Collector all-direction intersection;
C) 199 Street and Right-in/Right-out intersection (east side), Right-in only (west side);
D) 199 Street and 24 Avenue – Commercial all-direction intersection; and
E) 199 Street and Right-in/Right-out intersection.

Existing Accesses:

1) Resident Access – To be relocated onto Woodbend Wynd;
2) Second resident access to the same property as above – to be closed;
3) Resident Access – To be closed. Access to this property to be provided from the proposed 27 Avenue collector road;
4) Farm Access – To be closed. Access to this property to be provided from the proposed 27 Avenue collector road;
5) Resident Access – To be closed. Access to this property to be provided from the proposed 27 Avenue collector road;
6) Public Utility Access – To be closed. Access to this property will be from 199 Street; however no private crossing will be provided;
7) Public Utility Access - Access to this property will be from 199 Street; however no private crossing will be provided; and
8) Public Utility Access – Access to this property will be from 199 Street, however no private crossing will be provided.



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199 STREET
35th AVENUE TO 23rd AVENUE
EXISTING INTERSECTIONS & ACCESSES
Figure 4.0

2.1.6 Infrastructure Condition

According to site reconnaissance, the existing road is in fair to poor condition with transverse cracking along the entire corridor. Presently the roadway is a rural asphalt paved roadway with steep side slopes and no curb and gutter. The original pavement structure consisted of approximately 80 mm of asphalt underlain by 200 mm of granular base. This section of roadway was overlaid with an asphalt overlay in 2008 (thickness unknown) and was crack sealed in 2011. There is the possibility that the underlying clay fill may be contaminated with organic material which may need to be addressed. It is recommended that test holes be drilled throughout the section to determine the roadway structure in the next design phases. The ultimate arterial roadway along 199 Street will have an urban cross section, which may require that this entire section of road be completely rebuilt.

Side slopes along 199 Street vary from 2:1 to 3:1. The ditch bottom is relatively undefined, approximately 1 m in width, and the back slopes vary from flat to 4:1 along the corridor. There are small pockets of trees, shrubs and underbrush along the ditches and back slopes on both sides of 199 Street between 23 Avenue and the Wedgewood Creek Ravine. The ditches and back slopes through the Wedgewood Creek ravine are fully treed on both sides of 199 Street.

There are overhead power lines on the east side of 199 Street along the entire corridor and crossing 199 Street just north of the current 23 Avenue intersection. There are three Altalink public utility transmission lines that cross 199 Street approximately 800 m north of 23 Avenue.

There is no existing street lighting along 199 Street.

2.1.7 Collision History

Collision information was provided by the City of Edmonton for the time period from 2009 to 2013 covering a period of five years, as shown in **Appendix C**. There have been 36 collisions within the 199 Street corridor between 23 Avenue and 35 Avenue in the last five years.

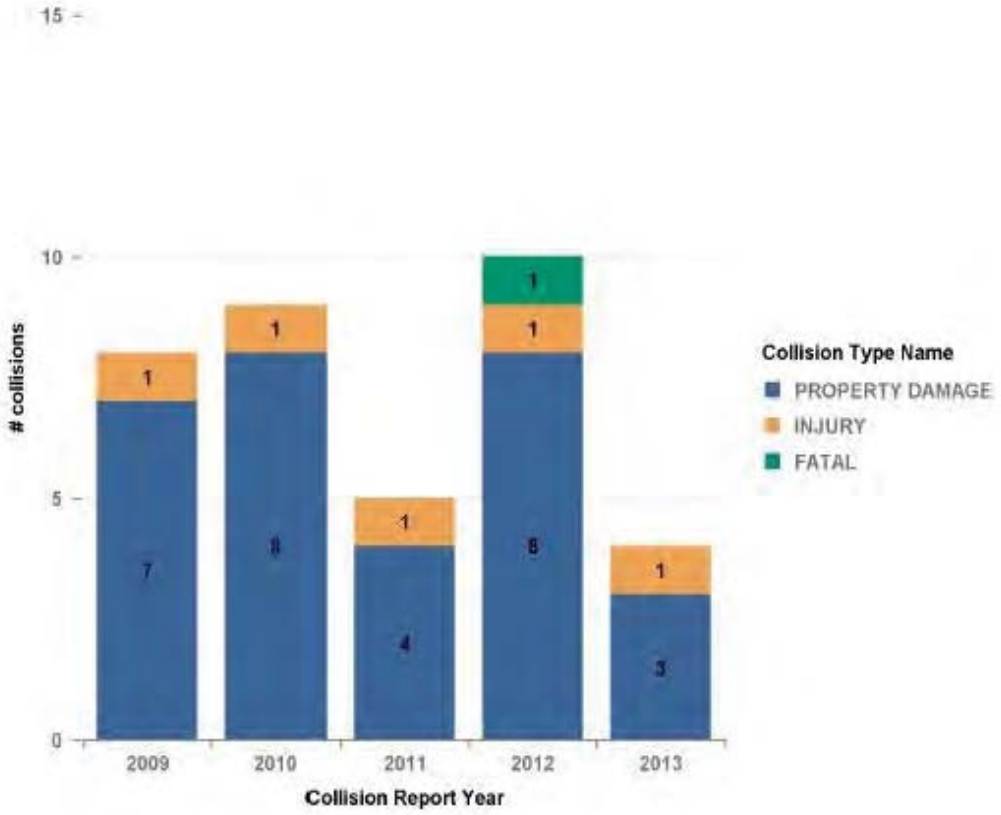
There are three intersections within the study corridor where collisions have been recorded. These intersections are:

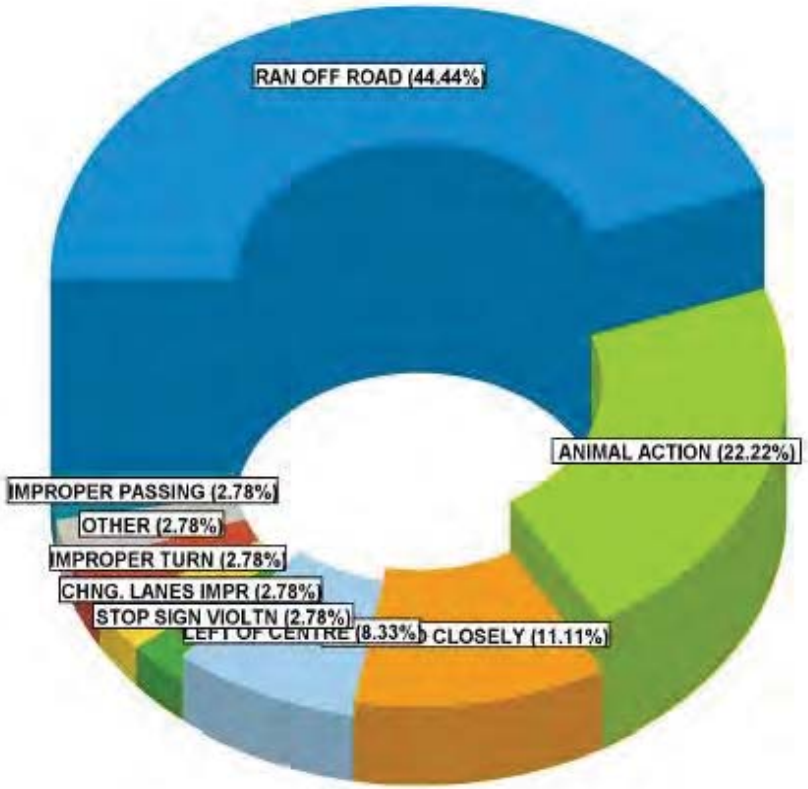
- 23 Avenue and 199 Street – 11 collisions
- Woodbend Wynd and 199 Street – one collision
- 35 Avenue and 199 Street – one collision

The collision data shows a total of 13 collisions at these three intersections as well as an additional 23 midblock collisions within the study area.

A breakdown of the overall collisions by severity and cause is presented in *Figure 5*. The total number of collisions is significant; however this can be attributed to 199 Street being a link between the City of Edmonton and Parkland County.

Figure 5 – Collision Breakdown by Severity and Cause





E00540A

Reference: Figures clipped from the City of Edmonton collision report (February 27, 2014)

A breakdown of the collision data show that approximately 44% of the accidents were run off the road classification with the other major cause being animal action at 22%. The run off the road cause could be attributed to 199 Street being a narrow roadway with steep side slopes which give little or no recovery once a vehicle has exited the roadway. The animal action cause can most likely be attributed to the rural lands surrounding 199 Street and also there currently is no wildlife passage across 199 Street at the Wedgewood Ravine.

Most of the current accident trends, such as the high run off the road accident percentage, point to a geometric or roadway improvement factor. It is anticipated that upgrading 199 Street to an urban cross section and accommodating wildlife passage will decrease the current cause of collisions along this corridor.

2.1.8 Site Investigation

A site investigation was completed on July 29, 2014. Any utilities, overhead power, private fences and gates, existing signage, etc. were noted. Nothing extraordinary was noted during the site investigation.

There is an existing overhead power line running parallel to 199 Street along the east side of the street with this line crossing the road in two locations. This overhead line crosses 199 Street at (approximately) the future 27 Avenue intersection and also crosses at the existing 23 Avenue intersection. Also shown on the plans is the existing Altalink utility right-of-way for the high voltage transmission lines. Crossing agreements for this right-of-way will need to be in place prior to construction.

Within the project area, there is an TELUS buried phone cable running parallel to 199 Street on the west side of the street. The second utility to note is an ATCO Gas line running parallel to 199 Street on the east side of the street. The ATCO Gas line resides outside of the project limits. Both of these utilities have been noted on the plans included in the conceptual plan set. The buried telephone cable is shown in yellow and the gas line is shown in blue.

2.1.9 Environmental and Historical Resources

An Environmental Overview was completed for neighbourhoods 1, 2 and 3 in the Riverview area by Stantec Consulting Ltd. (June 2014). The most significant finding in this report was one dry oil well drilled in 1951 on the west side of 199 Street at 35 Avenue, which is now abandoned. It should be noted this well site is located outside of the current project limits. No other impacts were identified in this report. A copy of the environmental overview is has been included in **Appendix D**.

A Historical Resources Impact Assessment (HRIA) was completed for the Riverview area by Stantec Consulting Ltd. (August 2013). Signed clearance has been received for this area from Alberta Culture. A copy of the clearance letter has been included in **Appendix E**. The HRIA is a 500 page document, and has not been included in this report. It is available upon request.

2.1.10 Geotechnical Investigation

A preliminary geotechnical investigation was completed by Hoggan Engineering & Testing (1980) Ltd. in February 2014 for the proposed Riverview neighbourhoods 1-3. This preliminary report has been included in **Appendix F**. For this report, testing was completed to determine soil conditions with the project area in order to provide geotechnical recommendations for preliminary approvals. The fieldwork for this project was completed from September to December 2013. Please refer to the report for more geotechnical information in the project area.

In total, 44 test holes were drilled in the proposed project area with locations that had been previously chosen and surveyed. The results of these test holes are included with the report. Overall recommendations determined the soil and groundwater conditions at this site were feasible for residential subdivision development. However, the report specifies that the subsurface conditions are poor to satisfactory for roads, curbs, and sidewalks. The anticipated conditions and construction recommendations should be carefully reviewed during planning of further geotechnical work as well as during roadway design. A more comprehensive geotechnical review will be completed for the project area during the preliminary design stage of this project.

In addition to the preliminary geotechnical investigation, slope stability assessments were done for the east bank of Wedgewood Creek and west bank of the North Saskatchewan River. The slope assessments are separate from the geotechnical investigation and are not directly relevant to the roadway reconstruction. Impacts due to the road should be considered and additional study may be required. The slope stability assessment for Wedgewood Creek has also been included in **Appendix F**. Please refer to this report for more detailed information on the slope stability for the project area.

3. Concept Plan Development

3.1 Traffic Analysis

A Traffic Impact Assessment for the Riverview area was completed in November 2014 (Final Draft) by Bunt and Associates. The Riverview ASP land use concept was also used in developing the traffic trips for this TIA. A copy of the TIA has been included in **Appendix G**.

The traffic analysis recommended that 199 Street be developed as a four-lane divided arterial. Based on the projected volumes, it was determined that standard City turn bay and taper lengths would be sufficient at all intersections, with the exception of the southbound left turn movement at 27 Avenue, where the storage length for this movement has been increased to 70 m. To accommodate predicted traffic volumes and queue lengths, the lane requirements for the intersections along the corridor from 23 Avenue to 35 Avenue are as follows (please note the intersections listed below follow the labels assigned from page 9, *Figure 4*):

Existing Intersections:

ii) Single left-turn lane in the southbound direction.

Future Intersections:

A) Single left-turn and single right-turn lanes required for both the northbound and southbound directions. Left and through/right-turn lanes for both the eastbound and westbound directions. Single receiving lanes on both the east and west sides of the intersection.
B) Single slotted left-turn and single right-turn lanes required for both the northbound and southbound directions. Left and through/right-turn lanes for both the eastbound and westbound directions. Single receiving lanes on both the east and west sides of the intersection.
C) Auxiliary lanes required for both the northbound and southbound directions.
D) Dual slotted left-turn lanes and single right-turn lanes required for both northbound and southbound directions. Left, through and right-turn lanes required on both eastbound and westbound traffic. Dual receiving lanes are required on both sides of the intersection.
E) Auxiliary lanes required for both the northbound and southbound directions.

3.2 Access

The internal road network for the Riverview neighbourhood has not yet been completely finalized however the access points along 199 Street have been confirmed and will be located as required by the concept plan. Accesses along the 199 Street corridor within the study area will be provided at seven locations as follows (please note the intersections listed below follow the labels assigned from page 9, *Figure 4*):

ii) 199 Street and Woodbend Wynd – Existing local 'T' intersection providing an access roadway for the country residential lots along the Woodbend Ravine, located approximately 225 m north of future 27 Avenue.

A) Located approximately 418 m north of future 25 Avenue.
B) Located approximately 248 m (curb face to curb face) north of 24 Avenue.
C) Auxiliary lanes have been provided for both accesses. The existing point for the eastbound access is south of the left turn taper and is located approximately 60 m north of 24 Avenue. The right-in only is 70 m north of 24 Avenue providing 70 m of storage for the right-turn lane.
D) This intersection is located 250 m (curb face to curb face) north of the 23 Avenue/199 Street intersection.
E) Auxiliary lanes have been provided for both accesses. The exit points for the west access is upstream of the left turn taper as shown in the City of Edmonton Access Management Guidelines and is greater than 50 meters south of 24 Avenue. For the East access a short 35 meter taper has been provided north of 23 Avenue to transition into the Auxiliary lane. The exit point is 100 meters south of 24 Avenue.

It should be noted, the right-in/right-out accesses, as well as the right-in access along 199 Street north of 23 Avenue have not been reviewed or approved by Development Planning as part of a formal development application for the site. The exact location and configuration of accesses will be determined at the subdivision and development permit stage.

3.3 Transit

The Riverview ASP identifies a transit center will be located in the southeast quadrant of the 23 Avenue and 199 Street intersection. Transit will utilize the arterial roadway system to travel to designated destinations within or outside the area. Bus stops have been shown at five locations along 199 Street as per ETS's comments at 24 Avenue, 25 Avenue, 27 Avenue, Woodbend Wynd and 35 Avenue. Bus stops have also been shown on the three collector roadways at 24, 25 and 27 Avenues. The proposed bus stop locations have been shown on the concept plans in **Appendix A**.

3.4 Utilities

A set of utility plans has been created and is included in **Appendix H**.

3.4.1 Power

There are existing overhead power distribution lines paralleling 199 Street to the east which also cross 199 Street just north of the current 23 Avenue intersection. These lines will be buried to accommodate the ultimate development of 199 Street and the surrounding lands.

There are also three high voltage Altalink transmission lines that cross 199 Street approximately 800m north of 23 Avenue. The southernmost line operates at 500kV while the remaining two lines to the north operate at 240kV. The table below shows vertical clearances required from vehicles and street lighting for the different lines.

Clearance from	Minimum Vertical Clearance Required (m)	
	240kV power line	500kV power line
Vehicles	8.5	15.4
Street Lighting / Trees	5.9	*Street lights and trees are not permitted under the 500kV line

The AltaLink facilities will not require relocation, but crossing agreements will need to be in place prior to the commencement of any work adjacent to or underneath the lines. After a discussion with AltaLink, the agreements needed for construction will be:

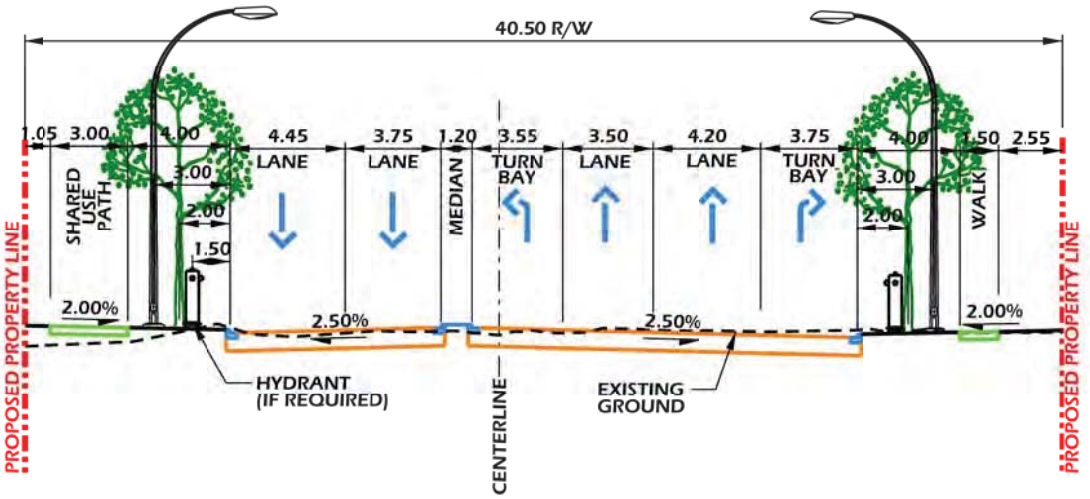
- Road Crossing Agreement,
- Temporary Working Space Agreement,
- Street Lighting Request, and
- Tree Placement Request.

EPCOR has expressed an interest in including power ducts across the Wedgewood Creek crossing, refer to section 3.11 for more details. If any additional power lines are required along 199 Street, they should be installed following the recommended locations as per the City's standard cross section for an urban arterial divided roadway.

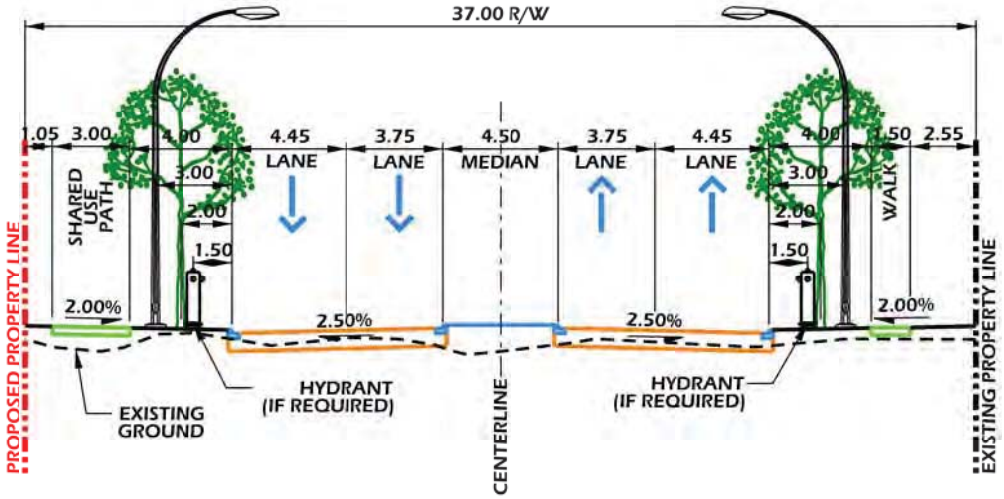
3.4.2 Street Lights

Street lights will be required along the 199 Street corridor. It is recommended that all street lights be installed in the recommended locations as per the City's standard cross section for an urban arterial divided roadway. The design of the street lights will need to be completed by others during the preliminary design phase of this project.

As shown in *Figure 6* the cross section for 199 Street will include street lighting on both sides of the corridor.



NARROW MEDIAN CROSS-SECTION



TYPICAL WIDE MEDIAN CROSS-SECTION

CIMA
Partners in excellence

199 STREET
35th AVENUE TO 23rd AVENUE
TYPICAL CROSS SECTION ALONG 199 STREET
Figure 6.0

3.4.3 Gas

There is an existing ATCO Gas distribution line on the east side of 199 Street servicing the country residential lots along Woodbend Wynd. This line is located outside of right-of-way that will be required for 199 Street but crosses the proposed 24, 25, and 27 Avenue collector roadways. This line will likely be reconstructed during the arterial road upgrades.

If any additional gas services are required along the 199 Street corridor, it is recommended that these services be installed in the recommended locations as per the City's standard cross section for an urban arterial divided roadway.

3.4.4 Drainage

The existing drainage along 199 Street is all overland via existing ditches. The ultimate 199 Street corridor will be an urban cross section with catch basins collecting the street runoff and then connected to an underground storm trunk pipe system. The storm trunk for the corridor will outlet into the stormwater retention pond on the west side of 199 Street along the new collector.

The draft Neighbourhood Design Report for Riverview Neighbourhoods 1, 2, and 3 was completed by MMM Group Limited in November 2014. The vertical design along 199 Street was co-ordinated so there is sufficient fall from the high point along 199 Street to the stormwater retention facilities. Longitudinal grades of the curb and gutter are all 0.6% or greater. All existing overland flow including the existing ditches along 199 Street will be mitigated with site grading of the adjacent property.

3.4.5 Telecommunications

There is an existing TELUS telephone line on the west side of 199 Street along the existing right-of-way. This line will need to be abandoned and replaced or relocated once the 199 Street upgrades on the west side are under construction.

Existing utility conflicts along the corridor from the proposed upgrades to 199 Street will need to be mitigated in the detailed design.

If there are additional telecommunications required along the 199 Street corridor, it is recommended that they be installed in the recommended locations as per the City's standard cross section for an urban arterial divided roadway.

3.4.6 Water

There are currently no known water mains along the 199 Street corridor. There is a 600 mm water main planned to be installed along 199 Street, it is recommended that this water main be installed in the recommended location as per the City's standard cross section for an urban arterial roadway.

3.5 Traffic Signals, Pedestrian Signals, and Crosswalks

The existing corridor between 35 Avenue and 23 Avenue currently has no traffic signals.

The TIA, as noted in **Appendix G**, requires traffic signals at the 24 Avenue and 27 Avenue at full build out. No other traffic signals are expected at additional access points between 35 Avenue and 23 Avenue.

There is a midblock crosswalk planned across 199 Street where the Altalink public utility transmission lines cross the corridor. This crosswalk is approximately centered between the collector intersections located north and south of the Altalink public utility. Pedestrian actuated signals or amber flashers are required at this location and are shown on the concept plans in **Appendix A**. It should be noted that the Pedestrian flashes cannot be installed under the 500 KV power lines. As such, this crossing has been located to avoid the power lines; however this location will need to be confirmed in the preliminary design.

Painted cross walks have been shown at the two signalized intersections within the study corridor, at 24 Avenue and 27 Avenue. A cross walk warrant may be needed to be completed at a later date to confirm additional cross walk locations.

3.6 Pedestrian Connectivity

The concept design along 199 Street incorporates a shared use path (SUP) along the entire length on the west side and a regular boulevard walk on the east side. The SUP connects to the proposed SUP on the north side of 23 Avenue and a connection is also provided to the proposed SUP north of 35 Avenue. Across the Wedgewood Ravine the SUP and boulevard walk will follow the 199 Street alignment as shown on wildlife crossing concept plan S199-141-05 in **Appendix A**.

There is also a SUP planned within the Altalink public utility corridor which crosses perpendicular across the 199 Street corridor; this crossing is shown on the plans in **Appendix A**.

3.7 Noise Impact Assessment

A draft Environmental Noise Impact Assessment was completed (by others) in July 2014. The report recommended installing a 1.83m barrier for all residential locations adjacent to 199 Street NW north of 23 Avenue NW. A copy of the report has been included in **Appendix I**.

3.8 Pavement Design

There has been no pavement design completed for the 199 Street concept plan; however, a typical arterial road pavement structure is proposed. The pavement design will need to be confirmed during detailed design.

3.9 Urban Design, Landscaping, and Aesthetics

The 199 Street corridor will be an urban design following the City of Edmonton design and construction standards. The boulevard on both sides of the roadway will be grassed and tie into the surrounding lands at the property line. Trees may be planted along the corridor. The urban design, landscaping and aesthetics for this corridor will need to be completed during the detailed design.

3.10 Guardrail

The only guardrail and handrail required along 199 Street is around the animal underpass in the Wedgewood Creek ravine. The animal underpass is discussed in more detail in section 3.11, and will be a bridge structure with bridge rails. Guardrails will be required on approach and departure, for both the northbound and southbound traffic. Handrails will be required across the bridge structure. For additional details refer to the Wedgewood Creek crossing plan S199-141-05 in **Appendix A**. All guardrail and handrail lengths will need to be reviewed and confirmed in the preliminary design phase of this project.

3.11 Wedgewood Creek Crossing

The existing Wedgewood Creek crossing consists of a 1.8 meter diameter by 62.8 meter long structural plate culvert, built in 1952, and is in poor condition. The existing roadway is approximately 8 meters wide and is located an average of 10 meters above the stream. There are w-beam guardrails along both sides of the shoulder of the existing roadway through the ravine.

Given the poor condition of the culvert and the significant embankment widening required to accommodate the new roadway, a new water conveyance system is required under 199 Street.

Terrace Engineering Ltd. has completed a Conceptual Bridge Planning Report for the Wedgewood Creek crossing at 199 Street. This report includes an analysis of culvert versus bridge at this location with a cost comparison. Three options were analyzed:

1) A multi-span bridge across the entire ravine,
2) An oversized culvert suitable for wildlife passage in addition to stream flows,
3) A culvert sized for the stream flow with a separate shorter bridge structure crossing for wildlife passage.

Each option was reviewed in detail, Option 1 requires additional costs in the order of $18 million or more compared to the other feasible options. Option 2 was ruled out due to the length and size of culvert that would be needed. The report recommends Option 3 for this crossing as a culvert, sized for the stream flows, and a separate wildlife passage structure higher up the embankment. The report has been included in **Appendix J**.

Extensive dialogue between CIMA+, Facility and Capital Planning and Urban Ecology was conducted for the wildlife crossing. This included multiple letters from all parties addressing

comments and concerns and also a site visit. Copies of all the correspondence have been included in **Appendix J** in chronological order. The final crossing concept is shown in plan S199-141-05 in **Appendix A**.

The crossing includes a 2.85 meter diameter culvert paralleling the existing culvert at stream level on the south side, and a 14 meter long by 4.5 meter deep wildlife crossing structure. The wildlife crossing is a bridge on a 25 degree skew that passes under the proposed roadway. The skew improves the sightlines for the wildlife and avoids the Edgemont storm outfall on the west side, north of Wedgewood Creek.

Additional retaining walls have been added to provide a wildlife path that is above the high water level of the stream and leads to the animal crossing. The extents of the retaining walls will need to be designed in the preliminary design phase of this project.

Based upon the findings of the wildlife passage assessment and rare plant survey, the User Checklist provided within Appendix D of the City of Edmonton's Wildlife Passage Engineering Design Guidelines was completed. A copy of the completed checklist is included in **Appendix K**.

Urban Ecology in their response to the report noted several items that need to be addressed in the preliminary design. A brief summary of these items is shown below:

1) Changes to improve the line of sight, including grading, and modifications to the wing walls of the bridge structure,
2) An understanding of how open the structure really is,
3) Vegetation of the wing walls leading up to the structure to provide naturalization,
4) Mitigate noise under the bridge from the traffic above,
5) Inclusion of an open median in the wildlife crossing structure,
6) Include design considerations in the bridge structure for the use of this passage for small/medium EDG's,
7) Minimize light pollution,
8) Fencing is provided for both wildlife and people management,
9) An open bottom culvert with natural substrate is the preferred option for the stream culvert, and
10) A copy of the letter from Urban Ecology is included in **Appendix J**.

EPCOR has expressed an interest in including power ducts in the Wedgewood Creek crossing bridge structure to accommodate future power feeds. The additional duct work will need to be included in the preliminary and detailed design of the structure to accommodate future EPCOR installation.

4. Public Involvement

There was an invitation only open house held on Tuesday, February 25, 2014 by Stantec for the overall Riverview neighbourhood, which existing landowners within the Riverview neighbourhood were invited to attend. From the Stantec records, there were 14 residents that attended this open house. CIMA+ attended as well and displayed a preliminary concept plan for 199 Street. There were no comments specifically for the 199 Street Concept Plan.

The most frequently asked question was directed at the timing of construction with a related comment that more specific timelines were required. Another main comment from the attendees was that existing residents did not want to look at the back of houses; it was preferred to have the future homes face existing residences. It was also strongly noted by the residents that River Heights Drive should stay dedicated to the residents and not to construction vehicles.

The open house invite and residents' comments are included in **Appendix L**.

5. Final Concept Plan

5.1 Design

The recommended concept plan for upgrading 199 Street to a four-lane divided arterial from 35 Avenue to 23 Avenue can be found in **Appendix A**.

5.1.1 Roadways

199 Street is classified as an arterial road within the City of Edmonton road network. There is an at-grade arterial road intersection at the south end of the study area at 23 Avenue. 199 Street throughout the study area will be developed as a four-lane divided urban cross section with straight face curb and gutter.

5.1.2 Design Criteria

The City of Edmonton Design and Construction Standards and Transportation Association of Canada (TAC) Design Guidelines were used in the development of the plans. *Table 2* below shows the minimum design criteria that were used for this concept plan.

Table 2 – Design Criteria

Parameter	Design Critreria
Design Speed	70 km/hr
Posted Speed	60 km/hr
Curb Return Radius	15.0 m on Arterial/Collector
Lane Widths	Arterial Roadway: Standard lane width – inside 3.75 m (to FOC), outside 4.45 m (to FOC) Through lanes at intersection – inside 3.50 m, outside 4.20 m Single left-turn lane – 3.55 m (to FOC) Double slotted left-turn lane – inside 3.75 m, outside 3.50 m (to FOC) Single right-turn lane – 3.75 m (to FOC) High-entry angle channelized right-turn lane – 5.00 m (to FOC) Auxiliary lane – 3.75 m (to FOC) Right-in/Right-out – 8.5 m access

Parameter	Design Critreria
	Right-in – 5.0 m access (commercial access) Collector Roadway: Standard through lane/right-turn lane – 3.50 m Single left-turn lane – 3.55 m (to FOC) Commercial Roadway: Standard lane widths – 3.55 m (to FOC) left turn, 3.50 m through and 3.75 m through/right
Taper Lengths	60 m for a single turning lane 50 m for a two-lane channelized left-turn slot 30 m for a one-lane channelized left-turn slot
Bay Lengths	Right-turn lane – 50 m Single left-turn lane – 50 m Single/Double slotted left-turn lane – 105 m
Roadway Crown	2.5% crossfall for urban arterial
Walkway	Refer to City Standards, Volume 2, Section 3.6.2
Curb Ramps	Refer to City Standards, Volume 2
Min. intersection spacing (m) – Major arterial to collector	250 m (access management guideline, City of Edmonton) 400 m (TAC table 1.3.4.2)
Intersection angle (on centreline)	Minimum 70°
Merge angle on channelized right-hand turning lanes without auxiliary lanes	70°

5.1.3 Roadway Geometry

The horizontal roadway geometry on the south end at 23 Avenue was developed centered on the existing right-of-way and tying into the City's current 23 Avenue concept plans. On the north end the horizontal alignment across the Wedgewood Creek and past the existing Woodbend Wynd intersections is shifted to the west so the east property line follows the existing property line. There are existing country residential lots on both the north and south sides of Woodbend Wynd that have developed residents and out buildings that should be avoided. The transition of the alignment from centered to the west occurs in between 25

Avenue and 27 Avenue. The transition was developed such that both of the collector intersections are on a tangent section of the alignment.

The alignment shift to the west across the Woodbend Creek Ravine not only avoids existing properties, it also will allow for more flexibility in staging the construction. In the interim stage where only two lanes are developed, the traffic will be able to use the existing crossing while the new crossing is being constructed on the west side. This would significantly reduce or eliminate road closures along this section.

It should be noted that a 24 m wide Right-of-Way was used on 25 Avenue, which is greater than the City of Edmonton 20 m collector road width standard. This was done to follow developer requests for a wider boulevard to allow for additional plantings. A 28 m wide Right-of-Way was used on 27 Avenue to accommodate medians in the roadway for a possible entrance feature.

Slotted single left turns have been included at 25 Avenue to provide geometric and operational consistency to the drivers through a complex segment of 199 Street. The requirement for a dual slotted left turn SB-EB at 24 Avenue would require a very short transition from a standard left turn to develop the additional median width necessary for the dual slotted left turns. The median width is 11.9 m at the point between 24 Avenue and 25 Avenue where the left turn lanes need to be developed. This width is greater than the required 10.8 m median width from TAC, and therefore geometrically warrants a slotted left turn. As well, the slotted single left turns at 25 Avenue in the north and southbound directions provide a robust design for this intersection that would allow for future traffic signalization with minimal reconstruction work. Note that no signal is currently planned at this intersection in the TIA, however if a signal is needed in the future, the slotted left turn will increase the capacity of this intersection. The volume warrant for a signalized intersection is also satisfied.

By using slotted left turn lanes, the intersection safety will be increased by improving the visibility for drivers turning left. This intersection is directly north of a town center commercial zoned area and while it is not anticipated that this intersection will be used by a large percentage of heavy vehicles, the slotted left turns will provide assistance with that turning movement for heavy vehicles if needed.

AutoTurn templates were used to confirm the geometry along 199 Street. Sketches showing the turning movements for all directions at the five intersection locations along 199 Street have been developed and are included in **Appendix M**. A WB-21 tractor trailer unit was used as the design vehicle on all arterial to collector intersections where the collector leads to a commercial/town center commercial area. A WB-15 design vehicle was used at intersections where the collector roadway services residential areas only. A summary showing the auto turn findings is presented below in *Table 3*.

Table 3 – Auto Turn Summary

Intersection	Turning Movement	Design Vehicle
199th Street & 24th Avenue (Arterial to Commercial Collector)	NB-WB & SB-EB (Figure 1.1)	WB-12 (outside lane) & SU9 (Inside Lane)
	WB-SB & EB-NB (Figure 1.2)	WB-21
	NB-EB, WB-NB, EB-SB & SB-WB (Figure 1.3)	WB-21
199 Street & 25th Avenue (Arterial to Residential Collector)	NB-WB & SB-EB (Figure 2.1)	WB-15
	WB-SB & EB-NB (Figure 2.2)	WB-15
	NB-WB, WB-NB, EB-SB & SB-WB (Figure 2.3)	WB-15
199 Street & 27th Avenue (Arterial to Residential Collector)	NB-WB & SB-WB (Figure 3.1)	WB-15
	WB-SB & EB-NB (Figure 3.2)	WB-15
	NB-WB, WB-NB, EB-SB & SB-WB (Figure 3.3)	WB-15
199 Street & Woodbend Wynd (Arterial to Residential Collector)	WB-NB (Figure 4.1)	WB-15
	WB-SB (Figure 4.2)	WB-15
	NB-EB (Figure 4.3)	WB-15
	SB-EB (Figure 4.4)	WB-15

5.2 Property Requirements

To accommodate the ultimate right-for-way for 199 Street including through lanes, slotted left-turn lanes, right-turn lanes, auxiliary lanes additional right-of-way outside of the existing 199 Street right-of-way will be required. However, all of the required right-of-way is on developer lands and will be dedicated to 199 Street at the neighbourhood subdivision stage. A summary of the property requirements is provided in *Table 4*; right-of-way plans have been created and are included in **Appendix N**.

Table 4 – Property Requirements

Legal Description	Drawing Number	Required Area (acres/hectares)
SW 5-52-25-4 Plan 8221585	S199 LAND 01	1.38 ac/0.76 ha
SW 5-52-25-4 Plan 8221585	S199 LAND 02	0.03 ac/0.01 ha
Block A, Plan 4862NY	S199 LAND 03	0.002 ac/0.0006 ha
NW 5-52-25-4 Block A, Plan 4862NY	S199 LAND 04	0.21 ac/0.09 ha
NW 5-52-25-4 Block 19, Plan 716TR	S199 LAND 05	0.08 ac/0.03 ha
SE 6-52-25-4	S199 LAND 06	2.00 ac/0.81 ha
SE 6-52-25-4	S199 LAND 07	0.09 ac/0.04 ha
NE 6-52-25-4	S199 LAND 08	0.10 ac/0.04 ac
NE 6-52-25-4	S199 LAND 09	1.22 ac/0.49 ha
NW 5-52-25-4 Block 1, Lot 1A, Plan 802 1161	S199 LAND 10	0.27 ac/0.11 ha
NW 5-52-25-4 Block C, Plan 5629RS	S199 LAND 11	0.23 ac/0.09 ha

There is 0.50 ac (0.20 ha) of right-of-way required from the landowners of Block 1, Lot 1A, Plan 802 1161 and Block C, Plan 5629RS to accommodate a 3:1 back slope on the ultimate cross section for the Wedgewood Creek crossing. An alternative to this design would be the installation of a retaining wall. Discussions with the affected landowners regarding the required land and back slope options versus retaining wall will be required during the preliminary or detailed design phases. The drawings showing the retaining wall alternative are included in **Appendix O**.

6. Cost Summary

A planning level cost estimate will be developed once the City has approved the 2nd submission concept plans. The total costs will be broken down into items and summarized in the *Table 5*. The detailed cost estimate will be provided with the final submission and a breakdown has been provided in **Appendix P**.

Table 5 – Cost Estimate Summary

Item	Estimated Cost
Straight Face Curb and Gutter	$1,140,000
Shared Use Pathway (3.0m width)	$230,000
Concrete Sidewalk (1.5m width)	$200,000
Asphalt Concrete Pavement	$2,870,000
Granular Base Course	$1,540,000
Cement Stabilized Subgrade	$310,000
Street Lighting	$660,000
Traffic Signalization	$500,000
Pedestrian Crossing Signals	$80,000
Common Excavation	$550,000
Borrow Excavation	$1,090,000
Wildlife Underpass	$4,100,000
Culvert	$2,500,000
Estimated Construction Sub-Total	**$15,770,000**
Mobilization (7%)	$1,103,900
Contingencies (10%)	$1,687,390
Total Estimated Project Cost	**$18,561,290**

7. Follow-up Work

After the completion of the concept plan and the report has been approved by the City of Edmonton, the following work should be completed in subsequent design phases:

1) Complete a land survey of the study area.
2) Development of the preliminary and detailed design and all associated work.
3) Complete a more comprehensive geotechnical study for the project area.
4) Complete an Environmental Overview for the project area north of Wedgewood Creek.

8. City Comments

The second submission plans were circulated to Sustainable Transportation, Transportation Operations and Development Planning and Engineering. Comments from these departments and also the Facility and Capital Planning group were all received and are included in **Appendix Q**.

A summary of the recommendations and comments is as follows;

- The right-in/right-out accesses, as well as the right-in access along 199 Street north of 23 Avenue have not been reviewed or approved by Development Planning as part of a formal development application for the site. While the general location of the accesses is acceptable, the exact location and configuration of accesses will be determined at the subdivision and development permit stage.

- Please ensure that the wildlife crossing requirements at the Wedgewood Creek crossing have been discussed with the Urban Ecology, and that they support the proposed design.

- The TIA for Riverview identifies 199 Street as a four lane divided arterial roadway. The concept plans should clearly identify that the additional northbound and southbound lanes are “auxiliary lanes” that are required to facilitate access to the adjacent land uses, and do not represent a six lane divided arterial roadway.

- Please note that EPCOR has expressed an interest in including power ducts in the Wedgewood Creek crossing bridge structure to accommodate future power feeds. Please ensure that additional duct work is included in the preliminary and detailed design of the structure to accommodate future EPCOR installation.

- The location of handrails and guard rails to be clarified in the Preliminary design.

- All other comments refer to minor updates to the concept report and plans.

9. Conclusion and Recommendation

The 199 Street concept plan has been developed following the City of Edmonton Roadway Design and Construction Standards and also the Transportation Association of Canada guidelines.

The alignment was developed to tie into the two existing concept/detailed designs on each end of the study area.

The Wedgewood Creek Crossing is recommended to be a culvert with a separate wildlife passage bridge structure higher up the embankment and is the preferred option for the next stages of design. Multi span Bridge costs for this location exceed other feasible options in the order of $18 million.

It is recommended that this concept planning report be adopted by the City of Edmonton and this project proceeds into the preliminary design stage based on the concept design provided in **Appendix A**.

VOLUME 1

Appendix A **199 Street Concept Plans**

Appendix B **Existing Concept Plans**

Appendix C **Collision History**

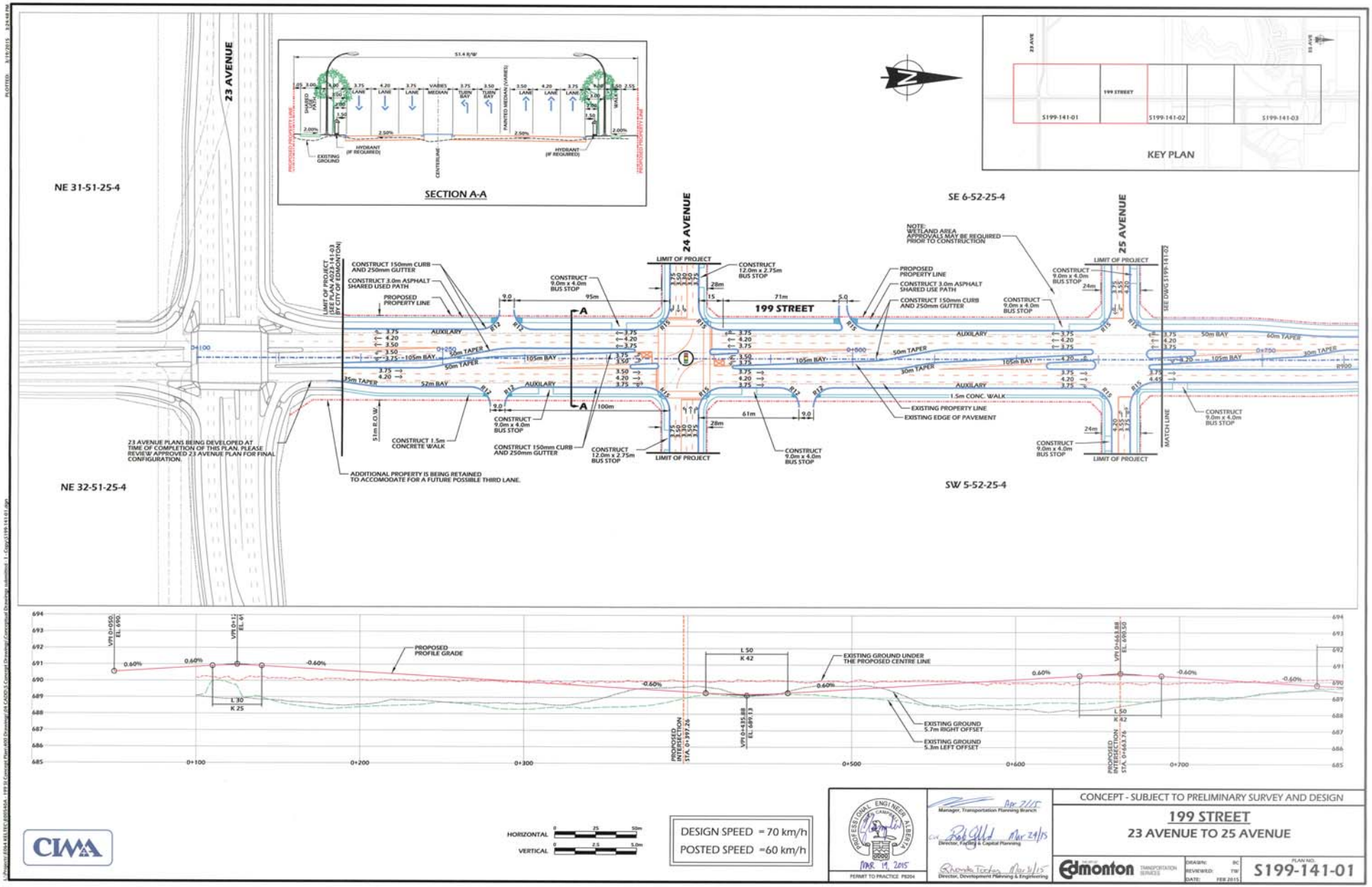
Appendix D **Environmental Overview**

Appendix E **Historical Resources Impact Assessment Clearance Letter**

E00540A

APPENDIX A

199 Street Concept Plans



CONCEPT - SUBJECT TO PRELIMINARY SURVEY AND DESIGN

199 STREET
23 AVENUE TO 25 AVENUE

PERMIT TO PRACTICE P8204

Manager, Transportation Planning Branch — Apr 21/15

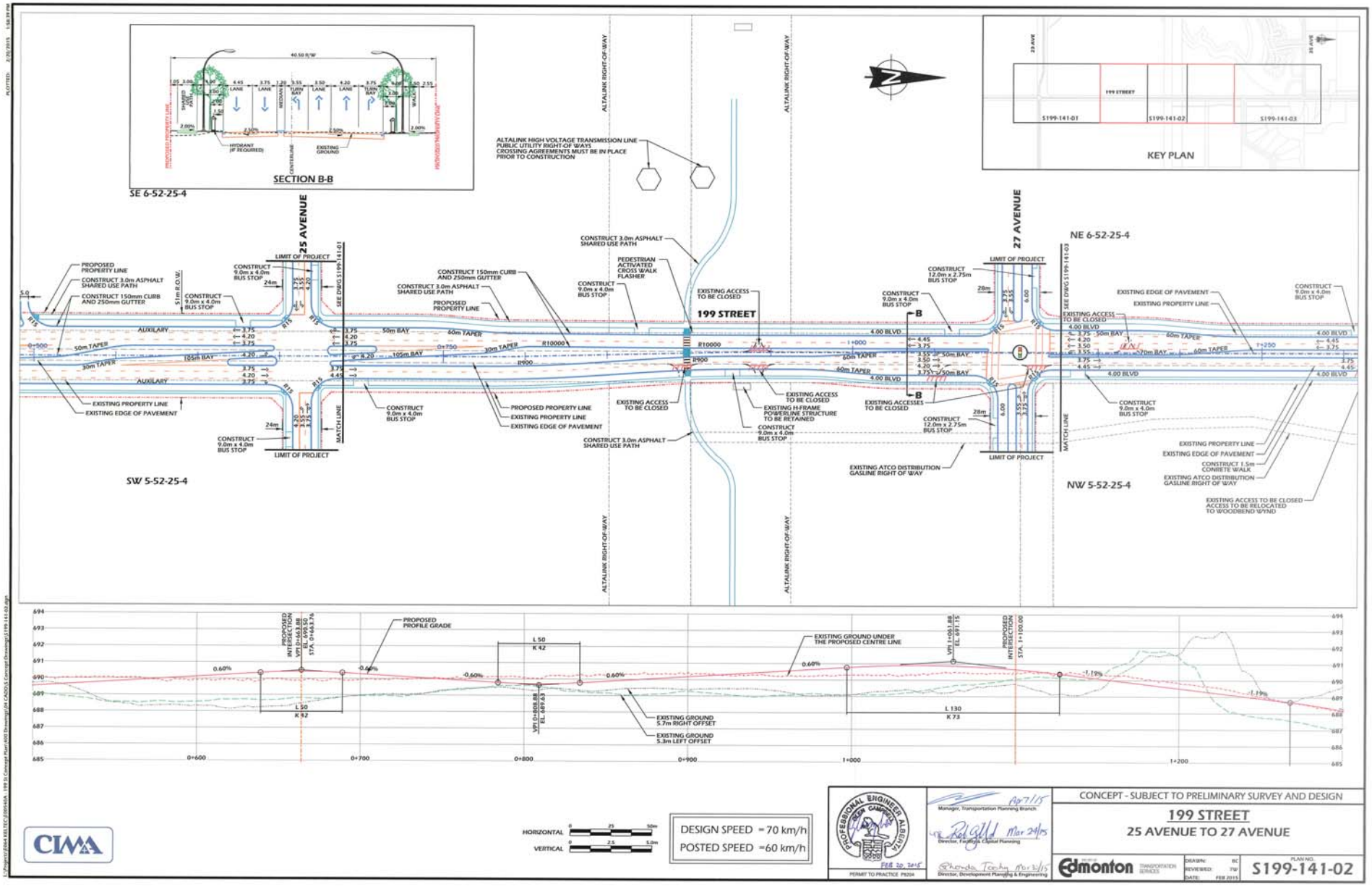
Director, Facility & Capital Planning — Mar 24/15

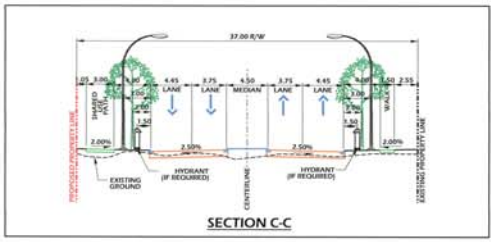
Director, Development Planning & Engineering — Mar 31/15

Edmonton Transportation Services

DRAWN: BC
REVIEWED: TW
DATE: FEB 2015

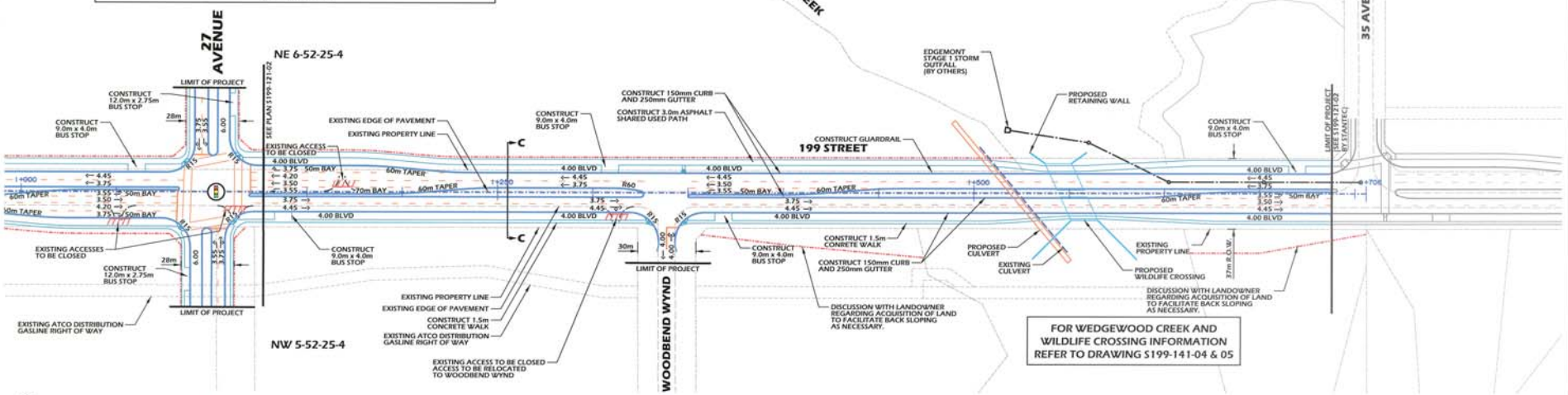
PLAN NO. S199-141-01


SECTION B-B
SE 6-52-25-4
ALTALINK HIGH VOLTAGE TRANSMISSION LINE
PUBLIC UTILITY RIGHT-OF-WAYS
CROSSING AGREEMENTS MUST BE IN PLACE
PRIOR TO CONSTRUCTION
ALTALINK RIGHT-OF-WAY
KEY PLAN
S199-141-01
S199-141-02
S199-141-03
199 STREET
25 AVENUE
27 AVENUE
SW 5-52-25-4
NE 6-52-25-4
NW 5-52-25-4
PROPOSED PROPERTY LINE
CONSTRUCT 3.0m ASPHALT SHARED USE PATH
CONSTRUCT 150mm CURB AND 250mm GUTTER
CONSTRUCT 9.0m x 4.0m BUS STOP
LIMIT OF PROJECT
EXISTING PROPERTY LINE
EXISTING EDGE OF PAVEMENT
PROPOSED PROPERTY LINE
CONSTRUCT 150mm CURB AND 250mm GUTTER
PEDESTRIAN ACTIVATED CROSS WALK FLASHER
EXISTING ACCESS TO BE CLOSED
EXISTING H-FRAME POWERLINE STRUCTURE TO BE RETAINED
EXISTING ACCESSES TO BE CLOSED
CONSTRUCT 12.0m x 2.75m BUS STOP
EXISTING ATCO DISTRIBUTION GASLINE RIGHT OF WAY
CONSTRUCT 1.5m CONRETE WALK
EXISTING ACCESS TO BE CLOSED ACCESS TO BE RELOCATED TO WOODBEND WYND
MATCH LINE
AUXILIARY
50m TAPER
30m TAPER
105m BAY
50m BAY
60m TAPER
4.00 BLVD
PROPOSED PROFILE GRADE
EXISTING GROUND UNDER THE PROPOSED CENTRE LINE
EXISTING GROUND 5.7m RIGHT OFFSET
EXISTING GROUND 5.3m LEFT OFFSET
PROPOSED INTERSECTION
VPI 0+663.76
EL. 690.58
STA. 0+663.76
VPI 0+808.88
EL. 689.63
VPI 1+061.88
EL. 691.15
PROPOSED INTERSECTION
STA. 1+100.00
L 50
K 92
L 50
K 42
L 130
K 73
0.60%
-0.60%
-1.19%
HORIZONTAL
VERTICAL
DESIGN SPEED =70 km/h
POSTED SPEED =60 km/h
PERMIT TO PRACTICE P8204
FEB 20, 2015
Manager, Transportation Planning Branch
Director, Facility & Capital Planning
Director, Development Planning & Engineering
CONCEPT - SUBJECT TO PRELIMINARY SURVEY AND DESIGN
199 STREET
25 AVENUE TO 27 AVENUE
Edmonton
TRANSPORTATION SERVICES
DRAWN: BC
REVIEWED: TW
DATE: FEB 2015
PLAN NO.
S199-141-02

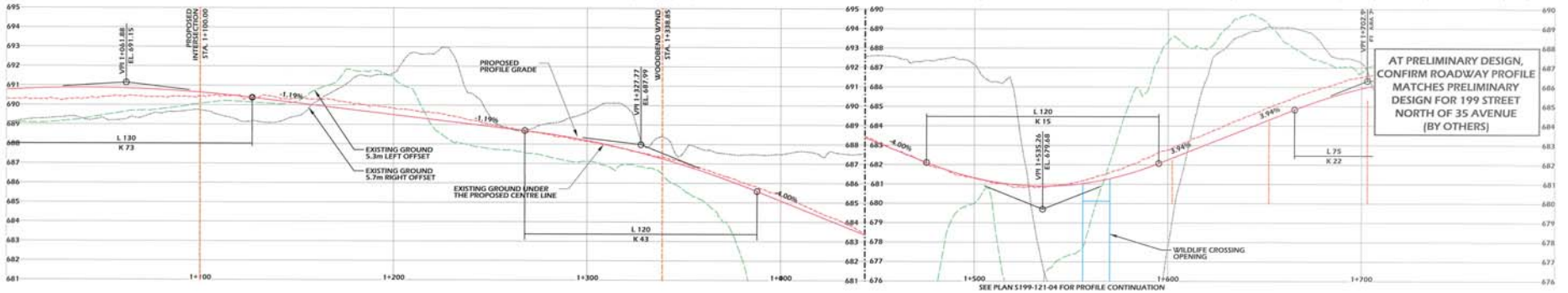


SECTION C-C

KEY PLAN



FOR WEDGEWOOD CREEK AND WILDLIFE CROSSING INFORMATION REFER TO DRAWING S199-141-04 & 05



AT PRELIMINARY DESIGN, CONFIRM ROADWAY PROFILE MATCHES PRELIMINARY DESIGN FOR 199 STREET NORTH OF 35 AVENUE (BY OTHERS)

HORIZONTAL 0 25 50m
VERTICAL 0 2.5 5.0m

DESIGN SPEED = 70 km/h
POSTED SPEED =60 km/h

PROFESSIONAL ENGINEER ALBERTA
MAR 19, 2015
PERMIT TO PRACTICE P8204

Manager, Transportation Planning Branch
Director, Facility & Capital Planning
Director, Development Planning & Engineering

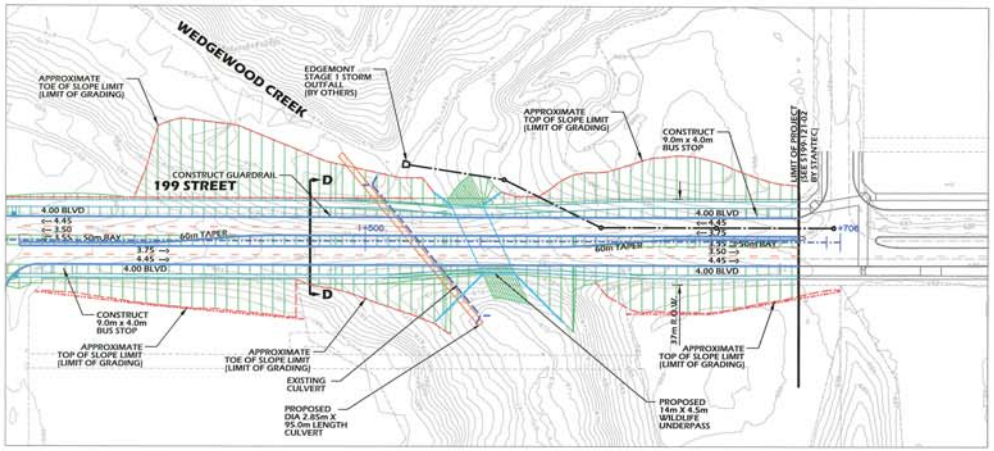
CONCEPT - SUBJECT TO PRELIMINARY SURVEY AND DESIGN

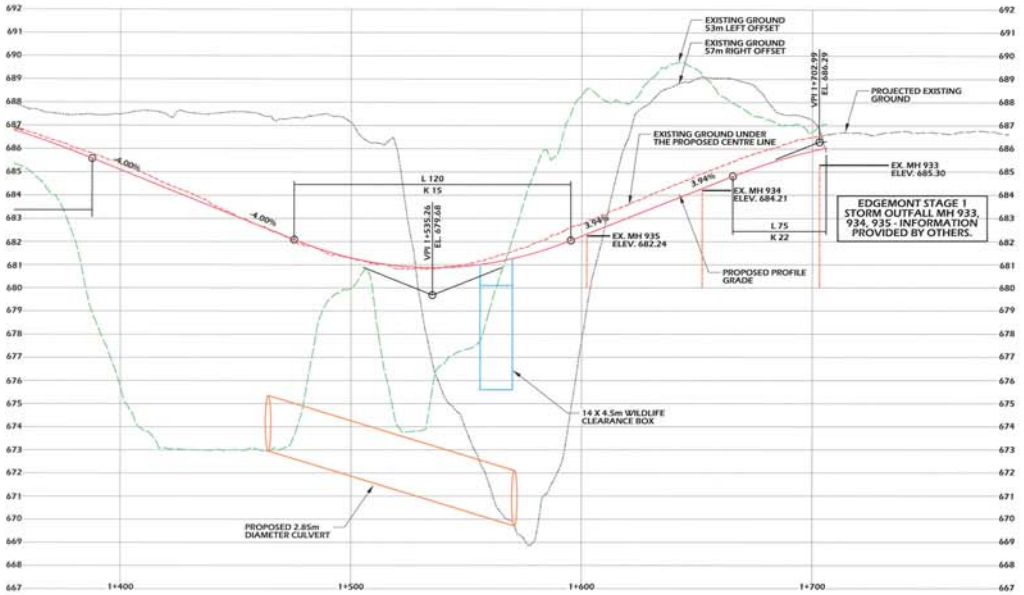
199 STREET
27 AVENUE TO 35 AVENUE

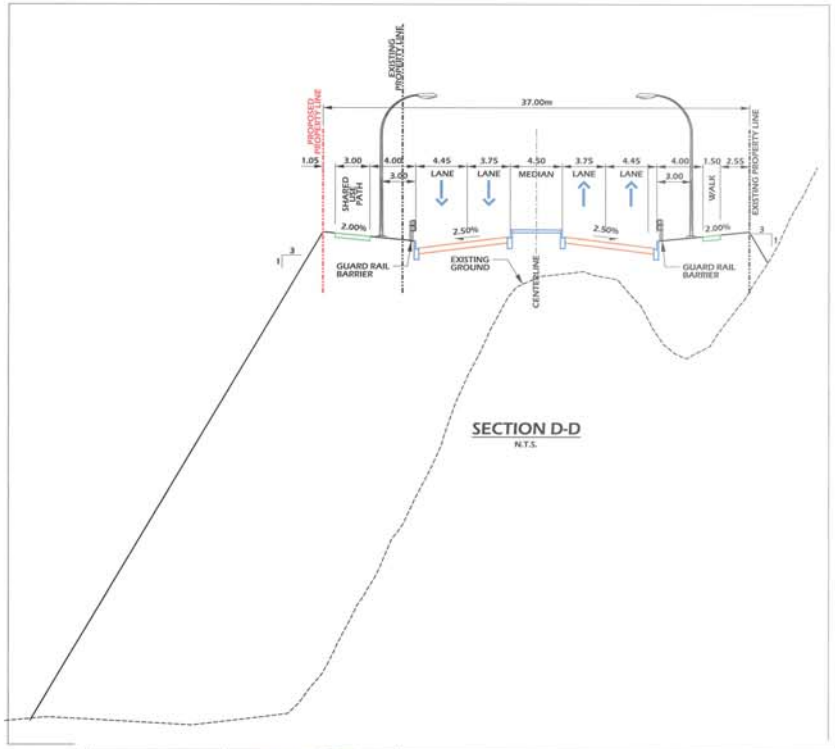
The City of Edmonton TRANSPORTATION SERVICES

DRAWN: RC
REVIEWED: TW
DATE: MAR 2015

PLAN NO. S199-141-03







CIMA

HORIZONTAL 0 25 50m
VERTICAL 0 2.5 5.0m

DESIGN SPEED = 70 km/h
POSTED SPEED =60 km/h

PROFESSIONAL ENGINEER ALBERTA
MAR 19, 2015
PERMIT TO PRACTICE P6004

Apr 2/15
Manager, Transportation Planning Branch
Mar 24/15
Director, Facility & Capital Planning
Mar 31/15
Director, Development Planning & Engineering

CONCEPT - SUBJECT TO PRELIMINARY SURVEY AND DESIGN

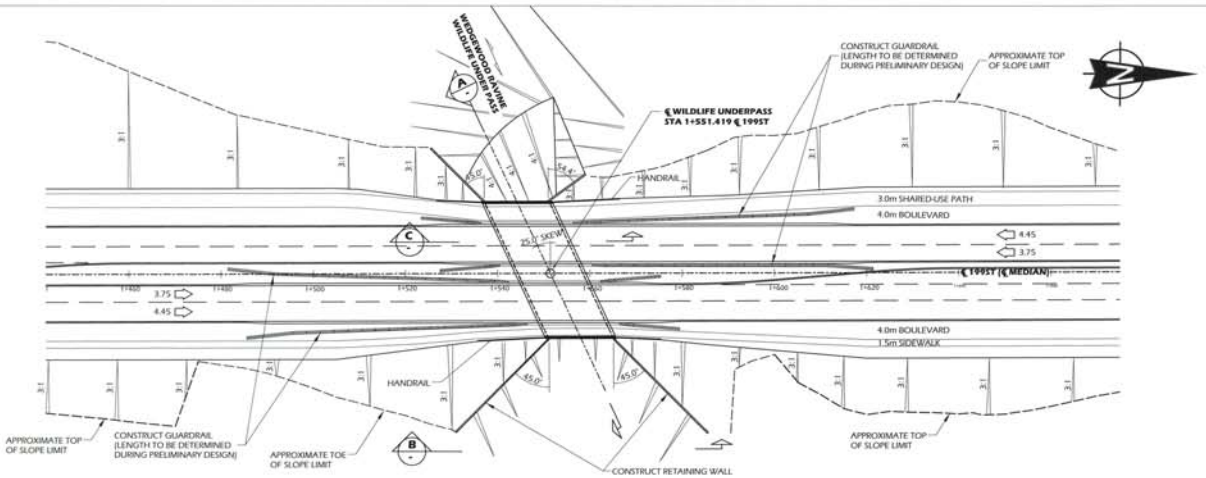
199 STREET

WEDGEWOOD CREEK AND WILDLIFE CROSSING INFORMATION

The City of Edmonton TRANSPORTATION SERVICES

DRAWN: BC
REVIEWED: TW
DATE: MAR 2015

PLAN NO. S199-141-04



PLAN
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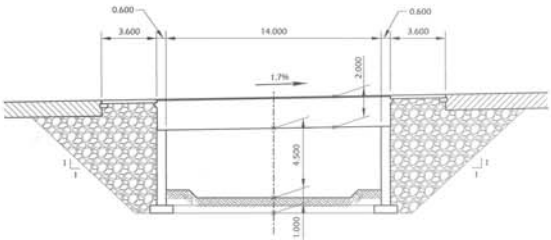
KEY PLAN



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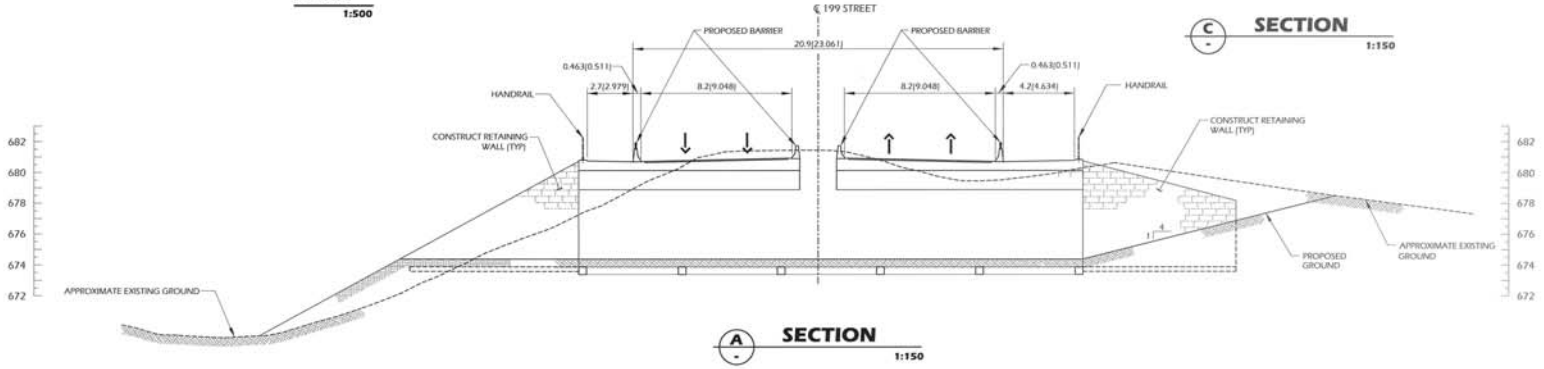

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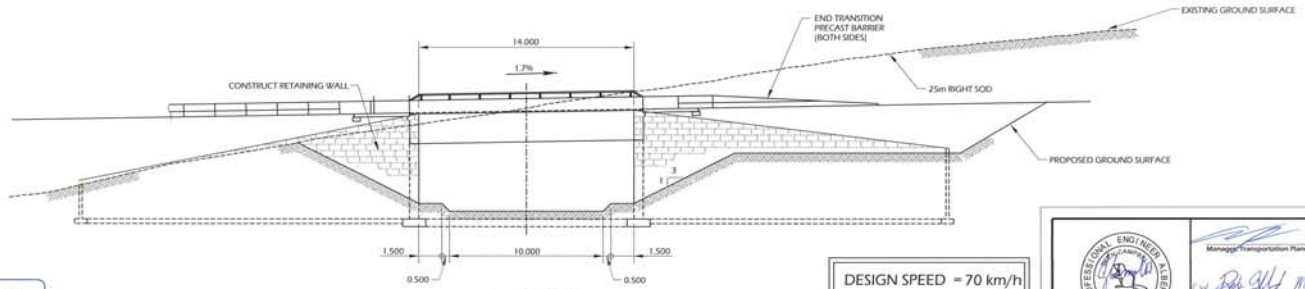


B **SECTION**
1:150

DESIGN SPEED = 70 km/h
POSTED SPEED =60 km/h

GENERAL NOTE

1. ALL DIMENSIONS IN METRES.
2. DIMENSIONS IN ( ) ARE MEASURED ON SKEW.
3. ADDITIONAL EPCOR POWER DUCTS TO ACCOMODATE FUTURE POWER FEEDS CROSSING THE BRIDGE STRUCTURE. TO BE INCLUDED IN THE PRELIMINARY AND DETAILED DESIGN.

PROFESSIONAL ENGINEER ALBERTA
PERMIT TO PRACTICE P8004
MAR 14, 2015

Apr 7/15
Manager, Transportation Planning Branch
Mar 24/15
Director, Facility & Capital Planning
Mar 26/15
Director, Development Planning & Engineering

CONCEPT - SUBJECT TO PRELIMINARY SURVEY AND DESIGN

199 STREET
WEDGEWOOD RAVINE WILDLIFE CROSSING CONCEPT

The City of Edmonton — Transportation Services

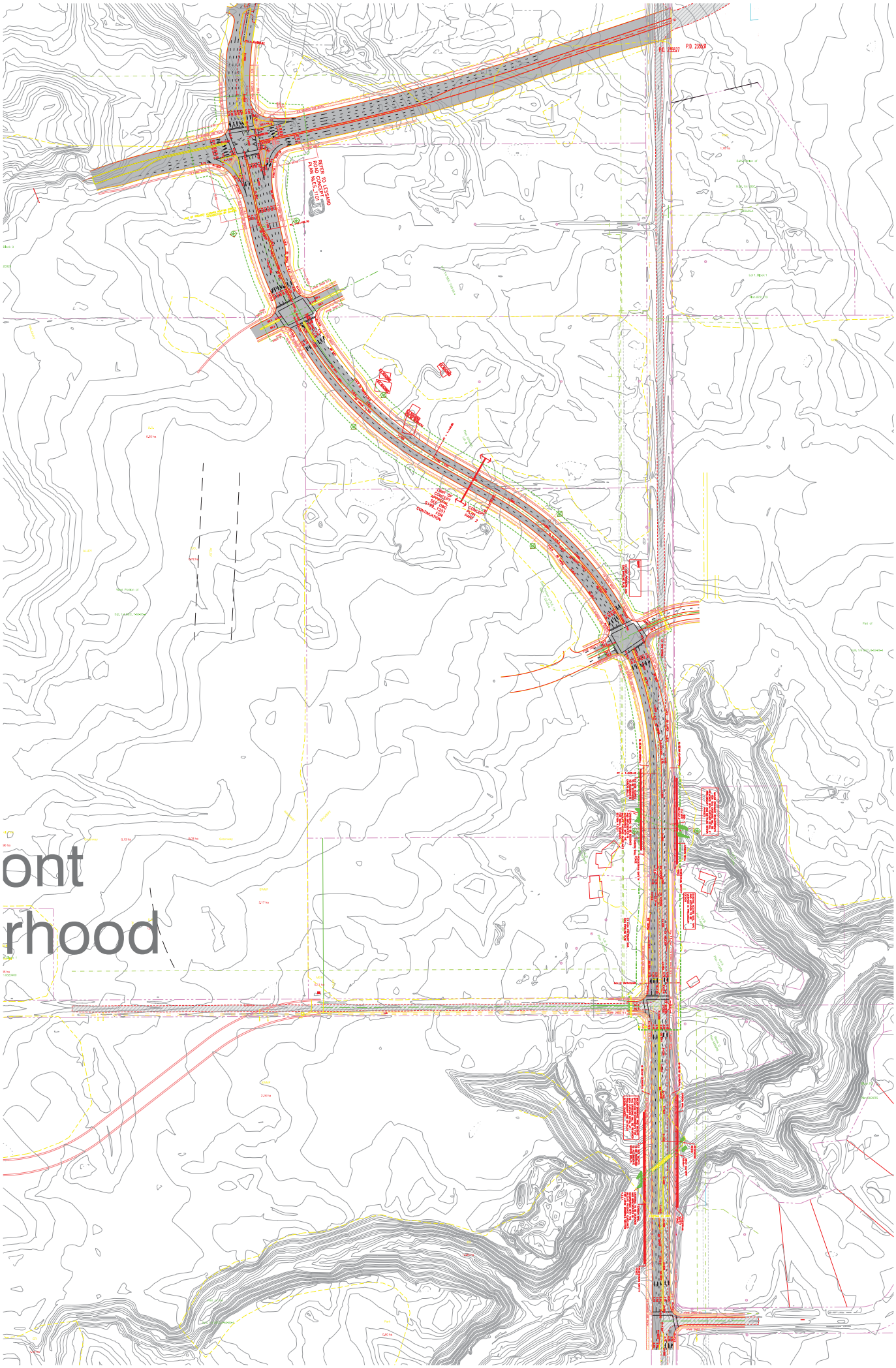
DRAWN: JR
REVIEWED: TW
DATE: MAR 2015

PLAN NO. S199-141-05

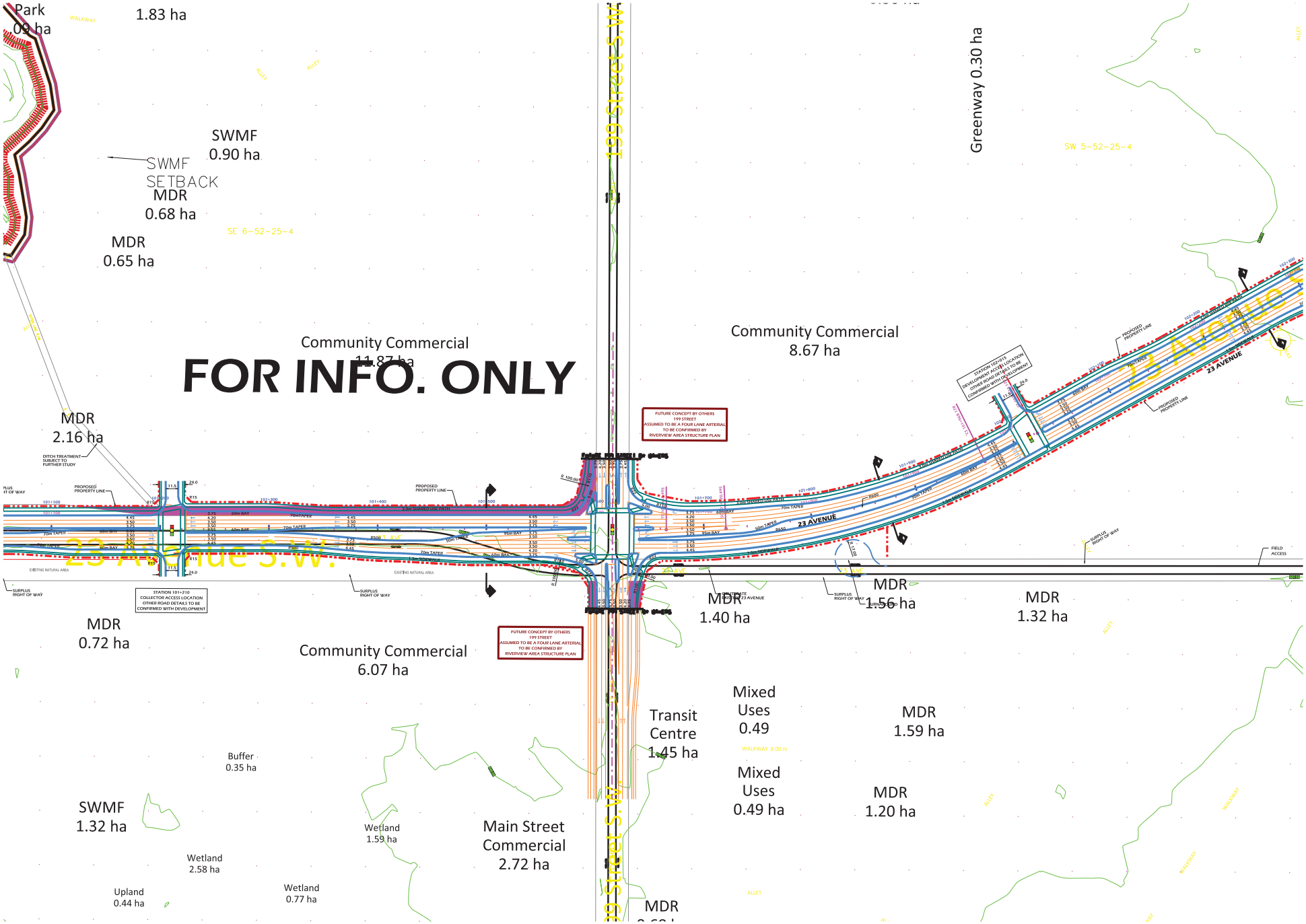
PLOTTED: 5/18/2015 12:57:05 PM
I:\Projects\2064 KELTEC\2065456 - 199 St Concept Plan\400 Drawings\04 CADD\5 Concept Drawings\Conceptual Drawings submitted - 1 - Copy\S199-141-05.dgn

APPENDIX B

Existing Concept Plans



ont
rhood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0.09 ha
1.83 ha
SWMF
0.90 ha
SWMF
SETBACK
MDR
0.68 ha
MDR
0.65 ha
Greenway 0.30 ha
Community Commercial
11.87 ha
FOR INFO. ONLY
Community Commercial
8.67 ha
MDR
2.16 ha
199 Street S.W.
23 Avenue S.W.
MDR
0.72 ha
MDR
1.40 ha
MDR
1.56 ha
MDR
1.32 ha
Community Commercial
6.07 ha
Transit
Centre
1.45 ha
Mixed
Uses
0.49
MDR
1.59 ha
Mixed
Uses
0.49 ha
MDR
1.20 ha
Buffer
0.35 ha
SWMF
1.32 ha
Wetland
1.59 ha
Main Street
Commercial
2.72 ha
Wetland
2.58 ha
Upland
0.44 ha
Wetland
0.77 ha
MDR

APPENDIX C

Collision History

Historical Collision Summary Report 2009-2013

199 St (23 Ave to 35 Ave)

Prepared by: Office of Traffic Safety

February 27, 2014

For more information contact:

Brandt Denham
Collision Data Supervisor
Phone: 780-495-9905
Email: brandt.denham@edmonton.ca

199 St (23 Ave to 35 Ave) Collisions Overall (2009-2013)

2014-Feb-27

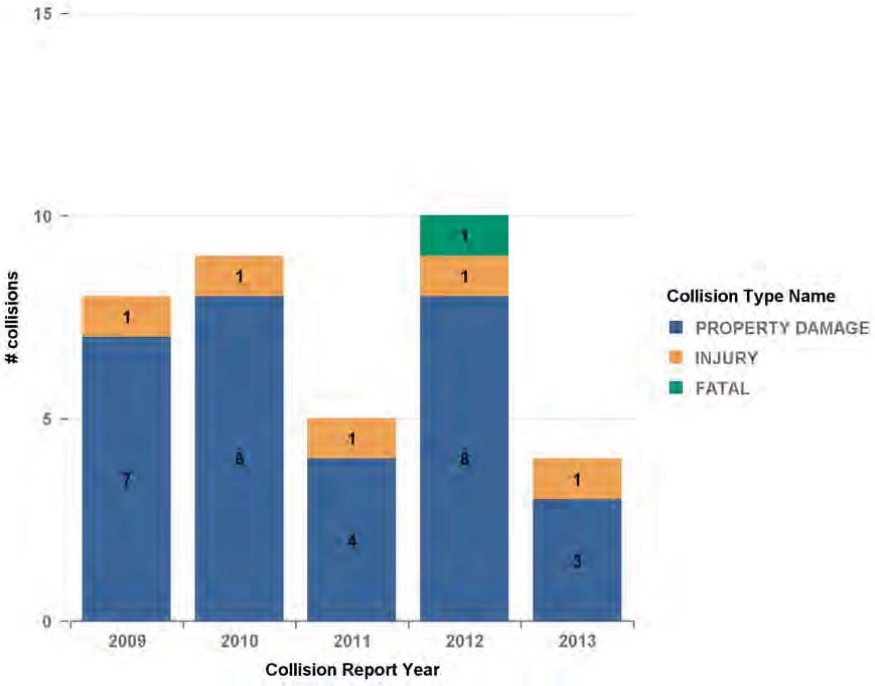


Figure 1: Collisions by Severity

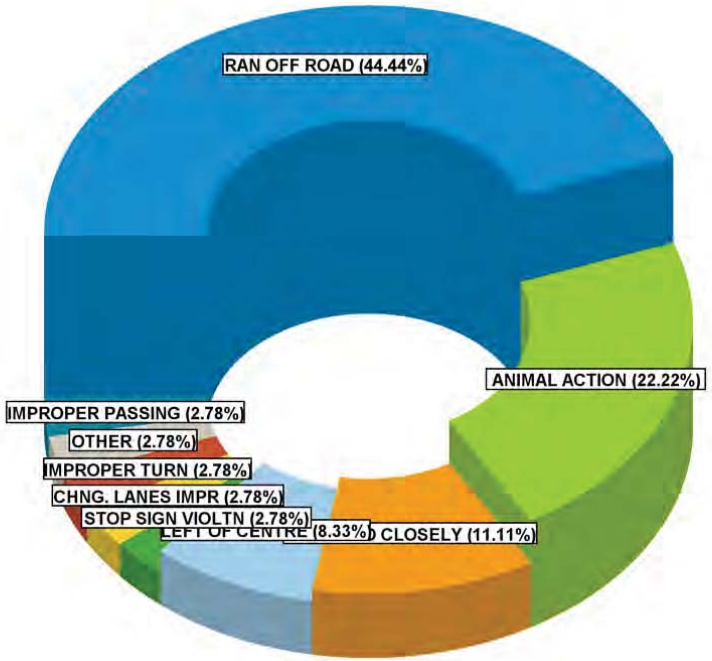


Figure 2: Collisions by Top 5 Causes

Note: The property damage reporting threshold was raised from $1000 to $2000 in 2011 resulting in fewer PDO collisions in the collision database

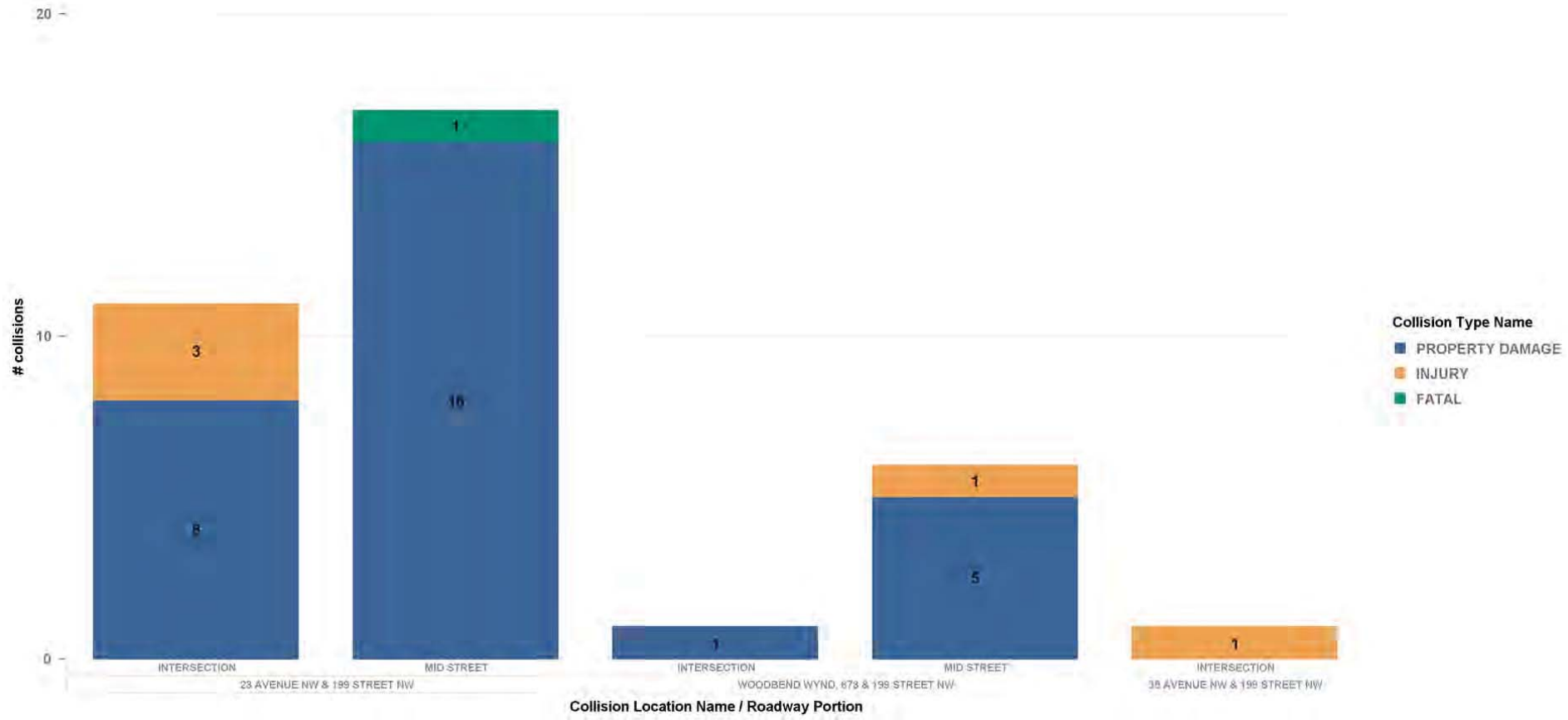


Figure 3: Top 5 Collision Locations by Severity

199 St (23 Ave to 35 Ave) Collisions Overall (2009-2013)

2014-Feb-27

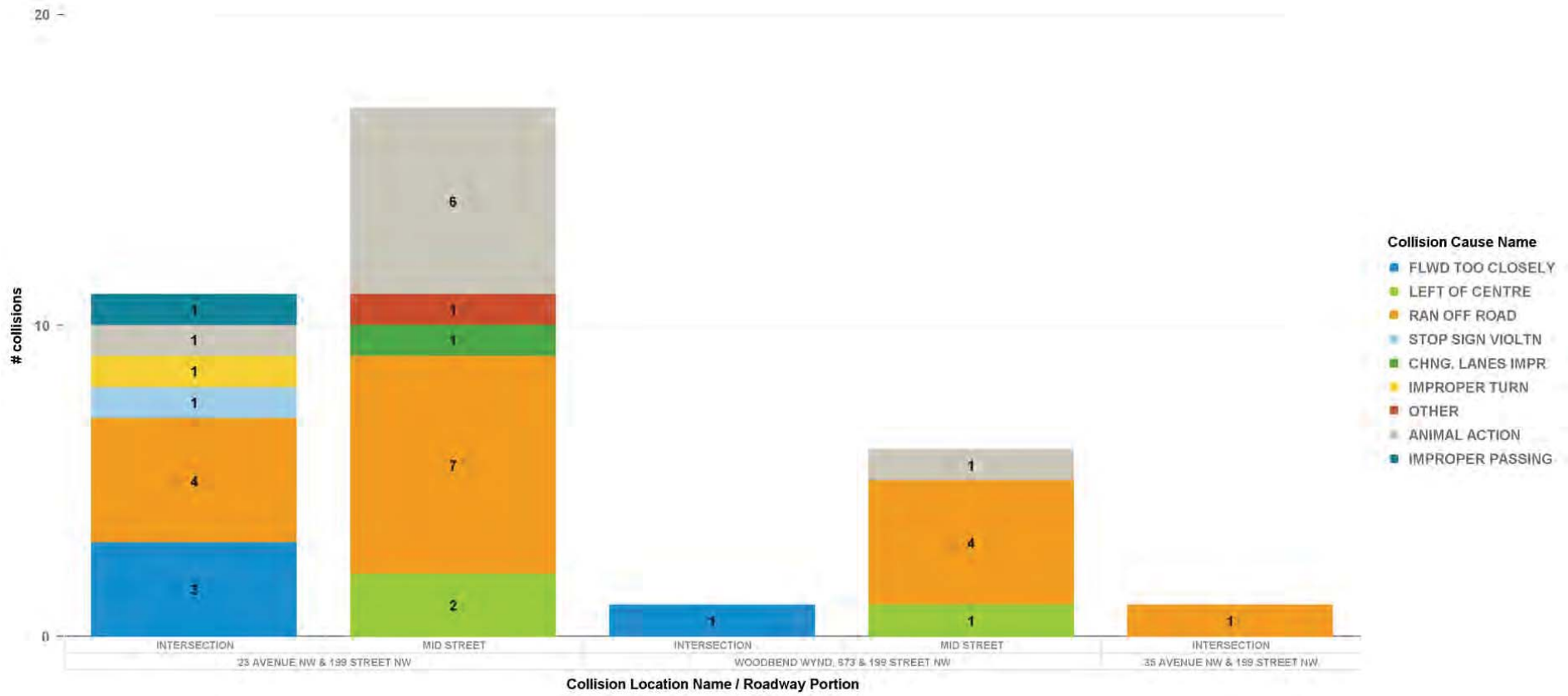


Figure 4: Top 5 Collision Locations by Cause

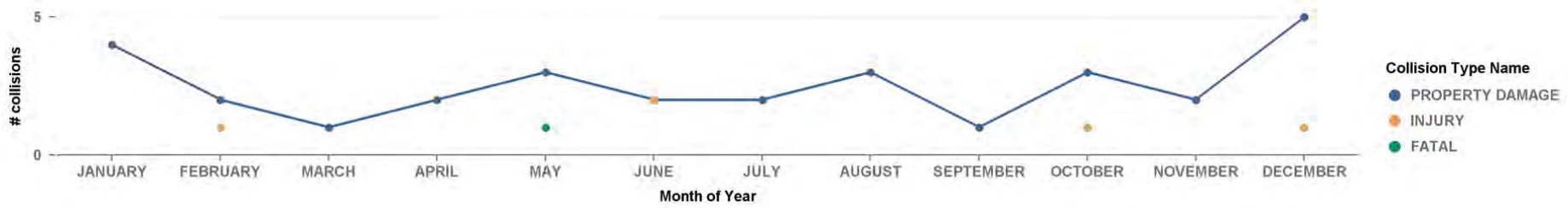


Figure 5: Collisions by Month

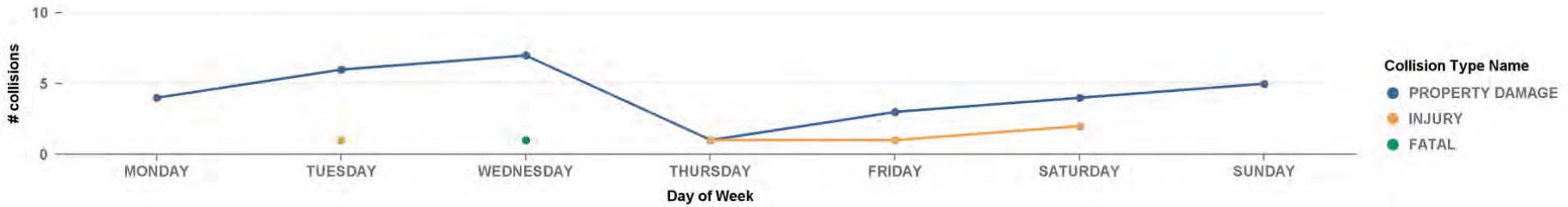


Figure 6: Collisions by Day of Week

Figure 7: Collisions by Time of Day

199 St (23 Ave to 35 Ave) Collisions Overall (2009-2013)

2014-Feb-27

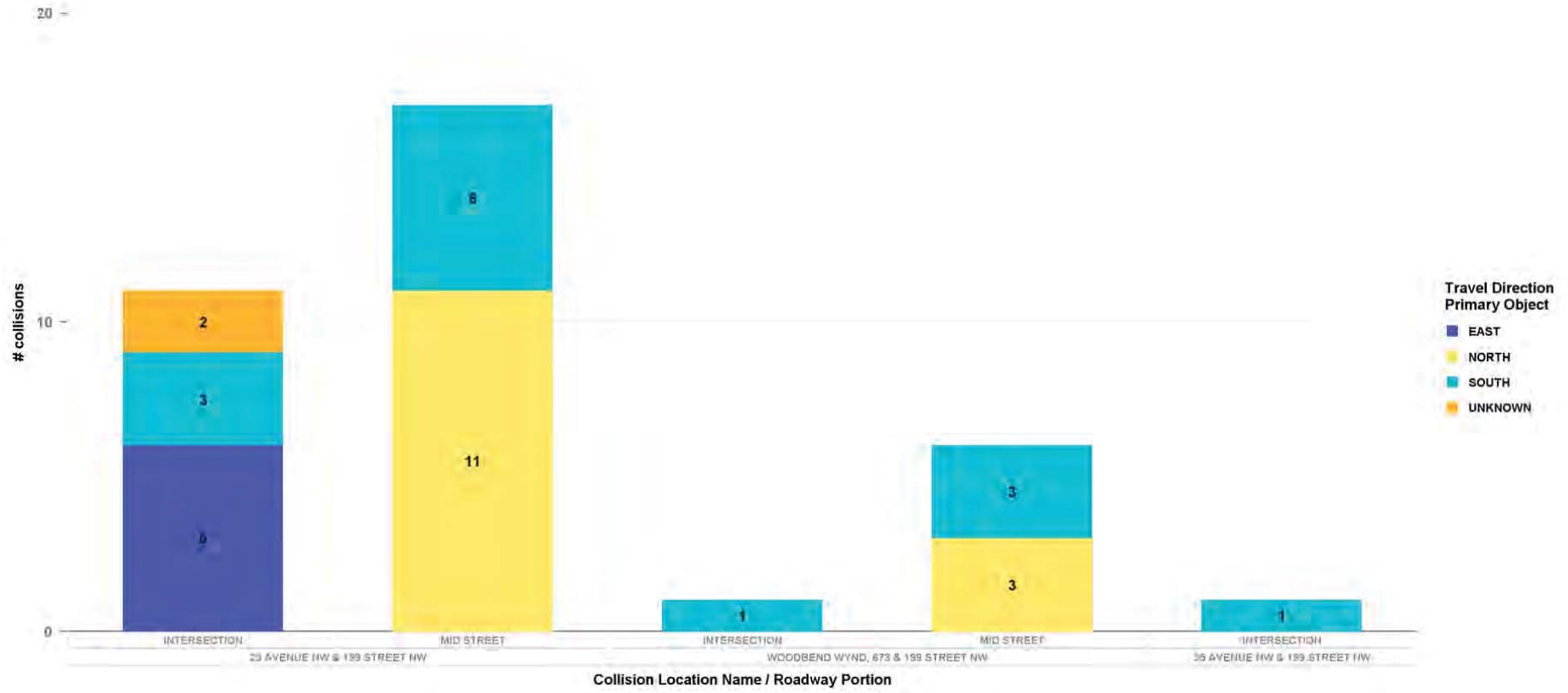


Figure 8: Top 5 Collision Locations by Travel Direction (Primary Driver)

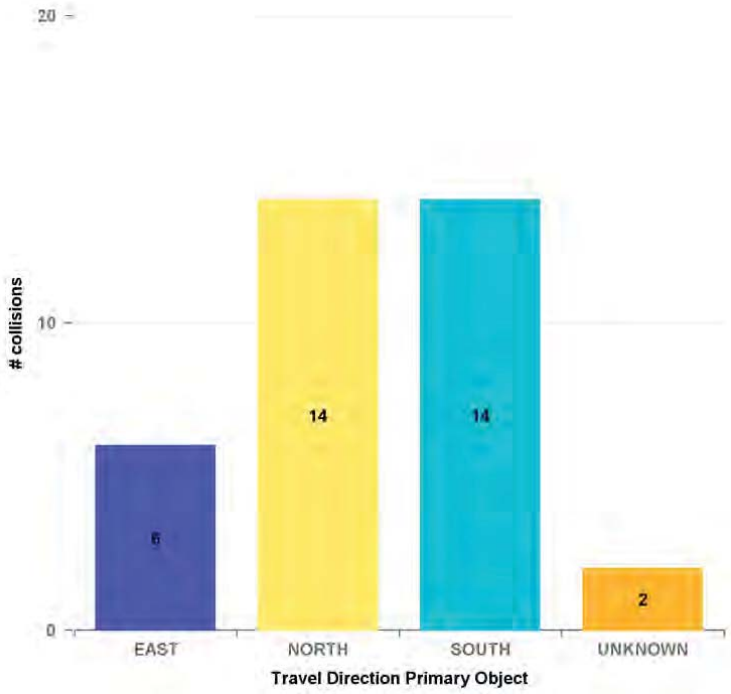


Figure 9: Collisions by Travel Direction (Primary Driver)

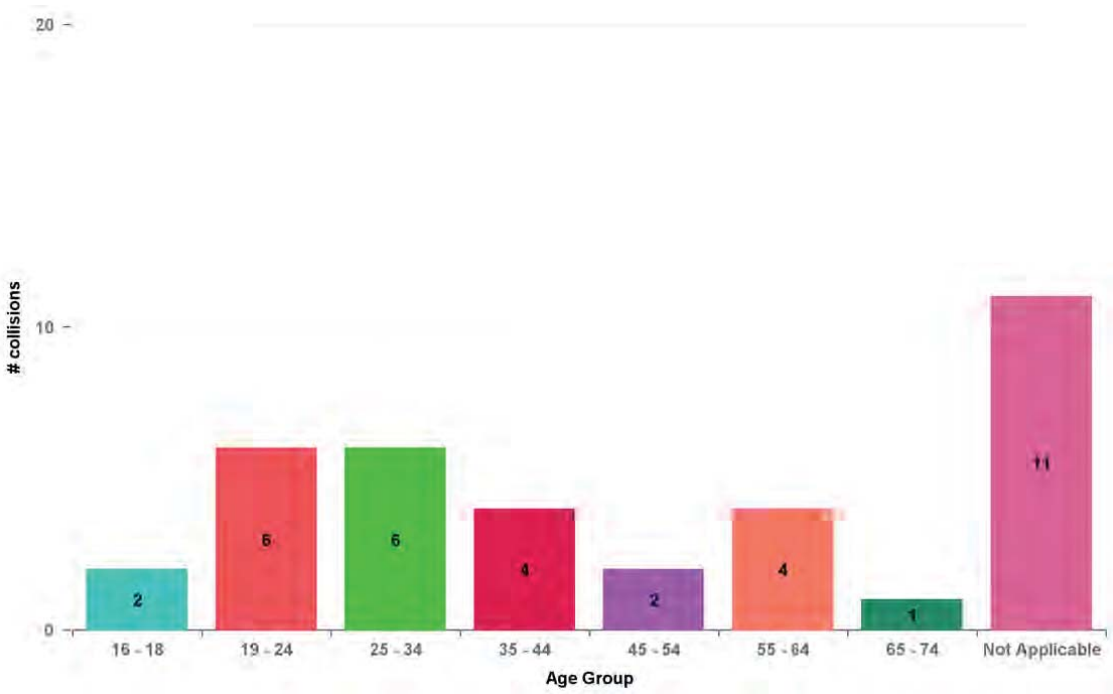


Figure 10: Collisions by Age Group

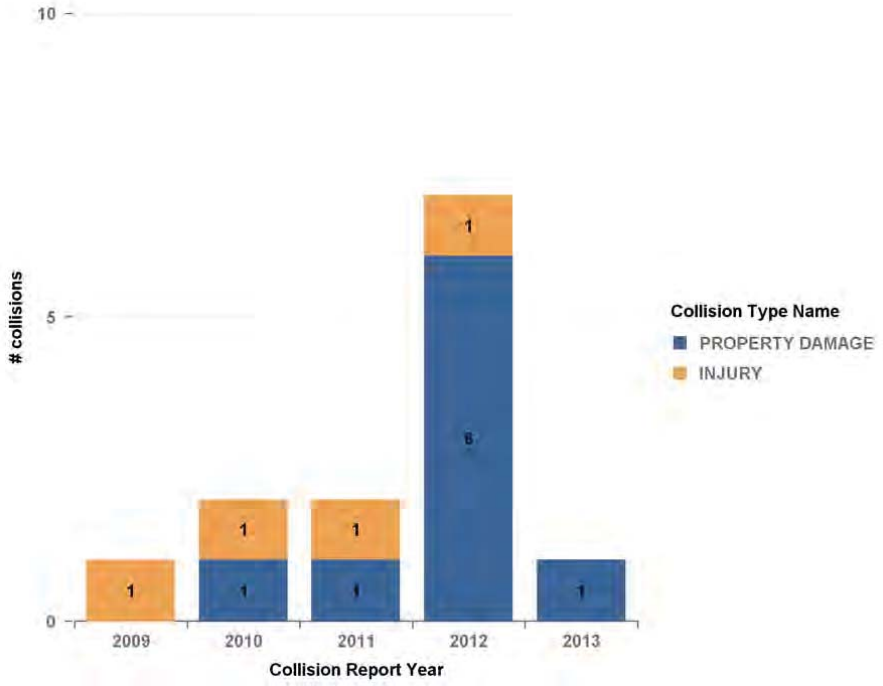


Figure 1: Collisions by Severity

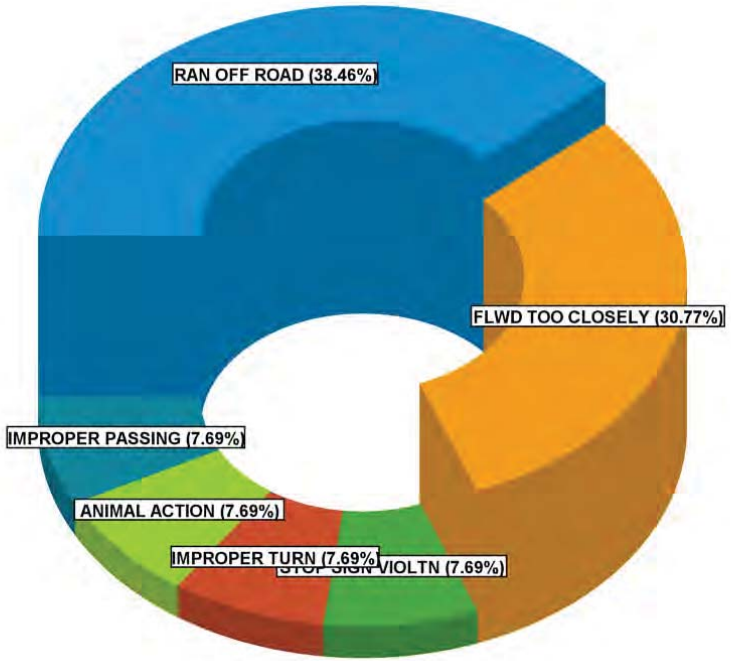


Figure 2: Collisions by Top 5 Causes

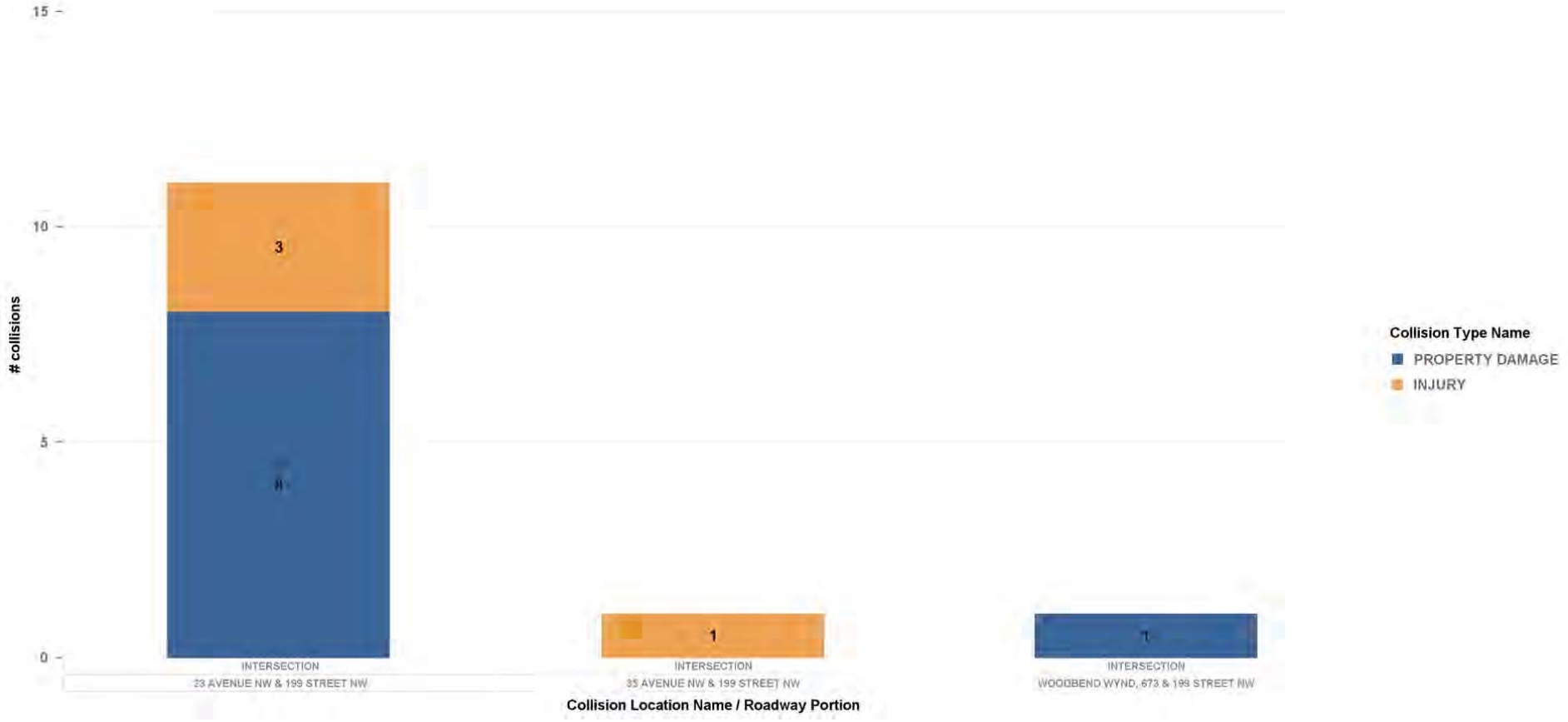


Figure 3: Top 5 Collision Locations by Severity

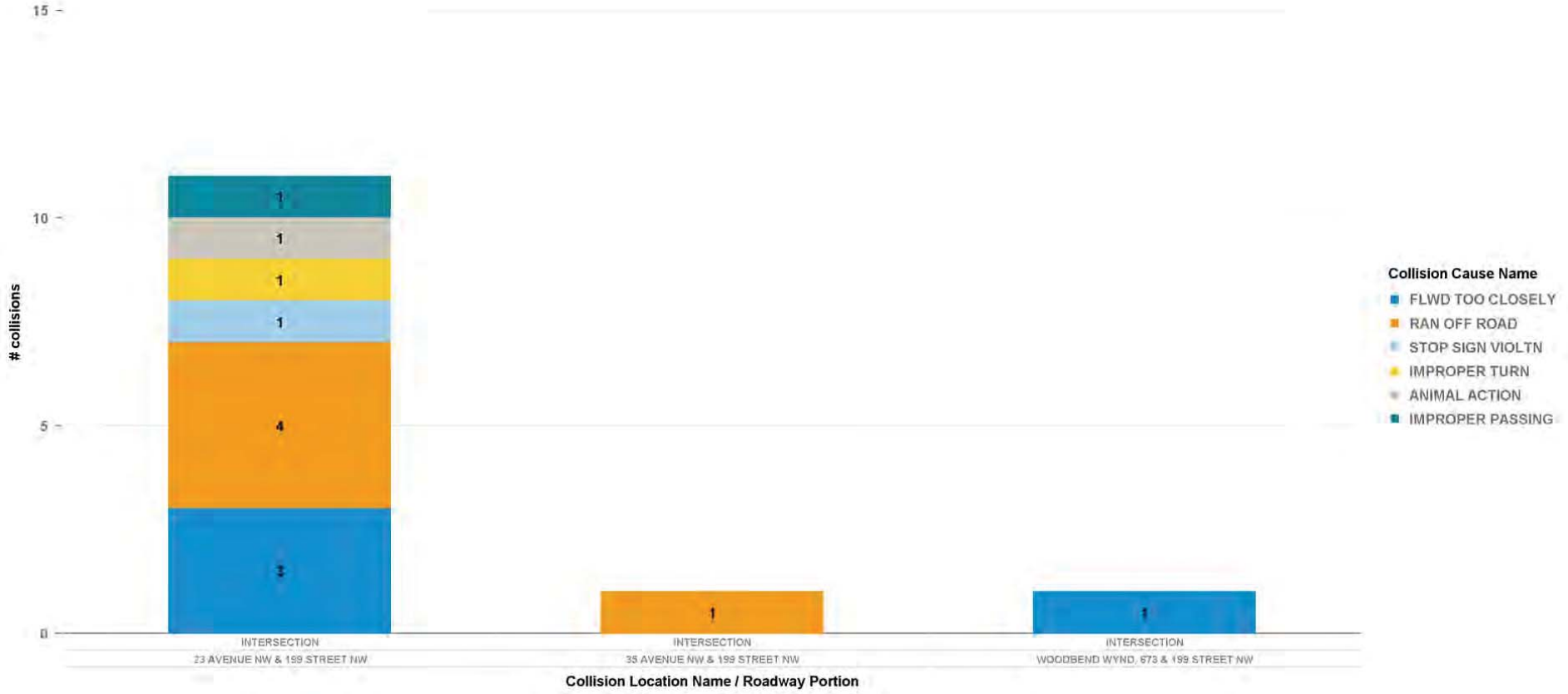


Figure 4: Top 5 Collision Locations by Cause

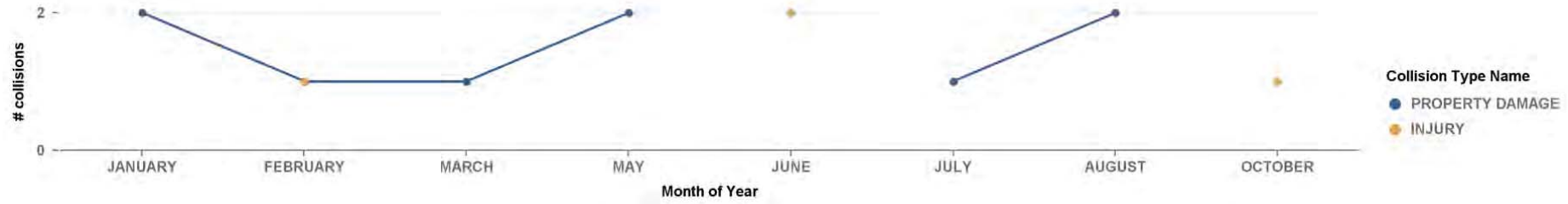


Figure 5: Collisions by Month

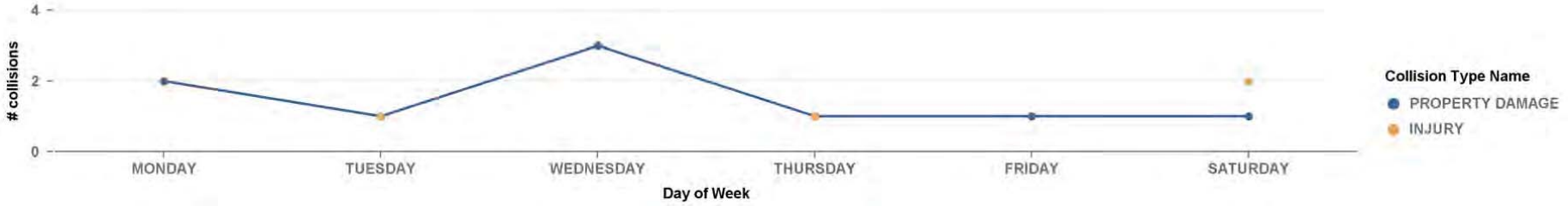


Figure 6: Collisions by Day of Week

Figure 7: Collisions by Time of Day

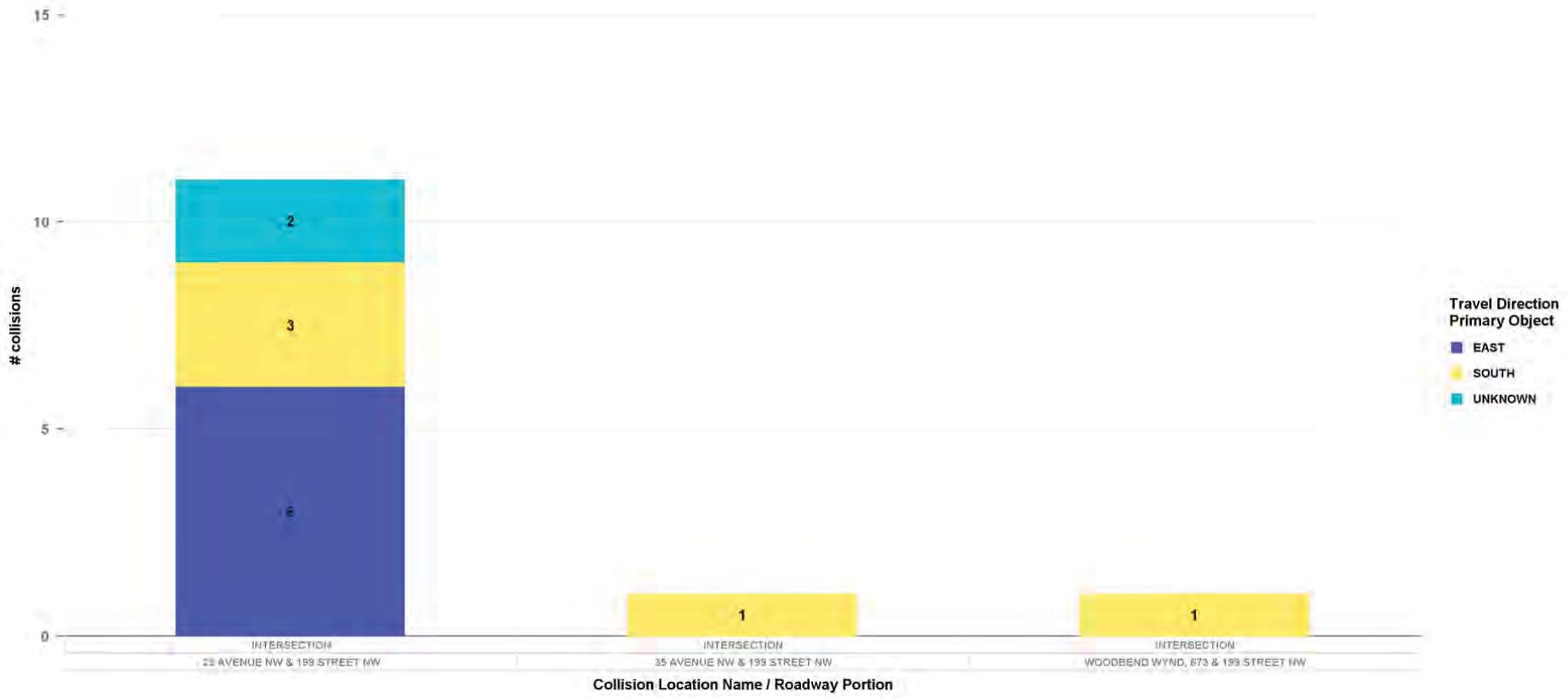


Figure 8: Top 5 Collision Locations by Travel Direction (Primary Driver)

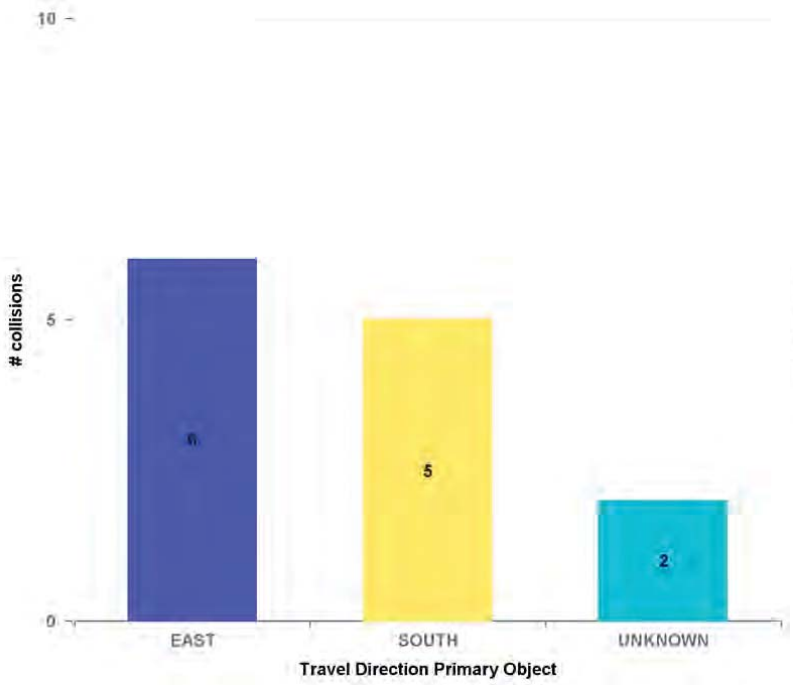


Figure 9: Collisions by Travel Direction (Primary Driver)

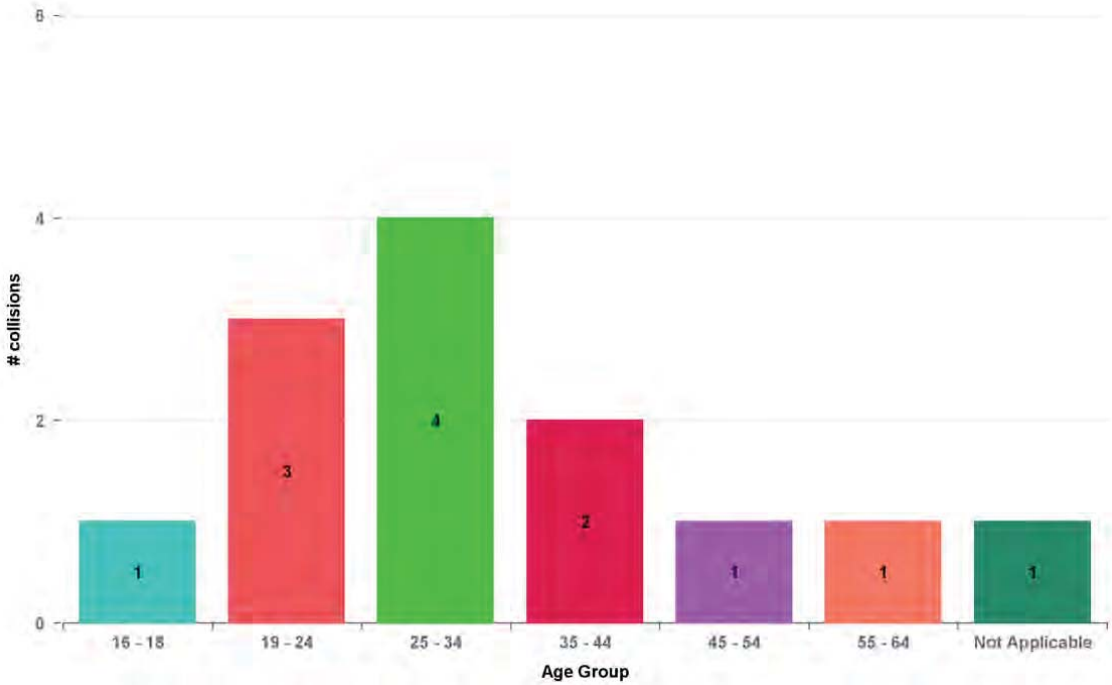


Figure 10: Collisions by Age Group

199 St (23 Ave to 35 Ave) Collisions on Midblocks (2009-2013)

2014-Feb-27

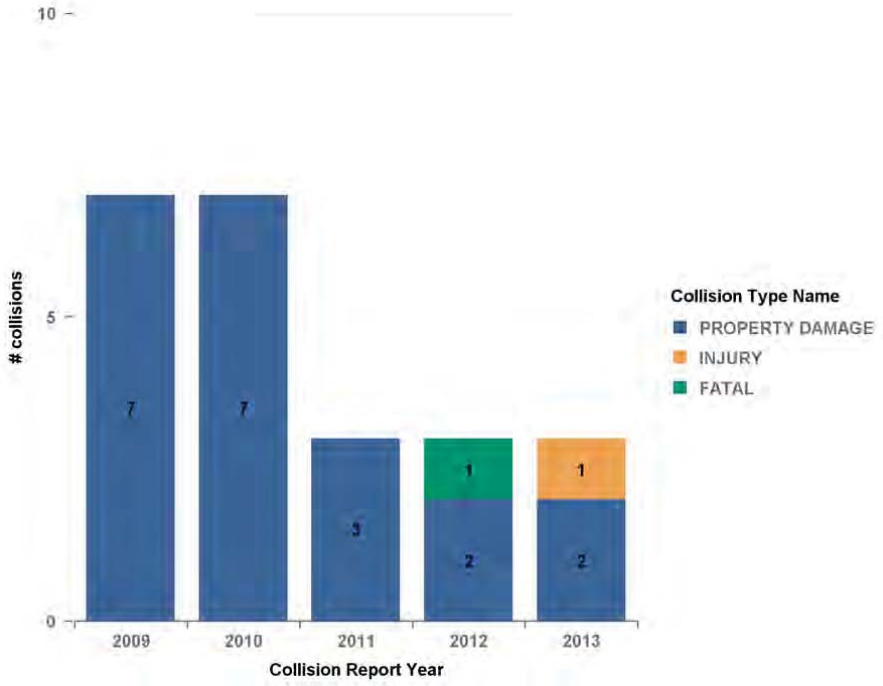


Figure 1: Collisions by Severity

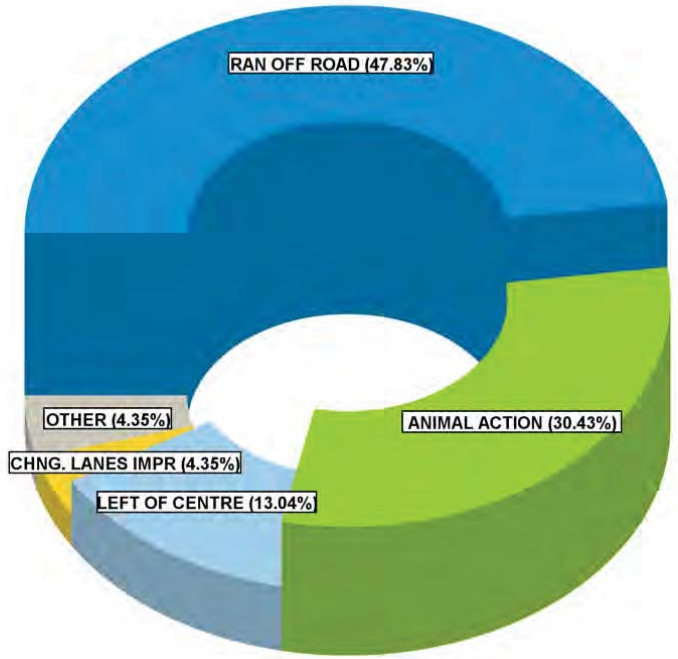


Figure 2: Collisions by Top 5 Causes

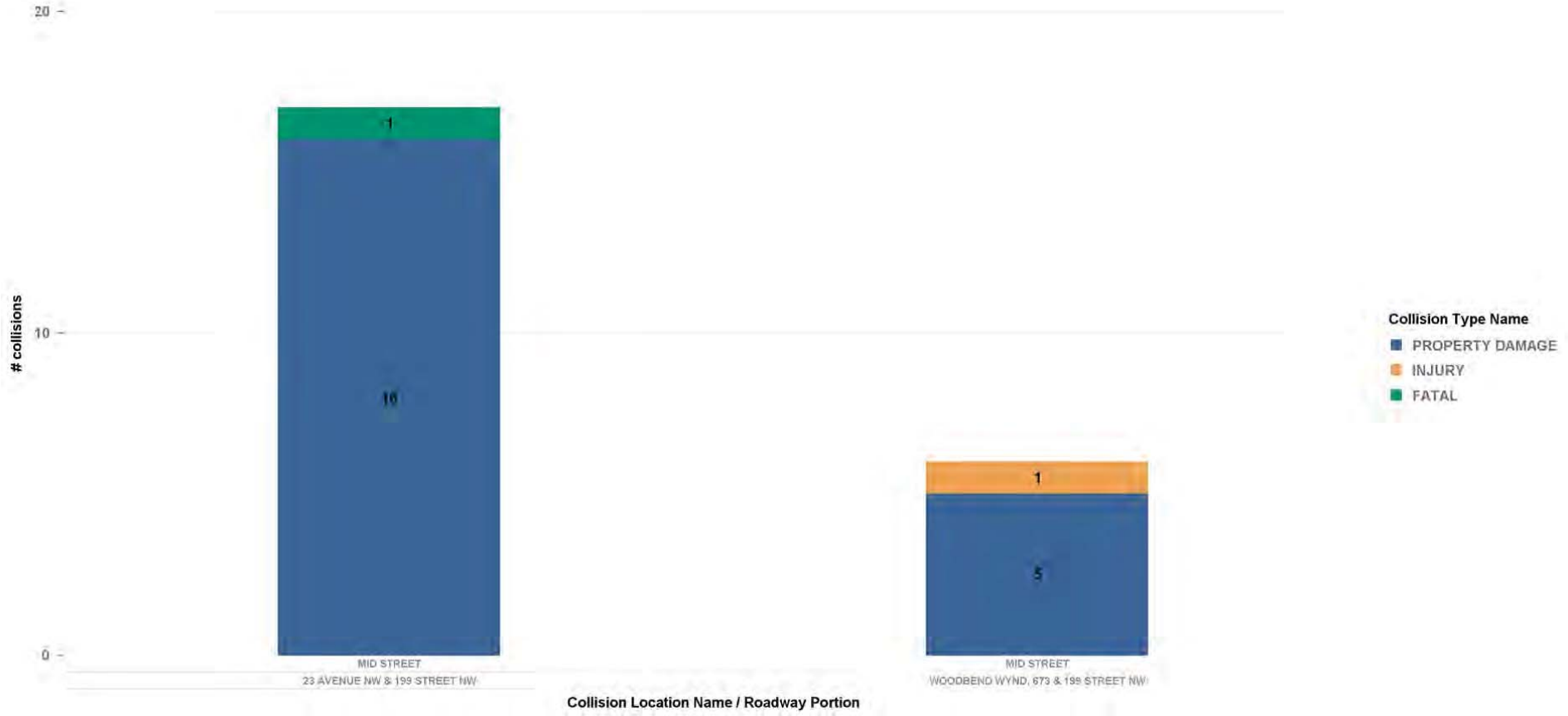


Figure 3: Top 5 Collision Locations by Severity

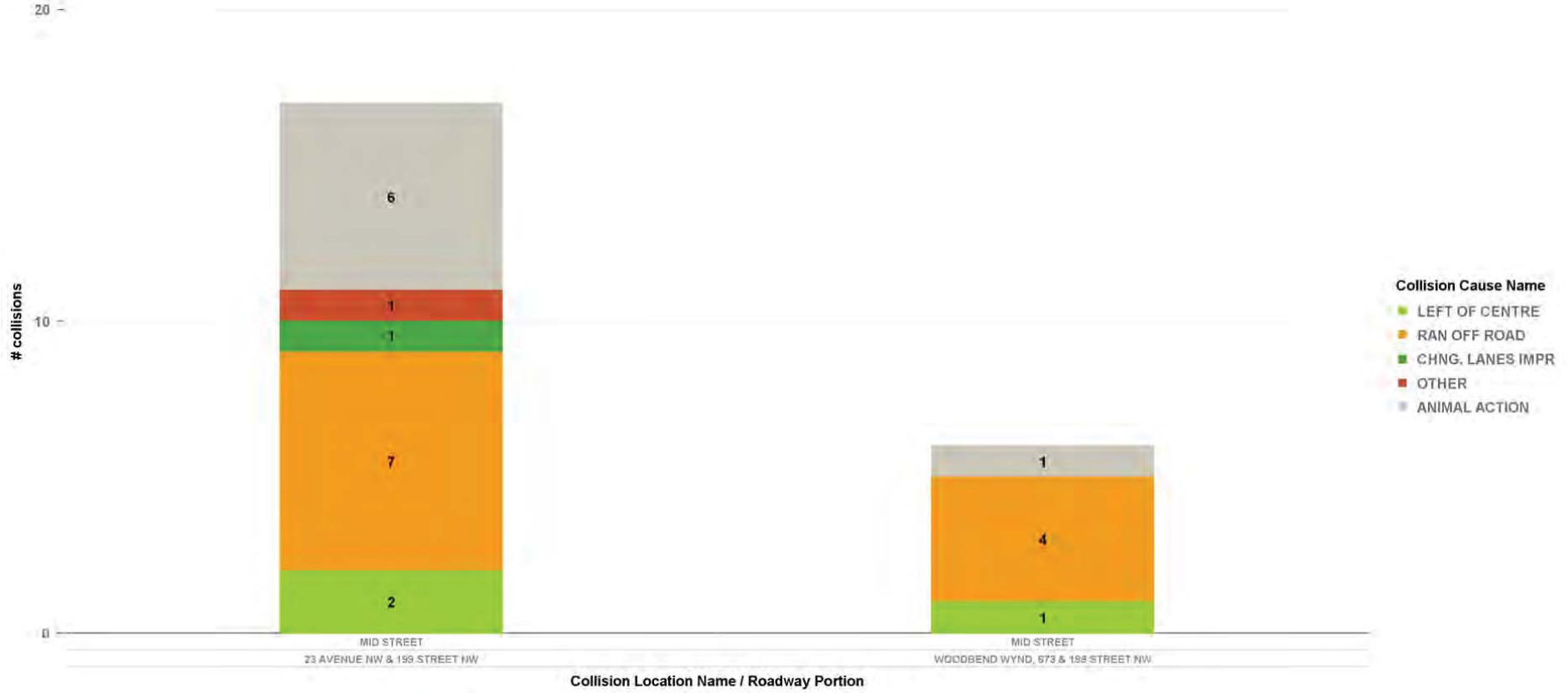


Figure 4: Top 5 Collision Locations by Cause

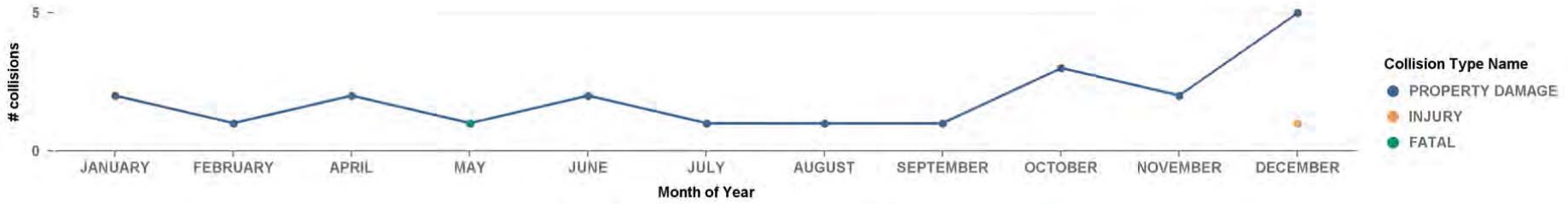


Figure 5: Collisions by Month

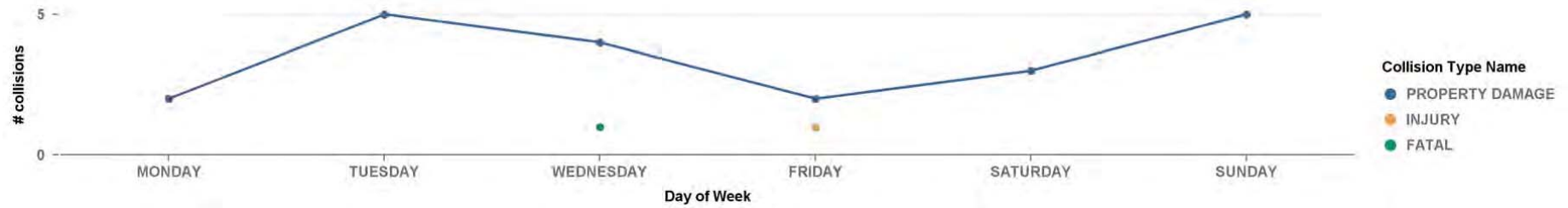


Figure 6: Collisions by Day of Week

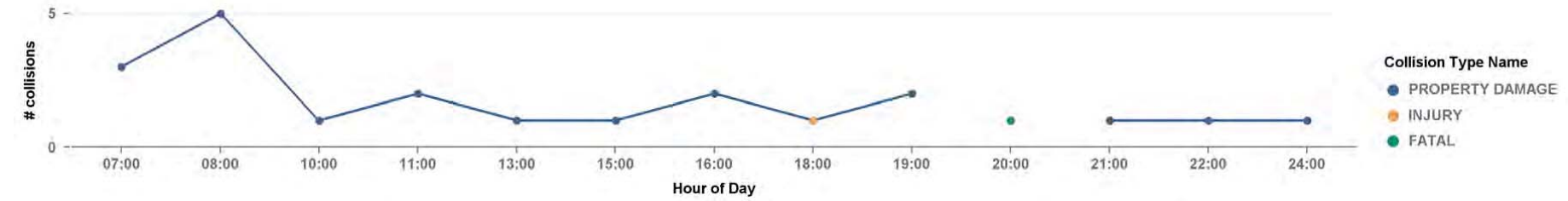


Figure 7: Collisions by Time of Day

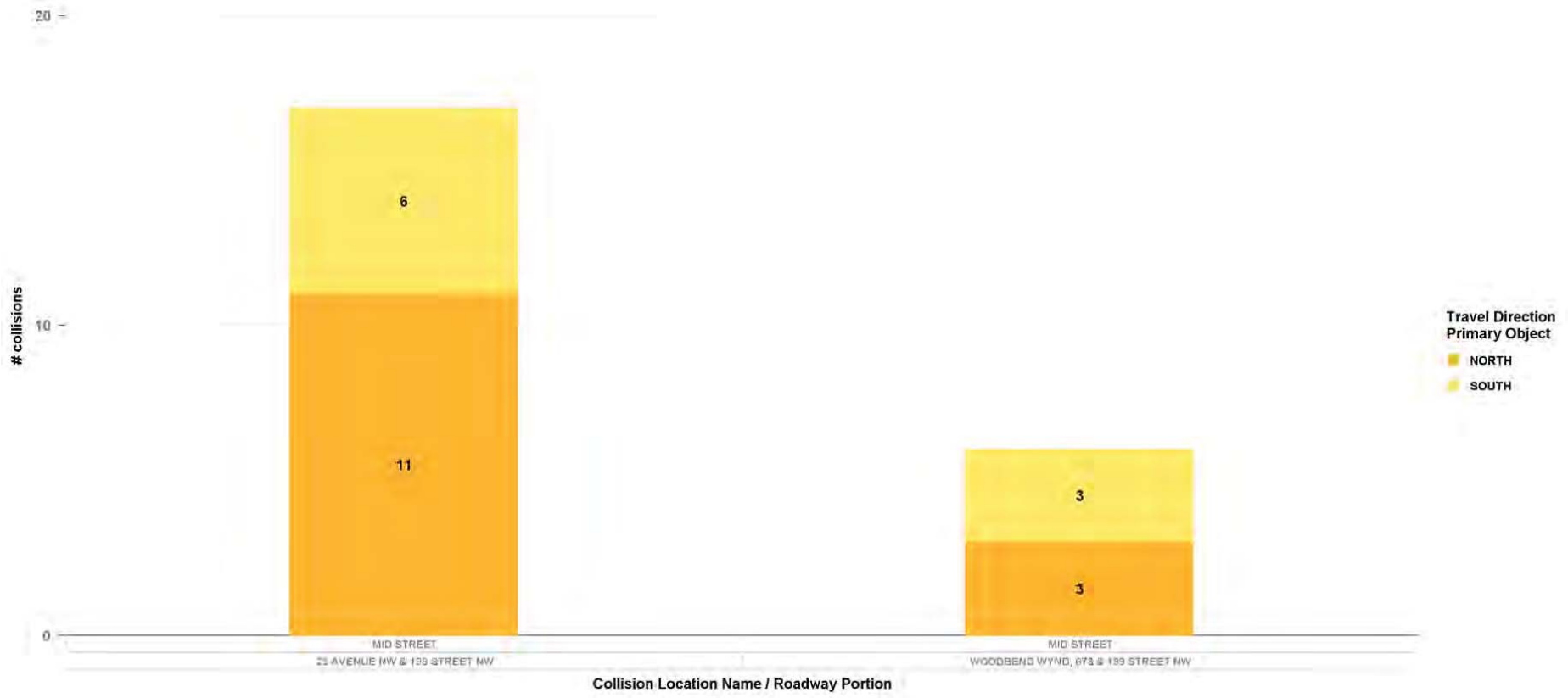


Figure 8: Top 5 Collision Locations by Travel Direction (Primary Driver)

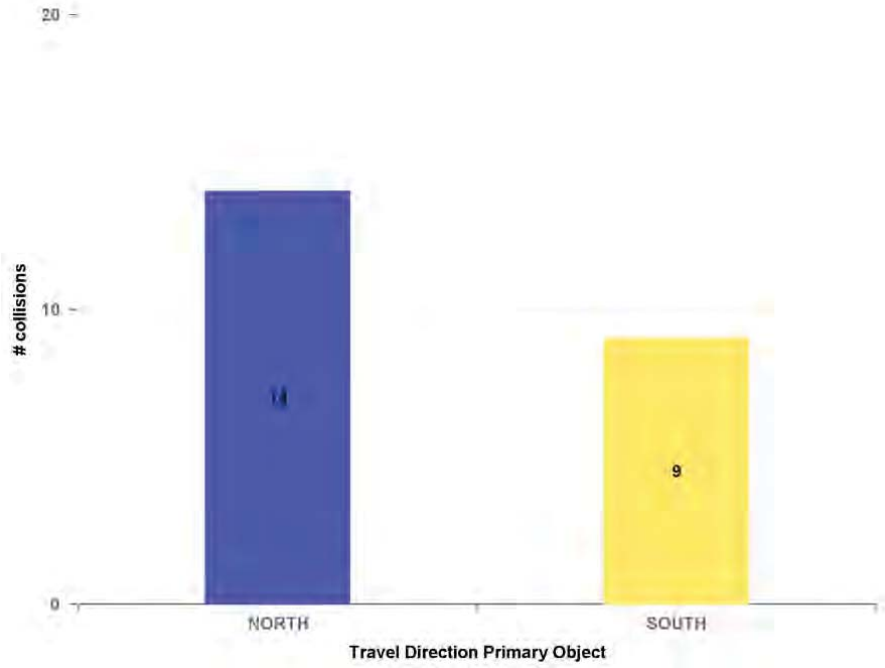


Figure 9: Collisions by Travel Direction (Primary Driver)

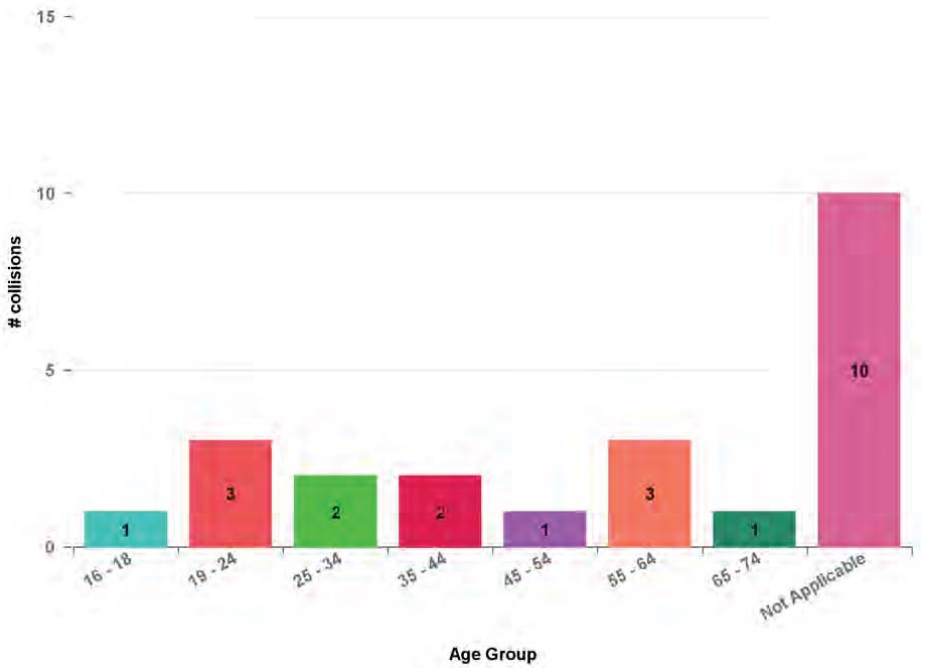


Figure 10: Collisions by Age Group

APPENDIX D

Environmental Overview

Environmental Overview Report for Riverview Neighborhoods 1, 2 and 3 Edmonton, Alberta

Prepared for:
Riverview Owner's Group

Prepared by:
Stantec Consulting Ltd.

File 1102-18864

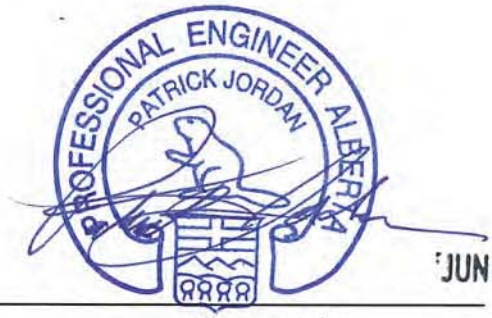
June 2014

Stantec Quality Management Program

This document entitled Environmental Overview Report for Riverview Neighborhoods 1, 2 and 3 Edmonton, Alberta was prepared by Stantec Consulting Ltd. for the account of Riverview Owner's Group.

Prepared by _____
(signature)

Alison Kirwan, B.Sc., P.Ag. (BC, AB), EPt
Environmental Scientist



JUN 19 2014

Reviewed by _____
(signature)

Patrick Jordan, P.Eng
Senior Environmental Engineer

APEGA Permit to Practice No. P258

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APPENDIX F ENVIRONMENTAL SITE ASSESSMENT REPOSITORY (ESAR) SEARCH F.1

1.0 Review of Site Information

The following section summarizes the findings from the desktop review of selected maps and aerial photographs. This review was completed to identify general site conditions, land use, historical construction activity, pipeline installations, visual evidence of potential waste disposal pits, buildings, open excavations, spills, vegetation stress, or other factors of environmental significance.

1.1 TOPOGRAPHY AND SOILS

A preliminary geotechnical investigation was carried out by Hoggan Engineering &Testing between September and December, 2013. The investigation consisted of the advancement of 44 test holes drilled between 8.8 and 67 metres below ground surface (mbgs). During this investigation, topography at the site was noted as flat to gently rolling with hummocky terrain at NW 31-51-25 W4M. Generally drainage at the site was north toward Wedgewood Creek and east toward the North Saskatchewan River. Soils at the site were typically topsoil ranging from 50 to 750 millimetres below ground surface, underlain by a native deposit of lacustrine clay turning silty in some areas. Clay till was generally encountered between 9.8 mbgs to 16.6 mbgs and bedrock encountered between 13.7 mbgs to 41.5 mbgs in the deeper holes (Hoggan Engineering & Testing, 2013).

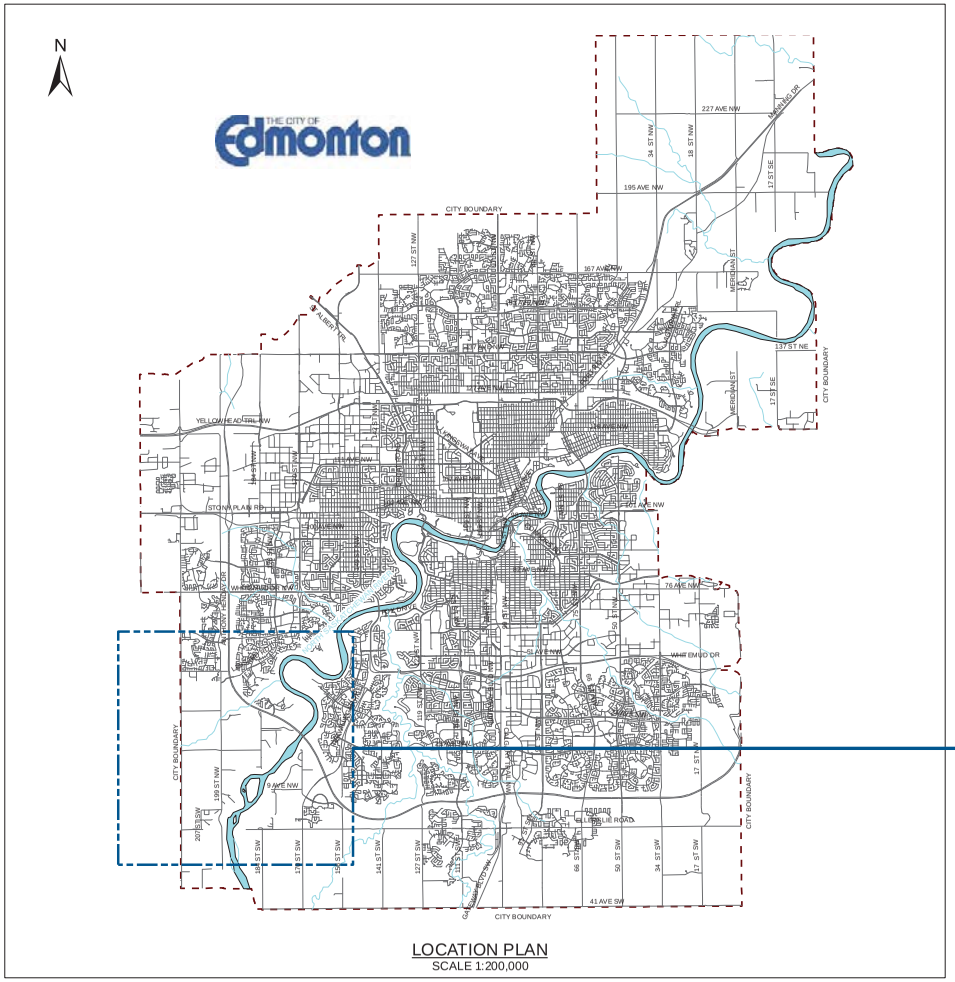
1.2 HYDROGEOLOGY

Regional hydrogeology in the vicinity of the Study Area was reviewed from the Hydrogeology of the Southwest Segment of Edmonton Area, Alberta (Ceroici 1979). The hydrogeology map indicates that bedrock under the Study Area is in the Wapiti Formation (Kwt) consisting of sandstone, mudstone, bentonite, and coal beds (Ceroici 1979). The possible groundwater yield is expected to be 2 to 8 L/sec on the western side of the Study area and 0.4 to 2 L/sec on the eastern side, closest to the river. Groundwater is expected to flow southwesterly toward the North Saskatchewan River.

Groundwater levels measured during the preliminary geotechnical investigation were found to be variable across the site ranging from 0.60 mbgs in June 2012 to 1.02 mbgs in October 2013 with the deepest measurement at 7.09 mbgs (Hoggan Engineering & Testing, 2013)

1.3 HISTORICAL AERIAL PHOTOGRAPHS

Selected aerial photographs were reviewed dating from 1950 – 2012. Aerial photographs were obtained from Alberta Environment and Sustainable Resource Development Air Photo Distribution Office (1950–2001), and from the City of Edmonton (2007–2012). Review of the aerial photographs indicates that the Study Area has predominantly been agricultural land since 1950. Portions of the land along the North Saskatchewan River Valley had been developed to include



LOCATION PLAN
SCALE 1:200,000

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February, 2014
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Stantec

Projection: 3TM CM:114° Datum:NAD83
Imagery obtained from City of Edmonton, Transportation, 2012.

Study Area
ATS Section Grid

Site Description
Within:
30-51-25 W4M
31-51-25 W4M
32-51-25 W4M
33-51-25 W4M
04-52-25 W4M
05-52-25-W4M
06-52-25 W4M
08-52-25 W4M
Edmonton, Alberta

Scale
0 500 1,000 1,500 2,000 2,500
1:50,000 Metres
This map is for reference purposes only

Client/Project
RIVERVIEW OWNERS GROUP
ENVIRONMENTAL OVERVIEW
FOR RIVERVIEW NEIGHBOURHOODS
1, 2, AND 3

Figure No.
1

Title
SITE LOCATION PLAN

residential properties commencing in 1972. A descriptive summary of the aerial photography for the study area is provided in Table 1-1. Copies of the aerial photographs are provided in Appendix A with Flagging Maps of the three neighbourhoods provided in Appendix B.

Table 1-1 Aerial Photograph Summary

Year	Description
1950	The aerial photograph did not provide coverage of the northeast portion of the Study Area. The Study Area consisted of agricultural land. The surrounding properties were predominantly agricultural with evidence of oil and gas activity. The Study Area was bordered by an unpaved road (present day Winterburn Road (215 Street SW)) to the west. The North Saskatchewan River Valley borders the Study Area on the east. There appears to be a small farmyard in the north central portion of the Study Area, located south of the Wedgewood Ravine and adjacent to present day 199 Street SW. Structures stand in the southwest corner of the Study Area that could potentially be a farmyard. Multiple unpaved roads, including present day 23 Avenue, 207 Street SW, 184 Street, and River Valley Road (199 Street SW), are visible within the Study Area. The North Saskatchewan River Valley contained a large number of trees along the east border of the Study Area. There are several light and dark areas throughout the Study Area which may be depressional areas or wetlands. 1950 – AS136-58
1962	The aerial photograph did not provide coverage of the southwest portion of the Study Area. The remainder of Study Area and the surrounding properties appear similar to the previous aerial photograph. There were more trees located in Wedgwood Ravine on the north border of the Study Area. Some structures are visible adjacent to the treed ravine tip in the east side of the Study Area, east of 184 Street. Two farmyards are visible in the center and in the east of the Study Area. One located west of 199 Street SW and one located east of 199 Street SW near the river. The CFRN Radio Tower Site is visible east of Winterburn Road developing south off of 23 avenue SW. A new road was observed off of 184 Street to the north of the potential ravine tip heading east then turning at a 45 degree angle to the southeast. 1962- AS818-14
1967	The Study Area appears similar to the previous photograph. The agricultural land appears to be cultivated throughout the Study Area. A new road was observed in the southeast portion of the Study Area heading east from 199 Street NW towards the North Saskatchewan River. Infrastructure is noted in the southern portion of the Study Area west of 199 Street NW potentially associated with country residences. 1967-AS979-43
1972	The aerial photograph did not provide coverage of a small area of the southwest portion of the Study Area. The Study Area and the surrounding properties appear similar to the previous aerial photograph. Some structures are visible adjacent to the treed ravine tip along the new road noted in the 1962 aerial photograph in the eastern portion of the Study Area, east of 184 Street. A new road was visible in the northern portion of the Study Area, south of the Wedgewood Ravine and country residences are being developed to the north of this road. Possible oil and gas activity is noted in the northeast corner of the Study Area, located east of 184 Street. 1972-AS1207-46

Year	Description
1977	The Study Area appears similar to the previous photograph with the exception of more country residential development on the north and east side of the Study Area, along the Wedgewood Creek Ravine and the North Saskatchewan River ravine tip. More country residential developments were visible north of the northern ravine on the east side of the Study Area. There appeared to be a possible well site with a lease road located south of the new residential development, east of 184 Street and south of 23 Avenue. 1977-AS1592-37
1987	The Study Area appears to be cultivated in this aerial photograph. More country residential developments are seen in the northern most part of the Study Area, located south of the Wedgewood Ravine and east of 199 Street SW. Possible oil and gas activity can be seen in the northeast portion of the site. 1987-AS3590-39 and AS3590-168
1993	The aerial photograph did not provide coverage of the southwest portion of the Study Area. The Study Area appears similar to the previous photograph. The agricultural land appears to be cultivated. 1993-AS4383-116 and AS4383-209
2001	The Study Area appears similar to the previous aerial photograph. A small disturbance was visible in the southeast corner on the west side of 199 Street. This area may potentially have been a well site. As well, a country residence could be seen in the southwest corner of the Study Area. The tear drop shape of the area suggests a potential well site. 2001-ED2001-01-110
2007	The Study Area appears similar to the previous aerial photograph. A country residence was visible in the east central portion of the Study Area adjacent to 184 Street. The tear drop shaped area in the previous aerial photograph has broadened into a rectangular area. City of Edmonton, Transportation, 2007
2010	The Study Area appears relatively unchanged from the previous aerial photograph. Trees across the Study Area appear to be much denser which could be attributed to the time of year of the aerial photograph. City of Edmonton, Transportation, 2010
2012	The Study Area appears similar to the previous aerial photograph. A small country residence appears at the southernmost end of 184 Street. A new paved road has been built entering the Study Area at the northeast corner attaching to 184 Street. City of Edmonton, Transportation, 2012

1.4 2011 SITE VISIT

On December 7, 2011, Stantec personnel completed a site visit which included a visual assessment of the Study Area and surrounding properties. The purpose of the site visit was to gain an understanding of the current land uses, identify the current environmental condition of the properties and identify possible items of concern such as air emissions, storage and use of hazardous building materials and chemicals, waste handling procedures, and aboveground and underground storage tanks from the adjacent roadways. The site visit consisted of a visual assessment of the Study Area and was limited to observations made from publicly accessible

roadways. Since the date of the site visit the neighbourhood boundaries have been adjusted and some of the site visit includes areas outside of the current study area.

1.5 SITE DESCRIPTION

The Study Area was bordered by the North Saskatchewan River Valley to the east, 33 Avenue SW (Township Road 512A), to the South, Winterburn Road (215 Street SW), to the West and Anthony Henday, Wedgewood Ravine and 35 Avenue NW to the North. The Study Area was 1,484 hectares in size and consisted mostly of agricultural land, undeveloped land and country residential properties.

The following items were observed during the site visit:

- five farms –one of which appeared to be abandoned
- a radio transmitter tower site
- ten pump jacks (one might be located just outside the Study Area)
- a power transmission line
- a large AST with what appeared to be a type of gas facility
- a power line was visible oriented east-west located north of 23 Avenue

Note that as the Site visit was limited to observations made from roadways only, the preceding cannot be considered a complete inventory. Observations could not be made within treed areas. From the roadway, no ASTs were observed on the farmyards. There were several buildings observed on each identified farmyard which may contain chemicals or pesticides for agricultural purposes.

Pump jacks and a gas facility were observed in the northeast corner of the Study Area. Due to a road closure, Stantec personnel could not access the pump jacks or the gas facility. A power transmission line corridor was observed north of the pump jacks and gas facility. The transmission line was noted west of the Anthony Henday and extended west through the Study Area.

2.0 Review of Online Databases

The review of available online databases was completed to obtain information about potential environmental concerns including pipelines, oil wells, spills/releases, coal mines, water wells and obtain records of publically available reports/information and reclamation certificates. The findings of this review are summarized in the following sections.

2.1 PIPELINES, OIL WELLS, AND SPILLS/RELEASES

The Abacus Datagraphics website (Abadata), which includes up-to-date Alberta Energy Resources Conservation Board (ERCB) pipeline, oil well, and spill information, was searched for the Study Area. The results of this search indicate that there are 26 wells (13 abandoned), 15 pipelines, 7 spills and/or releases and one facility within the Study Area. The results are summarized according to the Alberta Township System and are included in Appendix B.

2.2 COAL MINES

The ERCB online Coal Mine Atlas was searched to determine if operating or abandoned coal mines are within the Study Area. The results of this search indicate that there are three records of abandoned mines and tunnels that may be located within the Study Area. The search results indicate that the location is uncertain so it is unknown if these coal mines and tunnels are actually located within the Study Area. The ERCB search results are included in Appendix C.

Table 2-1 Coal Mines – Summary for the Study Area

Coal Mine Number	Owner	Type	Status	Mining Method	Comments
1550	George Burham	Underground	Abandoned	Room and Pillar	Uncertain Location
0721	H.G. Worthing and R. Cunningham	Underground	Abandoned	Adit (Tunnel)	Uncertain Location
0865	J.H. Farnell	Underground	Abandoned	Adit (Tunnel)	Uncertain Location

2.3 WATER WELLS

The Alberta Environment water well database was searched for water wells located in the Study Area. The results of the search indicate that there are 64 records of water wells throughout the Study Area. It is not known if some water wells are actually within the Study Area because the database locates the records by quarter section. These records are summarized according to the Alberta Township System (ATS) and are included in Appendix D.

2.4 PUBLICALLY AVAILABLE REPORTS AND INFORMATION (ESAR)

The Alberta Environment Site Assessment Repository website (ESAR) was searched for routinely available environmental reports and land reclamation certificates for the Study Area. The results of this search indicated that there were no records of reports or correspondence for the Study Area. However, there is Phase I and Phase II ESA correspondence and a Phase II ESA report for properties located within NE¼ 05-52-25 W4M, northeast of the Study Area. A screenshot of the ESAR search is included in Appendix E.

2.5 LAND RECLAMATION CERTIFICATES (ESAR)

The Alberta Environment Site Assessment Repository website (ESAR) was searched for available environmental reports and land reclamation certificates for the Study Area. The results of this search indicated that there were 13 reclamation certificates for the Study Area. The reclamation reports did not identify environmental concerns associated with 13 wells located within the following sections: 33-51-25 W4M, 32-51-25 W4M, 31-51-25 W4M, 04-52-25 W4M, and 05-52-25 W4M. The reclamation reports identified that the well located within 05-52-25 W4M (Westhill Armisie 8-5-52-25) had topsoil spread over the property. This was not identified as an environmental concern.

The reclamation dates for the wells range between the years 1967 to 2000. The legislation and requirements to receive a reclamation certificate have changed since the year 2000 (2010 Reclamation Criteria – Cultivated Lands). The well sites may require further investigation to identify if the well sites meet present day requirements for reclamation. A screenshot of the ESAR search results for each section of the Study Area, labeled with the Well ID number, and a summary of the certificates are included in Appendix E.

3.0 Areas of Potential Concern

Based on a review of the information within this Environmental Overview the following is a list of key items that may require future investigation identified within the Riverview ASP Area:

- 26 wells, 15 pipelines, 7 spills and/or releases and one facility were identified in the Abadata search. The AER and facility owner should be contacted prior to development to identify appropriate setbacks and development restrictions
- There are several abandoned wells with old reclamation certificates which may require further investigation to identify if the well sites meet present day requirements for reclamation. Prior to developmental earthwork activity within the vicinity of abandoned wells, the abandonment depth should be verified to ensure the wellhead will not be struck, damaged or unearthed by such earthwork.
- There are 121 water wells identified in the Study Area. Prior to development, any remaining water wells should be identified and decommissioned according to the *Alberta Water Act* and/or Capital Health protocols
- There were five farms observed during the site visit. Based on the age of the buildings, there is the potential for building materials containing asbestos, urea formaldehyde foam insulation, PCBs and lead based paint. These buildings may require a hazardous materials assessment when the farmyards are decommissioned
- No AST or septic systems were observed within the farmyards from the roadway. There is the potential that AST and septic systems are present on the farmyards. If septic systems are present, they should be appropriately decommissioned. A detailed assessment of the farmyards should be completed at the NSP stage to identify if ASTs are present or any additional potential environmental concerns
- A radio transmitter tower site and power transmission line were observed within the north portion of the Study Area. The owners of these facilities should be contacted to identify any potential development restrictions or required setbacks

4.0 Limitations

In conducting the Environmental Overview and rendering our conclusions, Stantec gives the benefit of its best judgment based on our experience and in accordance with generally accepted professional standards for this type of assessment. This report has been prepared for the exclusive use of Riverview Owner's Group for the purpose of assessing the past/current potential environmental concerns that may be present at the location identified in Section 1.0. No warranty, expressed or implied, is given concerning contamination at this site. It should be noted that when an environmental site assessment is completed without chemical analysis of building materials, soil, and groundwater on the property, as in this study, no statement of scientific certainty can be made regarding latent conditions which may be the result of on-site or off-site sources. The findings and conclusions of this report are not scientific certainties, but rather, probabilities based on professional judgment concerning significance of the data gathered during the course of this Environmental Overview.

Stantec is not able to represent that the site or adjoining land contain no hazardous substances or other latent conditions beyond that detected or observed by Stantec during this Environmental Overview. The possibility always exists for contaminants to migrate through surface water, soil, air or groundwater. The ability to accurately address the environmental risk associated with transport in these media is beyond the scope of this investigation. Any use in which a third party makes of this report, or any reliance on or decisions to be based on it, are the responsibility of such third parties. Stantec will accept no damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

The limitations of this Environmental Overview include the following:

- The Environmental Overview is not a Phase I Environmental Site Assessment
- The site visit was conducted on the specified date
- The site visit was conducted from the roadways only as land access was not available and a detailed inventory of each parcel of land was not completed
- Stantec spent only a limited amount of time on the property, and thus is not aware of any activities conducted on the property prior to or following the site visits
- Information from online databases was only obtained for the Study Area
- The aerial photograph review was only completed for the Study Area
- The completeness and accuracy of information obtained from the online databases

The locations of any utilities illustrated in this report, if any, including pole lines, conduits, water mains, sewers and other surface or sub-surface utilities and structures are not necessarily as described in this report or its appendices, and where shown or described, the accuracy of the position of such utilities and structures is not guaranteed. Before starting work, any individual should confirm the exact location of all such utilities and structures and assume all liability for damage to them.

5.0 References

Abacus Datagraphics Ltd. 2008. *AbaData*. Accessed February 6, 2014. <http://www.abacusdatagraphics.com/abadata/mgFrames.asp>

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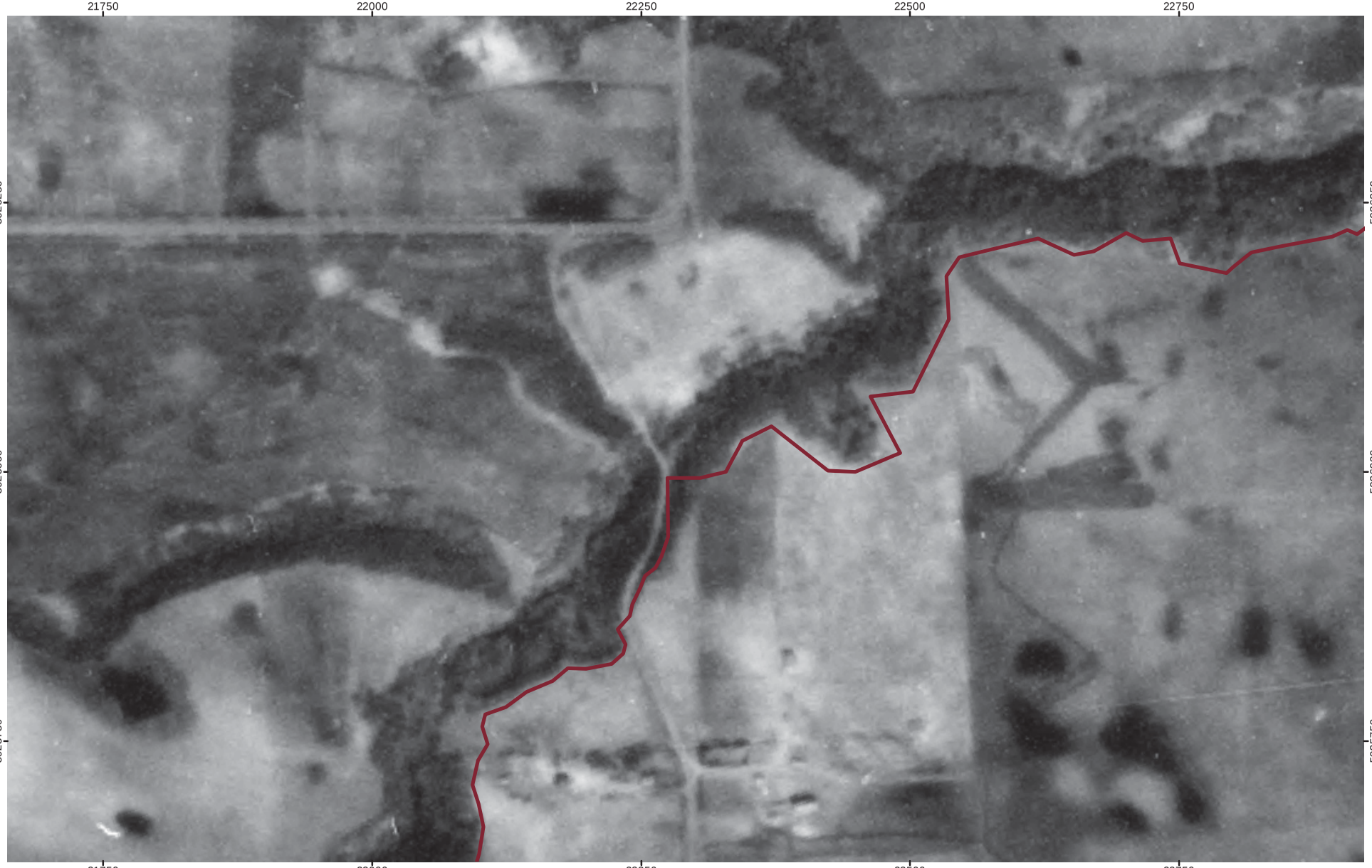
Ceroici, W. 1978. *Hydrogeology of the Southwest Segment, Edmonton Area, Alberta*. Earth Sciences, Report No. 1978-05. Research Council of Alberta.

Government of Alberta. *2010 Reclamation Criteria for Wellsites and Associated Facilities for Cultivated Lands* Accessed February 4, 2012. <http://environment.alberta.ca/documents/2010-Reclamation-Criteria-for-Wellsites-and-Associated-Facilities-for-Cultivated-Lands.pdf>

Hoggan Engineering &Testing. 2013. *Preliminary Geotechnical Investigation Proposed Riverview Neighbourhoods 1 – 3 Approximately 199 Street and 23 Avenue NW Edmonton, Alberta.*

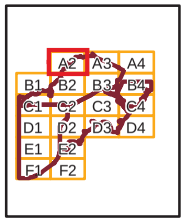
Appendix A
Aerial Photographs



Study Area

Riverview Owners Group - Phase II ENR Riverview

Historical Aerial Review 1950



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Projection: 3TM CM:114° Datum: NAD 83

Acknowledgements:
Imagery obtained from Alberta Sustainable Resource Development, AS136-58, May1950.

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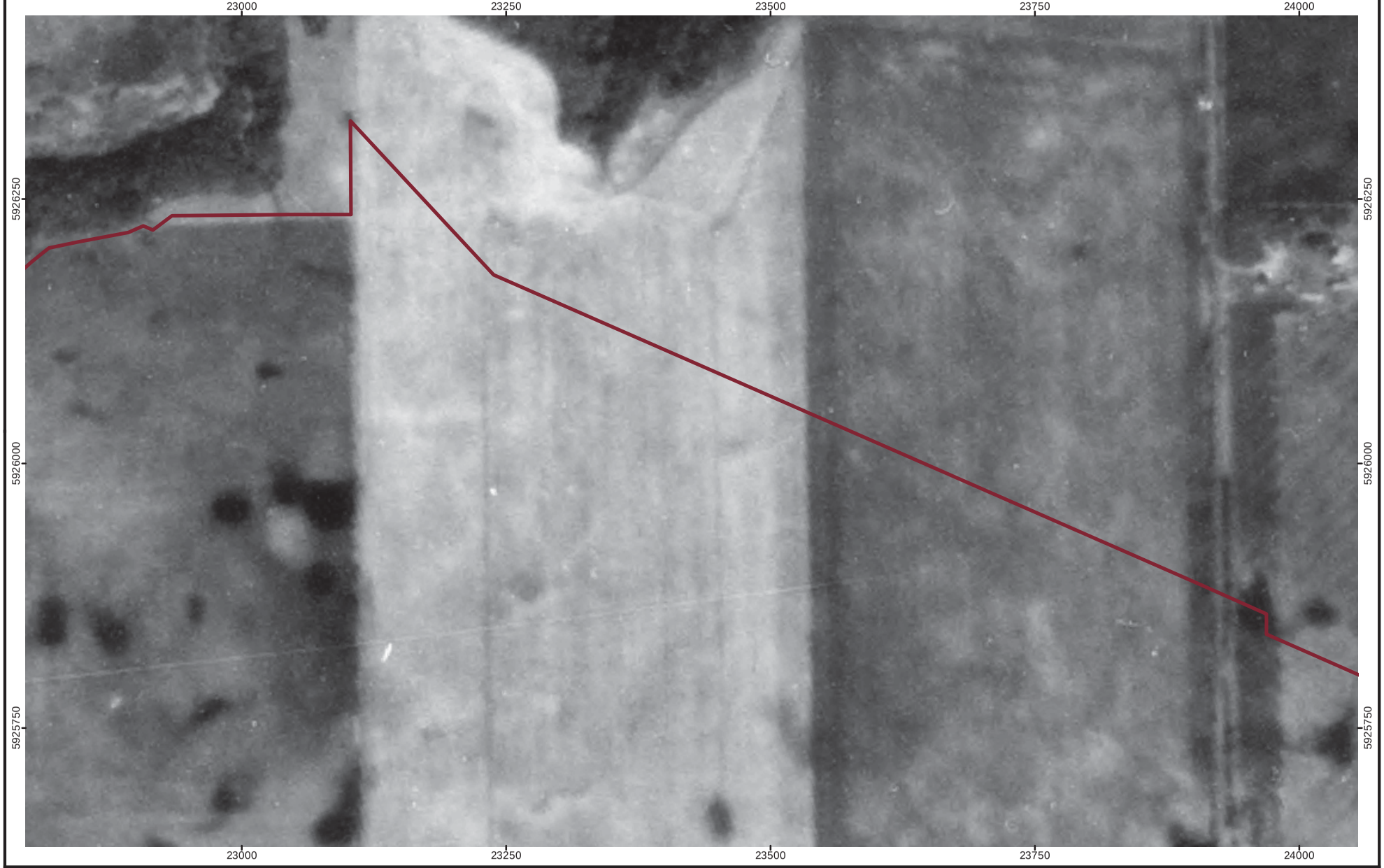
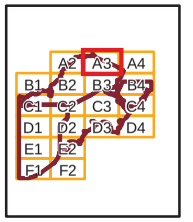


Study Area

Riverview Owners Group - Phase II ENR Riverview

Historical Aerial Review 1950



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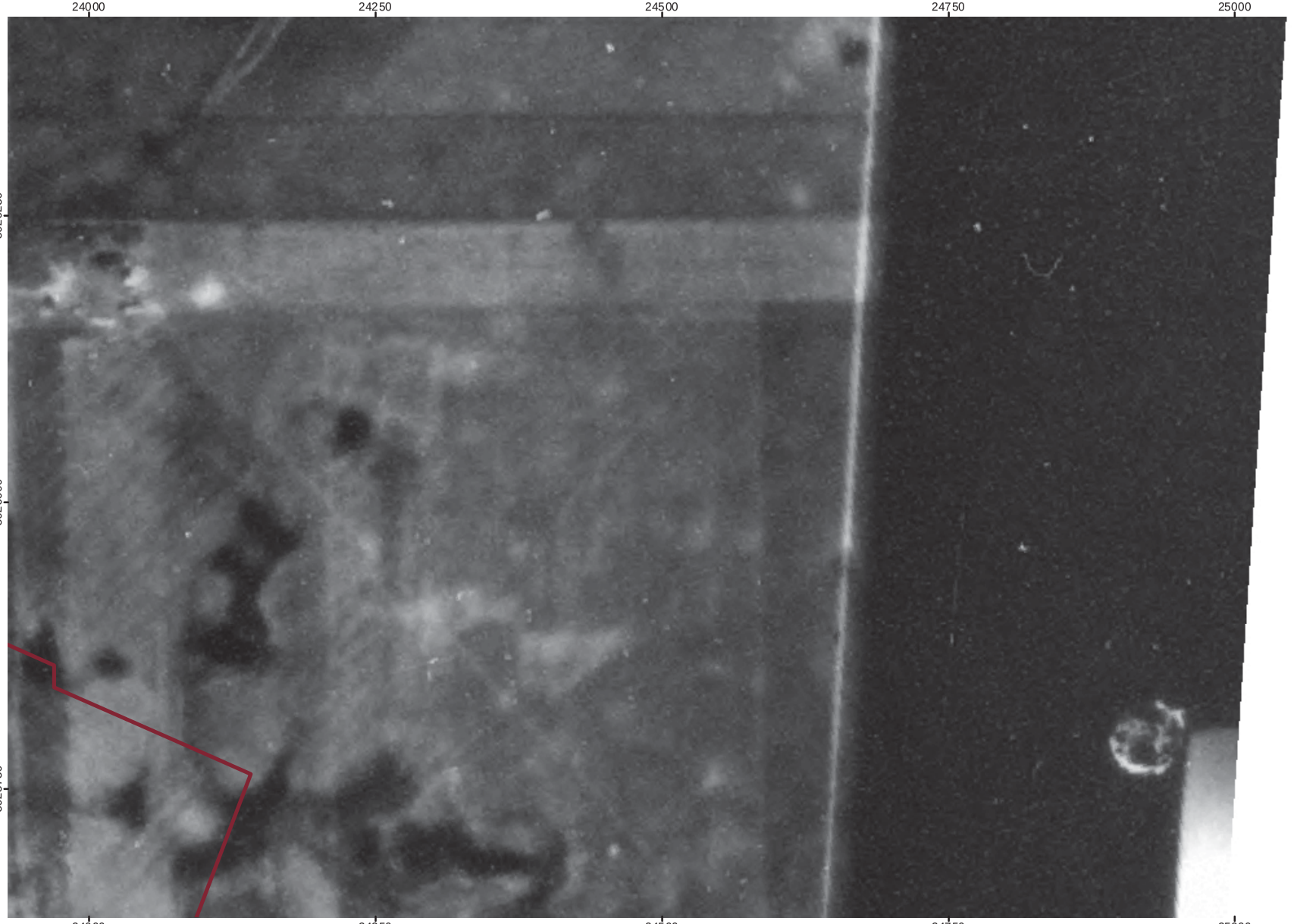

Study Area

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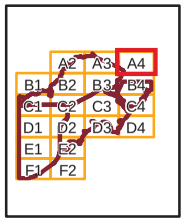
Historical Aerial Review 1950



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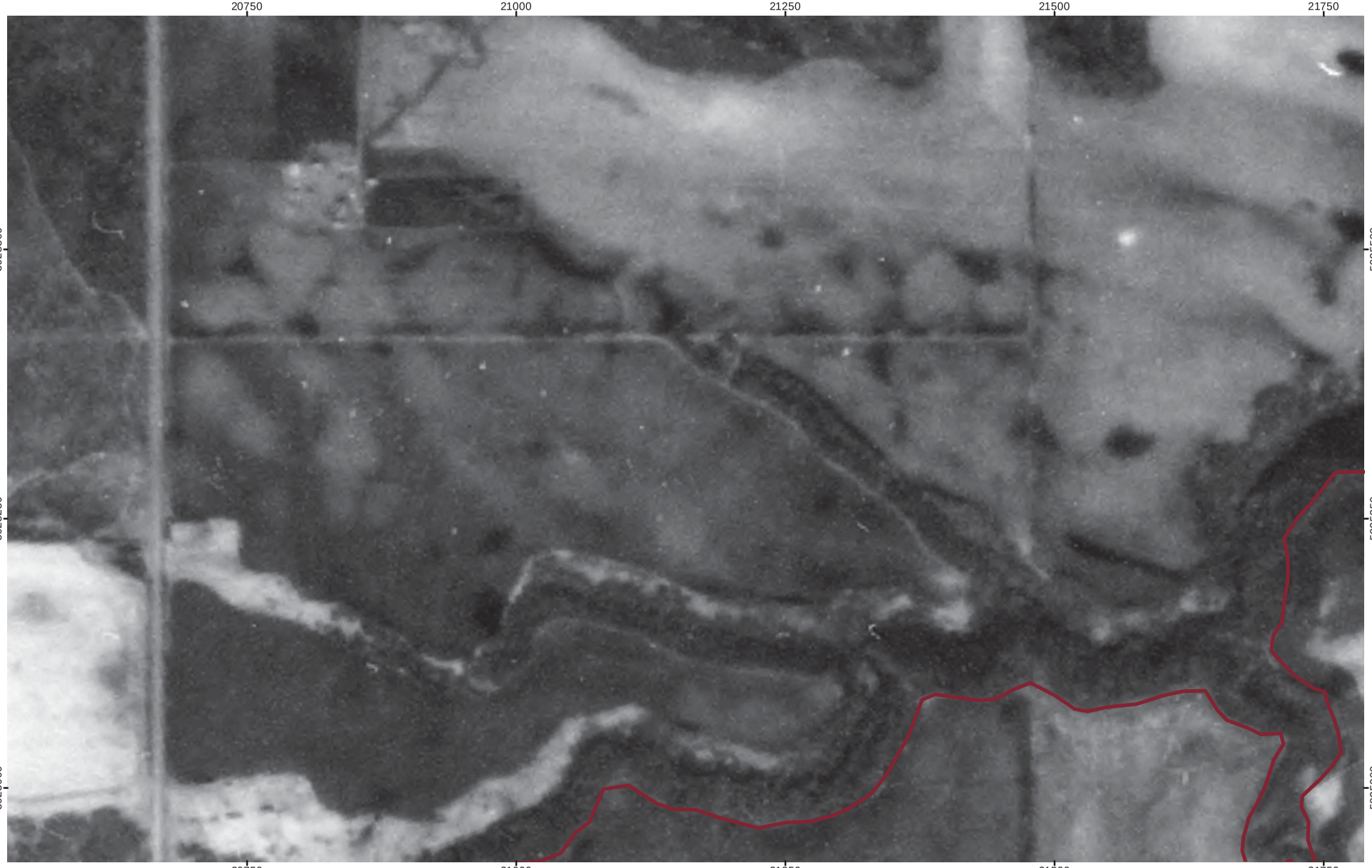

Study Area

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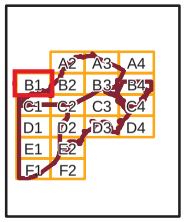
Historical Aerial Review 1950



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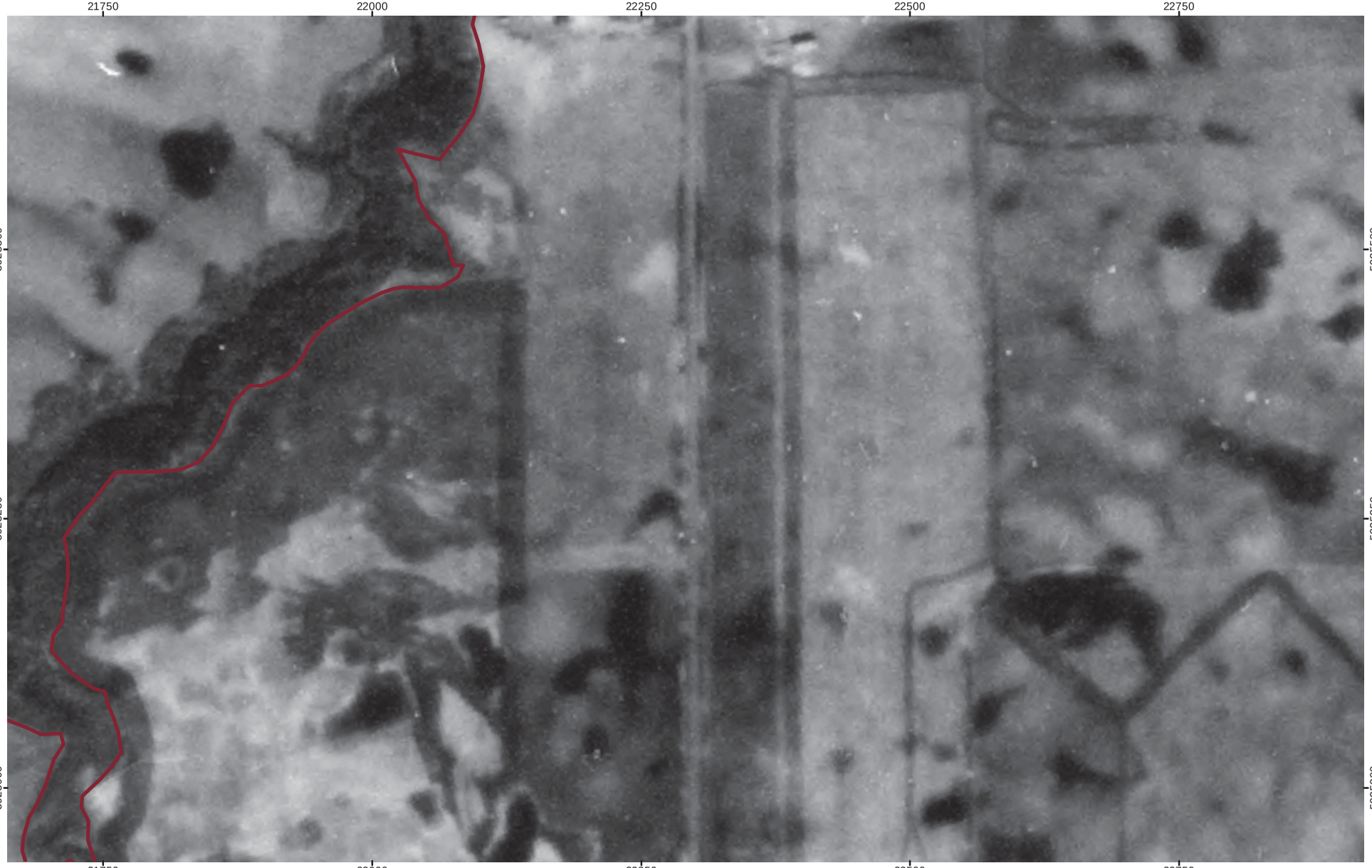
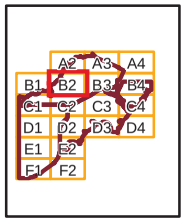


Study Area

Riverview Owners Group - Phase II ENR Riverview

Historical Aerial Review 1950



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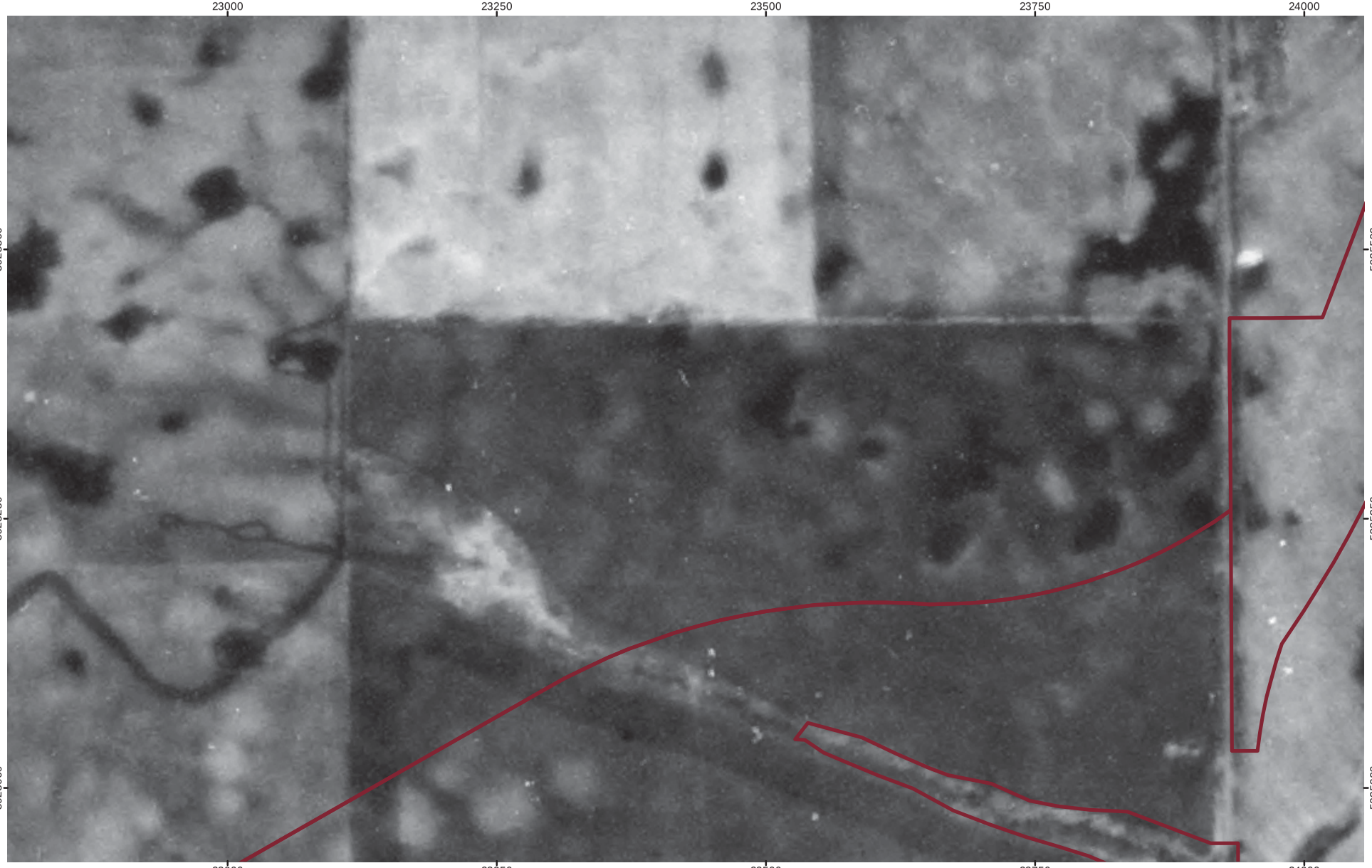

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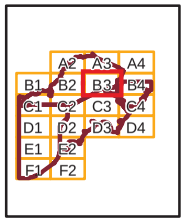

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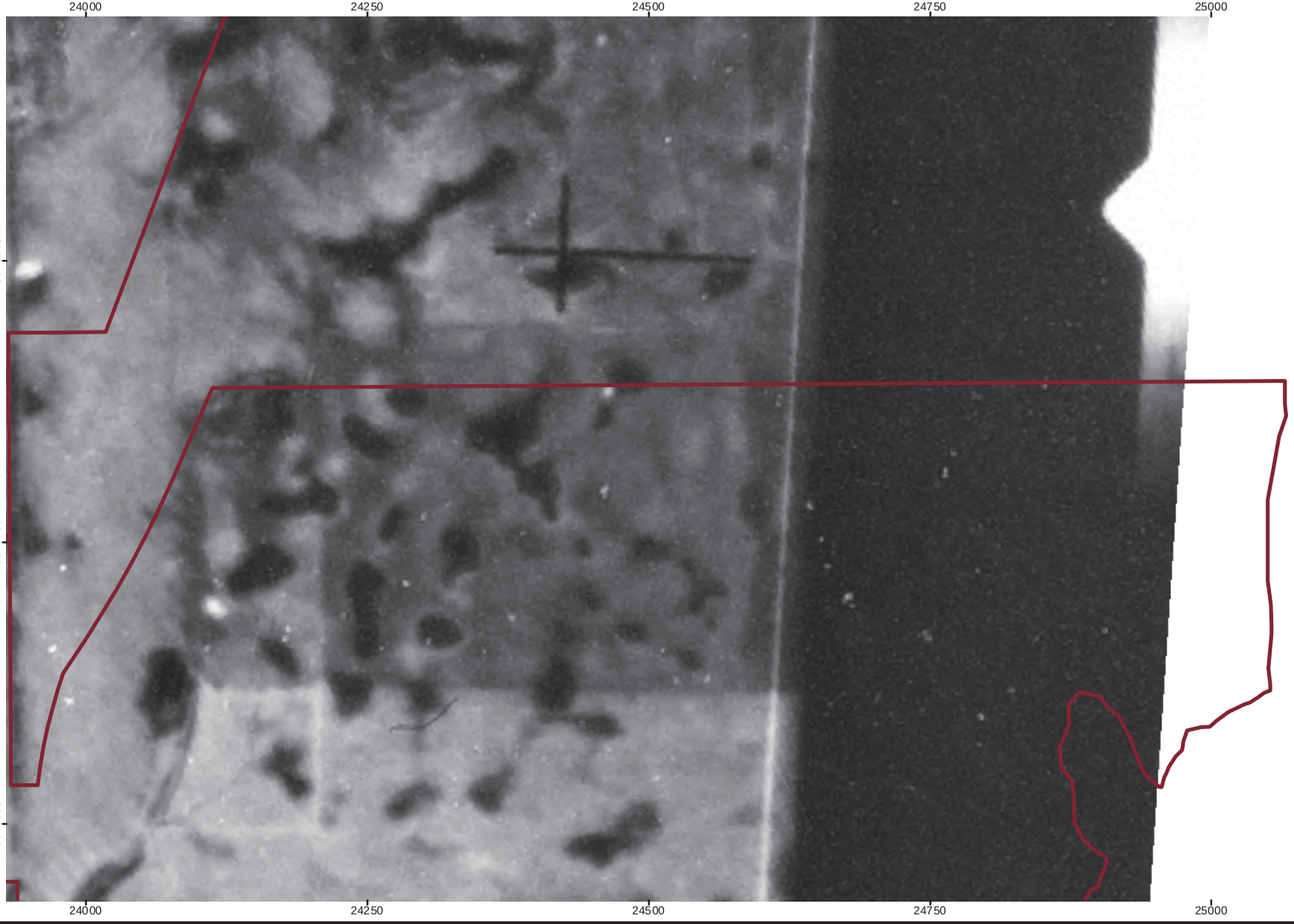
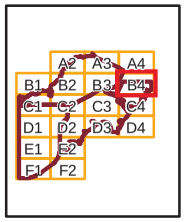


Study Area

Riverview Owners Group - Phase II ENR Riverview

Historical Aerial Review 1950



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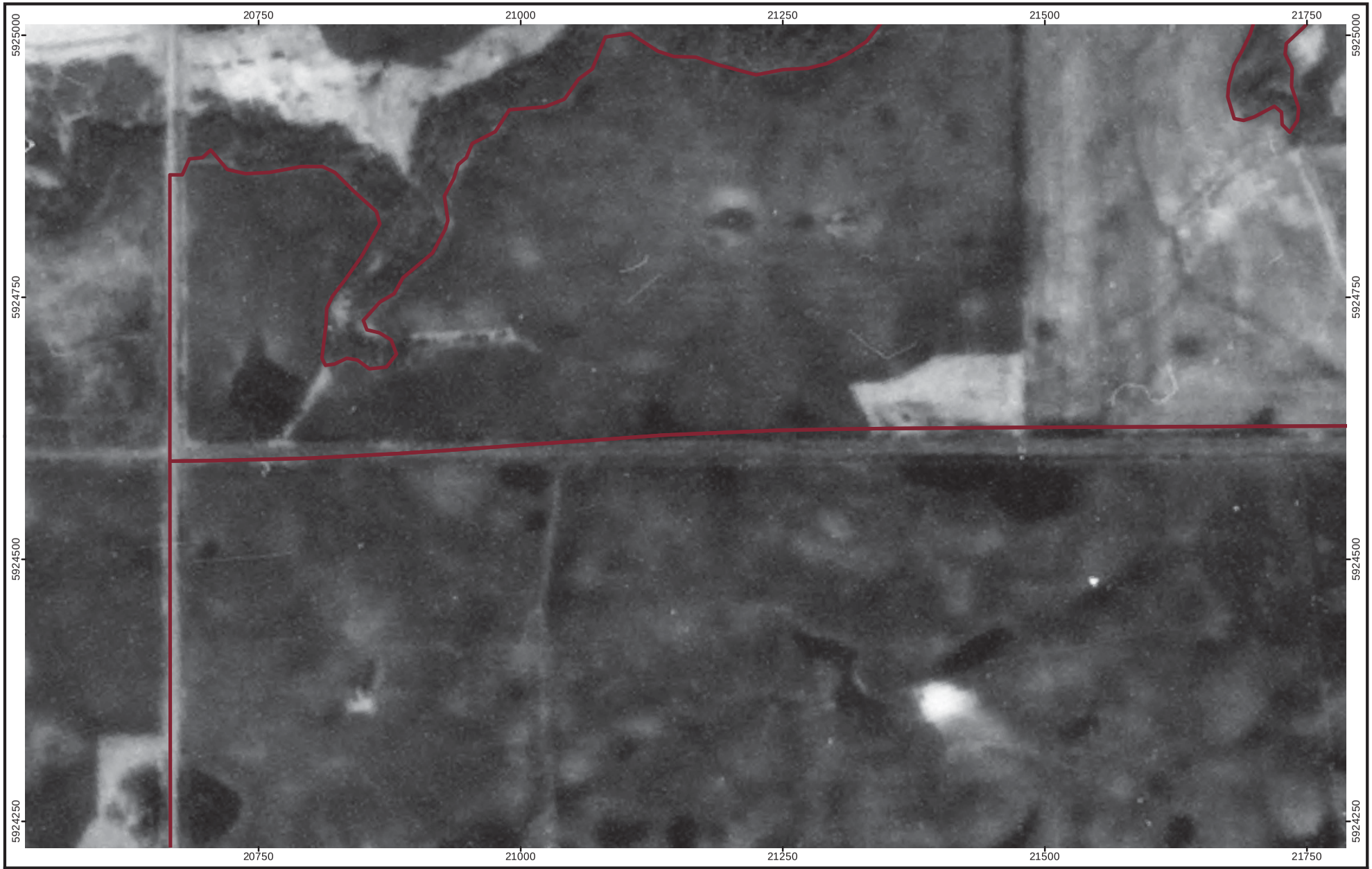
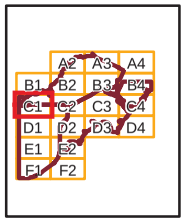


Study Area

Riverview Owners Group - Phase II ENR Riverview

Historical Aerial Review 1950



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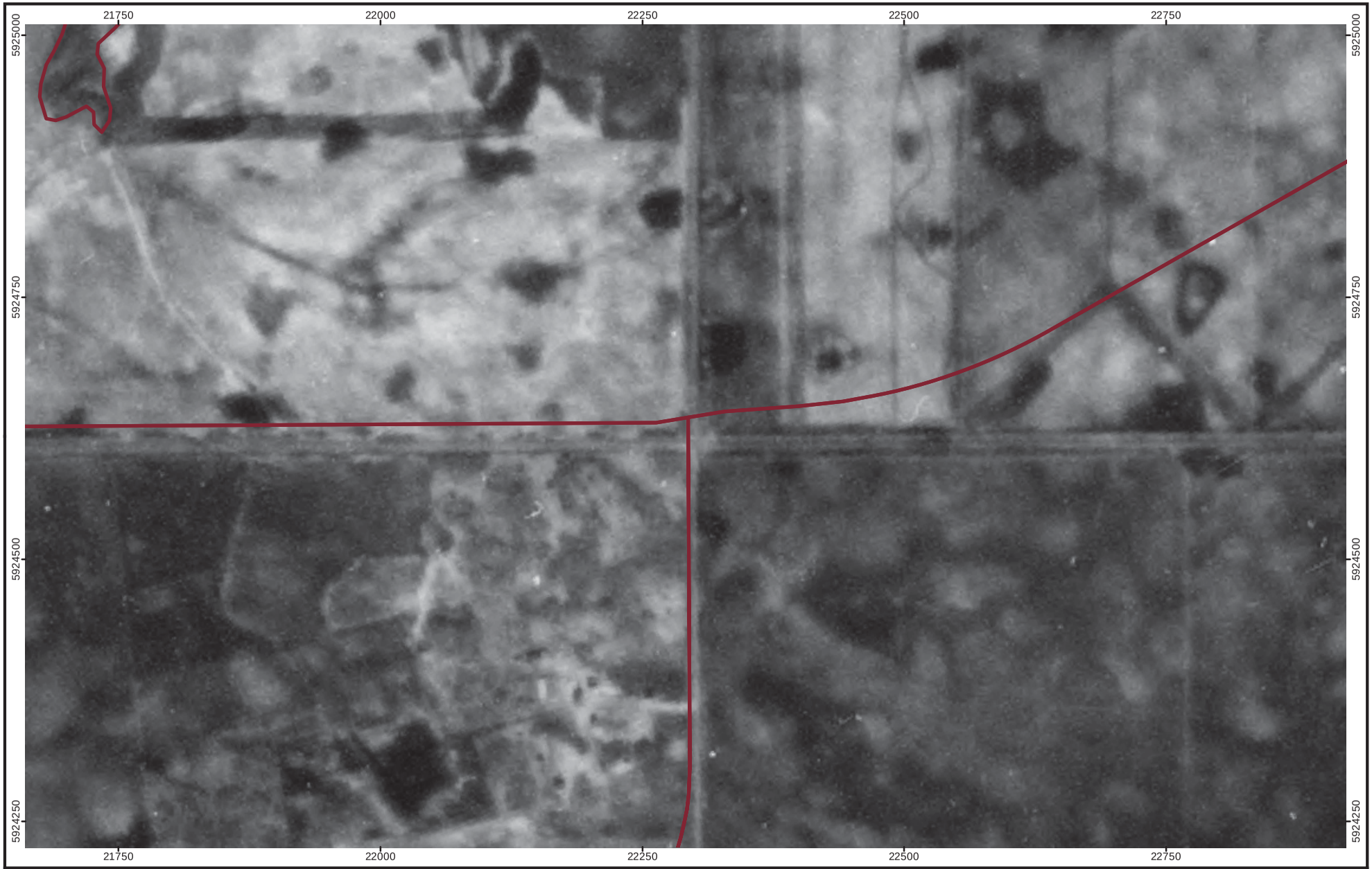
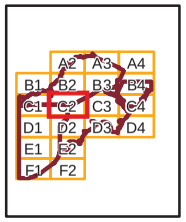


Study Area

Riverview Owners Group - Phase II ENR Riverview

Historical Aerial Review 1950



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Meters

Projection: 3TM CM:114° Datum: NAD 83

Acknowledgements:
Imagery obtained from Alberta Sustainable Resource Development, AS136-58, May1950.

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DRAFT DATE	SCALE
December 12, 2012	1:5,000
REVISION DATE	PROJECT
May 23, 2014	110218864

DRAWN	CHECKED	APPROVED	VOL	FIGURE NO.
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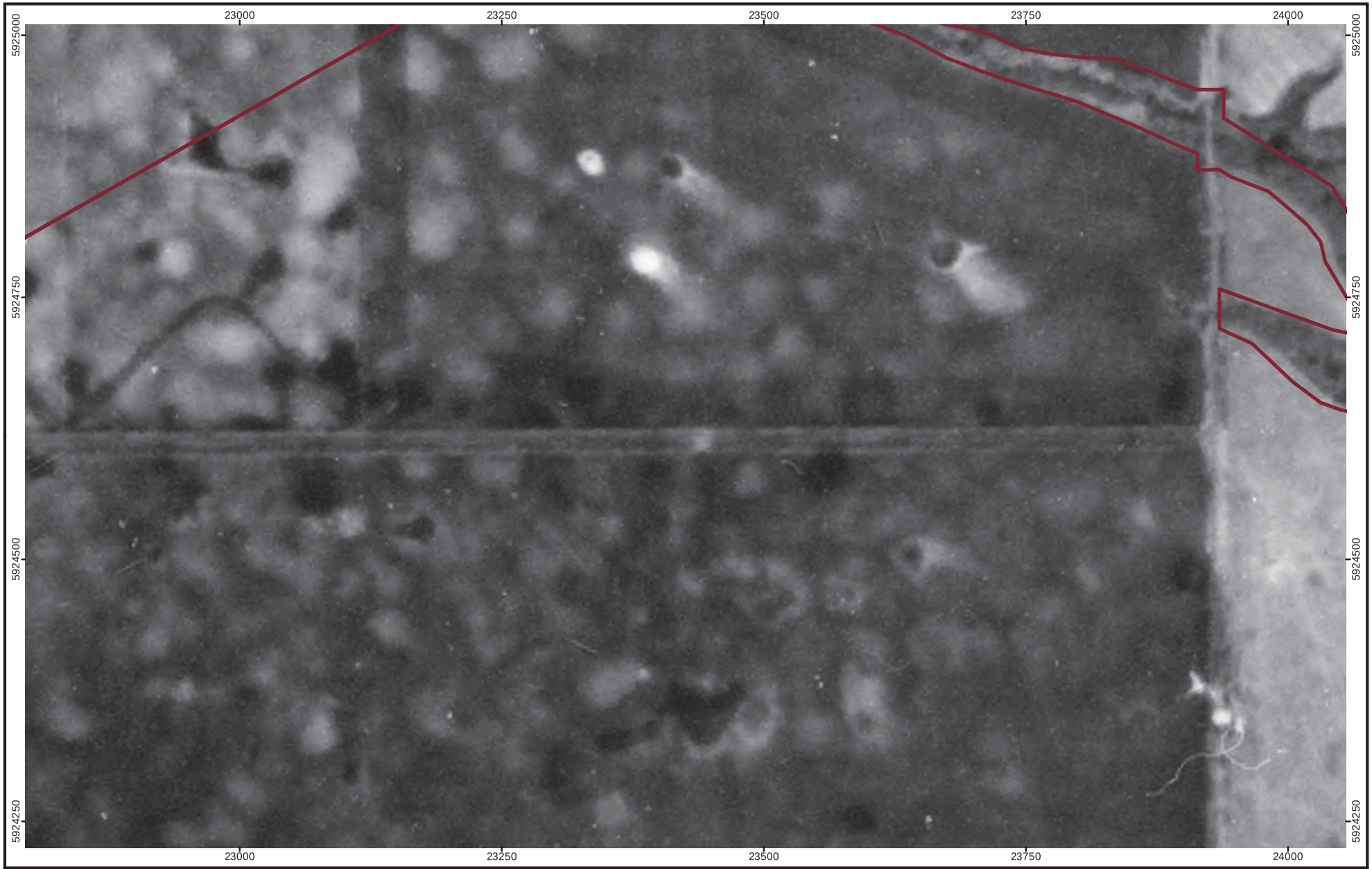
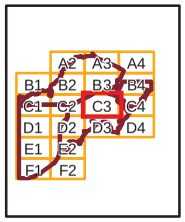


Study Area

Riverview Owners Group - Phase II ENR Riverview

Historical Aerial Review 1950



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PREPARED BY	PREPARED FOR			
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DRAFT DATE: December 12, 2012		SCALE: 1:5,000		
REVISION DATE: May 23, 2014		PROJECT: 110218864	FIGURE NO.: 1950	
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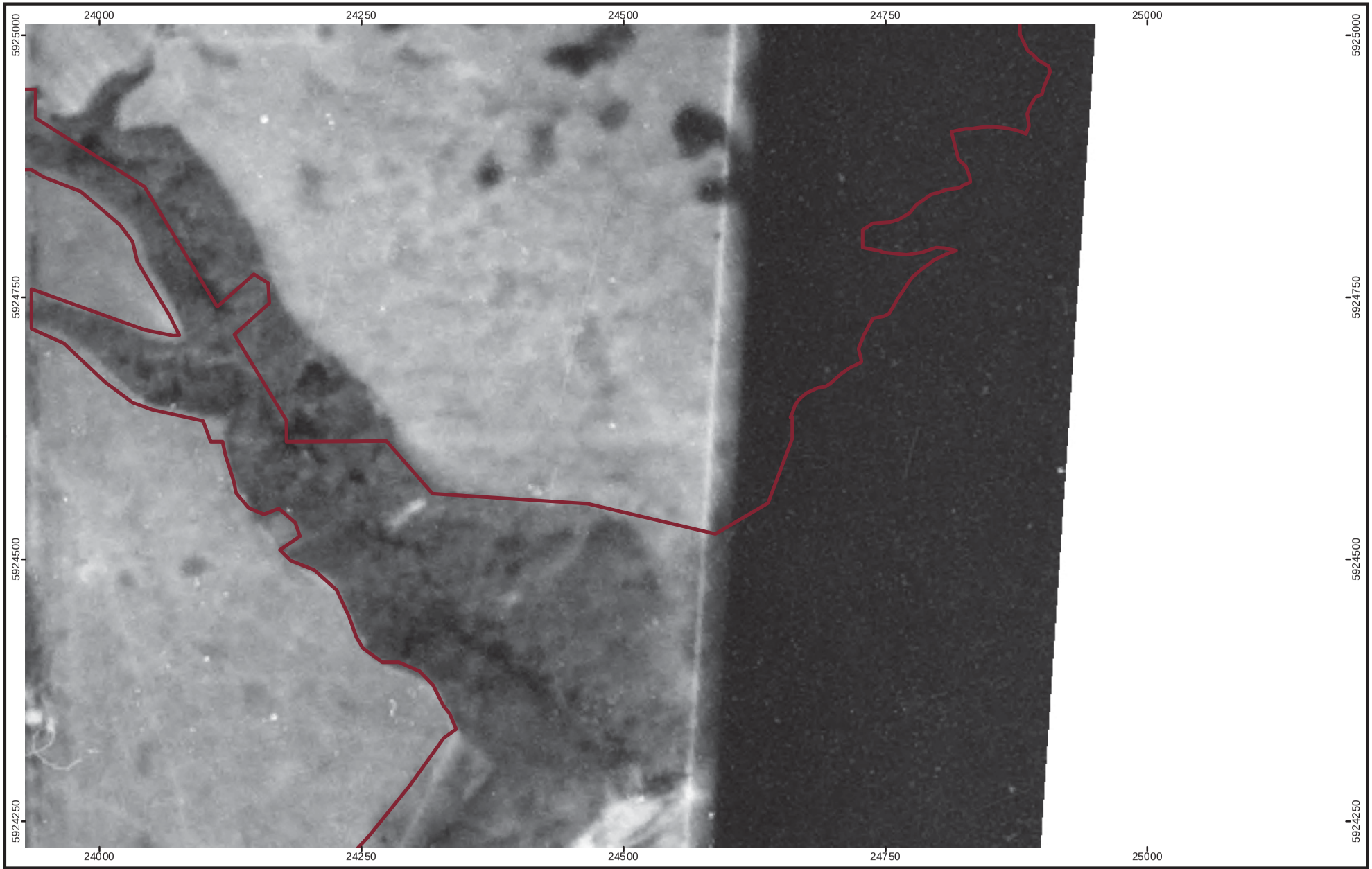
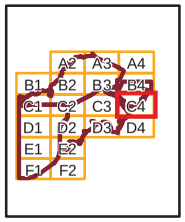


Study Area

Riverview Owners Group - Phase II ENR Riverview

Historical Aerial Review 1950



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REVISION DATE: May 23, 2014				PROJECT: 110218864	FIGURE NO.: 1950
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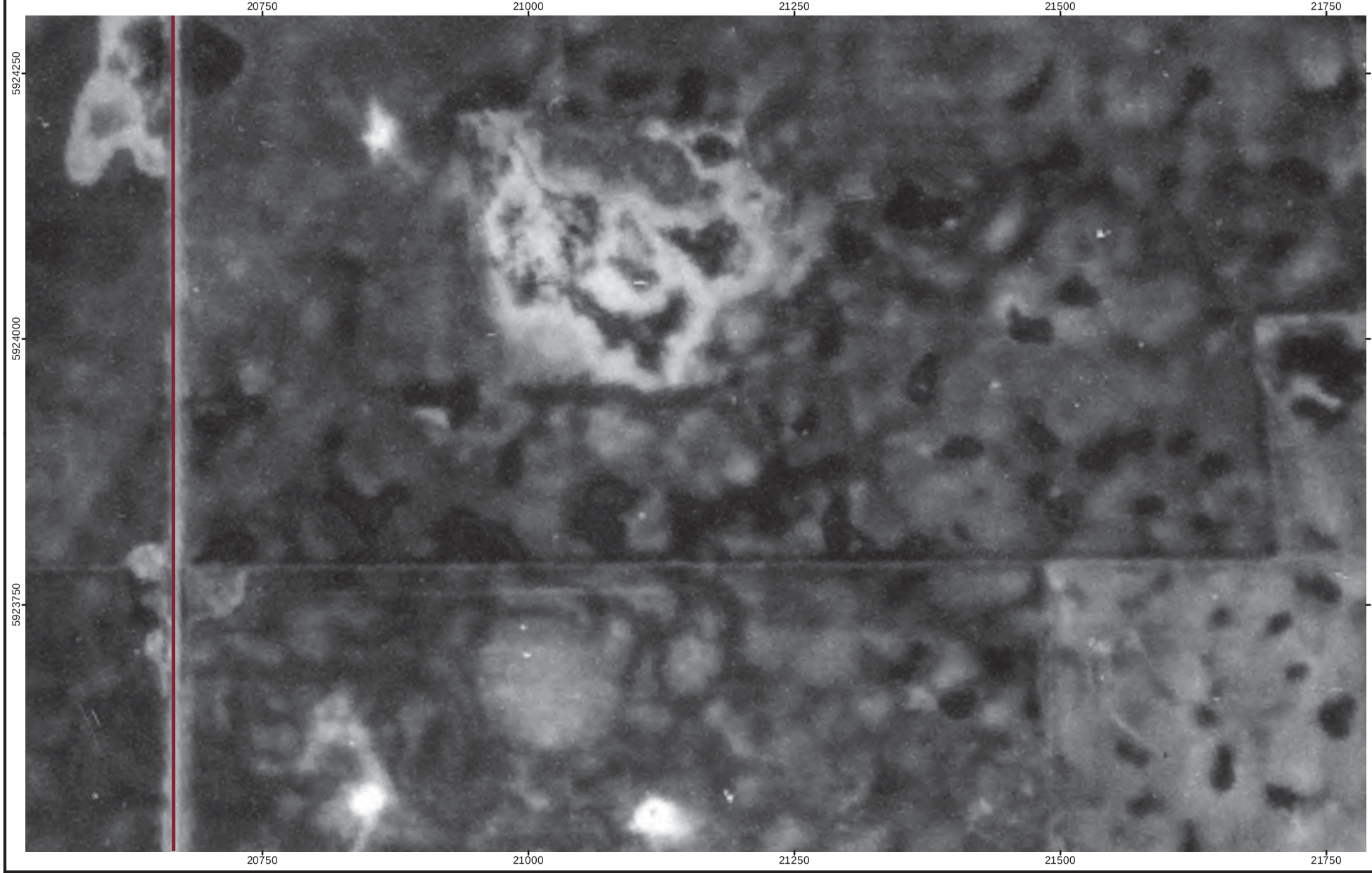
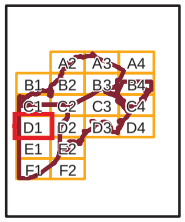


Study Area

Riverview Owners Group - Phase II ENR Riverview

Historical Aerial Review 1950



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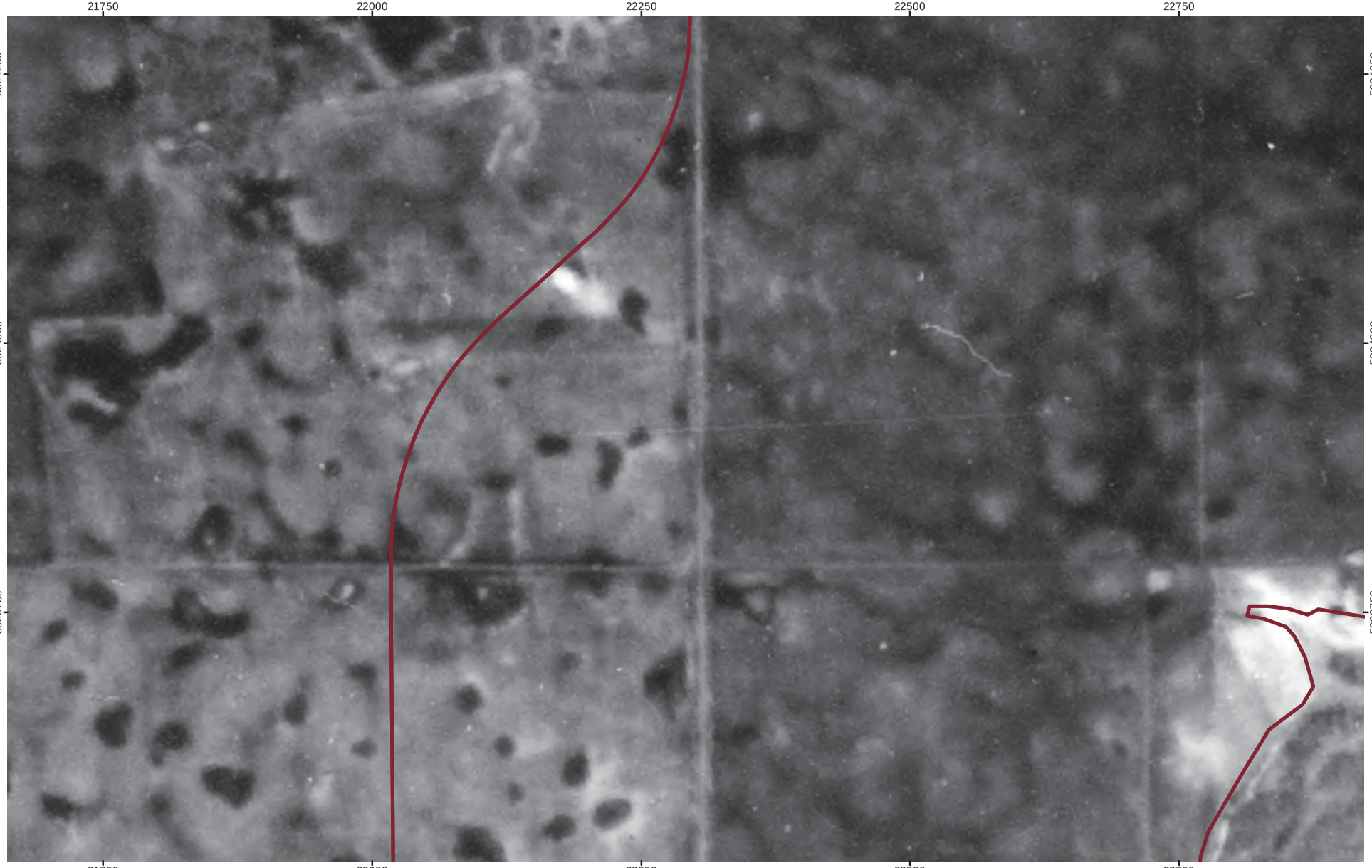
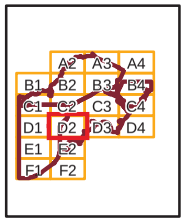


Study Area

Riverview Owners Group - Phase II ENR Riverview

Historical Aerial Review 1950



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May 23, 2014	110218864

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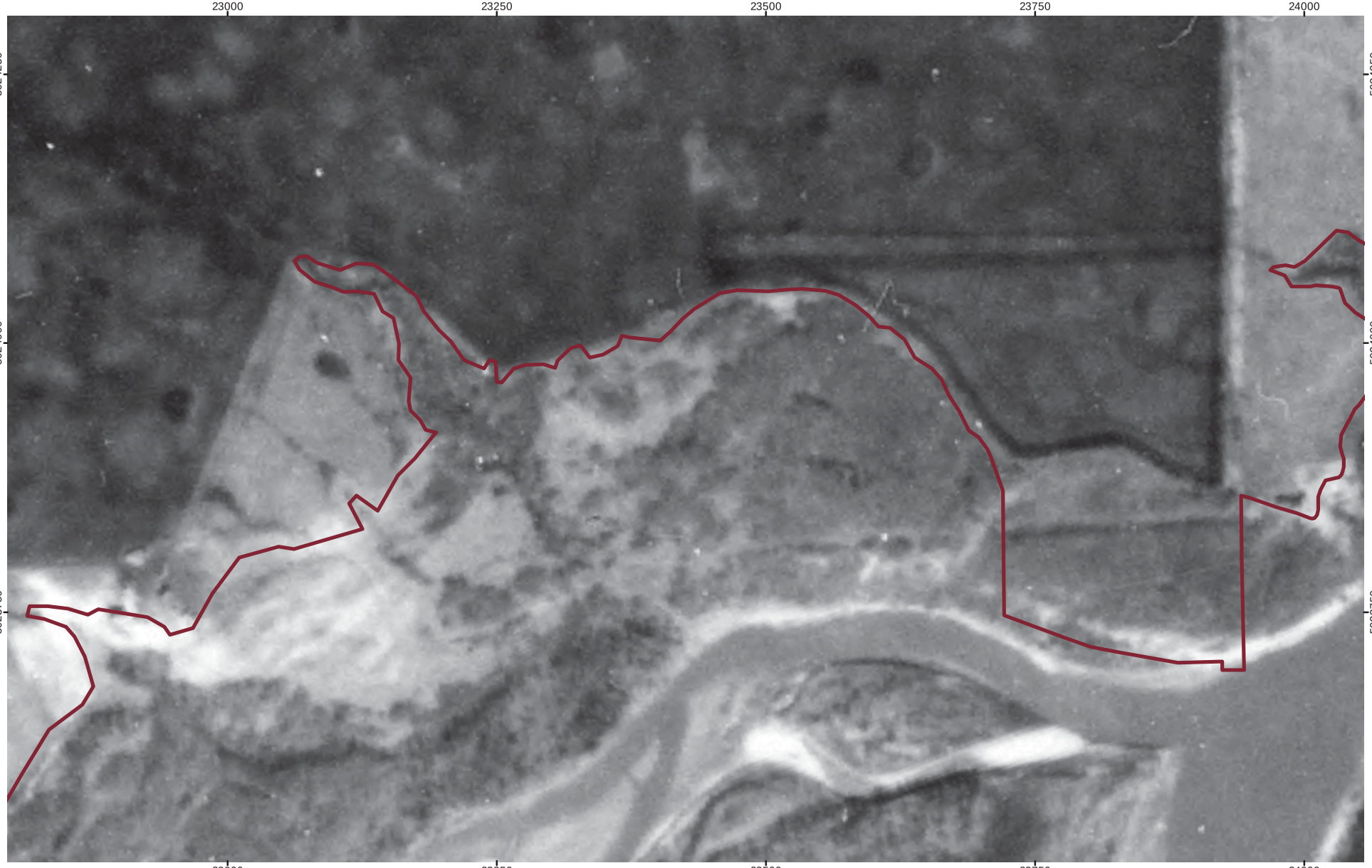
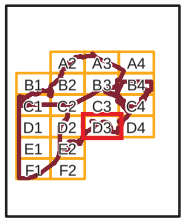


Study Area

Riverview Owners Group - Phase II ENR Riverview

Historical Aerial Review 1950



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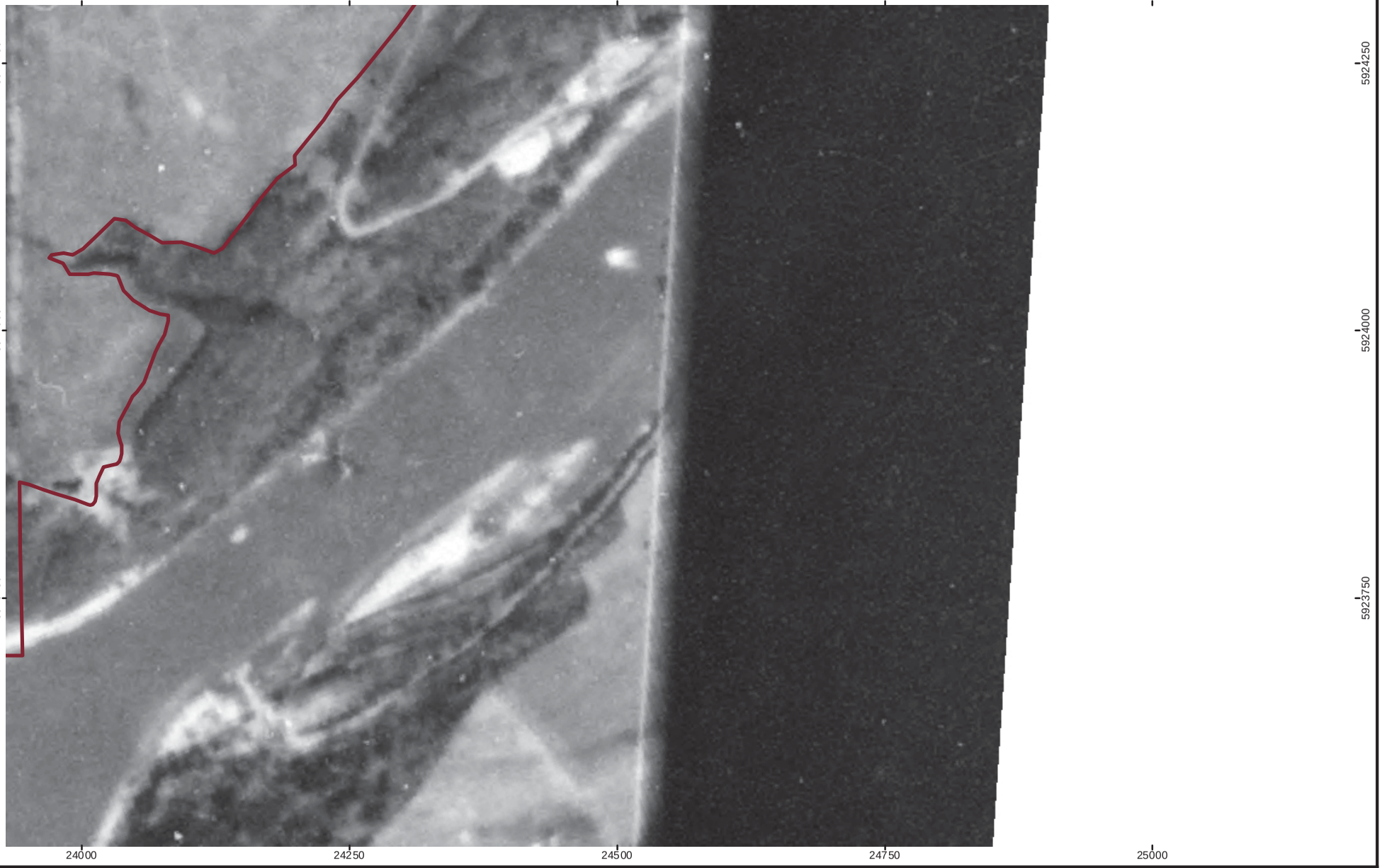
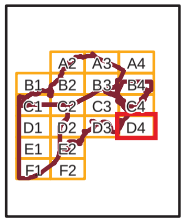


Study Area

Riverview Owners Group - Phase II ENR Riverview

Historical Aerial Review 1950



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JC	LF			1950

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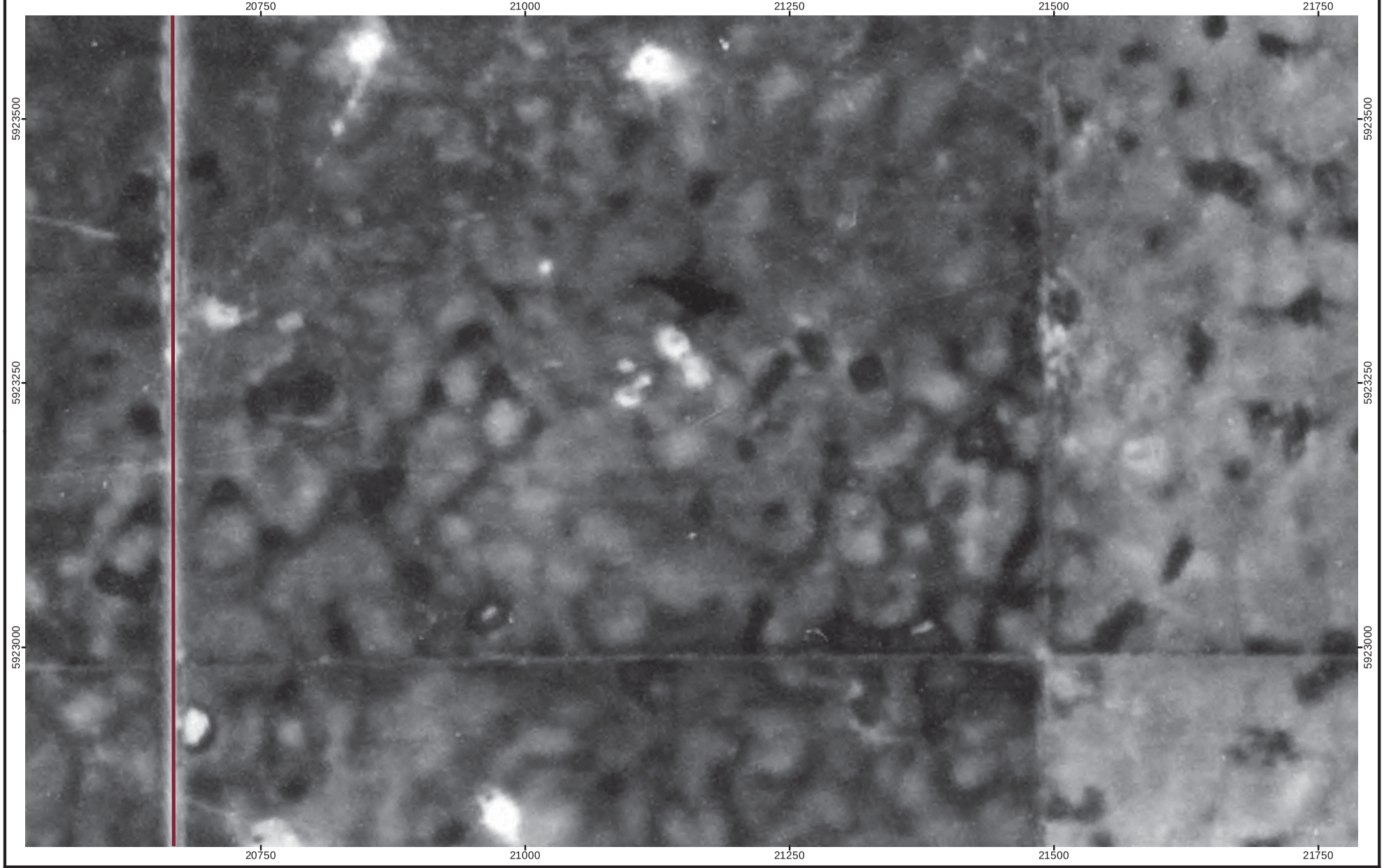
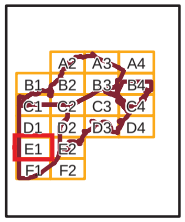


Study Area

Riverview Owners Group - Phase II ENR Riverview

Historical Aerial Review 1950



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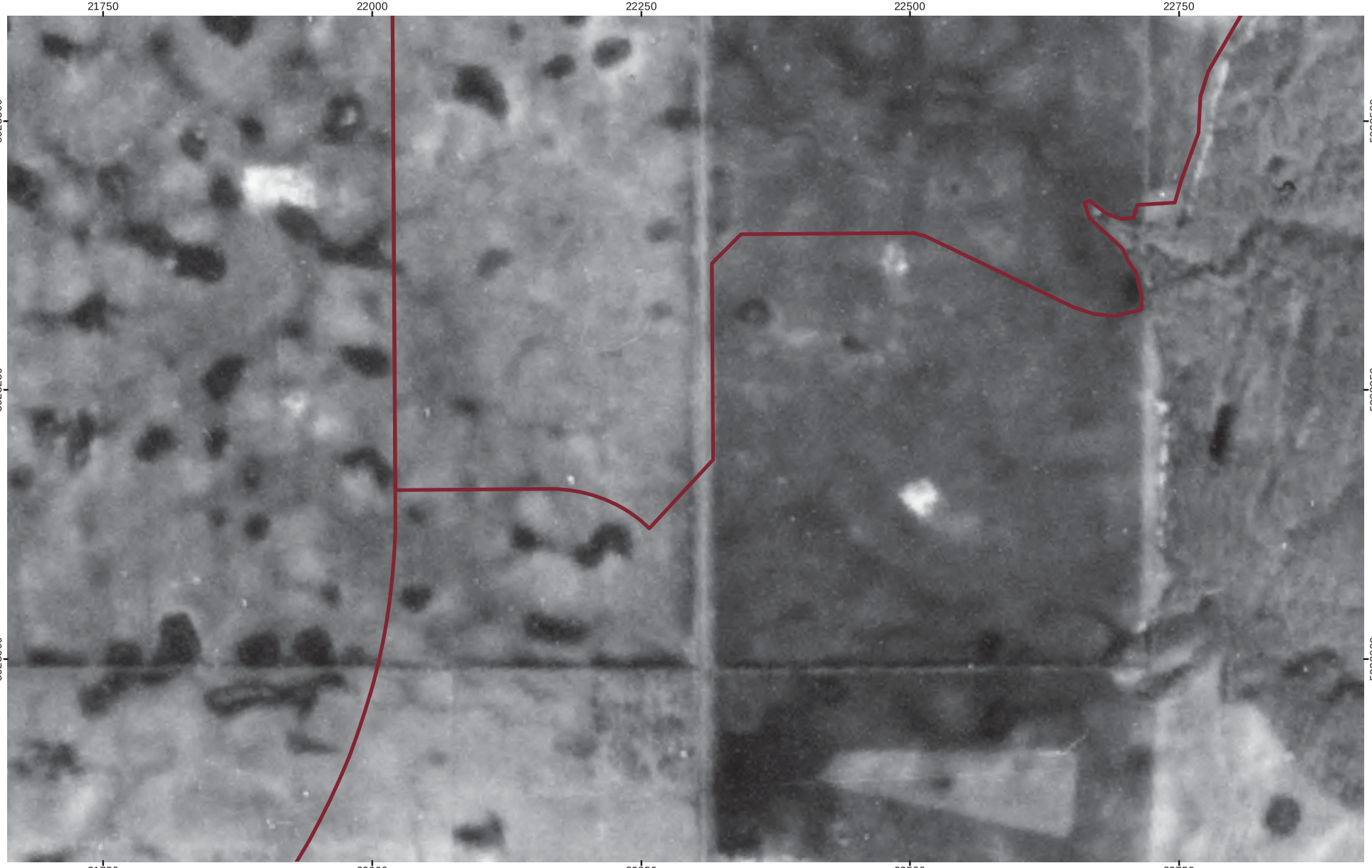
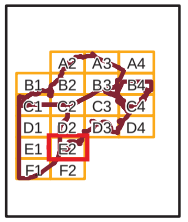


Study Area

Riverview Owners Group - Phase II ENR Riverview

Historical Aerial Review
1950



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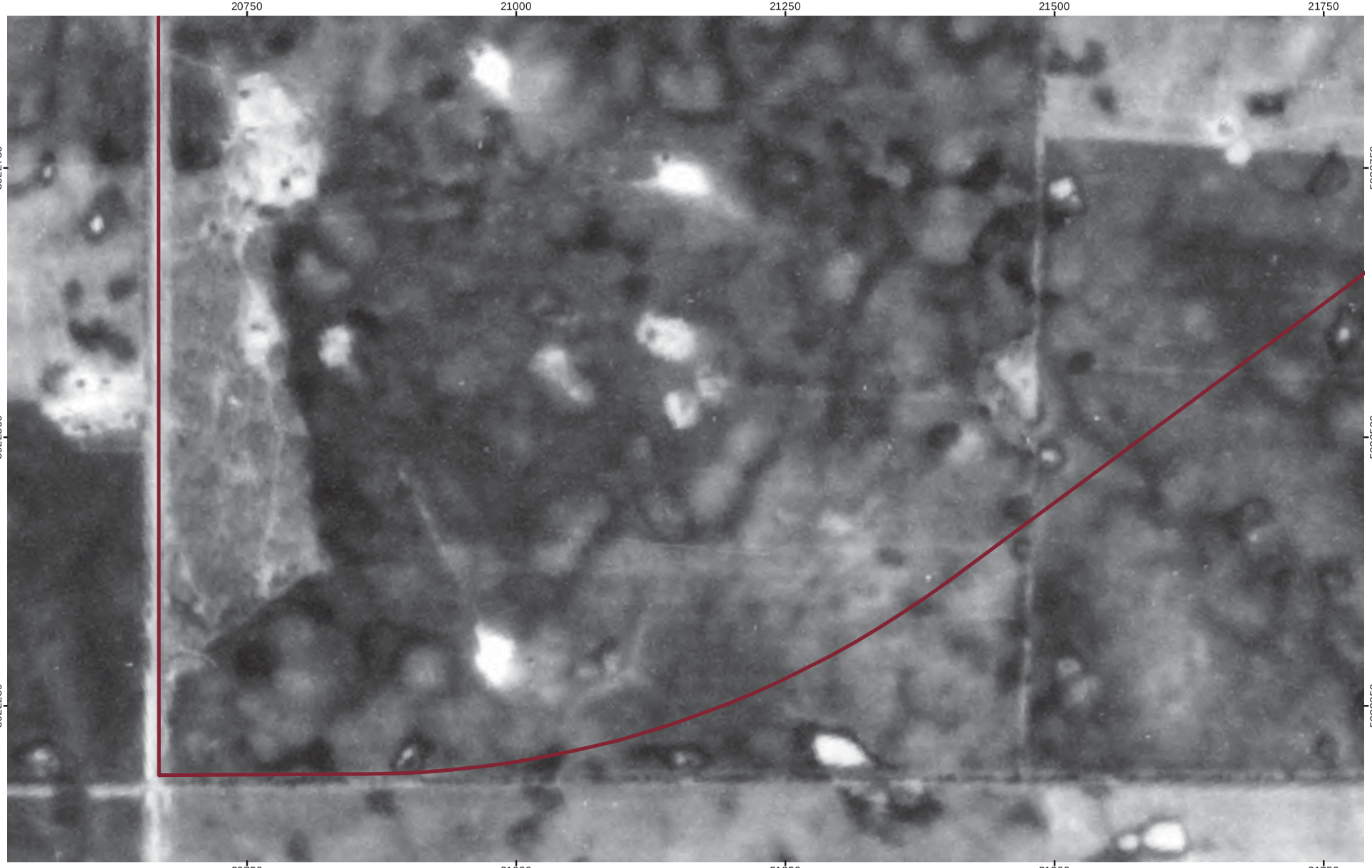
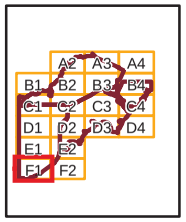


Study Area

Riverview Owners Group - Phase II ENR Riverview

Historical Aerial Review 1950



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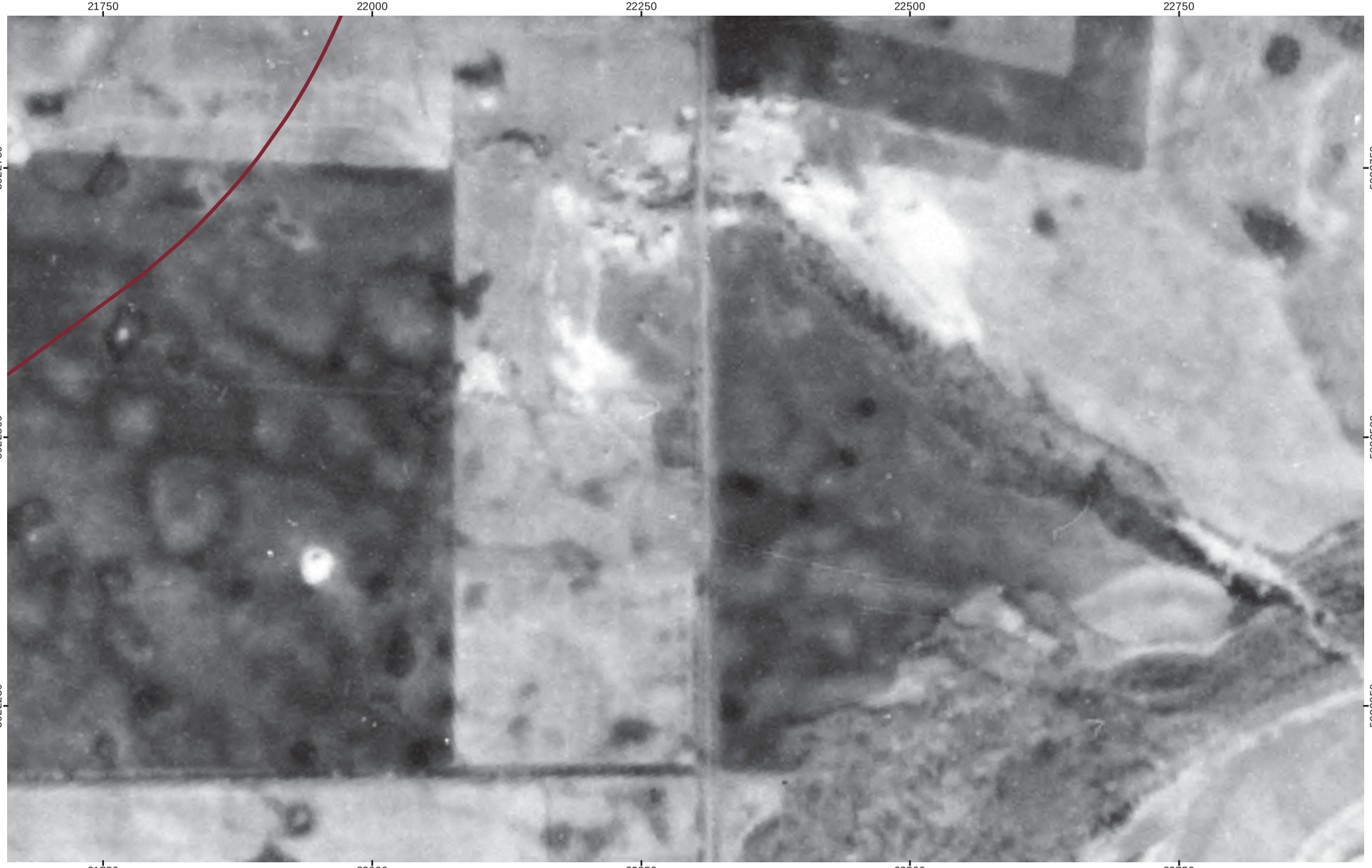
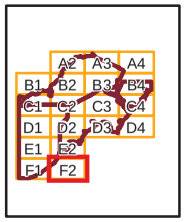


Study Area

Riverview Owners Group - Phase II ENR Riverview

Historical Aerial Review 1950



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DRAFT DATE December 12, 2012				SCALE 1:5,000	
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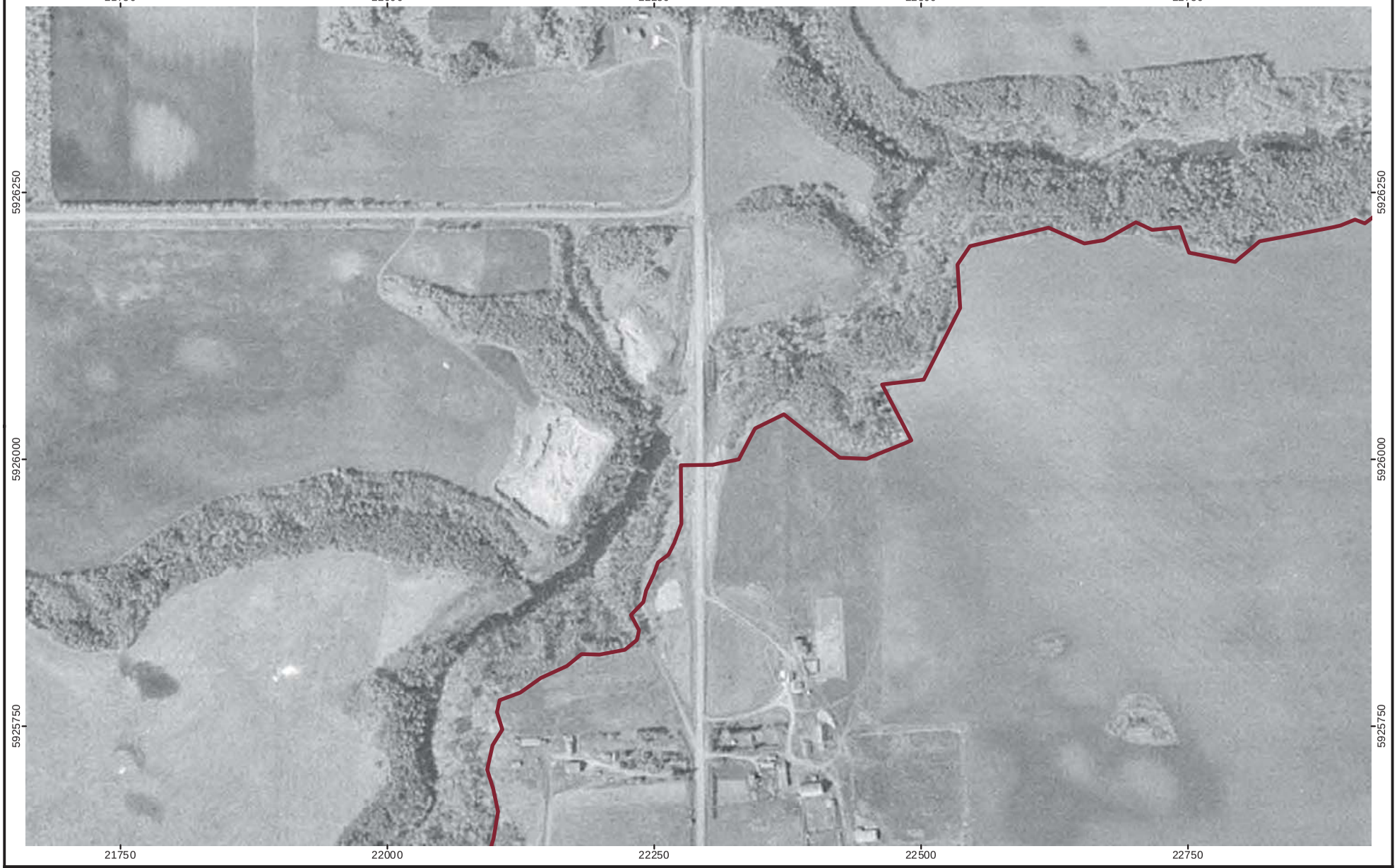
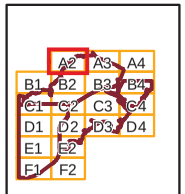


Study Area

Riverview Owners Group - Phase II ENR Riverview

Historical Aerial Review 1962



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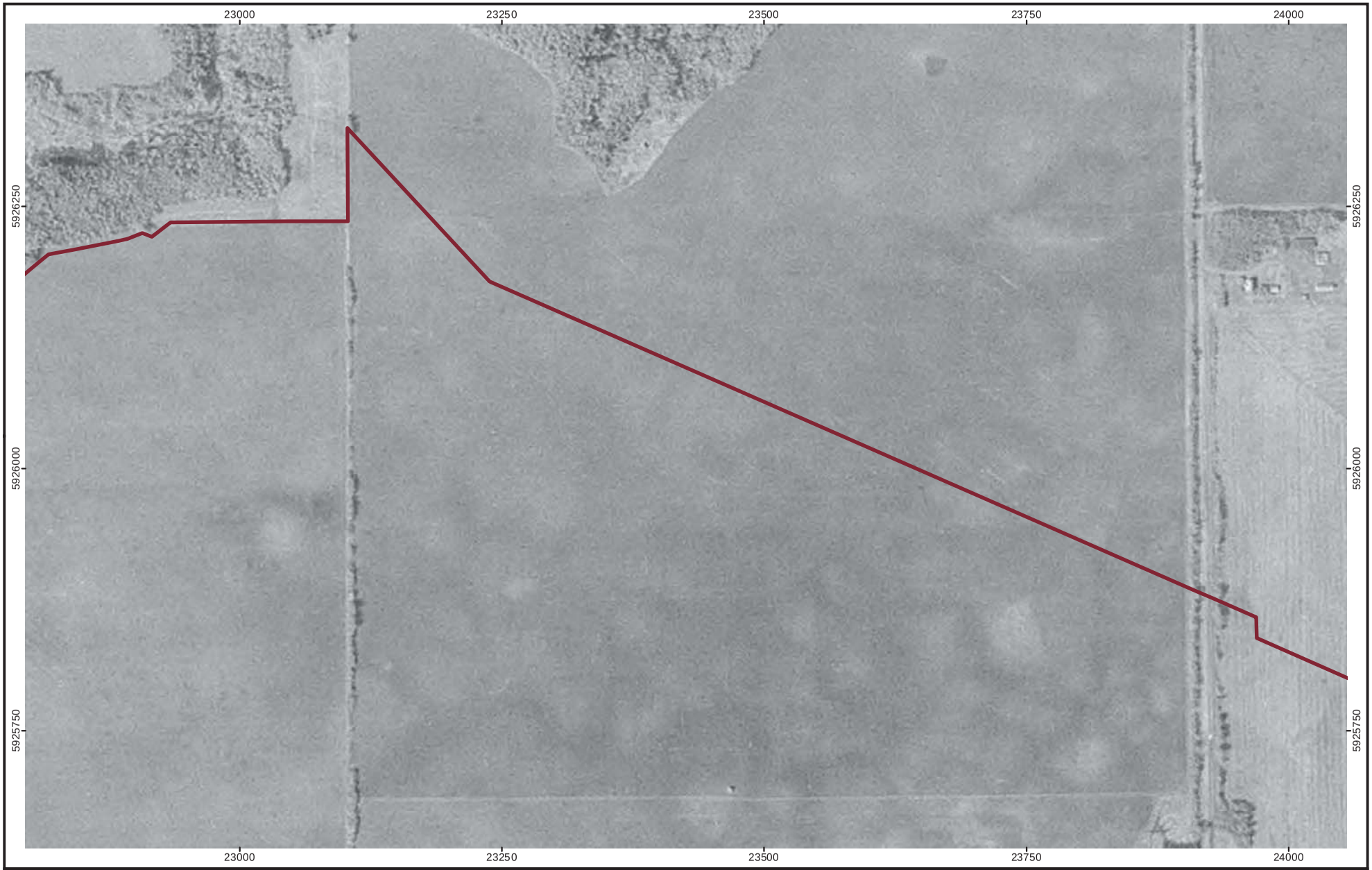
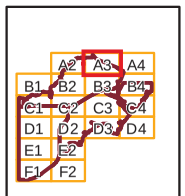


Study Area

Riverview Owners Group - Phase II ENR Riverview

Historical Aerial Review 1962



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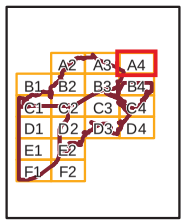
Study Area

Riverview Owners Group - Phase II ENR Riverview

Historical Aerial Review 1962



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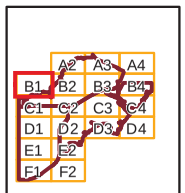
Study Area

Riverview Owners Group - Phase II ENR Riverview

Historical Aerial Review 1962



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Jun 12, 2014				110218864	1962
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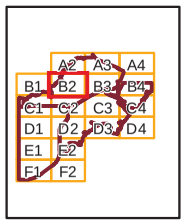
Study Area

Riverview Owners Group - Phase II ENR Riverview

Historical Aerial Review 1962



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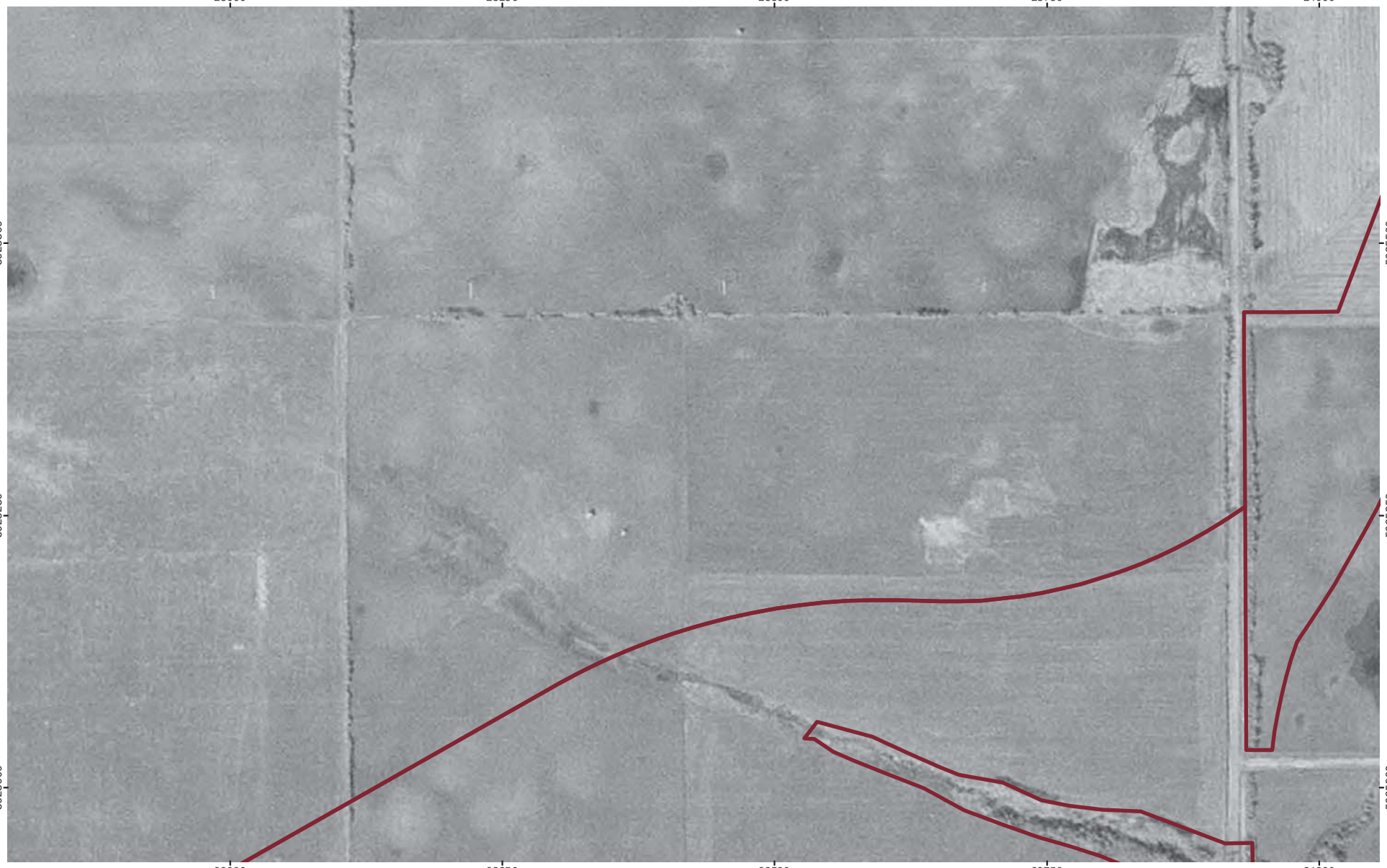

Study Area

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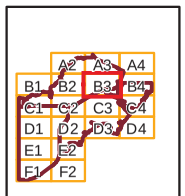
Historical Aerial Review 1962



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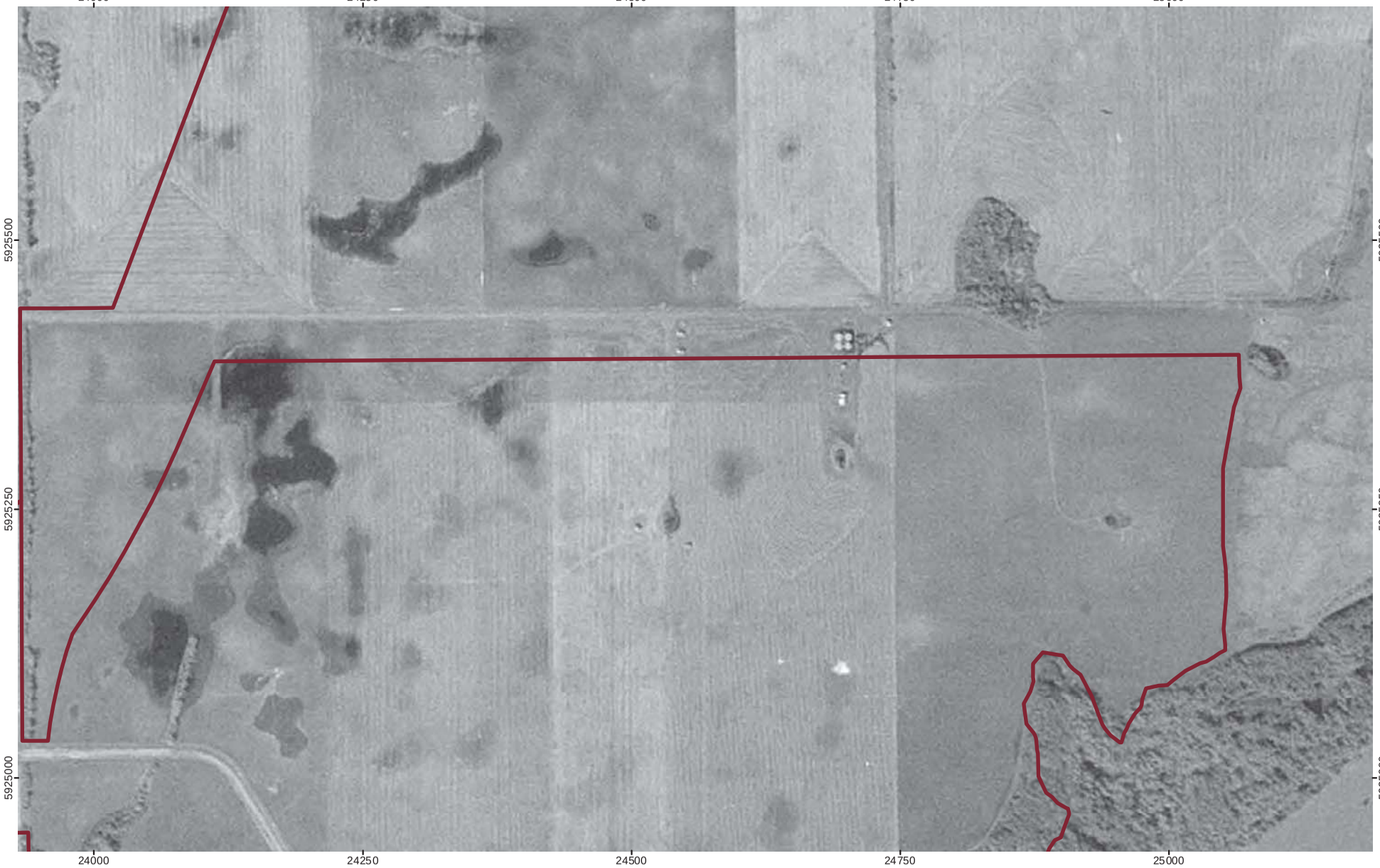

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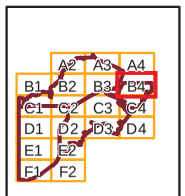
Historical Aerial Review 1962



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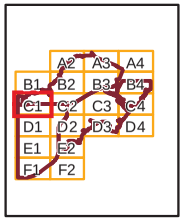

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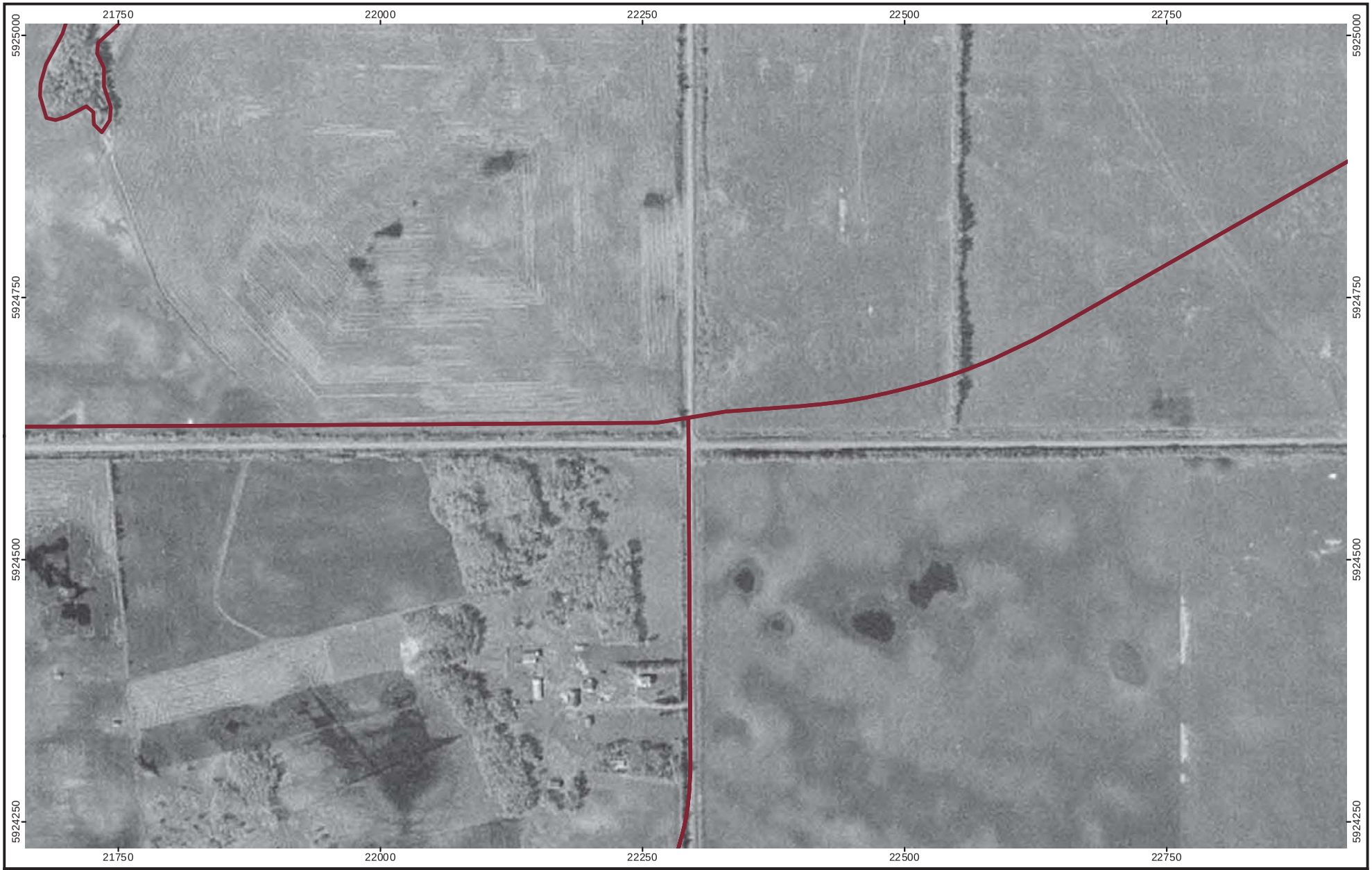
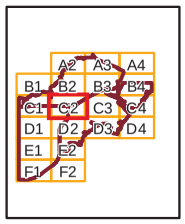


Study Area

Riverview Owners Group - Phase II ENR Riverview

Historical Aerial Review 1962



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Projection: 3TM CM:114° Datum: NAD 83

Acknowledgements:
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PREPARED BY	PREPARED FOR
Stantec	Riverview Owners Group

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Jun 12, 2014	110218864 / 1962

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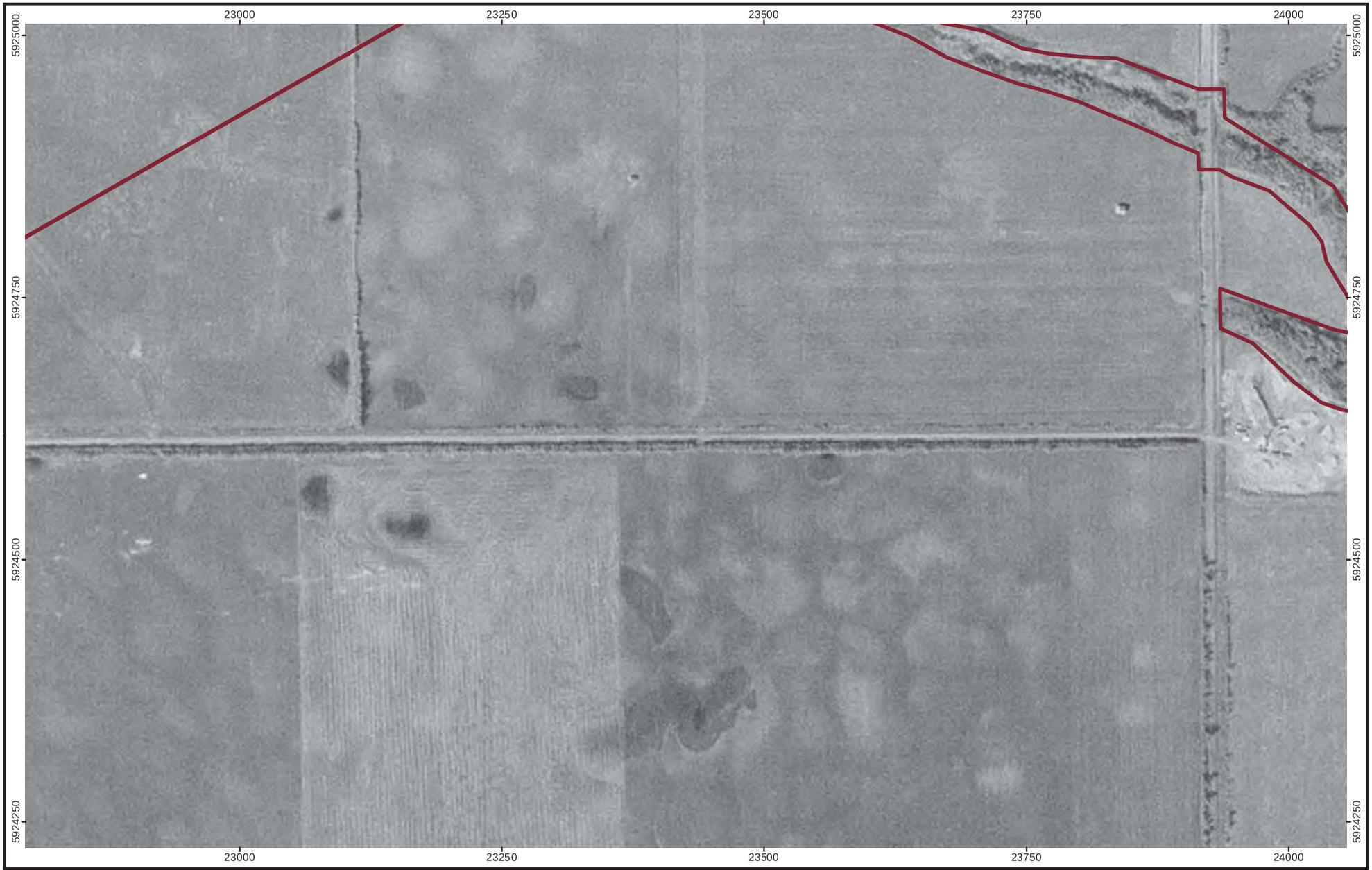

Study Area

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Historical Aerial Review
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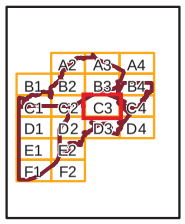

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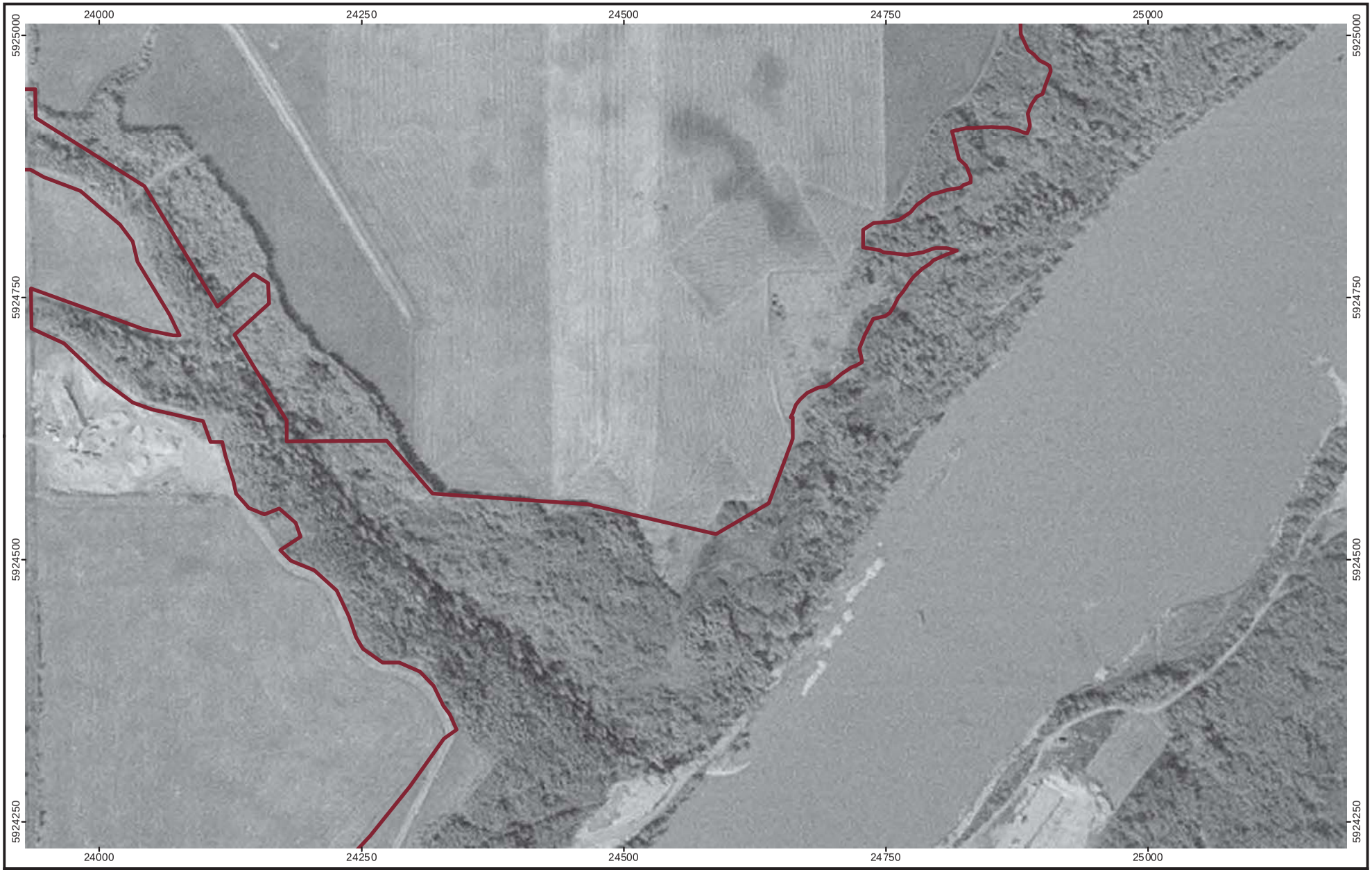

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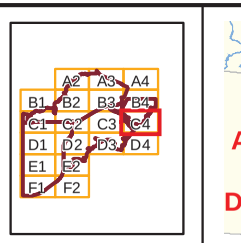

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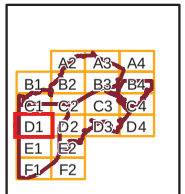

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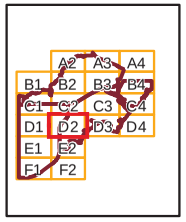

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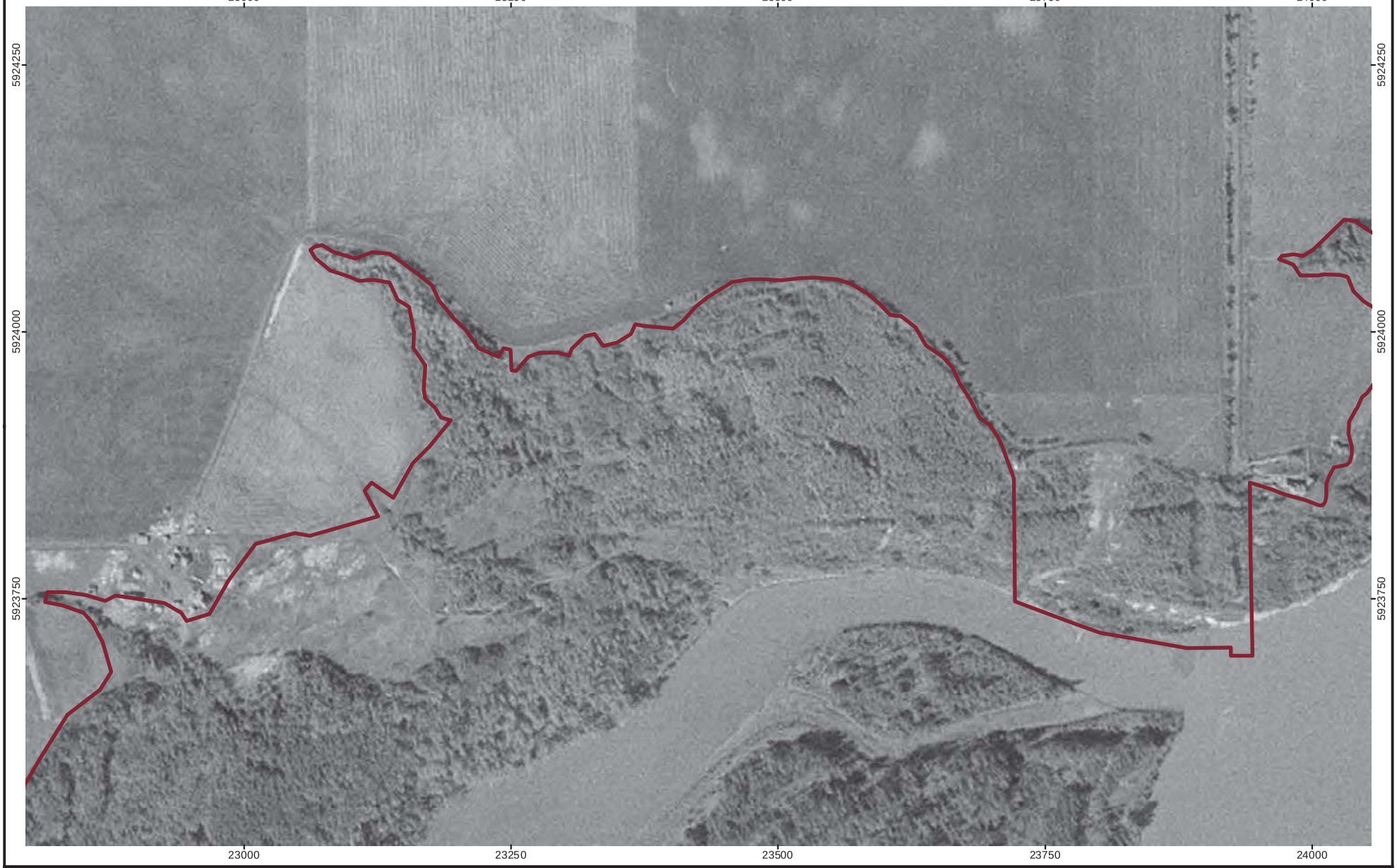

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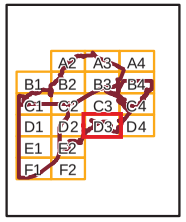

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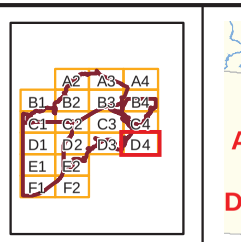

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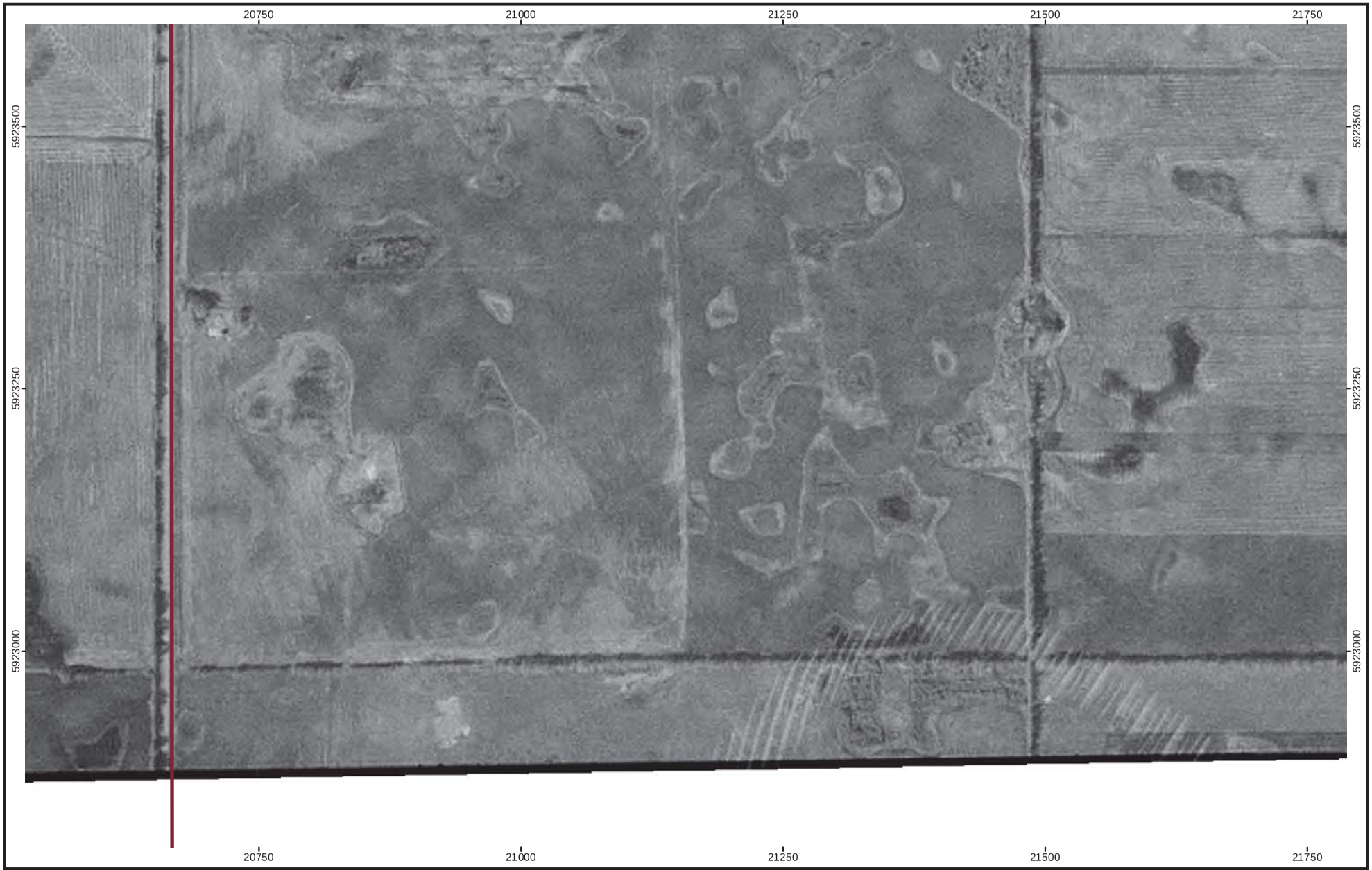

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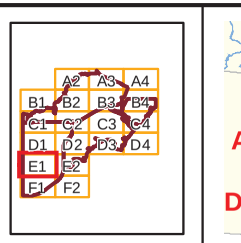

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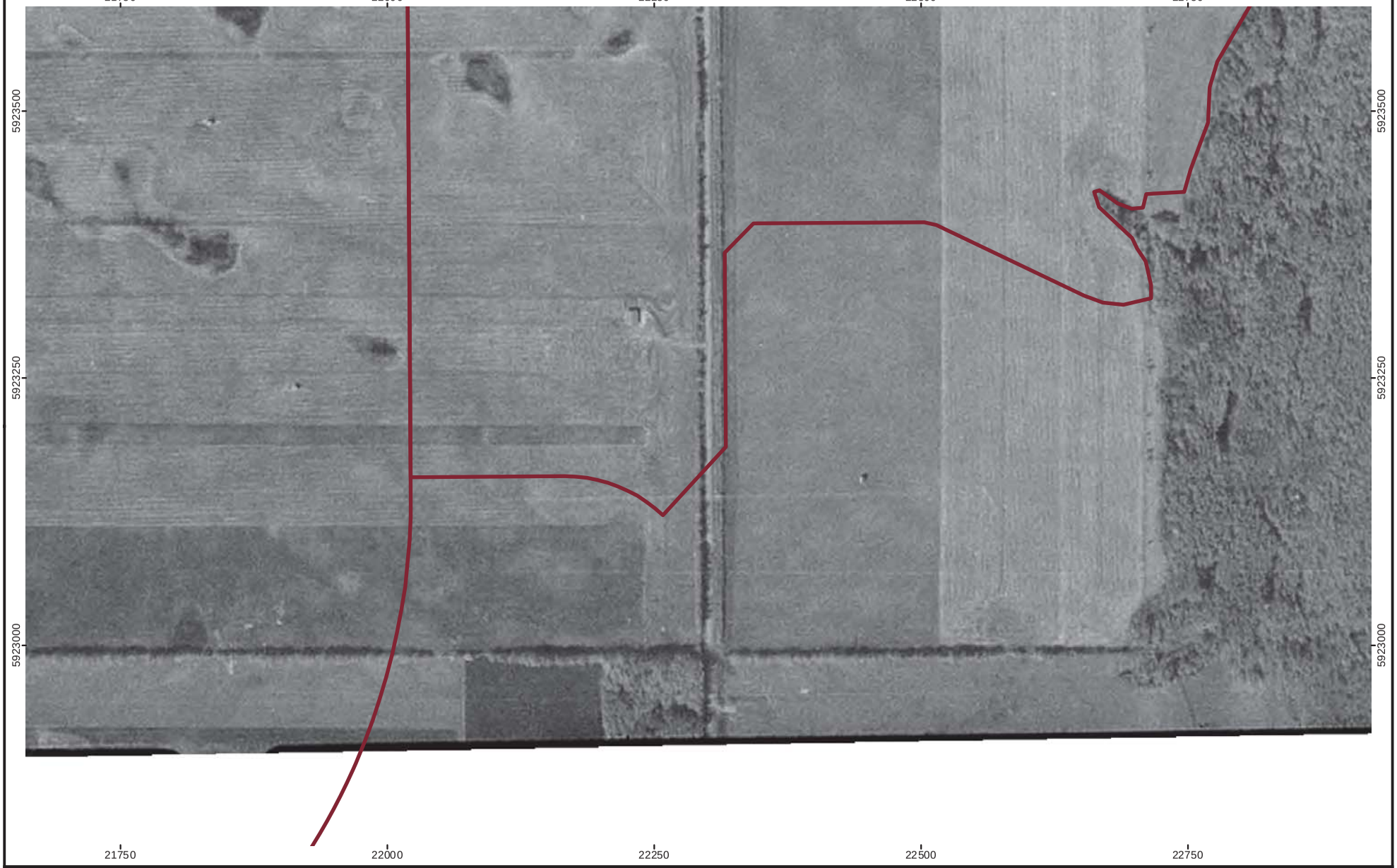

Study Area

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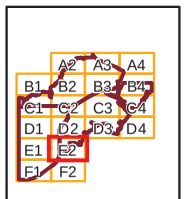

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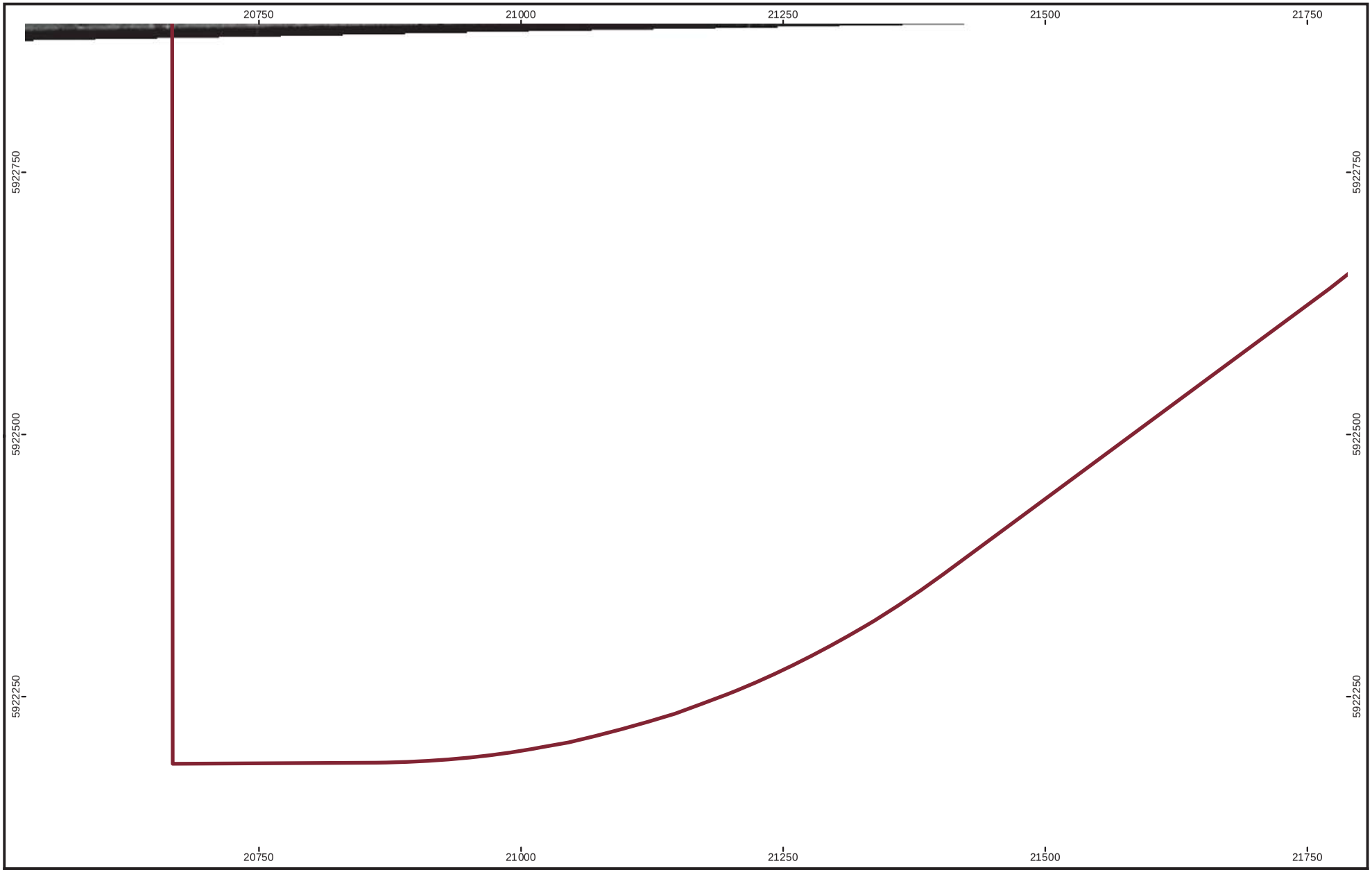

Study Area

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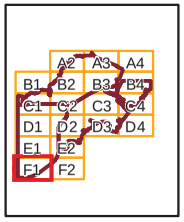
Historical Aerial Review 1962



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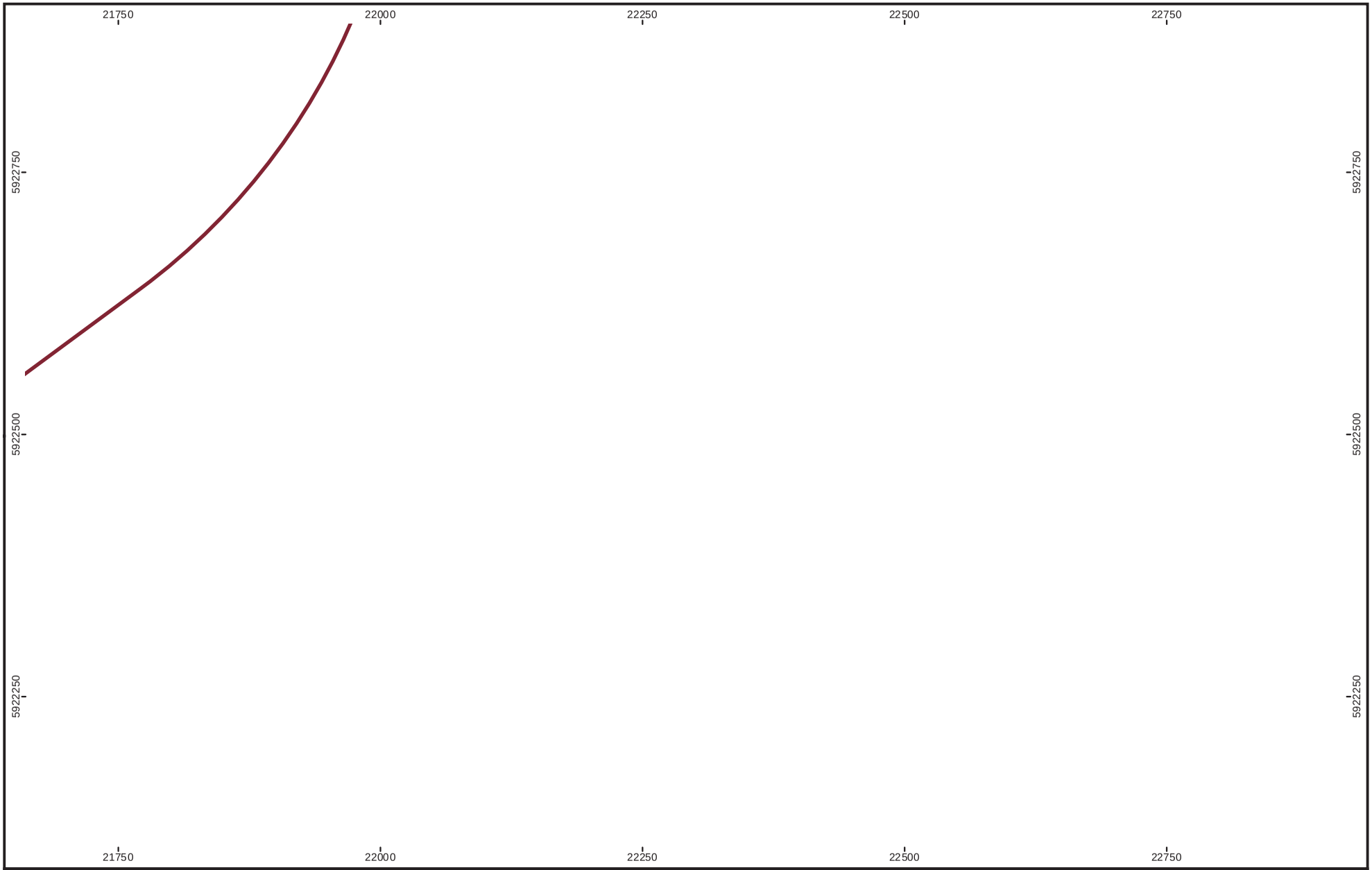

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Riverview Owners Group - Phase II ENR Riverview

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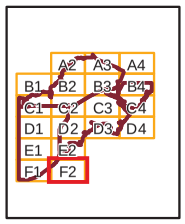

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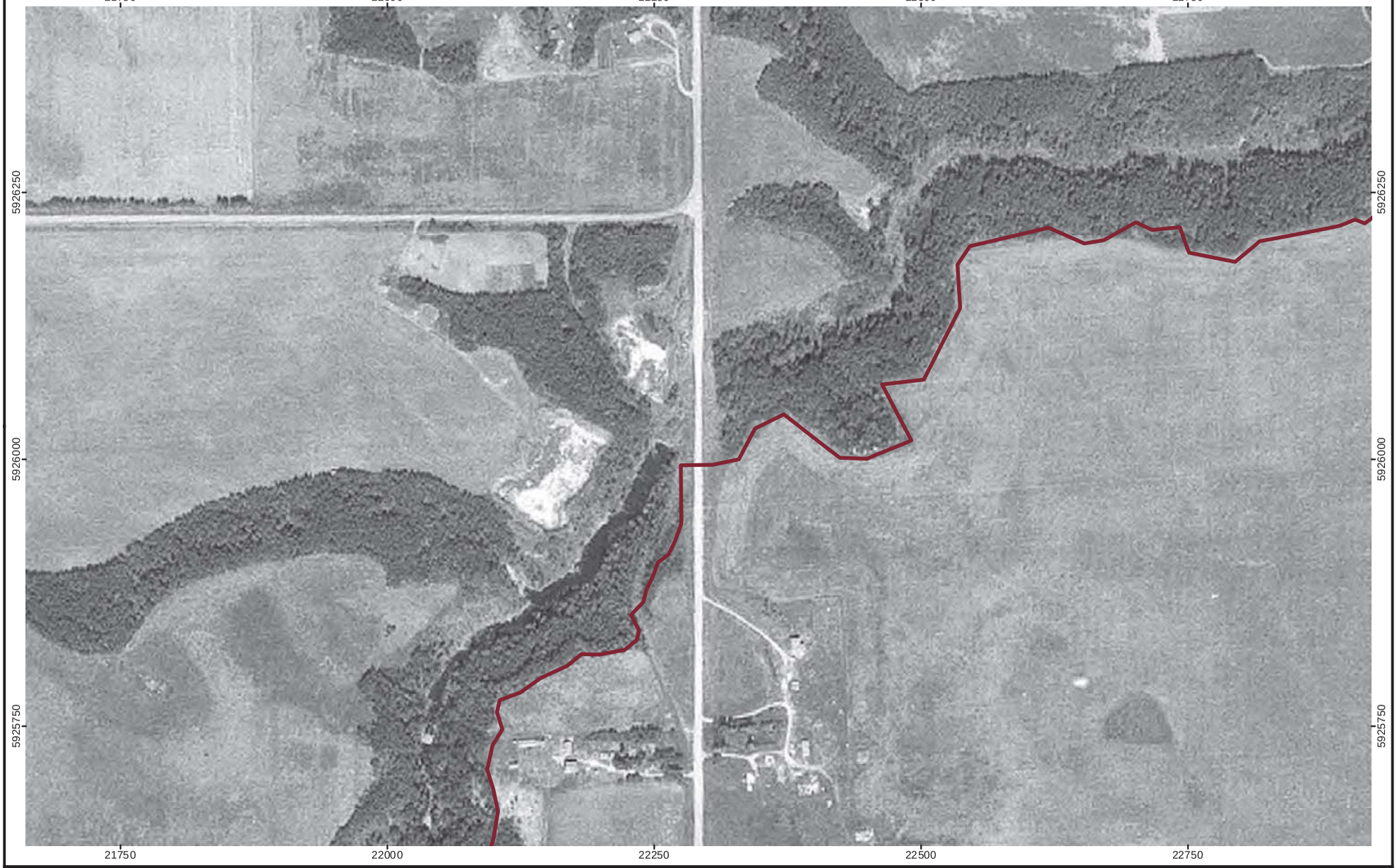

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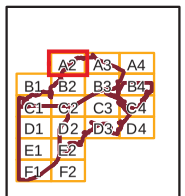
Historical Aerial Review 1967



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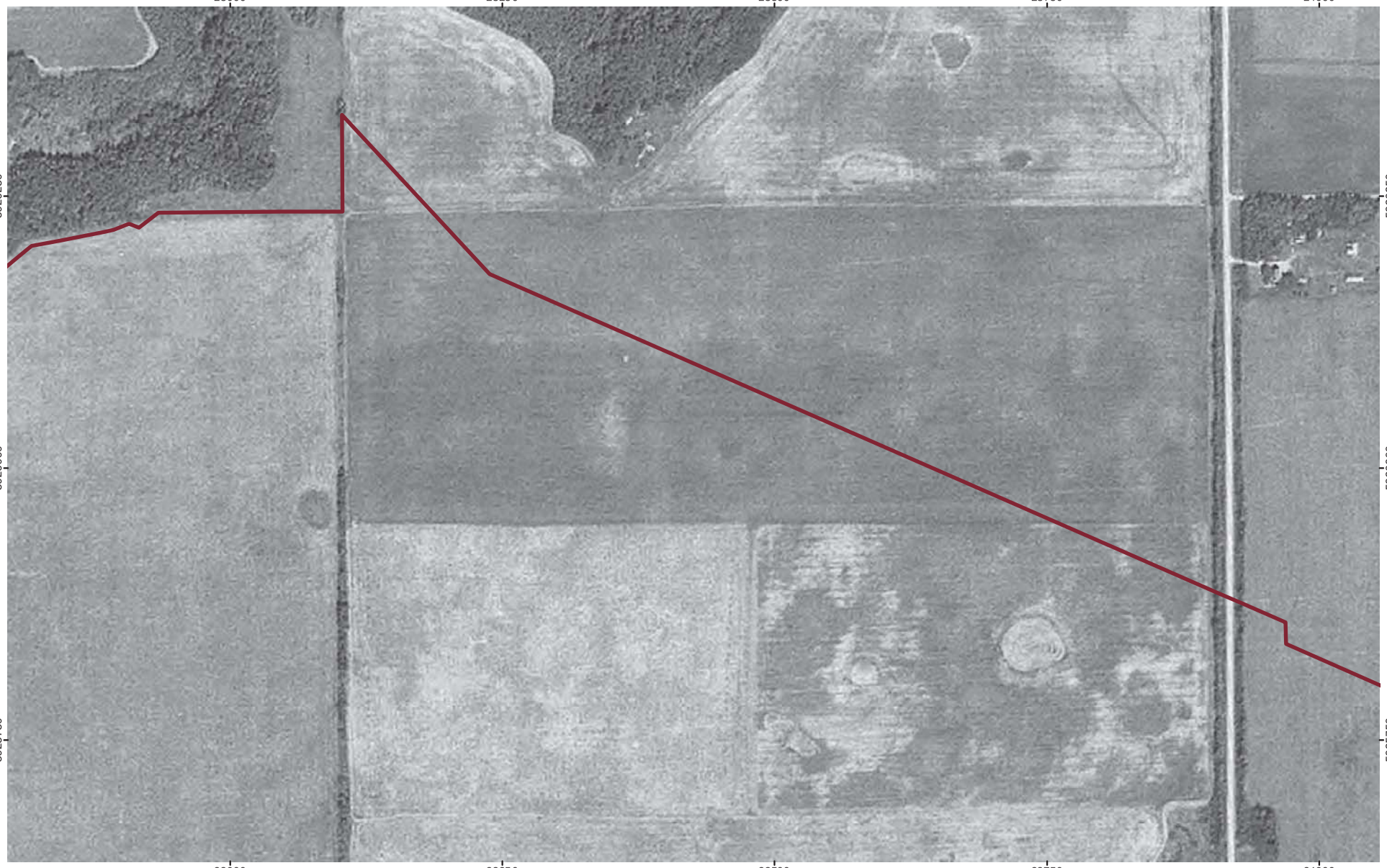

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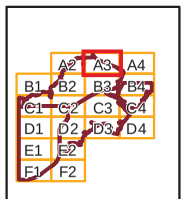

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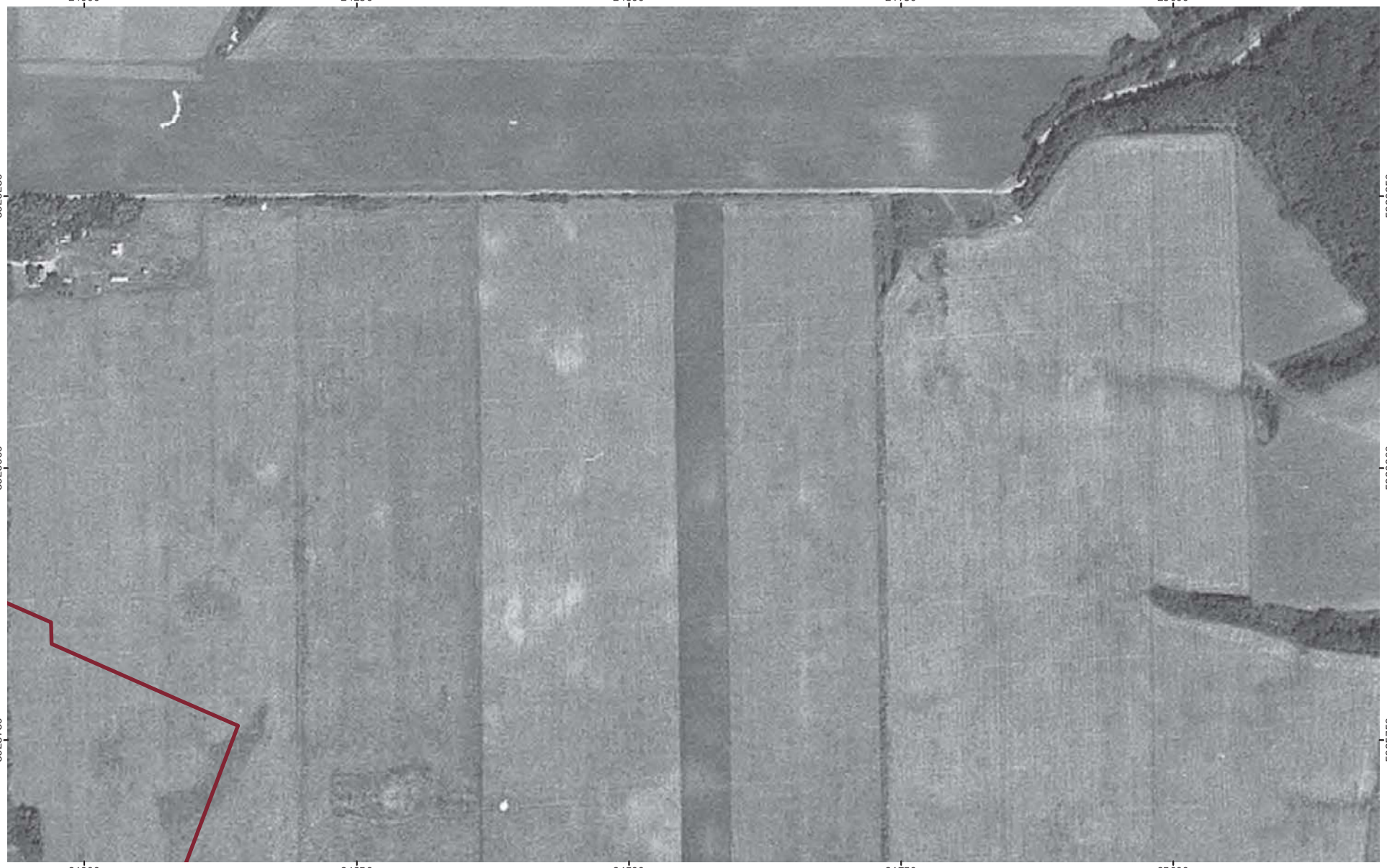

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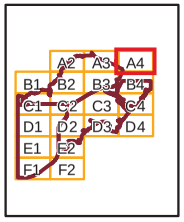

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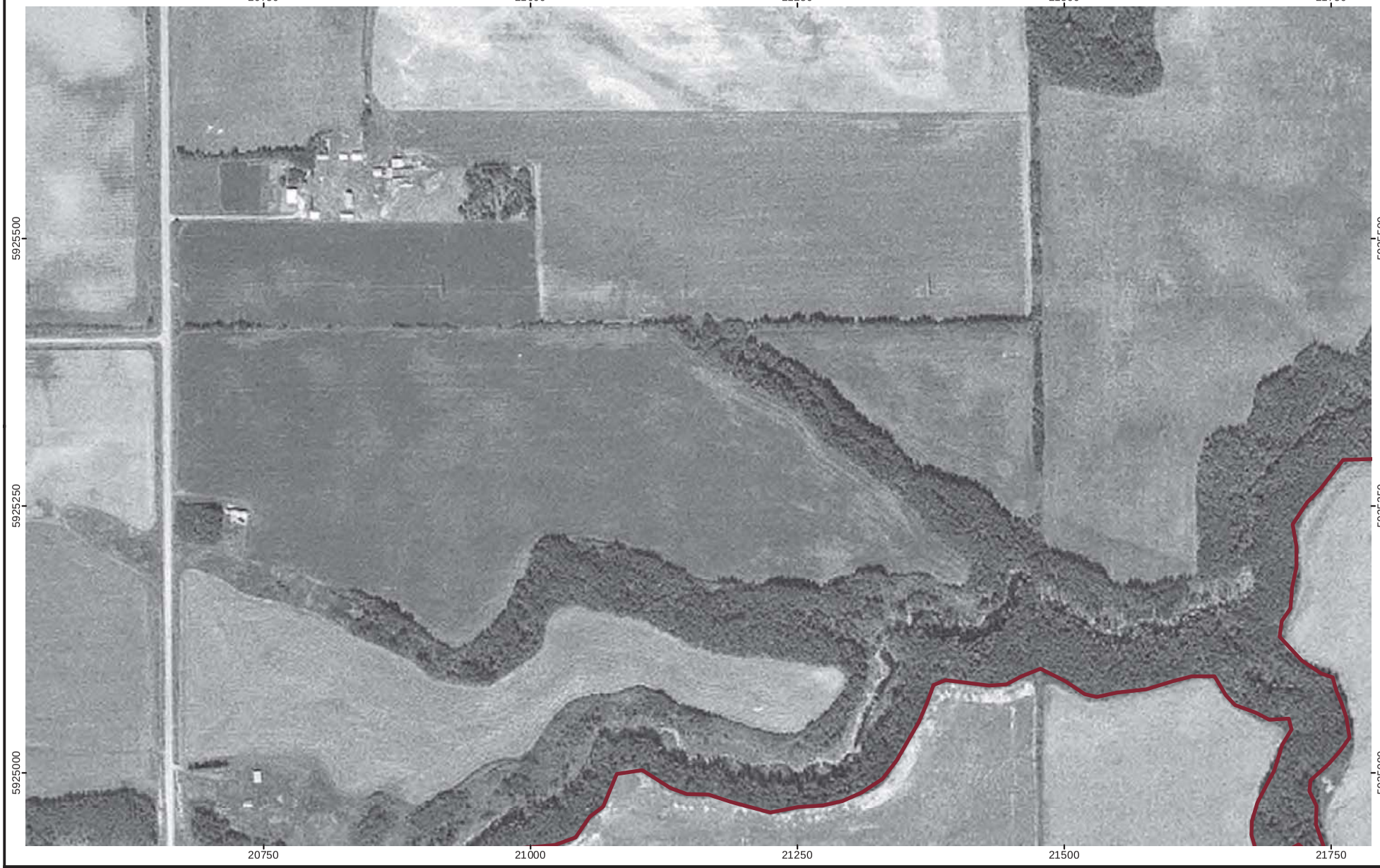

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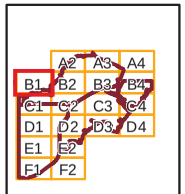

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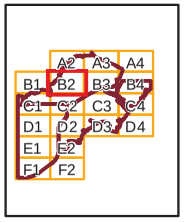

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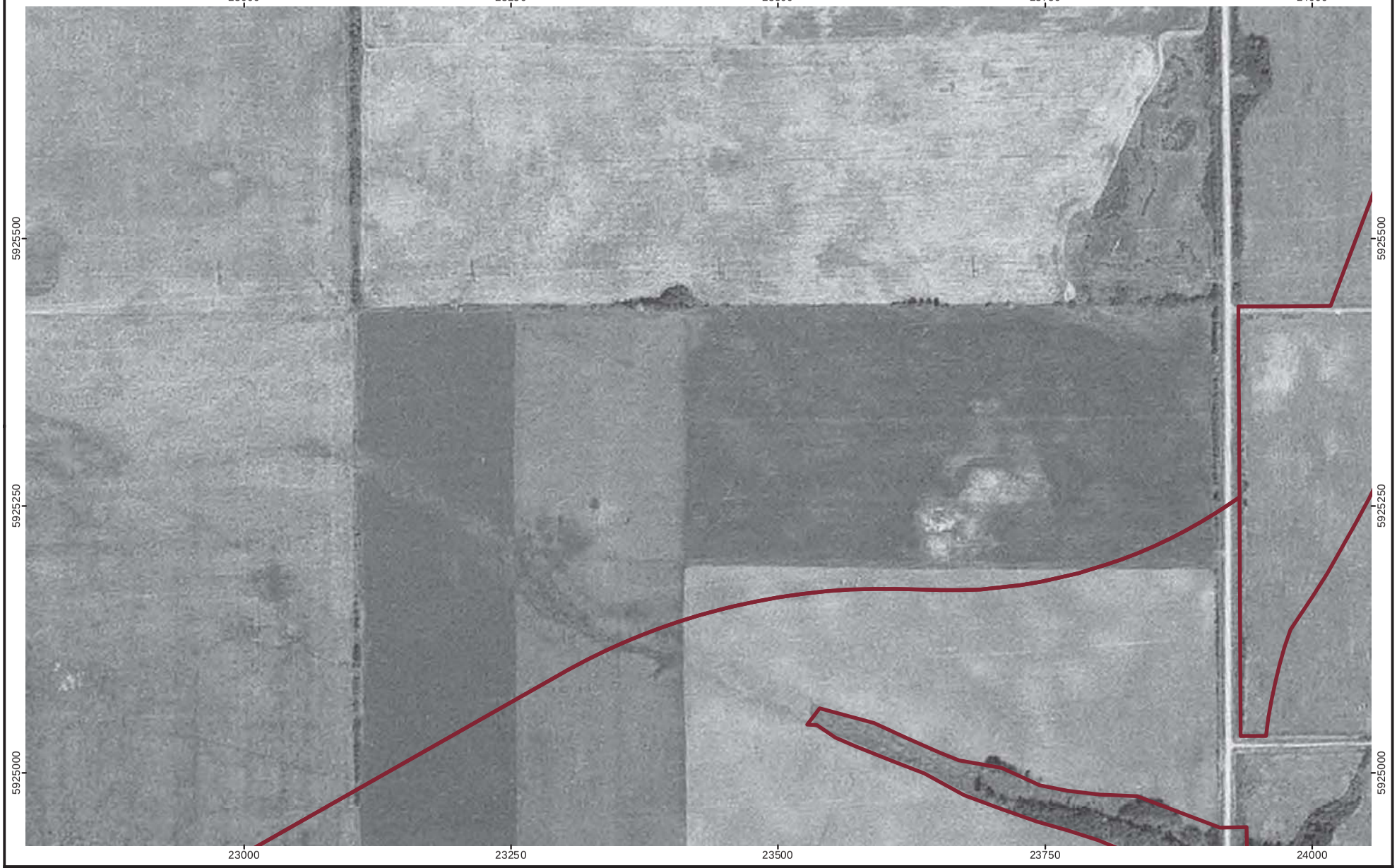

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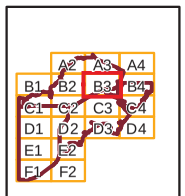

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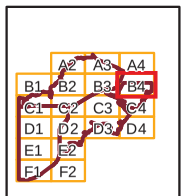

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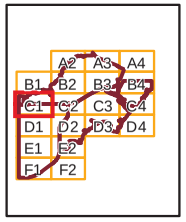

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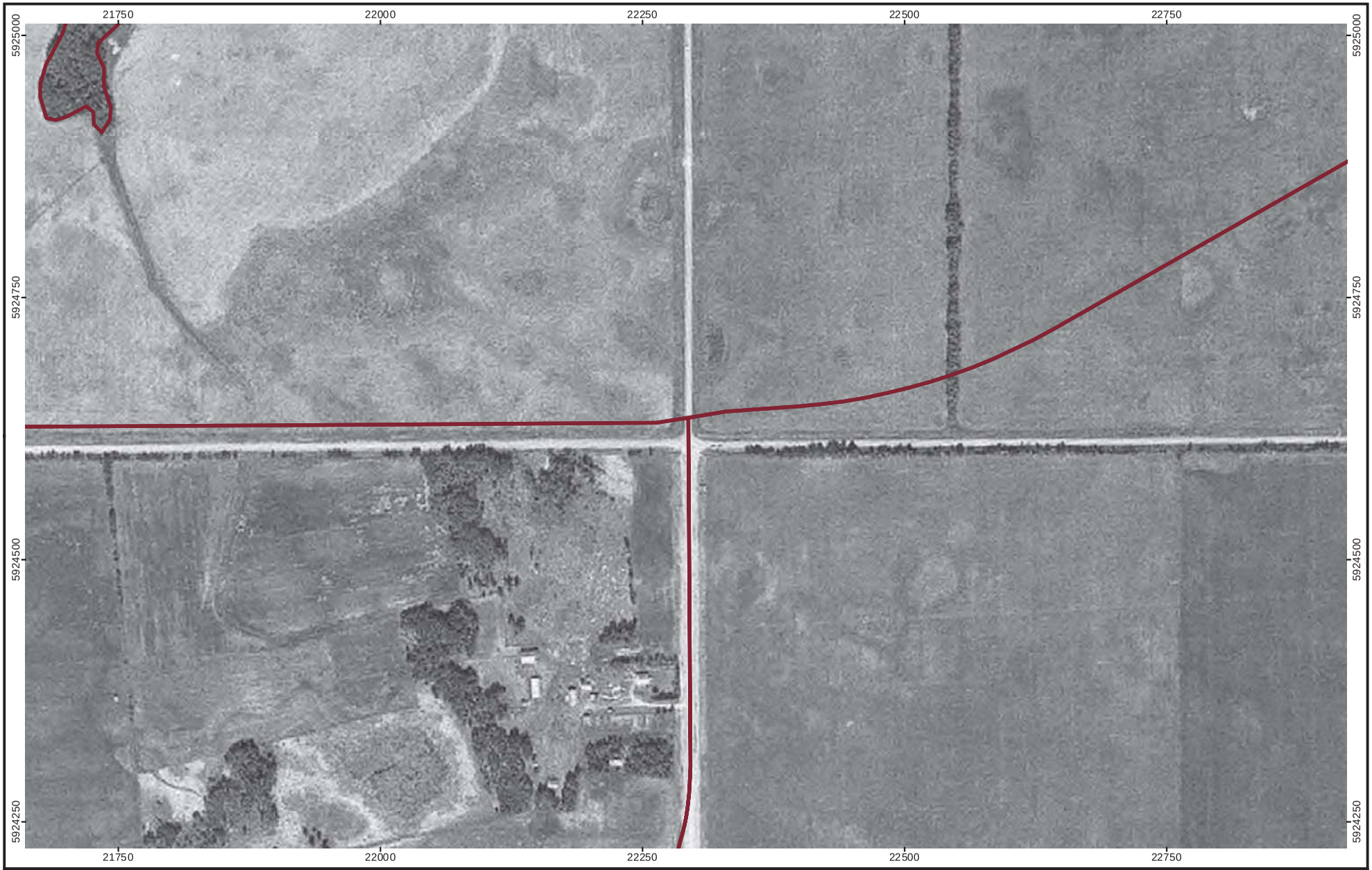

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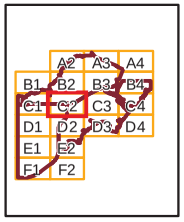
Historical Aerial Review 1967



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Meters

Projection: 3TM CM:114° Datum: NAD 83

Acknowledgements:
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PREPARED BY: Stantec				PREPARED FOR: Riverview Owners Group	
DRAFT DATE: December 12, 2012				SCALE: 1:5,000	
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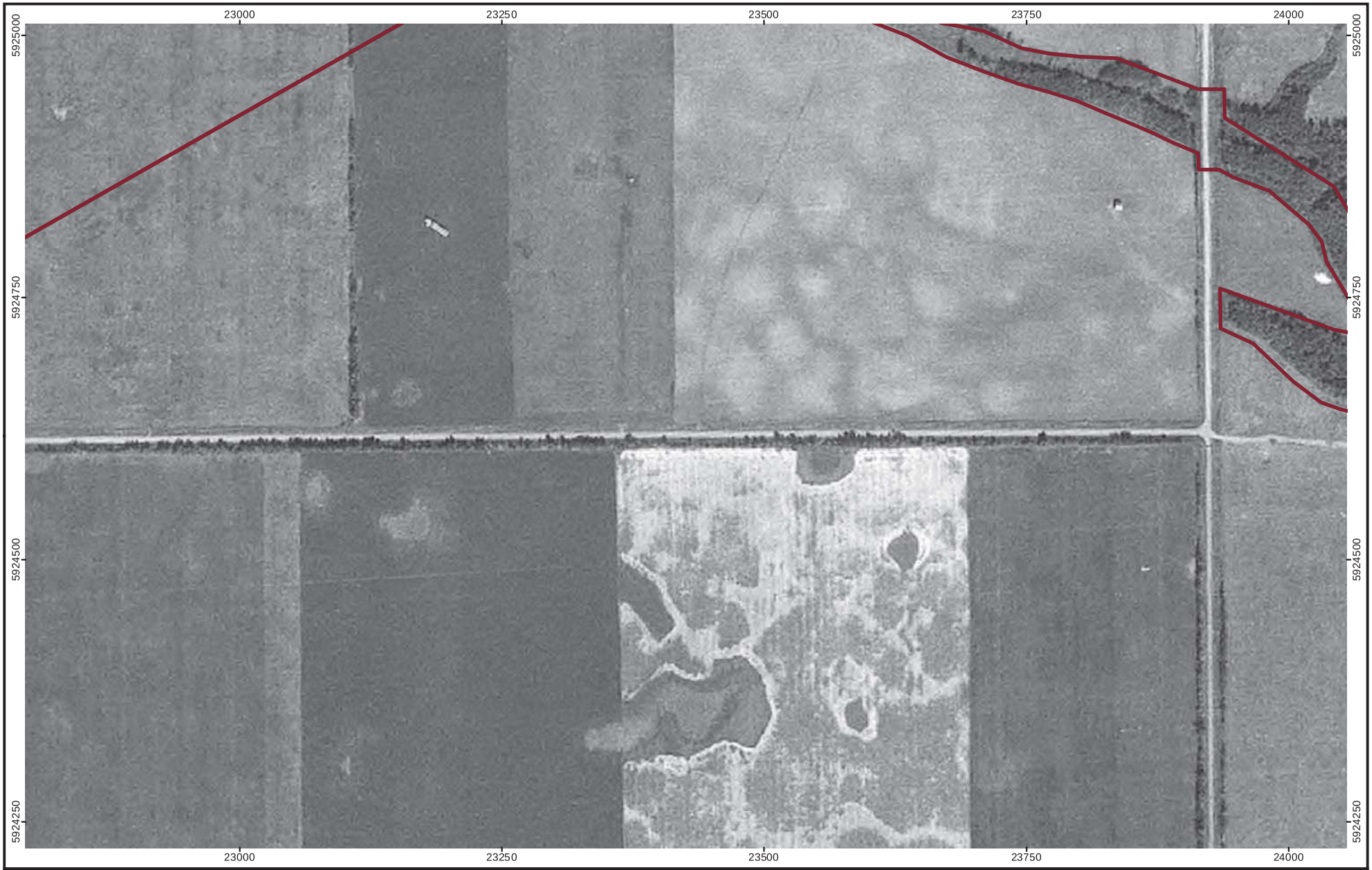
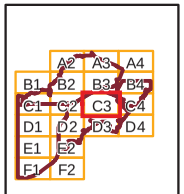


Study Area

Riverview Owners Group - Phase II ENR Riverview

Historical Aerial Review 1967



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Study Area

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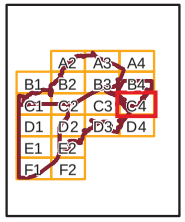

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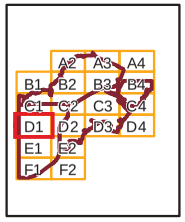

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Riverview Owners Group - Phase II ENR Riverview

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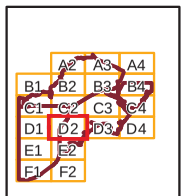

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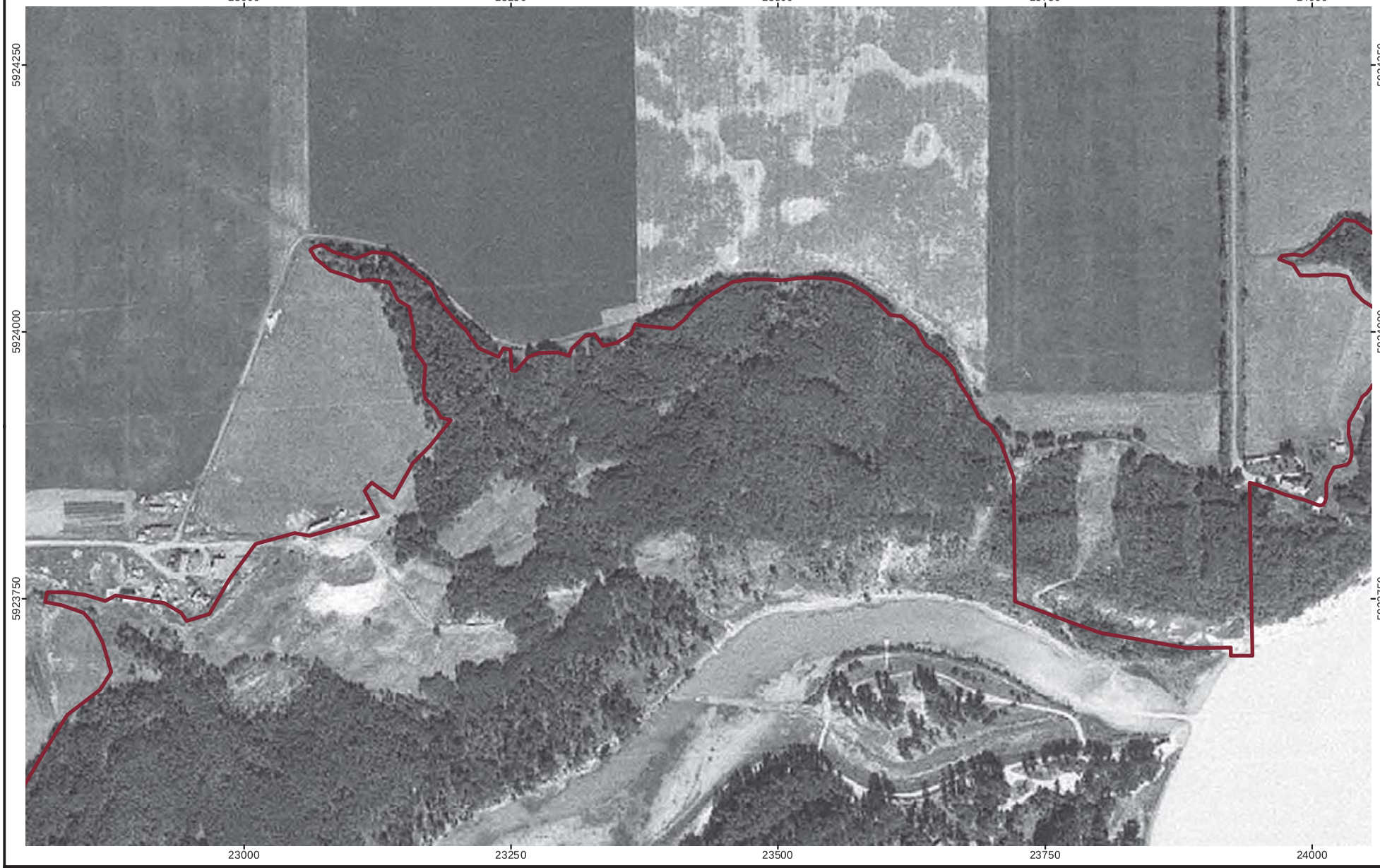

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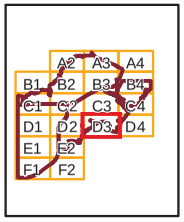

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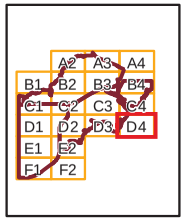

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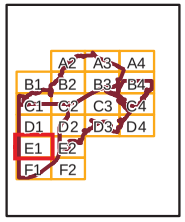

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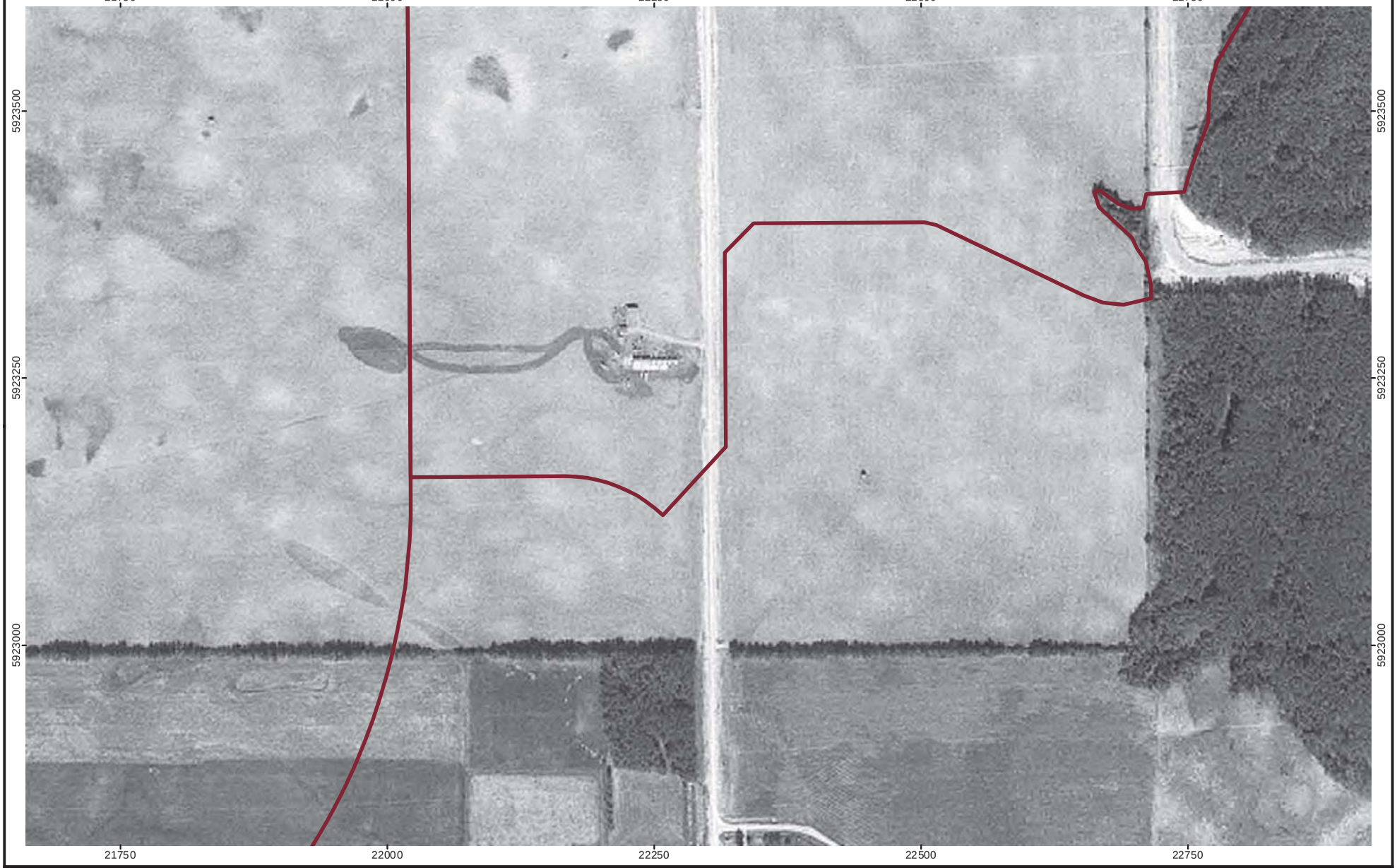

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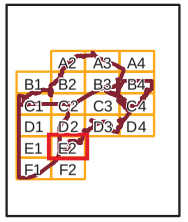

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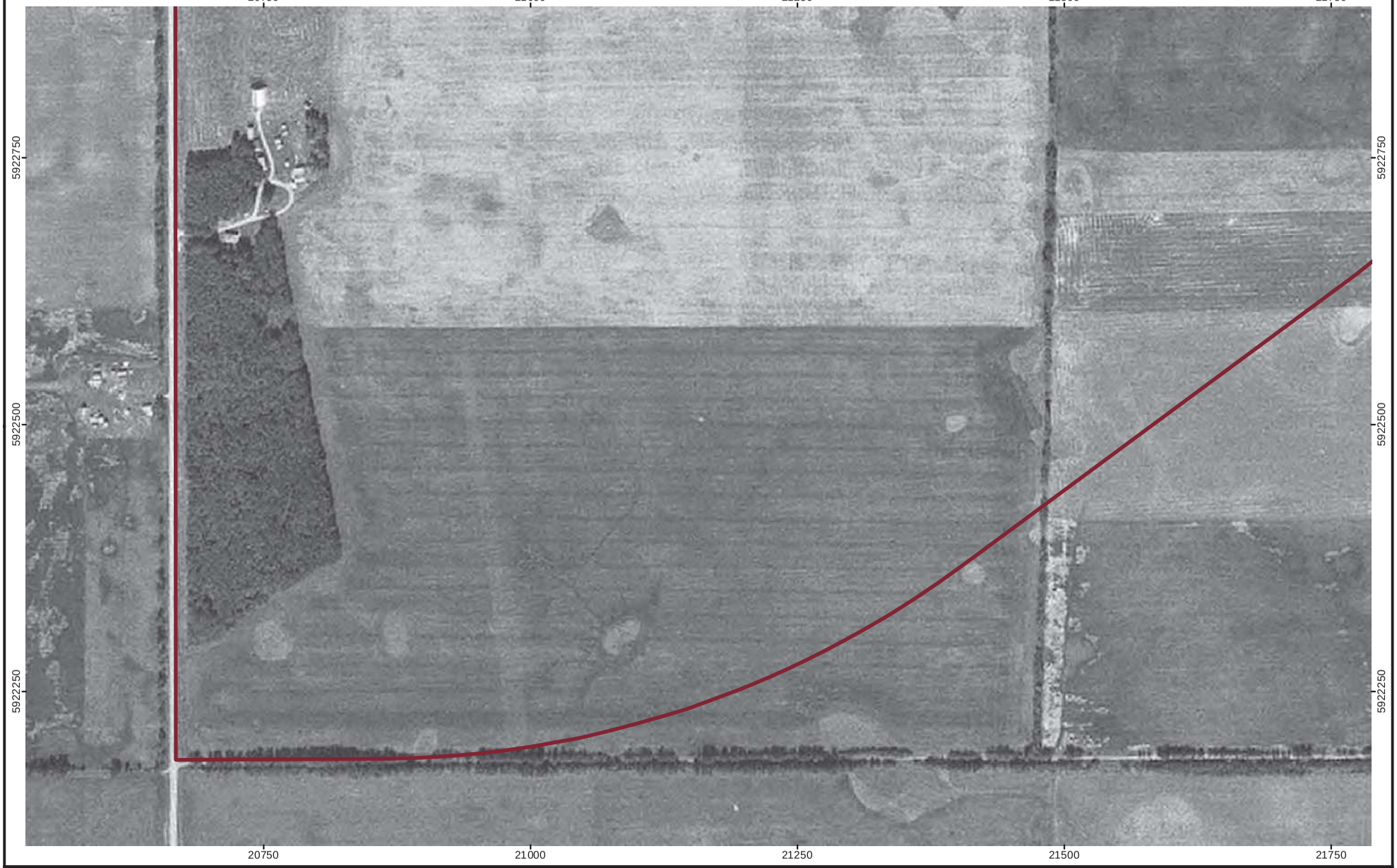

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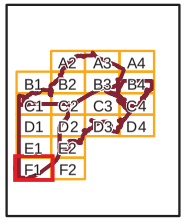
Riverview Owners Group - Phase II ENR Riverview

Historical Aerial Review 1967



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Jun 12, 2014	110218864 / 1967

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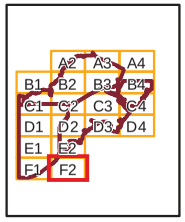

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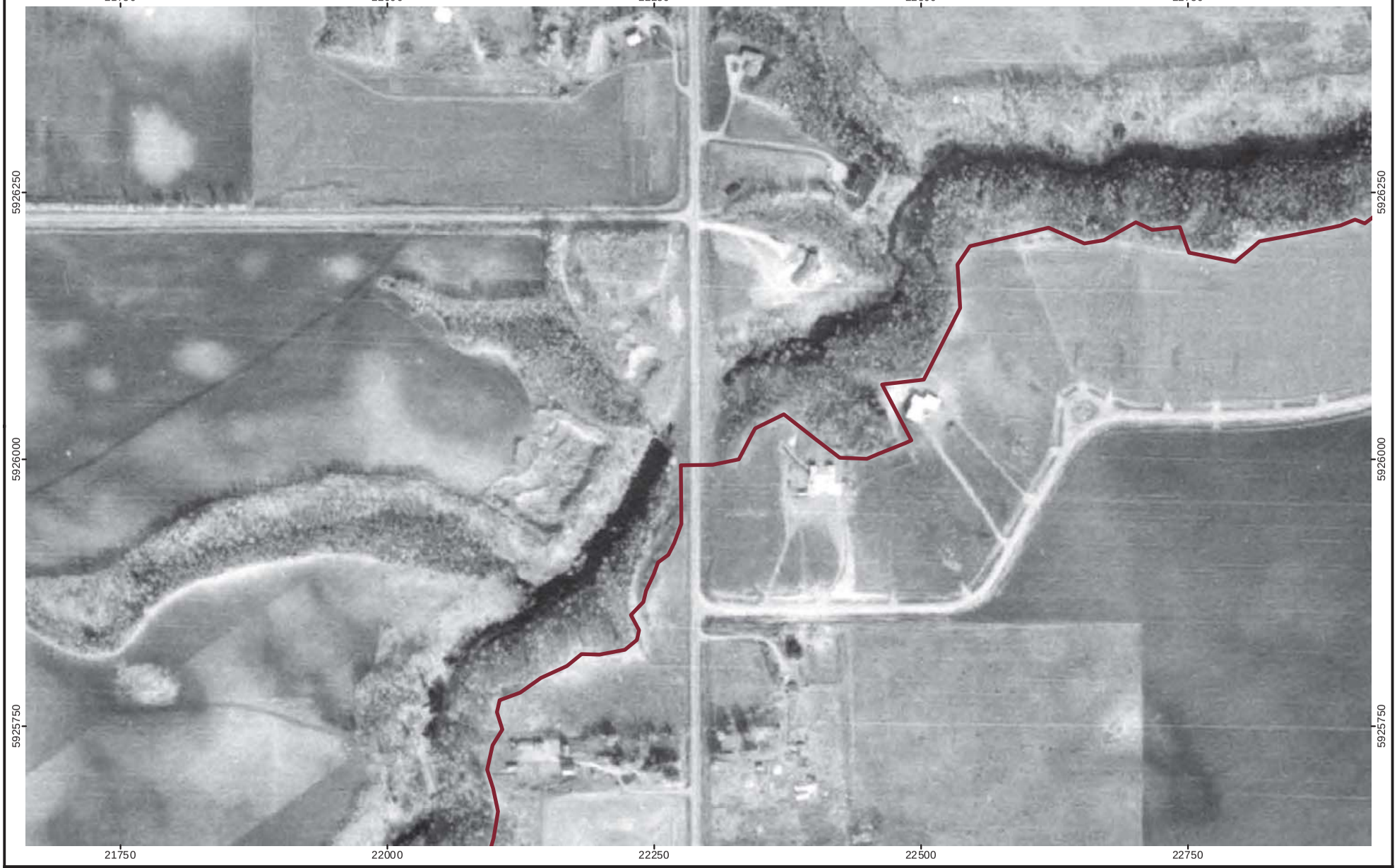
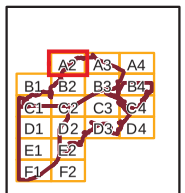


Study Area

Riverview Owners Group - Phase II ENR Riverview

Historical Aerial Review 1972



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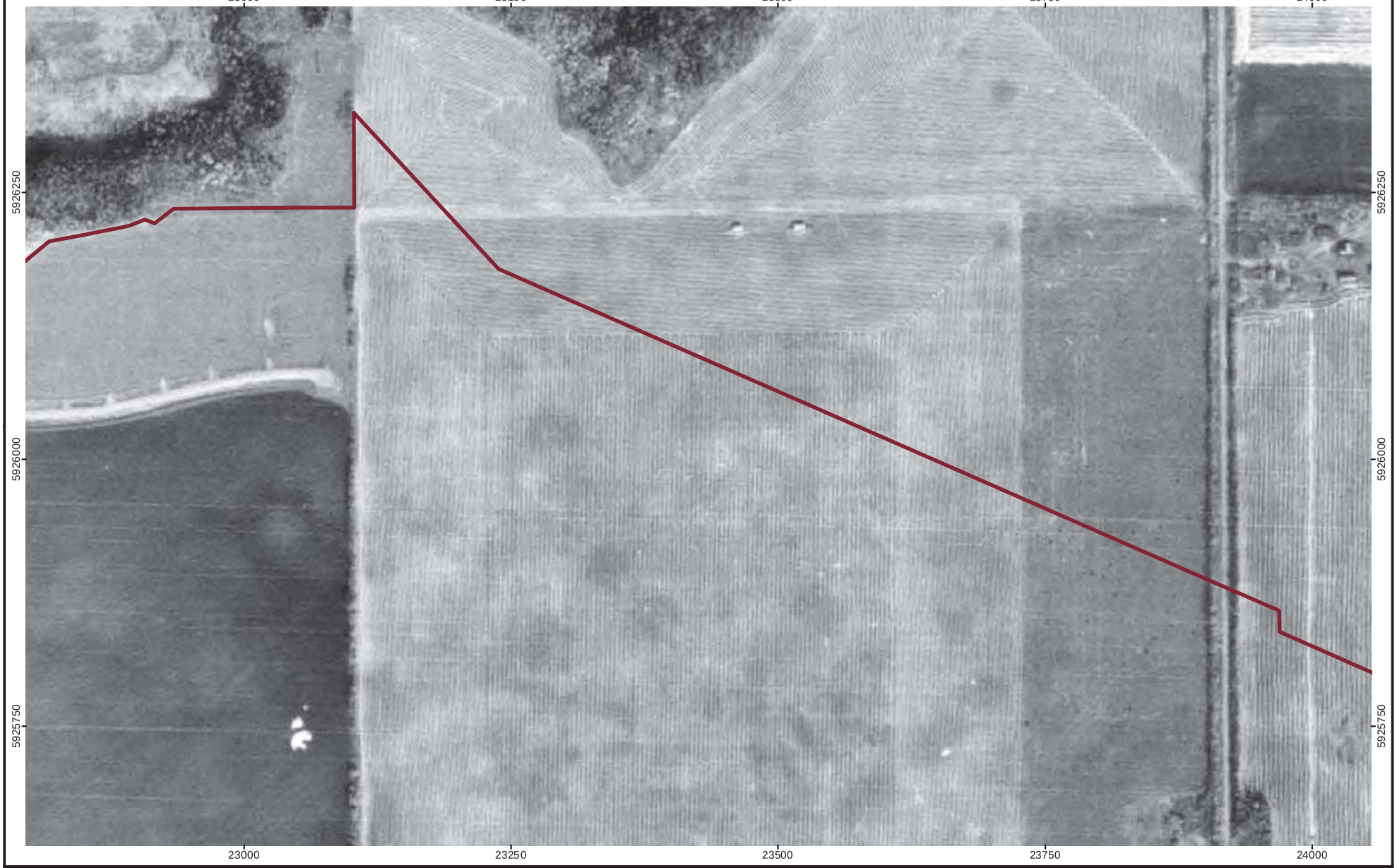

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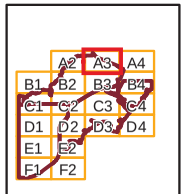
Riverview Owners Group - Phase II ENR Riverview

Historical Aerial Review 1972



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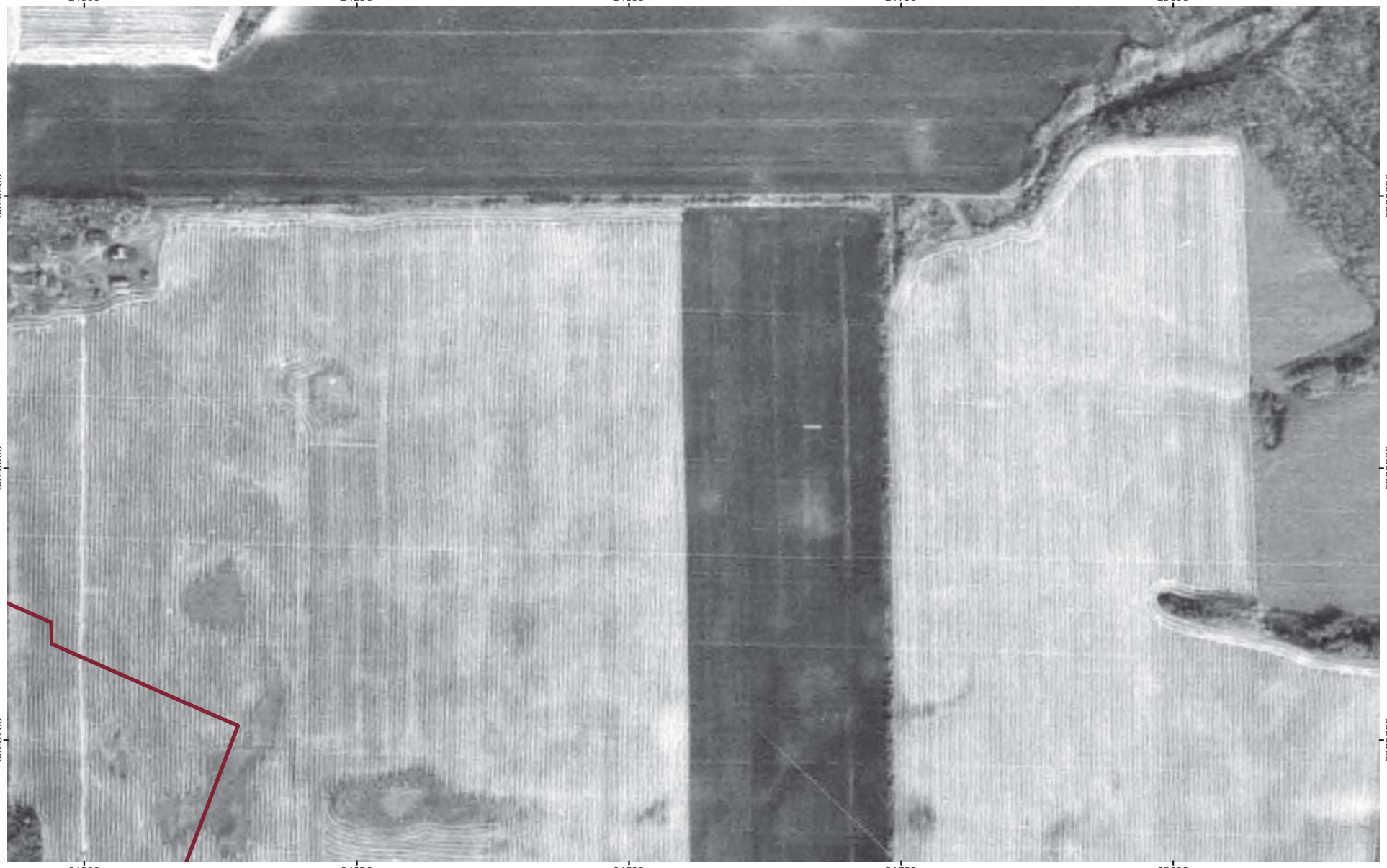

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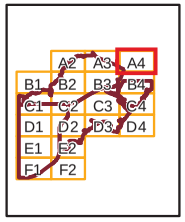
Riverview Owners Group - Phase II ENR Riverview

Historical Aerial Review 1972



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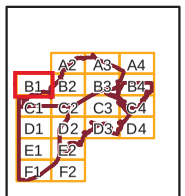

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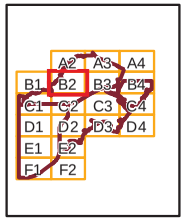

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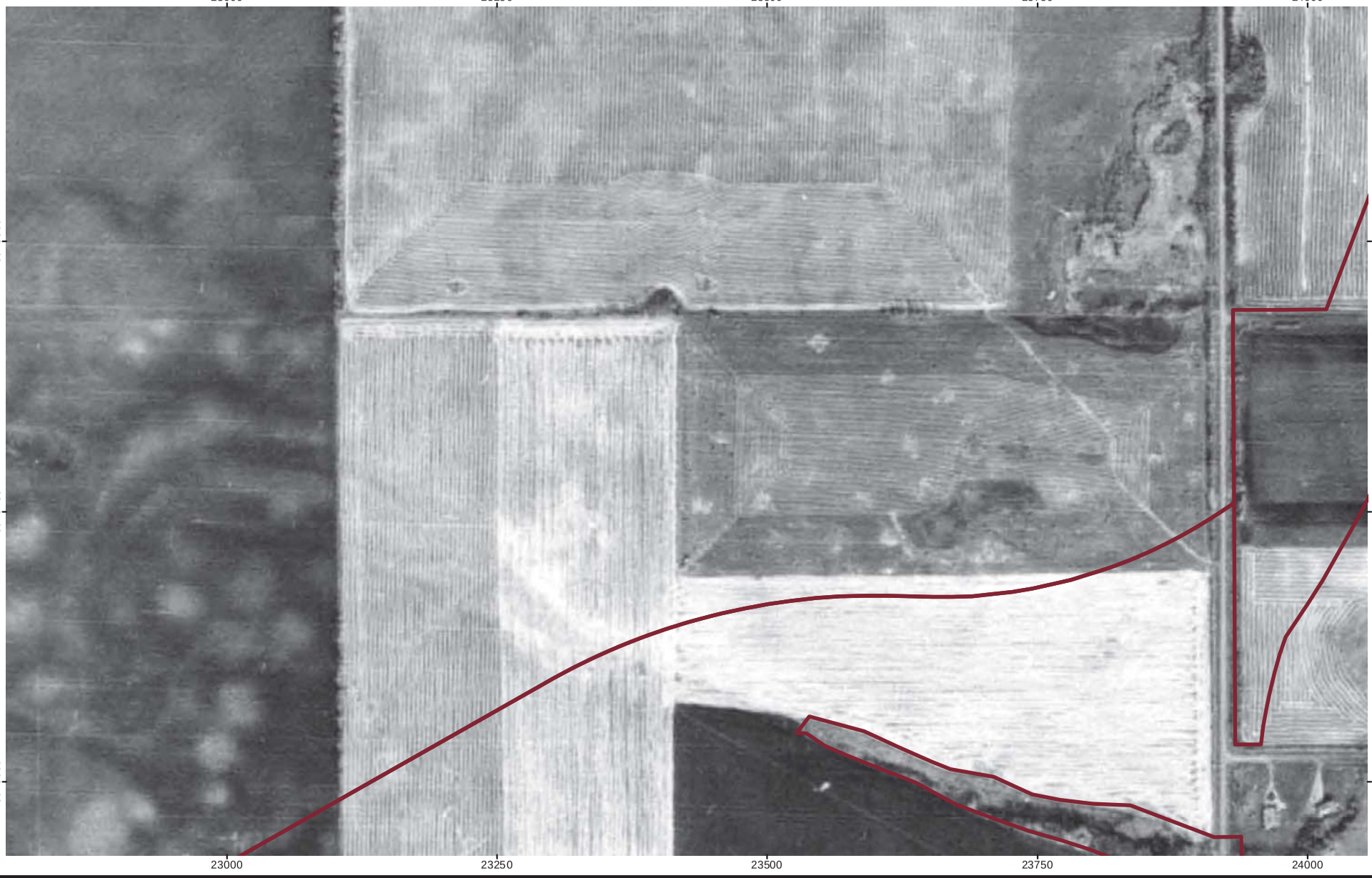

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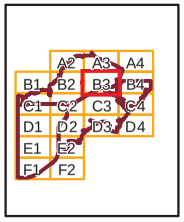

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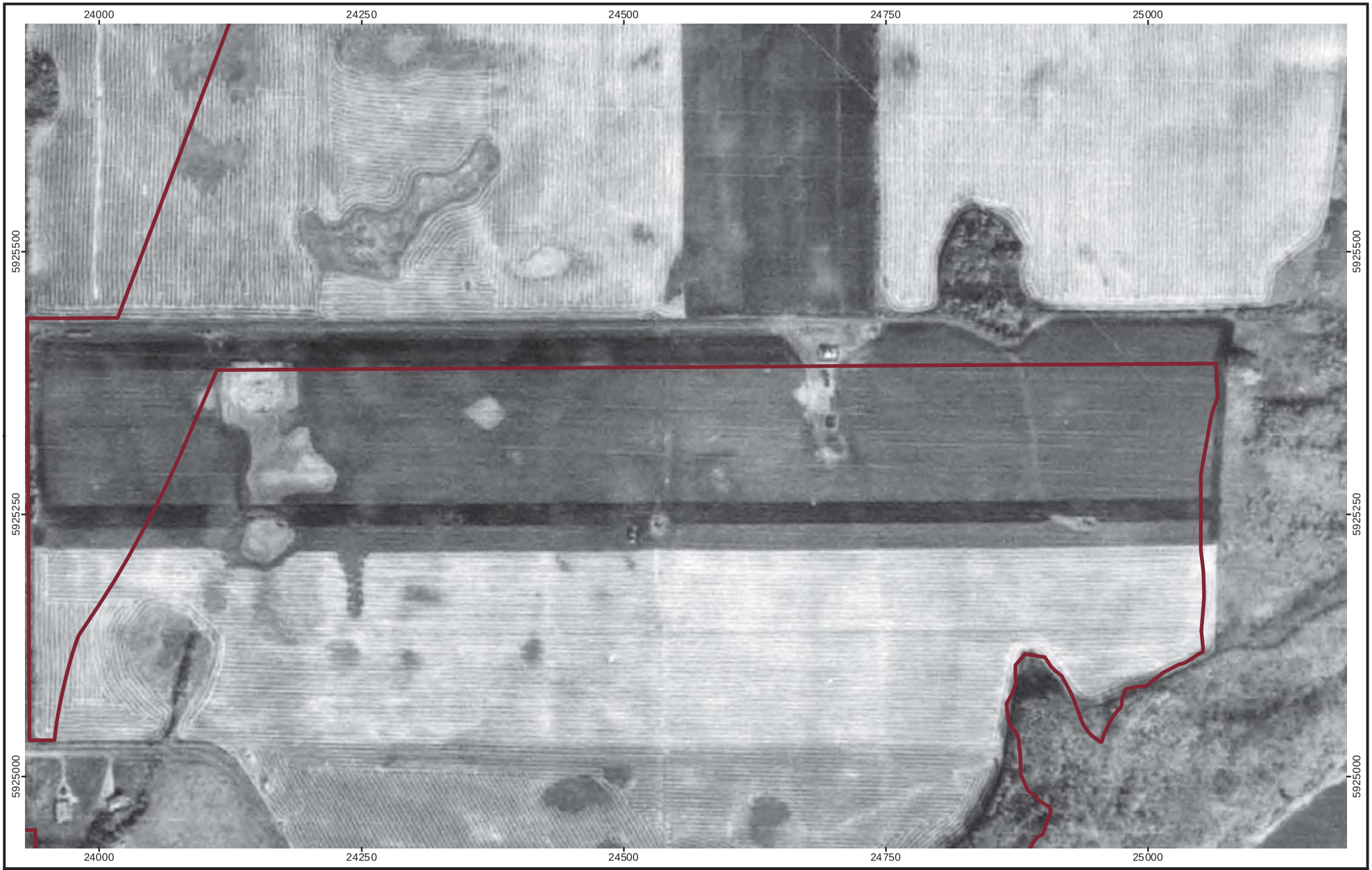

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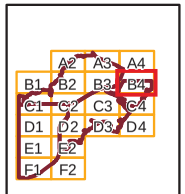

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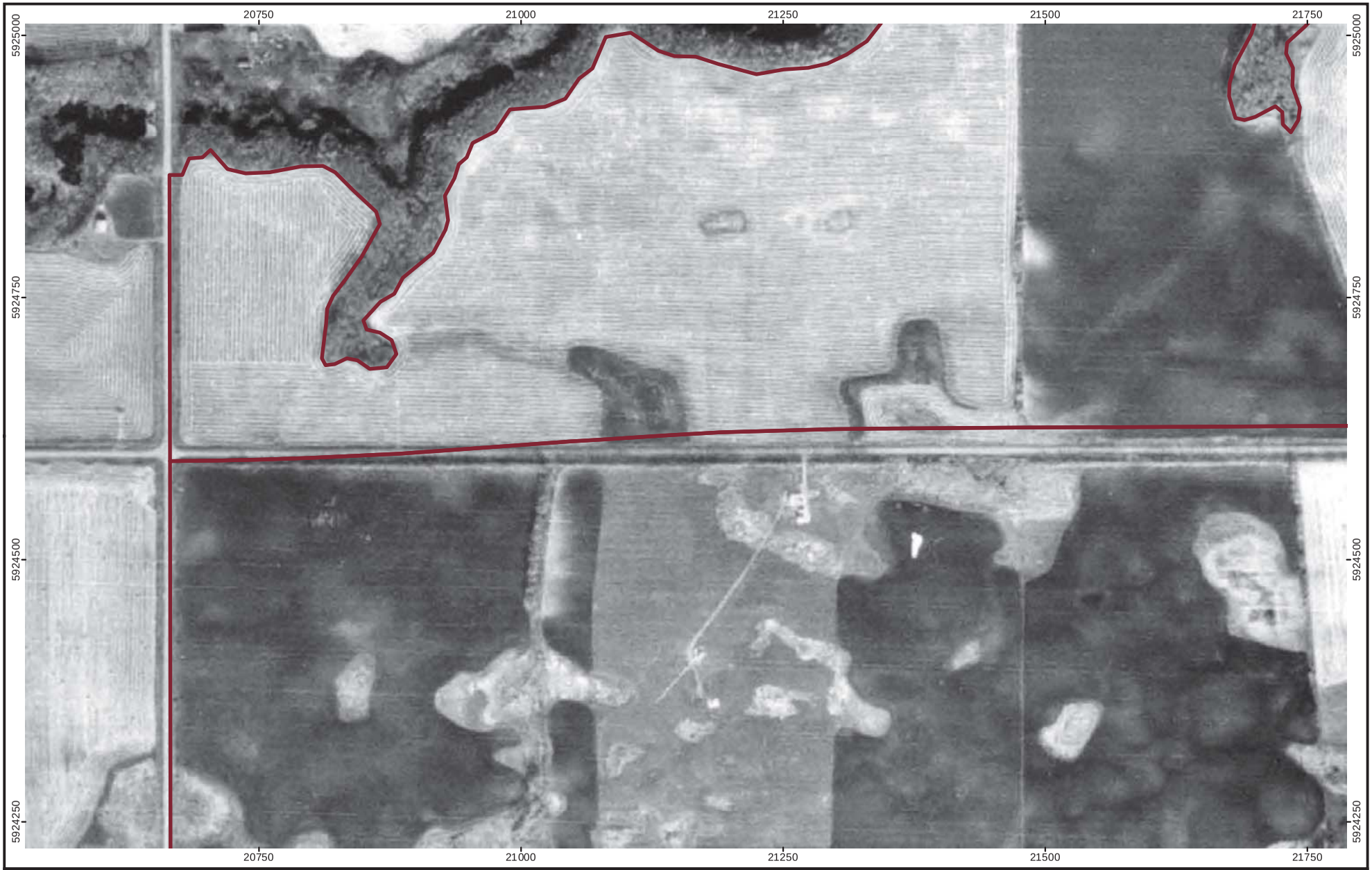

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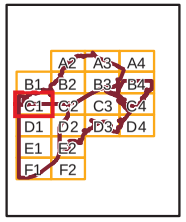

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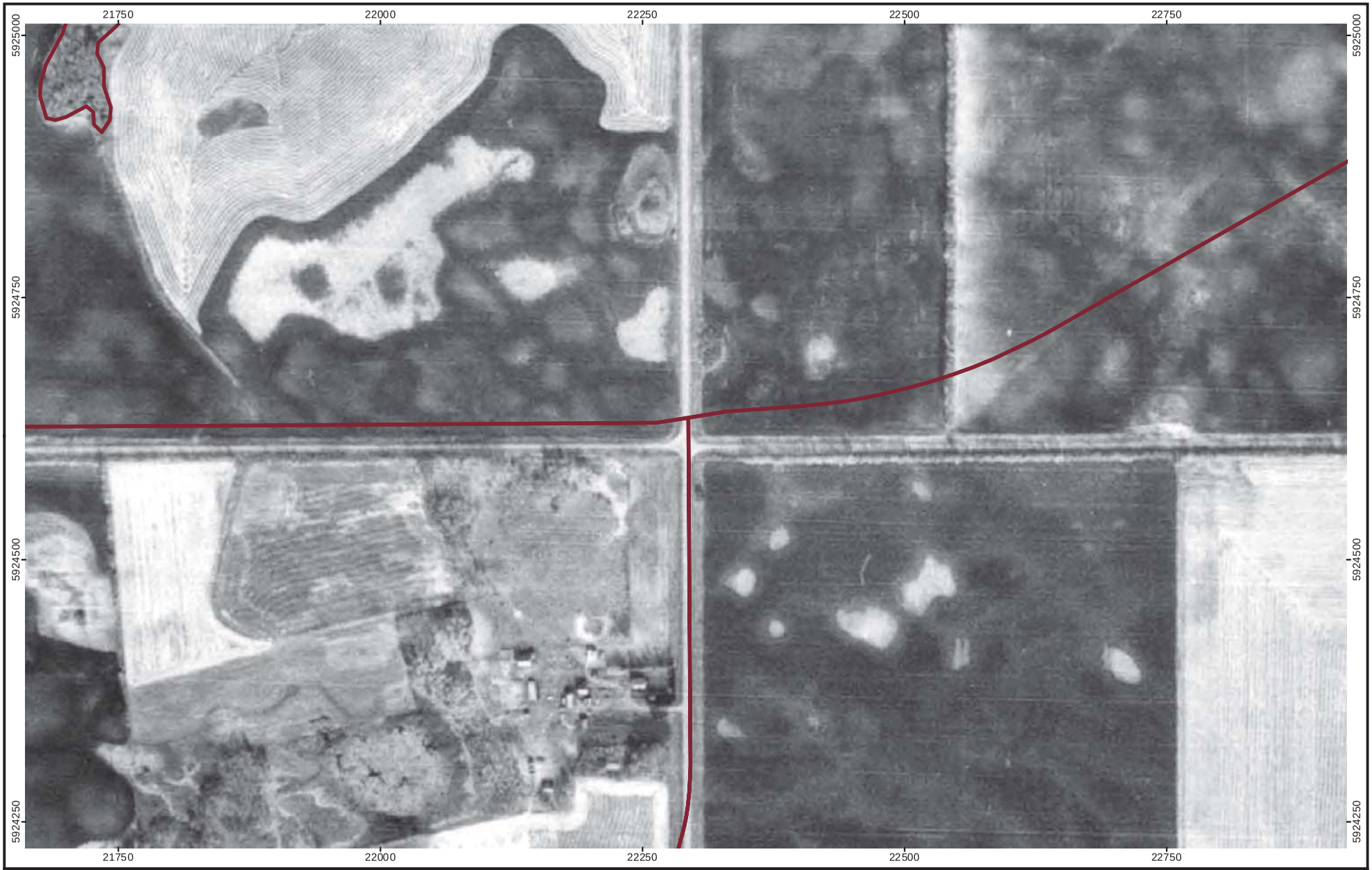

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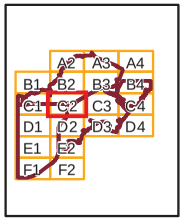

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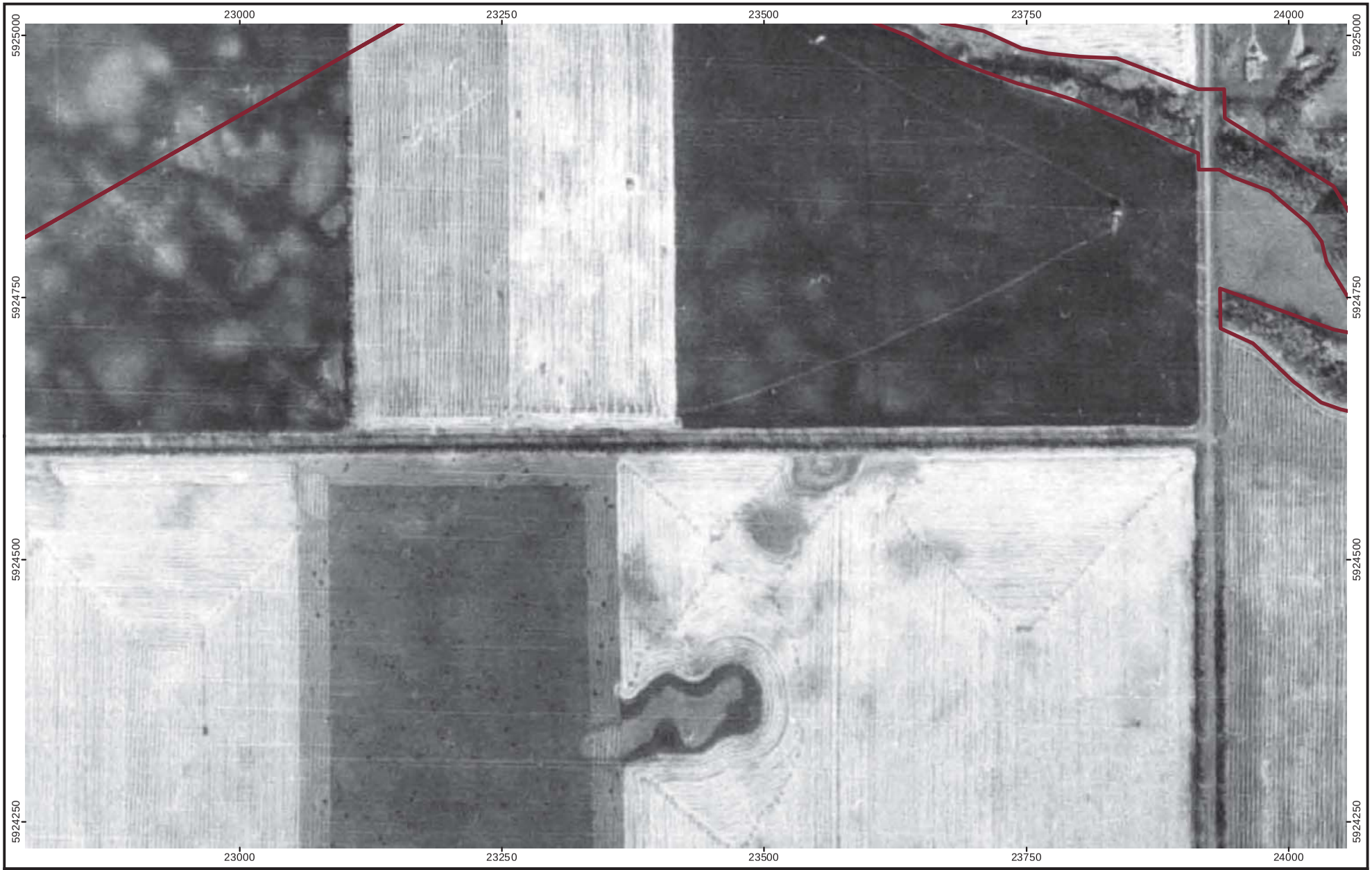

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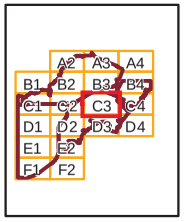
Riverview Owners Group - Phase II ENR Riverview

Historical Aerial Review 1972



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Meters

Projection: 3TM CM:114° Datum: NAD 83

Acknowledgements:
Imagery obtained from Alberta Sustainable Resource Development, AS 1207-3, June 1972.

PREPARED BY			PREPARED FOR	
Stantec			Riverview Owners Group	
DRAFT DATE: December 12, 2012			SCALE: 1:5,000	
REVISION DATE: June 12, 2014			PROJECT: 110218864	FIGURE NO.: 1972
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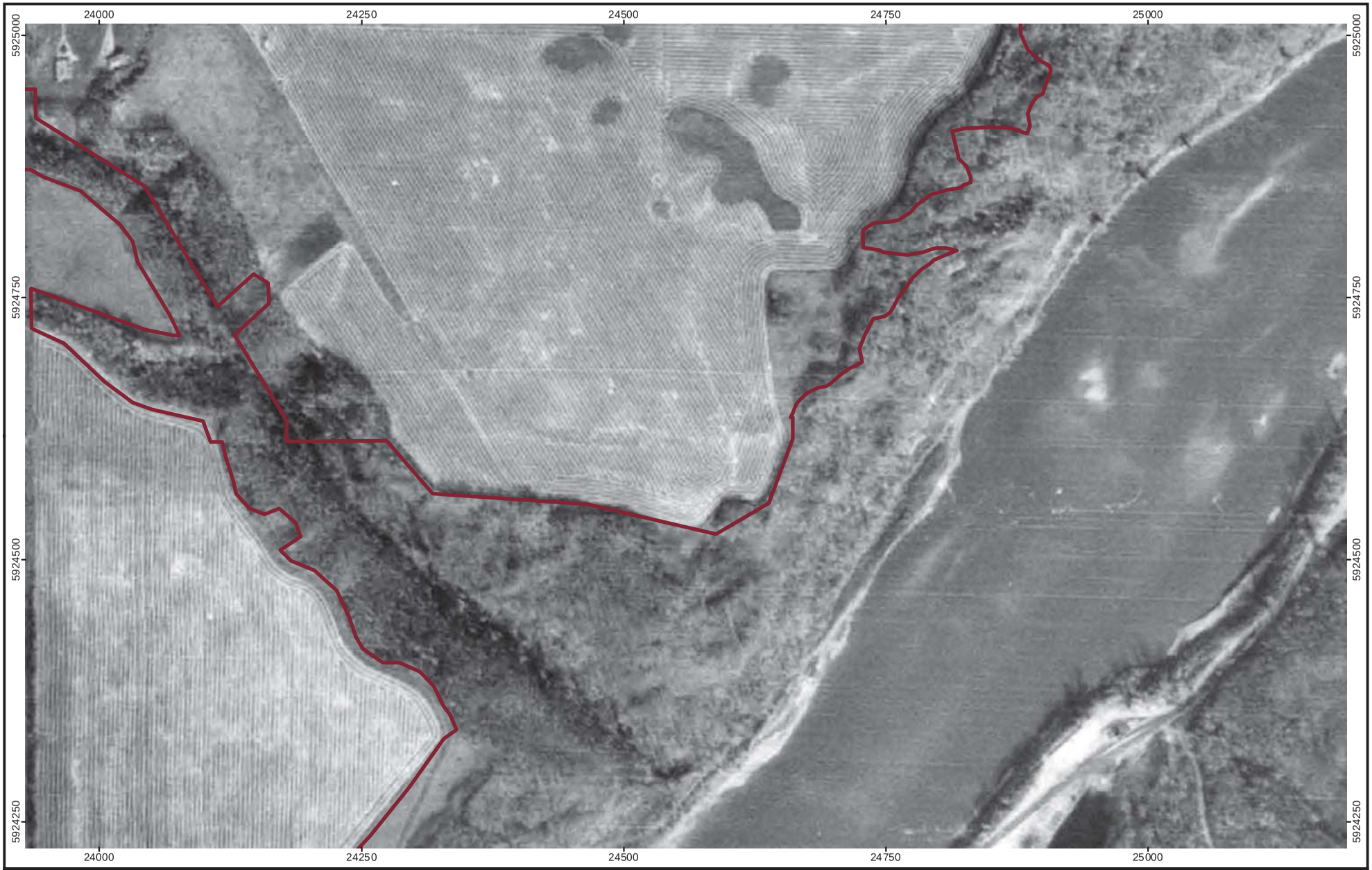
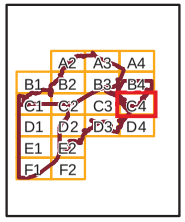


Study Area

Riverview Owners Group - Phase II ENR Riverview

Historical Aerial Review 1972



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June 12, 2014	110218864

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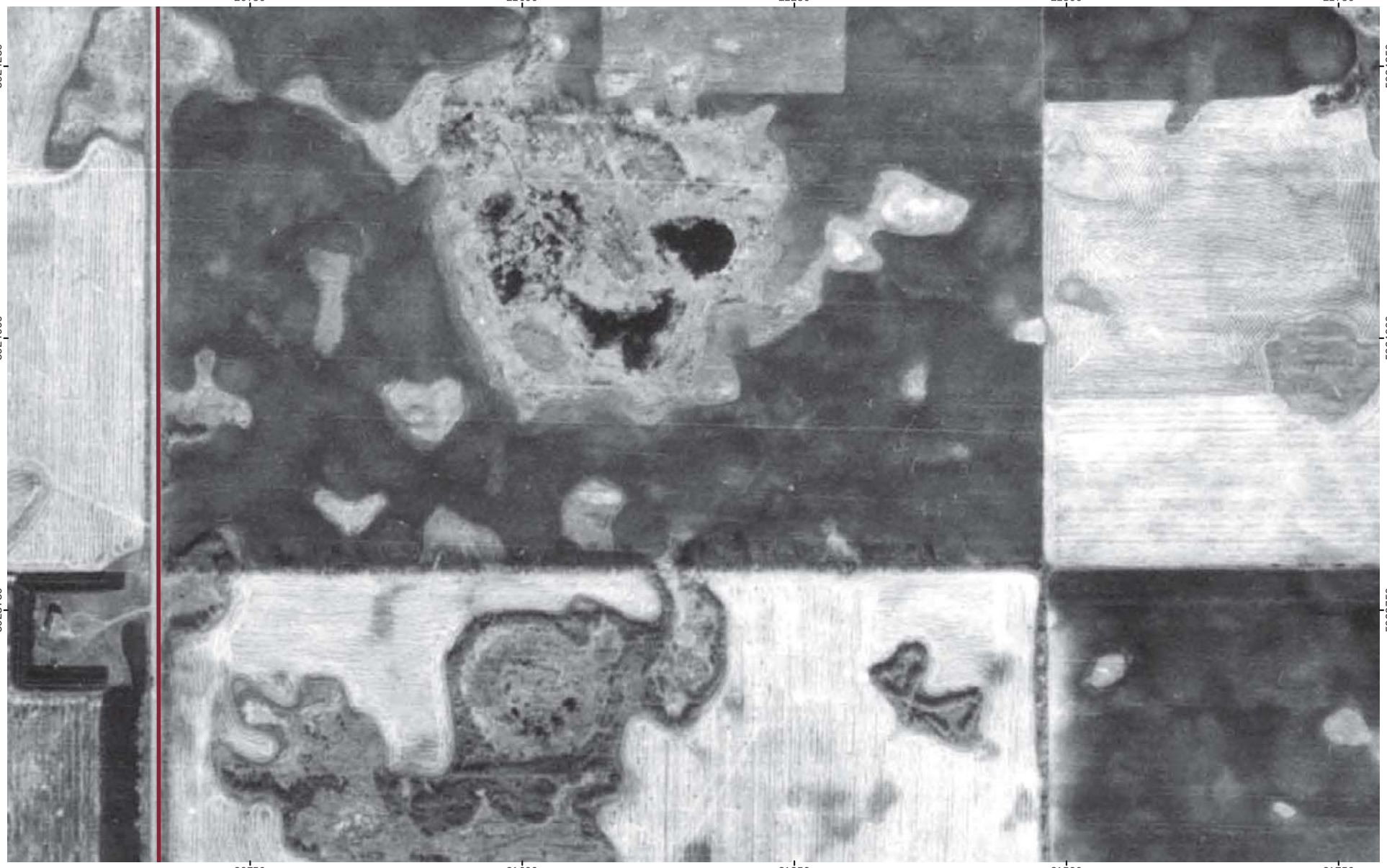

Study Area

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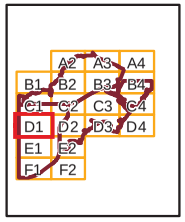
Historical Aerial Review 1972



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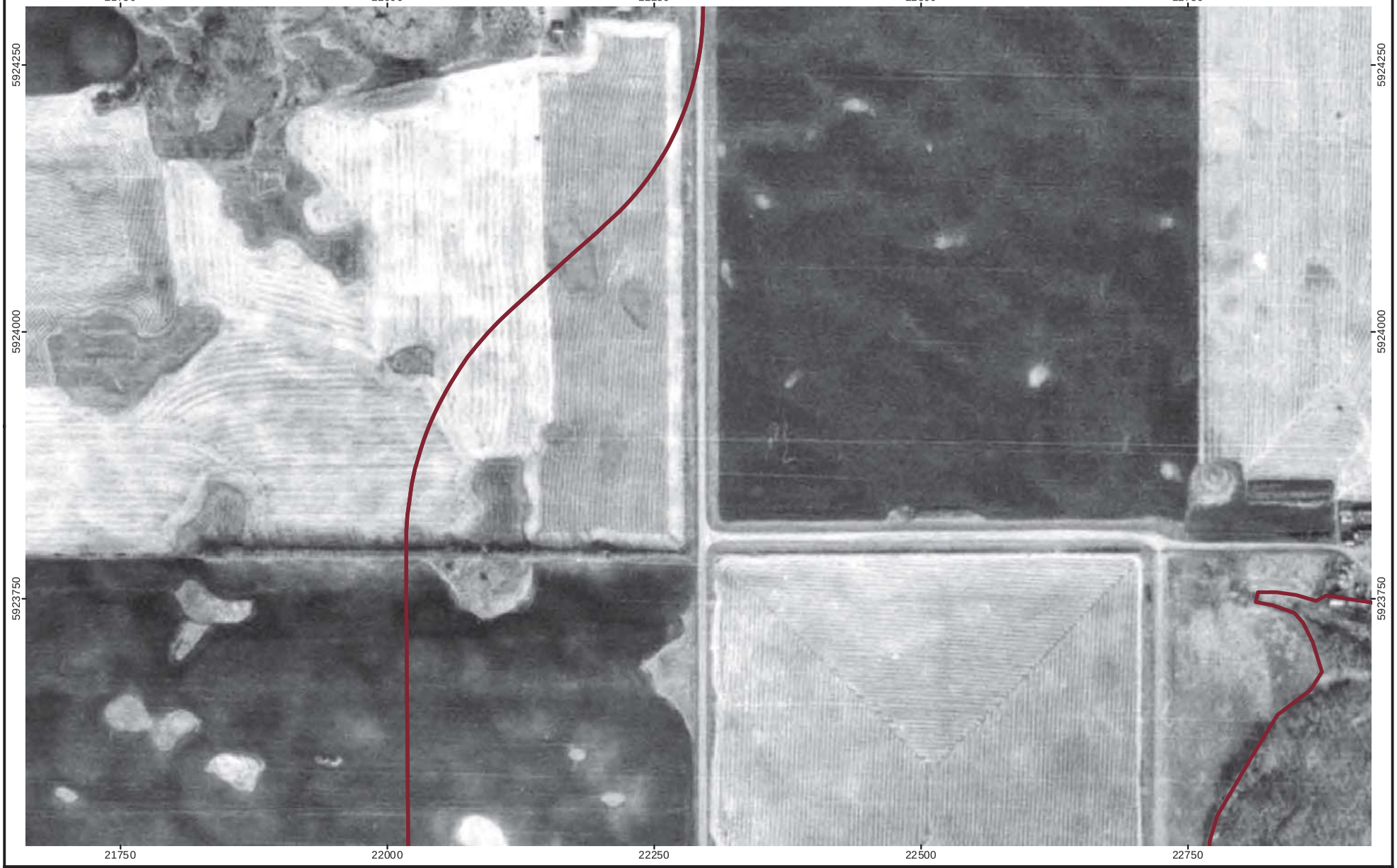

Study Area

Riverview Owners Group - Phase II ENR Riverview

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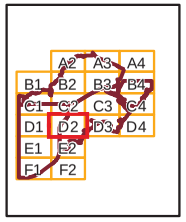

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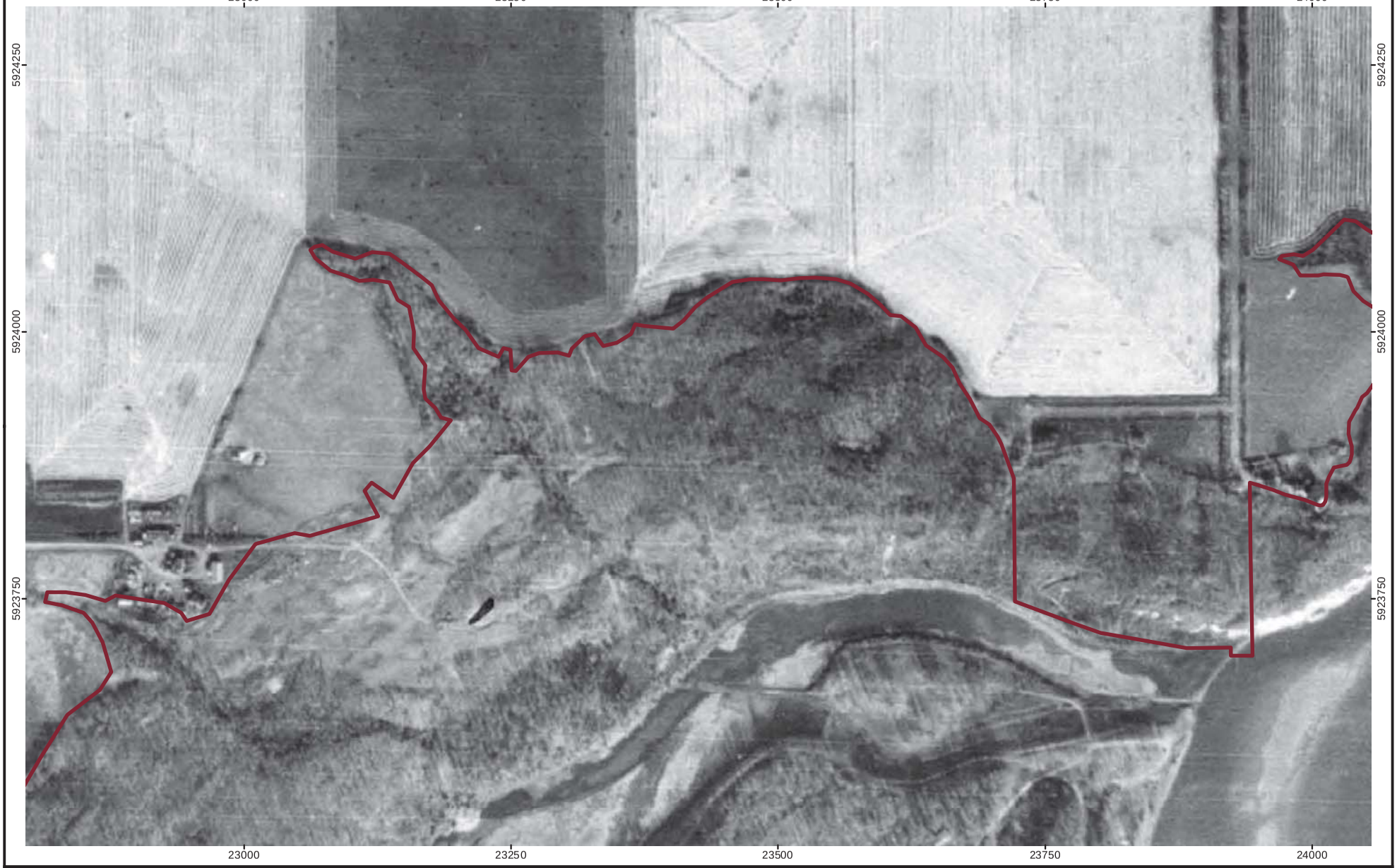

Study Area

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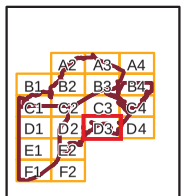
Historical Aerial Review 1972



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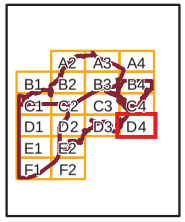
Study Area

Riverview Owners Group - Phase II ENR Riverview

Historical Aerial Review 1972



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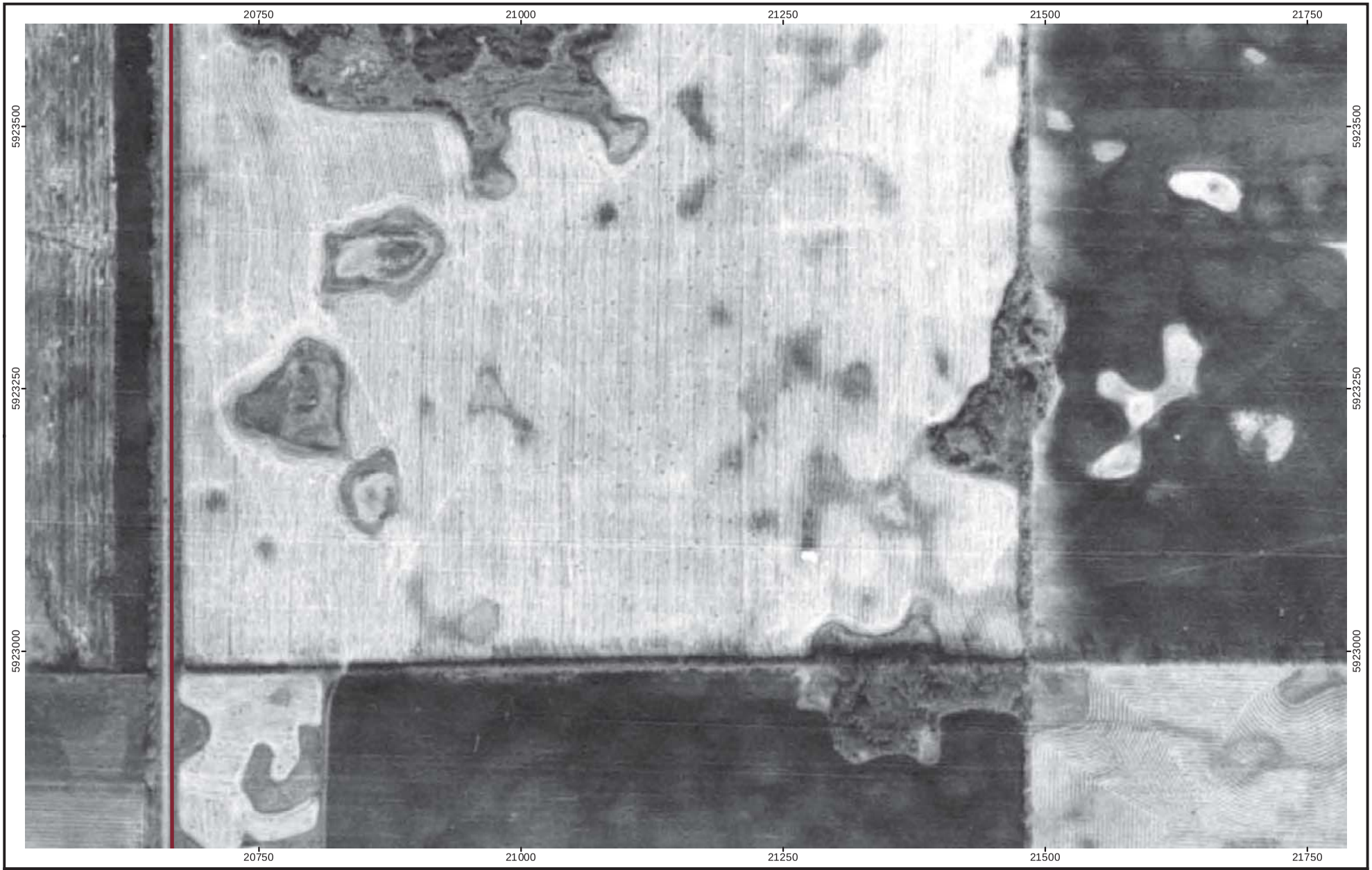

Study Area

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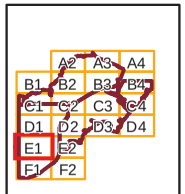
Historical Aerial Review 1972



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June 12, 2014				110218864	1972
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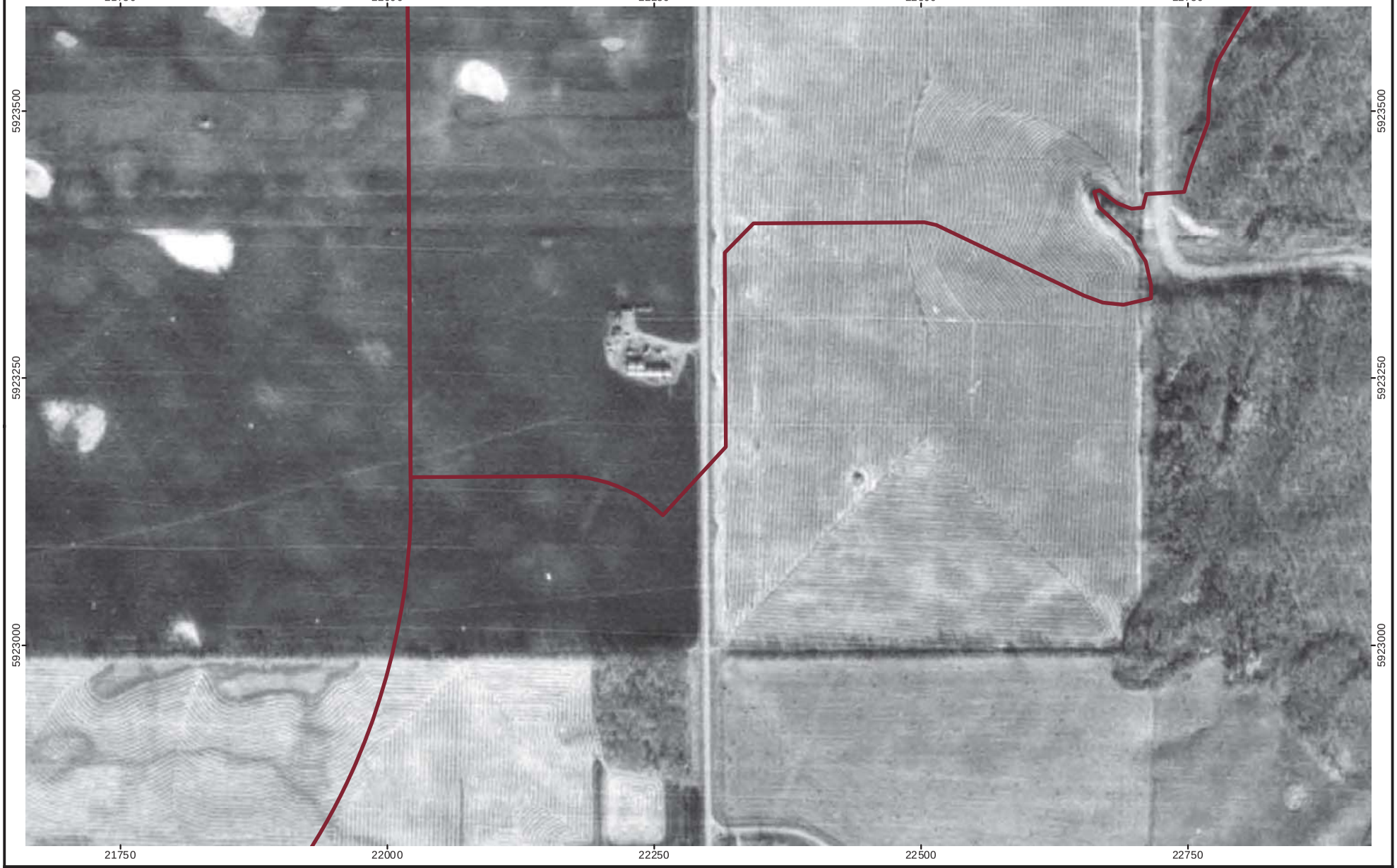

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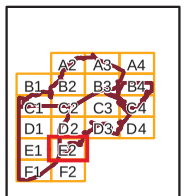
Historical Aerial Review 1972



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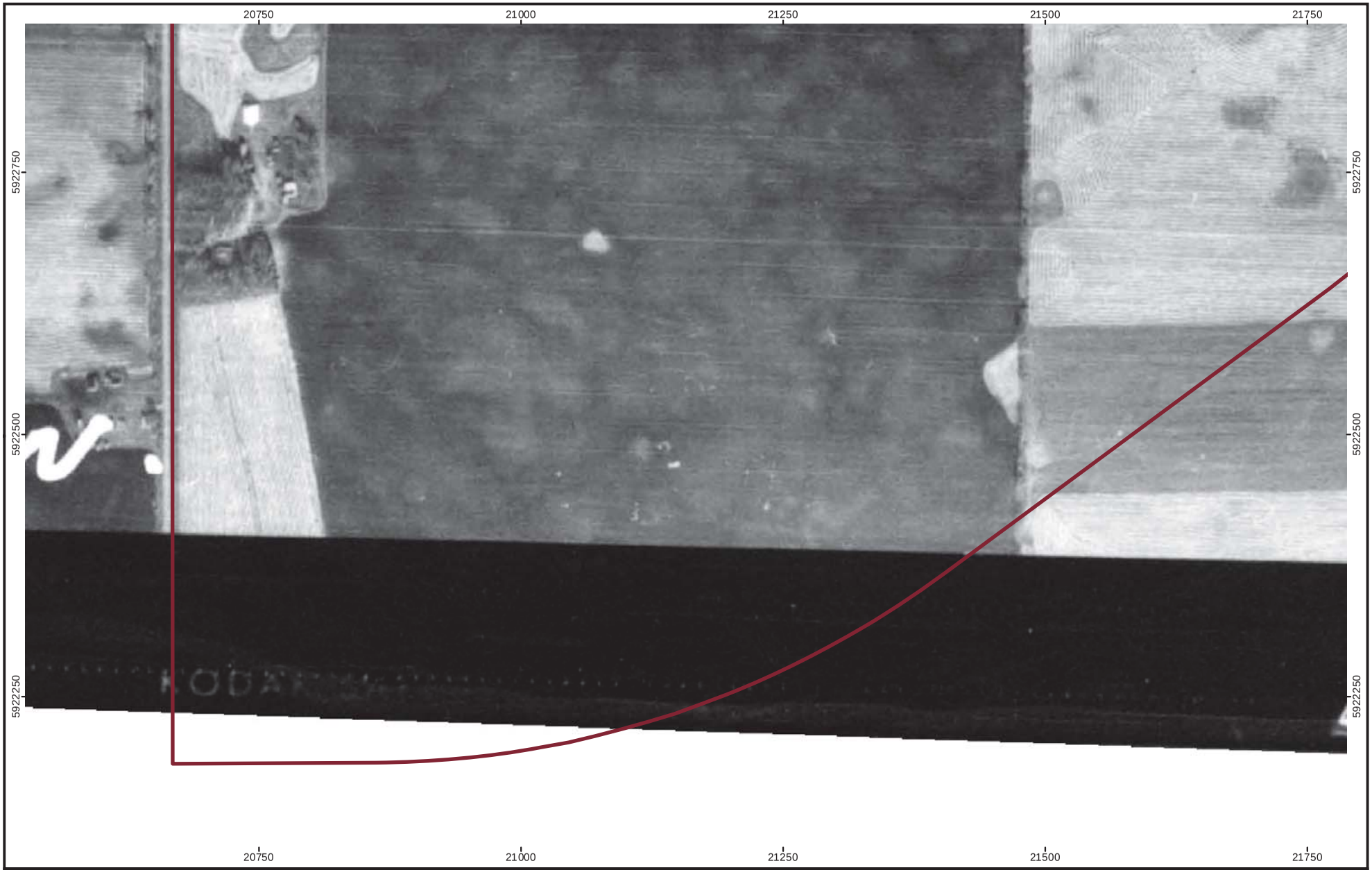

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Riverview Owners Group - Phase II ENR Riverview

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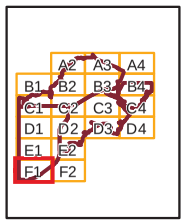

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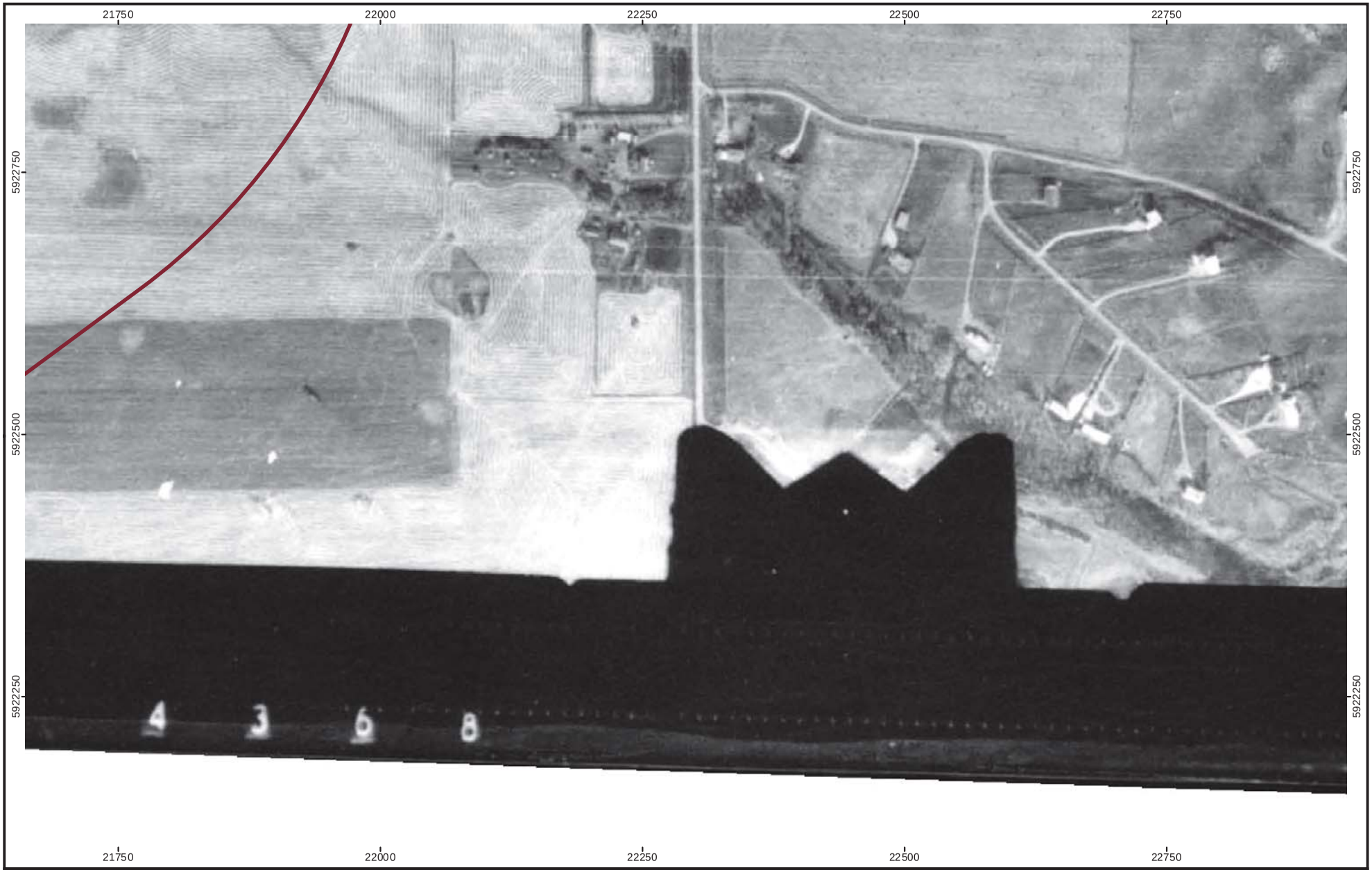
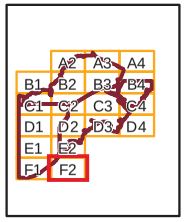


Study Area

Riverview Owners Group - Phase II ENR Riverview

Historical Aerial Review 1972



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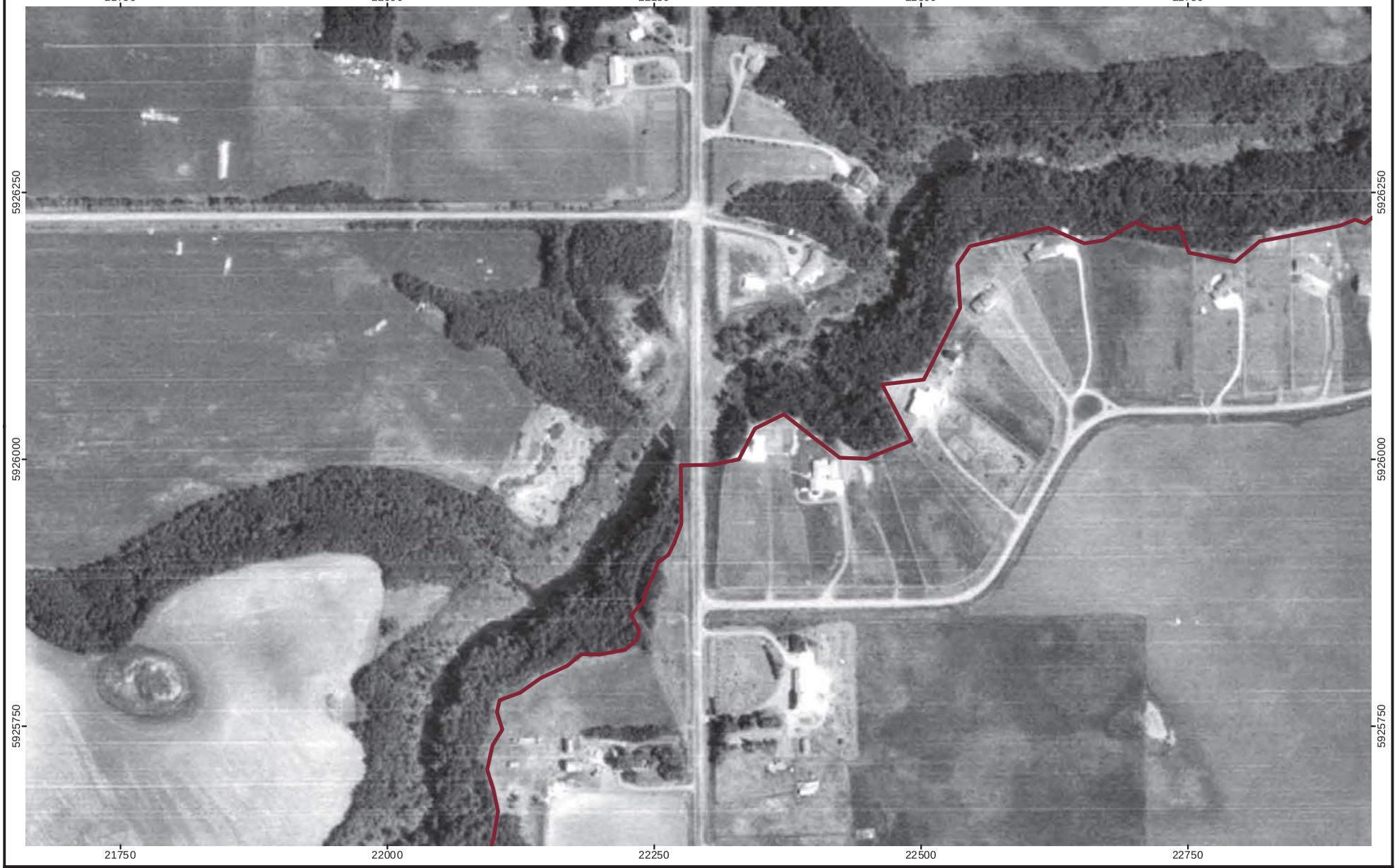
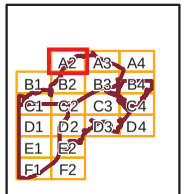


Study Area

Riverview Owners Group - Phase II ENR Riverview

Historical Aerial Review 1977



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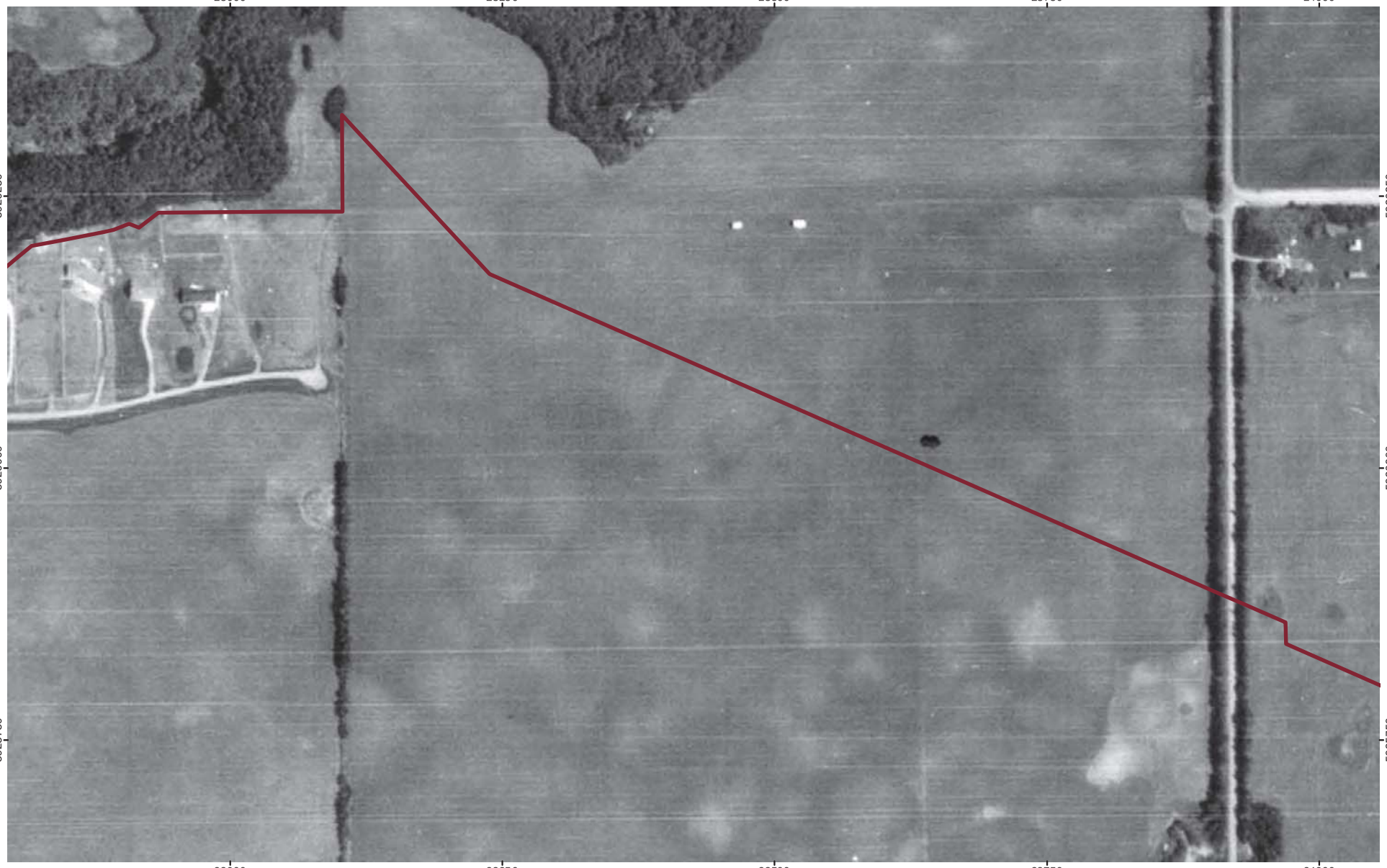
May 23, 2014	110218864

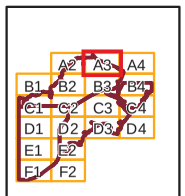
DRAWN	CHECKED	APPROVED	VOL	FIGURE NO.
JC	LF			1977



Study Area

Riverview Owners Group - Phase II ENR Riverview

Historical Aerial Review 1977



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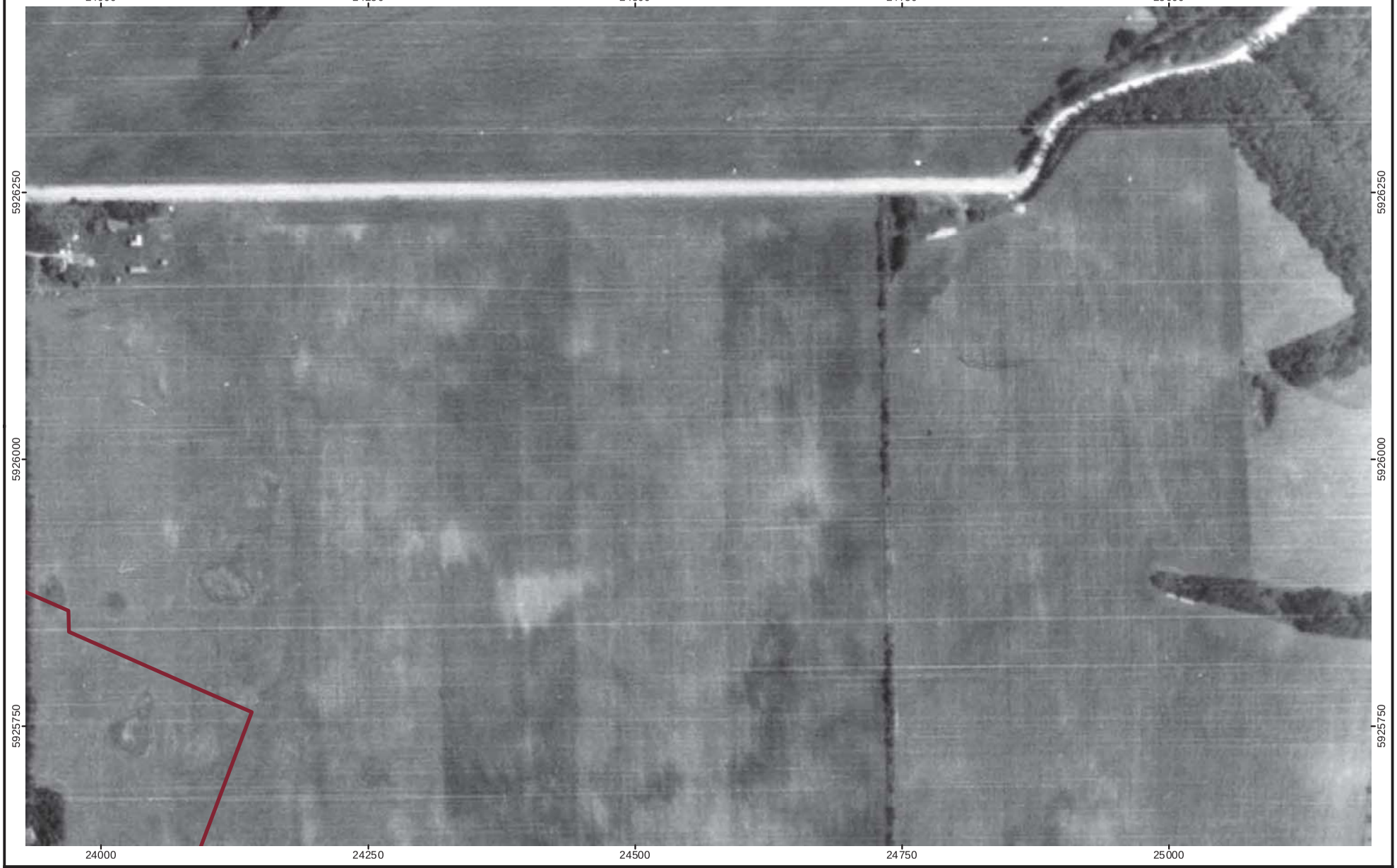

Study Area

Riverview Owners Group - Phase II ENR Riverview

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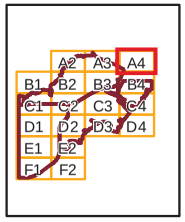

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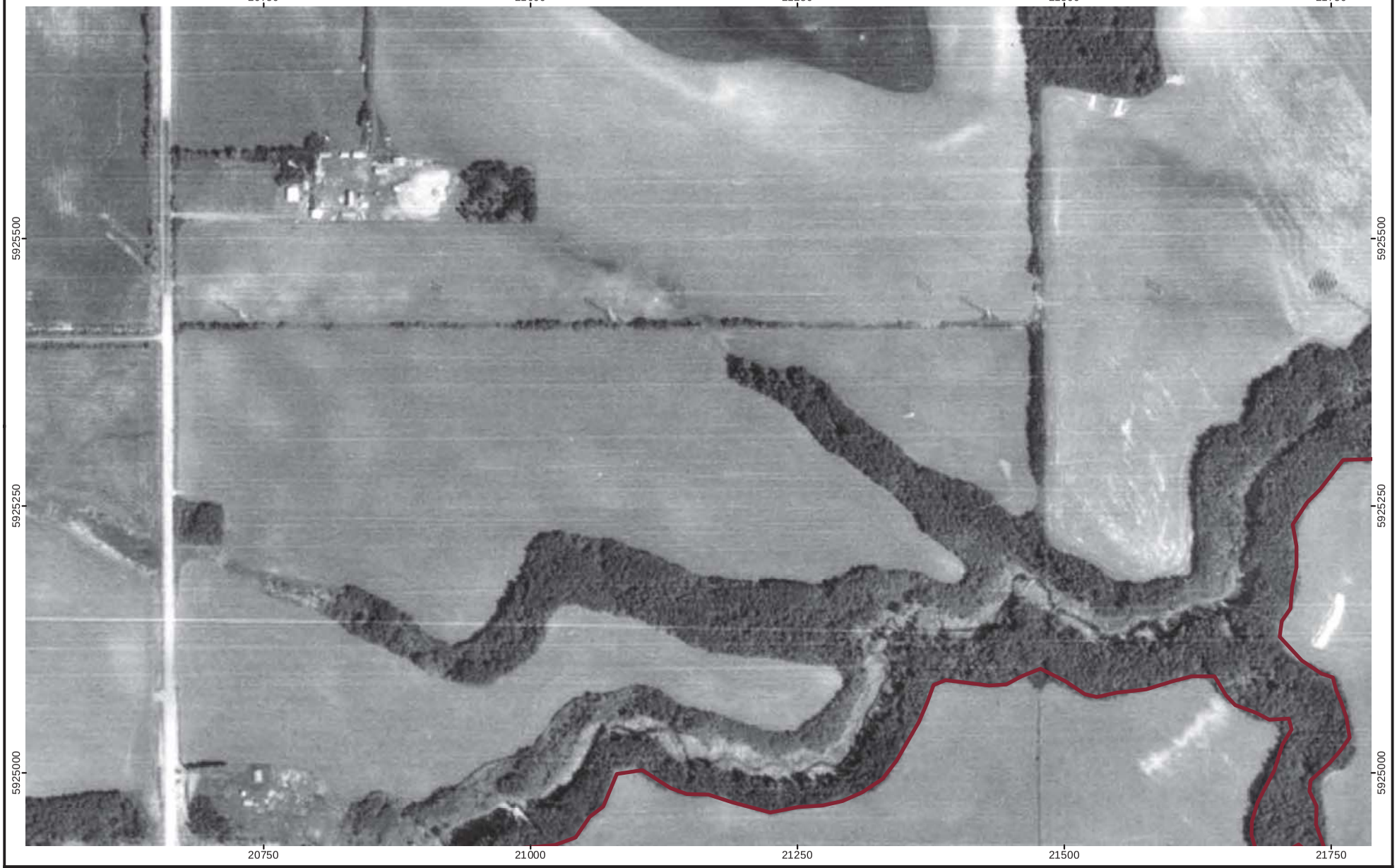

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Riverview Owners Group - Phase II ENR Riverview

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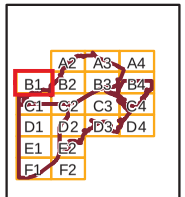

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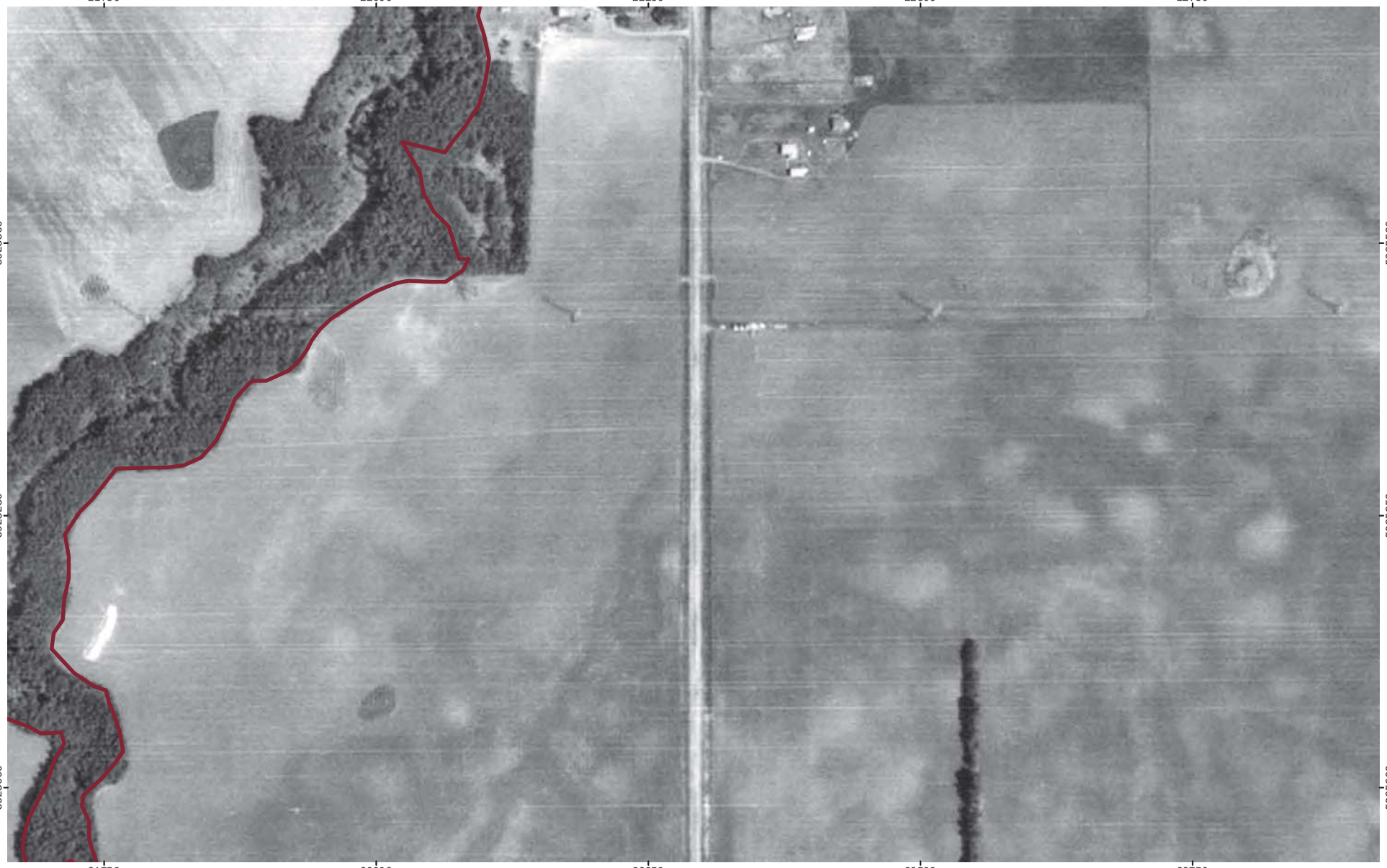

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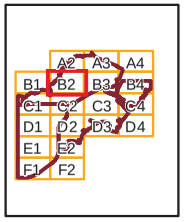

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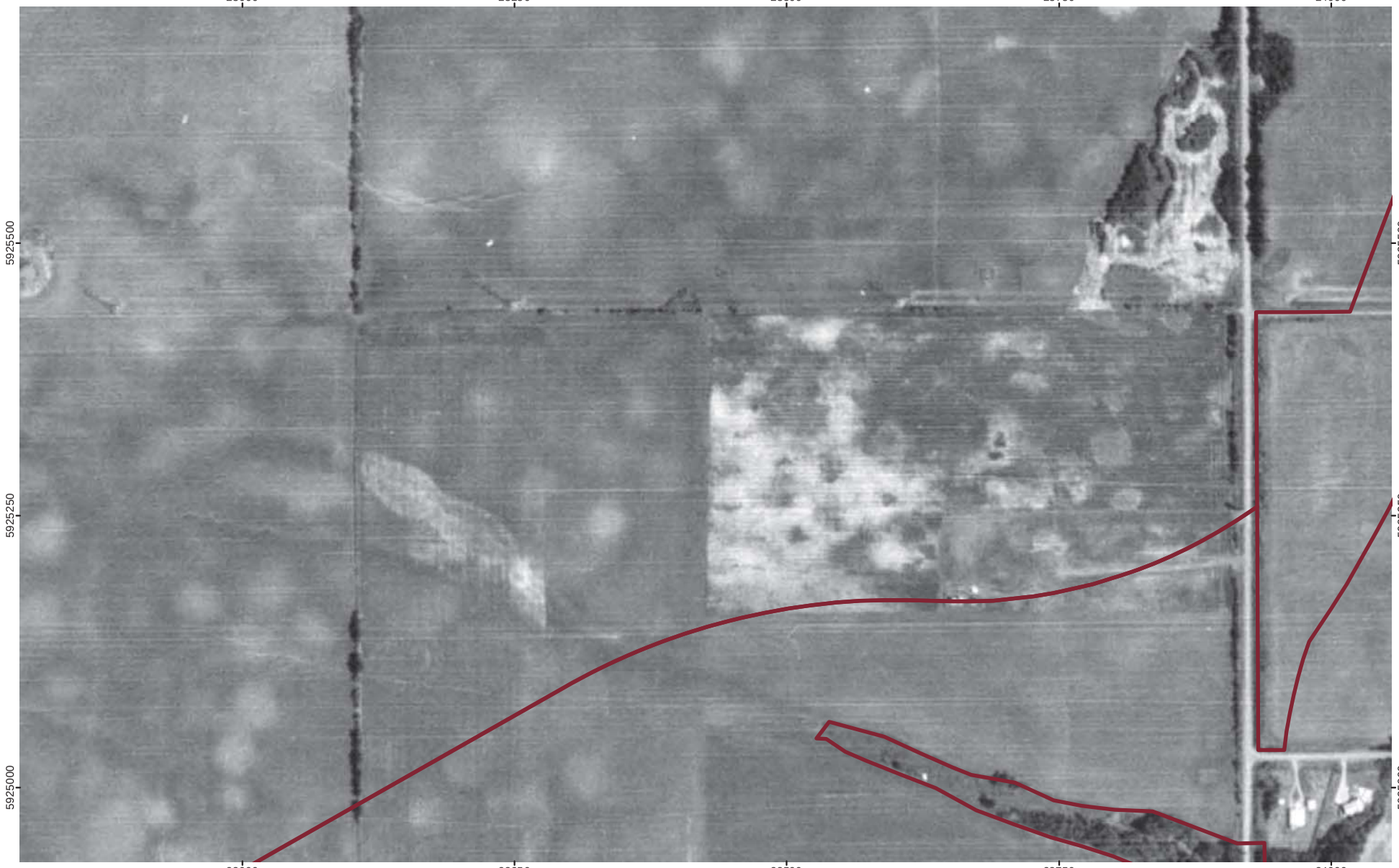

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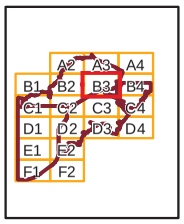

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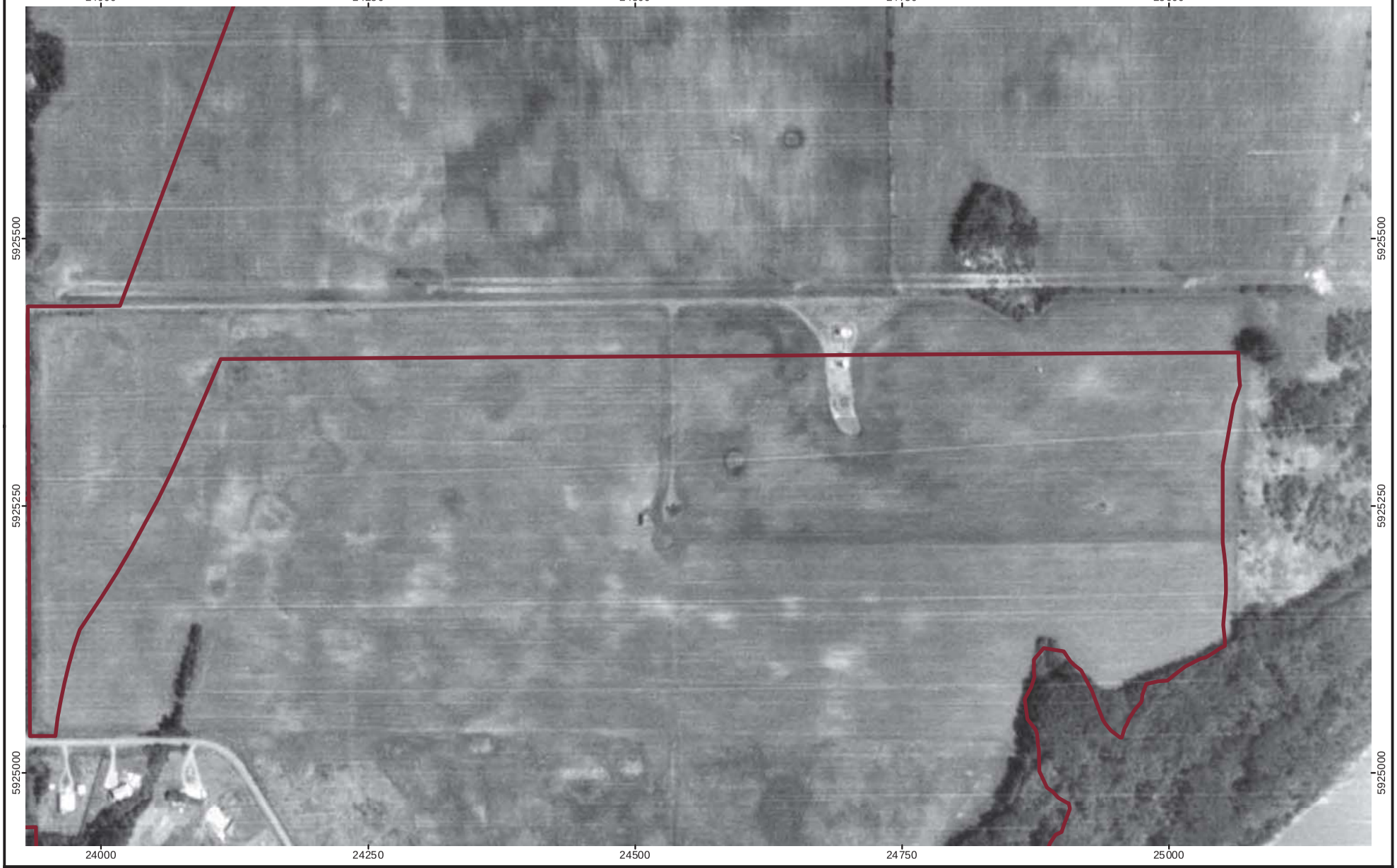

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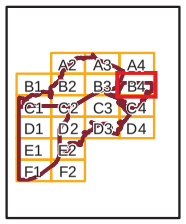

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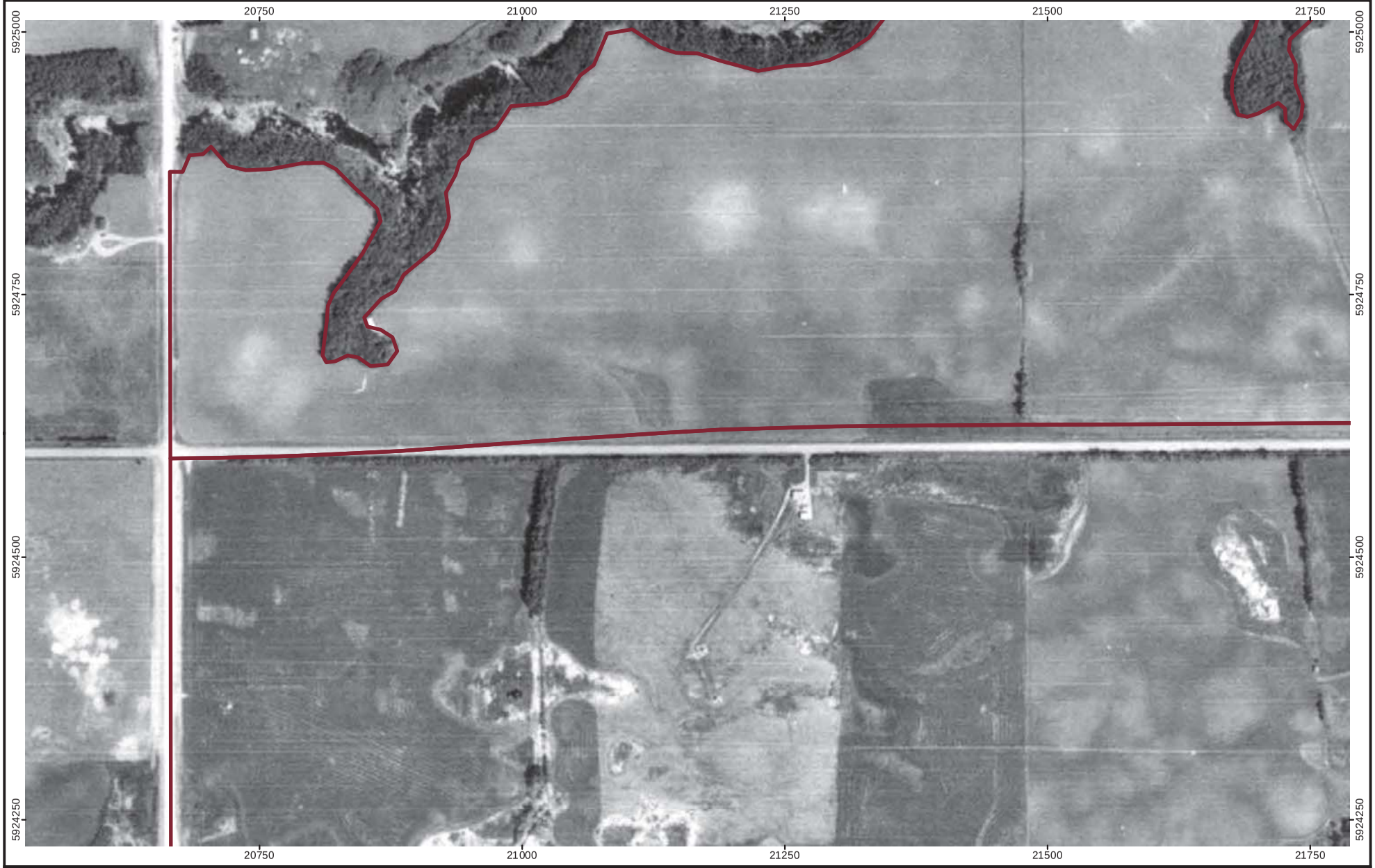

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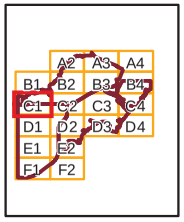

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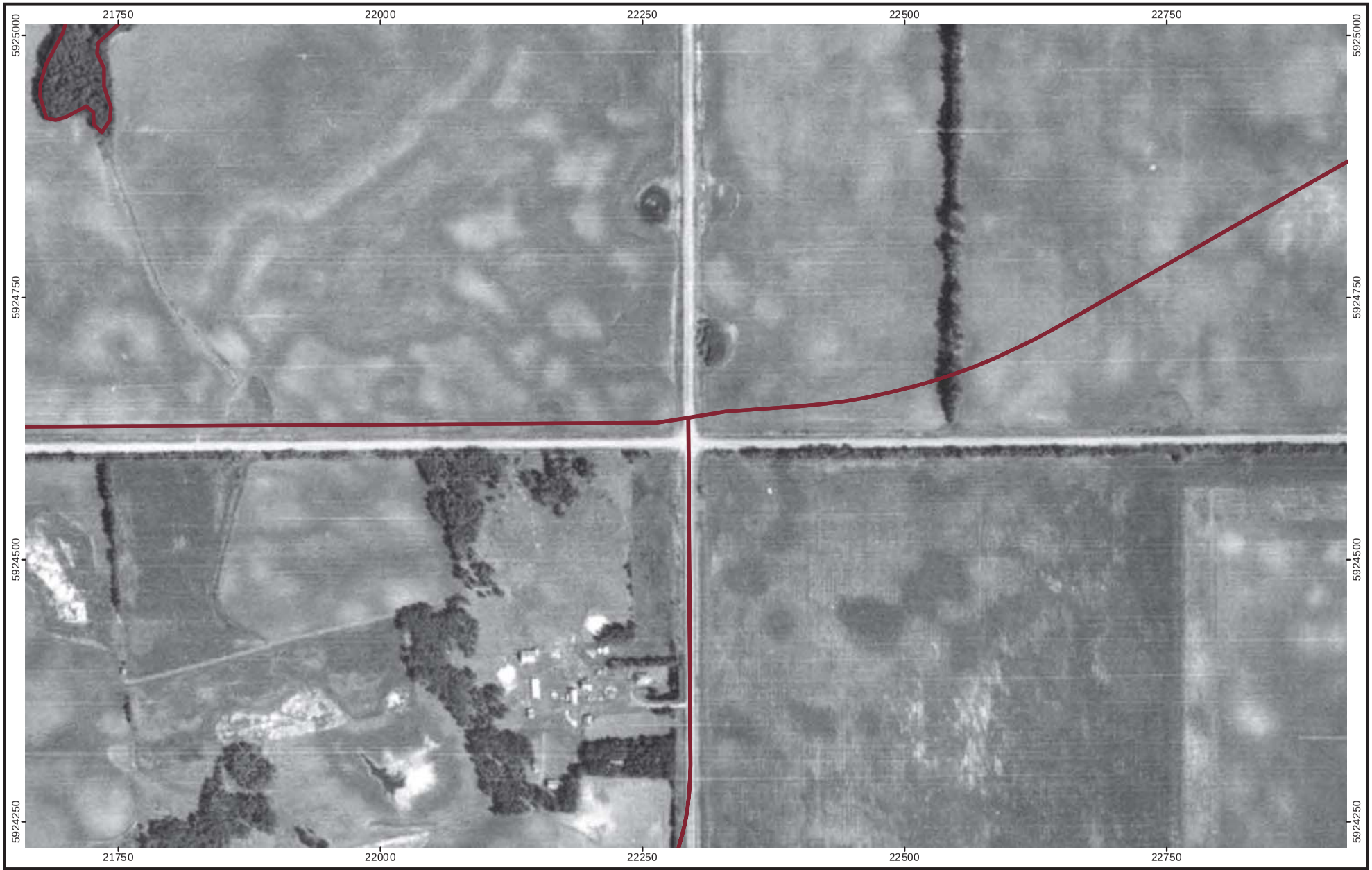

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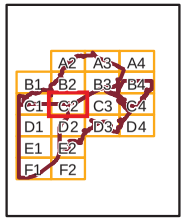
Riverview Owners Group - Phase II ENR Riverview

Historical Aerial Review 1977



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Meters

Projection: 3TM CM:114° Datum: NAD 83

Acknowledgements:
Imagery obtained from Alberta Sustainable Resource Development, AS1592-37, June 1977.

PREPARED BY	PREPARED FOR
Stantec	Riverview Owners Group

DRAFT DATE	SCALE
December 12, 2012	1:5,000

REVISION DATE	PROJECT	FIGURE NO.
May 23, 2014	110218864	1977

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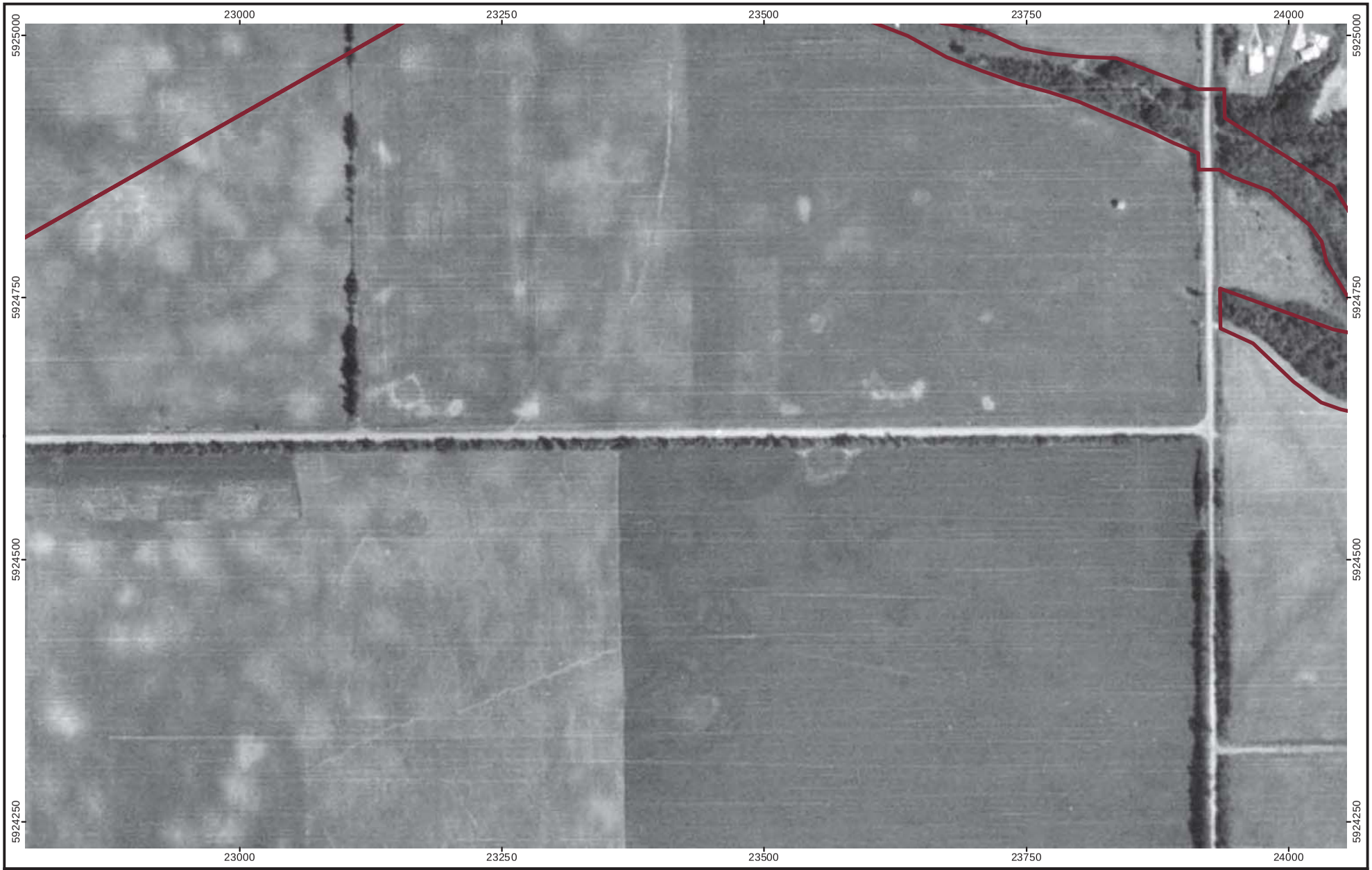
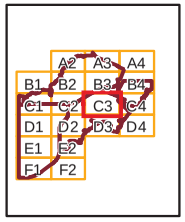


Study Area

Riverview Owners Group - Phase II ENR Riverview

Historical Aerial Review
1977



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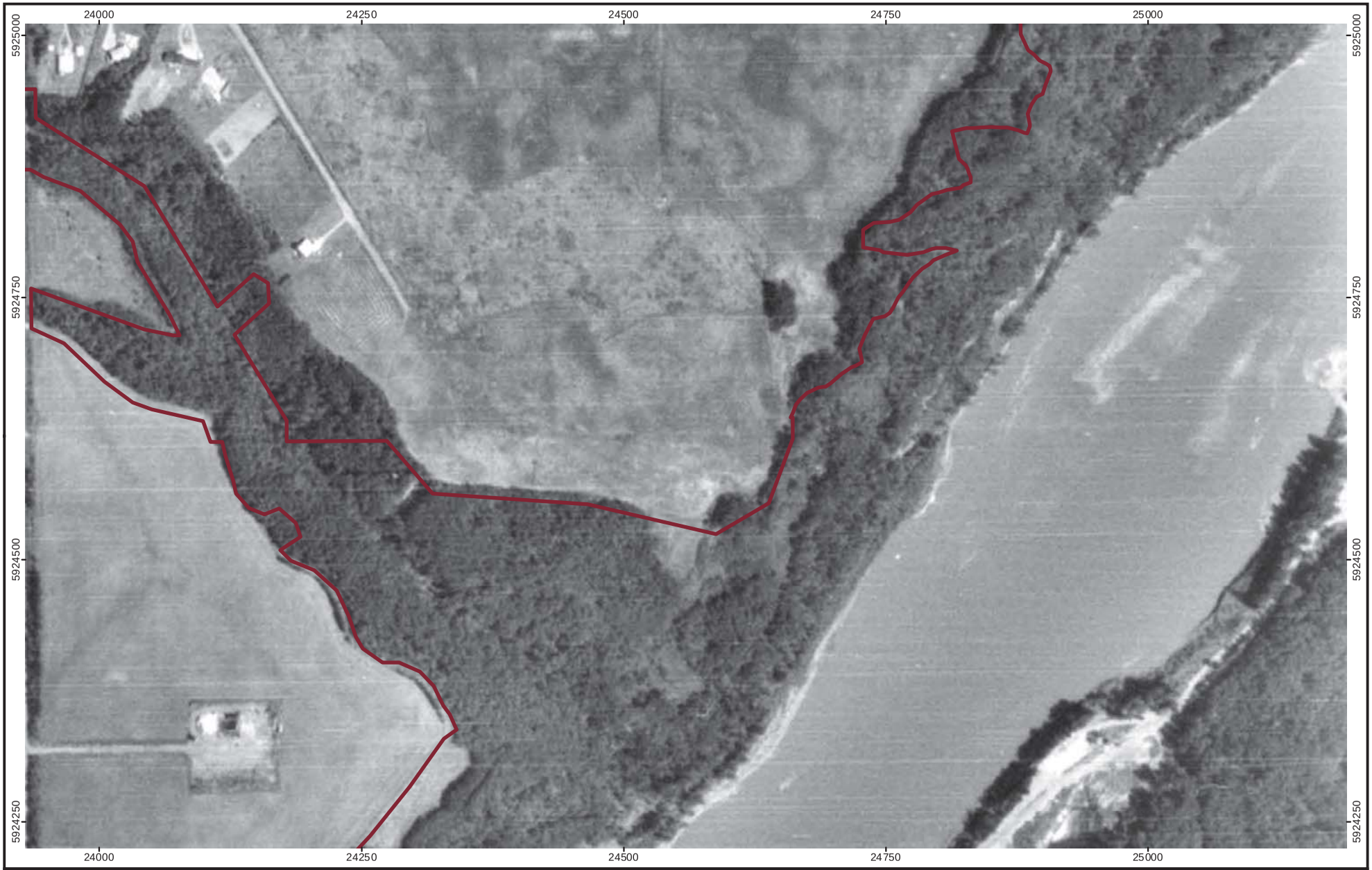

Study Area

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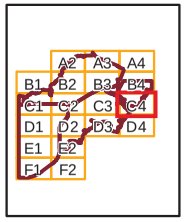

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Study Area

Riverview Owners Group - Phase II ENR Riverview

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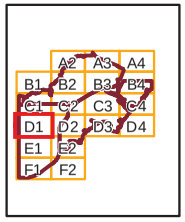

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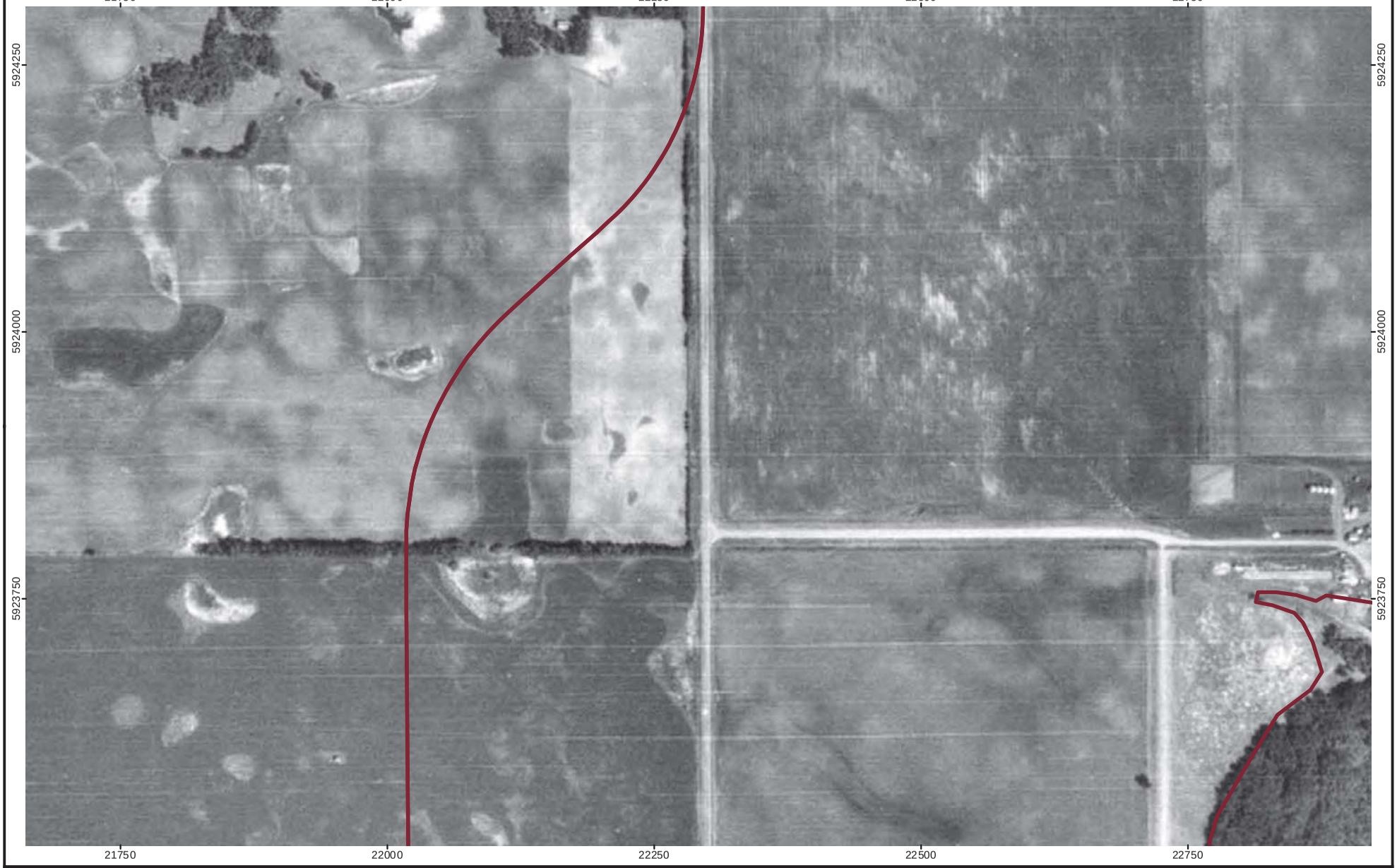

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Riverview Owners Group - Phase II ENR Riverview

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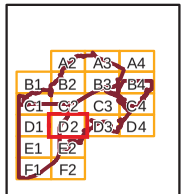

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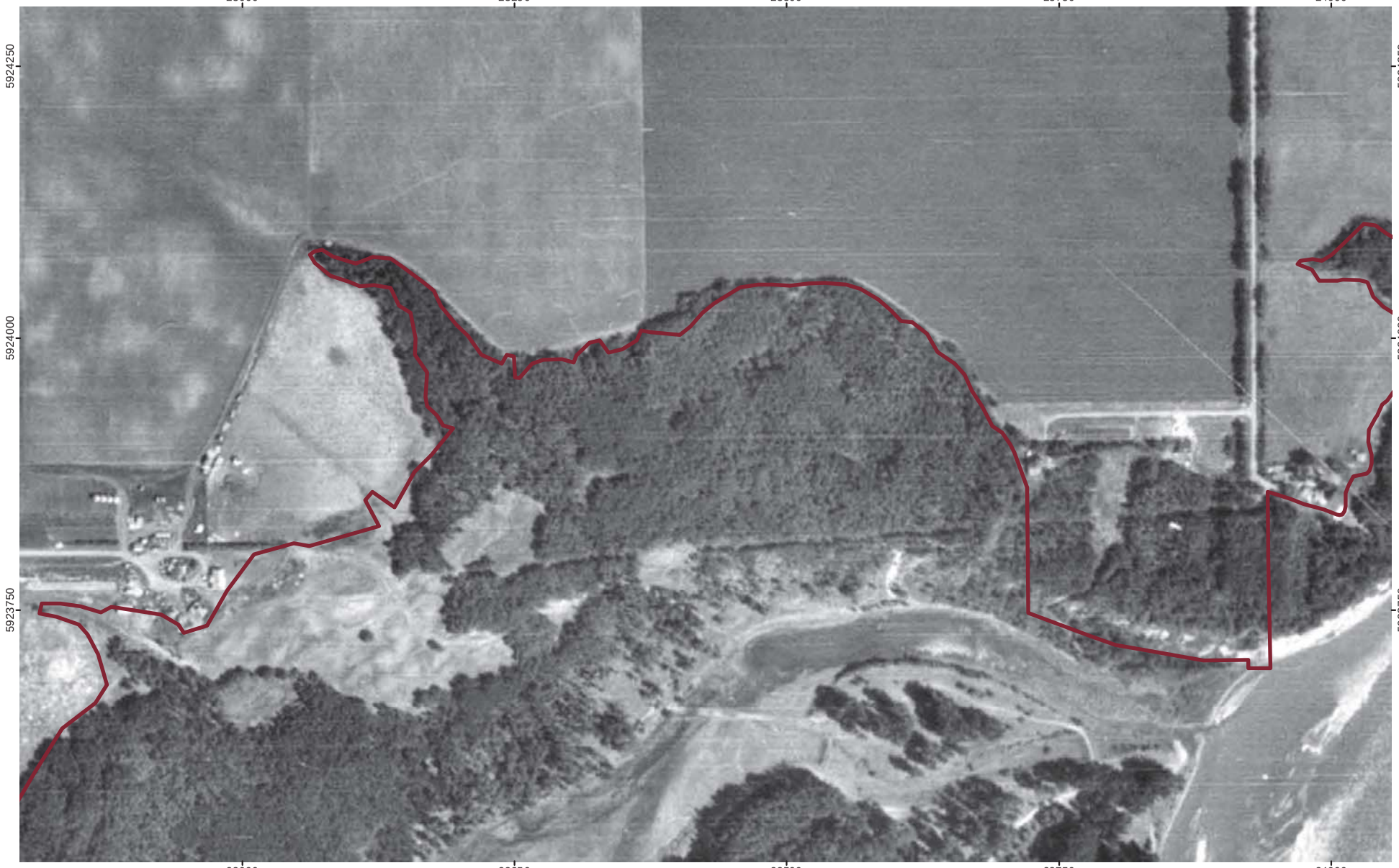

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Riverview Owners Group - Phase II ENR Riverview

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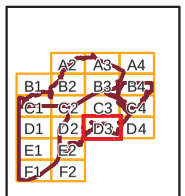

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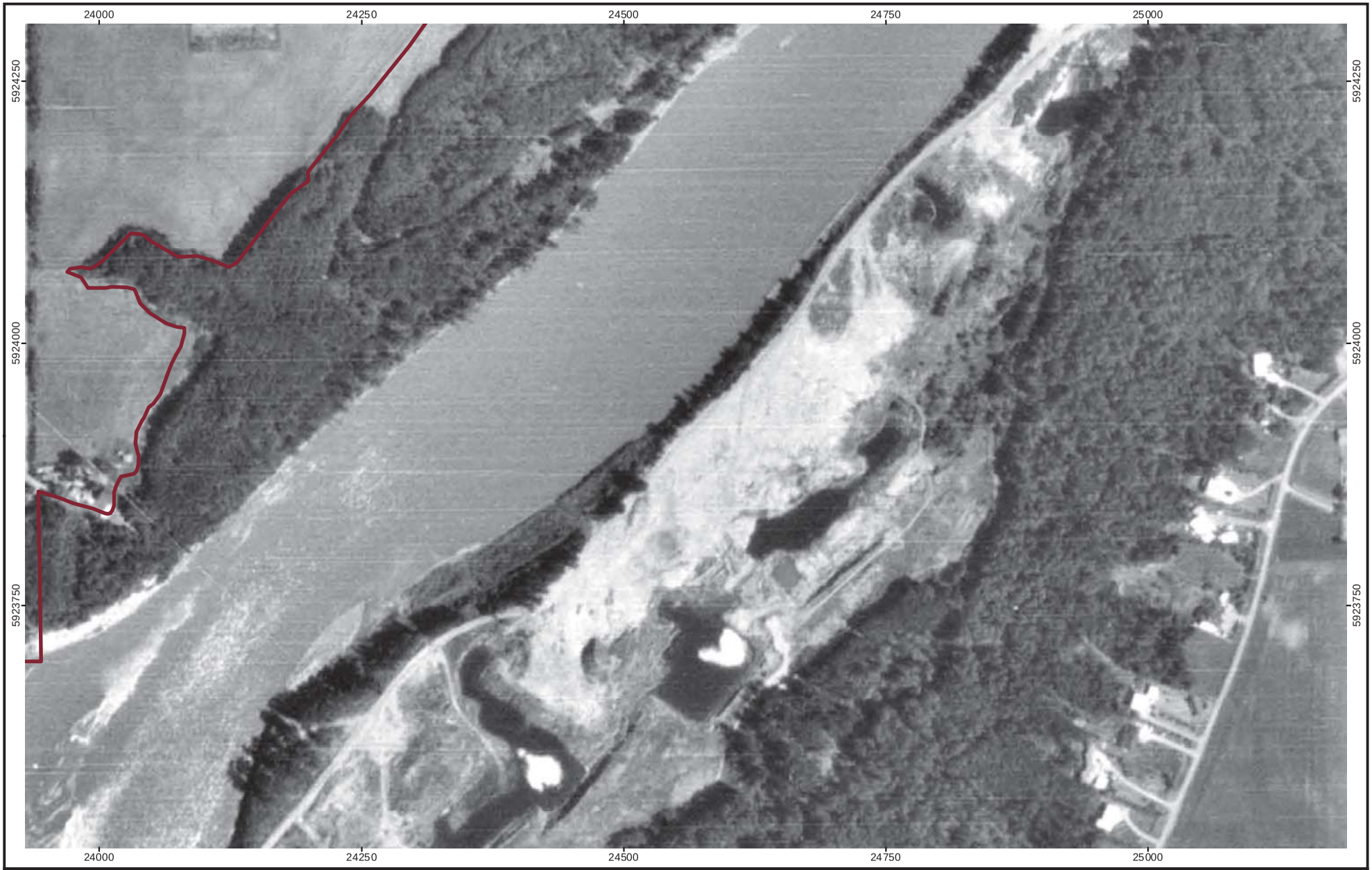

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Riverview Owners Group - Phase II ENR Riverview

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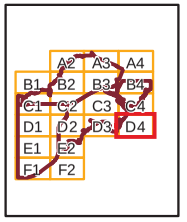

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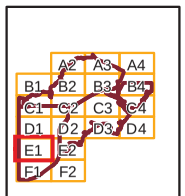

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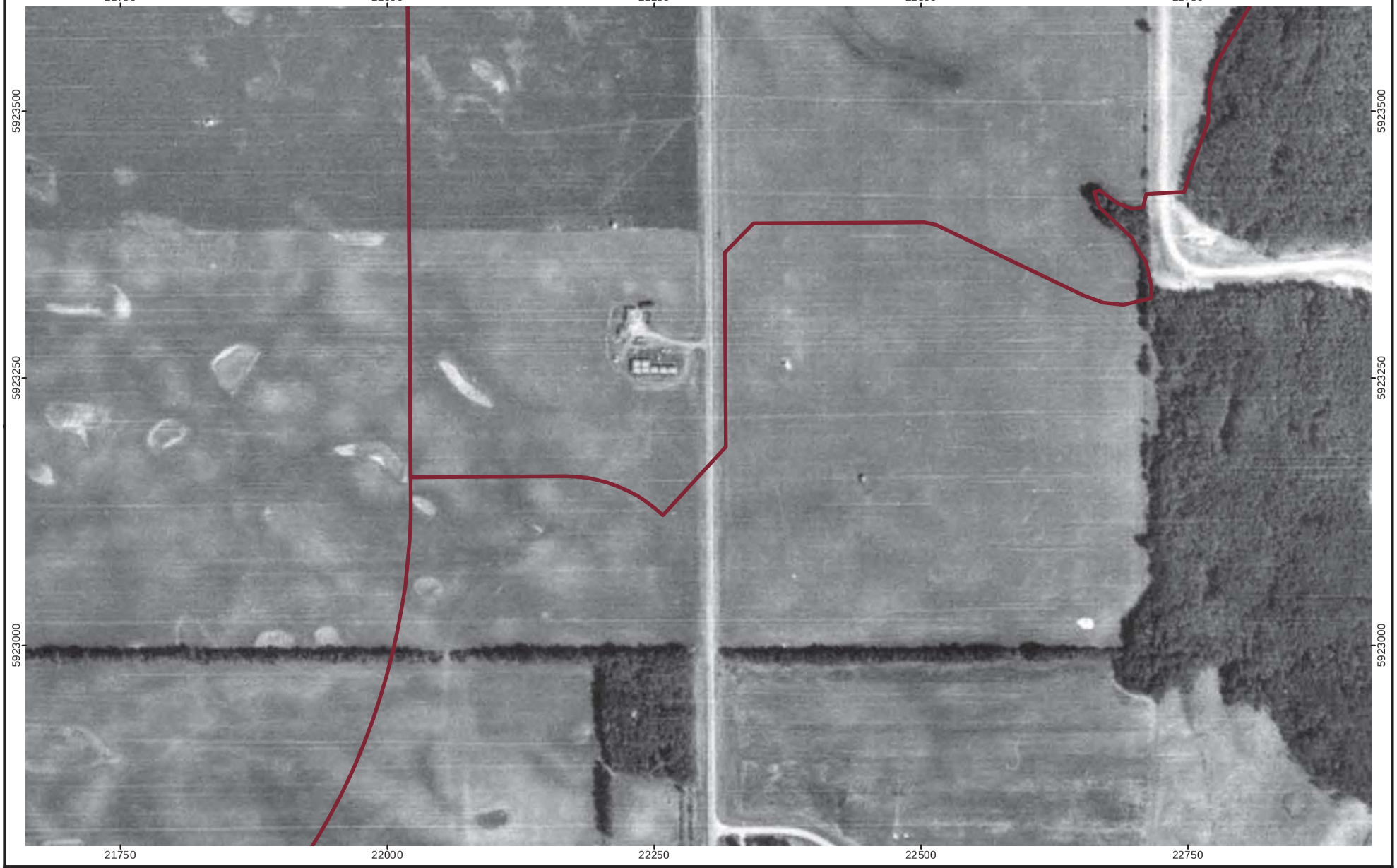
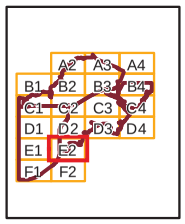


Study Area

Riverview Owners Group - Phase II ENR Riverview

Historical Aerial Review 1977



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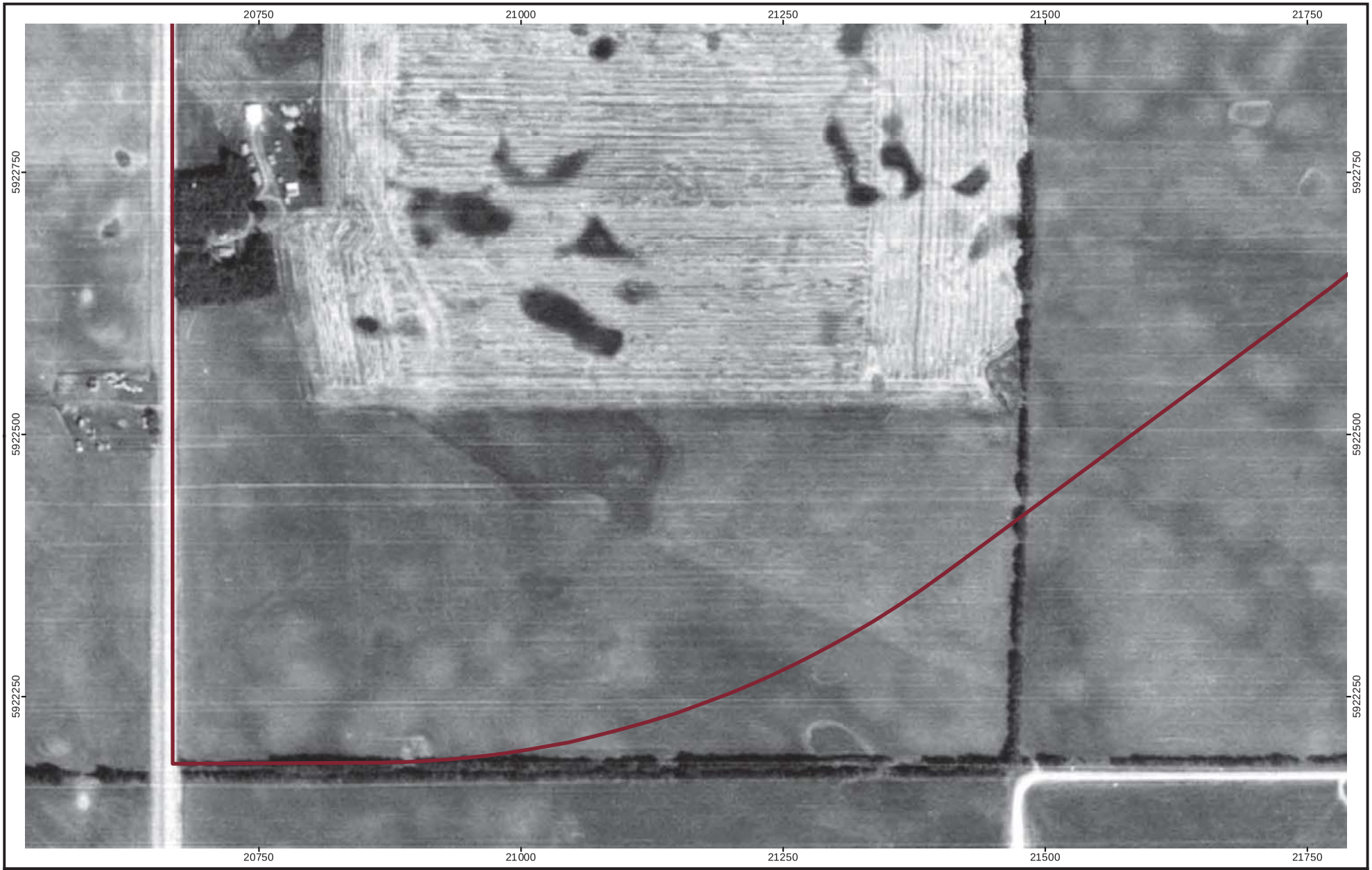
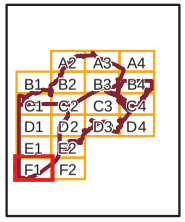


Study Area

Riverview Owners Group - Phase II ENR Riverview

Historical Aerial Review 1977



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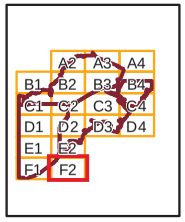
Riverview Owners Group - Phase II ENR Riverview

Historical Aerial Review 1977



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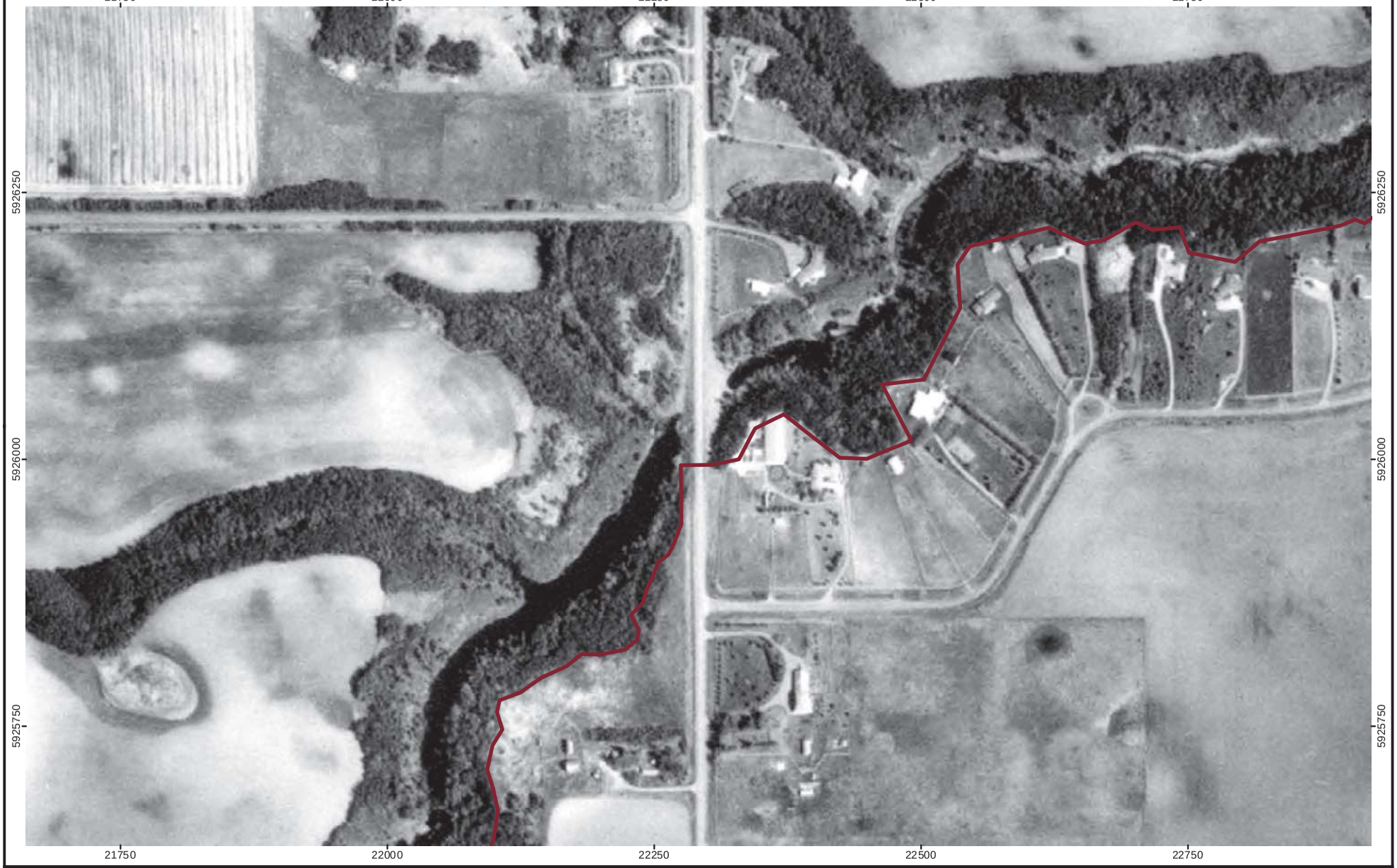
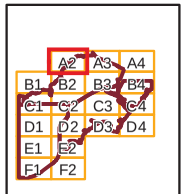


Study Area

Riverview Owners Group - Phase II ENR Riverview

Historical Aerial Review 1987



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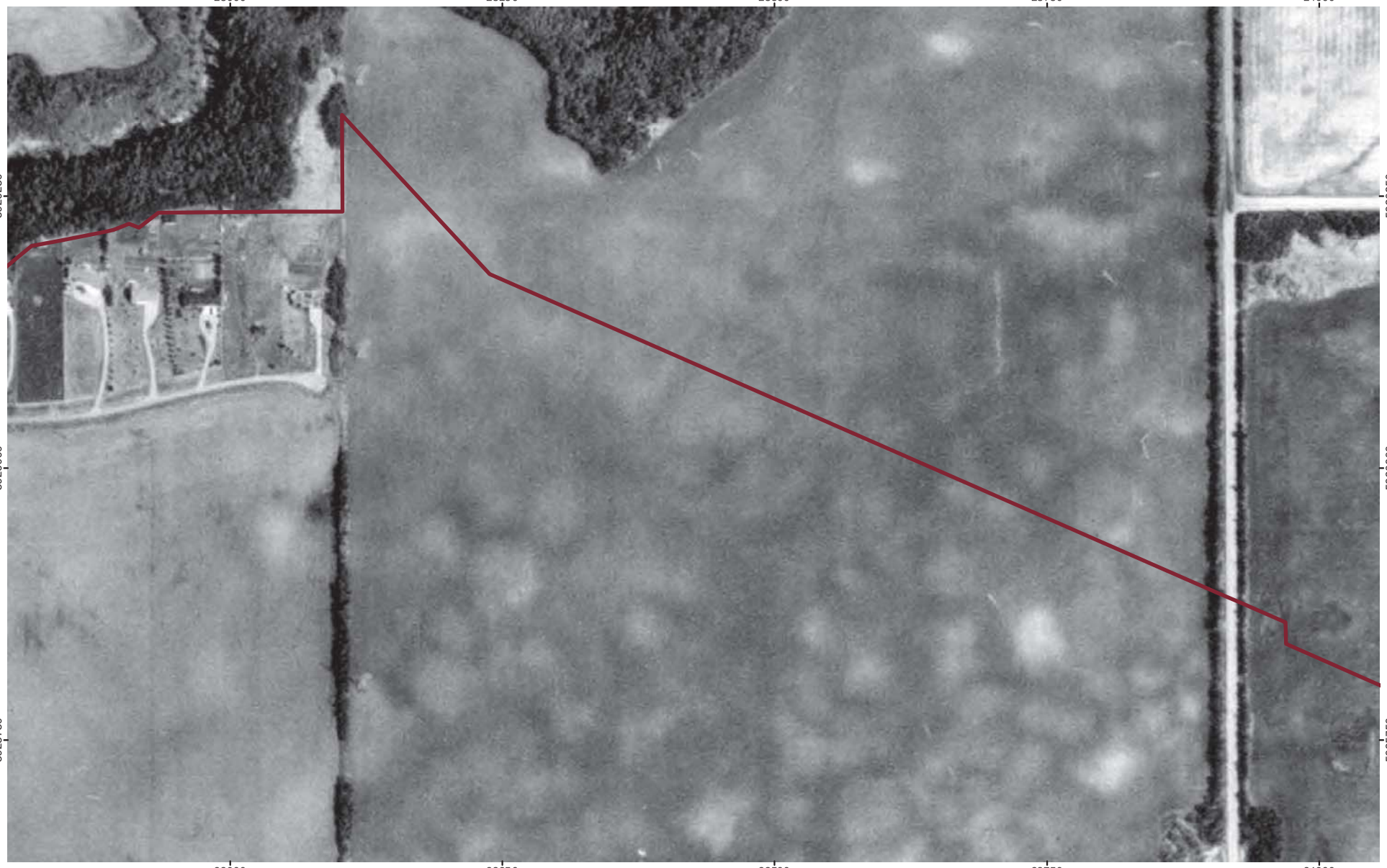
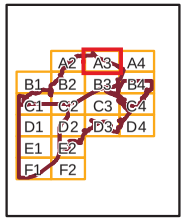
JC	LF			1987



Study Area

Riverview Owners Group - Phase II ENR Riverview

Historical Aerial Review 1987



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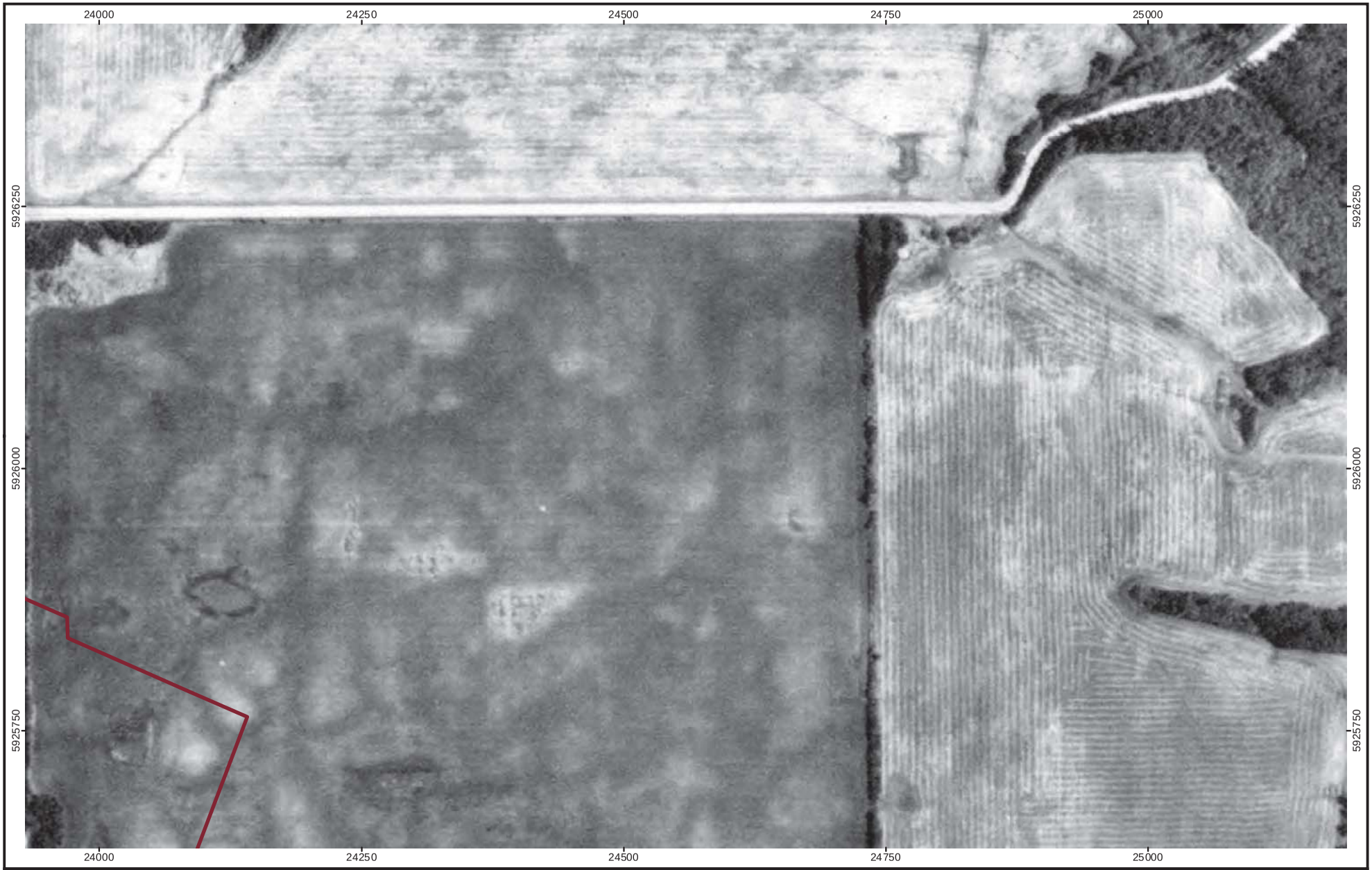
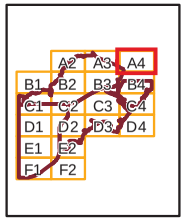


Study Area

Riverview Owners Group - Phase II ENR Riverview

Historical Aerial Review 1987



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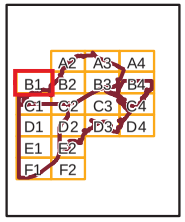
Study Area

Riverview Owners Group - Phase II ENR Riverview

Historical Aerial Review 1987



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Riverview Owners Group - Phase II ENR Riverview

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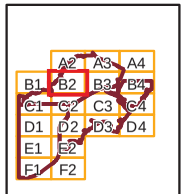

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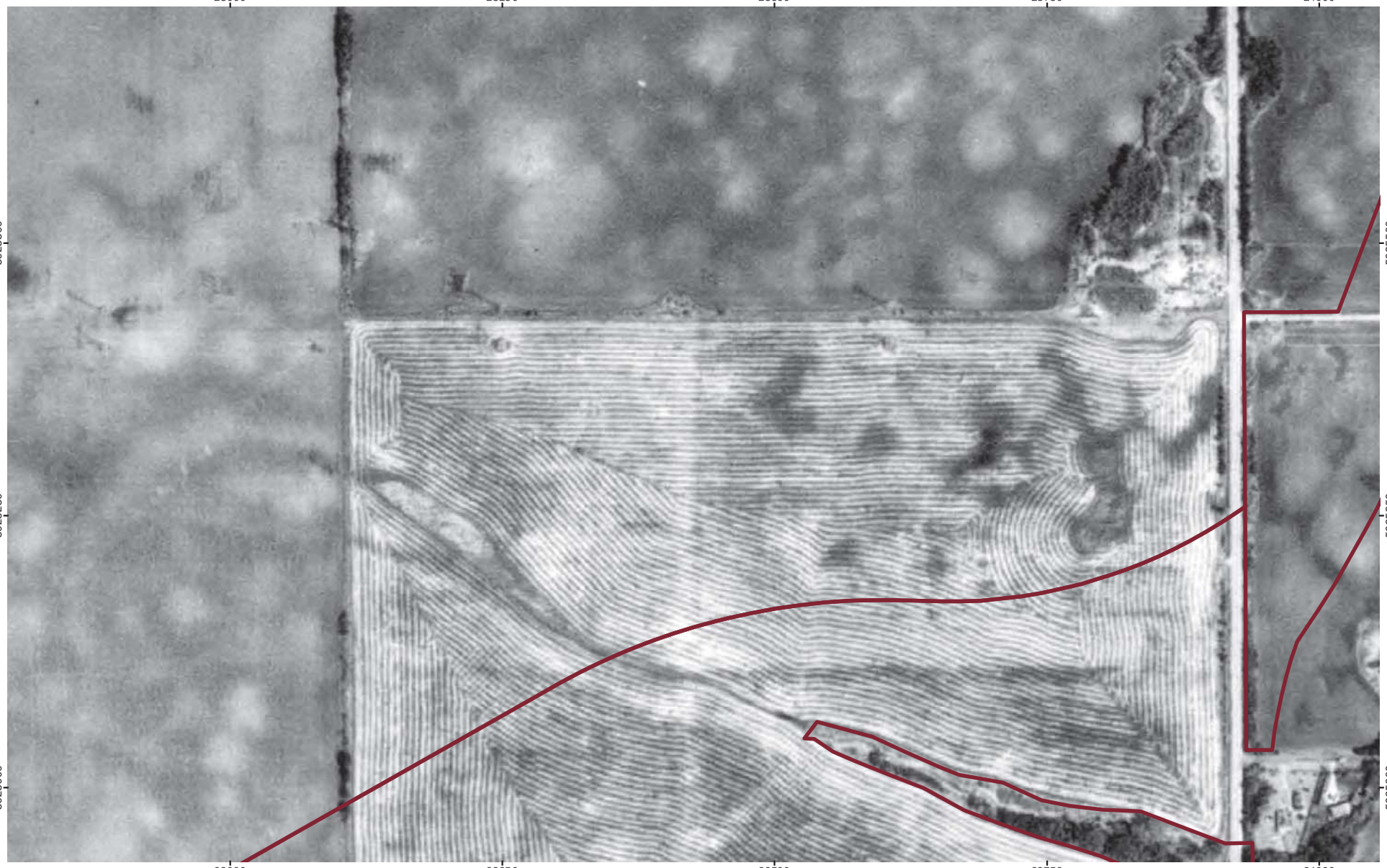

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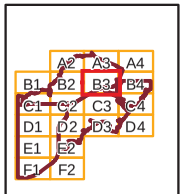

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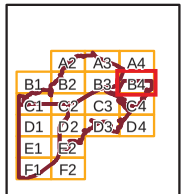

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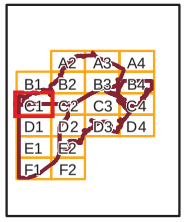

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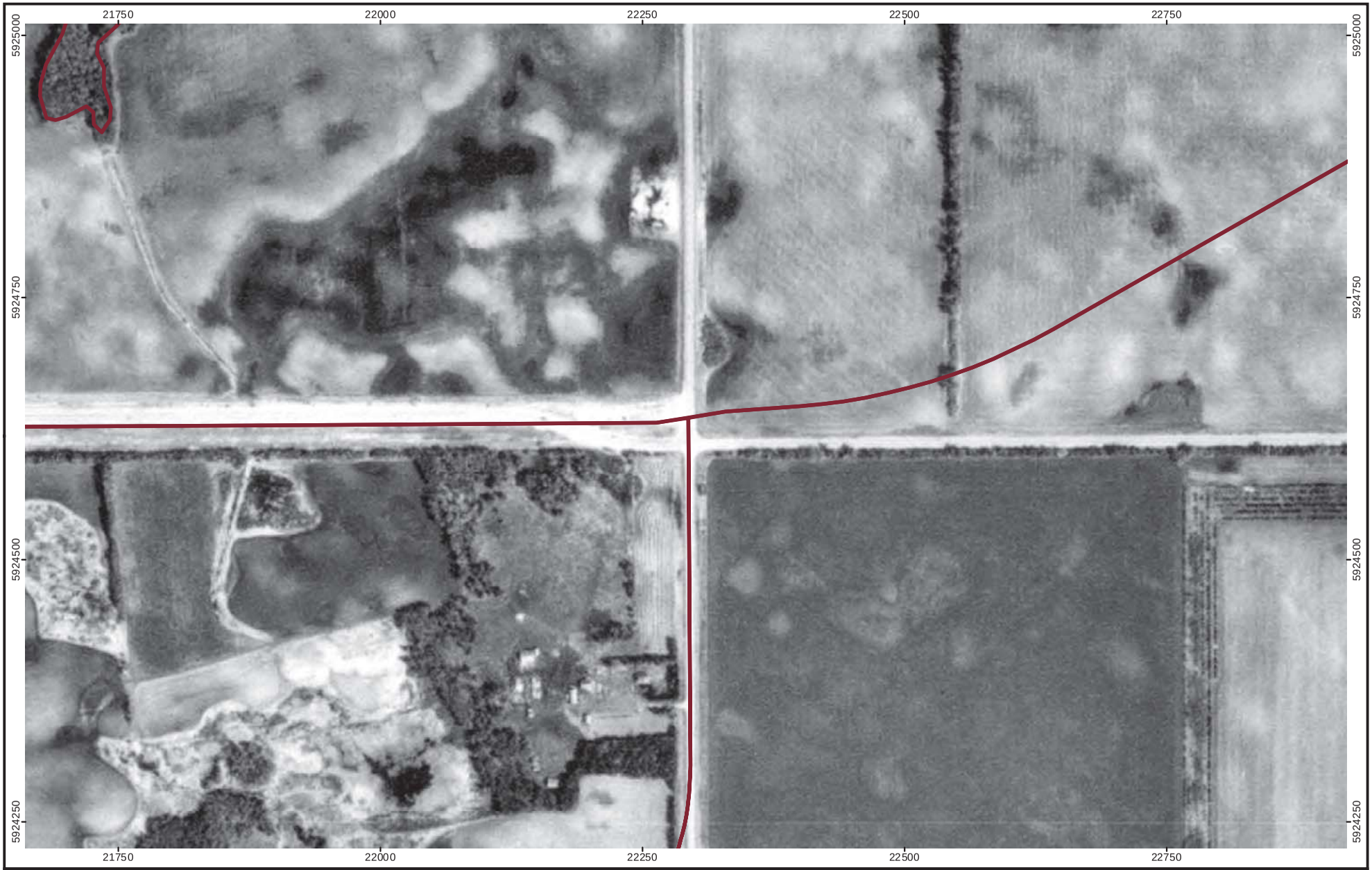

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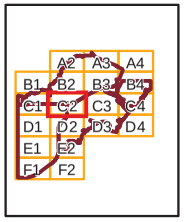

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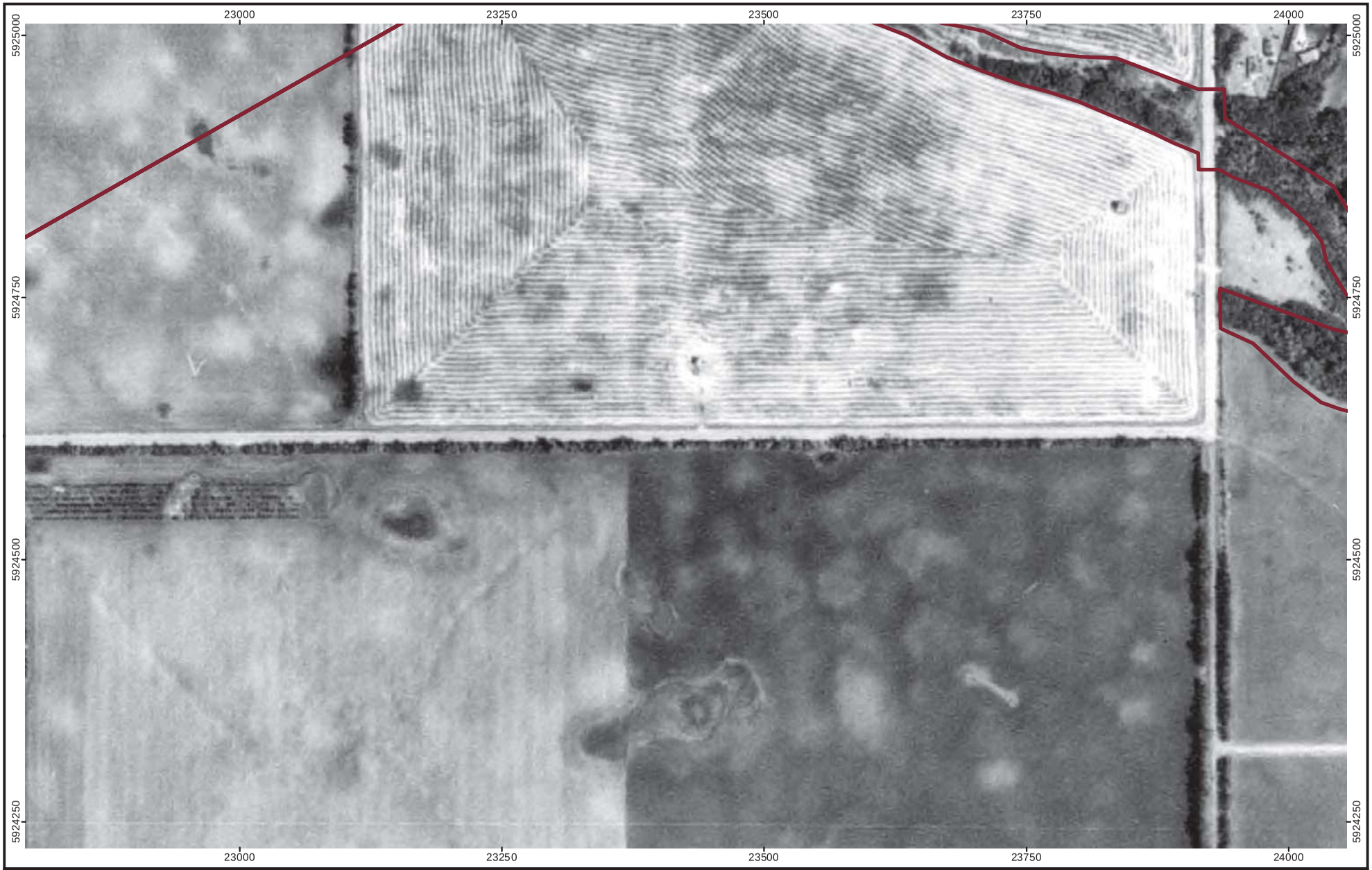

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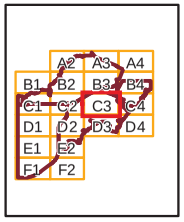
Riverview Owners Group - Phase II ENR Riverview

Historical Aerial Review 1987



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Meters

Projection: 3TM CM:114° Datum: NAD 83

Acknowledgements:
Imagery obtained from Alberta Sustainable Resource Development, AS3590-39, June 1987.

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Stantec	Riverview Owners Group

DRAFT DATE	SCALE
December 12, 2012	1:5,000

REVISION DATE	PROJECT	FIGURE NO.
Jun 12, 2014	110218864	1987

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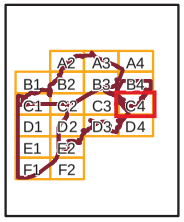
Study Area

Riverview Owners Group - Phase II ENR Riverview

Historical Aerial Review 1987



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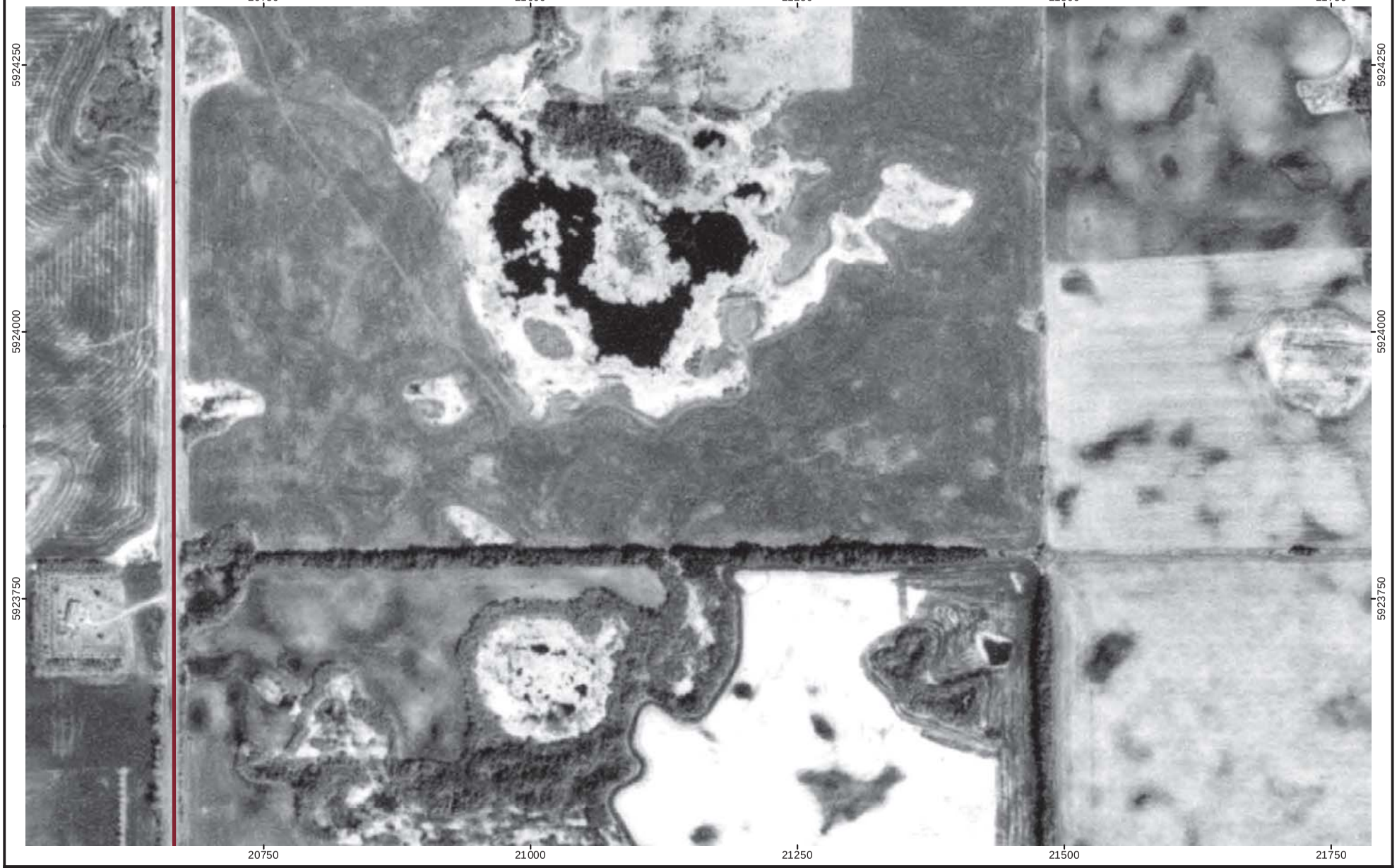

Study Area

Riverview Owners Group - Phase II ENR Riverview

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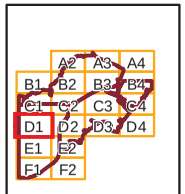

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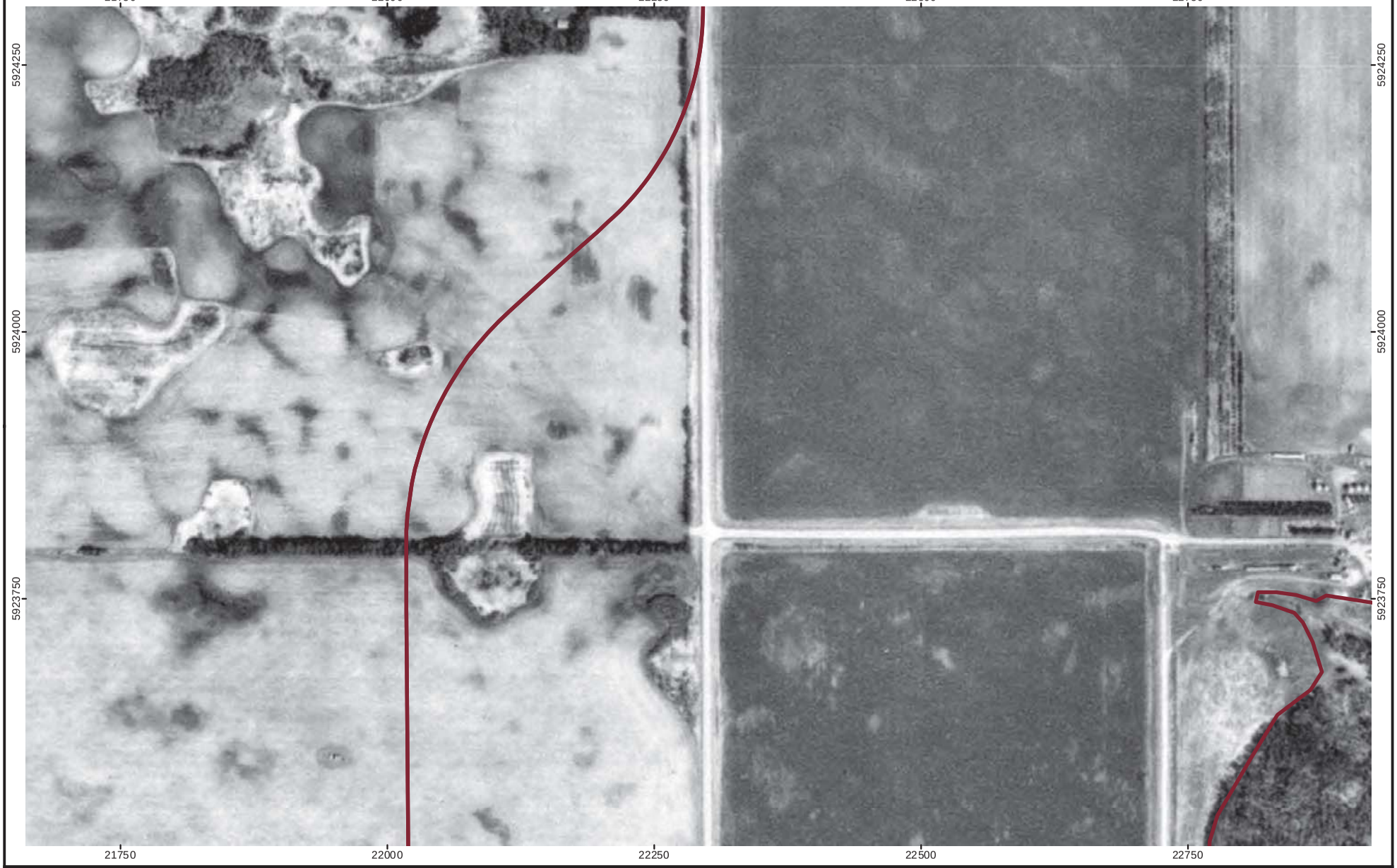
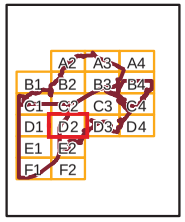


Study Area

Riverview Owners Group - Phase II ENR Riverview

Historical Aerial Review 1987



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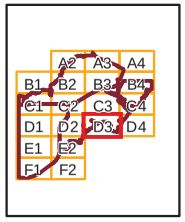
Study Area

Riverview Owners Group - Phase II ENR Riverview

Historical Aerial Review 1987



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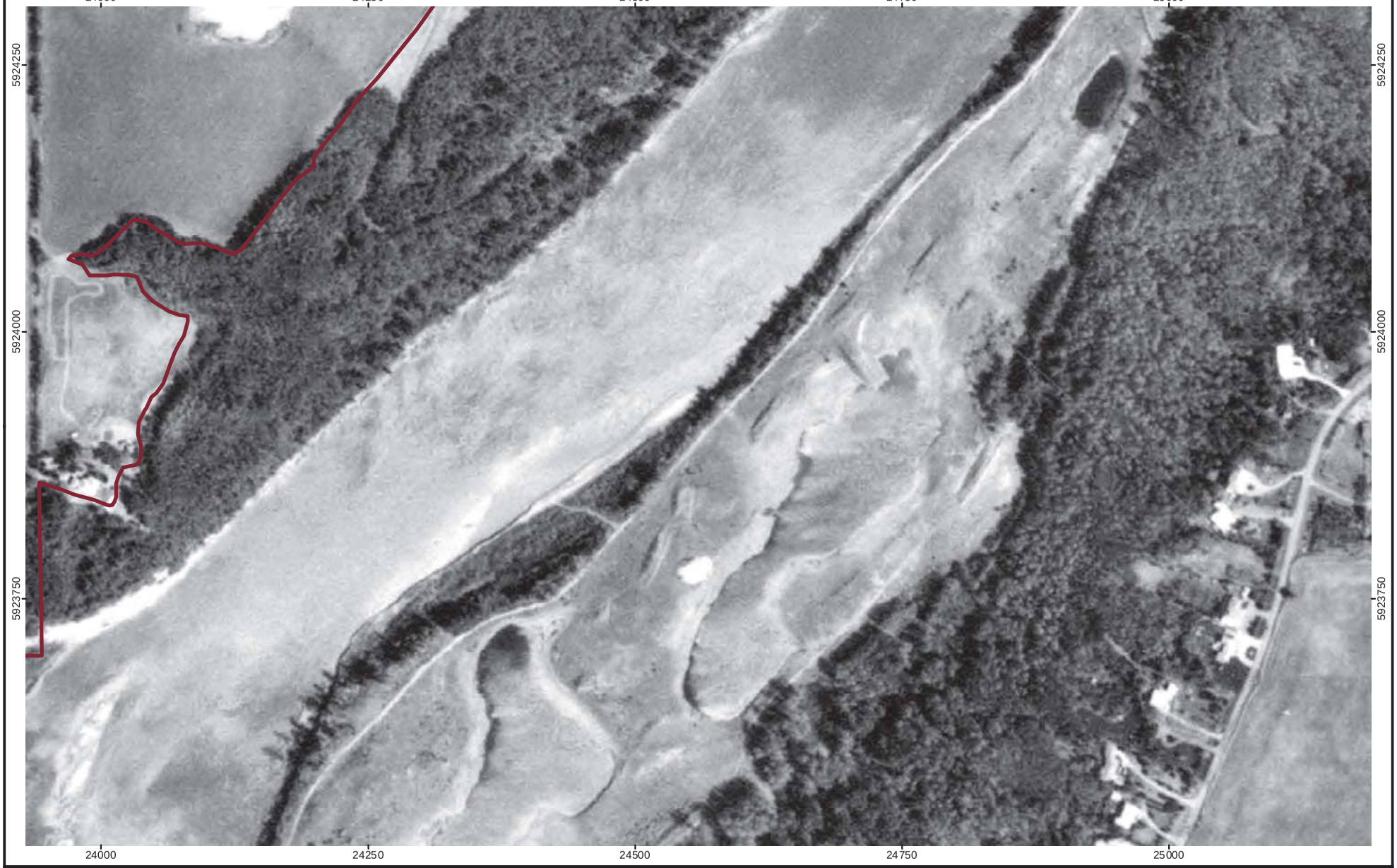

Study Area

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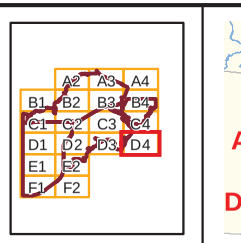
Historical Aerial Review 1987



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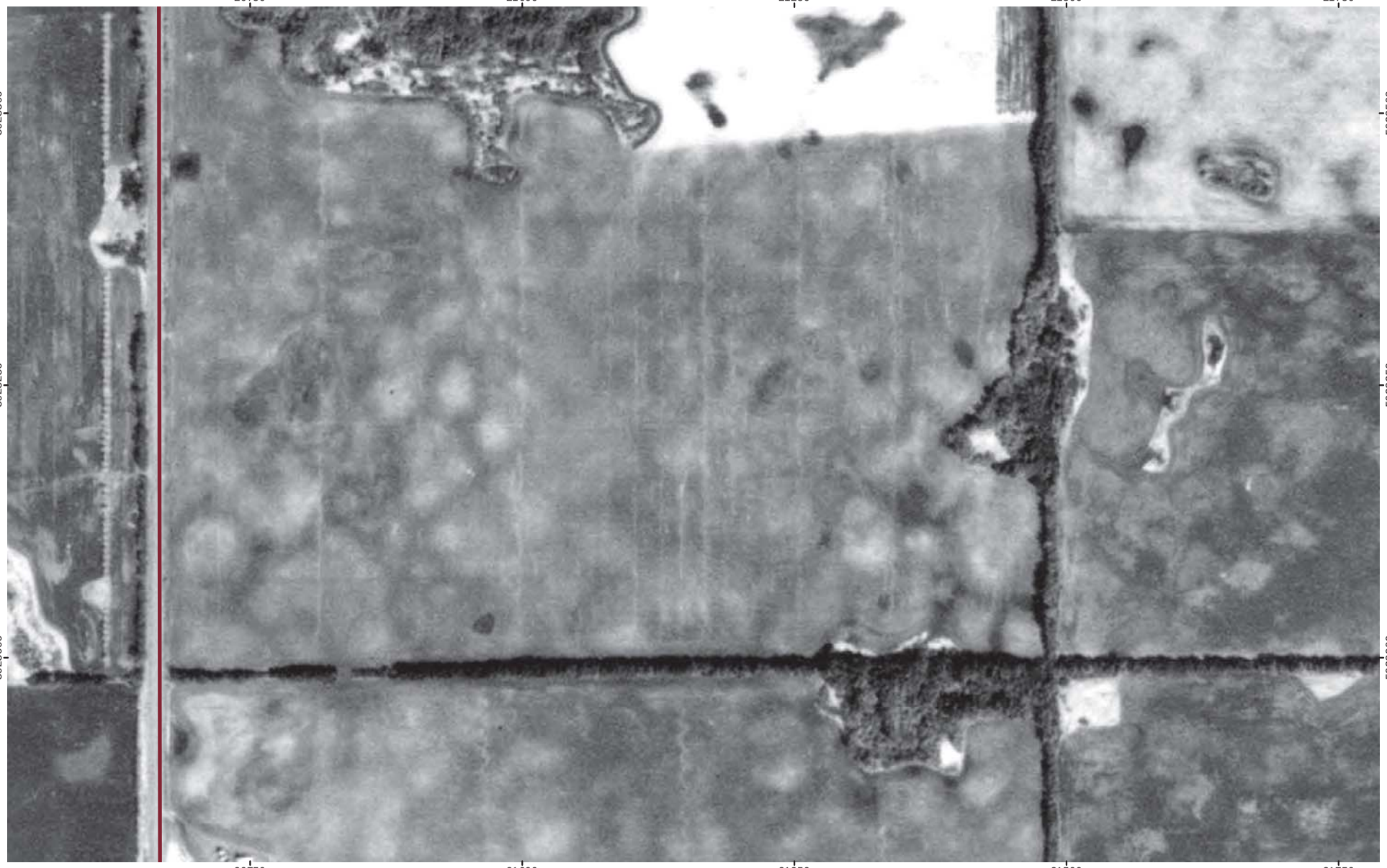

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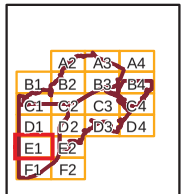
Riverview Owners Group - Phase II ENR Riverview

Historical Aerial Review 1987



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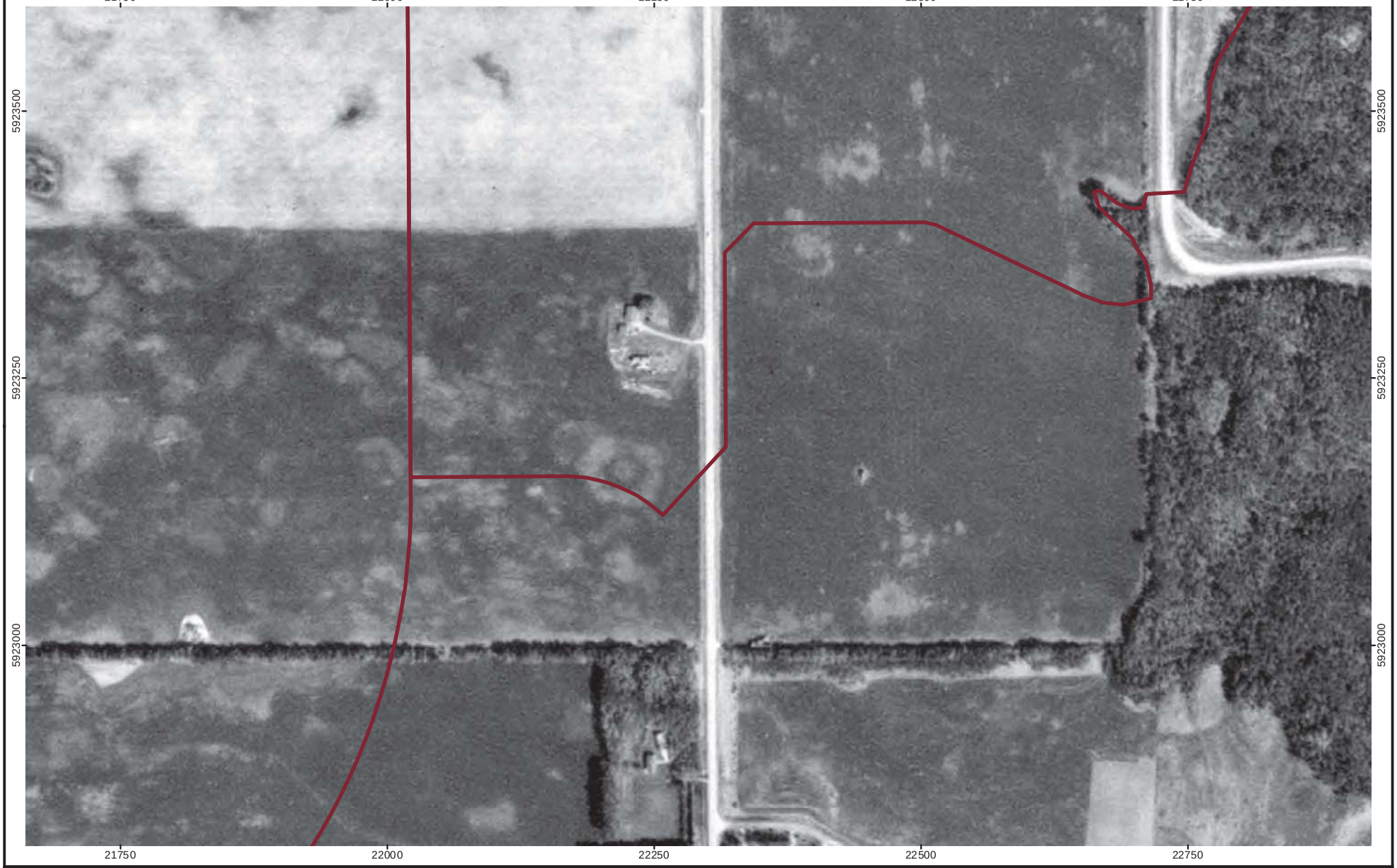
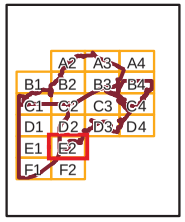


Study Area

Riverview Owners Group - Phase II ENR Riverview

Historical Aerial Review 1987



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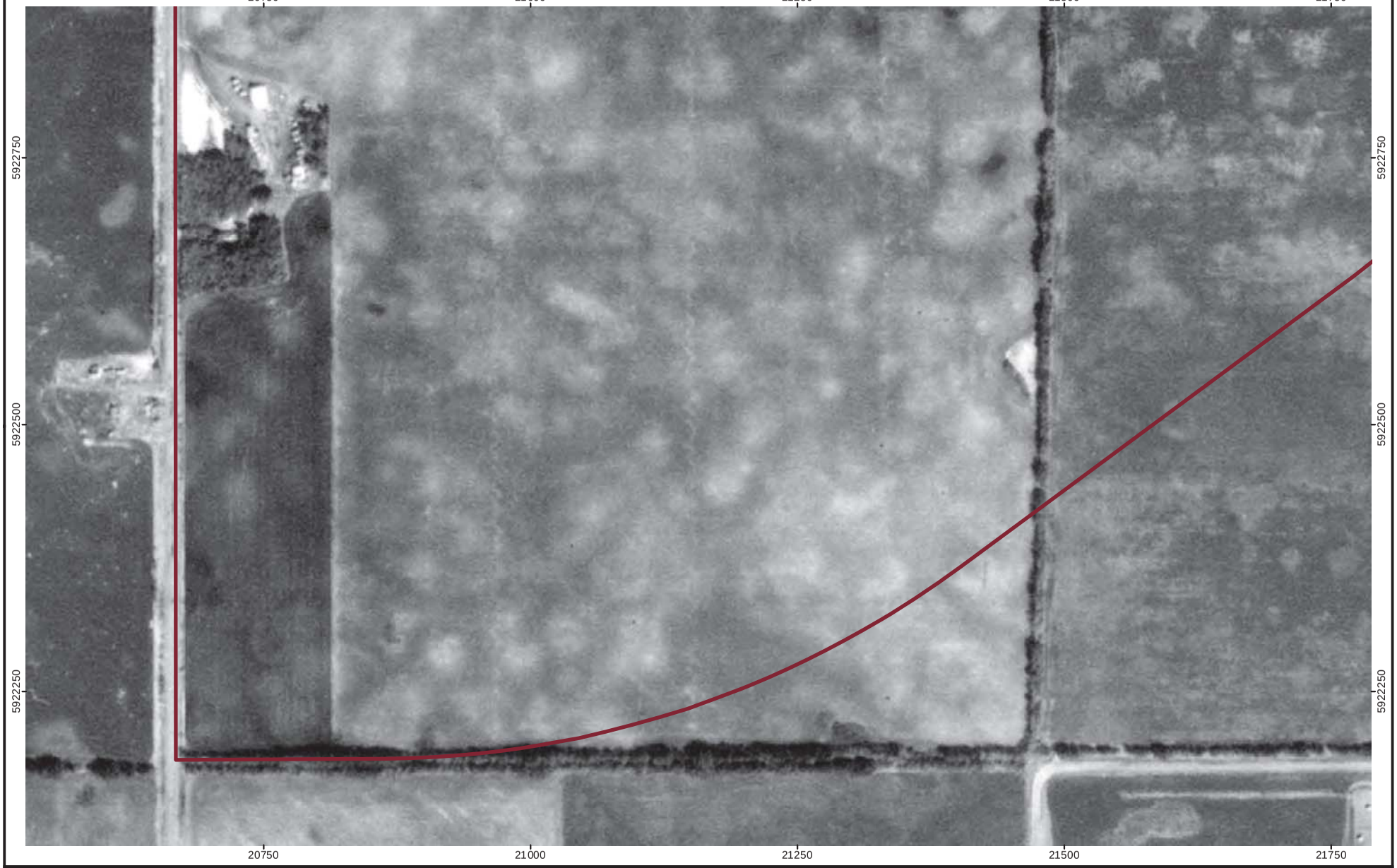
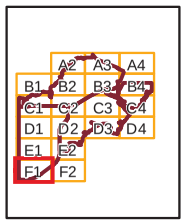


Study Area

Riverview Owners Group - Phase II ENR Riverview

Historical Aerial Review 1987



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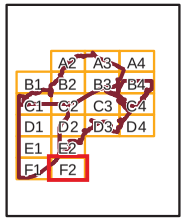
Study Area

Riverview Owners Group - Phase II ENR Riverview

Historical Aerial Review 1987



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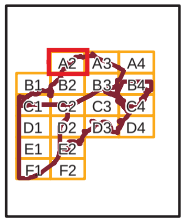
Study Area

Riverview Owners Group - Phase II ENR Riverview

Historical Aerial Review
1993



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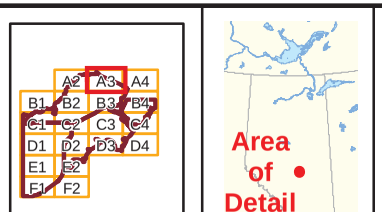
Study Area

Riverview Owners Group - Phase II ENR Riverview

Historical Aerial Review
1993



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PROJECT	110218864
FIGURE NO.	1993
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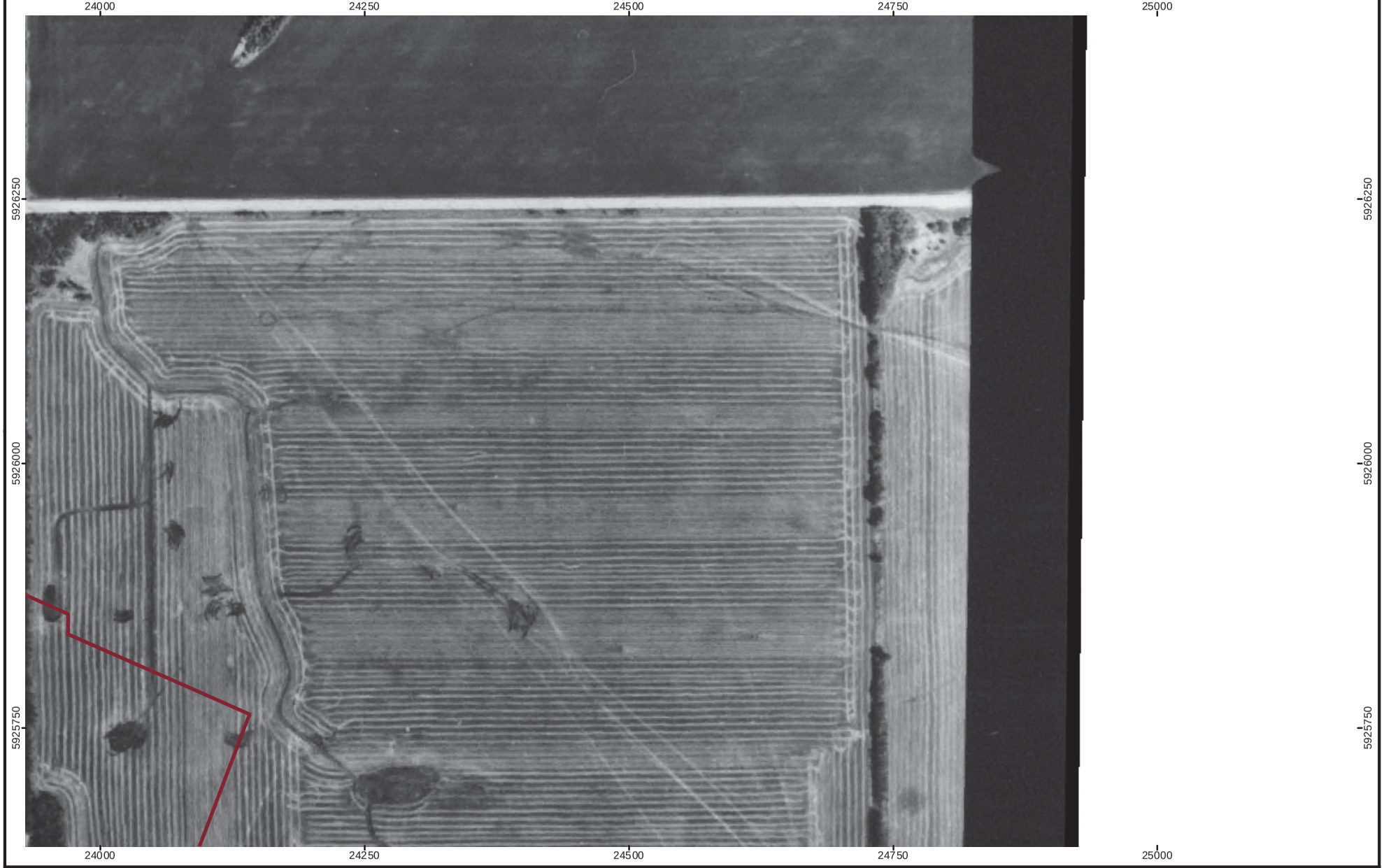
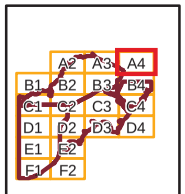


Study Area

Riverview Owners Group - Phase II ENR Riverview

Historical Aerial Review
1993



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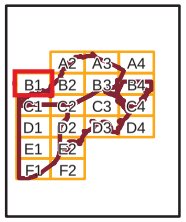
Study Area

Riverview Owners Group - Phase II ENR Riverview

Historical Aerial Review 1993



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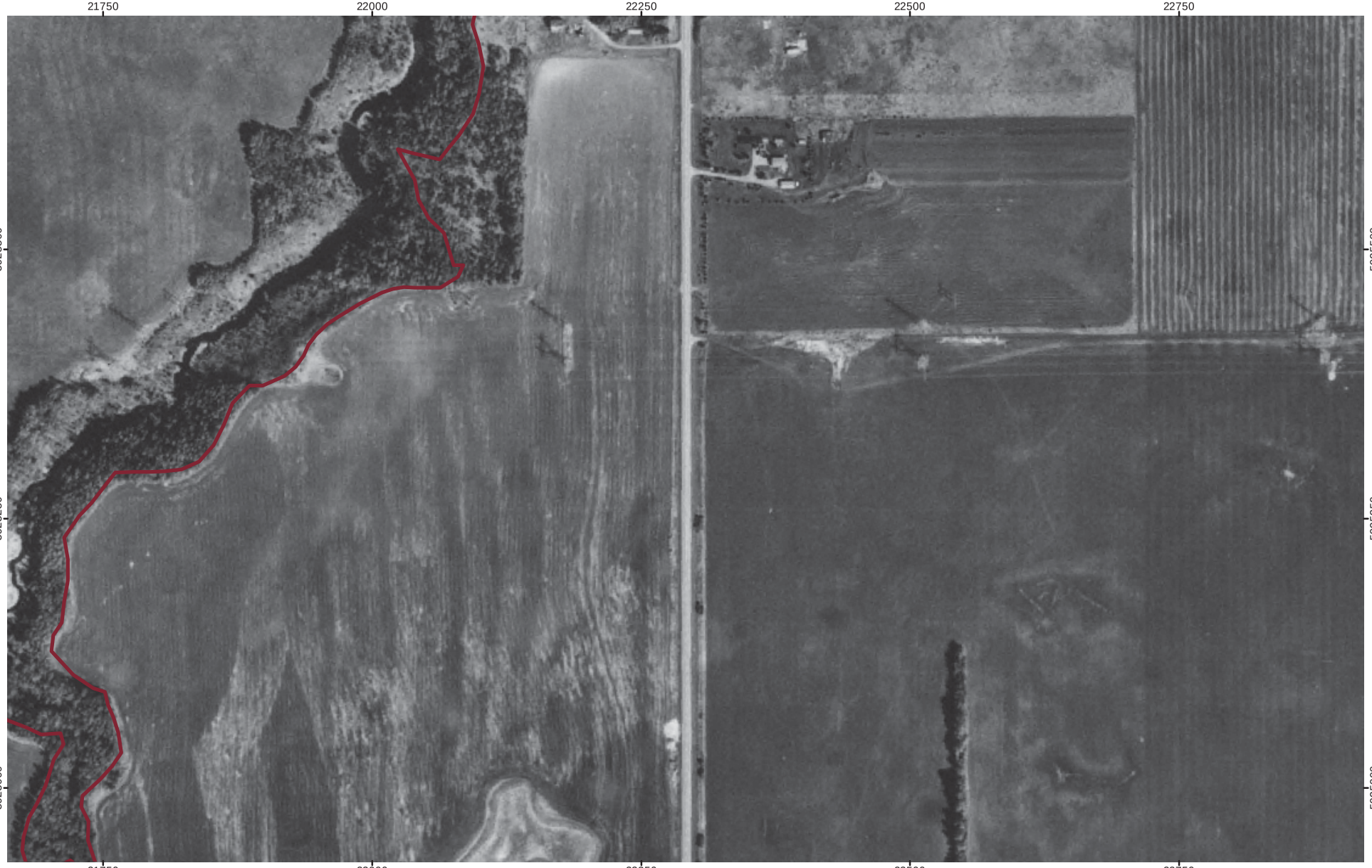

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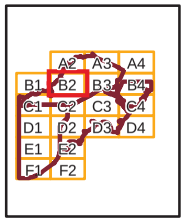
Historical Aerial Review
1993



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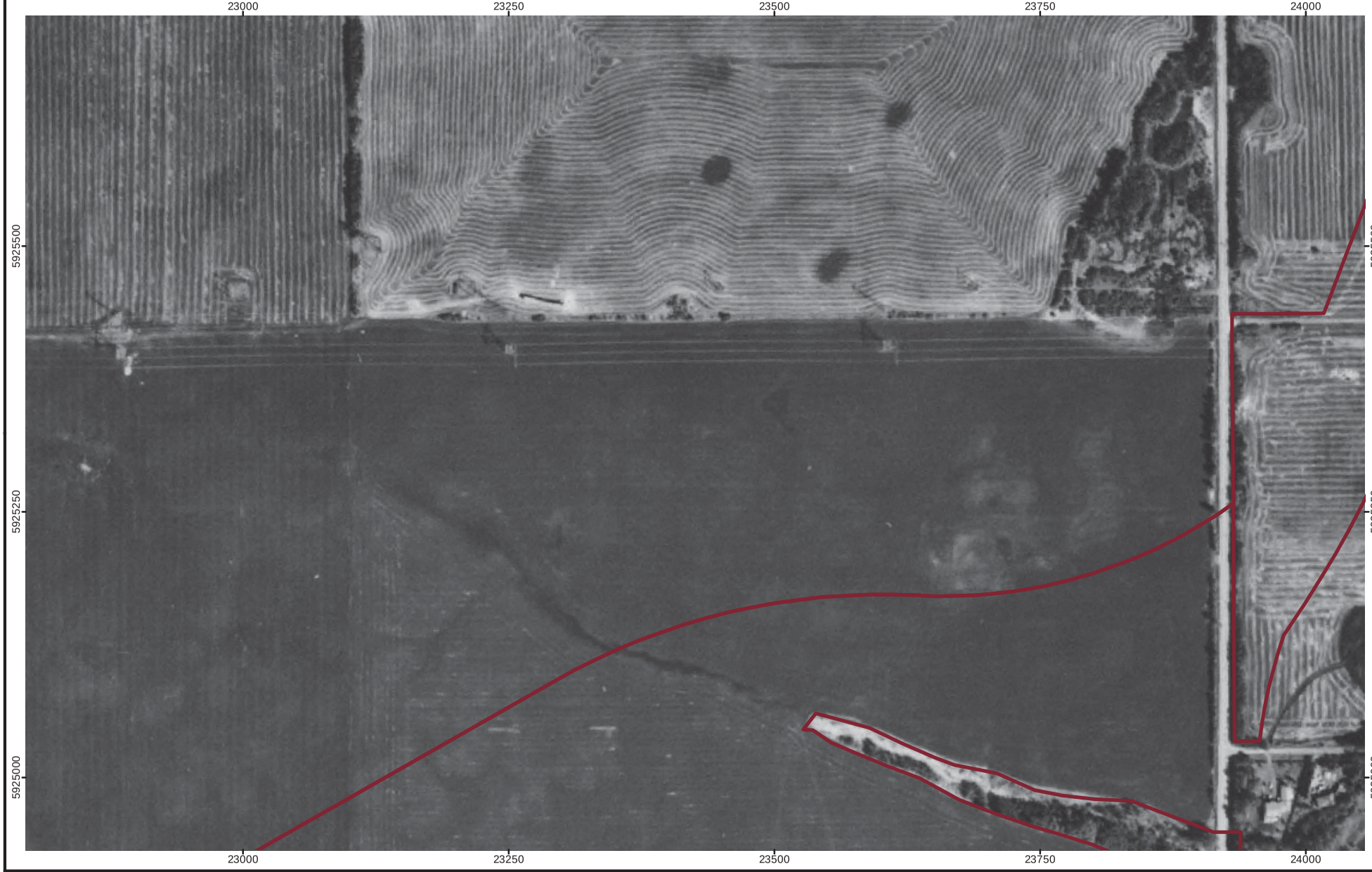

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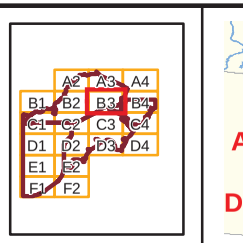
Historical Aerial Review 1993



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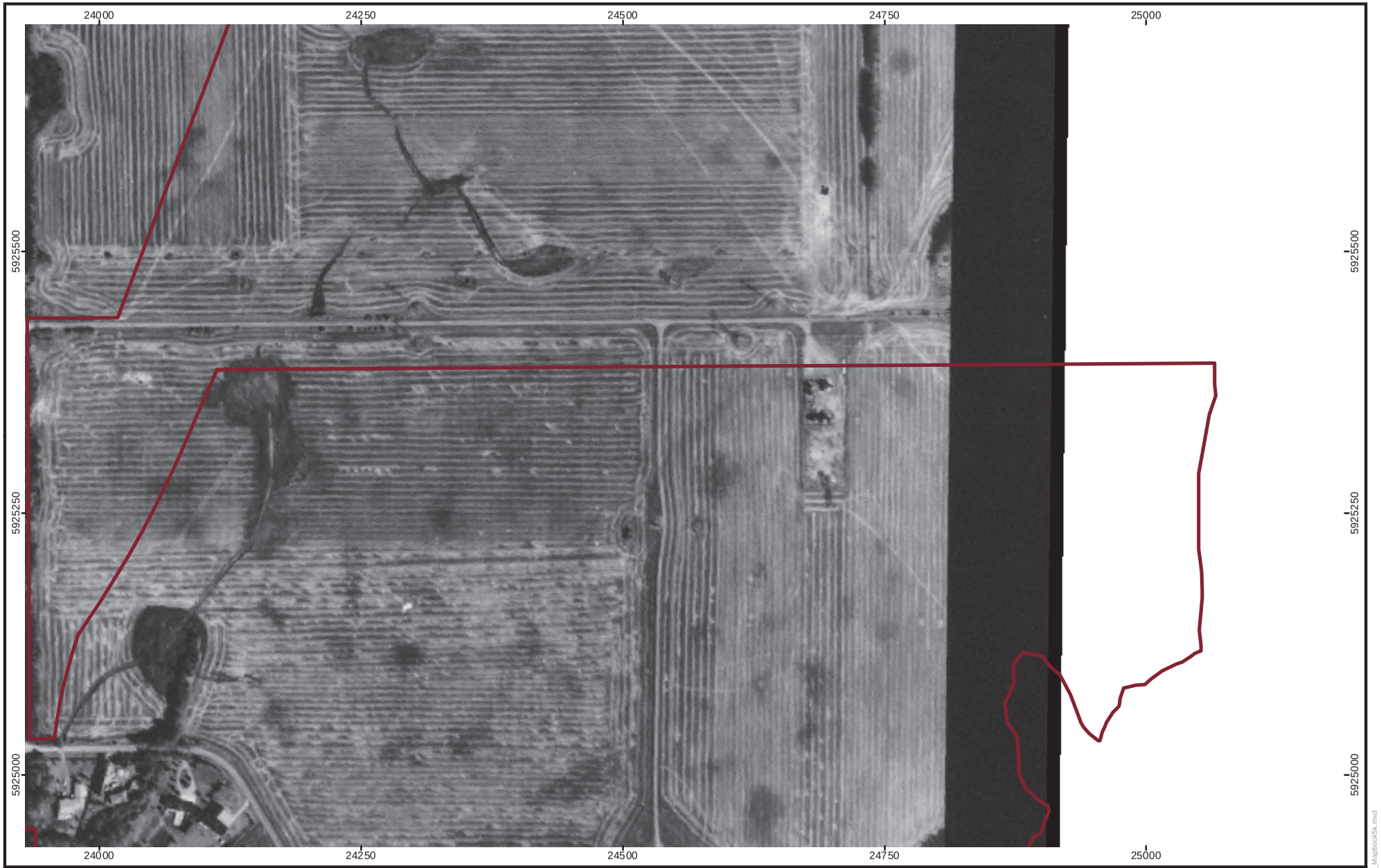

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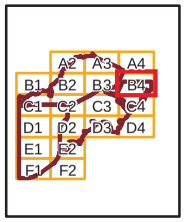
Historical Aerial Review
1993



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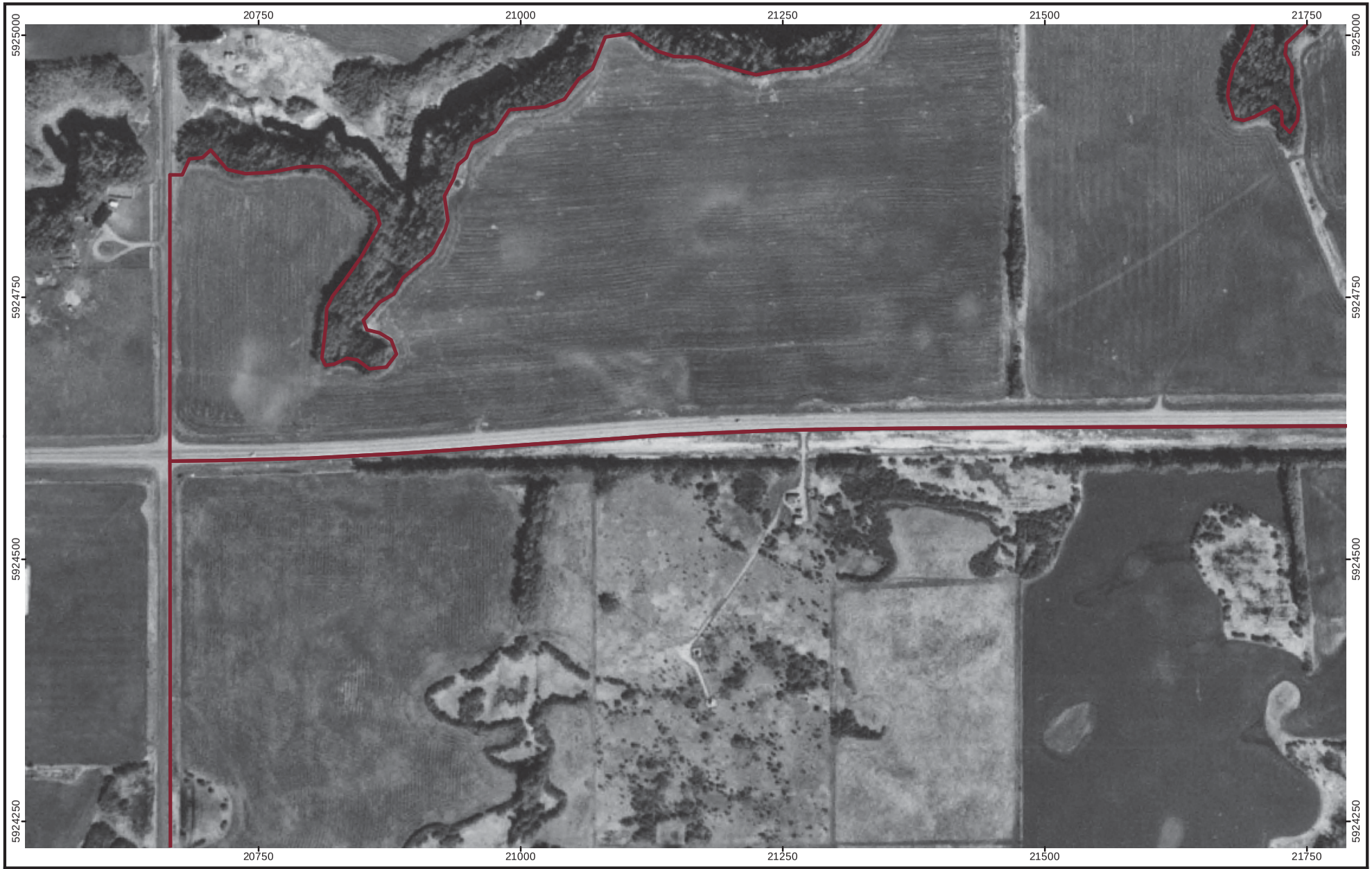

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Historical Aerial Review
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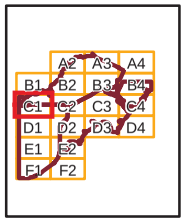

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