

Grand Forks Sensitive Ecosystems Inventory - DRAFT -

MARCH 2, 2018

PRESENTED TO:

Development and Engineering Services
City of Grand Forks

PRESENTED BY:

EcoLogic Consultants
4369 Poplar Ridge Crescent
Crescent Valley, BC V0G1H1
Phone: 250-359-7420

PREPARED BY:

A handwritten signature in blue ink, appearing to read "Ryan Durand".

Ryan Durand, RPBio.
Ecologist and Project Manager
EcoLogic Consultants Ltd.

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TABLE OF CONTENTS

Table of Contents	i
1. Introduction	1
2. Methodology.....	3
2.1 Ecosystem Mapping	5
2.2 Field Surveys.....	6
3. Sensitive Ecosystems Inventory Classification	7
3.1 Sensitive Ecosystems.....	10
3.1.1 Old Forest (OF)	13
3.1.2 Broadleaf Woodland (BW)	13
3.1.3 Woodland (WD:6).....	15
3.1.4 Grassland (GR)	15
3.1.5 Sparsely Vegetated (SV)	17
3.1.6 Riparian (RI)	19
3.1.7 Wetland (WN)	21
3.1.8 Freshwater (FW).....	23
3.2 Other Important Ecosystems	23
3.2.1 Mature Forest (MF)	26
3.2.2 Woodland (WD:5).....	26
3.2.3 Grassland (GR:dr)	26
3.2.4 Sparsely Vegetated (SV:es).....	27
3.2.5 Wetland (WN:mo)	27
3.2.6 Seasonally Flooded Fields (FS).....	29
3.3 Not Sensitive.....	29
3.3.1 Young Forest (YF).....	32
3.3.2 Pole Sapling (PS)	32
3.3.3 Woodland (WD:3).....	32
3.3.4 Old Field (OD)	32
3.3.5 Cultivated Field (CF)	32
3.3.6 Not Sensitive (NS).....	33

4. Conservation Mapping	34
5. Recommendations	41
References	43

List of Figures

Figure 1-1. SEI Study Area	2
Figure 3-1. SE Categories.....	8
Figure 3-2. Primary Sensitive Ecosystem Inventory Classes	9
Figure 3.1-1. Sensitive Ecosystems	11
Figure 3.2-1. Other Important Ecosystems.....	25
Figure 3.3-1. Not Sensitive.	31
Figure 4-1. Modelled Western Rattlesnake Denning Suitability	37
Figure 4-2. Modelled Western Rattlesnake Living Suitability	38
Figure 4-3. Modelled Lewis’ Woodpecker Breeding Suitability	39
Figure 4-4. Modelled Lewis’ Woodpecker Living Suitability	40

List of Tables

Table 2-1. Potential SE Classes and Subclasses.....	3
Table 3.1-1. Sensitive Ecosystems.....	12
Table 3.2-1. Other Important Ecosystems	24
Table 3.3-1. Not Sensitive Ecosystems.....	29
Table 4-1. Habitat Suitability Ranks	34
Table 4-2. Habitat Suitability Ranks for Western Rattlesnake and Lewis’s Woodpecker	34

List of Plates

Plate 3.1-1. Broadleaf woodland (BW:ac) aspen copse.....	14
Plate 3.1-2. Broadleaf woodland (BW:as) aspen seepage in the background, with Not Sensitive disturbed areas in the foreground.....	14
Plate 3.1-3. Mature woodland ecosystem (WD:6).....	15
Plate 3.1-4. Remnant native grassland (GR:gr) with a shrub-filled depression below.	16
Plate 3.1-5. Dry shrub grassland (GR:sh) with a variety of low and tall shrubs and sporadic Douglas fir.....	17
Plate 3.1-6. Mosaic of sparsely vegetated ecosystems, including cliffs (SV:cl), rock outcrops (SV:ro) and talus (SV:ta), with mature conifer woodland (WD:6) above.	18
Plate 3.1-7. A small talus (SV:ta) slope below cliffs (SV:cl).	19
Plate 3.1-8. Low bench floodplain (RI:fl) in the foreground, with medium bench floodplain (RI:fm) behind.	20
Plate 3.1-9. Cattail marsh wetland (WN:ms) is blue-listed in the region.....	22
Plate 3.1-10. Typical wetland complex with Shallow Open Water (WN:ow) in the foreground, Marsh (WN:ms) in the middle, and Swamps (WN:sp) in the background.	22
Plate 3.1-11. Freshwater Pond (FW:pd) with Shallow Open Water (WN:ow) and Marsh (WN:ms) in the background.	23
Plate 3.1-12. Disturbed grassland (GR:dr) with a high cover of introduced grass and herbs.....	27
Plate 3.1-13. Modified wetland (WN:mo) dominated by introduced and invasive grasses, with a native marsh (WN:ms) to the right.	28
Plate 3.1-14. Modified swamp wetland (WN:mo) that is dominated by introduced shrubs.	28
Plate 3.1-15. A Seasonally Flooded Field (FS) located next to a wetland complex.....	29

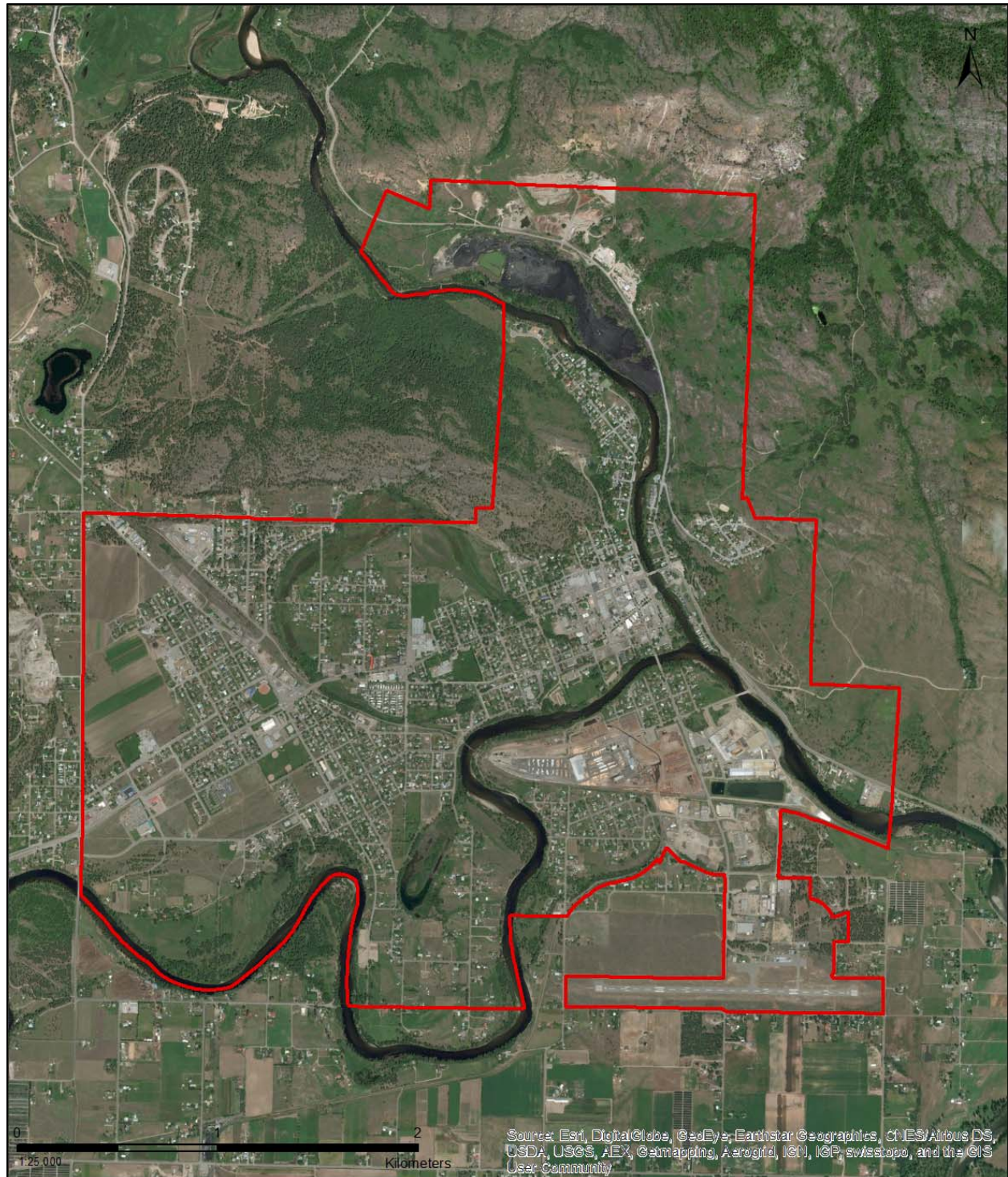
1. INTRODUCTION

The goal of this project was to use Sensitive Ecosystems Inventory (SEI) methodology to map the City of Grand Forks (Fig. 1-1), BC (the City). SEI mapping was created in 1993 by the Canadian Wildlife Service and the BC Conservation Data Centre. It was created in *'response to a need for inventory of at-risk and ecologically fragile ecosystems, and critical wildlife habitat areas on the east side of Vancouver Island.'* Since then, numerous projects have been completed throughout the province. In 2006 a *Standard for Mapping Ecosystems At Risk in British Columbia* was created by the Resource Inventory Standards Committee to promote a standardized process province wide (RISC 2006).

The main purpose of SEI mapping is to describe the ecological diversity of a given area, and determine the type and extent of vulnerable and rare elements (RISC 2006). The SEI standard describes an overview of the assessment process as follows:

'The SEI classification uses two primary groupings of ecosystems: **Sensitive Ecosystems** and **Other Important Ecosystems**. Within each of these groups a series of classes and subclasses is defined that provides a general level of ecosystem description that is appropriate for public education and local planning exercises. Sensitive Ecosystem categories are generalised [sic] groupings of ecosystems that share many characteristics, particularly ecological sensitivities, ecosystem processes, at-risk status, and wildlife habitat values. Criteria for ecological sensitivity include: **environmental specificity**, susceptibility to hydrological changes, soil erosion, especially on shallow soils, spread of invasive alien plants, and sensitivity to human disturbance. Other Important Ecosystems have significant ecological and biological values associated with them that can be identified and mapped, although they are not defined as Sensitive Ecosystems because they have been substantially altered by human use. Consideration of Other Important Ecosystems is critical to capturing key elements of biodiversity of some project areas; they sometimes provide recruitment sites for ecosystems at risk or important wildlife habitat requiring recovery or restoration.'

This report serves as the preliminary findings of the SEI project. It describes the type and extent of ecosystems found in the City. It also provides some example conservation mapping using two locally occurring rare species. Finally, recommendations are provided for future projects to build upon this initiative.



Grand Forks Sensitive Ecosystems Inventory

Figure 1-1. Study Area

Date: 3/5/2018



Coordinate System: NAD 1983 UTM Zone 11N
Projection: Transverse Mercator
Datum: North American 1983

2. METHODOLOGY

Preliminary SEI classes and subclasses were developed for this project from previous SEI projects in the Lower Mainland, Vancouver Island, Gulf Islands, West Kootenay and Okanagan. Some descriptions were changed to reflect location conditions. Table 2-1 presents the full range of SEI classes and subclasses that were available (and appeared to be applicable) for this project.

Table 2-1. Potential SE Classes and Subclasses

SEI Class	SEI Subclass	Brief Description
OF: Old Forest		Forests > 140 yrs.
OF	bd: broadleaf	Broad-leaf dominated (> 75% of stand composition).
OF	co: coniferous	Conifer > 75% of stand.
OF	mx: mixed	Stand composition > 25% conifer and > 25% broadleaf.
MF: Mature Forest		Forests > 80 yrs, < 140 yrs.
MF	co: coniferous	Conifer-dominated (> 75% of stand composition).
MF	mx: mixed	Stand composition > 25% conifer and > 25% broadleaf.
MF	bd: broadleaf	Broad-leaf dominated (> 75% of stand composition).
YF: Young Forest		Patches of forest – stands > 30 yrs, < 80 yrs.
YF	co: coniferous	Conifer-dominated (> 75% of stand composition).
YF	mx: mixed	Stand composition > 25% conifer and > 25% broadleaf.
YF	bd: broadleaf	Broad-leaf dominated (> 75% of stand composition).
PS: Pole Sapling		Trees > 10 m tall, usually 10 - 15 yrs.
PS	co: coniferous	Conifer-dominated (> 75% of stand composition).
PS	mx: mixed	Stand composition > 25% conifer and > 25% broadleaf.
PS	bd: broadleaf	Broad-leaf dominated (> 75% of stand composition).
BW: Broadleaf Woodland		
BW	ac: aspen copse	Aspen copse ecosystems occur in broad, moist depressions in grassland areas. They are typically small ecosystems with trembling aspen overstories and shrubby understories dominated by common snowberry and roses.
BW	as: aspen seepage	Aspen seepage ecosystems occur on slopes with subsurface seepage in a matrix of coniferous forests. These ecosystems are moist and rich as a result of nutrient inputs from seepage and the annual input of leaf litter. They have trembling aspen overstories and diverse, shrubby understories.

SEI Class	SEI Subclass	Brief Description
WD: Woodland		
		Dry site, open stands with between 10 and 25% tree cover including Douglas fir and Ponderosa pine. Patchy shrubs such as Saskatoon and oceanspray are common. Often associated with rock outcrops and cliffs.
WD	3: shrub/herb	Shrub cover 20% or greater, tree cover less than 10%
WD	4: pole sapling	Trees are > 10 m tall and have 10% or greater cover, dense stands, generally 10-40 years old.
WD	5: young forest	Trees are > 10 m tall and have 10% or greater cover, dominated by young trees about 40-80 years old.
WD	6: mature forest	Trees are > 10 m tall and have 10% or greater cover, dominated by mature trees about 80-250 years old.
GR: Grassland		
GR	gr: grassland	Remnant native grasslands with bunchgrasses.
GR	sh: shrub	Dry shrublands – often patchy and interspersed with native and introduced grasses. Common species include snowberry, Saskatoon, rose and sumac.
GR	dr: disturbed	Dry grassland with variety of introduced grass and herbs.
SV: Sparsely Vegetated		
		Areas with 5 – 10% vascular vegetation.
SV	sh: shrub	Shrub ecosystems occur on small rock outcrops with cracks and crevices. They most commonly occur in a grassland matrix.
SV	cl: cliff	Steep slopes of exposed bedrock.
SV	ro: rock outcrop	Rock outcrops – areas of bedrock exposure.
SV	ta: talus	Dominated by rubbly blocks of rock.
SV	es: exposed soil	Any area of exposed soil that is not in other definitions.
RI: Riparian		
		Ecosystems associated with and influenced by freshwater. Structural stages are useful modifiers.
RI	fh: high bench	High bench floodplain terraces.
RI	fm: medium bench	Medium bench floodplain terraces.
RI	fl: low bench	Low bench floodplain terraces.
RI	fd: disturbed floodplain	Floodplain ecosystems that are located on modified river banks. Do not necessarily flood, but contain important cottonwood stands and habitat.
RI	gu: gully	Gully riparian ecosystems occur at the base and lower slopes of moderate to steep-sided linear sites (small valleys or ravines) with significant moisture. These ecosystems have either permanent or intermittent surface water flow, or significant subsurface flow, but are usually not subject to flooding.

SEI Class	SEI Subclass	Brief Description
RI	gb: gravel bar	Non-vegetated gravel bars within the river high water mark.
RI	ri: river	River and creeks.
WN: Wetland		Terrestrial – freshwater transitional areas.
WN	ms: marsh	Graminoid or forb-dominated nutrient-rich wetlands.
WN	sp: swamp	Shrub or tree-dominated wetlands.
WN	ow: shallow water	Permanently flooded, water less than 2m deep at mid-summer.
WN	mo: modified	Modified wetlands (including non-native species such as maple or reed canarygrass) that still retain some wetland functions and processes.
FW: Lakes and Ponds		
FW	pd: pond	Open water > 2 m deep and generally < 50 ha.
FS: Seasonally Flooded Fields		Annually flooded cultivated fields, hay fields, range land, or old fields.
OD: Old Field		Old field ecosystems. May have evidence of old dirt roads and cultivation.
CF: Cultivated Field		Field currently or recently used for various types of agriculture.
NS: Not Sensitive		Disturbed and permanently developed/modified areas.

2.1 ECOSYSTEM MAPPING

Preliminary ecosystem mapping was completed during the summer of 2017 by City staff Rosemary Dykhuizen (Engineering Technologist) and GIS co-op student (Vidula Kalkarni). After field-truthing, the final version was created by Ryan Durand (EcoLogic).

Mapping was completed in ESRI ArcMap 10.5 using heads-up delineation. As the goal of the project was to identify all ecosystem types, a minimum polygon size or mapping scale was not used, rather they were adjusted to fit natural features as needed. Mapping procedures generally followed the protocol for Terrestrial Ecosystem Mapping (RISC 1998) and Standard for Mapping Ecosystems at Risk in British Columbia (RISC 2006), but was limited by the lack of stereo imagery. Base data used for the project was supplied by the City and included:

- ♦ a 2014 15-cm resolution orthomosaic;
- ♦ a 2005 orthomosaic; and
- ♦ LiDAR-derived hillshade, surface model, contours, and canopy height model.

Each ecosystem polygon included attributes describing the type of ecosystem (SEI class and, if applicable, subclass) that occurred (up to three types per polygon) and the approximate area of each ecosystem type. For example, a polygon code may appear as follows:

5MF:co - 3YF:co - 2WN:sp

The above SEI code can be broken down to describe the polygon as containing:

50% mature coniferous forest, 30% young coniferous forest, and 20% swamp.

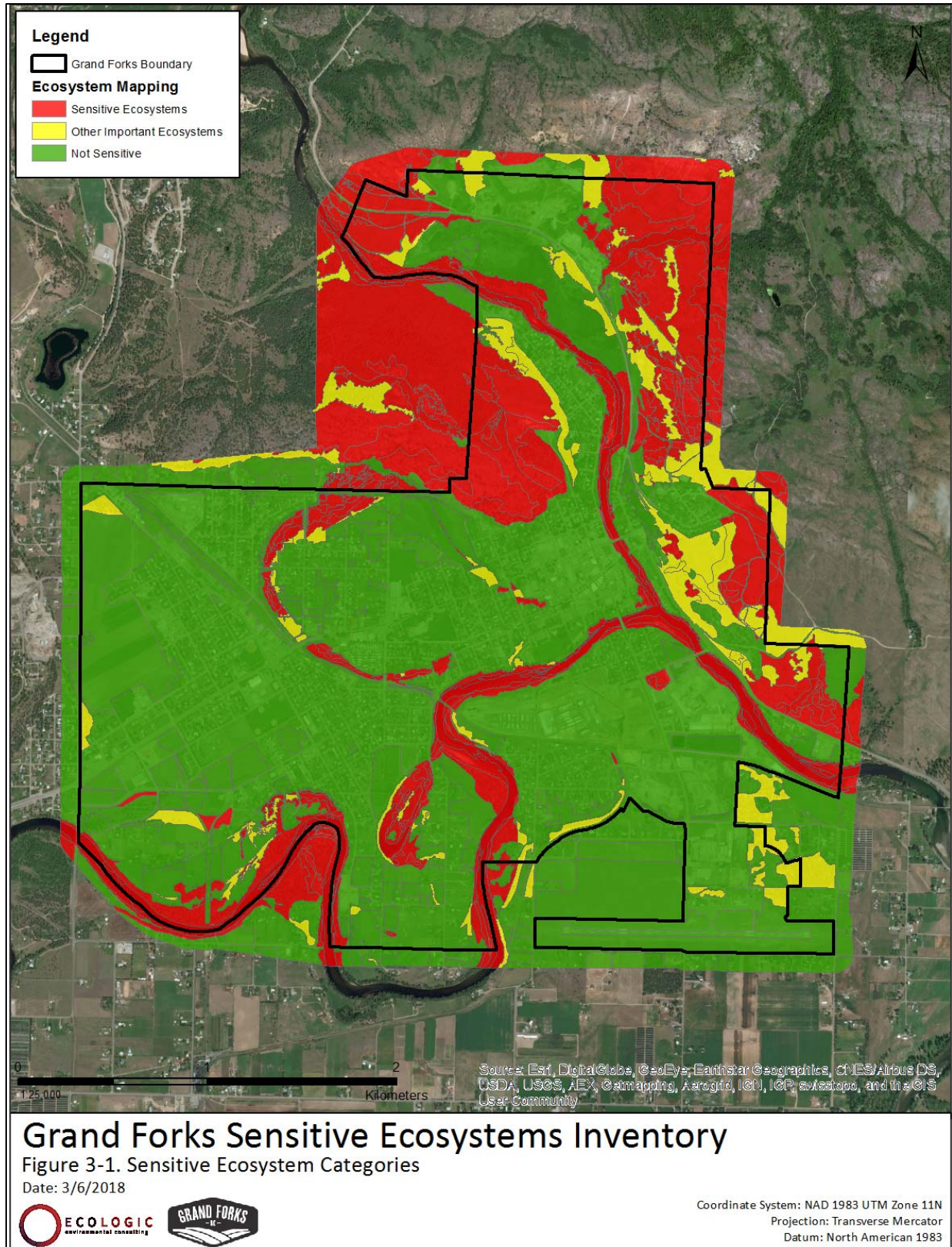
2.2 FIELD SURVEYS

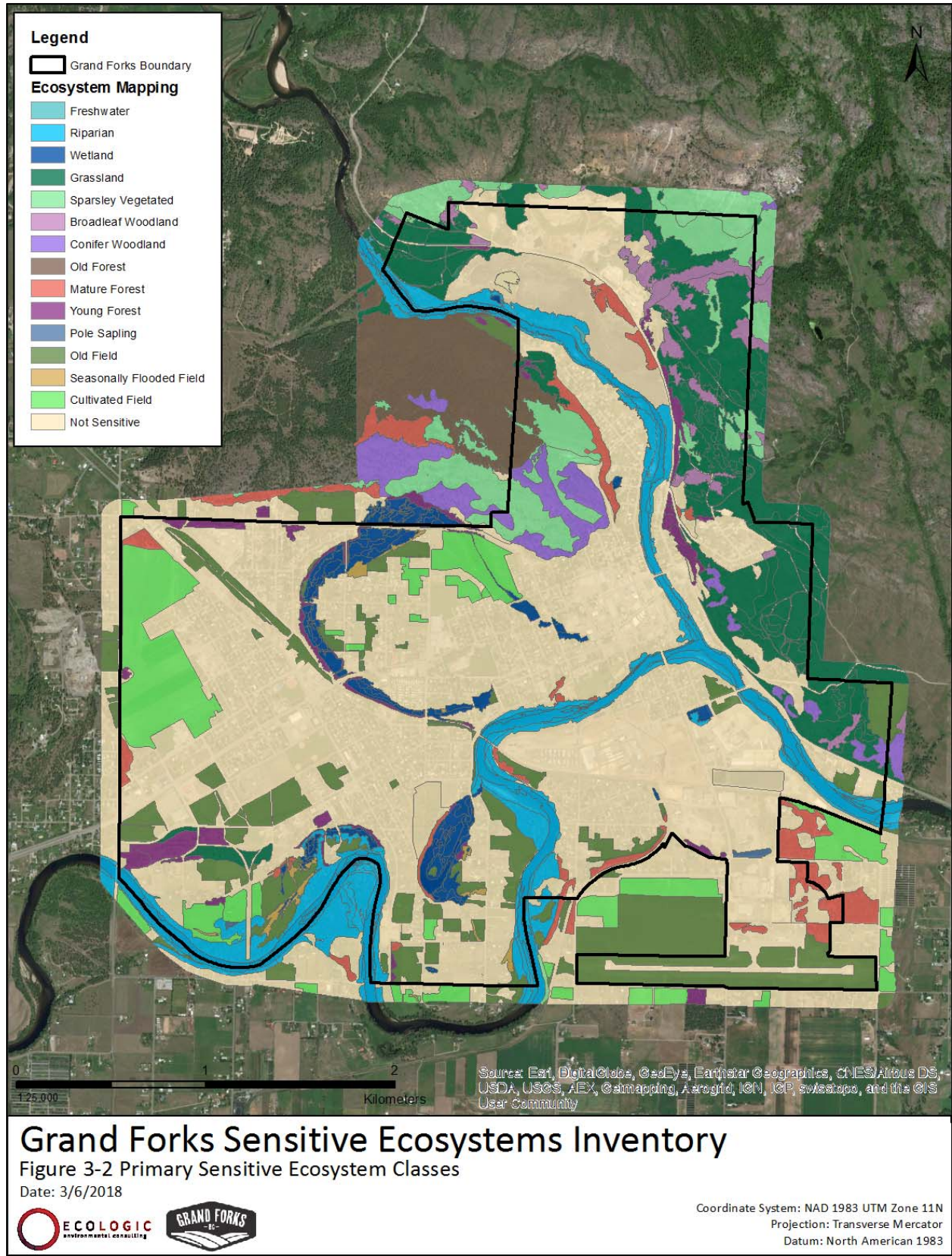
Field surveys were completed on July 20 and September 1, 2017. The surveys included site inspections of both representative ecosystem types and as large of an area possible within the City. Visual plots were completed at a total of 120 locations. The following data were collected in the field:

- ♦ location (UTMs);
- ♦ dominant vegetation type;
- ♦ SEI class and subclass;
- ♦ disturbance and condition notes;
- ♦ representative photos; and
- ♦ additional notes as necessary.

3. SENSITIVE ECOSYSTEMS INVENTORY CLASSIFICATION

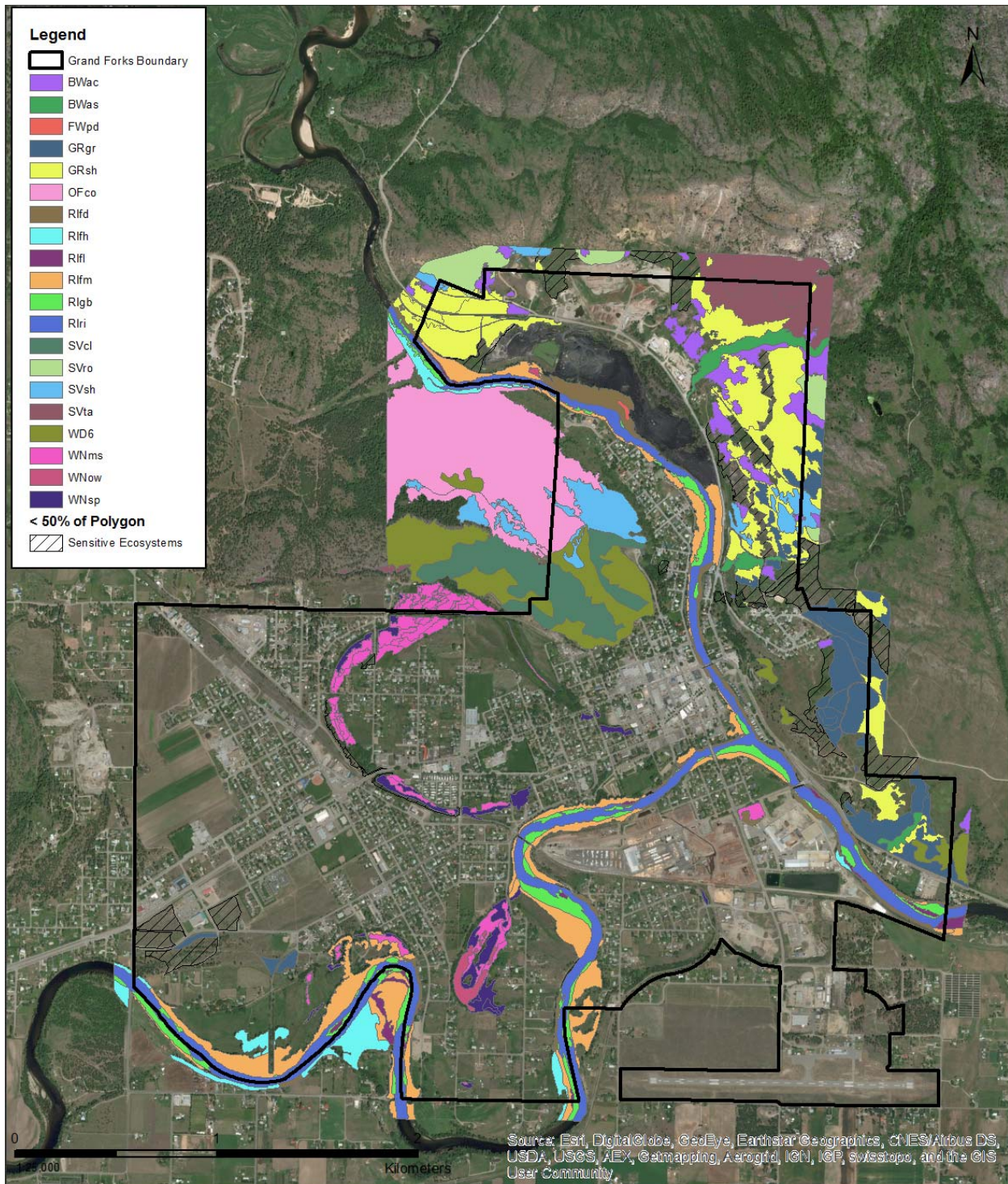
A final determination as to which mapped SEI classes and subclasses should be considered to be Sensitive Ecosystems (SE), Other Important Ecosystems (OIE), and Not Sensitive (NS) was completed based on other SEI projects and expert opinion (Fig. 3-1). The following sections indicate which classes and subclass were used in this project, and which ones fall into the SE, OIE and NS categories (Fig. 3-2).





3.1 SENSITIVE ECOSYSTEMS

Eight SEI classes are recognized as Sensitive Ecosystems in the study area (Table 3.1-1; Fig. 3.1-1). The classification is based on susceptibility to disturbance, high biodiversity and rare species potential, and the ecosystem services they provide.



Grand Forks Sensitive Ecosystems Inventory

Figure 3.1-1. Sensitive Ecosystems

Date: 3/6/2018



Coordinate System: NAD 1983 UTM Zone 11N
Projection: Transverse Mercator
Datum: North American 1983

Table 3.1-1. Sensitive Ecosystems

SEI Class	SEI Subclass	Brief Description
OF: Old Forest		Forests > 140 yrs.
OF	co: coniferous	Conifer > 75% of stand.
BW: Broadleaf Woodland		
BW	ac: aspen copse	Aspen copse ecosystems occur in broad, moist depressions in grassland areas. They are typically small ecosystems with trembling aspen overstories and shrubby understories dominated by common snowberry and roses.
BW	as: aspen seepage	Aspen seepage ecosystems occur on slopes with subsurface seepage in a matrix of coniferous forests. These ecosystems are moist and rich as a result of nutrient inputs from seepage and the annual input of leaf litter. They have trembling aspen overstories and diverse, shrubby understories.
WD: Woodland		Dry site, open stands with between 10 and 25% tree cover including Douglas fir and Ponderosa pine. Patchy shrubs such as Saskatoon and oceanspray are common. Often associated with rock outcrops and cliffs.
WD	6: mature forest	Trees are > 10 m tall and have 10% or greater cover, dominated by mature trees about 80-250 years old.
GR: Grassland		
GR	gr: grassland	Remnant native grasslands with bunchgrasses.
GR	sh: shrub	Dry shrublands – often patchy and interspersed with native and introduced grasses. Common species include snowberry, Saskatoon, rose and sumac.
SV: Sparsely Vegetated		Areas with 5 – 10% vascular vegetation.
SV	sh: shrub	Shrub ecosystems occur on small rock outcrops with cracks and crevices. They most commonly occur in a grassland matrix.
SV	cl: cliff	Steep slopes of exposed bedrock.
SV	ro: rock outcrop	Rock outcrops – areas of bedrock exposure.
SV	ta: talus	Dominated by rubbly blocks of rock.
RI: Riparian		Ecosystems associated with and influenced by freshwater. Structural stages are useful modifiers.
RI	fh: high bench	High bench floodplain terraces.
RI	fm: medium bench	Medium bench floodplain terraces.
RI	fl: low bench	Low bench floodplain terraces.

SEI Class	SEI Subclass	Brief Description
RI	fd: disturbed floodplain	Floodplain ecosystems that are located on modified river banks. Do not necessarily flood, but contain important cottonwood stands and habitat.
RI	gu: gully	Gully riparian ecosystems occur at the base and lower slopes of moderate to steep-sided linear sites (small valleys or ravines) with significant moisture. These ecosystems have either permanent or intermittent surface water flow, or significant subsurface flow, but are usually not subject to flooding.
RI	gb: gravel bar	Non-vegetated gravel bars.
RI	ri: river	River and creeks.
WN: Wetland		Terrestrial – freshwater transitional areas.
WN	ms: marsh	Graminoid or forb-dominated nutrient-rich wetlands.
WN	sp: swamp	Shrub or tree-dominated wetlands.
WN	ow: shallow water	Permanently flooded, water less than 2m deep at mid-summer.
FW: Lakes and Ponds		
FW	pd: pond	Open water > 2 m deep and generally < 50 ha.

3.1.1 Old Forest (OF)

Old Forests are stands that are greater than 140 years old. One sub-class is recognized: coniferous (OF:co). Old forests were only mapped on Observation Mountain and the classification was not confirmed in the field. There is an abundance of literature describing the ecological importance of old forests, including significant biodiversity, rare species, carbon storage, and unique wildlife habitat.

3.1.2 Broadleaf Woodland (BW)

Broadleaf Woodland (BW) are aspen-dominated ecosystems that are widespread on dry south- and western-facing slopes in the region. They typically occur as small patches in water-receiving areas, such as depressions, gullies, toes of slopes, and along watercourses. Trembling aspen forms a nearly continuous cover of typically even-aged trees, while thick understories of various shrubs are common. Two subclasses occur in the City: Aspen Copse (BW:ac) and Aspen Seepage (BW:as). Aspen Copses (Plate 3.1-1) occur in small patches, typically interspersed in larger grassland areas, while Aspen Seepages (Plate 3.1-2) normally occur associated with fluvial features (linear communities along small watercourses and seepage sites). Aspen Seepages have high shrub and herb diversity, due to increased soil moisture and nutrients.



Plate 3.1-1. Broadleaf woodland (BW:ac) aspen copse.



*Plate 3.1-2. Broadleaf woodland (BW:as) aspen seepage in the background, with
Not Sensitive disturbed areas in the foreground.*

3.1.3 Woodland (WD:6)

Woodlands are classified based on an open canopy cover (less than 25%) and their occurrence on dry, water shedding sites with thin soils. They occur on south- and western-facing slopes, interspersed with rock outcrops, cliffs and grasslands. Coniferous trees form the sparse canopy cover, including Douglas fir, Ponderosa pine and lodgepole pine. Understories are varied, with shrub species such as oceanspray common, along with a variety of grasses and herbs. Conifer woodlands are stereotypical fire-maintained ecosystems, with stand-replacing events commonly occurring.

One (of the four mapped WD subclasses) subclass is recognized as sensitive: mature (WD:6). Woodland forests are common in the Grand Forks area, often forming large stands on dry southern slopes (Plate 3.1-3). They have the potential to provide important ecological niches that other forest stands lack, are often inhabited by uncommon or rare species, and are generally sensitive to disturbance.



Plate 3.1-3. Mature woodland ecosystem (WD:6).

3.1.4 Grassland (GR)

Grasslands occur on dry, hot western and south slopes in the Grand Forks area. These sites are typically too dry and hot for trees to become widely established. Most grassland in the area has a significant disturbance history, including grazing, agriculture, fires, and an abundance of roads. Introduced and invasive species are abundant in local grasslands, with true remnant ecosystems uncommon near any developed areas. Two of the three grassland subclasses are considered to be sensitive; Grassland (GR:gr) and Shrubland (GR:sh).

Grasslands are uncommon in the study area, mainly occurring on mid to upper slopes above Valley Heights. They are patchy in occurrence, and additional field surveys will likely reduce the mapped extent (Plate 3.1-4). Bunchgrass is a key indicator of grasslands, along with a wide variety of native grasses and herbs. They are highly susceptible to disturbance and threatened by a variety of invasive species.

Shrubland occurs in areas that are slightly moister than adjacent grasslands, including slight depressions and the toe and lower slopes of water shedding sites (Plate 3.1-5). They are dominated by a high cover of shrubs, including snowberry, rose species, and sumac. Other shrubs occur sporadically, such as elderberry, Saskatoon, mock orange and the occasional conifer.



Plate 3.1-4. Remnant native grassland (GR:gr) with a shrub-filled depression below.



Plate 3.1-5. Dry shrub grassland (GR:sh) with a variety of low and tall shrubs and sporadic Douglas fir.

3.1.5 Sparsely Vegetated (SV)

Sparsely Vegetated ecosystems occur in bedrock and colluvial sites where soil and moisture are limited. Vegetation is sparse and discontinuous, with large extents of exposed bedrocks and talus (Plates 3.1-6 and 3.1-7). Four of the five SV subclasses are considered to be sensitive due to susceptibility to disturbance (and the long period of recovery post-disturbance) and the potential for unique wildlife habitat. Sensitive SV subclasses are shrub (SV:sh), cliff (SV:cl), rock outcrop (SV:ro) and talus (SV:ta).

Iverson and Cadrin (2003) describe the sensitive SV subclasses below:

“Shrub Ecosystems (SV:sh) occur on small rock outcrops with cracks and crevices. They most commonly occur in a grassland matrix. These ecosystems are often steep with soils restricted to small pockets. Scattered shrubs grow in cracks and cliff ferns often grow in small crevices.

Cliff Ecosystems (SV:cl) are steep, vertical cliffs, often found above talus ecosystems. Cliffs have minimal vegetation that is restricted to cracks and crevices, narrow ledges and small soils pockets. Shrubs typically occur in crevices and grasses and forbs occur in small soil pockets on ledges.

Talus Ecosystems (SV:ta) occur on steep slopes covered with angular rock fragments, usually below rock outcrops or cliffs. Soil is restricted to small pockets between rock

fragments. Vegetation usually includes scattered trees, shrubs and cliff ferns. Occasional grasses and forbs grow in soil pockets between rock fragments. Vegetation cover is higher on sites with smaller rock fragments where there is more soil.

Rock Outcrop Ecosystems (SV:ro) occur on areas of exposed rock that have very little soil development and sparse vegetation cover. Vegetation cover typically consists of bunchgrasses and scattered shrubs that are restricted to crevices and pockets of soil. These ecosystems are gently to steeply sloping, but are neither vertical (these are cliff ecosystems), nor dominated by shrubs (these are shrub ecosystems).”



Plate 3.1-6. Mosaic of sparsely vegetated ecosystems, including cliffs (SV:cl), rock outcrops (SV:ro) and talus (SV:ta), with mature conifer woodland (WD:6) above.



Plate 3.1-7. A small talus (SV:ta) slope below cliffs (SV:cl).

3.1.6 Riparian (RI)

Riparian Ecosystems are associated with and influenced by freshwater, generally along rivers, streams, and creeks, but for SEI, also include fringes around lakes. Ecosystems are influenced by factors such as erosion, sedimentation, flooding, or subterranean irrigation due to proximity to the waterbody. Riparian ecosystems form a transition zone between aquatic and terrestrial ecosystems and encompass areas (often linear) along creeks, streams, rivers and lakes that have more soil moisture, and therefore often have noticeably different vegetation, than the adjacent upland. They are subject to fluctuating water tables and flooding and the soils are usually nutrient-rich. Riparian ecosystems are also generally more humid and have greater air circulation than surrounding areas, resulting in a slightly different microclimate. Riparian ecosystems are well known to have significant ecological value, including high biodiversity and a wide variety of wildlife habitat (including the rare Lewis's Woodpecker in the City). They also provide important ecosystem services, such as flood control.

Seven subclasses are recognized in the study area: High Bench (RI:fh), Medium Bench (RI:fm), Low Bench (RI:fl), Disturbed Floodplain (RI:fd), Gully (RI:gu), Gravel Bar (RI:gb), and River (RI:ri).

Medium bench floodplains (RI:fm) are flooded every one to six years for short periods (10 to 25 days). They contain deciduous (mainly cottonwood) or mixed forest dominated by species tolerant of flooding and periodic sedimentation. Typical RI:fm in the study area are extents of young to mature cottonwood floodplains that occur along the majority of the Granby and Kettle Rivers. High bench floodplains (RI:fh) are periodically and briefly inundated by high waters, but contain lengthy subsurface flow in the rooting

zone. They are less common than RI:fm, and often contain a large component of coniferous trees. RI:fl are low bench floodplains that are flooded at least every other year for moderate periods of the growing season. They contain plant species adapted to extended flooding and scouring, typically low covers of shrubs such as willow and cottonwood (Plate 3.1-8; MacKenzie & Moran 2004, Metro Van Parks 2010).

Disturbed Floodplain (RI:fd) is a subclass that was created for this project. The Grand Forks area has a high number of riparian areas along the Granby and Kettle Rivers that have been modified in various ways. These areas include portions of dikes, rip-rap and old fill, and other disturbances. While modified, many of these areas contain ecosystems that are partially functional, and may be prime locations for future restoration.

Gully (RI:gu) ecosystems are typically linear communities that occur at the base of moderate to steep sides valleys and ravines. Permanent or intermittent watercourses that flow through the gullies result in continual soil moisture or seepages. Gullies can be highly productive and diverse relative to the typically dry, open landscape they occur within. In the Grand Forks areas they are limited in extent, occurring in areas otherwise dominated by grasslands and aspen copses.

River (RI:ri) includes large river ecosystems, excluding gravel bars, and smaller creeks and streams that are devoid of vegetation. Gravel Bars (RI:gb) are non-vegetated areas within the river that change on a yearly basis.



Plate 3.1-8. Low bench floodplain (RI:fl) in the foreground, with medium bench floodplain (RI:fm) behind.

3.1.7 Wetland (WN)

Wetland ecosystems are found where soils are saturated by water for enough time that the excess water and resulting low oxygen levels influence the vegetation and soil. The water influence is generally seasonal or year-round and occurs either at or above the soil surface or within the root zone of plants. Wetlands are usually found in areas of flat or undulating terrain. Three sensitive subclasses are recognized in the study area: marshes (WN:ms), swamps (WN:sp), and shallow water (WN:ow). (Metro Van Parks 2010)

Marshes (WN:ms) are characterized by permanent or seasonal flooding by nutrient-rich waters. They are dominated by sedges, cattails and rushes, often with one or two species forming the majority of the thick vegetative cover (Plate 3.1-9; MacKenzie & Moran 2004).

Swamps (WN:sp) are wooded wetlands dominated by 25% or more cover of flood-tolerant trees or shrubs. They are characterized by periodic flooding and nearly permanent sub-surface water flow through mixtures of mineral and organic materials; swamps are high in nutrient, mineral and oxygen content. While swamps occur in a variety of landscape positions, they are most often found in small depressions in level areas, and gently sloping toes along creeks and streams. They are highly variable, but typically contain thick shrub layers and an irregular tree canopy (MacKenzie & Moran 2004).

Shallow Water (WN:ow) wetlands are characterized by still or slow-moving water less than 2 m in depth in mid-summer. They are often transitional between deep water bodies and other wetland ecosystems (Plate 3.1-10). Vegetation is general limited to a few species of floating aquatic species (such as yellow pond lily and duckweed) and/or submerged aquatic species (MacKenzie & Moran 2004; Metro Van Parks 2010).



Plate 3.1-9. Cattail marsh wetland (WN:ms) is blue-listed in the region.



Plate 3.1-10. Typical wetland complex with Shallow Open Water (WN:ow) in the foreground, Marsh (Wn:ms) in the middle, and Swamps (WN:sp) in the background.

3.1.8 Freshwater (FW)

Freshwater ecosystems include bodies of water such as lakes and ponds that usually lack floating vegetation. One subclass was found in the study area; Freshwater Ponds (FW:pd). FW:pd are naturally occurring, small bodies of open water (ponds), greater than 2 m deep and generally less than 50 ha, with little to no floating vegetation (Plate 3.1-11).



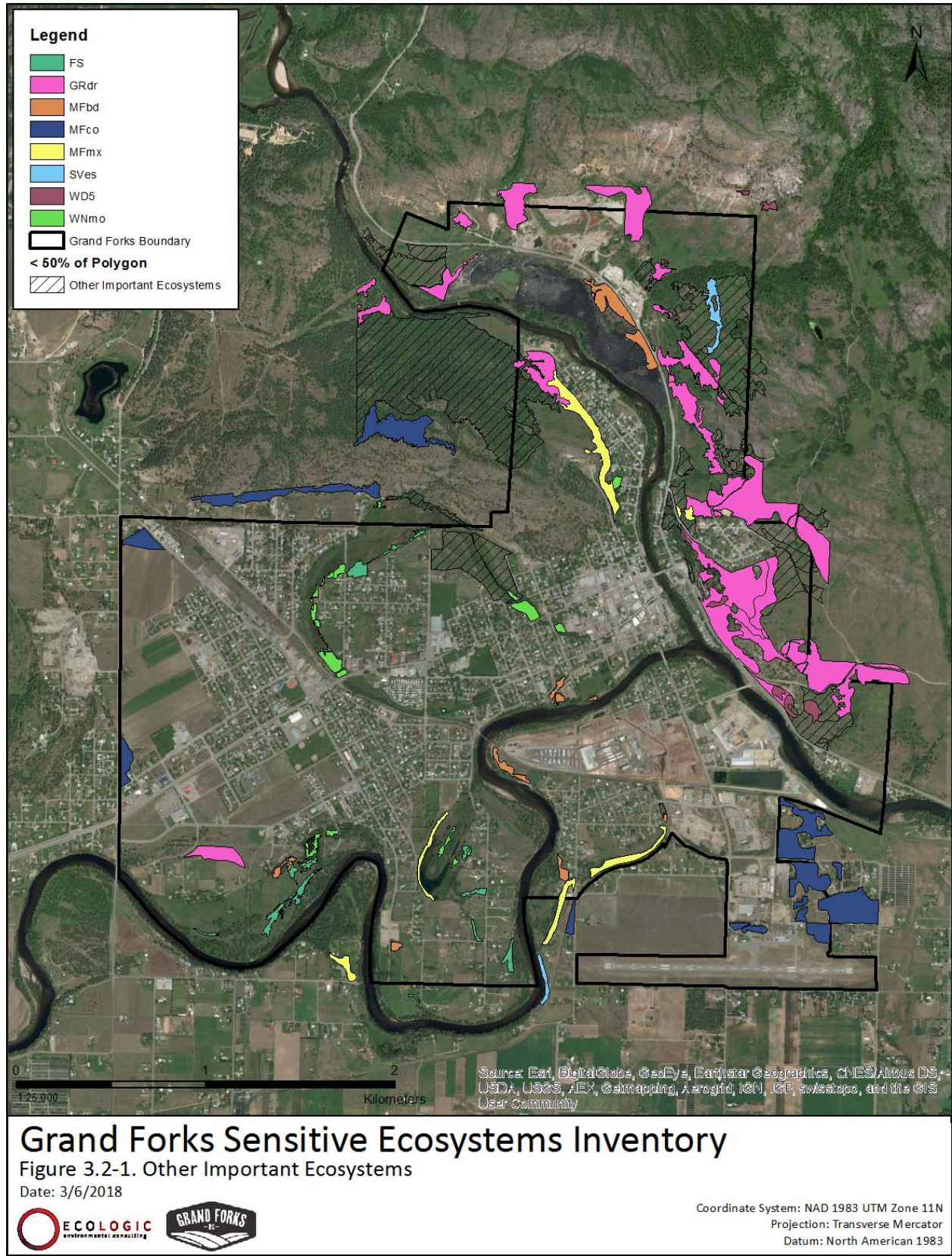
Plate 3.1-11. Freshwater Pond (FW:pd) with Shallow Open Water (WN:ow) and Marsh (WN:ms) in the background.

3.2 OTHER IMPORTANT ECOSYSTEMS

Other Important Ecosystems (OIE) are mapped to identify important elements of biodiversity or recruitment sites for ecosystems at risk or important wildlife habitat requiring recovery or restoration. While these areas are not currently considered to be sensitive, they may evolve (such as mature forests progressing to old forests) in the future to sensitive classes. They also may serve as important landscape level linkages to allow for the flow of genetic material. As the SEI system for the City continues to be developed and improved, some of the OIE classes may be changed to sensitive. Table 3.2-1 lists the SEI classes and subclasses that are considered to be OIE (Figure 3.2-1).

Table 3.2-1. Other Important Ecosystems

SEI Class	SEI Subclass	Brief Description
MF: Mature Forest		Forests > 80 yrs, < 140 yrs.
MF	co: coniferous	Conifer-dominated (> 75% of stand composition).
MF	mx: mixed	Stand composition > 25% conifer and > 25% broadleaf.
MF	bd: broadleaf	Broad-leaf dominated (> 75% of stand composition).
WD: Woodland		Dry site, open stands with between 10 and 25% tree cover including Douglas fir and Ponderosa pine. Patchy shrubs such as Saskatoon and oceanspray are common. Often associated with rock outcrops and cliffs.
WD	5: young forest	Trees are > 10 m tall and have 10% or greater cover, dominated by young trees about 40–80 years old.
GR: Grassland		
GR	dr: disturbed	Dry grassland with variety of introduced grass and herbs.
SV: Sparsely Vegetated		Areas with 5–10% vascular vegetation.
SV	es: exposed soil	Any area of exposed soil that is not in other definitions.
WN: Wetland		Terrestrial – freshwater transitional areas.
WN	mo: modified	Modified wetlands (including non-native species such as maple or reed canarygrass) that still retain some wetland functions and processes.
FS: Seasonally Flooded Fields		Annually flooded cultivated fields, hay fields, range land, or old fields.



3.2.1 Mature Forest (MF)

Mature forests are stands that are 80 to 140 years in age. Subclasses include coniferous (MF:co), mixed (MF:mx), and broadleaf (MF:bd). This forest type covers a small portion of the study area and contains significant wildlife habitat, floral diversity, and buffers to riparian areas. The more sensitive elements of these stands are included in various classes of the Sensitive Ecosystems (such as floodplains). While not considered to be sensitive ecosystems, mature forests are classified as OIE due to the many ecosystem services they provide, and as recruitment stands for eventual old forests.

3.2.2 Woodland (WD:5)

Young conifer woodlands (WD:5) occur in similar conditions as described in the SE Woodland section: generally hot, dry and rocky mountain slopes. Young stands are considered to be OIE as they may not have had time (post-disturbance) to develop important habitat features or rare species. Additional study is required to determine the actual extent of these communities (slow growth on many sites gives the impression of a young stand, but they may be older) and the ecological values they provide.

3.2.3 Grassland (GR:dr)

The Disturbed Grassland (GR:dr) subclass includes a wide variety of grassland communities. These communities are typically close to developed areas and roads, and likely were used as range land. They contain a wide variety of introduced and invasive grasses and herbs (Plate 3.1-12). While modified, these areas often contain a portion of the ecological services that the native grasslands provide (such as wildlife forage and snake habitat) and are susceptible to further disturbance.



Plate 3.1-12. Disturbed grassland (GR:dr) with a high cover of introduced grass and herbs.

3.2.4 Sparsely Vegetated (SV:es)

The Exposed Soil (SV:es) subclass of the Sparsely Vegetated ecosystem class was not field-verified, and is limited in extent. Naturally occurring exposed soils have minimal vegetation development and are highly susceptible to erosion and invasive species. In some landscapes they provide important niche wildlife habitat. This subclass has been placed in the OIE category until additional field studies can provide more information.

3.2.5 Wetland (WN:mo)

Modified wetlands (WN:mo) are common throughout the City. Two main types were observed: swamps that contained a large portion of introduced species, such as Norway maple (Plate 3.1-13), and marshes dominated by introduced or invasive grasses such as reed canarygrass and orchard grass (Plate 3.1-14) that occurred adjacent to developed and agricultural areas or in old riverine side channels. Modified wetlands often continue to provide important ecological services (such as water storage, and limited wildlife habitat), but contain reduced biodiversity. They are prime locations for ecological restoration.



Plate 3.1.13. Modified wetland (WN:mo) dominated by introduced and invasive grasses, with a native marsh (WN:ms) to the right.



Plate 3.1-14. Modified swamp wetland (WN:mo) that is dominated by introduced shrubs.

3.2.6 Seasonally Flooded Fields (FS)

Seasonally flooded fields are typically current or old agricultural or range land located on active floodplains. A portion of the area is expected to flood in any given year, resulting in the potential for abnormal vegetation or wildlife communities to develop or for temporary wildlife habitat to occur (Plate 3.1-15). These areas are not generally considered to be sensitive as they are highly disturbed or modified, but they are useful to separate as distinct ecosystem types for future analysis.



Plate 3.1-15. A Seasonally Flooded Field (FS) located next to a wetland complex.

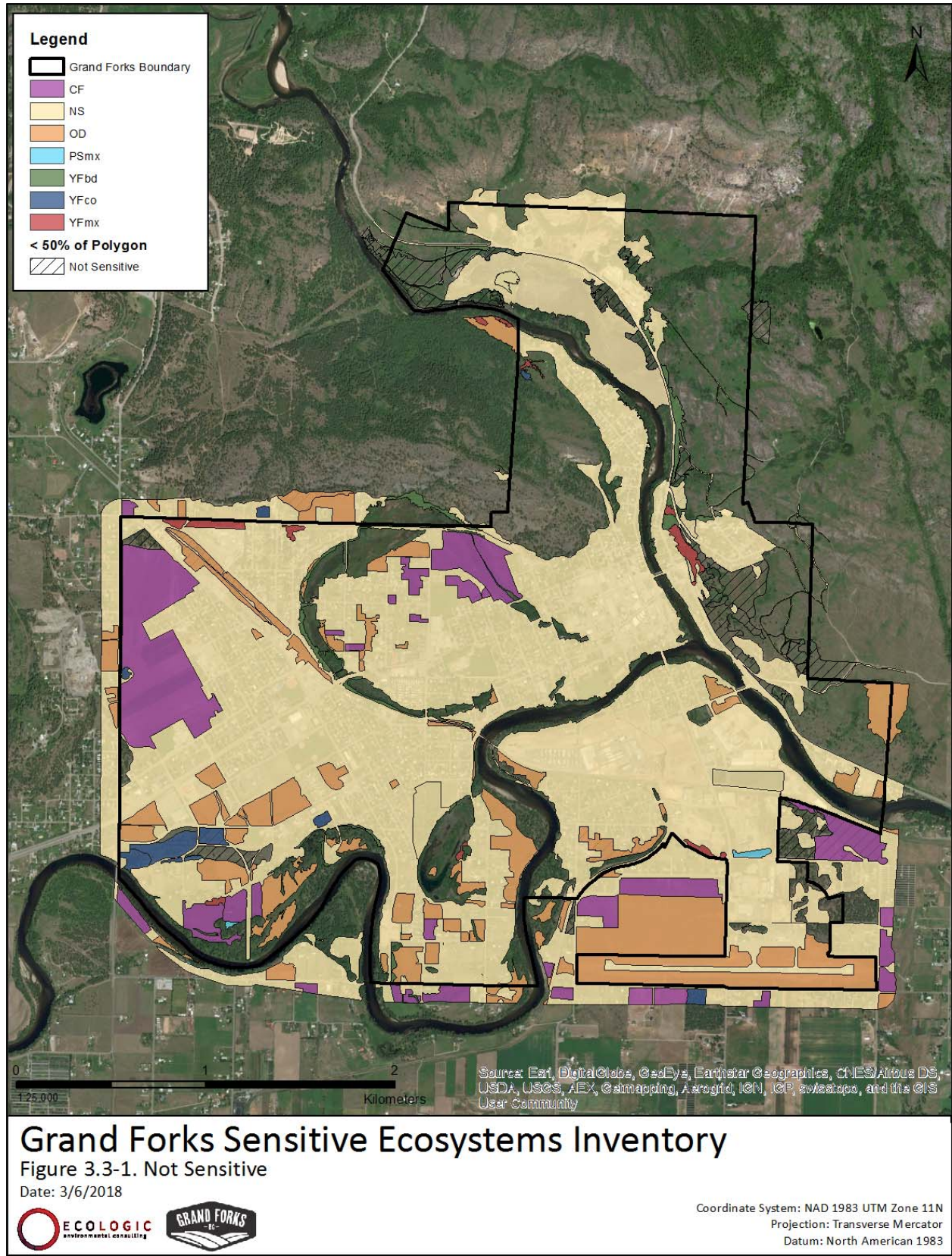
3.3 NOT SENSITIVE

Mapped areas that do not fall in the SE and OIE classes (primarily those with recent or permanent disturbances) are classified as Not Sensitive Ecosystems. The following section provides a brief description of each NS subclass (Table 3.3-1).

Table 3.3-1. Not Sensitive Ecosystems

SEI Class	SEI Subclass	Brief Description
YF: Young Forest		Patches of forest – stands > 30 yrs, < 80 yrs
YF	co: coniferous	Conifer-dominated (> 75% of stand composition)
YF	mx: mixed	Stand composition > 25% conifer and > 25% broadleaf
YF	bd: broadleaf	Broad-leaf dominated (> 75% of stand composition)

SEI Class	SEI Subclass	Brief Description
PS: Pole Sapling		Trees > 10 m tall, usually 10 - 15 yrs
PS	mx: mixed	Stand composition > 25% conifer and > 25% broadleaf
WD: Woodland		Dry site, open stands with between 10 and 25% tree cover including Douglas fir and Ponderosa pine. Patchy shrubs such as Saskatoon and oceanspray are common. Often associated with rock outcrops and cliffs.
WD	3: shrub/herb	Shrub cover 20% or greater, tree cover less than 10%
OD: Old Field		Old field ecosystems. May have evidence of old dirt roads and cultivation.
CF: Cultivated Field		Field currently or recently used for various types of agriculture.
NS: Not Sensitive		Disturbed and permanently developed/modified areas.



3.3.1 Young Forest (YF)

Young forest includes stands that are 30 to 80 years old. Subclasses include coniferous (YF:co), mixed (YF:mx) and broadleaf (YF:bd). In the study area, most young forests are the result of previous logging, clearing, or forest fires. They are not considered to be sensitive ecosystems as young forest generally do not contain attributes that are required for wildlife habitat, have limited vertical structure, and are often comprised of early successional species (with low biodiversity in general). Over time and in the absence of disturbance, these stands will develop into mature forests and develop attributes that may lead to greater importance and therefore sensitivity.

3.3.2 Pole Sapling (PS)

Pole sapling includes stands that are 10 to 15 years old and less than 10 m in height. One subclass was mapped in the study area: Mixed (PS:mx). Pole sapling ecosystems are early successional stages that occur as shrub- and/or herb-dominated areas begin to develop into forests. Biodiversity and wildlife habitat values are limited, and they typically have had recent significant stand level disturbances.

3.3.3 Woodland (WD:3)

Woodlands are classified based on an open canopy cover (less than 25%) and their occurrence on dry, water shedding sites, often with thin soils. The WD:3 (shrub/herb) subclass is assumed to be a post-disturbance site. While they may eventually develop into proper woodlands, the past disturbance limits the current ecological value.

3.3.4 Old Field (OD)

Old fields are generally dominated by a high cover of herbaceous species. These areas have persisted as fields for a significant period of time and may have higher than expected biodiversity and/or the potential for rare species. In the Grand Forks area, most old fields were dominated by a wide variety of introduced and invasive species. As such they are mapped as distinct ecosystem types, even though they are considered to be not sensitive.

3.3.5 Cultivated Field (CF)

Cultivated fields include areas that are currently or recently being used for agriculture. They are distinguished from old fields by obvious signs of plowing and established crops. They were mapped separately as they may turn into Old Fields in the future. Cultivated Fields are assumed to have little to no native species and low overall biodiversity.

3.3.6 Not Sensitive (NS)

Not sensitive includes any area with significant recent (such as logging) or permanent (such as roads, residential areas, etc.) disturbance. These areas are considered to have no significant ecological value in the landscape.

4. CONSERVATION MAPPING

In order to aid conservation planning, the SEI mapping was used to model the habitat suitability for Western Rattlesnake and Lewis's Woodpecker. These species were selected as they utilize different portions of the landscape, are rare species, and are well-documented to occur in the City. This modelling was completed to show the utility of the SEI mapping for future conservation-related projects. Any species or ecological value can be spatially assessed if a rank can be determined for a given ecosystem type.

For the two selected species, each SEI class and subclass was assessed by local biologist Jenny Coleshill (Granby Wilderness Society) using a four rank (Table 4-1) system (nil, low, medium, and high) for its suitability to provide features selected by the species for living (feeding, travel) and breeding (large cottonwood snags) or denning (rock and talus caves and crevasses; Table 4-2).

Table 4-1. Habitat Suitability Ranks

Value	Rank	Description
0	Nil	Habitat not used by species
1	Low	Limited potential use based on habitat present in the ecosystem type.
2	Medium	Moderate attraction to features present in the ecosystem type.
3	High	Species strongly attracted to the habitat for feeding or breeding (large cottonwood snags) or denning (rock and talus caves).

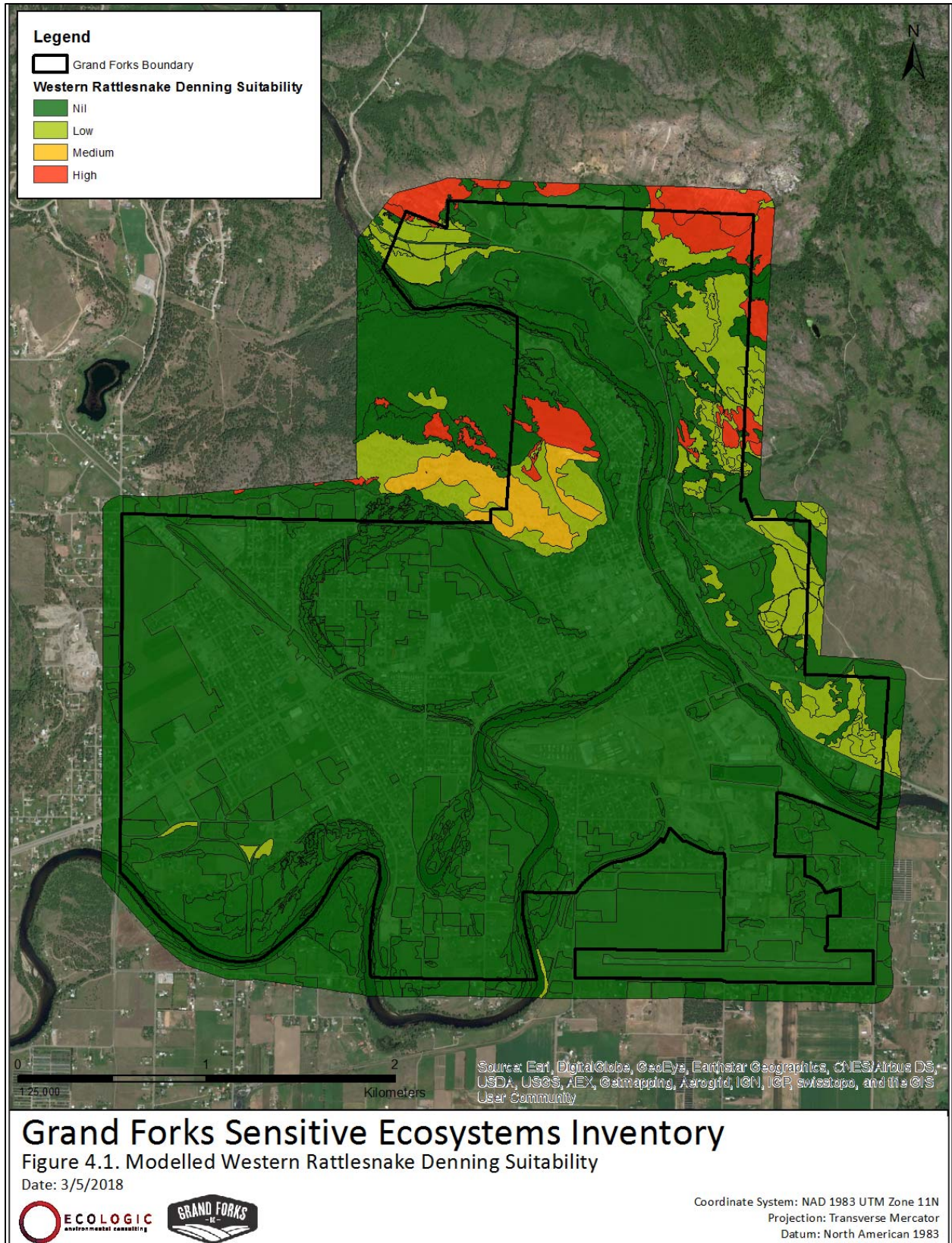
The result of this assessment is a simplistic model that does not take into account actual species occurrence data; rather it uses the ecosystem mapping to give an indication of where suitable habitat occurs. Figure 4-1 depicts Western Rattlesnake denning suitability and Figure 4-2 depicts the Western Rattlesnake living suitability, while Figures 4-3 and 4-4 present the Lewis's Woodpecker breeding and living suitability.

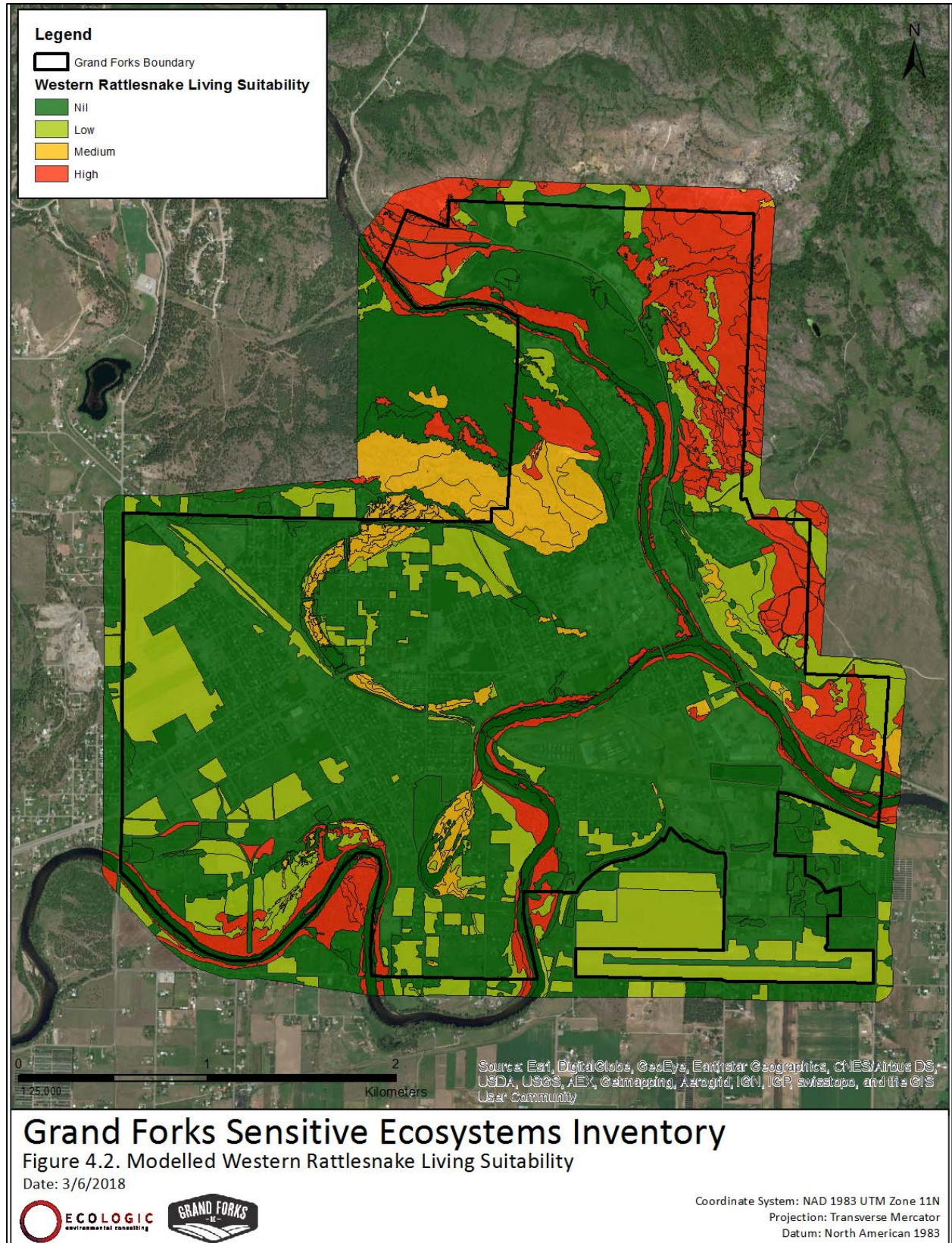
Table 4-2. Habitat Suitability Ranks for Western Rattlesnake and Lewis's Woodpecker

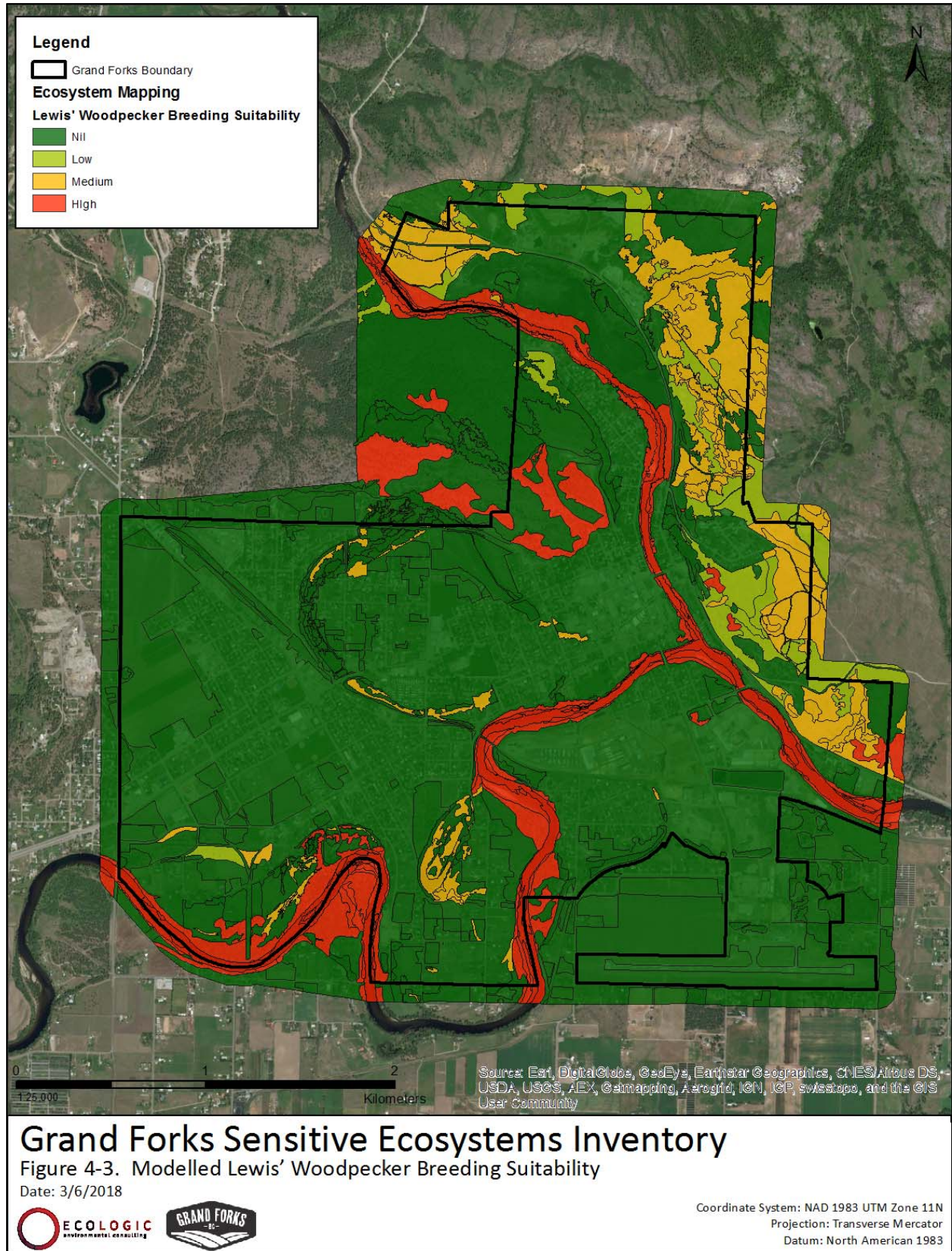
SEI Class	SEI Subclass	Lewis's Woodpecker		Western Rattlesnake	
		Living	Breeding	Living	Denning
OF: Old Forest					
OF	co: coniferous	0	0	0	0
MF: Mature Forest					
MF	co: coniferous	0	0	0	0
MF	mx: mixed	0	0	0	0
MF	bd: broadleaf	0	0	0	0
YF: Young Forest					

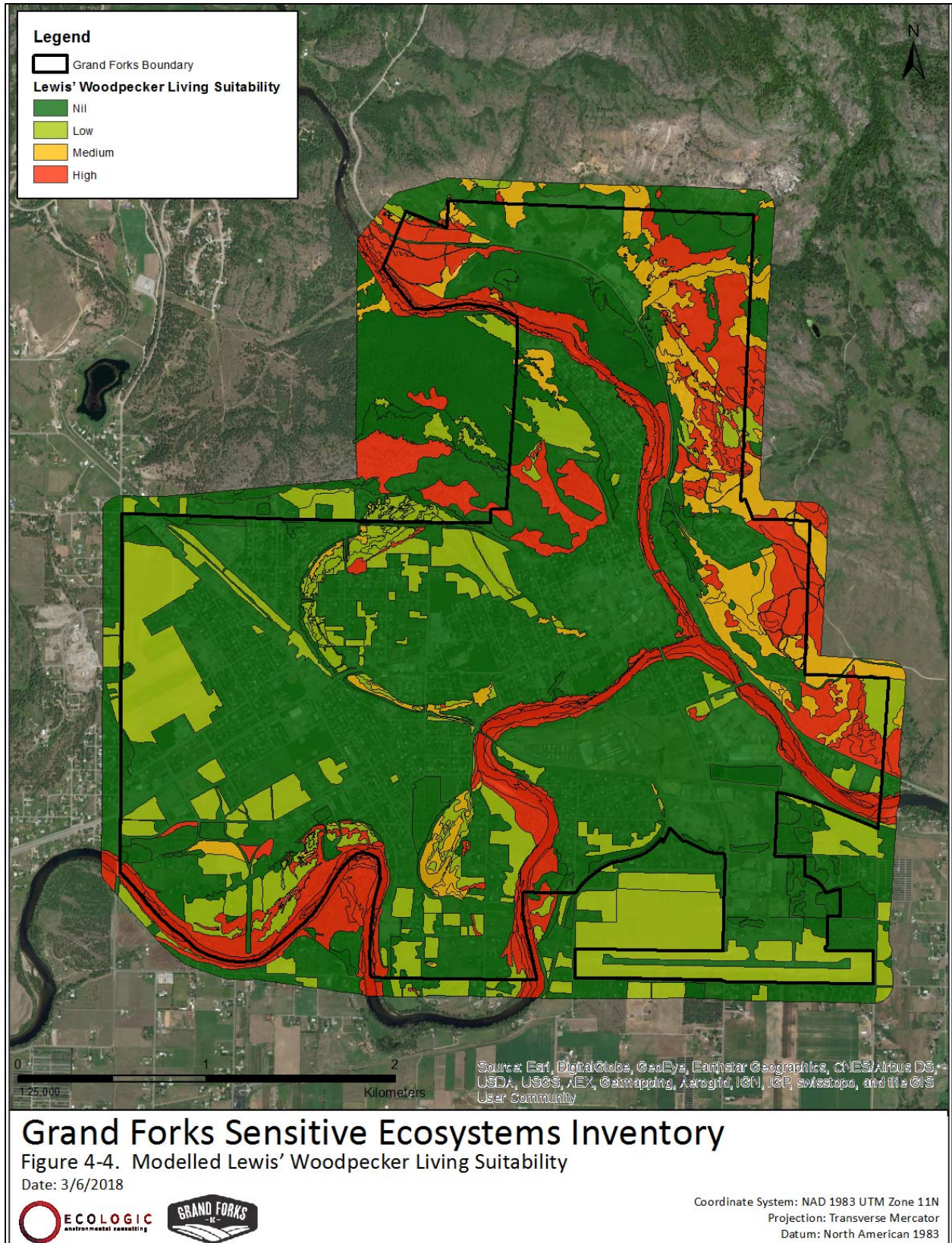
SEI Class	SEI Subclass	Lewis's Woodpecker		Western Rattlesnake	
		Living	Breeding	Living	Denning
YF	co: coniferous	0	0	0	0
YF	mx: mixed	0	0	0	0
YF	bd: broadleaf	0	0	0	0
PS: Pole Sapling					
PS	mx: mixed	0	0	0	0
BW: Broadleaf Woodland					
BW	ac: aspen copse	2	2	3	0
BW	as: aspen seepage	2	2	3	0
WD: Woodland					
WD	4: pole sapling	2	2	2	1
WD	5: young forest	2	2	2	1
WD	6: mature forest	3	3	2	1
GR: Grassland					
GR	gr: bunchgrass	3	2	3	1
GR	sh: shrub	3	2	3	1
GR	dr: disturbed	2	1	1	0
SV: Sparsely Vegetated					
SV	sh: shrub	1	0	3	3
SV	cl: cliff	0	0	2	2
SV	ro: rock outcrop	0	0	3	3
SV	ta: talus	0	0	3	3
SV	es: exposed soil	0	0	1	1
RI: Riparian					
RI	fh: high bench	3	3	3	0
RI	fm: medium bench	3	3	3	0
RI	fl: low bench	3	3	3	0
RI	fd: disturbed floodplain	3	3	3	0
RI	gu: gully	3	3	3	0
RI	gb: gravel bar	3	3	0	0
RI	ri: river	3	3	0	0

SEI ClassSEI Subclass		Lewis's Woodpecker		Western Rattlesnake	
		Living	Breeding	Living	Denning
WN: Wetland					
WN	ms: marsh	1	0	2	0
WN	sp: swamp	2	2	2	0
WN	ow: shallow water	2	2	0	0
WN	mo: modified	1	0	0	0
FW: Lakes and Ponds					
FW	pd: pond	0	0	1	0
FS: Seasonally Flooded Fields		3	2	1	0
OD: Old Field		1	0	1	0
CF: Cultivated Field		1	0	1	0
NS: Not Sensitive		0	0	0	0









5. RECOMMENDATIONS

This report presents an initial assessment of the sensitive ecosystems present in the Grand Forks area. While we believe it is an accurate representation of the study area, several improvements could be made:

- Additional field verification. Particularly in the grasslands and old forest ecosystems which were poorly inventoried. As well, site visits to private land were not included in this assessment, limiting field verification to visual observations from road sides.
- Full ecosystem classification. SEI is by nature a simplistic method of classifying ecosystems. It is designed as a communication tool to allow for relatively easy descriptions and presentation of what is normally much more complex ecosystem mapping (such as Terrestrial Ecosystem Mapping). For many sensitive ecosystem subclasses, a full ecosystem description to the Biogeoclimatic Ecosystem Classification (BEC) site series level would be ideal and enable the status (red and blue listed as per the BC Conservation Data Centre) of the ecosystems to be determined.

The conservation planning section presented in this report was intended to provide an example of what can be done with the SEI base layer. The two simplistic models illustrate how ecosystem data can be ranked and spatially portrayed to provide an idea of habitat suitability for two at risk species. The same approach can be taken with any species or other ecological value as per the interest of the final users.

Another conservation planning tool that could be created from these data is an Environmentally Sensitive Areas (ESA) assessment. An ESA moves beyond just the sensitive ecosystem classifications, to combine it with any other value of your choice. Using a value matrix, multiple disparate values can be combined into a single spatial product to help guide future conservation projects (such as parks, and potential locations for restoration), and provide input into appropriate locations for future development (such as the creation of environmental development permit areas).

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Personal Communications

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- Jenny Coleshill. January 2018. Granby Wilderness Society. Personal communication: Email and phone conversation regarding conservation planning.