



CITY OF SURREY

Anniedale-Tynehead NCP Area Wetland Inventory and Watercourse Assessment

October 2020 - Final - 20-2332

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Introduction

Dillon Consulting Limited (Dillon) was retained by the City of Surrey (the City) to conduct a wetland inventory and watercourse assessment within the Anniedale-Tynehead Neighbourhood Concept Plan (NCP) Area. Watercourses and wetlands within the Project Area were originally evaluated in 2009 as part of an overview environmental assessment of the area. The assessment was updated in 2012 as part of the NCP. Subsequent to the completion of the NCP, the Provincial *Water Act* became the *Water Sustainability Act* (WSA) in 2016 and the Provincial Riparian Areas Regulation was revised into the Riparian Areas Protection Regulation (RAPR) in 2019. Both of the WSA and the RAPR govern development in and around aquatic habitat. In addition, these pieces of legislation both have differing definitions for what constitutes a stream. As such, aquatic features may be managed differently under specific pieces of legislation. For example, the RAPR is specific to watercourses that are connected to the drainage network. However, the WSA considers wetlands to be ‘streams’ even if isolated.

In addition to the Provincial legislation described above, the City has also initiated a Sensitive Ecosystem Development Permit Area (SEDPA) process and implemented a Streamside Protection Bylaw, both of which inform development constraints in the vicinity of wetted features. Under the SEDPA process, Streamside Protection Areas are defined under Part 7A of the City’s Zoning Bylaw.

Given the varying approaches outlined in the above-described legislation specific to aquatic habitat, it is important to identify baseline conditions in order to inform future land use planning decisions. To support decision making and environmental protection, assessments of the aquatic features identified within the NCP Area were conducted in order to inventory them and identify their overall value. This information may also be used to update the City of Surrey Mapping Online System (COSMOS) website and assist the City in confirming that any proposed development is completed in compliance with current practice and based on the most up to date environmental conditions.

The objective of the wetland inventory and watercourse assessment for the Anniedale-Tynehead NCP Area included:

- Assessment of habitat identified on COSMOS to confirm watercourse classification;
- Determination if there is aquatic habitat currently unidentified based on a review of available background information supplemented by site assessment; and
- Determination of habitat value.

2.0 Methodology

The Project Area is located in northeast Surrey and is roughly bound by Highway 1/96th Avenue on the north, 92nd Avenue/90th Avenue alignment on the south, 168th Street on the west, and Harvie Road on the east (see **Figure 1**). Land use is a mix of low-to high-density residential, commercial, and light industrial. The Agriculture Land Reserve dominates the area to the south of the NCP Area.

The presence of potential wetlands, watercourses and roadside ditches within the NCP Area were identified through a review of available background information including:

- The watercourse classification layer on COSMOS;
- Available background reports, specifically the NCP and overview environmental assessment; and
- Aerial imagery interpretation, including air photos and LiDAR.

Additional detail on the methodology is provided in the subsections below.

2.1 Background Information Review

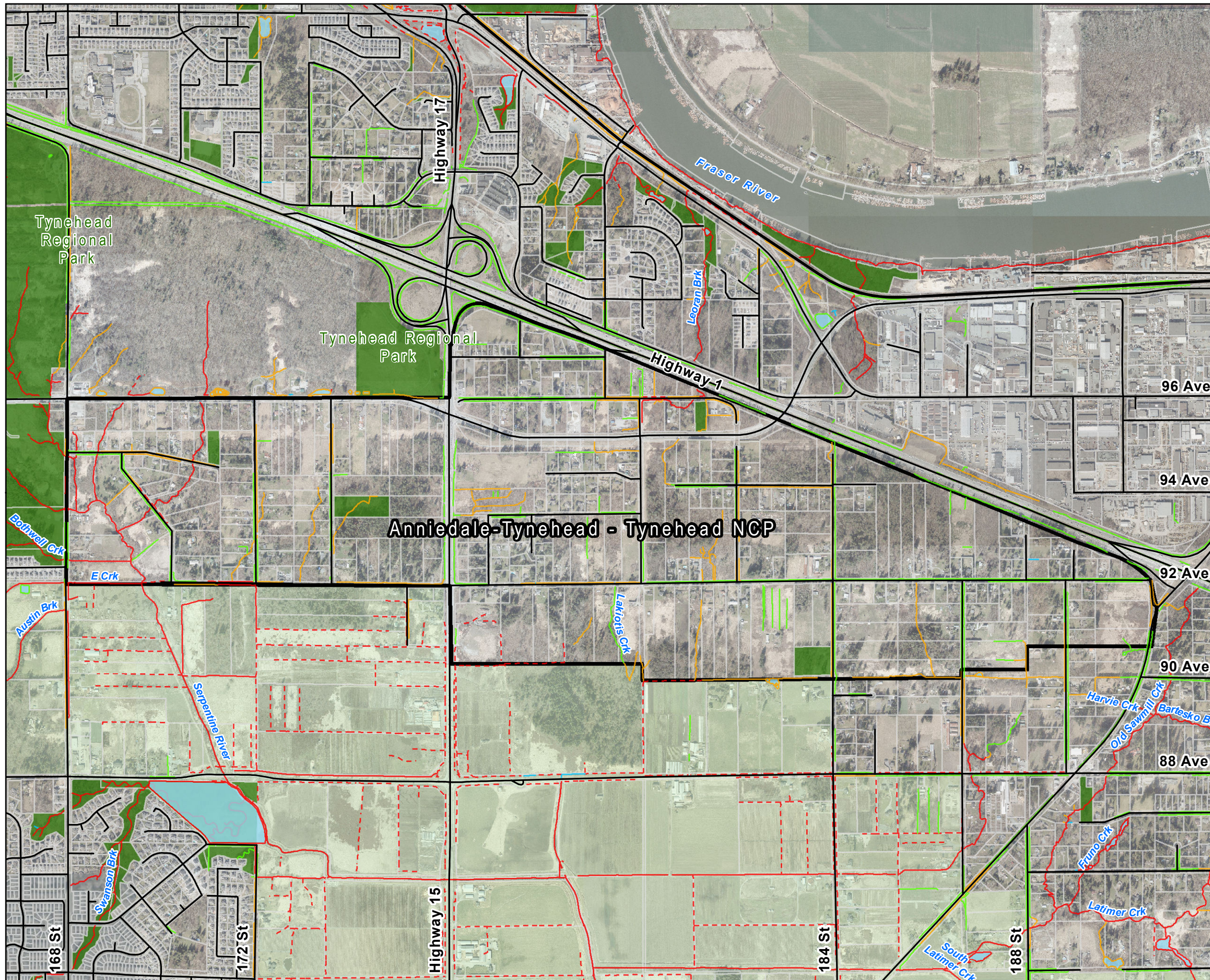
A review of background information provided by the City was completed in order to identify the locations of aquatic habitat within the NCP Area and, if possible, determine existing conditions. Key documents reviewed included:

- Anniedale-Tynehead NCP Area Overview Environmental Assessment (2009);
- Response to questions in focal areas 1-4 - Anniedale-Tynehead (2010); and
- Anniedale-Tynehead Neighbourhood Concept Plan (2012).

A detailed evaluation of available online ortho-imagery from COSMOS was also completed to determine potential areas of interest for the wetland inventory and watercourse assessments and to guide the field inventories. Ortho-imagery used included aerial photos from 2019, 2018, and 2016 as well as LiDAR from 2018 and 2017. The review of information on COSMOS also included evaluating existing fish classifications for watercourses with the NCP Area.

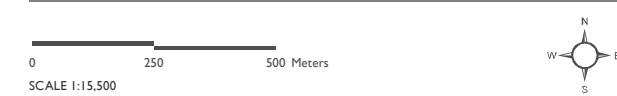
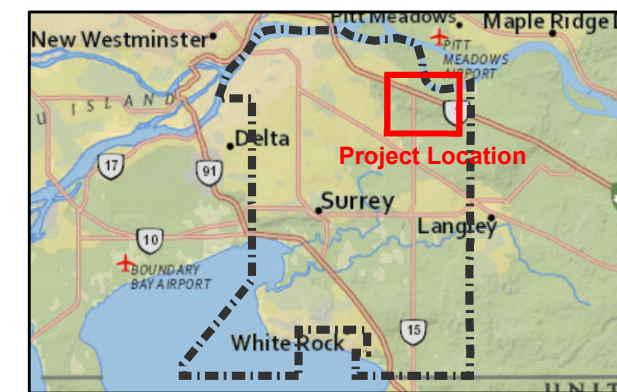
Given the size of the NCP Area and the potential for many wetted areas within the NCP Area to be considered wetlands, the City requested in late-January 2020 that an initial desktop evaluation be completed to determine “areas of interest” that have the potential to support a wetland ecosystem. Areas of interest, for the purposes of this assignment, include areas on properties within the NCP Area that support a wetland (i.e., confirmed through the wetland inventory) or areas that have the potential to support a wetland (i.e., were identified through the review of ortho-imagery and/or were not accessed as part of the wetland inventory). Information on the areas of interest will be used by the City in the development phase to identify the potential need of a Qualified Environmental Professional (QEP) to be retained for future wetland assessments. Additional information on the methods used for the wetland field inventory is provided in **Section 2.2**.

Figure I.
Project Area Location Map



LEGEND

- | | |
|--|---|
| Anniedale-Tynehead - Tynehead NCP Area | Fish Classification (Open Channel) |
| Parcel | Class A |
| Park | Class A(O) |
| Agricultural Land Reserve (ALR) | Class B |
| Road | Class C |
| Fish Classification (Waterbody) | Unknown |
| Class A | |
| Class A(O) | |
| Class B | |
| Class C | |



MAP DRAWING INFORMATION:
 DATA PROVIDED BY DILLON CONSULTING LIMITED,
 CITY OF SURREY

MAP CREATED BY: RBB
 MAP CHECKED BY: SW, LKD
 MAP PROJECTION: NAD 1983 UTM Zone 10N

2.2 Wetland Inventory

An initial background review identified several areas of interest within the NCP Area that warranted field assessments to confirm the presence of wetland ecosystems. In addition, areas of interest were identified through the watercourse assessment. A wetland inventory was conducted at each site/property within the NCP Area that was identified as an area of interest, where safe access allowed, to determine wetland presence.

For those sites/properties within the NCP Area where time or safe access did not warrant a full investigation to determine wetland presence, the site/property was identified as an area of interest and ranked as no, low, moderate, or high potential to support a wetland ecosystem. Definitions of the ranking are as follows:

- No potential – property without the potential to support wetland ecosystem.
- Low potential – property has no obvious wetland indicators; however, the presence of water features within or near the property boundaries may promote wetland development.
- Medium potential – property contains wetland indicators, including vegetation characteristics and/or hydrological features suggestive of supporting wetland ecosystems.
- High potential – property contains obvious wetland indicators and a full wetland assessment of both soil and vegetation not completed due to access and timing constraints.

The wetland inventory was initiated by Dillon following the mail-out to local residents conducted by the City. Dillon subsequently conducted assessments from accessible public property (roads and rights-of-way) and with permission from local property owners. Wetland assessments were completed on February 19, 20, and 25, and March 6, 2020. Wetland Classification and type was determined through vegetation assemblages, substrate, presence of inflow and outflow channels, estimated size, depth of water, and landscape position. The purpose of the wetland inventory was to confirm the presence of wetlands within the NCP Area and provide high level habitat characteristics of wetland ecosystems, where possible.

It should be noted that properties or areas within the NCP Area identified as confirmed wetlands represent preliminary information on the presence and location of wetland ecosystems. Confirmed wetlands, including the descriptions and locations outlined in this report, are intended to present preliminary information on wetland presence for land use planning purposes and to identify locations that require further detailed vegetation, soil, and hydrologic evaluation. The wetlands presented in this report will require site-specific assessments by qualified professionals to determine location and extent of wetlands and the potential application of provincial legislation, such as the RAPR and the WSA.

2.3 Watercourse Assessment

Two biologists conducted field assessments of the watercourses within the Anniedale-Tynehead NCP Area on February 18, 20, 21, and 24, 2020. Values assessed for each watercourse included channel morphology, the presence/absence of emergent aquatic vegetation, extent and composition of riparian vegetation, presence of flow or connection to source of groundwater, and connectivity to known fish-occupied watercourses. The observations collected were then analyzed to determine whether each watercourse met the definition of a stream per the WSA. Under the WSA, a stream is defined as:

- (a) *a natural watercourse, including a natural glacier course, or a natural body of water, whether or not the stream channel of the stream has been modified, or*
- (b) *a natural source of water supply, including, without limitation, a lake, pond, river, creek, spring, ravine, gulch, wetland, or glacier, whether or not usually containing water, including ice, but does not include an aquifer.*

In April 2020, the City updated the watercourse classification system to match current regulations (A. Doiron, pers. comm., April 2020). The updated classification system, used to direct the field assessments within the NCP area are outlined below:

- Class A – Inhabited by fish year round or potentially inhabited by fish year round. Considered ‘streams’ as defined by the Provincial *Water Sustainability Act* and Riparian Areas Protection Regulation. Considered fish habitat as defined by the Federal *Fisheries Act*.
- Class A(O) – Inhabited by fish primarily during the over-wintering period or potentially inhabited by fish during the over-wintering period with access enhancement. Considered a ‘stream’ as defined by the Provincial *Water Sustainability Act* and Riparian Areas Protection Regulation. Considered fish habitat as defined by the Federal *Fisheries Act*.
- Class B – Provides food/nutrient value to downstream fish habitat. No fish potential present at any time of the year. Considered a ‘stream’ as defined by the Provincial *Water Sustainability Act* and Riparian Areas Protection Regulation. Considered fish habitat as defined by the Federal *Fisheries Act*.
- Class C – A water feature that is not considered a ‘stream’ as defined by the Provincial *Water Sustainability Act* and Riparian Areas Protection Regulation. Not considered fish habitat as defined by the Federal *Fisheries Act*. No fish potential present at any time of the year.

The City’s new definition of a Class C water feature has been updated to more clearly indicate that it is not protected by any provincial, federal, or municipal regulation (A. Doiron, pers. comm., April 2020).

If the watercourse met the requirements of a ‘stream’ per the WSA, the characteristics of the watercourse were then used to determine whether the current assigned classifications (as labelled in COSMOS) was accurate or, if no classification had been assigned, to determine which class to assign. It

should be noted that there was an absence of significant rain during the assessment; however, the assessments were initiated approximately one week after a very large rain event.

Watercourses connected to confirmed wetlands and/or areas of interest have been considered Class B per WSA and RAPR definitions of a stream. Further detailed assessments are required to confirm the connectivity of wetland ecosystems, whether confirmed or areas of interest, to watercourses and the potential application of WSA and RAPR requirements.

2.4 Roadside Ditch Assessment

A Dillon Biologist completed the roadside ditch assessments on February 27 and 28, 2020. These assessments were completed via a roadside pedestrian survey. Values assessed are the same as those outlined in **Section 2.3** with particular focus on connectivity to known fish-bearing streams. The roadside ditch assessment was completed after five days of light rain in the previous 5-day period.

In-situ water quality data (dissolved oxygen, pH, temperature, conductivity, and turbidity) was collected with a YSI ProDSS multi-meter which was professionally calibrated prior to each use. Two test pit investigations were completed in ditches identified as D23 and D38 to determine if there was groundwater penetration and whether or not the soils were “gleyed”, a soil characteristic of wetlands. Each test pit was excavated by hand to an approximate depth of 0.2-0.3 m. These test pits are labeled as W13 and W14, as described in **Table 1**.

Similar to the watercourse assessments, the ditches were identified using the City’s recently revised classification system and the current definition of a stream under the WSA.

Table 1: Confirmed Wetlands within the Anniedale-Tynehead NCP Area

| Wetland Site ID | Address | Wetland Presence Confirmed (yes/no) | Soil Sampling Conducted (yes/no) | Outflow / Inflow | General Characteristic on Vegetation and Location |
|-------------------|-------------------------------------|-------------------------------------|----------------------------------|--|--|
| W1 | 16842 96 Avenue and 9542 168 Street | Yes | Yes | Overland flow is from north to south, shedding to Class A watercourses to the southeast and southwest. | Swamp and marsh wetlands confirmed through wetland assessment conducted for another project. Vegetation including many pockets of sedge, soils, and water level confirms a wetland across the southwestern portion of 16842 96 Avenue and eastern portion of 9542 168 Street, from the house to the east property line. |
| W2 | 16836 94A Avenue | Yes | No | Class A channel. | Swamp on bench along eastern edge of deep, sluggish channel. Vegetation is typical of swamp with willow, hardhack, western redcedar and deciduous snags. |
| W3 | 16836 94A Avenue | Yes | Yes | Overland flow with possible connectivity to Class A channel. | Reed canary grass field with pockets of standing water in small depressions. Wetland confirmed in one location (hydric soils) and could be extensive. |
| W4 | 16873 94A Avenue | Yes | No | Yes, Class A stream flows through broad channel. | Broad, open channel north of 94A Avenue. Small patches of common cattail with reed canary grass and Himalayan blackberry. Areas of common cattail represent marsh along the broader portions of the channel. |
| W5 / Right-of-Way | 9233 173A Avenue | Yes | No | Class B channel. | Forested lot with Class B channel that appears to flow south. Skunk cabbage in small swamp wetland at southeastern corner. Large forested area north and east, adjoining this area contains black cottonwood, many small 2 to 4 m western redcedar, salmonberry, osoberry and piggy-back plant. Small creek shallowly incised suggests potential off-channel wetlands. Rootwad excavation pools from felled trees are present. |

| Wetland Site ID | Address | Wetland Presence Confirmed (yes/no) | Soil Sampling Conducted (yes/no) | Outflow / Inflow | General Characteristic on Vegetation and Location |
|-------------------|------------------|-------------------------------------|----------------------------------|--|---|
| W6 | 9244 173A Avenue | Yes | No | Groundwater or flow from open Class B channel north on 173A Street not visible. Outflow to Class B ditch on 92 Avenue. | Small wetland at southern end of property. Small shallow water wetland ringed by a narrow band of red alder, osoberry, salmonberry, Himalayan blackberry, small western redcedar, and reed canary grass. Yellow flag iris grows in the shallow water. |
| W7a W7b W7c | 9126 176 Street | Yes | Yes | Yes, flow through large, sluggish AO channel (7a). North pockets of common cattail marshes are not channelized but in depressions west of a north-south channel along the east property boundary (7b, 7c). | W7a: Along the south border of the property. Swamp and marsh "spill" onto property from the A(O) channel to the south. Vegetation includes western redcedar, paper birch, red-osier dogwood, hardhack, Himalayan blackberry, small-flowered bulrush, grasses, and creeping buttercup. Wetland confirmed from vegetation and water levels. W7b and W7c: Two small common cattail marshes are present amongst reed canary grass north of the boundary along the west edge of the east border. Small-flowered bulrush and forget-me-not are also present. |
| W8 | 17734 92 Avenue | Yes | No | No distinct outflow channel. Inflow from diffuse seepage along the steep north bank with scouring rush. | Water-filled bowl in dense forest. No aquatic plants noted in open water. Surrounded by mature and young, regenerating western redcedar, red alder, salmonberry, English ivy, common periwinkle, and scouring rush which is abundant on north seepage slope. Wetland condition looks poor, age unknown. |

| Wetland Site ID | Address | Wetland Presence Confirmed (yes/no) | Soil Sampling Conducted (yes/no) | Outflow / Inflow | General Characteristic on Vegetation and Location |
|-----------------|---|-------------------------------------|----------------------------------|---|--|
| W9 | 18044 96 Avenue (north of 96 Avenue) | Yes | Yes | Class A ditch on north and west sides of property, potential seepage or overland flow from smaller Class B channels that convey flow to Class A channel. | Reed canary grass wetland present in northern portion of property and site, north of Golden Ears Way. Hydric soils with gleying and mottling <30 cm. In a hardhack thicket at the south end of the site, soils were coarse (sand) to about 80 cm, with less distinctive hydric features (orange with some gleying). |
| W10 | 18067 92 Avenue 18080 / 18086 94 Avenue 18044 96 Avenue (southern half from 96 Avenue) | Yes | No | Inflow is uncertain and possibly from multiple channels or broad, diffuse flow. None are indicated on COSMOS. Outflow is through a Class B stream through dense natural vegetation, including mature western redcedar, south into developed properties. | Large wetland (approximately 60 m x 100 m) of (mostly) swamp with shrubs, trees and small areas of shallow water. Wetland spans at least 4 properties. Vegetation includes black cottonwood, paper birch, western redcedar, salmonberry, hardhack, red-osier dogwood, slough sedge, sword fern, salal ("island"), willow species, and English ivy. Recently felled large black cottonwood (rootwad excavation) and numerous snags throughout. Vegetation and water levels confirm wetland. |
| W11 | 9307 184 Street | Yes | No | No obvious inflow or outflow; drainage channel appears isolated on property. | Small slough sedge marsh (approximately 30 m ²) in black cottonwood stand along drainage at northeast corner of property. |

| Wetland Site ID | Address | Wetland Presence Confirmed (yes/no) | Soil Sampling Conducted (yes/no) | Outflow / Inflow | General Characteristic on Vegetation and Location |
|-----------------|------------------------------------|-------------------------------------|----------------------------------|--|--|
| W12 | 9075 Harvie Road | Yes | No | Yes. Class B channel flowing through broad draw. | Swamp along sluggish channel in broad draw. Vegetation includes hardhack, red-osier dogwood, Pacific willow (few), common rush, grass (<i>Poa</i> sp.). Channelized draw and wet depressions north of this swamp have high wetland (marsh) potential. Vegetation is predominantly common rush and creeping buttercup. Other depression areas of the field may be reed canary grass marsh. |
| W13 | 9356 176 Street (west side) | Yes | Yes | Yes. Class B channel flows located in ditch. | Wetland confirmed within ditch along east side of 176 Street. Standing water and adjacent grasses. Watercourse classification has been upgraded to Class B (see C13, Table 3 for more details). |
| W14 | 18974 92 Avenue (northeast corner) | Yes | Yes | Yes. Class B channel flows in ditch. | Wetland confirmed within ditch along south side of 92 Avenue. Grasses and common cattail present. |

3.0 Results

This section presents the results of the background review and field assessment. Discussion is provided separately for each of the wetlands, watercourses, and roadside ditches. However, it should be noted that in some cases, a particular wetted feature displayed characteristics of several of the categories (e.g., a roadside ditch with wetland vegetation). In these cases, the feature in question is discussed in both sections.

Section 3.1 outlines the results for wetlands, both confirmed and areas of interest that may support wetlands not identified during the background review or field assessment. Classifications for watercourses and roadside ditches are presented in **Sections 3.2** and **3.3** respectively. The results of the investigation are presented in a series of tables indicating current classification (if any) and recommended classification based on observed site conditions.

As indicated previously, the results are meant to confirm classification and outline habitat values to assist the City with future planning specific to the constraints resulting from the presence of aquatic habitat.

3.1 Wetland Inventory

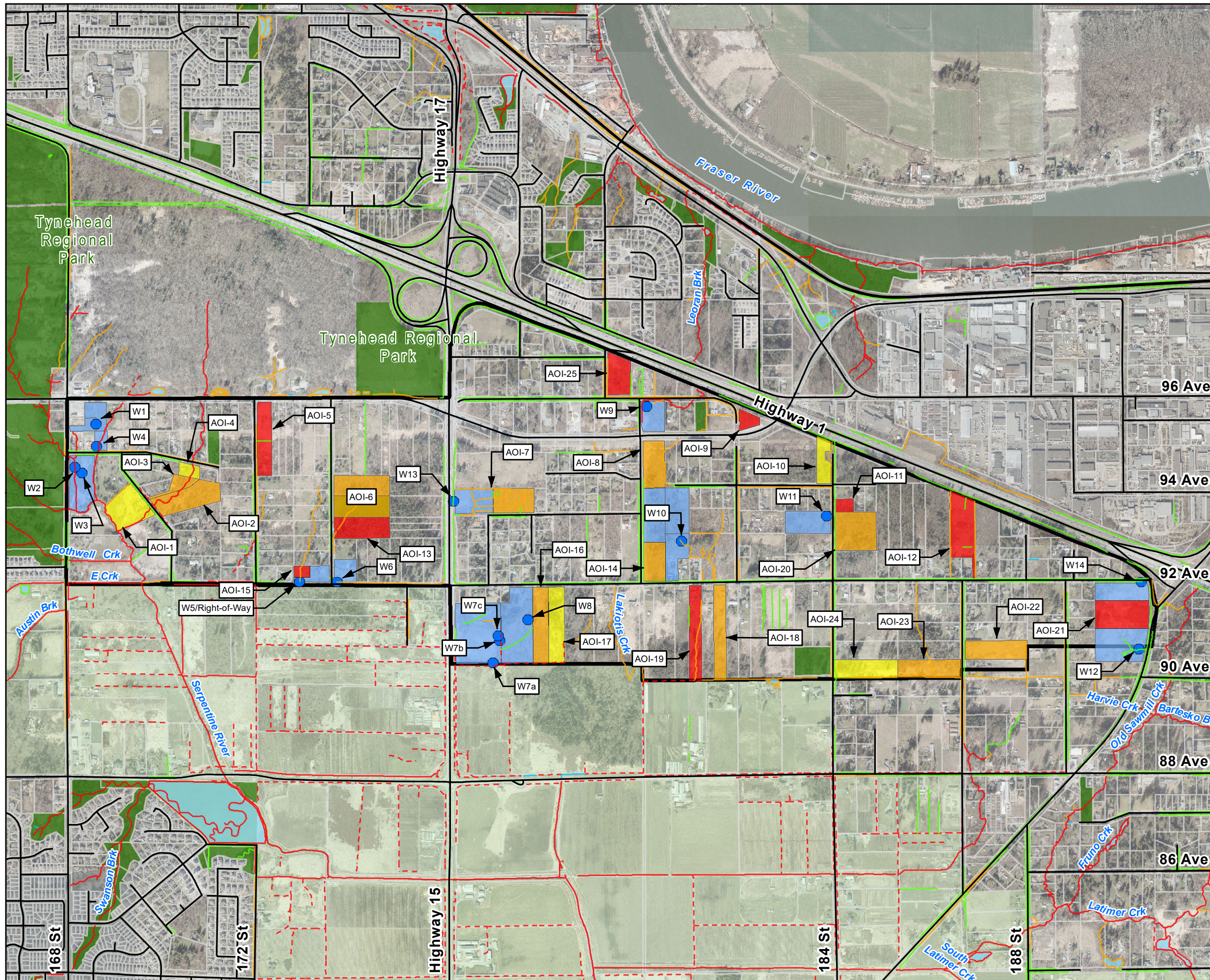
Wetlands develop where water is present long enough and frequently enough to create conditions of low oxygen that influence the development of soils and plants. In urban and rural environments, wetlands occur in a variety of locations, not all of which are expected. They may not match standard concept of wetlands. Some are easy to recognize; others are not. The expectation is to find wetlands in remnant natural areas, as was observed during the wetland inventory; however, wetlands were also observed in ditches, fields, and along benches of creek channels. Despite their various states, many are valuable ecologically and they all fall under the definition of stream per the WSA.

Fourteen wetlands were confirmed to be present within the NCP Area through the wetland inventory field assessment (**Section 3.1.1**). Twenty-five sites were identified as areas of interest and their potential to support wetland ecosystems was ranked (**Section 3.1.2**). The sites/properties within the NCP Area with confirmed wetland presence and those identified as areas of interest are indicated in **Figure 2**.

3.1.1 Confirmed Wetlands

Confirmed wetlands were identified across several sections of the NCP Area, including remnant forests, depressions in fallow fields, flooded sections along creeks, and in level portions of ditches from which water does not drain. Some were determined from aerial imagery through COSMOS; however, some areas, particularly those in forested areas, were often only identified during the wetland inventory field assessment. The results presented in **Table 1** outline information for each confirmed wetland within the NCP Area. **Photos 1 to 4** provide examples of confirmed wetlands.

Figure 2.
Confirmed Wetlands and Areas of Interest



LEGEND

- | | |
|--|---|
| Confirmed Wetlands | Fish Classification (Waterbody) |
| ● Wetland | ■ Class A |
| ■ Wetland Property | ■ Class A(O) |
| Area of Interest | ■ Class B |
| ■ High | ■ Class C |
| ■ Medium | Fish Classification (Open Channel) |
| ■ Low | — Class A |
| □ Anniedale-Tynehead - Tynehead NCP Area | --- Class A(O) |
| □ Parcel | — Class B |
| ■ Park | — Class C |
| ■ Agricultural Land Reserve (ALR) | — Unknown |
| — Road | |



0 250 500 Meters
 SCALE 1:15,500

MAP DRAWING INFORMATION:
 DATA PROVIDED BY DILLON CONSULTING LIMITED,
 CITY OF SURREY
 MAP CREATED BY: RBB
 MAP CHECKED BY: SW.LKD
 MAP PROJECTION: NAD 1983 UTM Zone 10N



Photo 1: Reed canary grass wetland at W3, 16836 94A Avenue.



Photo 2: Confirmed wetland at W3, 16836 94A Avenue along Class A watercourse on western boundary of property.



Photo 3: Swamp wetland at W8, 17734 92 Avenue



Photo 4: Reed canary grass wetland at W9, 18044 96 Avenue, surrounded by hardhack thickets. Note this is the northern portion of 18044 96 Avenue, north of Golden Ears Way.

Most wetlands occurred as small remnant portions of larger terrestrial features and many resulted from neglect as in the case of agricultural or industrial fields that had been left to establish or re-establish wetland features. Wetlands included marshes of reed canary grass and sedge, and swamps of hardhack and willow along broad, sluggish watercourses. Several were small ponds or shallow water. One large wetland complex (W10) spans at least four properties and was predominantly swamp but all of its features were not determined, and it likely contains other wetland components.

3.1.2 Areas of Interest

Twenty-five areas of interest were identified in the NCP Area through the background review and the field assessments (i.e., wetland inventory and watercourse assessments). The areas of interest represent properties within the NCP Area that have the potential to support wetland ecosystems. Due to access and time constraints, not all potential wetland sites were visited in the NCP Area, and as such, areas of interest were identified to support the City in determining potential properties that may require investigation in the future (e.g., potential property development).

Table 2 outlines areas of interest within the NCP and their respective ranking for potentially supporting wetted areas or wetland ecosystems. Five properties were identified as low potential, 11 as medium, and 9 as high. Generally, areas of interest with the potential to support wetland ecosystems were found in the vicinity of existing watercourses, remnant forested areas, and depression areas of fields. Areas of interest that currently support wetted areas have the potential to develop into wetland ecosystems should hydrologic conditions support water retention. **Photos 5 to 8** show examples of areas of interest identified within the NCP Area.

Table 2: Wetland Areas of Interest within the Anniedale-Tynehead NCP Area

| Area of Interest Site ID | Address | Potential to Support Wetland Ecosystem | Site Access and Assessment Details | General Observations |
|--------------------------|---------------------------------------|--|---|--|
| AOI-1 | 9361 Bothwell Drive | Low potential | Property assessed from road | Reed canary grass field with other grasses, remnant wetland may be supported in this area; however, potential is low. |
| AOI-2 | 9376 Bothwell Drive | Medium potential | Property assessed from road | Potential for wetlands (e.g., swamp or marshes) at base of slope between this property and along the natural area at 94A Avenue and along the creek. Natural forest along creek inhabited by red alder, western redcedar, bigleaf maple, salmonberry, osoberry and some Himalayan blackberry. |
| AOI-3 | 9394 Bothwell Drive | Medium potential | Property assessed from road | Potential for swamp or marshes along creek, in forest. |
| AOI-4 | 17070 94A Avenue | Low potential | Property assessed from road | Property has the potential to support pooling water in forested areas or along existing watercourse. |
| AOI-5 | 9450 172 Street | High potential | Property assessed from road | Field within property has two main patches of common rush and reed canary grass in depression. A swale occurs perpendicular to 96 Avenue along the northeast property boundary. Swale inhabited by <i>Juncus</i> sp. and reed canary grass. |
| AOI-6 | 9420 173A Avenue and 9370 173A Avenue | Medium potential | Property accessed and western half of properties assessed | Forest along meandering, shallowly incised creek. No wetlands observed during wetland inventory; however, properties may support swamps or marshes along watercourses or pooling areas. Vegetation along watercourses includes black cottonwood, red alder, salmonberry (dense), osoberry, and Himalayan blackberry. |

| Area of Interest Site ID | Address | Potential to Support Wetland Ecosystem | Site Access and Assessment Details | General Observations |
|--------------------------|--|--|------------------------------------|--|
| AOI-7 | 9356 176 Street | Medium potential | Property accessed and assessed | Pooled water in small channels. Area generally appears wet and poorly drained. Vegetation consists of small red alder (20-25 cm dbh), hardhack, osoberry, salmonberry, red-osier dogwood and Himalayan blackberry in openings of tree canopy, mostly to the north. |
| AOI-8 | 18044 96 Avenue (northern half immediately south of 96 Avenue) | Medium potential | Property assessed from road | Large tract of dense hardhack beneath hydro line. |
| AOI-9 | 9564 182 Street | High potential | Property assessed from road | Small, natural forested remnant which may support wetland ecosystems as the area is predominantly inhabited by hardhack and contains deciduous tree snags. |
| AOI-10 | 18379 94 Avenue | Low potential | Property assessed from road | North end of property, north of cul-de-sac. Small area of hardhack and reed canary grass on the west side of creek channel. |
| AOI-11 | 9358 184 Street | High potential | Property accessed and assessed | Remnant natural vegetation along small channel and within wet depressions on property. Vegetation included black cottonwood, red alder, Himalayan blackberry, reed canary grass, yellow flag iris, and creeping buttercup. Likely small wetlands could be supported along portions in broad channel areas. |
| AOI-12 | 18685 92 Avenue | High potential | Property accessed and assessed | Small, shallow pond in central area of tree farm/field has some common rush but is otherwise sparsely vegetated. May hold water long enough to develop wetland characteristics but no solid indicators at time of visit. |

| Area of Interest Site ID | Address | Potential to Support Wetland Ecosystem | Site Access and Assessment Details | General Observations |
|--------------------------|------------------|--|------------------------------------|---|
| | | | | A small channel draining the pond flows to the north connecting with a channel that runs along the northern side of the property. Some common rush and creeping buttercup suggest wetland could develop over time if left unaltered. |
| AOI-13 | 9312 173A Street | High potential | Property accessed and assessed | A human-created wetland was observed at 9312 173A Street. A Class B watercourse flows through the western portion of 9312 173A Street and through the human-created wetland. The wetland observed on this property is currently inhabited by domestic geese and fenced. Substrate and presence of wetland soils not assessed. |
| AOI-14 | 18043 92 Avenue | Medium potential | Property accessed from road | Potential for wetland to be supported on eastern end of property, near W10. |
| AOI-15 | 9233 173A Street | High potential | Property accessed and assessed | Swamp wetlands observed within forested areas of property at 9233 173 A Street to the west. Potential for swamps along road right-of-way. |
| AOI-16 | 17780 92 Avenue | Medium potential | Property accessed from road | Potential for pooling water or wetted areas along Class A(O) watercourses along eastern and southern portion of property boundary. |
| AOI-17 | 17828 92 Avenue | Low potential | Property accessed from road | Potential for pooling water or wetted areas along Class A(O) watercourses along southern portion of property boundary. |
| AOI-18 | 18170 92 Avenue | Medium potential | Property accessed from road | Given proximity to wetlands at neighbouring properties with similar features, potential for wetlands in historical remnant depressions and/or forested areas. |
| AOI-19 | 18118 92 Avenue | High potential | Accessed and assessed | Constructed pond. Open, with no discernable vegetation. |

| Area of Interest Site ID | Address | Potential to Support Wetland Ecosystem | Site Access and Assessment Details | General Observations |
|--------------------------|------------------|--|------------------------------------|--|
| AOI-20 | 9282 184 Street | Medium potential | Property accessed from road | Potential small depression (approximately 900 m ²) at the western edge of the property that could support a wetland based evaluation from road. |
| AOI-21 | 9133 Harvie Road | High potential | Desktop evaluation | Potential for wetland presence as properties north and south of 9133 Harvie Road have confirmed wetland presence. |
| AOI-22 | 9072 187 Street | Medium potential | Desktop evaluation | Vegetation characteristics in air photos and undulating nature of property as viewed through LiDAR indicate property may support wetlands. Class B and C watercourses surround property. |
| AOI-23 | 9019 187 Street | Medium potential | Desktop evaluation | Class B channel bisects property and flows along southern property boundary. Potential for wetted areas or depressions on western half of property. |
| AOI-24 | 9022 184 Street | Low potential | Desktop evaluation | West of AOI-23 (9019 187 Street). Potential for wetted areas along southern or eastern half of property. |
| AOI-25 | 17937 96 Avenue | High potential | Desktop evaluation | Similar reed canary grass field as nearby W9 (18044 96 Avenue) along northwestern portion of the property. |

Several potential properties initially identified in the background review as areas of interest were evaluated during the field assessment and determined not to support wetland habitat. These properties included, but were not necessarily limited, to the following:

- 9316 172 Street;
- 9366 172 Street;
- 17121 92 Avenue;
- 17372 96 Avenue;
- 17109 94A Avenue;
- 9436 184 Street; and
- 9236 184 Street.



Photo 5: Common rush and reed canary grass depression at AOI-5 (high potential), 9450 172 Street.



Photo 6: Pooled water at AOI-7 (medium potential), 9356 176 Street.



Photo 7: Remnant natural vegetation along small channel at AOI-11 (high potential), 9358 184 Street.



Photo 8: Forested areas along existing watercourse at AOI-4 may support wetlands at 17070 94A Avenue (low potential).

3.2 Watercourse Assessment

The watercourse assessment found that the majority of the Class A and Class B watercourses fit within the descriptions of their given classifications as indicated on COSMOS, but the majority of Class C classifications in COSMOS were updated to Class B to reflect the WSA and RAPR definition of a stream. A summary of observations is provided in **Table 3** below. Watercourses are indicated in **Figure 3**.

The watercourse identified as C18 is currently classified as a Class C watercourse. Based on the conditions observed, Dillon recommends that this is upgraded to a Class B. The assessment found areas with dense undergrowth of salmonberry with some osoberry, an area of dense young alder stand and a section with an excellent layered forest structure including western redcedar, black cottonwood, bigleaf maple, red alder, vine maple, salmonberry, sword fern and piggy-back plant. The substrate varied from areas with gravel and cobbles in the flatter sections to areas with large cobbles and boulders in the steeper, cascade-pool sections of the stream.

At the time of assessment, C20 had no defined drainage. This area was a small depression which appeared to collect standing water. However, it did not connect to any observed or mapped watercourses. Dillon has recommended that it is no longer classified as a watercourse.

Table 3: Known Watercourse Traits and Recommended Classifications

| ID | Location | Existing Classification | Recommended Classification | Description Traits/Values |
|-----|---|-------------------------|----------------------------|---|
| C1 | Serpentine River | A | A | Serpentine River. |
| C2 | 17053, 17089, 17070 94A Avenue, 9376, 9394, 9361 Bothwell Drive | A | A | Significant contributor to Serpentine River. |
| C3 | 16386 94A Avenue | A | A | Significant contributor to Serpentine River. |
| C4 | 16386 94 Avenue | A | A | Significant contributor to Serpentine River. |
| C5 | 9280, 9212 168 Street (Bothwell Creek) | A | A | Significant contributor to Serpentine River. |
| C6 | 9455, 9361 Bothwell Drive | B | B | Healthy native riparian vegetation. Moderate flow. Drains roadside ditches into C1. |
| C7 | 9331 Bothwell Drive | C | B | Slightly defined channel in a low laying area that follows property line. Limited water quantity. Cobble substrate but looks to be from old road. Overgrown with reed canary grass and Himalayan blackberry. Channel is located at the Serpentine's top of bank, therefore not fish accessible. |
| C8 | 17141 92 Avenue, 9235, 9255, 9293, 9316, 9366, 9400 172 Street | B | A(O), B | Healthy riparian vegetation with high quality substrate. During high water levels the southern reach of this creek likely connects to an A class ditch and has potential for fish access and habitat during higher water levels. |
| C9 | 9265 Bothwell Drive | A(O) | A(O) | No barriers at the confluence to the Serpentine River. However, a gated culvert approximately 20m upstream of the confluence currently severely limits fish ingress/egress. Likely fish access with channel enhancements with channel improvements. |
| C10 | 9212, 9170 168th Street (E Creek) | A | A | Significant contributor to Serpentine River. |
| C11 | 9233-9419 173A Street | B | B | Flows through healthy mixed forest. Gravel and cobble substrate. Appears to empty into low laying wetland area outside of the project boundary. |

| ID | Location | Existing Classification | Recommended Classification | Description Traits/Values |
|-----|--|-------------------------|----------------------------|--|
| C12 | 9370-9298 173A Street | B | B | Healthy stream flows through forest and enters goose pond, which then drains into a storm drain. |
| C13 | 9356 176 Street and ROW south of 9356 176 Street | B, C | B | Channels running through young mixed deciduous forest. Water, likely some groundwater contribution, present but flow appeared to be minimal to non-existent. Substrate mainly organics. Riparian vegetation was native and abundant which would provide a source of nutrients to downstream fish habitat. Class C channel recommended to upgrade to Class B, as there is little difference in habitat characteristics and values. The site has also been confirmed as a wetland, represented as W13. |
| C15 | 17909 92 Avenue | C | B | Water flows south and enters the north ditch on 92nd Avenue in a drainage swale. Channel daylights approximately 40 m north of 93a Ave. Headwaters appear to be a drainage swale. Significant reed canary grass growth and organic substrate throughout. The watercourse is likely a source of food and nutrients to downstream fish habitat. |
| C16 | 17922 94 Avenue | C | C | Clearly defined channel; however, no water at the time of assessment. No apparent groundwater contribution or source of flow other than rainwater. Drainage PVC pipe entering roadside ditch that is isolated from other drainage systems. Riparian vegetation existed, though recently disturbed, but unlikely to provide food and nutrients naturally or through modification. |
| C17 | 9489 180 Street to 17813 94 Avenue | B, C | B | The section currently identified as Class C appears similar to the Class B section, but the channel becomes less defined on the western end. Flow is limited but channel has abundant riparian vegetation and is connected to a Class A channel. The watercourse is likely to contribute a source of food and nutrients to downstream fish habitat. |

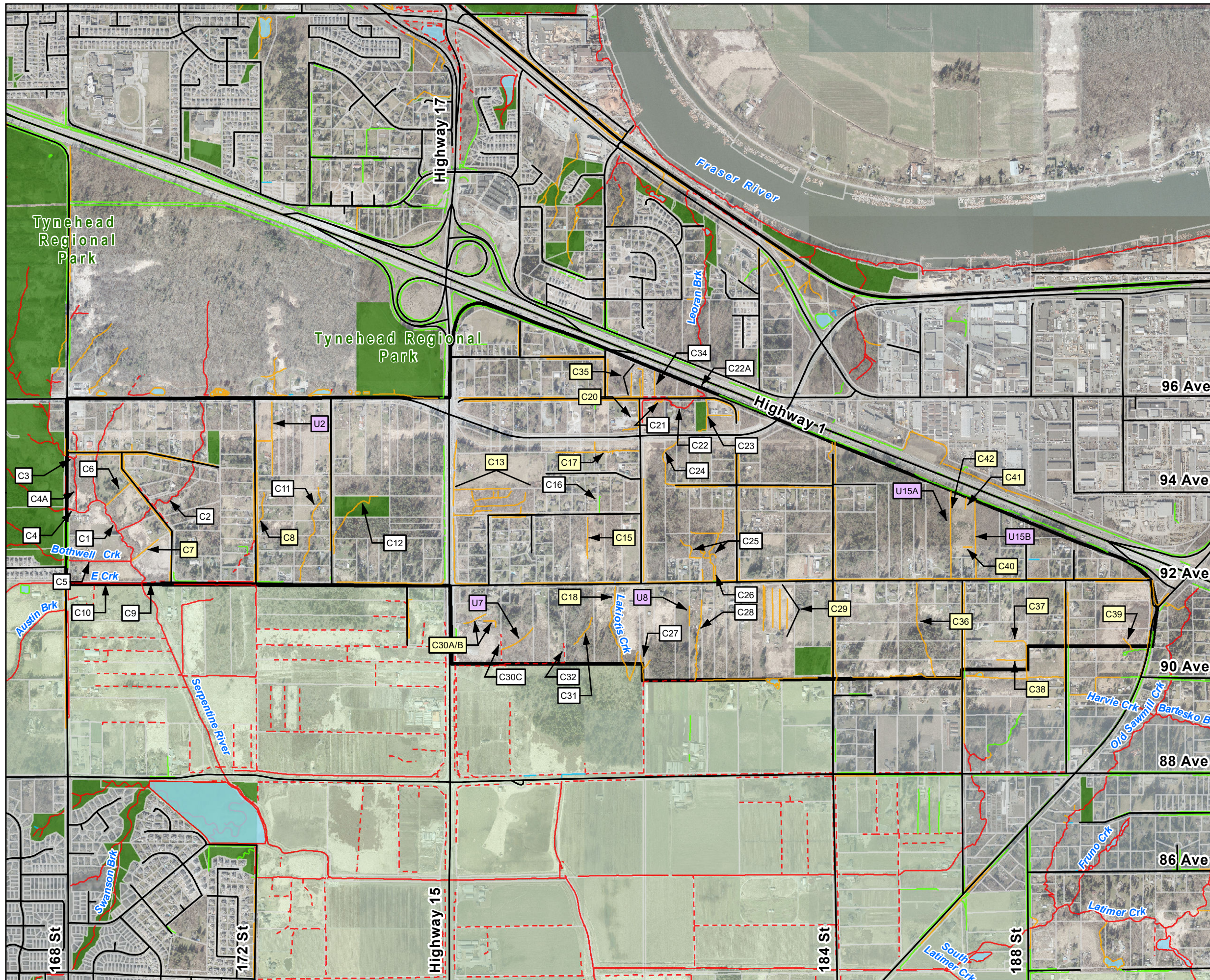
| ID | Location | Existing Classification | Recommended Classification | Description Traits/Values |
|-----|--|-------------------------|----------------------------|--|
| C18 | 17928, 17950, 8180 92 Avenue (Lakiotis Creek) | C | B | Cobble and gravels substrate, native riparian vegetation buffer and significant flow at the time of assessment. The southern section of the stream flows between mature coniferous and deciduous forests and connects to an A(O) classified watercourse. |
| C20 | 17944 96 Avenue | C | None | Appears to be an area where surface water can pool during rain events and does not have defined drainage. Likely no groundwater contribution or natural source of water other than rainwater. Areas located at the driveway have been culverted and discharges into the 180 Street west side ditch. This would not be considered a stream per the current definition under the WSA. |
| C21 | 18044 96 Avenue | B | B | Two small watercourses entering red classified ditch, limited flow and overgrown with reed canary grass; however they do run through dense native riparian vegetation. Likely still a nutrient contributing watercourse. |
| C22 | 18068, 18132 96 Avenue (Leoran Brook headwaters) | A | A | High quality watercourse with cobble and gravel substrate, dense native riparian vegetation and significant flow with riffle/pool characteristics. |
| C23 | 18150, 18132 96 Avenue, 9545 182 Street | B | B | Lower quality B watercourse. No flow at time of assessment. Healthy riparian vegetation. Substrate primarily organics and silt. Likely affected by headwaters of C24. |
| C24 | 18709, 18089 94 Avenue | B | B | Lower quality B watercourse with small volume of flow at time of assessment. Organic heavy substrate. Very dense and native riparian vegetation. Eventually connects to C23 and Leoran Brook. Water source is the roadside ditches on 94 Avenue where there was significant sitting water due to multiple plugged culverts. If culverts were cleared, flow would likely return to the watercourse and improve overall quality. |

| ID | Location | Existing Classification | Recommended Classification | Description Traits/Values |
|------|-----------------------|-------------------------|----------------------------|--|
| C25 | 9245, 9351 182 Street | B | B | Limited flow; however, water is trickling into the north ditch on 92 Avenue. Several lower quality tributaries with organic heavy substrate with low flow volume. Several high quality tributaries with higher flow and cobble substrate. All drain or are connected to a local wetland. An additional channel runs along the property line of 9245 182 Street and 18067 92 Avenue and enters a culvert at the northwest corner of 18125 92 Avenue which connects to the north ditch on 92 Avenue. |
| C26 | 9245 182 Street | B | B | Limited flow but healthy watercourse overall. |
| C27 | 18038 92 Avenue | B | B | Small flow volume but healthy surrounding vegetation. Gravel and sand substrate. |
| C28 | 18118 92 Avenue | B | B | High quality watercourse, bordered by mature coniferous and deciduous trees. Boulders, cobbles and gravels present. Significant flow and cascade pool type system observed. B classification only due to the steep grade of the watercourse making it impassable for fish. |
| C29 | 18280 92 Avenue | C | B | Drainage swales running through old grass field, likely receive groundwater contribution. Presence of wetland vegetation (common sedge) suggests pooling water therefore further assessment is recommended. |
| C30a | 9126 176 Street | A(O) | B | Small channel that carries water away from the house and drains down the hill through dense understory via an undefined channel to connect to C30c. The hill has a steep gradient and limited flows that restrict fish passage; however, it is a nutrient contributor given the dense riparian vegetation that it runs through. |

| ID | Location | Existing Classification | Recommended Classification | Description Traits/Values |
|------|---|-------------------------|----------------------------|--|
| C30b | 9126 176 Street | A(O) | B | Isolated shallow ditch that runs along the driveway and does not have obvious connectivity to other drainage systems, therefore unlikely to have fish present. Lacking food/nutrient contribution as there is no riparian vegetation (other than an ornamental cedar hedge) and organic, grassy substrate. However, is located within a confirmed wetland and would therefore be considered a stream per the current WSA definition. |
| C30c | 9126 176 Street, 17734 92 Avenue | A(O) | A(O) | Watercourse that runs north-south along property line. Significant water present; however, flow is limited. This segment does connect to the segment that runs east-west along both listed property lines. Area has several wetland characteristics. |
| C31 | 17870 92 Avenue | B | B | Limited flows through a dense native forest. Cobble and gravel substrate. Extensive patch of knotweed just north of creek headwaters. |
| C32 | 17734-17828 92 Avenue | A(O) | A(O) | Difficult to accurately assess due to very dense Himalayan blackberry growth in the area. Significant amount of water observed; however, appeared to be limited flow and organic heavy substrate. Connectivity to A class streams outside the project area. |
| C34 | 18013 96 Avenue | B | B | Small volume of flow at time of assessment; however, healthy native riparian forest and a mix of gravel and organic substrate was observed. |
| C35 | 17981 96 Avenue | C | B | Very small drainage channels that enter roadside ditch with no flow at the time of assessment. Significant riparian vegetation present. Channels are located within a high area of interest potential wetland. Further assessment is recommended. |
| C36 | 18590 92 Avenue and 9019 to 9145 187 Street | C | B | Moderate flows present at the time of the site assessment with significant riparian vegetation. Substrate was comprised of gravel. |

| ID | Location | Existing Classification | Recommended Classification | Description Traits/Values |
|-----|------------------|-------------------------|----------------------------|--|
| C37 | 9072 187 Street | C | B | No visible drainage, but the property is a medium area of interest - wetland stream classification should be confirmed by wetland presence prior to development. |
| C38 | 9072 187 Street | B, C | None | Channel does not exist. No visible drainage, but the property is a medium area of interest wetland- stream classification should be confirmed by wetland presence prior to development. |
| C39 | 9075 Harvie Road | C | B | Watercourse is very small and had minimal flow at the time of the site visit. Likely collects and drains groundwater. Bank vegetation is comprised of grasses and substrate is predominantly fines. Located within a confirmed wetland and would therefore be considered a stream per the current definition under the WSA. |
| C40 | 18685 92 Avenue | C | B | Watercourse appears to be a swale used to drain groundwater to a peripheral watercourse along the eastern property boundary that is also unmapped. Swale is very small and had minimal flow at the time of the site visit. Bank vegetation is comprised of grasses and substrate is dominantly fines. Exists approximately 100 m north of indicated COSMOS location. Located within a high area of interest potential wetland. |
| C41 | 18685 92 Avenue | C | B | Similar to C40. Drains into another swale parallel to Highway 1. Located within a high area of interest potential wetland. |
| C42 | 18685 92 Avenue | C | B | Channelized watercourse that follows property line and is a continuation of U15A (see Table 4). Substrate is comprised of fines and some small gravel and banks have a small riparian vegetation buffer. Located within a high area of interest potential wetland. |

Figure 3.
Watercourse Locations



| | |
|--|---|
| Anniedale-Tynehead - Tynehead NCP Area | Fish Classification (Open Channel) |
| Parcel | Class A |
| Park | Class A(O) |
| Agricultural Land Reserve (ALR) | Class B |
| Road | Class C |
| | Unknown |
| Fish Classification (Waterbody) | C1 COSMOS - No Change |
| Class A | C9 COSMOS - Recommended Change |
| Class A(O) | U7 Previously Unmapped Watercourses |
| Class B | |
| Class C | |



0 250 500 Meters
SCALE 1:15,500

MAP DRAWING INFORMATION:
DATA PROVIDED BY DILLON CONSULTING LIMITED,
CITY OF SURREY

MAP CREATED BY: RBB
MAP CHECKED BY: SW, LKD
MAP PROJECTION: NAD 1983 UTM Zone 10N

An unmapped section of watercourse associated with the currently mapped watercourse C25 was observed during the assessment. This additional section drains a significant wetland area and runs along the property line of 9245 182 Street and 18067 92 Avenue. This section has been added to **Figure 3**.

The watercourse identified as C30a/b/c is currently classified on COSMOS as A(O). After the assessment, Dillon is recommending that the classification of two sections of this watercourse be downgraded; to B in the case of Section 30a and B in the case of Section 30b. C30a does not connect to other watercourses, had no flow at the time of assessment and has limited riparian vegetation, but is within a confirmed wetland. C30b is a small drainage channel that eventually drains in a very undefined channel down a small hill through an area of dense native and Himalayan blackberry understory to drain into C30c. While this section will provide nutrients for the sections downstream, it is not fish passable due to a steep hill and limited water quantity. Section C30c contained a significant volume of water; however, there was little to no flow observed. Aquatic vegetation on the banks and beyond indicated that the area is frequently inundated. Connectivity of this watercourse to the ditch downstream is not known at this time and was outside of the assessment area limits.

The remainder of the recommended watercourses reclassification changes were updated to reflect the WSA and RAPR definitions of a stream.

One of the main focuses of the watercourse assessments was to determine the values surrounding currently unclassified watercourse sections within the Anniedale-Tynehead area. Potential unknown watercourses were identified using LiDAR and aerial image interpretation during the desktop evaluation. The classifications found to best represent the values of unclassified watercourses observed in the field are outlined in **Table 4**. Only those channels confirmed to be watercourses are presented in **Table 4**. Note that there are gaps in the numbering of watercourses listed in the table. Potential watercourses were assigned a code prior to the field assessment and if a watercourse was not found to exist or was identified as a wetland, no code was assigned. Watercourses identified as wetlands are presented in **Section 3.1.1**.

One of the most significant previously unmapped watercourses observed was U15A and U15B. This previously unmapped watercourse section connects to C42 and ditches along Highway 1 (mapped on COSMOS). Based on COSMOS, these ditches appeared to potentially connect to other Class A and Class B watercourses to the north. The assessment found dense red alder and black cottonwood stands with young western redcedar and vine maple along the watercourses that contributed leaf litter. The substrate was comprised of gravel. Based on conditions observed, Dillon recommends U15A and UA15B be classified as Class B.

Table 4: Unknown Watercourse Traits and Recommended Classification

| ID | Location | Existing Classification | Recommended Classification | Description Traits/Values |
|------|--|-------------------------|----------------------------|---|
| U2 | 9450 172 Street and 17246 96 Avenue | Unknown | B | Drainage swale that runs along property line, connects to already mapped C channel (D5 in Table 5). Likely receives flows from groundwater. Located in a high area of interest potential wetland. |
| U7 | 17734 92 Avenue | Unknown | B | Small ditch with obvious drainage pathway, dry at time of assessment that appears to have been created along a road built to access lower sections of the property. Located in a confirmed wetland and is therefore considered a stream per the current definition under the WSA. |
| U8 | 18118 92 Avenue | Unknown | B | Drainage ditch that likely receives groundwater and discharges into C28. Overgrown with blackberry. Located in a high area of interest potential wetland. |
| U15A | 18685 92 Avenue | Unknown | B | Channelized watercourse that follows the western property line. Substrate is comprised of fines and some small gravel and banks have a small riparian vegetation buffer comprised mainly of black cottonwood. Located within a high area of interest potential wetland. |
| U15B | 18685 92 Avenue | Unknown | B | Channelized watercourse that follows the eastern property line. Watercourse characteristics similar to U15A. Located within a high area of interest potential wetland. |

Several properties within the NCP area that were evaluated for potential unknown watercourses and found to not support previously unclassified watercourses include:

- 9043 184 Street;
- 18685 92 Avenue;
- 17460 96 Avenue;
- 9341 176 Street;
- 9325 176 Street ; and
- 9307 176 Street.



Photo 9: Watercourse C40, an example of a typical watercourse previously classified as Class C, but has been reclassified to Class B to reflect the WSA and RAPR definitions of a stream.

3.3 Roadside Ditch Assessment

In general, the majority of ditches were changed to Class B to reflect the WSA and the RAPR definition of a stream. **Table 5** below indicates the observed channel characteristics. Locations are indicated in **Figure 4**.

Water quality was collected at ditches where notable flow was observed and is presented in **Table 6**. At most locations, water quality was suitable to support fish presence, including salmonids. As such, the likely limiting factor precluding fish presence from most ditches in the Anniedale-Tynehead study area is water quantity and connectivity to channels confirmed to support fish presence.

Table 5: Ditch Characteristics and Recommended Classification

| ID | Location | Existing Classification | Recommended Classification | Description Traits/Values |
|-----|---|-------------------------|----------------------------|--|
| D1A | West side of 173A Street from approximately 130 m south of 96 Avenue to south end of 9455 173A Street | B | B | Linear roadside ditch originating as a depression at the north end. Banks are mowed and have patches of riparian vegetation that is likely a source of food and nutrients to downstream fish habitat. Limited flow at the time of site visit. Substrate is dominantly grasses and fines. |
| D1B | West side of 173A Street from south end of 9455 173A Street to 92 Avenue | C | B | Linear roadside ditch continuing south from Ditch D1A. Banks are mowed and have limited riparian vegetation, but likely is still a source of food and nutrients to downstream fish habitat. Limited flow at the time of site visit. Substrate is dominantly grasses and fines. |
| D2A | East side of 173A Street from approximately 125 m south of 96 Avenue to 9454 173A Street | B | None | No visible drainage. Based on Google Street View, appears to have been filled sometime between 2015 and 2019. |
| D2B | Adjacent to south side of 9454 173A Street | C | None | No visible drainage. |
| D3 | North side of 92 Avenue from 173A Street to Highway 15 | B | B | Linear roadside ditch. Limited riparian vegetation on the northern bank is likely a source of food and nutrients to downstream fish habitat. Substrate predominately gravel and water flows eastward into a culvert at 92 Avenue. |
| D4A | East side of 172 Street from approximately 100 m south of 96 Avenue to the north end of 9316 172 Street | B | B | Linear roadside ditch. Established native riparian vegetation on the eastern bank in patches is likely a source of food and nutrients to downstream fish habitat. Water flowed south into an unnamed creek. Gravel substrate at some portions of the ditch. |
| D4B | East side of 172 Street from the south end of 9316 172 Street to 92 Avenue | C | B | Linear roadside ditch originating as a depression at the north end. Banks are mowed but have riparian vegetation limited to patches of trees. Limited flow at the time of site visit. Substrate is predominantly grasses and fines. The ditch is likely a source of food and nutrients to downstream fish habitat. |

| ID | Location | Existing Classification | Recommended Classification | Description Traits/Values |
|-----|---|-------------------------|----------------------------|---|
| D5 | 9450 172 Street | C | B | Linear agricultural ditch on private property appears to be used for groundwater drainage. Limited flow at the time of site visit. Banks are overgrown with grasses and substrate is dominated by fines. Located within a high area of interest potential wetland. |
| D6 | West side of 172 St from approximately 290 m south of 96 Avenue to 92 Avenue | C | B | Linear roadside ditch. Banks are mowed but have patches of established riparian vegetation which are likely to contribute a source of food and nutrients to downstream fish habitat. Limited flow at the time of site visit. Substrate is predominantly grasses and fines. |
| D7 | North side of 92 Avenue and east side of 172 Street, approximately 100 m long | B | C | Linear roadside depression. Banks are mowed and have no riparian vegetation that is unlikely to provide a source of food and nutrients. No flow aside from impounded rainwater at the time of site assessment and likely does not receive groundwater contribution or other natural sources of water aside from rainwater. Though it is connected to a Class A stream by a small culvert under 92 Avenue, it would have to be entirely modified to support contribute food/nutrients or act as habitat. |
| D8 | North side of 92 Avenue and west side of 172 Street, approximately 200 m long | A | A | Linear roadside ditch. Established native and ornamental tree cover, but shrub layer is dominated by Himalayan blackberry. Significant volume of water at the time of the site visit. Substrate is unknown but likely dominated by organics and fines. Aquatic vegetation was noted. |
| D9A | South side of 92 Avenue and west side of 172 Street, approximately 200 m long | A | A | Similar to ditch D8. |
| D9B | South side of 92 Avenue and east side of Bothwell Drive, approximately 200 m long | A | A | Linear roadside ditch that extends approximately 50m west of ditch D9A would be classified similar to D9A. Beyond this point to Bothwell Drive, the ditch does not exist. |

| ID | Location | Existing Classification | Recommended Classification | Description Traits/Values |
|------|--|-------------------------|----------------------------|---|
| D10 | Northeastern corner of 92 Avenue and Bothwell Drive, approximately 90 m long | C | C | Linear roadside ditch isolated from other drainage systems. Banks are dominated by reed canary grass and a small number of alders. Limited flow at the time of site visit and likely no groundwater contribution or natural source of water other than rainwater. Substrate is predominantly reed canary grass. This would not be considered a stream per the current definition under the WSA. |
| D11 | West side of Bothwell Drive and north of 92 Avenue, approximately 100 m long | C | B | Linear roadside ditch. Banks are dominated by reed canary grass and Himalayan blackberry that may provide a source of food and nutrients to downstream fish habitat. Limited flow at the time of site assessment but is directly connected to, though is 1.5m higher than, an A(O) watercourse. Substrate is predominantly reed canary grass. |
| D12 | West side of Bothwell Drive south of 94A Avenue | C | B | Linear roadside ditch directly connected to, though is located at the top of bank to the unnamed creek crossing Bothwell Drive. Banks are mowed and have limited riparian vegetation that likely provides a source of food and nutrients to downstream fish habitat. Limited flow at the time of site visit. Substrate is predominantly grasses and fines. |
| D13A | East side of Bothwell Drive south of D13B, approximately 190 m long | A(O) | A(O) | Linear roadside ditch. Connected to the unnamed creek crossing Bothwell Drive. Established native riparian vegetation. Pooling water was noted at the time of site visit. Substrate is predominantly small gravel. |
| D13B | East side of Bothwell Drive south of D13C, approximately 65 m long | B | B | Linear roadside ditch. Banks are mowed and have no riparian vegetation. Limited to no flow at the time of site assessment but is directly connected to an A(O) watercourse and may contribute a source of food and nutrients to downstream fish habitat with channel enhancements. Substrate is predominantly grasses and fines. |
| D13C | East side of Bothwell Drive south of 94A Avenue, approximately 80 m long | C | B | Similar to ditch D13B. |

| ID | Location | Existing Classification | Recommended Classification | Description Traits/Values |
|-----|--|-------------------------|----------------------------|--|
| D14 | South side of 94A Avenue east of Bothwell Drive | B | B | Linear roadside ditch that is connected to ditch D16, but is disconnected from ditch D13C. Banks are mowed but have good cover from established trees that are likely a source of food and nutrients to downstream fish habitat. Limited flow at the time of site visit. Substrate is predominantly grasses and fines. |
| D15 | 94A Avenue east of 16873 94A Avenue | B | B | Linear roadside ditch that is culverted between 16983 to 17053 94A Avenue. Banks are mowed and have patches of riparian vegetation that are likely a source of food and nutrients to downstream fish habitat. Water flowed west towards 168 Street at the time of the site visit. Substrate varied between small gravel to fines/grasses. |
| D16 | South side of 94A Avenue between 168 Street and Bothwell Drive | C | B | Linear roadside ditch between the two unnamed tributaries of the Serpentine River crossing 94A Avenue. There was no flow at the time of the site assessment, but it is connected to two class A watercourses. Established native riparian vegetation is likely a source of food and nutrients to downstream fish habitat. Substrate is dominated by organics and fines. |
| D17 | North side of 94A Avenue between 168 Street and 16873 94A Avenue | C | B | Linear roadside ditch, dry at the time of site assessment but is directly connected to two class A watercourses. Banks are mowed and have no riparian vegetation aside from immediately around the unnamed watercourses. However, may contribute a source of food and nutrients to downstream fish habitat with channel enhancements. Substrate is predominantly grasses and fines. |
| D18 | West side of Highway 15 between 96 Avenue and 92 Avenue | C | C | Linear roadside depression. Banks are mowed and have limited riparian vegetation. The ditch was dry at the time of site assessment and likely no groundwater contribution or natural source of water other than rainwater. Connection to a class A(O) watercourse is limited by 200m long culvert, therefore unlikely to provide significant food and nutrients naturally or through modification. Substrate is predominantly grasses. |

| ID | Location | Existing Classification | Recommended Classification | Description Traits/Values |
|-----|--|-------------------------|----------------------------|---|
| D19 | North side of 92 Avenue between Highway 15 and 177 Street | C | B | Linear roadside ditch. Banks are mowed and have patches of riparian vegetation that is likely a source of food and nutrients to downstream fish habitat. Limited to no flow at the time of site assessment. Substrate is predominantly grasses with some gravel. |
| D20 | North side of 92 Avenue between 177 Street and 180 Street | B | B | Linear roadside ditch. Banks are mowed and most of the ditch section has limited riparian vegetation but has patches of established trees which is likely a nutrient source for downstream fish habitat. Water flowed to the west. Substrate is dominated by organics and fines with gravel in some areas. Aquatic vegetation was noted. |
| D21 | North side of 92 Avenue between 180 Street and Harvie Road | C | B | Linear roadside ditch connected to an unnamed creek at 18560 92 Avenue. Banks are mowed but most of the ditch section has established native riparian vegetation on the northern bank that is likely a source of food and nutrients to downstream fish habitat. While standing water was noted in some areas, most of the ditch was dry at the time of the site visit. Substrate is dominated by grasses, organics and fines. |
| D22 | South side of 92 Avenue between 187 Street and 189 Street | C | C | Linear roadside ditch originating as a depression and isolated from other drainage systems. Banks are mowed and have limited riparian vegetation. No flow at the time of site assessment and likely no groundwater contribution or natural source of water other than rainwater. Substrate is dominated by grasses and fines. This would not be considered a stream per the current definition under the WSA. |
| D23 | South side of 92 Avenue between 189 Street and Harvie Road | C | B | Linear roadside ditch. Banks are mowed and have limited riparian vegetation dominated by Himalayan blackberry that is likely a source of food and nutrients to downstream fish habitat. Pooled water was noted at the eastern end of the ditch section but was mostly dry at the time of the site visit. Substrate is dominated by grasses and fines. A test pit taken here showed soil mottling indicative of wetland characteristics. A significant amount of anthropogenic debris was noted in this ditch section. Wetland characteristics discussed in Section 3.1. |

| ID | Location | Existing Classification | Recommended Classification | Description Traits/Values |
|-----|--|-------------------------|----------------------------|---|
| D24 | West side of Harvie Road between 92 Avenue and 90 Avenue | B | B | Linear roadside ditch. Banks are mowed but have established native riparian vegetation on the western bank that is likely a source of food and nutrients to downstream fish habitat. The ditch was dry at the time of the site visit. Substrate is dominated by organics and fines. A significant amount of anthropogenic debris was present. Located in a confirmed and high area of interest potential wetland. |
| D25 | East side of 189 Street south of 92 Avenue | C | B | Linear roadside ditch. Banks are mowed but have established native riparian vegetation that is likely a source of food and nutrients to downstream fish habitat. The ditch was dry at the time of the site visit. Substrate is dominated by organics and fines. |
| D26 | West side of 189 Street south of 92 Avenue, approximately 130 m long | C | B | Linear roadside ditch. Banks are mowed and most of the ditch has established trees on the bank opposite 189 Street that is likely a source of food and nutrients to downstream fish habitat. Water flowed south. Substrate is predominantly sand and gravel. Benthic invertebrate habitat is present and COSMOS shows connection to Harvie Creek. |
| D27 | West side of 189 Street south of D26, approximately 100 m long | B | B | Similar to ditch D26. |
| D28 | East side of 187 Street south of 92 Avenue | C | B | Linear roadside ditch. Banks are mowed and have limited riparian vegetation but have patches of established trees that is likely a source of food and nutrients to downstream fish habitat. Limited flow at the time of site assessment. Substrate is predominantly grasses and fines. Portions located within a medium area of interest potential wetland – stream classification should also be confirmed by wetland presence prior to development. |

| ID | Location | Existing Classification | Recommended Classification | Description Traits/Values |
|-----|---|-------------------------|----------------------------|---|
| D29 | West side of 187 Street south of 92 Avenue | C | B | Linear roadside ditch. Banks are mowed and have limited riparian vegetation but has patches of established trees that are likely a source of food and nutrients to downstream fish habitat. Water flowed to the south. Substrate is dominantly organics and gravel at the higher gradient sections of the ditch. Benthic invertebrate habitat is present and is connected to a Class A watercourse. |
| D30 | East side of 184 Street between Highway 1 and 89B Avenue | C | B | Linear roadside ditch. The majority of banks are mowed and have limited to no riparian vegetation. Some patches of established riparian vegetation exist. Limited to no flow at the time of site assessment. Substrate is predominantly grasses and fines. Portions located within low to high areas of interest potential wetland – stream classification should also be confirmed by wetland presence prior to development. |
| D31 | West side of 184 Street between Highway 1 and 89B Avenue | B | B | Linear roadside ditch. Banks are mowed but have established riparian vegetation on the western bank that is likely a source of food and nutrients to downstream fish habitat. Water flowed toward the south and north to 92 Avenue and Highway 1, respectively. Substrate is predominantly gravel and cobbles. |
| D32 | South side of 94 Avenue between 182 Street and 184 Street | B | B | Linear roadside ditch. Banks are mowed and have limited riparian vegetation but with some established trees that are likely a source of food and nutrients to downstream fish habitat. Pooled water was noted at the eastern end, but became dry at the western end. Substrate is predominantly grasses and fines. |
| D33 | North and south side of 94 Avenue between 180 Street and 182 Street | C | B | Linear roadside ditches. Banks are mowed and have limited riparian vegetation but have established trees that are likely a source of food and nutrients to downstream fish habitat. Limited to no flow at the time of site assessment. Substrate is predominantly grasses and fines. |

| ID | Location | Existing Classification | Recommended Classification | Description Traits/Values |
|------|---|-------------------------|----------------------------|--|
| D34 | West side of 182 Street between Golden Ears Way and 92 Avenue | C | B | Linear roadside ditch. Banks are mowed but have established riparian vegetation on the eastern bank throughout most of the ditch section that is likely a source of food and nutrients to downstream fish habitat. Water flowed toward the south and north to 92 Avenue and Highway 1, respectively. Substrate is dominantly organics and fines. |
| D35 | East side of 182 Street between Golden Ears Way and 92 Avenue | B | B | Linear roadside ditch. Banks are mowed but have established riparian vegetation on the eastern bank throughout most of the ditch section that is likely a source of food and nutrients to downstream fish habitat. Water flowed toward the south and north to 92 Avenue and Highway 1, respectively. Substrate is dominantly organics and fines. |
| D36A | East side of 180 Street north of 92 Avenue to 94 Avenue | C | B | Linear roadside ditch. Banks are mowed and have limited riparian vegetation. Limited flow was noted at the time of the site assessment and connection to class A or B watercourses is limited by culverts. Substrate is predominantly grasses and fines. However, it is located within confirmed and medium area of interest potential wetlands. |
| D37A | North side of 93A Avenue west of 180 Street | C | None | No visible drainage. COSMOS indicates that a culvert exists but nothing observed in the field. |
| D37B | North and south side of 93A Avenue west of 178 Street | C | B | Linear roadside ditches. Healthy established native riparian vegetation exists along the banks opposite 93A Avenue. The ditches were dry at time of site visit; however, seasonal inundation is likely to provide food and nutrients to downstream Class A(O) watercourse. Substrate is predominantly non-aquatic vegetation and fines. |
| D38 | East side of Highway 15 between Golden Ears Way and 92 Avenue | C | B | Linear roadside ditch. Banks are mowed and have very few sedges and cattails. Limited to flow at the time of site assessment but likely from groundwater contribution. Substrate is predominantly grasses and fines. A test pit taken here showed soil mottling indicative of wetland characteristics. Wetland characteristics discussed in Section 3.1. |

| ID | Location | Existing Classification | Recommended Classification | Description Traits/Values |
|-----|--|-------------------------|----------------------------|---|
| D39 | East side of 180 Street north of Golden Ears Way, flowing north, then east along the south side of 96 Avenue into Leoran Brook | A | A | Linear roadside ditch connected to Leoran Brook. Banks are mowed and have limited riparian vegetation along 180 Street but have established native riparian vegetation along 96 Avenue. A moderate amount of water flowed towards the south. Substrate is dominantly sand and gravel with some cobbles and organics. |
| D40 | West side of 180 Street between 96 Avenue and Golden Ears Way | B | B | Linear roadside ditch. Banks are mowed and have limited riparian vegetation, but have some established trees that is likely a source of food and nutrients to downstream fish habitat. Water flowed towards the south. Substrate is predominantly organics and fines. |
| D41 | North side of 96 Avenue east of 180 Street, approximately 100 m long | A(O) | A(O) | Linear roadside ditch. Banks are mowed but have established native riparian vegetation on the northern bank. Water flowed towards the east but connectivity to Leoran Brook via D42 is naturally limited by a steep gradient. Connectivity to Leoran Brook via D39 is limited by a small culvert under 96 Avenue but this ditch section can be A(O) with channel enhancements. Substrate is predominantly sand and gravel with some cobbles and organics. |
| D42 | North side of 96 Avenue east of D41, approximately 120 m long | B | B | Linear roadside ditch. Banks are mowed but have established native riparian vegetation on the northern bank that is likely a source of food and nutrients to downstream fish habitat. Water flowed towards the east. Water quantity and steep gradient likely restricts fish presence. Substrate is dominantly sand and gravel with some cobbles and organics. |
| D43 | North side of 96 Avenue between 179 Street and 180 Street | B | B | Similar to ditch D42. Gradient is relatively gentle but water quantity is limited. |

| ID | Location | Existing Classification | Recommended Classification | Description Traits/Values |
|------|--|-------------------------|----------------------------|--|
| D44 | South side of 96 Avenue between 179 Street and 180 Street | B | B | Linear roadside ditch. Banks are mowed and have no riparian vegetation except a few trees. May contribute a source of food and nutrients to downstream fish habitat with channel enhancements. Water flowed towards the east and this ditch section connects two Class B ditches. Substrate is predominantly organics and fines. Benthic invertebrate habitat was not noted. |
| D45 | North side of 96 Avenue between Highway 15 and 179 Street | C | B | Linear roadside ditch. Banks are mowed and have limited riparian vegetation but small patches of established trees existed along the bank opposite the road that is likely a source of food and nutrients to downstream fish habitat. Water flowed towards the east. Substrate is predominantly organics and fines. |
| D46 | South side of 96 Avenue between Highway 15 and 179 Street | C | B | Similar to ditch D45. |
| D47A | West side of 179 Street between 97 Avenue and 96 Avenue | B | B | Linear roadside ditch. Riparian vegetation exists along the western bank and is dominated by Himalayan blackberry. Water and aquatic vegetation were noted at the time of the site visit. Substrate is predominantly fines. The ditch is likely a source of food and nutrients to downstream fish habitat. |
| D47B | East side of 179 Street between 97 Avenue and 96 Avenue | None | B | Linear roadside ditch. Riparian vegetation exists along the western bank and is dominated by Himalayan blackberry. Water and aquatic vegetation were noted at the time of the site visit. Substrate is predominantly fines. The ditch is likely a source of food and nutrients to downstream fish habitat. |
| D48 | North and south side of 97 Avenue between 177A Street and 179 Street | C | B | Linear roadside ditches. Banks are mowed and have limited riparian vegetation but with patches of established trees that are likely a source of food and nutrients to downstream fish habitat. Limited to no flow was noted the time of the site visit. Substrate is predominantly grasses and fines. |

| ID | Location | Existing Classification | Recommended Classification | Description Traits/Values |
|-----|--|-------------------------|----------------------------|--|
| D49 | West side of 177A Street between Highway 1 and 97 Avenue | C | B | Linear roadside ditch. Some riparian vegetation on the western bank that is likely a source of food and nutrients to downstream fish habitat. Limited flow was noted at the time of the site visit. Substrate is predominantly organics and fines. |



Photo 10: Ditch D8, an example of a typical Class A ditch with channel definition, likely sufficient water quantity, substrate and riparian vegetation for year-round salmonid habitat.



Photo 11: Ditch D13A, an example of a typical Class A(O) watercourse with channel definition, likely sufficient water quantity, substrate and riparian vegetation for overwintering salmonid habitat.

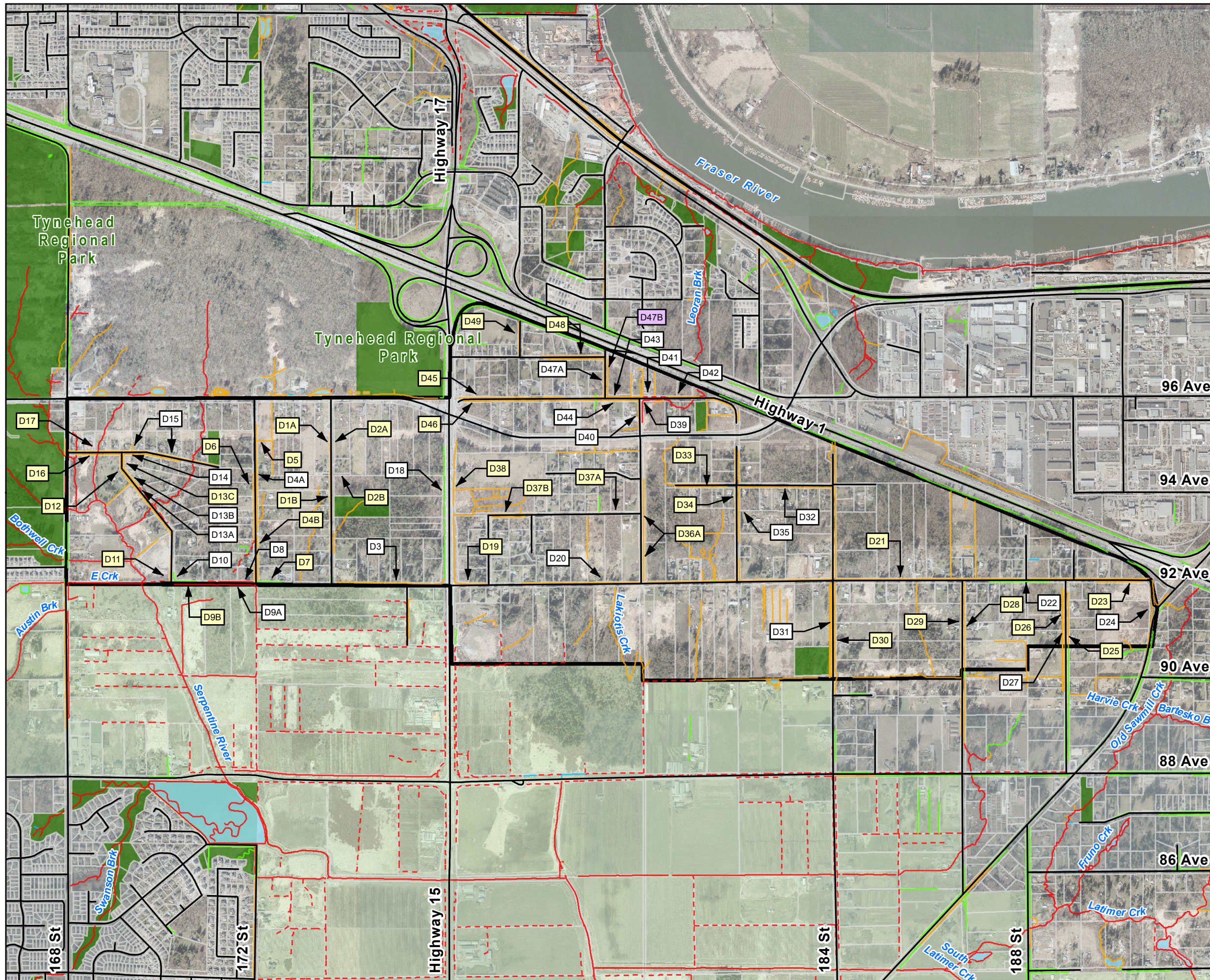


Photo 12: Ditch D3, an example of a typical Class B watercourse with channel definition and riparian vegetation that is likely a source of food and nutrients to downstream fish habitat.



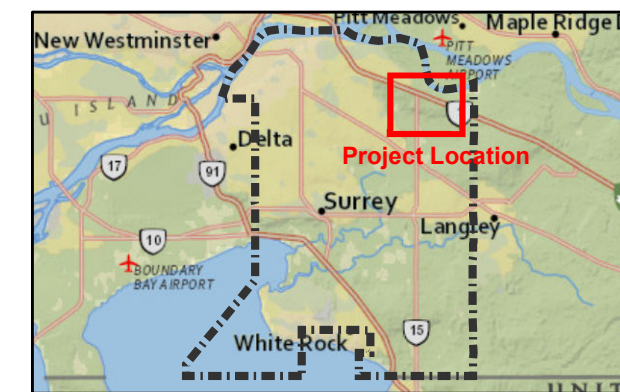
Photo 13: Ditch D7, an example of a typical Class C watercourse not considered a stream under the current WSA definition.

Figure 4.
Roadside Ditch Locations



LEGEND

- | | |
|--|---|
| Annedale-Tynehead - Tynehead NCP Area | Fish Classification (Open Channel) |
| Parcel | Class A |
| Park | Class A(O) |
| Agricultural Land Reserve (ALR) | Class B |
| Road | Class C |
| Fish Classification (Waterbody) | Unknown |
| Class A | D11 COSMOS - No Change |
| Class A(O) | D20 COSMOS - Recommended Change |
| Class B | D36A Previously Unmapped Watercourses |
| Class C | |



0 250 500 Meters
SCALE 1:15,500

MAP DRAWING INFORMATION:
DATA PROVIDED BY DILLON CONSULTING LIMITED,
CITY OF SURREY
MAP CREATED BY: RBB
MAP CHECKED BY: SW, LKD
MAP PROJECTION: NAD 1983 UTM Zone 10N

Table 6: Ditch Assessment Water Quality Results

| ID | Turbidity (NTU) | Dissolved Oxygen (mg/L) | Conductivity ($\mu\text{S}/\text{cm}$) | pH | Temperature (C) |
|------|-----------------|-------------------------|--|------|-----------------|
| D3 | 0.93 | 11.65 | 102.3 | 6.74 | 6.6 |
| D4A | 7.33 | 11.62 | 64.4 | 7.24 | 5.9 |
| D8 | 18.38 | 8.80 | 81.8 | 6.39 | 6.6 |
| D9 | 4.92 | 12.12 | 61.9 | 6.89 | 6.4 |
| D13A | 25.95 | 12.46 | 31.6 | 7.21 | 6.1 |
| D15 | 13.82 | 12.08 | 73.5 | 7.52 | 6.5 |
| D31 | 1.59 | 11.55 | 68.3 | 7.52 | 6.8 |
| D32 | 6.42 | 11.84 | 98.7 | 7.46 | 6.8 |
| D34 | 14.53 | 9.04 | 137.4 | 6.80 | 7.5 |
| D35 | 2.75 | 10.92 | 91.8 | 6.89 | 7.0 |
| D39 | 3.61 | 11.24 | 143.2 | 7.40 | 6.9 |
| D40 | 20.97 | 10.98 | 163.3 | 7.57 | 7.0 |
| D20 | 4.43 | 12.3 | 68.4 | 6.11 | 6.9 |
| D28 | 15.74 | 11.14 | 393.0 | 7.58 | 9.6 |
| D29 | 0.76 | 10.93 | 88.0 | 6.62 | 7.1 |

Two test pit investigations were excavated to determine if roadside ditches displayed wetland characteristics. The locations of each are indicated as W13 and W14 in **Figure 2** and are further discussed in **Table 1**. Both test pits found evidence of mottled and gleyed soils and were potentially saturated by slow groundwater infiltration.

Discussion and Conclusion

The background review and site assessments identified 14 wetlands throughout the Project Area. Most of these wetlands occurred as small remnant portions of larger terrestrial features. A number of them were the results of agricultural or industrial fields which were left to lie fallow which allowed for the establishment or re-establishment of wetlands features. A variety of wetland types were identified including reed canary grass and sedge marshes, swamps of willow and hardhack along broad, slow flowing watercourses, and small ponds. The largest wetland noted was W10 which spanned over at least three properties between 92 Avenue and 96 Avenue east of 180 Street. This wetland mostly displayed swamp characteristics but given its size could support other wetland types.

An additional 25 areas of interest with the potential to support wetlands were also identified ranging from low (5 properties), medium (11 properties) to high (9 properties) potential. Areas of interest were generally found in proximity to existing watercourses, remnant forested areas, and depressional areas of fields. These areas have the potential to develop into wetlands should hydrologic conditions allow for water retention.

A total of 41 potential watercourses were identified during the background review. These consisted of watercourses previously identified on COSMOS or other available information. Of these, 2 sites did not appear to have visible drainage and were not located within confirmed wetlands nor areas of interest. The remaining 39 sites still qualify as watercourses: 9 for reclassification have been made; 13 of which were made to update Class C watercourses to reflect the WSA and RAPR definitions of a stream.

An additional 5 previously unclassified watercourses were identified through review of aerial imagery. None appeared to be fish accessible.

A total of 57 roadside ditch assessments were conducted and similar to the watercourses, the majority of recommendations for reclassifications were to update C class ditches to reflect the WSA and RAPR definitions of a stream. The large majority of the classifications recommended are Class B (44). The remainder were Class A (4), Class A(O) (2), and Class C (4). Three watercourses on COSMOS did not appear to exist at the time of the assessment. A total of 31 classification changes were recommended.

As indicated in this report, wetted habitat is confirmed to be present throughout the NCP Area. In addition, a number of properties were determined to have potential to support wetlands or other aquatic habitat. The information presented above will allow the City to update its existing database of information to conform to existing conditions. This will in turn allow for City staff to have an understanding of the habitat or potential habitat that may be present on proposed development sites.

This will be an important planning tool which will assist proponents and the City in confirming expectations and allow development to proceed consistent with current City planning practices.

It should be noted that the assessment conducted for this project identified conditions as of February and March 2020. Ongoing changes in the NCP Area could result in the creation of additional habitat or the loss of existing channels and wetlands. In addition, time and access constraints did not allow for the detailed assessment of aquatic habitat that could be supported on all local properties. As such, detailed assessments of each of the wetted features or potential areas discussed in this report are recommended in the event that any of the local property owners decide to proceed with development.