Garry Oak Park Restoration at 1436 Ryan Street

ER390 – Habitat Restoration Project
Restoration of Natural Systems Program
Andrew Walker
V00137194

Abstract:

This report on the restoration of a disturbed *Quercus garryana* ecosystem into a 'Garry Oak Park' at 1436 Ryan Street was done as part of my final project for the Restoration of Natural Systems program at the University of Victoria. The site for this project is a disturbed *Quercus garryana* ecosystem located in the Oaklands neighbourhood of Saanich, British Columbia. 1436 is a disturbed Garry oak ecosystem overgrown with invasive species. The main issue faced at the site is *Rubus discolor*, or Himalayan blackberry; however, other invasive species, namely *Conium maculatum*, or Poison hemlock, *Hyacinthoides hispanica*, and *Galanthis nivalus*, are significant invasive species at the site as well. My contacts for this project are Fred Hook and Thomas Munson of the City of Victoria Parks Department. The goal of my project was to assess and carry out the initial part of a long-term restoration plan of a disturbed Garry oak ecosystem located at 1436 Ryan Street. The work done on this project took place October, 2010 and April, 2011, and included a power point presentation done March 26th, 2011, for the City of Victoria Parks Department's month-end volunteers meeting. This report introduces the Ryan street site, describes the issues facing restoration of 1436 Ryan Street as a Garry Oak Park, details the work that has been done to date, and outlines recommendations for future work to be done at the site.

Table of Contents:

Garry oak ecosystems are a unique national treasure. Thousands of plant and animal species inhabit Garry oak ecosystems. They are the richest land-based ecosystems in coastal British Columbia, they are a defining landscape characteristic of this region and they are an integral part of the culture of this area.
- Garry Oak Gardener's Handbook. Authors: Dunster et al (2009)

Background:

Ryan Street 'Garry Oak Park'

CRD Natural Areas Atlas 2007 Colour Orthophoto of Site Location. Includes Ryan Street Greenway Location

This is a report on the habitat restoration work done at 1436 Ryan Street in Saanich, British Columbia. The goal of my project was to assess and carry out the initial part of a long-term restoration plan of a disturbed *Quercus garryanas* ecosystem located at 1436 Ryan Street. The work done on this project took place between October, 2010 and April, 2011. The main issue faced at the site is *Rubus discolor*, or Himalayan blackberry; however, other invasive species, namely *Conium maculatum*, or Poison hemlock, *Hyacinthoides hispanica*, or Spanish bluebells, and *Galanthis nivalus*, or Common snowdrop, are prominent at the site as well. The 'in the field' restoration work

done, this written report, and a powerpoint presentation presented at a City of Victoria Parks Department month end volunteer meeting were done as part of my final project for the Restoration of Natural Systems program at the University of Victoria.

An unassuming city owned residential lot, overgrown with alien and invasive species; 1436 Ryan Street is actually a significant piece of property. The property is significant because it offers a unique opportunity for Garry oak restoration, unlike any other in the city of Victoria, BC. 1436 Ryan Street is the first and only[i] city owned lot in Victoria, BC, that is designated specifically for ecological use, as a native ecology 'Garry Oak Park,' instead of recreational use for people (Committee Meeting, 2005). The City's original intent was to auction the lot for residential development; however, the local neighbourhood got together and fought this decision with a common goal to protect the lot as a natural space. During a 'Committee of the Whole' meeting in 2005 between the City of Victoria and a committee of Ryan Street residents, Councillor Coleman declared that the "City Solicitor [prepare] a bylaw to reserve the City owned lot located at 1436 Ryan Street as Neighbourhood Park for the purpose of preserving the natural habitat of this site" (Committee Meeting, 2005). This was a significant decision, as the property at 1436 Ryan Street is likely very valuable and would have brought the City of Victoria a large sum of money if auctioned. A unique opportunity now exists, however, to create the first 'Garry Oak Park,' supporting native ecology and expanding true Garry oak habitat, in a residential neighbourhood in Victoria, BC. This site offers the unique opportunity of a neighbourhood supported Garry Oak Park restoration project located in an urban/residential area where human disturbances can be effectively minimized.

Garry oak and associated Garry oak ecosystems are extremely important and valuable on Vancouver Island, yet overall Garry oak habitat has largely decreased over the past century (GOERT, n.d.). Within Canada, Garry oak and associated Garry oak ecosystems exist only on southeast Vancouver Island, the Gulf Islands, and two locations in the Fraser Valley, and as of 2009, less than %5 of those Garry oak ecosystems in Canada remain in a near-natural state (Garry Oak Gardeners Handbook, 2009). Garry oak ecosystems contain more than 1/5th of the rarest plants in British Columbia, and more than 100 at-risk species have been identified by the federal and provincial governments in Garry oak and associated ecosystems (Dunster, 2009; GOERT, n.d) [Table 1]. Garry oak ecosystems offer habitat for birds, butterflies and bees which are crucial for the pollination, and thus survival, of flowering plants on Vancouver Island. By restoration 1436 Ryan Street as a Garry Oak Park, we will be performing the critical task of expanding *Quercus garryana* habitat on Vancouver Island.

Successful restoration of 1436 Ryan Street as a functioning *Quercus garryanas* habitat will also link this site to the Ryan Street Greenway, and to the 'Saanich Greenway Loop,' an ecological corridor project designed by Fred Hook and the City of Victoria Parks Department, on southern Vancouver Island.

(Ryan Street Greenway Project)

Ryan Street Greenway Project and Saanich Greenway Loop:

My project site connects with the Ryan Street Greenway project, as part of the City of Victoria Parks Department's proposed 'Saanich Greenway Loop.' The term "Greenway" has conflicting definitions depending on the intended application of a

specific Greenway project. Greenway projects are commonly defined as "green" pedestrian or bicycle paths, designed to "expand the opportunities for urban recreation" (City of Vancouver, 2010). Greenways can also, however, be defined as biodiversity conservation strategies in urban/residential areas where habitats are fragmented (Bryant, 2006). Greenway projects within this definition are designed for ecological/habitat restoration purposes, rather than recreational purposes; however, some Greenway projects can encourage both biodiversity conservation and recreation (Greenways Land Trust, 2010). The Saanich Greenway Loop is an example of a Greenway project that has been designed and planned for ecological use, as an 'ecological corridor.' with the goal of connecting fragmented habitats on southern Vancouver Island.

The Ryan Greenway Project is an urban restoration project created by the Oaklands Community Association (OCA) volunteer group, led by local gardener Ludo Bertsch, in conjunction with the City of Victoria parks department, with the goal of restoring Garry Oak meadow ecosystems as vegetation corridors in the Oaklands Neighbourhood, as part of the 'Saanich Greenway Loop,' an ecological corridor project that links various in-progress 'Greenway' projects facilitated by the City of Victoria's Parks Department. The individual Greenway projects act to increase natural and native habitats with the main purpose of supporting birds, butterflies, bees and other insects, and native flora on Urban/Residential sites that have been overrun by invasive species due to various disturbances – most commonly human development. Connected, these Greenways create an ecological corridor for the southern tip Vancouver Island, increasing habitat space and connecting fragmented habitats for countless at-risk species (GOERT, n.d.; Greenways Land Trust, 2010; [Table 1]).

Introduction:

(Roadside entrance to 1436 Ryan Street)

1436 Ryan Street is a relatively small plot of city owned land located directly off the roadway on the upper slope of the Ryan street hill. The area is bordered by two houses on the east and west side as well as two more houses – one occupied, one abandoned) at the north end of the site. There are two steep slopes, one on the west side near the middle of the plot (a recently cleared blackberry patch), and one east, a grassy hill, near the road side entrance. Near the road side entrance is a granite rocky outcrop, which leads into a less-severe, sparsely treed north facing slope that twists and gullies down into a small, flat Garry Oak dominated stand. The crown class consists entirely of

Garry oaks, while the shrub and herb layers consisted mainly of invasive species with a few native species – Common snowberry, *Symphoricarpos albus*, Great camas, *Camassia leichtlinii*, and *Mahonia aquifolium*, mainly – prior to the work done for this project.

Data collected for the project includes a general site description, a ground inventory, a slope assessment, and a wildlife tree assessment, all done as part of a smaller project for another restoration of natural systems course, ER312B, "Introduction to field studies". Field work involved the removal of invasive species – mainly Himalayan blackberry, *Hyacinthoides hispanica*, and *Galanthus nivalis* – the planting of various native Garry oak species, and the building of slope-stabilizing terraces on slope 1 [Table 6] where a large thicket of Himalayan blackberry was removed. Research was done on typical Garry oak ecosystem restoration / "Garry oak gardening" methods (Dunster, 2009; GOERT, n.d); the best methods to eliminate specific invasive and alien species; and also on which native species would survive in the various site conditions present at 1436 Ryan Street (Erickson, 2007; Pojar, 2004). Research was also done on slope stabilization methods (Pollster, 2003) to determine the best strategies for stabilizing slope 1 [Table 6].

The data collected, and restoration work done during the course of my project is intended to assist, not complete, the restoration of a 'Garry Oak Park' at 1436 Ryan Street. Restoration efforts and site management will need to continue for several years following this project to ensure the successful elimination of persistent invasive species like Himalayan blackberry, Poison hemlock, Hyacinthoides hispanica, and *Galanthus nivalis*, while promoting the growth and success of a typical Garry oak ecosystem with a native species dominated understory.

Methods:

Data Collection:

Initial data collection involved a walk around the site with Fred Hook on October 26th, 2010, where we discussed strategies for eliminating the Himalayan blackberry, and Fred identified various invasive and native species on the site while I took pictures of each species and labelled them in my field notebook. A complete list of invasive species was provided by Thomas Munson of the City of Victoria Parks Department [Table 4]. Further data collection was done as part of another course, ER312B: introduction to field studies, and specifically involved a site description [Table 5], slope assessment [Tables 6 & 7], ground inspection form [Table 8], and a wildlife tree analysis [Table 9]. All data was analyzed and used to create an overall restoration plan for the site.

Data collection for the site description, slope assessments, and ground inspection form (GIF) were done using government standardized methods and forms as described in the Field Manual for Describing Terrestrial Ecosystems (Field Manual for Describing Terrestrial Ecosystems, 1998) and Richard Hebda's ER312B Coursepack (Hebda, 2010).

A site description was done to give a summarized account of the geographic, topographic, geological, and to a certain extent, hydrological and climatic conditions of my study site. Slope assessments were done to help determine the need for slope failure prevention (ie. by building terraces, using 'live cuttings,' and planting native species to develop supportive root systems) (Pollster, 2003). A Ground Inspection Form was filled out to assess various indicators, such as topography and soil and drainage conditions, in

order to determine what conditions should ideally exist on the site. Using the data from these three government standardized assessment forms (Field Manual for Describing Terrestrial Ecosystems, 1998), as well as information from Dave Pollster's paper on Soil Bioengineering (Pollster, 2003), and Wayne Erickson's book on Garry Oak communities in British Columbia (Erickson, 2007), I – with assistance from Fred Hook and Thomas Munson of the City of Victoria Parks department – was able to create a native species planting list for the Ryan Hill site. Initial data collected through site description and GIF forms was improved and expanded upon using Erickson's improved Garry Oak classification system (Erickson, 2007) [Table 10], while data found during slope assessments was expanded upon using Pollster's paper (Pollster, 2003).

Tools and research used for data collection include: a digital camera, a field notebook, the BC field manual (Field Manual for Describing Terrestrial Ecosystems, 1998), my ER 312B Coursepack (Hebda, 2010), and personal observation; a 15m measuring tape; a clinometer and compass; a hand-held GPS; the CRD Natural Areas Atlas; British Columbia Government Websites; and Google Earth. In-field sketches were recopied into digital format using Microsoft paint, and accurately represent the sketches in my field notebook.

I selected the two largest and steepest slopes for the two slope assessment forms [Tables 6 & 7], but further slope assessments to the center gully of the site and the northernmost slope would provide valuable data and should be done. Slope 1 [Table 6] was also selected because it is a recently cleared thicket of *Rubus discolor*, and is therefore a highly disturbed slope. Slope 2 [Table 7] was also selected because it borders the roadside of the site, and the volunteer Oaklands Community group has, according to

Fred Hook, discussed the potential of building a staircase on this slope leading down to the lower roadway. I am not an expert on this issue; therefore, I simply offer the slope assessment data for further analysis and assessment of the viability of building a staircase here.

For the Ground Inspection Form [Table 8], I chose a sample plot at the northern end of the site to avoid the large amounts of 'fill' in the middle of the site. For the soil moisture and nutrient regimes I dug a soil pit within my sample plot at the north end of the lot. The north end was chosen because, as mentioned above, due to residential construction much of the middle area of the site consists of deep fill and organic material, and therefore would not give an accurate representation of soil conditions, and would be difficult to analyze. I used the GPS to record location (LAT/LONG), and then dug a soil pit roughly 30-35cm in length. I did a hand texture test of the soil using the key to soil texturing handed out in class. Soil Moisture and Nutrient Regimes, humus form, and moisture subclass were recorded using the tables and definitions in my coursepack (Hebda, 2010). I then measured 5m in each direction, using my soil pit as a middle point, to form a 10x10m quadrat, creating my sample area. Within the sample area I recorded all vegetation and estimated percent cover of each on my indicator/dominant species list. Crown closure and percent cover by stratum (tree, shrub, grass [no fungal layer present]) were visually estimated.

Location (Lat/Long) and elevation were determined using a hand-held Garmin GPS unit, and then later changed slightly – using information on Google Earth – to be closer to the road-side entrance of the lot at 1436 Ryan Street. Slope and aspect was calculated using a clinometer and compass. Map Sheet, UTM Zone, Ecosection, Forest

Region, and BGC unit were found using BC government websites[1]. All other data points were filled out using the BC field manual.

Site series was determined based on a combination of soil moisture regime and soil nutrient regime, as well as the vegetation recorded as present in the sample quadrat. Site modifiers and structural stage were chosen based on definitions as described in the BC field guide (Field Manual for Describing Terrestrial Ecosystems, 1998) and Hebda's coursepack for ER312B (Hebda, 2010). I later used Erickson's Garry Oak community classification guide (2007) [table 10] as a reference to compare my site at Ryan road with typical Garry oak communities based on vegetation and soil conditions. Site conditions at my site are very different from the conditions at the Ryan Street Greenway; therefore, the Greenway was not used as a comparable site for determining vegetation community type. As mentioned above, all initial vegetation community data determined using the BC field guide (Field Manual for Describing Terrestrial Ecosystems, 1998) and Richard Hebda's ER312B coursepack (Hebda, 2010) was expanded upon using Erickson's classification guide (Erickson, 2007).

For the wildlife tree assessment [table 9], I chose the largest Garry oak tree in the center of the site. I used the diameter tape to record the breast height diameter (DBH), and did a 360° walking inspection of the lower 5m of the tree. I then measured 10m from the base of the tree and used the clinometer to estimate the height of the tree. Pointed at the top of the tree, the clinometer read 150%; therefore, the height of the tree is 15m. I also used the clinometer to record slope, and the compass to record aspect.

Field Work:

'In the field' work was done by me, Fred Hook, Thomas Munson, and – during one afternoon session – six students from the University of Victoria, between November, 2010 and March, 2011. Field work involved invasive species removal, native species planting, and terrace construction for slope stabilization on slope 1 [Table 6].

The biggest invasive species problem at the site prior to any field work was Himalayan blackberry. A full list of invasive species on the site was provided to me by Thomas Munson of the City of Victoria [Table 4]. The large blackberry shrub layer that consumed the site prior to November, 2010, has actually been machine cut down by the City of Victoria Parks labourers three times since 2005, only to re-establish itself at the site. The most recent machine-cutting session happened in November, 2010. Following this, all invasive species removal, including removal of the remaining blackberry roots – although many blackberry roots and a variety of invasive species still remain on the site –

was done by hand-pulling the roots out of the ground. Native plant species were provided by the City of Victoria Parks Department's nursery.

I created an initial native species planting list [Table 2] using Erickson's classification system and earlier soil moisture, soil nutrients, and present vegetation data collected for my ER312B project [Table 10]. My plant list was then expanded upon by the expertise of Fred Hook and Thomas Munson of the City of Victoria to create the finalized plant list [Table 3]. The site was divided into two sections: the dry, sunny area at the north end [Figure 1.0], and the wet, shady area at the south end of the site [Figure 1.1]. Native species were planted according to which conditions – dry and sunny, or wet and shady – they would most have the best chance of succeeding in. Nootka rose, *Rosa nutkana*, and Tall Oregon grape, *Mahonia aquifolium*, were planted throughout all areas of the site, as they are both relatively hearty species that can succeed in many various conditions – wet or dry; sunny or shady; steep slopes or flat land. Native species were planted, where possible, in areas where invasive had just been removed, often times in the exact spot that blackberry or other invasive roots, for example, had been pulled out of the soil. This was done for two reasons: first, to minimize overall soil disturbance on the site, and second, to reduce the chance of invasive species re-sprouting if roots were not fully removed from the base or seeds were released/distributed during the removal of invasive species (Dunster, 2009; Management Strategies for Invasive Plants, n.d.).

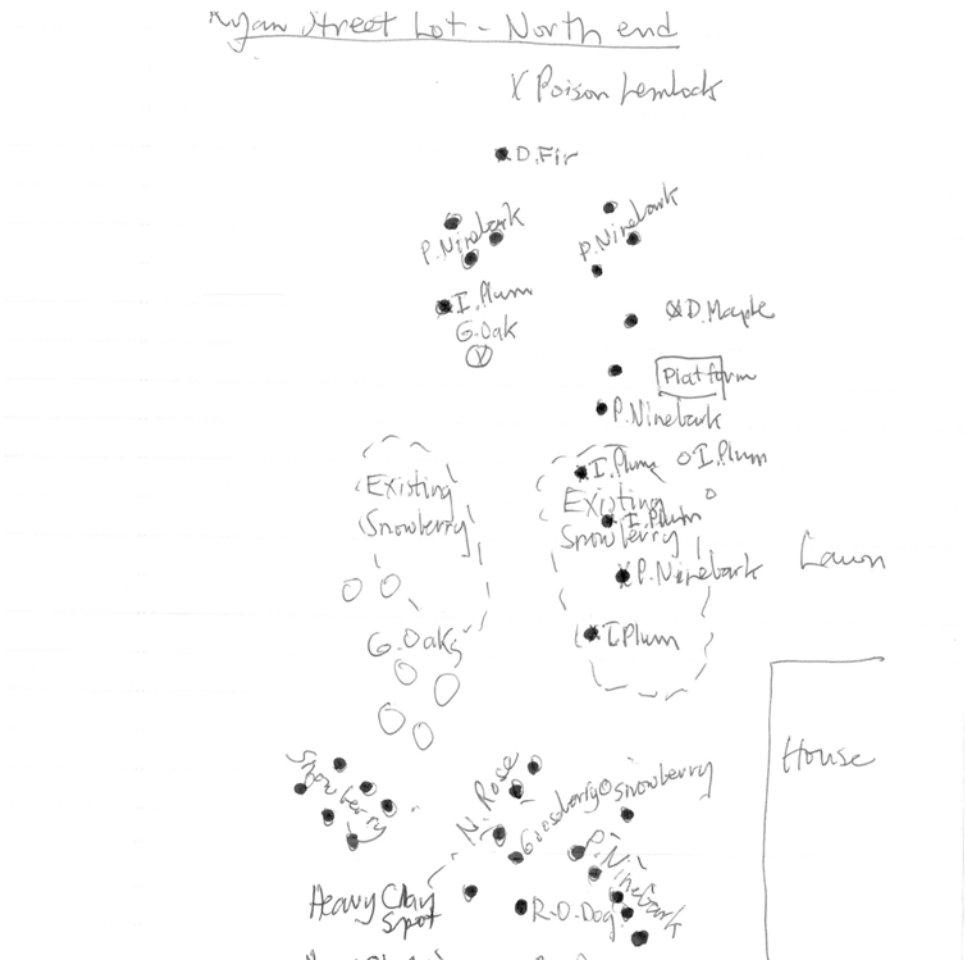


Figure 1.0 – Dry Sunny North End Planting Map

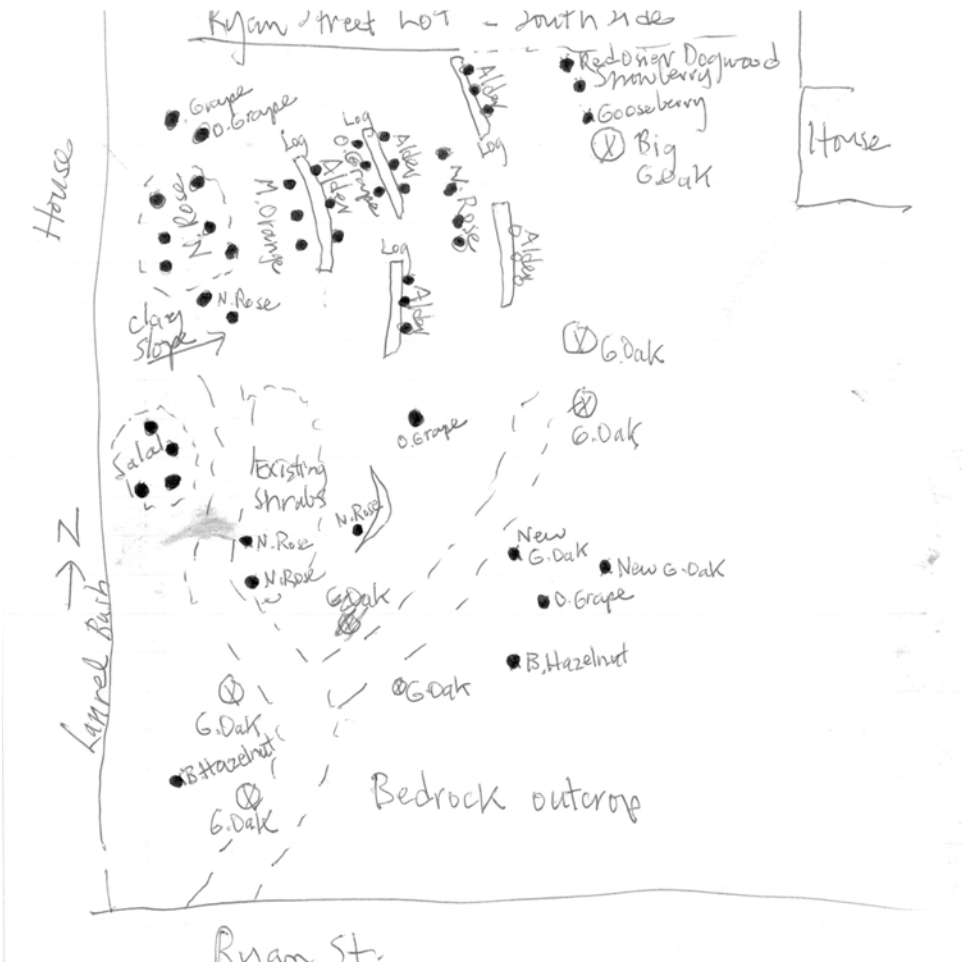


Figure 1.1 – Damp, Shady South End Planting Map

Hand pulling of invasive species and planting of native species was done over three separate 2-4 hour sessions. The first removal and planting session included Fred Hook, Thomas Munson, and me. Participants during the second planting/removal session were me, Fred Hook, and a group of six environmental studies students from the University of Victoria. The final planting/removal session was done by me and Thomas Munson.

During the three invasive removal sessions, invasive plants and roots were put into piles, which were removed on a fourth and final day by me and Thomas Munson,

and properly disposed by Thomas at the Saanich Garden Waste Disposal site at the public works yard on McKenzie Avenue in Victoria, BC.

Although it is an aggressive invasive species, the Himalayan blackberry roots acted to stabilize slope 1 [Table 6] at the site, which is a very wet, very steep slope. As a result, immediately following the cutting of the blackberry shrub layer and the removal of its roots, some type of slope stabilization had to be developed to avoid slope failure (Pollster, 2003). To do this, we built five 'eyebrow' terraces on the slope using driftwood and rocks [figure 2.0]. Small ditches were dug into the slope, where the logs were placed. We planted *Rosa nutkana*, *Mahonia aquifolium*, and Mock orange on soil above the logs to root the terraces, and placed and rocks about a foot to two feet in size under the logs to catch water running down the slope to irrigate what we had planted. We also staked live red Alder cuttings underneath the terraces, a process called "live staking" (Pollster, 2003), which we hope will take root and act to further stabilize the slope. Red Alder is a pioneering species that grows quickly in disturbed sites, such as roadside ditches, logging roads, and recently logged lots (Pojar, 2004) and can create a thick shrub layer that will ideally replace the blackberry layer that previously existed at the Ryan Hill site. For the Alder cuttings, I drove out to Langford, BC, about 20 minutes out of Victoria, BC, with a friend, and helper, Kevin Paterson, and clipped suckling alder branches roughly 1 meter in length and about the width of my thumb from young looking Alders (we cut branches that looked more reddish than brown and seemed to be from younger Alders rather than mature Alders) (Live Stakes, n.d.; Live Stakes for Restoration Plantings, 2009). We took 16 cuttings in total, which we stored in a 5L paint bucket filled with water overnight to keep alive, and planted at the site the next day.

After we constructed the terraces, Victoria had a couple of weeks of off and on heavy wind storms, so I went back to the site on March 18th and had to replace one out of the five terraces, as it had been blown down the slope. Two out of the three alder cuttings from the fallen terrace were lost; however, the other terraces and alder cuttings remained in tact.

Figure 2.0 – "Eyebrow Terraces W/ Red Alder cuttings

Results:

(Data Collection:)

Site Description:

The site is a highly disturbed Garry oak stand that has little to no native understory vegetation. Located directly in a residential neighbourhood and surrounded on all sides by houses, the site has many variable and potential a-typical conditions. The entire site consists of a two distinctive conditions based on different factors including species present, slope, drainage, weather patterns, and residential conditions; therefore, the site can be broken up into two sections for classification purposes: a north, sunny and dry section, and a south, shady and wet section.

Slope Analysis:

Slope 1 [Table 6]

Slope 1 is a recently cleared, large patch of *Rubus discolor,* or Himalayan blackberry, an introduced invasive species in British Columbia. The root system still remains from the cleared patch, and needs to be removed by hand pulling.

The concave shape of the slope indicates slope erosion, and the irregular/benchy shape of the slope may indicate past slope failures, causing although there is little

indication at the base of the slope like large boulders to indicate slope failure. The most prominent past landslide type is likely "creep," which involves the "slow downslope movement of overburden" at very slow to slow rates, and occurs on all slopes (cm/year to mm/year) (Hebda, 2010). The angular shape of the coarse fragments, combined with knowledge that a root system of the *Rubus discolour* prominently exists on the slope, indicate that slope failure has not happened recently, and that the slope has gone largely undisturbed over the past 10 years, or longer. Lack of recent weathering and disturbances are indicated by the high content of clay in the overburden, as well as mottling and gleyed patches in the soil, which is caused by high moisture content and poor drainage. This means that Slope 1 is likely a very thick, cohesive layer of clay overburden roughly 1m in thickness, that is currently resisting slope failures because of the existing *Rubus discolor* root system.

Slope 2 [Table 7]

Slope 2 has very different conditions than Slope 1. Slope 2 is concave, as opposed to convex, with a steep slope angle, as opposed to a more gradual one. Large exposed patches of bedrock form the upper slope, as well as the base of the slope. Past evidence of landslides looks to be results of bedrock slumping. Bedrock slumps "typically occur as displacement of one or more blocks, which rotate backward along a curved basal shear surface…" (Hebda, 2010). Bedrock slumps usually happen very slowly (mm/year), but can happen moderately quickly (meters/day). This site appears to have slumped over long periods of time at very slow rates, as there is little fresh bedrock

exposed: most of it looks very weathered. There are also tension fractures and exposed cliff faces in the bedrock throughout the slope, indicating high levels of stress and past failures in the bedrock.

Most of the coarse materials are rounded, as opposed to angular like on Slope 1, likely resulting from being transported in a stream, and indicating high levels of abrasion and erosion over long periods of time. Bent/leaning trees, as well as heavy, large debris, 1-3m in diameter, at the bottom of the slope strongly indicate past slope movement, as well as wind-throw.

The SMR on Slope 2 is far drier than the soil on Slope 1, which is likely due to being more exposed to the elements than the soil on Slope 1 that was protected by the heavy thicket of *Rubus discolor*. The SNR is "rich" like the SNR on Slope 1, meaning the two slopes do share some similar properties. Slope 2 seems to have better drainage, however, than Slope 1, as the soil has a higher sand content and shows no signs of mottling or gleyed soil. The overburden on Slope 2 is still held in place by the root systems from the Garry oaks at the top of the slope and the shrubs on the slope itself. Slope 2 has less clay content, has drier soil and a shallower layer of overburden than slope 1.

Ground Inventory Form [Table 8]:

Based on my initial site description, the site code for the sample site is GO5sB, which translates to young forest, Garry oak stand, in this case in a rural/residential area (RR),

and one that is a single-storied broadleaf stand. The fact that it is in a residential area, and that it is a single-storied, broadleaf stand, as opposed to a mixed, multi-storied stand, indicates that the site is likely disturbed to some degree, and probably has a-typical conditions.

Site series was determined based on soil and geographic conditions, including soil moisture and soil nutrient regime, and a visual survey of vegetation; however, the results seem abnormal considering the vegetation present. Although the location I selected for my soil pit is away from the majority of the back fill in the middle of the site, the pit is very close to the neighbouring properties, which may have resulted abnormal soil conditions for a Garry oak and could have altered the test results. A 'wet' soil moisture regime and 'rich' soil nutrient regime point to the site as being a Western Red-Cedar dominated (CwBg-Foamflower) stand; however, the vegetation clearly points to a Garry oak (Qg-Ocean spray) dominated stand. Increased moisture and nutrient regimes in my results point to CwBg-Foamflower; however, these conditions have likely been caused by the invasion of dense thickets of *Rubus discolor*, which can "increase flooding and erosion potential by out-competing deep-rooted native shrubs that would otherwise provide bank stability" (BC Invasive Plant Council, 2008). Drainage has likely decreased, as observed in the mottled and gleyed soil in the overburden of Slope 1, causing soil moisture and richness to increase. The base of Slope 1, a recently cleared thicket of Rubus discolour, is adjacent to the sample soil pit – an assessment of Slope 1 showed evidence of erosion and past landslide – which may have altered the SMR and SNR conditions. A wet and rich soil moisture and soil nutrient, however, does not prove that the site has a-typical conditions, however, as Garry oak sites are considered

"noncorrelated units" on the Provincial Site Series Codes handout, and are not attributed a typical soil moisture regime (Field Manual for Describing Terrestrial Ecosystems,1998). Classification of this site was expanded upon using Erickson's classification system, and is discussed following this section (Erickson, 2007). Based on the knowledge that much of the site has recently been cleared of a massive thicket of the invasive *Rubus discolor*, I do know that the site is highly disturbed and has a-typical vegetation for a Garry oak site.

Crown cover is roughly 70% of the site, and the tree layer consists of roughly 60% of the entire site; however, the understory layers consist of a small, patchy shrub layer and a grass layer. The site has limited biodiversity, which can largely be attributed to the recently cleared patch of *Rubus dicolor,* which was slowly taking over and dominating the site, out-competing native understory species. Small patches of *Symphoricarpos albus* remain as the one intact native shrub layer. The tree layer has decent to good height compared to similar areas in the Oaklands neighbourhood, and crown cover based on its composition (young forest); however, the tree layer is single-storied and is comprised only of Garry oaks.

Erickson's Classification [Table 10]:

Using Erickson's classification system (Erickson, 2007), I determined the site classification can be broken up into two separate vegetation communities, one for the damp shady slope area and one for the dry north sunny area. Site codes were determined primarily by looking at soil moisture conditions and vegetation present. The

classifications are: Qgos-C8 (Garry Oak-Common snowberry-Nootka rose) for Slope 1 and the south end of the site [Figure 7], and Qggc-c48 (Garry oak – Miner's-lettuce) for the north end of the site. Using Erickson's classification tables [Figure 11], I was able to create an initial planting list [Table 2], which was then expanded upon by Fred Hook and Thomas Munson [Table 3].

Wildlife Tree Assessment [Table 9]:

The tree I selected for the wildlife tree assessment is visually and structurally a healthy tree that shows little to no signs of decay or decomposing. My sample tree also does not have any visible nesting holes or signs of wildlife use. The tree is a standing Garry oak, with all of its bark remaining intact. The tree is located at the base of a steep slope, but is on flat ground, and is co dominant with the rest of the crown, meaning the tree does not extend above the general level of the highest crown layer (Field Manual for Describing Terrestrial Ecosystems, 1998). The appearance of the crown is coded as a 2, which means "some of all foliage lost; possibly some twigs lost; all branches usually present; possible broken top" (Field Manual for Describing Terrestrial Ecosystems, 1998). Bark retention is coded as a 1: all bark present. Wood condition is also a 1: No decay. There are some lichens below the 4.5 m mark. Wildlife uses are mainly P, perching, by B, birds (Field Manual for Describing Terrestrial Ecosystems, 1998).

Field Work:

One hundred and nine native plant species were planted at 1436 Ryan Street between the months of November, 2010 and March, 2011 (Figure 2.1). 100% of the *Rubus discolor* shrub layer was cut by Fred Hook and the City of Victoria Parks Department team, while roughly 60-70% of the *Rubus discolor* roots were actually removed from the ground. An estimated 80-90% of the *Conium maculatum* was removed by Thomas Munson, while roughly 20-30% of the other existing invasive species [Figure 1.0] were removed via hand pulling by me, Fred Hook, Thomas Munson, and the student volunteers from the University of Victoria.

Field work results, specifically of the success of planted native species and the success of invasive species removal, will be an ongoing process, and will not be determined until further monitoring during and following the upcoming spring season when plants have an opportunity to bloom. Monitoring of invasive species removal, specifically the *Rubus discolor*, over the next year, will be crucial to determine the success of cutting the *Rubus discolor* shrub layer combined with hand pulling of the *Rubus discolor* roots. Success will be based on the amount of *Rubus discolor* that returns

on the site compared to the amount of coverage (70-80%) existed prior to the restoration work done between November 2010 and March 2011.

Discussion:

GIF

Successful restoration of a healthy understory consisting of native shrub and herb layers will provide many services, such as creating root systems to improve drainage on the two major slopes, as well as increasing native Garry oak habitat to promote bird, insect, butterfly and other wildlife use. The first step to restoring a native understory was to remove, as much as possible, the invasive species on the site by hand pulling the roots. The native species we planted - *Symphoricarpos albus*, *Mahonia aquifolium*, *Rosa nutkana*, Cascara (*Rhamnus purshiana*), etc - will ideally out-compete the invasive/alien species and, following further removal of invasive/alien species and planting of native species, transform the site from a disturbed Garry oak ecosystem into a self-perpetuating native Garry Oak Park.

Slope 1:

The *Rubus discolor* has likely held much of the slope in place over the past few years with an extensive root system; however, the blackberry was spreading throughout

the entire site, and out-competing native species like *Symphoricarpos albus*. The cover provided by the *Rubus discolor* would have caused the slope to go largely undisturbed, and would have trapped a lot of rain water, which likely contributed to the high moisture and clay content of the soil on Slope 1; conditions which are very different from the conditions on soil 2. Once the *Rubus discolor* roots were removed, the slope consisted of a wet, heavy layer of clay-rich overburden, and was therefore at a significantly increased risk of a slope failure, especially if hit with heavy rains. The cohesion strength of silt and clay rich soils is dependant on mineralogy and moisture content of the overburden: increased water content will cause the clay to mobilize as water is absorbed into the clay structure; therefore, increasing the risk of deformation and failure in the slope (Hebda, 2010). Reestablishment of a native plant community on Slope 1 following the complete removal of the *Rubus discolor* root system was a top priority to prevent soil failure and further disturbance at the site. By constructing terraces and planting *Rosa nutkana*, *Mahonia aquifolium* and Mock orange on the terraces, we began the process of stabilizing the otherwise very wet and mobile overburden by stabilizing the slope and improving both cohesion and drainage of the soil.

Slope 2:

Because slope 2 has less clay content, drier soil, and a shallower layer of overburden than slope 1, slope 2 is probably at less risk of immediate slope failure than Slope 1; therefore, work restoration on Slope 2 will be less of an immediate priority than restoring vegetation on Slope 1. Road and house construction in the areas surrounding

Slope 2 have likely affected the water table and the hydrology of the overburden, which will have increased the potential of slope failure; therefore, restoration of Slope 2 should still be a priority in this project.

At this point, I do not think that building a staircase on Slope 2, running from the upper slope down to the lower roadway, is a viable option. The slope is too steep and too irregularly shaped to make simple construction possible. Building a staircase would likely require more work and costs than the City of Victoria is willing and able to cover. Instead, I recommend that Garry oak trees and other native Garry oak ecosystem species are planted along the upper slope to further promote a strong root support system, as well as to shelter the area from heavy weathering.

Wildlife Tree Assessment:

I selected this tree because it is the biggest tree on the site, and has some potential for wildlife services, such as large, strong branches for perching. The tree is also located very close to a neighbouring house, and I wanted to assess it for danger tree potential (ie. the risk that the tree might fall onto the house during a large storm). I am not a wildlife tree expert, nor am I certified to assess wildlife trees, but based on the assessment form in the BC field guide book (Field Manual for Describing Terrestrial Ecosystems, 1998), this tree has little to no danger tree potential. However, this tree has few wildlife tree attributes, and every tree on the site should be assessed. I believe there are other trees on the site that would constitute better wildlife trees than the one I selected.

Although the tree has significant "perching" properties, this tree is close to a house and residential neighbourhood; therefore, the tree will only make a good perch for small mammals like raccoons, which are considered pests and not typically desired in such areas, which live in residential areas. Furthermore, the tree is exposed to elements such as weather, human access, predators and other invasive disturbances meaning more understory coverage is needed to make this tree a better protected perching site for birds and small mammals. As mentioned above, there are likely better potential wildlife trees on the site and all trees should be assessed, time allowing.

Field Work:

The field work done between November, 2010, and March 2011, was a significant start in the restoration of 1436 Ryan Street as a Garry Oak Park. The majority of the *Rubus discolor* was removed, and over a hundred native species were planted in its place. Come spring time, the site will likely be transformed from what was once an invasive species dominated site into a site where native Garry oak ecosystem species make up a large portion of the site. Invasive species are still rampant within the site, however. *Hyacinthoides hispanica* and *Galanthus nivalis,* have moved into many of the empty spaces where *Rubus discolor* once existed, and will now have to be weeded out. Ideally, the native species we planted will succeed on this site and will out-compete the invasive species, making the job of fully removing all invasives from the site easier; however, this will be a long term project that will require a lot more hands-on work pulling invasive

species out of the ground to succeed. The terraces built on slope 1 should act to stabilize the slope in the absence of the *Rubus discolor* roots, and will trap water as it runs down the slope, irrigating the *Rosa nutkana*, *Mahonia aquifolium* and Mock orange that we planted on the terraces, encouraging their growth. The red Alders that we planted have already taken root at the site and should grow quickly and create a shrub layer that will ideally out-compete and replace the previously existing *Rubus discolor*. As mentioned above, the work that has been done to date is merely a starting point for the restoration of the site as a whole; however, a good start has been made, and presuming follow work is done over the next few years, I strongly believe restoration of 1436 Ryan Street as a Garry Oak Park is achievable.

Recommendations:

Successful restoration of 1436 Ryan Street as a Garry Oak Park will likely require at least 3-5 years, and possibly 5-10 years, of restoration field work, continuing the process we have started thus far. Invasive species that were removed, such as *Rubus discolor* and *Conium maculatum*, will likely return to the site, and will have to be continually hand-pulled and cut down. *Hyacinthoides hispanica* and *Galanthus nivalis* remain a significant threat at the site and will need to be removed as quickly as possible.

While it is important to continue remove invasive species, it will also be equally important to immediately replace the removed invasive species with native species. By planting native species directly in the areas where invasive species were removed, we

will be blocking out any remaining invasive species roots, minimizing the opportunity for the invasive species to re-sprout, and therefore giving the native species the best opportunity to succeed and out-compete the invasives. Further planting of native species and Alder cuttings on Slope 1 will be important to minimize erosion that may happen due to the removal of the heavy ground cover and root systems created by the removed *Rubus discolor* patch.

There are two main groups of people who will be responsible for doing the work required for the future success of the restoration of 1436 Ryan Street: the City of Victoria Parks Department and various volunteer groups, including the neighbours of Ryan Street and student volunteers from the University of Victoria and Camosun College. The Parks Department can provide the tools (cutters, mowers, etc) and native plants from their nursery; however, they do not necessarily have the man power available to accomplish the work needed at this site. Volunteers will therefore be the best option to provide the man power to do the hands on work required at the site. The site is geographically close to the University of Victoria and Camosun College, and is easily accessible via bus routes, driving, walking, or cycling, which I believe will encourage students in Environmental Studies programs to utilize the site for school projects and in the field experience. We've already had one very successful volunteer work day with six 2nd year UVIC ES students, and I have been in contact with one of the volunteer students about using the site as a location for future projects present the site. The 'Restoration of Natural Systems volunteer network' is another great, relatively new, resource that can be 'tapped' for a constant source of restoration work, as they have an email network which informs members of ongoing restoration projects and monthly volunteer opportunities.

Finally, the local neighbours in the Ryan Street area have done some work on this site in the past, and did work on the Ryan Greenway (led by local gardener Ludo Bertsch), and although interest has seemingly faded, the neighbourhood is very supportive of the project and could likely be convinced to participate in volunteer days in the future.

Conclusion:

The empty city lot at 1436 Ryan Street offers a unique opportunity to be the first 'Garry Oak Garden' in a residential neighbourhood in Victoria, BC. As mentioned earlier, this is the first and only City park space designated for ecological, instead of recreational, use. The work we have done on this project to date represents the beginning stages of restorating 1436 Ryan Street from a highly disturbed *Quercus garryana* habitat into a true native habitat, which we are calling a 'Garry Oak Park.' Garry oak gardening is a practice that is becoming increasingly popular on Vancouver Island. Residents are realizing and being educated that *Quercus garryana* habitats are beautiful and important ecosystems that have substantially decreased over the past century on Vancouver Island, and that Garry Oak Gardens can be just as beautiful as gardens containing exotic species (Dunster, 2009; GOERT, n.d.). If restored into a fully-functioning *Quercus garryana* habitat, 1436 Ryan Street can act as a flagship for Garry Oak Parks and Garry oak Gardening in Victoria, BC.

Between November, 2010, and March, 2011, Fred Hook Thomas Munson, various City of Victoria workers, volunteers from the University of Victoria, and I began the long, arduous process of restoring a native *Quercus garryana* habitat at the 1436 Ryan Street lot. This process is not finished. My hope is that the presentation I did for the City of Victoria Parks department monthly volunteer meeting in March, as well as this report, will encourage others to carry this project forward and do the invasive species removal, native species planting, and other various restoration work required to make the Ryan Street 'Garry Oak Park' project a success.

Appendix:

[Table – 1]

See http://www.goert.ca/about_species_at_risk.php for full list of Garry oak ecosystem species at risk.

[Table – 2] My Initial Planting List

Common snowberry
Oceanspray
Nootka rose
Licorice fern
Indian plum
Tall Oregon grape
Miner's lettuce
Common camas
Red Alder

[Table – 3] Final Plant List (Provided by Thomas Munson, City of Victoria Parks Department)

Plant Latin name	Common name	Quantity
Open sunny habitat – North End		
Amelanchier alnifolia	Saskatoon Berry	2
Corylus cornuta	Beaked hazelnut	2
Holodiscus discolor	Ocean spray	6
Mahonia aquifolium	Tall Oregon grape	12
Oemleria cerasiformis	Indian plum	6
Philadelphus lewisii	Mock orange	6
Quercus garryana	Garry oak	2
Ribes lacustre	Black gooseberry	2
Rosa nutkana	Nootka rose	12
Damp shady habitat – South End		
Acer glabrum	Douglas Maple	2
Cornus stolonifera	Red-osier dogwood	6
Gaultheria shallon	Salal	15
Physocarpus capitatus	Pacific ninebark	12
Pseudotsuga menziesii	Douglas-fir	1
Rhamnus purshiana	Cascara	2
Rubus parviflorus	Thimbleberry	3
Sambucus racemosa	Red elderberry	6
Symphoricarpos albus	Snowberry	12

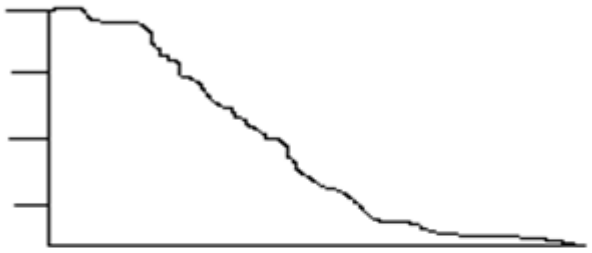
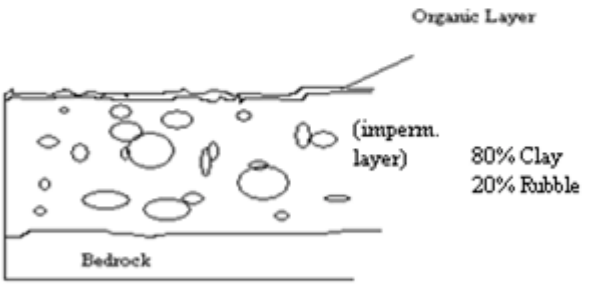
[Table – 4] List of Invasive Species (Provided by Thomas Munson)

Common Name	**Latin Name**
Poison hemlock	***Conium maculatum***
Spurge Daphne	***Daphne laureola***
Scotch broom	***Cytisus scoparius***
Himalayan blackberry	***Rubus armeniacus***
Golden chain tree	*Laburnum anagyroides*
Morning glory	*Convolvulus arvensis*
Cyclamen	*Cyclamen sp.*
Curled dock	*Rumex crispus*
Burdock	*Arctium lappa*
English ivy	*Hedera helix*
Hairy cat's ear	*Hypochaeris radicata*
Orchard grass	*Dactylis glomerata*
Purple dead-nettle	*Lamium purpureum*
Spanish bluebells	*Hyacinthoides hispanica*
Cherry laurel	*Prunus laurocerasus*
Common knotweed	*Polygonum aviculare*
Holly	*Ilex aquifolium*
Honesty	*Lunaria annua*
Common plantain	*Plantago lanceolata*
Common snowdrops	*Galanthus nivalis*

[Table – 5] Site Description

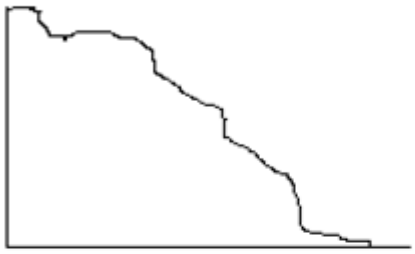
[Table - 4]	
Site Description*:	
Date:	9-Nov-10
Plot Number:	1
Project ID:	siteassessment_RyanStreet
Field Number:	greenway
Surveyor(s):	Andrew Walker
General Location:	Top of hill, Ryan Street, nears Hillside and Cedar Hill, in the Oaklands neighbourhood of Victoria, BC
Forest Region:	Vancouver
Map Sheet:	92B.044
UTM Zone:	10
Easting/Northing (m):	474716.60E / 5365280.94N (NAD 83)
Lat/Long:	48°26'24.59"N / 123°20'30.69"W
Plot Representing:	Plot Representing: Disturbed Garry Oak meadow in Urban/Residential area; recently cleared: large Himalayan blackberry patch
Biogeoclimatic Unit:	CDFmm (Zone: Coastal Douglas Fir, Sub-Zone: moist maritime)
Site Series:	GO (Qg (Garry Oak) - Oceanspray
Ecosection:	NAL (Nanaimo Lowlands)
Moisture Regime:	5(3) (dominant class = Subhygric [water removes somewhat slowly in relation to supply]
	(subdominant class= Submesic [water removed readily in relation to supply]))
Nutrient Regime:	D, C-D (Dominant class = Rich, Sub-Dominant = Medium to Rich)
Successional Status:	DC (Disclimax: normal succession has been arrested by an external physical or anthropogenic force)
Structural Stage:	5Bs (Young Forest, Broadleaf, single storied)
Site Disturbance:	S.c/T.s/X** (see notes) (Soil disturbance:compaction / Terrain-related effects: terrain failures)
Elevation:	58.5m
Slope (Road):	18%
Aspect (Road):	72°
Mesoslope Position (Road):	UP (Upper Slope)
Slope (gully)	28%
Aspect (gully)	5°
Surface Topography:	CC.st.gul (Concave surface. Strongly prominent features. Gullied.)
Exposure Type:	WI (Wind. Vegetation indicator: strongly reduced height growth and gnarled growth form with tree tops)
Surface Substrate:	85% Organic Material / 7% Bedrock / 5%Mineral Soil / 2% Rock / 1% Decaying Wood / 0%Water
Notes:	*All codes and definitions taken from BC's 'Field Manual for Describing Terrestrial Ecosystems' (1998)
	**X=urban/residential development

[Table – 6] Slope 1

[Table - 5]	
Slope Assessment	**Slope 1**
Landform/Slope Data	
Slope Shape:	Concave
Surface Configuration:	Irregular/Benchy
Slope Angle:	35° / 65%
Hillslope Profile:	
Overburden Characteristics	
Material Type:	Till
Texture: (Estimate)	20%Gravel/Rubble / 80%Fines (silt/clay) / 0%Sand
Coarse Fragment Shape:	Angular
Impermiable Layer:	Yes (0.3m)
Overburden Profile:	
Geological Process Data	
Landslides	
Evidence of Past Landslides:	Yes
Type:	Creep
Downslope Impact Entered Stream:	No
Dimensions:	Depth: 0.5m / Width: 10m / Length: 17m
Character of landslide starting zone	
Material Type:	Till
Texture:	20%Rubble / 80%Fines(Silt/Clay)
Slope Angle:	55°

Slope Shape:	Convex
Surface Configuration:	Irregular/Benchy
Evidence of Seepage:	No
Overall Drainage:	Poor
Landuse:	Natural (Near road)
Location:	Open slope (adjacent to gully)
Other Features that Indicate Instability	
Gully Erosion	
Area Disected by Gullies?	No
Number of Gullies in Area:	0
Landslide Evidence on Gully:	No
Termination Point of Gully:	N/A
Tension Fractures	
Tension Fractures Evident:	No
Landslide Deposits	
Debris Piles/Irregular mounts at base:	No
Fans/Cones at base of Slope:	No
Lobes/Levees on Fan Surface:	No
Bedrock Characteristics:	
Bedrock:	Subsurface
Type:	Granite
Structure:	Bedded
Local Setting	
Tension Fractures:	No
Cliffs:	No
Fresh rock exposed on cliff face:	N/A
Scattered boulder/blocks at base:	N/A
Talus at base of cliff:	N/A
Fresh rocks on talus/resh blocks at base:	N/A
Hydrologic Characteristics	
Evidence of Wet Soils:	
Mottles in Upper Meter of Soil:	Yes
Gleyed Soils:	Yes
Surface "Wet" Indicators:	None
Drainage of Overburden:	Imperfect-Poor
Vegetation	
Water Tolerant Vegetation Present:	No
Movement Indicators:	None
Evidence of Windthrow:	None
Site Conditions:	disturbed site, recently cleared blackberry patch

[Table – 7] Slope 2

[Table - 6]	
Slope Assessment	**Slope 2**
Landform/Slope Data	
Slope Shape:	Convex
Surface Configuration:	Irregular/Benchy
Slope Angle:	27° / 50%
Hillslope Profile:	
Overburden Characteristics	
Material Type:	
Texture: (Estimate)	10% Gravel/Rubble / 90% Sand / 0% Fines
Coarse Fragment Shape:	Rounded
Impermiable Layer:	No
Overburden Profile:	
Geological Process Data	
Landslides	
Evidence of Past Landslides:	Yes
Type:	Bedrock Slump
Downslope Impact Entered Stream:	No
Dimensions:	Depth: 0.7m / Width: 4m / Length: 16m
Character of landslide starting zone	
Material Type:	glaciofluvial/till
Texture:	20% Rubble / 80% Sand
Slope Angle:	65°

Slope Shape:	Convex
Surface Configuration:	Irregular/Benchy
Evidence of Seepage:	No
Overall Drainage:	Well
Landuse:	Road
Location:	Gully
Other Features that Indicate Instability	
Gully Erosion	
Area Disected by Gullies?	Not Applicable, Inherent from bed rock forms, not ero
Number of Gullies in Area:	1
Landslide Evidence on Gully:	No
Termination Point of Gully:	Lower Slope
Tension Fractures	
Tension Fractures Evident:	Yes
Landslide Deposits	
Debris Piles/Irregular mounts at base:	Yes
Fans/Cones at base of Slope:	No
Lobes/Levees on Fan Surface:	No
Bedrock Characteristics:	
Bedrock:	Exposed
Type:	Granite
Structure:	Jointed/Fractured
Local Setting	
Tension Fractures:	Yes
Cliffs:	Yes
Fresh rock exposed on cliff face:	No
Scattered boulder/blocks at base:	Yes
Talus at base of cliff:	No
Fresh rocks on talus/resh blocks at base:	No
Hydrologic Characteristics	
Evidence of Wet Soils:	
Mottles in Upper Meter of Soil:	No
Gleyed Soils:	No
Surface "Wet" Indicators:	None
Drainage of Overburden:	Rapid-Well
Vegetation	
Water Tolerant Vegetation Present:	No
Movement Indicators:	Yes (Leaning Trees / Curved Trees)
Evidence of Windthrow:	Yes (debris at bottom of slope)
Site Conditions:	roadside, highly disturbed site
Note: Slope Assessment form taken from ER312B coursepack (Hebda 2010)	

[Table – 8] Ground Inspection Form

[Table - 7]	
Ground Inspection Form	
G or V:	G (Ground inspection done physically on site)
Date:	10/11/2006
Project ID:	siteassessment_RyanStreet
Surveyor(s):	Andrew Walker
Mapsheet:	92B.044
Plot Number:	1
BGC Unit:	CDFmm
Ecosection:	NAL
UTM Zone:	10
Easting/Northing (m):	
Lat/Long:	48°26'26.9"N / 123°20'31.4"W
Elevation:	58.5m
Slope:	10%
Aspect:	290°
Meso-Slope Position:	Toe
Drainage-Mineral Soils:	Well
Moisture Subclasses - Organic Soils:	Perhumid
Mineral Soil Texture:	Sandy (LS)[Loamy-Sand]
Organic Soil Texture:	Fibric
Surf. Organic Horizon Thickness:	0-40cm
Humus Form:	Mull
Coarse Fragment Content:	20-35%
Root Restricting Layer:	No
Soil Moisture Regime (SMR):	5
Soil Nutrient Regime (SNR):	R (Rich)
TERRAIN	Terrain Texture
1)0-30cm	Fibric
2) >30cm	Mesic
1)Surficial Material	O
2)	OM
1) Surface Expression	j
2)	j
1) Geomorph Processes	F
2)	F

ECOSYSTEM		
BGC Unit:	CDFmm	
Site Series:	GO (Qg-Ocean spray)	
Site Modifiers:	RR, s, B	
Structural Stage:	5	
Crown Closure	70%	
Total % Cover (by stratum)	Trees: 60% Shrubs: 30% Grasses: 10%	
Site Code:	GORR5sB*	
DOMINANT/INDICATOR SPECIES LIST	**% COVER**	
Garry Oak	40	
Snowberry	30	
Blackberry	20	
Orchard Grass	10	
Plant list complete or partial?	Partial	
Note: All codes and definitions taken from BC's 'Field Manual for Describing Terrestrial Ecosystems' (1998)		
*Garry Oak, Rural, Mature, single storied, Broadleaf stand		

[Table – 9] Wildlife Tree Assessment:

[Table - 8]			
Tree Attributes for Wildlife			
Tree 1			
Date:	10/11/2010		
Project ID:	ecoassessment_RyanStreet		
Surveyor(s):	Andrew Walker		
Species:	Qg		
Stand/Fall:	Stand		
DBH (cm):	300		
M or E:	M		
Rem. Bark (%):	100		
Length			
Top (%):	30		
Bot (%):	70		
Bot pos (m):			
Slop Distance (m):	10		
Estimated Length (m):	15		
Crown Class:	C		
Height to Live Crown (m):	19		
Wildlife Codes			
Appearance:	3		
Crown:	2		
Bark:	1		
Wood:	1		
Lichen:	3		
Wildlife Use:	P,B		
Comments:			

[Table – 10] Erickson's Classification Tables:

Damp, Shady South End + Slope 1	
Site Code:	Qgos-c8
Name:	Garry oak - Common snowberry-Nootka rose
Moisture:	mesic-subhygric (damp to very wet)
Important Species:	Common snowberry, Nootka rose, Indian-plum, western trumpet

Dry, Sunny North End	
Site Code:	Qggc-c48
Name:	Garry oak - Miner's Lettuce
Moisture:	subxeric-mesic (partially dry to damp)
Important Species:	Great camas, Common snowberry, Pacific snakeroot, cleavers, tiny vetch

Appendices:

Information on Invasive Species:

Invasive Plant Council of BC (Blackberry):
http://www.invasiveplantcouncilbc.ca/invasive-plants/himalayan-blackberry
Citation:

"Himalayan Blackberry | Invasive Plants BC." *Invasive Plant Council of BC*. Web. http://www.invasiveplantcouncilbc.ca/invasive-plants/himalayan-blackberry

GOERT (BLACKBERRY)(2002):
http://www.goert.ca/documents/Best_Practices_for_Blackberry_revised.pdf
Citation:

Garry Oak Ecosystems Recovery Team. "Best Practices for Invasive Species Management in Garry Oak and Associated Ecosystems: Evergreen Blackberry (Rubus Laciniatus) and Himalayan Blackberry (Rubus Armeniacus/discolor/procerus)." *GOERT*. Nature Conservancy of Canada, Dec. 2002. Web. http://www.goert.ca/documents/Best_Practices_for_Blackberry_revised.pdf

Poisonous Plants: (Poison Hemlock)
http://cal.vet.upenn.edu/projects/poison/plants/pppoiso.htm
Citation:

Poisonous Plants. ""POISONOUS PLANTS SLIDES - POISON HEMLOCK"" *CAL Home*. University of Pennslyvania, 2002. Web. http://cal.vet.upenn.edu/projects/poison/plants/pppoiso.htm

Noxious Weed Fact Sheet: (Poison Hemlock)
http://www.co.thurston.wa.us/tcweeds/weeds/fact-sheets/Poison_Hemlock.pdf

Citation:

"Poison Hemlock Conium Maculatum." *Noxious Weed Fact Sheet*. *Thurston County, Washington*. Web. http://www.co.thurston.wa.us/tcweeds/weeds/fact-sheets/Poison_Hemlock.pdf

Coniine: (Poison Hemlock)

http://www.chm.bris.ac.uk/webprojects2001/gerrard/coniine.html

Citation:

"Coniine - (Poisin Hemlock)." *School of Chemistry - Bristol University - UK*. Web. http://www.chm.bris.ac.uk/webprojects2001/gerrard/coniine.html

Parks, Recreation and Community Development (Daphne):

http://www.victoria.ca/cityhall/pdfs/compar_invsv_fctsht.pdf

Citation:

Parks, Recreation and Community Development. "Invasive Aliens from the Garden: Spurge Daphne and Tree Lupine." *Invasive Aliens from the Garden*. City of Victoria. Web. http://www.victoria.ca/cityhall/pdfs/compar_invsv_fctsht.pdf

Invasive Plants of Southwestern B.C. (SCOTCH BROOM)

http://www.shim.bc.ca/invasivespecies/_private/scotchbroom.htm

Citation:

"Scotch Broom." *Invasive Plants of Southwestern B.C.* Web. http://www.shim.bc.ca/invasivespecies/_private/scotchbroom.htm

GOERT (SCOTCH BROOM):

http://www.goert.ca/documents/InvFS_cytiscop.pdf

Citation:

GOERT. "Cytisus Scoparius." (2002). *Garry Oak Ecosystems Recovery Team*. Web. http://www.goert.ca/documents/InvFS_cytiscop.pdf

Pojar 2004

Pojar, Jim, A. MacKinnon, and Paul B. Alaback. *Plants of Coastal British Columbia including Washington, Oregon & Alaska*. Edmonton: Lone Pine Pub., 2004. Print

List of Cited Sources:

Ryan Street Neighbourhood Committee, and Councillor Coleman. *Minutes of the Committee of the Whole Meeting of the City of Victoria*. 10 Mar. 2005. Victoria, British Columbia

GOERT: About Garry Oak Ecosystems: Welcome. Web. http://www.goert.ca/

Dunster, Katherine Jane. *The Garry Oak Gardener's Handbook: Nurturing Native Plant Habitat in Garry Oak Communities*. [Victoria, B.C.]: Garry Oak Ecosystems Recovery Team, 2009. *Garry Oak Ecosystems Recover Team*. GOERT. Web. http://www.goert.ca/documents/GOERT_Gardeners_Handbook.pdf

Greenways - Frequently Asked Questions." *City of Vancouver*. 17 June 2010. Web. http://vancouver.ca/engsvcs/streets/greenways/faq.htm

Bryant, M. "Urban Landscape Conservation and the Role of Ecological Greenways at Local and Metropolitan Scales." *Landscape and Urban Planning* 76.1-4 (2006): 23-44. *ScienceDirect*. Web. http://www.sciencedirect.com/science

"Welcome to Greenways." *Greenways Land Trust.* Web. 5 Nov. 2010. http://www.greenwaystrust.ca/

Erickson, Wayne R., and Dellis Vern Meidinger. *Garry Oak (Quercus Garryana) Plant Communities in British Columbia: a Guide to Identification*. Victoria: British Columbia, Ministry of Forests and Range, Forest Science Program, 2007. Print.

Pojar, Jim, A. MacKinnon, and Paul B. Alaback. *Plants of Coastal British Columbia including Washington, Oregon & Alaska*. Edmonton: Lone Pine Pub., 2004. Print

Polster, Dave F. "Soil Bioengineering for Slope Stabilization and Site Restoration." *Mining and the Environment III* (2003). Laurentian University, Sudbury, Ontario, Canada. Web. http://pdf.library.laurentian.ca/medb/conf/Sudbury03/Amendments/122.pdf

Field Manual for Describing Terrestrial Ecosystems. Victoria, BC: Ministry of Environment, Lands and Parks, 1998. Print

Hebda, Richard. *ER312B Field Study in Ecological Restoration II: Coursepack.* Victoria: University of Victoria, 2010. Print.

"Management Strategies for Invasive Plants." *Green Seattle Partnership* —. Web. http://greenseattle.org/how-to-remove-invasive-plants

"Live Stakes." (n.d.): n. pag. *IowaDNR*. The Iowa Deparment of Natural Resources. Web. http://www.iowadnr.gov/water/stormwater/forms/streambank_man2.pdf

"Live Stakes for Restoration Plantings." *King County, Washington*. N.p., 12 Mar. 2009. Web. http://www.kingcounty.gov/environment/stewardship/nw-yard-and-garden/live-stake-plantings.aspx

"Himalayan Blackberry." *Invasive Plant Council of BC.* 2008. Web. http://www.invasiveplantcouncilbc.ca/invasive-plants-bc/invasive-plant-watch/himalayan-blackberry

[i] Fred Hook, Parks Department, City of Victoria confirmed in several different discussions that the 1436 Ryan Street site is the first and only park space in Victoria, BC.