

2015 Pilot Project to Map and Control Invasive Plants on the South Klondike Highway, Tagish Road, and Atlin Road

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Maps: Map 1. South Klondike Highway
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Abstract

In 2015, Yucan Planning was contracted by YGH&PW Transportation Maintenance Branch (TMB) to design and implement a pilot project with the purpose of inventorying, documenting and controlling colonies of invasive plants along the South Klondike Highway, Tagish Road, and Atlin Road. This project was conducted to assist in developing and testing management tools to be used in TMBs larger invasive species management strategy.

The primary goal was to determine whether it could be an effective management tool for a one or two person crew to simply drive Yukon roadways that have low (or unknown) densities of invasive plants at slow speeds and cut or pull any invasive plant that is encountered. We refer to this as the "Patrol and Pull" method.

The secondary goal was to inventory and map the occurrence of invasive species on these roadways for the purpose of establishing a GIS database that can be used as a baseline for future monitoring. The intention was that the GIS-based inventorying and monitoring method developed in this project could be applied to other Yukon highways as well.

Other goals included testing the extent to which small to moderate infestations of sweetclover can be contained by hand cutting on an annual basis, and testing whether pulling/cutting of the first colonizing individuals of an invasive species can prevent the establishment of larger, resilient colonies.

The inventory and mapping aspect of this project showed that the level of infestation of invasive plants along these Southern Lakes roadways is generally low, but moderately problematic in five locations where sweetclover colonies have become well established: 1) the intersection of the South Klondike Highway and Alaska Highway, 2) the intersection of the Tagish Road and the Alaska Highway, 3) the first kilometer of the Robinson Subdivision Road, 4) small, but established, colonies between kilometre 16-18.5 along the Tagish Road, and 5) small, but established, colonies between kilometre 15-18.5 along the Atlin Road (sections that were upgraded in the last five years).

Every invasive plant or colony encountered in this project was photographed with a GPS-enabled camera, so the location and extent of infestation could be recorded and stored in an electronic database. This will facilitate GIS mapping of invasive plants on these roadways, with the ability to return to known locations in future years and monitor their populations. We recommend that this simple method of inventorying and monitoring be applied elsewhere along Yukon roadways.

The control aspect of this project demonstrated that the Patrol and Pull method shows high promise as an effective tool for controlling the spread of invasive plants on low to moderately infested roadways. It is a quick, efficient, and cost-effective means of knocking back invasive plants before they gain a foothold on otherwise "clean" roadways. Patrol and Pull is not specifically designed as a tool for controlling large stretches of sweetclover, but our results show that one or two people with gas-powered brush cutters can mow isolated patches of sweetclover up to 0.2 ha in size probably more effectively and more efficiently than general ROW mowing with heavy equipment. One of the clearest advantages of hand-mowing is that a person can mow over all types of terrain and potentially kill every individual invasive plant spotted, whereas equipment mowing is coarse grained, impeded by terrain and obstacles, and inevitably misses some plants, which then become the seed source for a persistent colony.

To test the long-term effectiveness of this Patrol and Pull pilot study, follow-up monitoring will be necessary, with some pulling/cutting as needed, in order to determine how many incipient colonies were eradicated by our efforts, and if there is an established seedbank in the soil from which new plants continue to germinate. The reason for the GPS inventory of individual plants/colonies was to facilitate this monitoring/follow-up by allowing TMB to return to exact locations and determine the level of persistence of each colony.

1 Introduction

In spring 2015, YG HPW Transportation Maintenance Branch (TMB) and Yucan Planning engaged in discussions about developing a strategic plan to manage invasive plant species along Yukon Highways. The outline of a draft strategy was developed with seven key interventions (management tools), but instead of spending time and resources developing a detailed strategy, it was decided to start with smaller pilot projects that would test the efficacy of the proposed interventions. As a result, in July 2015 Yucan Planning was contracted by TMB to design and implement a pilot project with the goal of inventorying, documenting and eradicating colonies of invasive plants along the South Klondike Highway, Tagish Road, and Atlin Road using a technique referred to as "Patrol and Pull".

1.1 TMB General Invasive Species Strategy

The draft strategic plan developed with TMB proposed seven practical management tools and interventions tailored for Yukon-specific conditions: 1) containment of existing, well-established invasive plant populations in order to prevent further spread via highway corridors and infrastructure; 2) preventing the establishment of new invasive plant growth centres by identifying and aggressively controlling or eradicating small colonizing populations; 3) reducing the spread of seed that occurs through aggregate hauling (i.e., granular material pits); 4) preventing the introduction of new seeds and colonizing plants into the territory; 5) continuing to deplete/exhaust the existing seed bank; 6) promoting the growth of desirable species that outcompete invasive plants; and 7) continuous inventorying and monitoring for the spread of existing populations and new occurrences.

It should be noted that sweetclover is the principle invasive species of concern in Yukon and the primary focus of TMB's invasive plant management efforts. Sweetclover is difficult to eradicate along Yukon roadways because after decades of growth there is now a vast sweetclover seed bank in the soil along extensive sections of highway. The main approach to sweetclover management in heavily infested areas is containment. However, efforts to eliminate sweetclover and other invasive species may still be realistic in less infested areas if they can be prevented from establishing a seed bank and resilient colonies.

1.2 2015 Pilot Project

In context of the draft TMB general invasive plant strategy, the purposes of this pilot project was to test whether it can be an effective management tool to have a small crew simply drive certain roads (those with low levels of infestation) at slow speeds and cut or pull (as appropriate) any invasive plant that is encountered. We refer to this as the "Patrol and Pull" method and its effectiveness was tested in this project along the South Klondike Highway, Tagish Road, and Atlin Road, including side roads. These roadways were selected because it is generally assumed that they have low infestations of sweetclover, compared to the extensive sweetclover cover along several other highways, though it is known that significant colonies of sweetclover are becoming established where these roadways intersect the Alaska Highway. Little is known about the occurrence of other invasive plant species along these three roads, and inventory data was deemed important for future management decisions.

Of the seven interventions/tools described in the general strategy, the applicable ones in this project are: preventing the establishment of new growth centres and exhausting the existing seed bank, as well as inventorying and monitoring. The project-specific goals were to: 1) document the extent of invasive plant

infestations on these three Southern Lakes roadways, 2) develop a GIS-based plant inventorying/monitoring protocol so infestations can be easily monitored and tracked in future years (adaptable for inventorying/monitoring use on other roadways as well), 3) test the extent to which small to moderate infestations of sweetclover can be contained or even eradicated by intense hand cutting on an annual basis, and 4) test whether intense pulling/cutting all individual plants of other invasive species early in the colonizing process can essentially eliminate them from the roadway by preventing the establishment of resilient colonies and a seed bank.

2 Methods and Summary of Activities

In this pilot project, we undertook a Patrol and Pull along the South Klondike Highway, Teslin Road, Atlin Road, and their side roads. We simultaneously identified, recorded and mapped each invasive plant/colony encountered, after which we cut or pulled the plants. The purpose of mapping the occurrence of each plant/colony was to document the extent of infestation along these roadways, and allow TMB to return in subsequent years and monitor how effective the cutting/pulling was at eradicating each colony.

The specific Patrol and Pull methodology used was as follows:

- The “crew” consisted of a single person, Ms. Toos Omtzigt, from Yucan Planning. Ms. Omtzigt is a trained professional biologist and botanist who has extensive experience working in the field of invasive plant management. Between July 21 and 31, 2015, Ms. Omtzigt drove the three roadways and all side roads scanning for invasive plant species growing in the shoulder and ditch. The list of side roads and sections of main highway surveyed can be found in Table 1.
- She conducted the survey in a company vehicle driving at a speed of approximately 40 km/hr with a cab beacon light and hazard lights turned on.
- Highway pull-offs (e.g., the truck chain-up pullout on the South Klondike Highway) were surveyed and treated, but gravel pits and other large public reserves (e.g., Carcross Airport) only received a cursory inspection and generally no eradication efforts were undertaken because they were outside the scope of this project (However, sweetclover in one gravel pit on the South Klondike Highway was removed.).
- Upon spotting a plant/colony of an invasive species, or a plant she did not recognize, Ms. Omtzigt pulled her vehicle onto the shoulder and examined the plant/colony more closely. If there were more than a few plants to document and remove, and she knew she would be parked for more than 5 minutes, she set up traffic signs alerting vehicles to slow down due to the presence of workers. If she could complete the examination/mowing in less than 5 minutes she did not deploy the signs, but left her hazard lights and beacon flashing.
- When an invasive plant/colony was spotted, Ms. Omtzigt recorded the species, its location and the number of plants present or area covered by the plants, and then photographed the plant/colony with a GPS-linked digital camera.
- After recording and documenting the plant/colony, the plants were mechanically killed/destroyed in a manner that is effective for each given species. Sweetclover plants were pulled or cut without concern of leaving roots in the ground because they do not regrow in subsequent years from rootstock. Cutting was performed with either a hand-held scythe or a gas-powered brush cutter (Stihl model FS240). Essentially all other species that were encountered (perennial sow

thistle, Russian wild rye, spotted knapweed) are perennials and can regrow from the roots, so were pulled by hand to extract both the above ground and below ground parts.

- If the cut/pulled plants did not have mature seed heads, they were left in the field. If seeds were near maturation, the plants were collected in paper bags and later incinerated. Three small colonies of Russian wild rye, a cluster of spotted knapweed, and three small colonies of perennial sow thistle were collected and destroyed in this manner. An alternative method is to collect the plants in plastic bags and let them rot, after which they can be disposed of at a landfill.

Table 1: Roadways Surveyed

Road Name		Kilometres Surveyed
South Klondike Highway (km 105-159)		44
	Kookatsoon Lake Road	0.75
	Mosquito Road	1.25
	CCC Road	2.5
	Cowley Lake Road	2
	Ingo's Road	1
	Percival Road	1
	Linville Road	0.5
	Narrow Gauge Road	1.5
	Robinson Subdivision Road	5.5
	Annie Lake Road (and feeders)	30
	Meadows Road	0.5
	Lewes Lake Road	1.5
	Carcross lagoon and Carcross Rod and Gun Club access road	0.5
	Watson Lake Subdivision Road	2
Tagish Road (km 0-54)		54
	Airport Road	1.5
	Chootla Subdivision Road	2.5
	Crag Lake Road	1
	10 Mile Road	2
	Taku Subdivision roads	7
	Tagish Estates Road	3.5
	Tagish River Road	1.5
	Microwave Tower Road	2
	Secret Valley Road	1
Atlin Road (km 0-41)		41
	Lubbock River Road	2
	Snafu Campground Road	1
	Tarfu Campground Road	2
	Camp Yukon Road	1
Total Kilometres Surveyed		217

3 Survey Results

3.1 General Comments and Results

Maps 1, 2 and 3 show the point locations of all invasive plants encountered during this project for the three road areas surveyed. Tables 2, 3 and 4 attached at the end of this document provide notes on each waypoint/colony shown in the maps. In the electronic GIS version of this dataset, each point is hyperlinked to a photo of the colony, as well as any corresponding data and notes.

Our general conclusion is that the level of infestation of invasive plants along these Southern Lakes roadways is very low in most areas, but problematic in five locations where (white) sweetclover (*Melilotus alba*) colonies have become well established: 1) the intersection of the South Klondike Highway and Alaska Highway, 2) the intersection of the Tagish Road and the Alaska Highway, 3) the first one kilometer of the Robinson Subdivision Road, 4) small, but established, colonies between kilometre 16-18.5 along the Tagish Road, and 5) small, but established, colonies between kilometre 15-18.5 along the Atlin Road. These are discussed in more detail below under the summary for each Roadway. Otherwise, we encountered occasional single plants or small colonies of white sweetclover, and small to moderate infestations of six other invasive species: yellow sweet clover (*Melilotus officinalis*), perennial sow thistle (*Sonchus arvensis*), spotted knapweed (*Centaurea biederstini*), yellow clematis (*Clematis tangutica*), Altai lyme grass (*Lymus angustus*), and unscented camomile (*Tripleurospermum inodorum*). Overall, we believe the actions taken this summer will help significantly in the containment of sweetclover on these highways, and will prevent all other species from getting a foothold if there is similar follow-up over the next two to three years.

We believe that the slow (~40 km/hr) driving/patrol method was very effective in spotting invasive plants, and it is probable that we killed >95% of the invasive plants growing along these roadways. The most labour and time intensive sections were the five areas mentioned above, which had sweetclover colonies up to 0.5 ha in size. It took two to four hours for one person to mow each of these sections with the power brush cutter. On average, we spent 15 minutes per km of roadway patrolled, including the time required to cut/pull plants and to drive to and from the site every day. The field work took seven days to complete. The overall effectiveness of the eradication methods is evaluated in Section 5, along with recommendations for follow up work and monitoring.

3.2 South Klondike Highway and Side Roads

The Patrol and Pull was conducted along 44 km of the South Klondike Highway (SKH) from the Carcross Cut-off to the Nares Bridge in Carcross, along with approximately 51 km of side roads that connect with this section of the highway. A total of 45 stops were made to remove and document invasive plants. As expected, the primary invasive species found within the area was sweetclover; all sweetclover plants encountered were cut or pulled. The largest infestations were found at: 1) the Carcross Corner (~1,000 m²), 2) within the first kilometer of the Robinson Subdivision (~500 m²), and 3) just north of the Nares Bridge (~100 m²). Small infestations consisting of 1 plant to patches up 10 m² were found between the Carcross Corner and the Annie Lake Road, but hardly any plants were found between the Annie Lake Road and Carcross. Most of the side roads were free of invasive plants, except a large patch of sweetclover along the Robinson Subdivision road and two small ones on the Annie Lake Road (a patch of 15 m² near km 4 and one single plant at 0.5 km).

We briefly surveyed the two active gravel pits along the South Klondike Highway at km 129 (Lewes Lake) and km 151 (Mosquito Road). We only found a small infestation near the entrance of the km 151 pit.

Other isolated populations of invasive plant species that were found in the South Klondike Highway area include:

- Yellow sweetclover: $\sim 100 \text{ m}^2$ at km 108.5 RHS. All plants were pulled or mowed.
- Perennial sow thistle: ~ 25 plants were found at the corner with the Alaska Highway (LHS). All plants removed and bagged for disposal.
- Altai lyme grass:
 - a. Large infestations ($> 75 \text{ m}^2$) were found on both sides of the road between Nares River Bridge and the road into Carcross proper (km 105). These infestations extend beyond the highway right-of-way. This grass grows in very tight, large tufts that are very well rooted. Hand pulling is extremely difficult and only works in cases of small infestation where tufts are limited in size. In this area no plants were removed. Further discussion regarding management of this species is included in Section 4.
 - b. 1.5 m^2 at km 144, RHS. All plants were removed and bagged for disposal.
- Yellow clematis: this species is growing on both sides of the road along a 100 m long section near km 106 (in front of the CTFN building and Montana Gas station). Although the growth ($\sim 75 \text{ m}^2$) is fairly extensive within this section, this species is not very invasive. The species is perhaps best classified as persistent, rather than invasive, and probably is not spreading aggressively in this area. It was therefore felt that removal of the plants was not a priority. Further discussion about managing this species is included in Section 4.

3.3 Tagish Road and Side Roads

Patrol and Pull work in the Tagish Road area included the entire Tagish Road (54 km) between Jake's Corner and the South Klondike Highway, along with approximately 22 km of side roads. Only the first few kilometers of the 10 Mile Road, Microwave Tower Road, and Secret Valley Road were surveyed because it became apparent that there was no adequate habitat for sweetclover along their roadsides. All other roads were surveyed for their entire length.

A total of 50 stops were made to remove and document invasive plants. Similar to the South Klondike Highway, the primary invasive species found within the Tagish Road area was sweetclover; all sweetclover plants that were noted were also cut or pulled. The largest infestations were found at Jake's Corner ($\sim 200 \text{ m}^2$) and between km 16-18.5 of the Tagish Road (500 m^2). There was a notable lack of invasive plants for a 20 km long section on the road between the Taku Subdivision and Choutla Lake. Of all the side roads, most were free of invasive plants, except for sweetclover patches that were found in three locations in the Taku Subdivision.

We briefly surveyed the one active gravel pit near km 30 (Taku Subdivision) and found no invasive plants.

Other isolated populations of invasive plant species that were found in the Tagish Road area include:

- Yellow sweetclover: $\sim 30 \text{ m}^2$ at km 21 (east of the Tagish Bridge). All plants were pulled or mowed.

- Perennial sow thistle:
 - a. ~10 m² near km 5.5 Tagish Road (LHS). All plants were removed and bagged for disposal.
 - b. ~60 m² near km 20 Tagish Road (RHS). An extensive infestation. Plants were just beginning to flower and many were still developing flower shoots. Only the shoots with flowers were removed. Additional control methods will likely be required to contain this infestation (see Section 4).
 - c. ~3 m² near km 49 (RHS; no GPS coordinates or photo available). All plants were removed and bagged for disposal.
- Altai lyme grass: 1.5 m² near km 28 (RHS). All plants were removed and bagged for disposal.

3.4 Atlin Road and Side Roads

Patrol and Pull work was conducted on 41 km of the Atlin Road from the intersection with the Tagish Road to the Yukon/B.C. border, as well as approximately 6 km of side roads. A total of 45 stops were made to remove and document invasive plants. As with the South Klondike Road and Tagish Road areas, the primary invasive species found within the Atlin Road area was sweetclover; all sweetclover plants that were noted were also cut or pulled. The largest infestations were found at between km 15 and 18.5, with one very large infestation of ~800-1,000 m² at km 16. Only the first few kilometers of the Lubbock River Road was surveyed because it became apparent that there was no adequate habitat for sweetclover along the roadside. All other side roads were surveyed for their entire length. No invasive plants were found on any of the side roads.

We briefly surveyed one active gravel pit along the Atlin Road at km 6 but no invasive plants were found. An old borrow area immediately adjacent to the road at km 22 contained a large infestation (~100 m²) of sweetclover, which was spread throughout most of the site.

Other isolated populations of invasive plant species that were found along the Atlin Road include:

- Yellow sweetclover: 3 plants at km 8 (RHS) and 1 plant at km 40 (LHS). All plant were pulled.
- Perennial sow thistle: ~15 plants near km 10 (RHS). All plants removed and bagged for disposal.
- Spotted knapweed: one dense clump consisting of multiple plants at km 12.5. The entire plant mass with roots was removed and bagged for disposal.
- Unscented chamomile and Shasta daisy: two 10 m² areas with small unscented chamomile plants were encountered on both sides of a private driveway entrance at km 11 (RHS). The plants were not removed because they were growing alongside Shasta daisies and it is likely that the property owner at km 11 planted both species as ornamentals. Further discussion regarding control of the unscented chamomile is included in Section 4.

4 Evaluation and Recommendations

4.1 Evaluation of the Methods

4.1.1 General Comments

It is our conclusion that the slow highway patrol and hand pulling/cutting method – the “Patrol and Pull” method – tested in this pilot project can be an extremely effective method of inventorying and controlling invasive plants along certain types of roadways in Yukon. The aspects of this method that recommend it most are:

- 1) It has a low cost relative to other methods, and especially relative to the results obtained.
- 2) Very little manpower is required.
- 3) It is low tech and can be carried out by one or two people equipped with the most basic equipment.
- 4) By using GPS-linked cameras, it is quick and easy to record the location and extent of invasive plants at the same time they are cut, thus providing key inventory data for future monitoring and management decisions.
- 5) All plants encountered can be killed regardless of terrain or their distribution, whereas large mechanical mowers are limited by terrain and will certainly miss some plants; when it comes to eradicating invasive plants, missing just a few adult plants can mean the seed bank and colony will persist. So in terms of containing small populations, it is probably the most effective method available.
- 6) It is not affected by scheduling bottlenecks that are inherent to allocating heavy mowing equipment during the summer.

There are two major limiting factors to the method:

- 1) It requires a crew, or at least a supervisor, that can identify native and invasive species well. Even if crews are trained to spot obvious species, such as sweetclover, those without much botany experience will not be able to distinguish other invasive species from native species. Consequently, untrained crews are likely not to detect the first occurrences of a new invasive species, which limits TMB’s ability to stop new infestations with Patrol and Pull. We suggest that TMB consider training its field personnel to recognize invasive plant species, with instructions to pull or cut any invasive plant they encounter during the course of their duties. Or, at a minimum remove questionable plants and ship them to an expert for further identification.
- 2) The second major limiting factor of Patrol and Pull is that it is a method best suited for spotting and eradicating new colonies before they become problematic, but it is not particularly suited for managing large colonies and major infestations. But this simply means that it is only one tool in the toolbox for controlling invasive plants, and not a panacea. When it is used to control small infestations, Patrol and Pull frees up mowing efforts/equipment to be focussed on large infestations.

It is not necessarily a bad option to use Patrol and Pull crews to hand mow larger colonies of invasive plants (i.e., sweetclover) using brush cutters, but this is more of a human resources deployment strategy and not one of efficacy. Our one-person crew was able to mow approximately 0.2 ha of heavy sweetclover in about 3-4 hours. A crew of two to four people could be deployed effectively to mow even larger, isolated pockets

of sweetclover, but we do not believe it to be an efficient strategy for mowing long sections of sweetclover growing along highways. Those are the locations where mowing is important and far more efficient. TMB may want to consider the combined use of equipment mowing and hand mowing on these stretches to increase the percentage of plants killed.

It is likely that the ultimate factor determining the long-term success of the Patrol and Pull method, or any control method for that matter, will be the extent of the seed bank already present in the soil. For the species that have few or no seeds banked in the soil, two to three years of follow-up pulling/cutting should effectively eradicate them, unless new seeds are introduced. For sweetclover, it is safe to assume that there is an extensive seed bank in areas where there are established colonies, and it would take over a decade of continuous mowing to eradicate them.

4.1.2 Comments on Specific Methods and Techniques

- 1) We found that the optimal vehicle speed for conducting the patrol is around 40 km/hr. Any slower, and the method becomes less efficient. Any faster, and it is likely some plants will be missed. It is especially important to drive slower when scanning a broad area of cleared ROW, as opposed to a narrow strip of shoulder.
- 2) The optimal crew size for Patrol and Pull is probably two people. That way, one person can focus on driving, while the other scans the ROW for invasive plants. However, we found that one person working alone was able to complete the job satisfactorily.
- 3) As mentioned in Section 3.1, the overall survey and control effort took seven days to complete and on average, it took 15 minutes per km of roadway patrolled, including the time required to cut/pull plants and to drive to and from the site every day.
- 4) Regarding equipment for cutting, we have the following observations:
 - a. We tried out two gas-operated Stihl brush cutters: a large 45 cc model weighing 8.4 lbs (FS460) and a smaller 38 cc model weighing 7.2 lbs (FS240). Both were equipped with a steel three-blade cutting wheel. We found that the smaller model was completely adequate for cutting any invasive species that could be encountered in Yukon, and was more manageable to operate. The larger models are made for cutting small diameter woody plants, which is not needed for this job. The three-blade cutting wheel worked well, compared to a rotary cutting blade and a string cutter.
 - b. It is not worth the hassle using the power brush cutter when small patches of plants need to be cut, so it is very useful to have a non-powered, hand-swung tool for cutting small patches. We experimented with various tools: shovels, rakes, weed whackers, and a hay scythe. We strongly preferred the hay scythe because it rarely required more than one swing and multiple plants were often topped with a single swing. When the technique of swinging the scythe is mastered, it is an ergonomically better tool as well.
 - c. Hand pulling is still the preferred method for very small infestations of less than five plants that need to be killed. Hand pulling is also the preferred method for plants in seed or when complete plants need to be removed and bagged.
- 5) In future Patrol and Pull projects, workers should be reminded of the importance of collecting cut/pulled plants that have mature seed heads. In our patrol, we collected and bagged perennial sow thistle, spotted knapweed and Altai lyme grass that were in seed.

- 6) One of our strongest impressions from this pilot project is how cutting and pulling weeds by hand can be so much more effective than mowing with large equipment in many areas since a person can easily walk on sections that heavy equipment cannot reach, either because of terrain limitations or obstacles such as posts. Many times, we spotted and pulled/cut plants that would have been missed by a mower.
- 7) In discussions with TMB, the question has been raised whether these Patrol and Pulls would be good projects for community involvement, similar to annual roadside garbage patrols. We support the idea in principle, but would point out the following considerations. First, all volunteers would need to be able to identify each species of invasive species. Who would provide that training, and would it be cost-effective? This may not be an issue, however, since many volunteers interested in this kind of work may already be good botanists. Our main reservation, however, is that the Patrol and Pull method is not inherently conducive to a large group effort. If there are only a few plants to cut/pull, then it only takes one or two people a few minutes to examine and clear a section, after which they move on to the next section. Managing a group of people to pull one or two plants and then move on would be inefficient, and volunteers may start to feel they are not being used well. Consequently, in community projects, small groups of only one or two people should be assigned specific sections of highway to patrol. Just as important, it would be difficult to incorporate any meaningful data collection component in community projects, due to the inconsistencies that are inherent to having so many people collecting data. This could impede, rather than assist, TMB monitoring efforts. Perhaps a better approach to community involvement would be a program more analogous to those in other jurisdictions where individuals, organizations, or businesses sponsor sections of roadway for cleanup. In this approach, groups could sign up to be stewards along specific sections of highway where they monitor and pull/cut invasive plants. Finally, it could be very effective to have groups of community volunteers perform cutting activities on large but isolated patches of sweetclover, such as the one on the Robinson Subdivision Road.

4.2 Overall Status of Invasive Plants

4.2.1 General Observations and Recommendations

In general, the level of infestation of invasive plants along these Southern Lakes roadways is low, but there are five locations where sweetclover colonies have become well established: 1) the intersection of the South Klondike Highway and Alaska Highway, 2) the intersection of the Tagish Road and the Alaska Highway, 3) the first kilometer of the Robinson Subdivision Road, 4) small, but established, colonies between kilometre 16-18.5 along the Tagish Road, and 5) small, but established, colonies between kilometre 15-18.5 along the Atlin Road (sections that were upgraded in the last five years). Other than these five areas, all other invasive plants we spotted and pulled/cut were isolated and probably did not represent well-established populations. However, we would flag the occurrence of spotted knapweed on Atlin Road as a special concern. This section of road around Km 12.5 should be monitored annually to ensure that knapweed does not become established. Once established, it will spread and could become as difficult to control as sweetclover.

With moderate effort and vigilance, TMB should be able to keep invasive species in check on these three roadways. Probably the biggest threat to their relatively clean status is the introduction of new seed during road reconstruction work and aggregate hauling. The stretch of sweetclover along the Atlin Road (and probably the spotted knapweed), for instance, is likely the result of recent road reconstruction work. From a risk management standpoint, special effort should be made to eradicate all invasive weeds, especially

patches of sweetclover, at the gravel pits located on these roadways, as they are a great potential source for spreading seed. It also underscores the need to enforce requirements to clean machinery before it is used for maintenance and reconstruction work on Southern Lakes roadways.

4.2.2 Species-Specific Considerations

Sweetclover (White and Yellow)

Eradicating sweetclover in Yukon is not a realistic goal at this time, but containment of existing populations and preventing them from spreading should be a top priority. Highway mowing programs are a vital component of containment strategies, especially along stretches of highway with large or well-established infestations. And while the five problem areas noted in this report certainly should be mowed annually (either with handheld brush cutters or large mowing equipment), we do not think that a general mowing program is warranted to control sweetclover elsewhere along these three road systems. Hand mowing and the Patrol and Pull method would be more effective at dealing with small pockets and individual plants than general mowing.

Spotted Knapweed

This is potentially an extremely invasive species that has caused significant economic and environmental harm elsewhere in North America. The heartiness and invasiveness of knapweed in the north is still not well established. We found one cluster containing a few dozen plants on a section of the Atlin Road that was reconstructed around 2010. So far, it appears not to have spread, but we recommend annual monitoring and aggressive removal of any encountered plants as the best insurance to prevent a potential outbreak.

Perennial Sow Thistle

Multiple small infestations and one fairly large infestation of sow thistle were observed in the course of this project. Mowing/cutting is ineffective against sow thistle, and it is even be difficult to control by hand pulling because the plant can regrow from any portion of the root left behind in the ground. Hand pulling small infestations for 2-5 consecutive years will usually eradicate the species, but it is unlikely to be effective for large infestations as it is simply too labour intensive. The use of herbicides is a very effective method to control this species and we recommend that the large infestation on the Tagish Road be controlled by means of herbicides.

Altai Lyme Grass

This grass is a very persistent species that is difficult to remove by means of hand pulling once well established. Mowing is not effective, as the plants will simply regrow. The four small infestations found during this project could be pulled by hand, but the large population near Nares Lake in Carcross could not be pulled and will require additional effort. In the past, volunteer crews have been deployed to dig out patches of Altai grass around the Carcross Dunes, but they have not been successful in eradicating the species and it is gradually spreading again. The species can be controlled well by using an herbicide, but care would be needed in the herbicide application due to the colony's proximity a large water body (Nares Lake).

Unscented Chamomile

A small infestation of this species was found next to a private driveway on the Atlin Road. Small infestations of this species can be controlled by means of mowing the plants before they flower and hand pulling them. Prior to any future control efforts, we recommend notification of the property owners to explain reason for the need to manage this invasive species.

Yellow Clematis

This is a persistent introduced species but it does not spread very aggressively and is not considered to be strongly invasive. At this time we recommend monitoring for Clematis but it is not necessary to take any specific measures directed at controlling the species.

MAPS

DATA LOGS

Table 2. South Klondike Highway

Data collected in WGS84

Site ID	Km	Side of Road	GPS Latitude	GPS Longitude	Species 1	Species 2	Notes	Photo File Name
RR01	1	LHS	60° 28' 38.316" N	134° 50' 40.872" W	Sweet clover		View west, 100 m Sweet clover within 500 m on north side of road, ~ 2m wide, thick growth	Robinson 01.JPG
RR02	1	LHS	60° 28' 38.316" N	134° 50' 40.872" W	Sweet clover		Same as Robinson 001, view east	Robinson 02.JPG
RR03	1	LHS	60° 28' 37.986" N	134° 50' 41.334" W	Sweet clover		Same as Robinson 001, view (west) after mowing of section	Robinson 03.JPG
RR04	1	LHS	60° 28' 33.822" N	134° 51' 22.590" W	Sweet clover		View west, 75 m of Sweet clover within 150 m on north side of road, ~5 m wide, thick growth	Robinson 04.JPG
RR05	0.5	LHS	60° 28' 33.822" N	134° 51' 22.590" W	Sweet clover		Same as Robinson 004, view east	Robinson 05.JPG
RR06	0.5	LHS	60° 28' 33.732" N	134° 51' 17.736" W	Sweet clover		Same as Robinson 004, view of mowed section	Robinson 06.JPG
CR01	142	RHS	60° 28' 6.048" N	134° 51' 47.712" W	Sweet clover		1 plant	Carcross Rd 01.JPG
CR02	144	RHS	60° 29' 17.568" N	134° 51' 50.424" W	Leymus		~6 m2 patch	Carcross Rd 02.JPG
CR03	144	RHS	60° 29' 18.354" N	134° 51' 49.896" W	Leymus		Same as Carcross Rd 002, pulled plants	Carcross Rd 03.JPG
CR05	149	RHS	60° 31' 48.534" N	134° 52' 20.694" W	Sweet clover		Small patch, 1.5m2	Carcross Rd 05.JPG
CR06	149	RHS	60° 31' 58.764" N	134° 52' 28.476" W	Sweet clover		1 plant	Carcross Rd 06.JPG
CR07	149	RHS	60° 31' 58.764" N	134° 52' 28.476" W	Sweet clover		Same as Carcross Rd 006	Carcross Rd 07.JPG
CR08	151	RHS	60° 32' 43.290" N	134° 52' 39.426" W	Sweet clover		Gravel pit entrance, a few small plants	Carcross Rd 08.JPG
CR09			60° 32' 45.870" N	134° 52' 33.798" W	Sweet clover		Gravel pit, small patch 4m2, near km 151	Carcross Rd 09.JPG
CR10	151	RHS	60° 32' 48.126" N	134° 52' 42.612" W	Sweet clover		North of gravel pit entrance, ~15 plants in 250 m section	Carcross Rd 10.JPG
CR11	151.5	RHS	60° 32' 59.970" N	134° 52' 52.704" W	Sweet clover		1 plant	Carcross Rd 11.JPG
CR12	152.5	RHS	60° 33' 34.722" N	134° 52' 35.100" W	Sweet clover		1 plant	Carcross Rd 12.JPG
CR13	153	RHS	60° 33' 56.118" N	134° 52' 18.984" W	Sweet clover		~10 plants in 20 m section	Carcross Rd 13.JPG
CR14	159	RHS & LHS	60° 35' 57.672" N	134° 52' 41.472" W	Sweet clover	Sow thistle	~ 25 sow thistle plants removed; ~ 1 km of Sweet clover on both sides along 2 km	Carcross Rd 14.JPG
CR15	159	LHS	60° 35' 57.672" N	134° 52' 41.472" W	Sweet clover		Same as Carcross Rd 014, after mowing	Carcross Rd 15.JPG
CR16	159	LHS	60° 35' 48.168" N	134° 52' 35.628" W	Sweet clover		Same as Carcross Rd 014, after mowing	Carcross Rd 16.JPG
CR17	156	LHS	60° 34' 36.036" N	134° 51' 23.586" W	Sweet clover		Small patch, 1 m2	Carcross Rd 17.JPG
CR18	153	LHS	60° 33' 56.658" N	134° 52' 19.470" W	Sweet clover		5 plants	Carcross Rd 18.JPG
CR19	150.5	LHS	60° 32' 36.966" N	134° 52' 36.420" W	Sweet clover		2 plants	Carcross Rd 19.JPG
CR20	148.5	LHS	60° 31' 26.712" N	134° 52' 6.960" W	Sweet clover		1 plant	Carcross Rd 20.JPG
CR21	147	LHS	60° 31' 0.018" N	134° 51' 47.952" W	Sweet clover		1 plant	Carcross Rd 21.JPG
ALR01	0.5	RHS	60° 26' 51.384" N	134° 51' 22.686" W	Sweet clover		1 plant	Annie Lk Rd 01.JPG
ALR02	3	RHS	60° 26' 11.604" N	134° 53' 30.336" W	Sweet clover		Patch 15 m2	Annie Lk Rd 02.JPG
CR24	138	LHS	60° 26' 20.022" N	134° 50' 29.118" W	Sweet clover		~18 plants	Carcross Rd 24.JPG
CR25	112	LHS	60° 13' 31.164" N	134° 43' 36.894" W	Sweet clover		1 plant	Carcross Rd 25.JPG
CR26	111	LHS	60° 12' 53.166" N	134° 43' 16.986" W	Sweet clover		Patch 30 m2	Carcross Rd 26.JPG
CR27	107.5	LHS	60° 11' 13.254" N	134° 42' 3.864" W	Sweet clover		2 plants	Carcross Rd 27.JPG
CR28	107	LHS	60° 11' 7.332" N	134° 42' 4.296" W	Sweet clover		Patch 20 m2	Carcross Rd 28.JPG
CR29	106.5	LHS	60° 10' 19.410" N	134° 42' 19.278" W	Yellow clematis		1 plants, not pulled	Carcross Rd 29.JPG

Table 2. South Klondike Highway

Data collected in WGS84

Site ID	Km	Side of Road	GPS Latitude	GPS Longitude	Species 1	Species 2	Notes	Photo File Name
CR30	106	LHS	60° 10' 17.748" N	134° 42' 19.188" W	Sweet clover		Patch 1 m2	Carcross Rd 30.JPG
CR31	105.5	LHS	60° 10' 8.538" N	134° 42' 15.582" W	Leymus		Large patch, 75 m2 (not pulled)	Carcross Rd 31.JPG
CR32	105	LHS	60° 10' 2.886" N	134° 42' 8.352" W	Sweet clover		Small patch ~ 15 plants	Carcross Rd 32.JPG
CR33	105	LHS	60° 10' 1.668" N	134° 42' 6.390" W	Sweet clover		Small patch ~ 5 plants	Carcross Rd 33.JPG
CR34	105	RHS	60° 10' 4.644" N	134° 42' 10.626" W	Sweet clover		Patch 75 m2, along Nares Lk edge	Carcross Rd 34.JPG
CR35	105	RHS	60° 10' 4.644" N	134° 42' 10.626" W	Sweet clover		Same as Carcross Rd 034	Carcross Rd 35.JPG
CR36a	105.5	RHS	60° 10' 9.162" N	134° 42' 15.120" W	Sweet clover	Leymus	2 Sweet clover plants, Leymus 10 m2 (Leymus not pulled)	Carcross Rd 36a.JPG
CR36b	105	RHS	60° 10' 4.800" N	134° 42' 9.678" W	Leymus		1 clump (pulled)	Carcross Rd 36b.JPG
CR37	105.5	RHS	60° 10' 10.764" N	134° 42' 15.936" W	Sweet clover	Yellow clematis	Sweet clover patch 3 x 1 m, yellow clematis 100 m2 (clematis not pulled)	Carcross Rd 37.JPG
CR38	106	RHS	60° 10' 18.270" N	134° 42' 18.126" W	Sweet clover		Patch 10 m2	Carcross Rd 38.JPG
CR39	107.5	RHS	60° 11' 13.518" N	134° 42' 2.454" W	Sweet clover		1 plant	Carcross Rd 39.JPG
CR40	108.5	RHS	60° 11' 32.424" N	134° 42' 17.190" W	Yellow sweet clover		~ 300 m2, thinly spread	Carcross Rd 40.JPG
CR41	115.5	RHS	60° 15' 3.270" N	134° 44' 49.710" W	Leymus		Small patch 1 m2 (pulled)	Carcross Rd 41.JPG
CR42	124	RHS	60° 19' 46.926" N	134° 46' 3.870" W	Sweet clover		10 plants	Carcross Rd 42.JPG
CR43	139.5	RHS	60° 25' 39.126" N	134° 50' 5.268" W	Sweet clover		1 plant	Carcross Rd 43.JPG

Table 3. Tagish Road

Data collected in WGS84

Site ID	Km	Side of Road	GPS Latitude	GPS Longitude	Species 1	Notes	Photo File Name
TR01	53.5	RHS	60° 10' 41.070" N	134° 41' 42.804" W	Sweet clover	8 plants	Tagish Rd 01.JPG
TR02	53.5	RHS	60° 10' 32.868" N	134° 42' 2.010" W	Sweet clover	~25 m2 patch	Tagish Rd 02.JPG
TR03	21	LHS	60° 18' 59.346" N	134° 15' 43.386" W	Yellow Sweet clover	~30 m2 patch	Tagish Rd 03.JPG
TR04	20.5	LHS	60° 19' 3.360" N	134° 15' 16.020" W	Sweet clover	~50 m2 patch	Tagish Rd 04.JPG
CHR01	0.5	LHS	60° 18' 56.010" N	134° 15' 18.096" W	Sweet clover	~10 m2 patch	Chinook Rd 01.JPG
TR05	20	LHS	60° 19' 11.436" N	134° 14' 38.892" W	Sweet clover	~ 5m2 patch	Tagish Rd 05.JPG
TR06	18	LHS	60° 19' 46.110" N	134° 13' 26.040" W	Sweet clover	1 plant	Tagish Rd 06.JPG
TR07	18	LHS	60° 19' 46.200" N	134° 13' 10.782" W	Sweet clover	~15 m2 patch	Tagish Rd 07.JPG
TR08	18	LHS	60° 19' 47.394" N	134° 12' 54.648" W	Sweet clover	~5 m2 patch	Tagish Rd 08.JPG
TR09	17.5	LHS	60° 19' 44.928" N	134° 12' 34.254" W	Sweet clover	~100 m2 in curve of road	Tagish Rd 09.JPG
TR10	19	LHS	60° 19' 45.852" N	134° 12' 14.508" W	Sweet clover	~2 m2 patch	Tagish Rd 10.JPG
TR11	16.5	LHS	60° 19' 40.416" N	134° 11' 38.862" W	Sweet clover	~75 m2 patch	Tagish Rd 11.JPG
TR12	14	LHS	60° 18' 54.564" N	134° 9' 25.626" W	Sweet clover	3 plants	Tagish Rd 12.JPG
TR13		LHS			Sweet clover	~5 m2 patch; no photo/GPS	
TR14	13	LHS	60° 18' 43.728" N	134° 8' 55.890" W	Sweet clover	~20 m2 patch; complete done flowering and in seed	Tagish Rd 14.JPG
TR15	11	LHS	60° 18' 28.728" N	134° 6' 55.134" W	Sweet clover	~50 m2 patch (next to Secret Valley Lane)	Tagish Rd 15.JPG
TR16	10.5	LHS	60° 18' 38.676" N	134° 6' 27.048" W	Sweet clover	~10 m2 patch	Tagish Rd 16.JPG
TR17	8.5	LHS	60° 19' 35.298" N	134° 5' 43.896" W	Sweet clover	~10 m2 patch	Tagish Rd 17.JPG
TR18	8	LHS	60° 19' 51.600" N	134° 5' 35.388" W	Sweet clover	~20 m2 patch	Tagish Rd 18.JPG
TR19	5.5	LHS	60° 19' 52.740" N	134° 3' 18.696" W	Sow thistle	~10 m2 patch (all plants pulled)	Tagish Rd 19.JPG
TR20	0	LHS & RHS	60° 20' 21.360" N	133° 59' 6.282" W	Sweet clover	~200 m2 at corner with AK Hwy	Tagish Rd 20.JPG
TR21	1	RHS	60° 20' 5.268" N	133° 59' 31.548" W	Sweet clover	~10 m2 patch	Tagish Rd 21.JPG
TR22	2	RHS	60° 19' 40.872" N	134° 0' 22.620" W	Sweet clover	~50 m2 patch (near turnoff to Atlin Rd)	Tagish Rd 22.JPG
TR23	4.5	RHS	60° 19' 31.728" N	134° 2' 32.328" W	Sweet clover	1 plant	Tagish Rd 23.JPG
TR24	9.5	RHS	60° 19' 14.124" N	134° 5' 53.088" W	Sweet clover	~10 m2 patch	Tagish Rd 24.JPG
TR25	13	RHS	60° 18' 45.102" N	134° 8' 57.816" W	Sweet clover	~5 m2 patch	Tagish Rd 25.JPG
TR26	15	RHS	60° 19' 9.084" N	134° 10' 23.628" W	Sweet clover	~10 m2 patch	Tagish Rd 26.JPG
TR27	15.5	RHS	60° 19' 27.654" N	134° 10' 44.406" W	Sweet clover	~40 m2 patch	Tagish Rd 27.JPG
TR28a	16.5	RHS	60° 19' 40.044" N	134° 11' 37.758" W	Sweet clover	~500 m2 patch	Tagish Rd 28a.JPG
TR28b	16.5	RHS	60° 19' 40.044" N	134° 11' 37.758" W	Sweet clover	Same location as Tagish Rd 28 a; ~500 m2 patch	Tagish Rd 28b.JPG
TR29	53.5	LHA	60° 10' 41.742" N	134° 41' 38.898" W	Sweet clover	1 plant	Tagish Rd 29.JPG
TR30	53	LHS	60° 10' 58.224" N	134° 41' 12.012" W	Sweet clover	~10 m2 patch	Tagish Rd 30.JPG

Table 3. Tagish Road

Data collected in WGS84

Site ID	Km	Side of Road	GPS Latitude	GPS Longitude	Species 1	Notes	Photo File Name
TR31	52.5	LHS	60° 11' 7.518" N	134° 40' 55.920" W	Sweet clover	~5 m2 patch	Tagish Rd 31.JPG
TR32	51.5	LHS	60° 12' 19.320" N	134° 39' 3.138" W	Sweet clover	1 plant	Tagish Rd 32.JPG
TR33	35.5	LHS	60° 15' 53.172" N	134° 26' 12.378" W	Sweet clover	5 m2 patch	Tagish Rd 33.JPG
TR34	28	LHS	60° 16' 36.366" N	134° 19' 3.786" W	Sweet clover	~3 m2 patch	Tagish Rd 34.JPG
TR35		LHS	60° 16' 51.420" N	134° 17' 17.424" W	Sweet clover	~40 m2 at the corner with Taku Subdiv. Rd	Tagish Rd 35.JPG
TR36	17.5	RHS	60° 19' 45.264" N	134° 12' 30.720" W	Sweet clover	~200 m2 along 500 m long section	Tagish Rd 36.JPG
TR37	18	RHS	60° 19' 47.814" N	134° 12' 57.474" W	Sweet clover	~150 m2 along 200 m long section	Tagish Rd 37.JPG
TR38	18	RHS	60° 19' 47.322" N	134° 13' 10.380" W	Sweet clover	~5 m2	Tagish Rd 38.JPG
TR39a	20	RHS	60° 19' 15.186" N	134° 14' 25.518" W	Sow thistle	~60 m2; pulled flowing plants; very extensive growth too much to pull all	Tagish Rd 39a.JPG
TR39b	20	RHS	60° 19' 15.186" N	134° 14' 25.518" W	Sweet clover	Same location as Tagish Rd 39a	Tagish Rd 39b.JPG
TR40	21	RHS	60° 18' 59.748" N	134° 15' 43.056" W	Sweet clover	~15 m2	Tagish Rd 40.JPG
TR41	21	RHS	60° 18' 59.580" N	134° 15' 46.110" W	Sweet clover	~15 m2 next to bridge	Tagish Rd 41.JPG
TR42	28	RHS	60° 16' 35.508" N	134° 18' 54.606" W	Leymus	~10 m2; all plants pulled	Tagish Rd 42.JPG
TR43	53	RHS	60° 10' 57.570" N	134° 41' 13.908" W	Sweet clover	~1 m2	Tagish Rd 43.JPG
TR44	49	RHS			Sow thistle	~3 m2 patch, all plants pulled. No photo	
TSR01a	3	LHS	60° 15' 55.050" N	134° 18' 5.376" W	Sweet clover	~5m2 patch at Tagish Fire Dept	Taku Subdiv Rd 01a.JPG
TSR01b	3	LSH	60° 15' 55.050" N	134° 18' 5.376" W	Sweet clover	~10 m2 patch behind Fire Dept shop	Taku Subdiv Rd 01b.JPG
TSR02	3	LSH	60° 15' 55.050" N	134° 18' 5.376" W	Sweet clover	~20 m2 patch at corner of Fire dpt with road	Taku Subdiv Rd 02.JPG
TSR04	3	RHS	60° 15' 54.210" N	134° 18' 14.604" W	Sweet clover	~40 m2 patch on Taku Blvd Rd, near corner with main subdiv road	Taku Subdiv Rd 04.JPG
TSR05	0.5	LHS	60° 16' 51.894" N	134° 17' 18.174" W	Sweet clover	3 plants at cemetery	Taku Subdiv Rd 05.JPG

Table 4. Atlin Road

Data collected in WGS84

Site ID	Km	Side of Road	GPS Latitude	GPS Longitude	Species 1	Notes	Photo File Name
AR01	0.5	RHS	60° 19' 33.534" N	134° 0' 6.738" W	Sweet clover	~75 m2 patch	Atlin Rd 01.JPG
AR02	1.5	RHS	60° 19' 14.406" N	134° 0' 6.642" W	Sweet clover	~10 m2 patch	Atlin Rd 02.JPG
AR03	1.5	RHS	60° 19' 1.176" N	134° 0' 7.044" W	Sweet clover	~5 m2 patch	Atlin Rd 03.JPG
AR04	4	RHS	60° 17' 49.032" N	133° 59' 6.834" W	Sweet clover	~5 m2 patch at road embankment at boat launch	Atlin Rd 04.JPG
AR05	4	RHS	60° 17' 46.038" N	133° 58' 49.362" W	Sweet clover	~2 m2 patch along guardrail	Atlin Rd 05.JPG
AR06	8	RHS	60° 16' 10.560" N	133° 56' 35.730" W	Yellow Sweet clover	3 plants	Atlin Rd 06.JPG
AR07	10	RHS	60° 15' 7.758" N	133° 55' 41.940" W	Sow thistle	15 plants (all pulled)	Atlin Rd 07.JPG
AR08	10.5	RHS	60° 14' 58.560" N	133° 55' 27.990" W	Sweet clover	~3 m2 patch	Atlin Rd 08.JPG
AR09	11	RHS	60° 14' 49.530" N	133° 55' 8.004" W	Sweet clover	~2 m2 patch	Atlin Rd 09.JPG
AR10a	12.5	RHS	60° 14' 8.070" N	133° 54' 6.990" W	Spotted knapweed	1 clump	Atlin Rd 10a.JPG
AR10b	12.5	RHS	60° 14' 8.070" N	133° 54' 6.990" W	Spotted knapweed	Same as Atlin Rd 10	Atlin Rd 10b.JPG
AR11	13	RHS	60° 13' 54.984" N	133° 53' 55.386" W	Sweet clover	~1 m2 patch	Atlin Rd 11.JPG
AR12	13	RHS	60° 13' 45.438" N	133° 53' 48.150" W	Sweet clover	1 plant	Atlin Rd 12.JPG
AR13	14.5	RHS	60° 13' 9.588" N	133° 53' 21.792" W	Sweet clover	~ 3 m2 patch	Atlin Rd 13.JPG
AR14	15.5	RHS	60° 12' 34.644" N	133° 52' 47.532" W	Sweet clover	~50 m2 along 150 m section of road	Atlin Rd 14.JPG
AR15	16	RHS	60° 12' 31.422" N	133° 52' 34.782" W	Sweet clover	Same area as Atlin Rd 14	Atlin Rd 15.JPG
AR16	17	RHS	60° 12' 7.290" N	133° 52' 2.796" W	Sweet clover	~2 m2 patch	Atlin Rd 16.JPG
AR17	17	RHS	60° 11' 58.722" N	133° 52' 8.196" W	Sweet clover	~20 m2 patch	Atlin Rd 17.JPG
AR18	18	RHS	60° 11' 35.178" N	133° 52' 39.420" W	Sweet clover	3 plants over ~100 m section	Atlin Rd 18.JPG
AR19	18.5	RHS	60° 11' 16.338" N	133° 52' 35.496" W	Sweet clover	~50 m2 along 100 m section	Atlin Rd 19.JPG
AR20	19	RHS	60° 10' 58.266" N	133° 52' 31.866" W	Sweet clover	1 plant	Atlin Rd 20.JPG
AR21	20	RHS	60° 10' 35.592" N	133° 52' 9.936" W	Sweet clover	~2 m2 patch	Atlin Rd 21.JPG
AR22	22	RHS	60° 9' 58.230" N	133° 51' 4.020" W	Sweet clover	1 plant	Atlin Rd 22.JPG
AR23	22	RHS	60° 9' 49.242" N	133° 50' 53.370" W	Sweet clover	~100 m2 from ROW into old borrow area	Atlin Rd 23.JPG
AR24	23.5	RHS	60° 9' 14.292" N	133° 50' 11.544" W	Sweet clover	2 plants in 100 m section that was revegetated/reconstructed in past 5 years	Atlin Rd 24.JPG
AR25	40	LHS	60° 0' 37.830" N	133° 47' 44.280" W	Yellow Sweet clover	1 plant	Atlin Rd 25.JPG
AR26	23.5	LHS	60° 9' 14.508" N	133° 50' 11.100" W	Sweet clover	1 plant	Atlin Rd 26.JPG
AR27	22	LHS	60° 9' 53.658" N	133° 50' 58.704" W	Sweet clover	2 plants in 100 m section	Atlin Rd 27.JPG
AR28	18.5	LHS	60° 11' 17.400" N	133° 52' 35.466" W	Sweet clover	~150 m2 patch	Atlin Rd 28.JPG
AR29	18.5	LHS	60° 11' 20.142" N	133° 52' 35.412" W	Sweet clover	2 patches, each ~2 m2 in 50 m section	Atlin Rd 29.JPG
AR30	18	LHS	60° 11' 25.176" N	133° 52' 38.520" W	Sweet clover	~4 m2 patch	Atlin Rd 30.JPG
AR31	17.5	LHS	60° 11' 45.636" N	133° 52' 31.596" W	Sweet clover	1 plant	Atlin Rd 31.JPG
AR32	17	LHS	60° 11' 56.010" N	133° 52' 12.276" W	Sweet clover	1 plant	Atlin Rd 32.JPG
AR33	17	LHS	60° 12' 7.548" N	133° 52' 1.842" W	Sweet clover	1 plant	Atlin Rd 33.JPG
AR34	16.5	LHS	60° 12' 22.848" N	133° 52' 12.012" W	Sweet clover	~20 m2 patch and a few plants in adjacent borrow area	Atlin Rd 34.JPG

Table 4. Atlin Road

Data collected in WGS84

Site ID	Km	Side of Road	GPS Latitude	GPS Longitude	Species 1	Notes	Photo File Name
AR35a	16	LHS	60° 12' 30.300" N	133° 52' 30.078" W	Sweet clover	Very large ~800-1000 m2 patch	Atlin Rd 35a.JPG
AR35b	16	LHS	60° 12' 31.422" N	133° 52' 29.424" W	Sweet clover	Same as Atlin Rd 35a	Atlin Rd 35b.JPG
AR36	15	LHS	60° 12' 37.416" N	133° 52' 50.154" W	Sweet clover	4 plants	Atlin Rd 36.JPG
AR37	13	LHS	60° 13' 47.382" N	133° 53' 48.378" W	Sweet clover	5 plants	Atlin Rd 37.JPG
AR38	13	LHS	60° 13' 58.626" N	133° 53' 56.682" W	Sweet clover	20 plants along guardrail	Atlin Rd 38.JPG
AR39	11	LHS	60° 14' 52.386" N	133° 55' 11.496" W	Sweet clover	2 plants	Atlin Rd 39.JPG
AR40	11	RHS	60° 14' 56.574" N	133° 55' 22.596" W	Unscented camomile	~ 25 m2 of shasta daisy and mixed in unSweet cloverented cammomile on both sides of driveway (did not remove)	Atlin Rd 40.JPG
AR40b	11	RHS	60° 14' 56.574" N	133° 55' 22.596" W	Unscented camomile	Same as Atlin Rd 40a	Atlin Rd 40b.JPG
AR41	10.5	LHS	60° 15' 1.818" N	133° 55' 31.668" W	Sweet clover	~10 m2 patch	Atlin Rd 41.JPG
AR42	9.5	LHS	60° 15' 26.358" N	133° 55' 54.678" W	Sweet clover	1 plant	Atlin Rd 42.JPG
AR43	6.5	LHS	60° 16' 49.044" N	133° 57' 15.948" W	Sweet clover	~75 m2 patch in abandonned road section	Atlin Rd 43.JPG
AR44	0.5	LHS	60° 19' 33.420" N	134° 0' 5.628" W	Sweet clover	~2 m2 patch	Atlin Rd 44.JPG