

**Occurrence of Common Reed (*Phragmites australis*) on
Lake Huron shorelines:**

Field Report and Recommendations

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The Lake Huron Centre for Coastal Conservation*

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Executive Summary

Common reed, or *Phragmites australis*, is an invasive grass that has recently established along the eastern coastline of Lake Huron. Forming dense stands to the exclusion of all else, *Phragmites* presents a significant threat to rare coastal open beach and dune communities, many of which provide habitat to rare species. The purpose of the fieldwork described in this report was to determine the extent and severity of Common Reed establishment along the Lake Huron shoreline from Point Clark to Southampton, and to develop a list of priority control sites. A secondary purpose was to evaluate current control efforts and, considering experience in Canada and the US, suggest methods that are most likely to be effective.

Fieldwork was conducted in mid-July, 2007. The area between Amberley Beach/Point Clark and the northern boundary of the Southampton was covered, representing approximately 60kms of shoreline. Coordinates for each location where Common Reed was found are contained in an appendix of this report.

The establishment of Common Reed along the Lake Huron coastline is extensive. Small stands, and often extensive patches of Common Reed were observed all along the coastline, in a variety of coastal habitats. Although Common Reed thrives in coastal meadow marshes, it capable of establishing along open sandy beaches, and in at least one case, sand dune habitat where it can access the water table. Common Reed was observed displacing two species of rare grasses in good quality dune habitat at several locations. No exhaustive search was made for rare species; however, it is probable that more species are at risk. Additional records of species at risk also occur along shorelines within the study area, including the nationally threatened Dwarf Lake Iris and Hill's Potamogeton. Two of the locations where Common Reed was found have also been identified as provincially rare vegetation communities.

Common Reed is most established at: Point Clark, Lurgan Beach, Boilers Beach, Miramichi Bay, and all along Sunset Drive (south of MacGregor Pt PP). Cut areas at Eidt's Grove and Gobles Grove were also thick prior to cutting. In addition to continuing cutting at the locations where it has already been initiated, ten small patches in good quality habitat are **high priority** for control. Although these may patches seem minor at the moment, the ability of this plant to spread rapidly means that "early containment" is critical in order to ensure wise use of limited resources. Another six areas are suggested for survey.

Control methods are also discussed. Two locations where black plastic or geotextile was used did not appear to be effective at controlling the growth of Common Reed, and this is also true from the US experience. It is suggested to continue cutting, avoiding heavy machinery where possible, and to experiment (where conditions allow) with a follow-up glyphosate-based herbicide, using a provincially licensed applicator approved by the municipality.

Background

Common reed, or *Phragmites australis*, is an invasive grass that has recently established along the eastern coastline of Lake Huron. Like many invasive species, *Phragmites australis* appears to be very adaptable in its choice of habitat, and its establishment on many Lake Huron beaches is a cause for concern. Not only could this plant change the character of much of the Lake Huron shoreline, its dense growth could permanently alter the sensitive habitat and exclude many other species, including some dune species that are locally or provincially rare.

The purpose of the fieldwork described in this report was to determine the extent and severity of *Phragmites australis* establishment along the Lake Huron shoreline from Point Clark to roughly Southampton. Where possible, the coastline between Southampton and Sauble Beach was also surveyed. With locations known, a secondary purpose was to suggest additional areas for control, especially where *Phragmites* was replacing existing open sand dune or sand beach habitat of good quality. Although known as an invader of wetlands and ditches [1, 2], *Phragmites* has not been described as an invader of coastal sand beach or dune communities, and in Ontario, many of these fragile communities contain rare species of conservation concern. Another aspect was to observe current efforts at control (e.g. cutting, black plastic) and consider whether these are likely to be both effective and cost-effective, as well as consider other options. Finally, specimens were taken to document the spread on *Phragmites* as a contribution to ongoing research undertaken by Dr. Paul Catling at Agriculture Canada.

The “Results” section outlines results of the fieldwork – which areas were covered, and where *Phragmites* was found, and also where it was not present.

The “Discussion” section covers several topics. Areas with the worst infestations in terms of size of area and density of *Phragmites* are outlined. Finally, areas to prioritize for *Phragmites* control and removal are listed. Additional locations are outlined that were not easily accessible and would benefit from additional survey. Finally, control options are discussed, including cutting, herbicide application, and trials with black plastic in 2007.

Methods

Fieldwork took place between July 15 and July 19, 2007. All fieldwork was completed by Holly Bickerton with assistance from Rye Witter of MacGregor Point Provincial Park on July 17. Norah Toth (MacGregor Point Provincial Park), Mike Myatt (Town of Saugeen Shores) and Mike Fair (Township of Huron-

Kinloss) also provided local knowledge and assistance.

The area covered in greatest detail was between Amberley Beach/Point Clark and the northern boundary of the Town of Saugeen Shores (i.e. northern boundary of Southampton). This represents approximately 60 km of shoreline. Shorelines in MacGregor Point Provincial Park and Inverhuron Provincial Park will be surveyed in detail by park staff. The shoreline of Bruce Nuclear Power Plant is inaccessible to the public and was not surveyed. The area to the north of the Town of Saugeen Shores was only surveyed at a few locations along County Rd 13 because there are few access points to the beach along this road, which is leased privately to cottagers by the Chippewas of Saugeen First Nations.

Shorelines were surveyed for the presence or absence of *Phragmites australis*. Where roads followed the shoreline, surveying was done by car. In other cases, I drove to an access point and walked along the shoreline to another access point (or as far as time permitted), recording patches of *Phragmites australis*. I was also able to scan the shoreline with binoculars to the north and south of each access point, especially where there were few locations for public beach access. I found that eventually I was able to reliably identify stands of *Phragmites australis* even 500m and sometimes up to 1000m away. In these cases, stands may not have waypoints but the approximate locations are noted in the field table under the nearest waypoint and drawn on accompanying maps. Often, the contours of the shoreline or the weather (e.g. haziness, fog) were a greater hindrance to identifying patches any further away.

Each patch was given a field number within the GPS, and UTM (Zone 17) coordinates were recorded from a GPS using WGS84 and NAD83. The following information was generally recorded for each patch: size (in metres) and sometimes density of patch (especially if sparse, as most often *Phragmites* grows densely); substrate (e.g. sand, rock (gravel, cobble, boulder), silt/muck), general vegetation community information (e.g. open beach, graminoid meadow marsh, etc.), and a list of plants (especially dominants) at this location. This information is summarized in Appendix 1, and maps of all patches are shown with a blue flag in the accompanying map series (Appendix 2). Where *Phragmites* was continuous over a larger area (e.g. greater than 100m), GPS waypoints were taken to record the continuous extent of the occurrence. Photos were taken at many sites, especially where *Phragmites* was invading sand beaches or dunes. Towards the southern end of the study area, the route followed was also saved as a series of points in the GPS and is displayed on the maps. This may be especially helpful to clarify areas that were covered but where *Phragmites* was not found.

Specimens of *Phragmites australis* were collected at 22 locations. Time did not permit collection at all sites – the aim was to provide specimens where higher quality natural communities were being replaced, as well as to represent the geographic distribution the area surveyed. Specimens were also collected when

there was perceived to be a possibility that the *Phragmites australis* represented the non-native (ssp. *australis*) or native (ssp. *americanus*) variety. Specimens will be deposited in the collections at Agriculture Canada (DAO) in Ottawa.

Other plant species were also collected if their identity was unknown and/or occasionally if they were believed to be species tracked by the NHIC. Time did not permit exhaustive surveys for rare species; however they were noted where found. All specimens were pressed and recorded for future identification. This will help to describe the natural habitat at each site and get some extent of the relative threats to biodiversity.

Field notes were recorded for each location and a copy of these has been provided. Field data has been summarized in a Table (Appendix 1) and maps were created from the GPS waypoints (Appendix 2). All digital photos have been renamed with the site number at the beginning of the filename.

At several locations, *Phragmites* had recently been cut, or was currently being cut. I also visited a site at Eidt's Grove, Port Elgin, which had been covered last fall by black geotextile cloth and was able to observe the effects of the cloth on *Phragmites* control.

Results

For complete location descriptions, please refer to the Excel spreadsheet of field data accompanying this report (Appendix 1). For maps of each location, refer to the map series in Appendix 2. Note that patch numbers are not arranged numerically from north to south but follow the order that they were observed in the field.

Amberley Beach to Kincardine:

A small patch was recorded at Amberley Beach just south of the public parking area (#65), in an area with otherwise good quality open sand beach with Great Lakes Wheatgrass (*Elymus lanceolatus* spp. *psammophilus*) and Sandbar Willow (*Salix exigua*). Great Lakes Wheatgrass is considered a rare species in Ontario and is ranked S3¹ and tracked by the Natural Heritage Information Centre (NHIC). The subspecies, found only on Great Lakes shorelines, may also be globally rare (having a global rank of "G5T3"). This patch, and others like it below are considered the highest priority for control because it may still be possible to prevent the establishment of *Phragmites* here, in otherwise good quality habitat with at least one rare species, for relatively little effort.

From this point north and including Point Clark, four locations were waypointed (#60, 62,63,64), although this represents several hundred linear metres of *Phragmites* establishment. There are especially large patches at the Point Clark

¹ A species rank of S3 refers normally to species believed to have 100 or fewer occurrences in Ontario.

Lighthouse (#60) and at the beach by 155 Huron Rd. (#63), and cutting has taken place at both of these locations. The stands here are very tall and dense and are growing along muck/rock shoreline, mainly replacing gramoid and forb wetland vegetation such as Broadleaf Cattail (*Typha latifolia*), Woolgrass (*Scirpus cyperinus*), Black Bulrush (*Scirpus atrovirens*), Boneset (*Eupatorium perforatum*) and Purple Loosestrife (*Lythrum salicaria*). *Phragmites* in this area is dense and well-established, although this stretch of shoreline is not sand beach or dune habitat.

To the north of the Point Clark lighthouse parking lot, at the mouth of Clark Creek (#61), there is a small stand of *Phragmites* that should be considered high priority for removal, growing on moderately disturbed open sand beach (American Beachgrass (*Ammophila breviligulata*, Sweet White Clover (*Melilotus alba*). American Beachgrass is a rare species in Ontario and is ranked S3 by the NHIC. There was no other *Phragmites* seen along this beach, which has fairly good graminoid/forb vegetation on the narrow foredune, despite some disturbance and moderate establishment of other non-native species.

Driving north along Lakeside Trail (adj. Victoria Rd.), I found a small patch just south of a public walkway (#66). This patch is growing on the wet beach with species such as Common Rush (*Juncus effusus*) and Sandbar Willow (*Salix exigua*), but is adjacent to some good quality foredune with rare beach grasses (American Beachgrass, Great Lakes Wheatgrass) and should be controlled.

It would be worthwhile to walk the beach between #66 and #61 (approx. the Pine Rivermouth to Clark Creek mouth) with cutters and remove any additional patches encountered here on sand beach. Due to hard rain and thunderstorms, I was not able to walk as much beach as I would have liked in this area and further north to Kincardine.

The next access point was at Lurgan Beach, which I accessed at the end of Bell Drive (#67). The *Phragmites* here is almost continuous for at least 500m to the north (#69) – at this point I had to turn back due to driving rain. It was continuous for another at least 100m to the north but I could not see around the next point. Much of this area had been cut, an impressive distance of about 400m along the beach. Mostly what had been cut was the area closest to the shoreline, often leaving a depth of several metres of *Phragmites* nearer to the cottages. Also all dune vegetation was cut in these areas – all other graminoids, and in some cases even fairly large willows and sand cherries had been cut. If possible, it would be preferable both to cut *Phragmites* more completely and maintain more of the larger vegetation. This area is wet open sand dominated by species such as Baltic rush (*Juncus balticus*), Field horsetail (*Equisetum arvense*), and Reed Canary Grass (*Phalaris arundinacea*).

At the end of Conc Rd. 6W there is another access point. I found only one small patch here (#70) and although I could see another small patch to the south, I did

not see any to the north where the cottages front along Tout's Grove Hill Rd. – at least it is not a major problem here. However, there is some natural beach vegetation here and it would be worth walking the distance with hedge clippers or a whippersnapper to prevent small patches from expanding.

I walked the entire length of Bruce Beach between Cty Rd 6 and Concession 10 and found only four small patches (#10, 11, 12, 71) of *Phragmites*. Bruce Beach is generally in good condition, and although this is only a “drop in the bucket” when it comes to *Phragmites*, these four small sites should be considered an urgent priority for control, so that the situation at Bruce Beach does not develop the type of problem at problem at Boiler Beach (see below).

Boiler Beach was mostly visible from the road. *Phragmites* is well established and virtually continuous for more than a kilometre, between #72 and #77 (from 200m south of 101 Boiler Beach Rd. to the intersection of Boiler Beach Rd and Kennedy Dr.). While #72, 73 and 74 were mostly invading thicket marsh habitat, at #75 (Boiler Beach Rd and Heritage Dr), the beach had turned to sand. It was in this area that the *Phragmites* had been cut, again partially cut along the shoreline.

From #77 (Boiler Beach Rd at Heritage Dr) north, the beach appears to be free of *Phragmites* for about 1.2 km to the north. At the end of Conc Rd 12, the beach also appeared to be free of *Phragmites*. There is another large infestation along Boiler Beach Rd./Goderich St. between #78 and #80 (intersection of Huronville St to Bruce Ave., Kincardine). This is at least 1 km of continuous invasion of sand beach. Again, most of this had been cut, at least along the beach side.

From #80 heading north, the shoreline turns to a steep, rocky bank unsuitable for *Phragmites*. I did not observe any *Phragmites* on the beaches in front of Goderich St, on the public beach in Kincardine, or looking north as far as the jetty.

Kincardine to Inverhuron Provincial Park:

No *Phragmites* was observed from the jetty in Kincardine to site #59 heading north when scanned with binoculars. Site #59 is a fairly large patch (at least 50m, dense and tall) on a sand/rock point. Heading north, *Phragmites* is almost continuous in good quality beach vegetation (McAskill Road Beach) between #57 and a rocky point that is about 200m to the south of #58 (about 500m, and it extends south of the point for at least 100m as well). *Phragmites* here is very sparse in places and the locations where it is growing in sand appear to be newly established. In many places, density is still very low, and the species may be able to be effectively controlled for relatively little effort. Similarly, two other small patches (#55 near access point at Dawson Drive; #56 about 200m south of this) were found in areas where rare dune grasses and other native dune vegetation (e.g. American Beachgrass, Great Lakes Wheatgrass, Wormwood (*Artemisia*

campestris) and Trembling aspen (*Populus tremuloides*) were dominant. I was not able to walk about 700m of this beach between #56 and #57, but it would be worth walking from the Dawson Drive access point to the wooden lookout at Saugeen St and ensuring that these and other newly establishing patches do not become a problem next season.

A large patch invading dune vegetation was found starting at #53 and virtually continuous south to #54. Site #53 starts about 200m south along the beach from Concession Rd 5 and continues for about 200m to the south, where the beach turns to a more rocky boulder beach. This extensive patch is invading an open sand beach with Field Horsetail, Wormwood, Canada Wild Rye (*Elymus canadensis*), Variegated horsetail (*Equisetum variegatum*), Rough Cocklebur (*Xanthium strumarium*) and other dune grasses. The coast to the north of this area (to a rocky point, about 1km) was scanned with binoculars and no *Phragmites* was evident, but this is another good quality (though impacted) area where it should be a high priority to prevent the establishment of all patches of *Phragmites* before it becomes a problem. McLeod Point is posted as a private drive with no access, but this beach could be walked from one end to the other in order to ensure that no *Phragmites* is found.

I did not walk the shoreline of Stoney Island Conservation Area, but I did access the beach at the end of Conc Rd 7 and found a small (20m) patch on a rocky point invading an open emergent graminoid marsh (with Baltic Rush, Reed Canary Grass and Greenish sedge (*Carex viridula*) just to the north of this access point.

I was not able to access the shoreline off of the loop at the bottom of Kinhuron Road; this appeared to be all private homes.

From the access point at the end of Parkwood Rd, there is a high energy cobble beach and I did not observe any *Phragmites* here or for about 200m to the N and 500m to the south.

At the end of Lorne Beach Rd. (#51), *Phragmites* is extensive through a bouldery/mucky bay and is establishing around the shoreline of this bay. It is much sparser to the south, where it is invading a coastal thicket marsh. This is a large population, although it is not found in dune habitat. At the north end of Upper Lorne Beach Rd (#50) there is another well-established patch of reasonable size in wetland vegetation, and two additional patches were viewed to the north of here (~500m) along the shore. Given that there was no beach access for approximately 1km between these two points, it is likely that more locations exist in similar habitat in between.

Phragmites is sparse but present at the beach along Lake St., south of Inverhuron (Cty Rd 15). Only three small patches (#47, 48, 49) were found here,

all under approximately 20m long. The beach here is rocky and is best characterized as coastal graminoid marsh (with cattails, rushes and sedges).

Inverhuron Provincial Park to MacGregor Point Provincial Park:

The shoreline of Inverhuron Provincial Park and the Baie du Dore will be surveyed by Ontario Parks staff, although no *Phragmites* was observed here at the day use beach or on nearby dunes. Bruce Nuclear Plant was not accessible.

Possibly the largest and densest area observed during the field survey where *Phragmites* had established was along Sunset Drive to the south of MacGregor Point Provincial Park. Sunset Drive was reached from Conc. Rd. 12. *Phragmites* is extensively established, especially in former graminoid emergent marsh habitat (Broadleaf cattail, Woolgrass, Black Bulrush), for approximately 4 kms along this coast (i.e. #42, 43, 44, 45, 46 can be considered continuous) . There is an extensive establishment of *Phragmites* at Brucedale Conservation Area. Although it is sometimes sparse, *Phragmites* is extremely widespread through this area, especially on rocky wave-washed points and in marshy bays. The size of this area means that it is probably impossible to control. One site (#45) is worth mentioning for two reasons. First, *Phragmites* is establishing here in dry sand, quite high from the waterline. This is an open dune habitat with Wormwood, Sand cherry, Salix sp. and Grass sp. Second, a large area appears to have been roto-tilled and all *Phragmites* removed here. Two smaller patches to the north of Conc. Rd. 12 were also found (#40, 41).

It is suggested that the sand dunes around #45 be surveyed in more detail to determine if the difficult job of keeping *Phragmites* out of this area is justified. It may be that this area falls within an identified Provincially Significant ANSI, described in the early 1990s as having a high biodiversity value with a mixture of coastal fen and dune grassland, with many rare species including Dwarf Lake Iris, Sand Reed Grass and Hill's Pondweed [3]. If this is the case, then control could be prioritized for this area.

Finally, more *Phragmites* was found just to the south of MacGregor Point Provincial Park (#38, #38a), off of Richardson Rd. *Phragmites* could be considered sparse here along approximately 500m of a rocky shoreline. While this is not dune habitat, the calm embayments here may be used by shorebirds and other birds in migration. It is not known how *Phragmites* may exclude these species but is probably worth monitoring through the local birding community.

MacGregor Point Provincial Park to Port Elgin:

The shoreline at MacGregor Point Provincial Park will be surveyed by Ontario Parks staff. One known population (#14) at Cottager's Beach was visited, where *Phragmites* is being cut and controlled using black plastic. Cottager's Beach is also moderately disturbed natural beach habitat with a fairly small coverage of

Phragmites and control should continue here. Both of the rare dune grasses, American Beachgrass and Great Lakes Wheatgrass, can be found at this site.

Between MacGregor Point PP and Port Elgin there are several areas where *Phragmites* has become established. Most or perhaps even all of them are known by the municipality, which has been very actively communicating concerns about the plant to residents.

A couple of very small patches (#15, 16) along the south end of Saugeen Beach Rd., although they occur more in rocky wet beach than in dune habitat, may be able to be quickly controlled. A slightly larger (100mX30m) patch (#17) was observed at the end of Smith Lane.

The patches at the southern end of Eidt's Grove (#18) is well known and had been cut the day it was visited. A similarly large patch (200m) at the north end (#19) had not been cut. In this area, *Phragmites* is invading a rocky emergent graminoid marsh. There is no easy access to this area except via the shoreline allowance. Another patch (#20) is near the road in a wet sandy swale, and from here another patch was visible about 0.5km to the south across a small sandy bay. This site appeared to be a sand beach. It would be advisable to walk the shoreline between Goble's Grove and Eidt's Grove with hand cutting tools in order to remove these and any additional small patches of *Phragmites* before they establish. Although these areas may not contain sand dune habitat, controlling them may help to prevent local spread.

The Goble's Grove site (#21, 13) is known by the municipality and cutting had just occurred. The experimental site with black geotextile was located here and the results were observed (discussed below). An additional patch (20mX20m) was found at Queen's Bush beach and another (not waypointed) was observed to the north of this (but before the public park). These locations are mainly on wet sandy swales and low beaches. Finally, two patches were found just to the north of the Port Elgin marina (#23) about 100m apart, and a third was visible (not waypointed) about 300m to the north of this at the base of a rocky point.

In general, the coastline between MacGregor Point and Port Elgin is very accessible and this area was well surveyed.

Port Elgin to Southampton:

Heading north from Port Elgin along North Shore Rd., the southernmost part of North Shore Rd is steep and rocky and probably unsuitable for *Phragmites*. There were only two small new patches (both included in #24) growing mainly with marsh vegetation on a rocky shoreline.

The worst patch within this stretch occurs at Miramichi Bay, where approximately 1 km of the bay (between #25 and #26) is one continuous stand of *Phragmites*.

In places it is less dense; however, many patches here appeared well established, tall, and with numerous flowering heads. During a second visit to this bay the following day, large parts of it had been cut by a municipal tractor. Much of this bay is rock as well as fine silt, with an open graminoid wetland community.

There was no obvious access to the shoreline at McNab Point. In contrast to Miramichi Bay, there was only one newly establishing patch (#27) observed in the adjacent Horseshoe Bay, although this could change quickly and it is suggested that this patch be removed urgently.

From the public beach at the corner of Huron and South Streets (Southampton), I walked the beach north approximately 1km to the corner of Lake Street and Bay Street. This all appeared to be good quality dune habitat (the best observed during this fieldwork) with graminoids such as American Beachgrass, Reed Canary Grass, Baltic Rush, Prairie Cordgrass (*Spartina pectinata*), etc. There was no *Phragmites* observed here or at the adjacent Chantry Dunes reserve (I walked the boardwalk to observe the backdunes). In general, there was no *Phragmites* observed between #27 and #28, which is about 3.25 kms.

Southampton to Sauble Beach:

I observed one very small patch of *Phragmites* on the rocky shoreline by the war memorial in Southampton (#28).

Accompanied by Rye Witter, I walked approximately 2km of shoreline to the north of the war memorial to the boundary of the Town of Saugeen Shores (parallel to Blanchfield Rd). We observed five areas where *Phragmites* was established along this shoreline (#33,34,35,36,37). These are small to medium-sized patches (one up to 50m but others only 5m in length) establishing on a rocky, disturbed beach with native wetland vegetation and also other weed species. These patches could be considered as sources for spread but are considered as lower priority due for control due to the poorer condition of this disturbed habitat.

Finally, I drove along Cty Rd 13 north to Sauble Beach. There were almost no marked access points along this stretch of privately owned cottages and I had little opportunity to observe the shoreline for more than 10km. The only location I was able to gain access to the shoreline was at French Bay (#31), where I found a fairly large established patch in a wet swale on an open sand beach with species such as Three-square (*Schoenoplectus pungens*), Spike-rushes (*Eleocharis* spp.), Joe-Pye Weed (*Eupatorium maculatum*), and Water Horehound (*Lycopus americanus*). From this location, two more large patches (not waypointed) were observed about 500m to the south and 500m to the north. It is likely that there is more *Phragmites* along the inaccessible 10km of this beach, and that gaining access to it at several points would be helpful. This patch is considered high priority for control.

Roadside occurrences

Four *Phragmites* occurrences were recorded on roadsides (#29, 30, 32, 39). Although this was not the focus of this study, wherever these were observed, they were recorded. The locations were quite small and widespread, suggesting that roadside maintenance is not responsible for spreading *Phragmites australis* to the extent that it is found on beaches and other shorelines in the area. Three of the four locations were along Cty Rd. 13.

Only two specimens were collected specifically because their red stems suggested they might be of the native subspecies (ssp. *americanus*). These have not yet been identified by Dr. Paul Catling. The locations of these specimens (one roadside ditch, one open beach with other (not red) specimens) make them unlikely to be the native subspecies.

Discussion

Establishment and dispersal

The establishment of *Phragmites australis* along the Lake Huron coastline is extensive. At least small stands, and often more extensive growth of *Phragmites* were observed very quickly at almost opportunity to access the Lake Huron coastline, in a variety of coastal habitats. The only locations observed that seem clearly to exclude *Phragmites* are shorelines of larger boulders and/or high energy (i.e. coastlines with high wave activity). In summary, it appears to be widespread but often in the early stages of establishment along much of the approximately 60 km of coastline covered in this study.

Although it appears to favour meadow marsh and rocky headland habitats (where it appears to establish and from which it appears to spread), it is establishing rapidly in a variety of vegetation communities, including open sandy beaches and even some open dunes, as well as calcareous coastal wetlands (where some typical fen species were observed in low numbers). *Phragmites* appears to be capable of establishing along open sandy beaches, as long as it can gain access to the water table using its extensive root system.

From local reports, *Phragmites* along the Lake Huron coastline is spreading rapidly once it establishes. Visible stolons (above-ground runners) are very long and robust (up to 25 m in length and often 2-3 cm thick). At Eidt's Grove, it was reported by a local volunteer and cottager that the "front" of expansion by *Phragmites* had advanced approximately 30 metres between 2006 and 2007.

According to some reports, *Phragmites* may have been present in the more established areas for more than five years. However, from both reports and observation, establishment in many areas has been recent (i.e. within the last

two years). Stands in many areas still did not have any flowering material, also suggesting recent establishment (possibly sometime in the 2006 season).

It is possible that *Phragmites* may establish first on points and headlands, and spread following the coastline into more sheltered bays. Spread probably occurs when fragments of runners (perhaps broken by wave action or animals such as muskrats) are washed along the Lake Huron coast. As *Phragmites* is now widely established in Lake St. Clair and to the north on Manitoulin Island, the original sources could be widespread, although the number of established populations observed along Lake Huron are now undoubtedly contributing to its wider spread. It is likely that the lowering of waterlevels in Lake Huron has contributed to the spread of *Phragmites* by creating large expanses of uncolonized, seasonally flooded coastal areas with silty or mucky substrates. Studies along the St. Lawrence River in Quebec have also demonstrated that low water levels favour the establishment of *Phragmites australis* [4] .

For example, at the Brucedale CA which appears to have been a sandy swimming beach, the shoreline has receded many tens of metres in places, and the bay is now virtually choked with *Phragmites*, leaving the sand strip far from water and separated from it by *Phragmites* and other wetland vegetation.

There was no evidence that *Phragmites* is originating inland and spreading to the coast along rivers and streams. Very little *Phragmites* was found along roadsides or in other creeks and streams encountered while driving through the area, especially when compared with the extent of its occurrence along the coastline.

Effects on biodiversity

Forming dense, monotypic stands to the exclusion of all else, *Phragmites* presents a significant threat to rare coastal open beach and open dune communities, many of which provide habitat to rare species including American Beachgrass, Great Lakes Wheatgrass and Sand Reed Grass (*Calamovilfa longifolia* var. *magna*), the latter of which was not observed but has been recorded at seven beaches in the study area [3]. However, no exhaustive search was made for rare species in this survey, and it is possible, even probable, that more rare species are at risk than the ones reported here. For example, records of species at risk also occur along shorelines within the study area, including the nationally threatened Dwarf Lake Iris (*Iris lacustris*) and Hill's Potamogeton (*Potamogeton hillii*) [3]. In two locations where *Phragmites* was found (Lurgan Beach and Point Clark/Amberley Beach), the area has been formally identified as a provincially rare grassland community. The area surrounding Scott Point near Sunset Drive was identified as an Area of Provincial and Scientific Interest (ANSI) for its combination of coastal fen and dune grassland, and this may be one of the areas where *Phragmites* invasion is at its worst. However, this should be confirmed.

Although dune and beach habitat was prioritized for this study, there important wetland areas along this coastline and the biodiversity impacts of *Phragmites* on these may also be high. For example, the Baie du Dore wetland (not visited, adjacent to the Bruce Nuclear Station) is a provincially significant wetland, with almost half of the wetland area identified as coastal fen community[3].

Although outside of the study area, the observations from this fieldwork cast concern on the well known, highly biologically diverse and sensitive areas of Bruce Peninsula coastal fen to the north of Sauble Beach (Oliphant area). Were *Phragmites* to establish in these sensitive coastal fens, the losses to biodiversity may be huge and potentially irreversible.

Priority areas for control

Despite the widespread establishment of *Phragmites* along the coastline, its recent advance does provide some opportunity for control. In many areas, establishment has been recent and stands are not yet so dense that native vegetation has been completely excluded.

Phragmites appears to be most established in the following areas observed:

- Point Clark (well established to south of lighthouse)
- Lurgan Beach
- Boilers Beach from about 500m north of Conc.Rd. 10 to Kennedy Rd. and from Huronville St. to Bruce Ave
- Miramichi Bay (extensively colonized throughout entire bay)
- All along Sunset Drive (south of MacGregor Pt PP) between Concession Rds 10 and 12, as well as to the north and south of these

Cut areas at Eidt's Grove and Gobles Grove were also quite thick prior to cutting in July 2007. It should be noted that this list is probably not comprehensive: some areas of coastline (e.g. Baie du Dore and Bruce Nuclear Power Plant) could not be accessed and additional areas of concern may be found in further surveys.

Phragmites was cut at many of these locations in July 2007, including Lurgan Beach, Boilers Beach, Eidt's Grove, Gobles Grove, and Miramichi Bay. These areas should also be cut in 2008. It is likely that repeated control efforts will be required as *Phragmites* is extremely resilient. Progress should be monitored carefully. If significant success is achieved, cutting alone may be sufficient. If *Phragmites* returns with vigour or even advances, cutting may be considered in combination with a safe herbicide (see discussion below).

Unless beaches represent a high social or economic value, it is not recommended to expand control at this time into new areas where infestation is severe. Although it may seem logical, a higher priority given limited resources (see below) is to continue existing control efforts while keeping *Phragmites* out of

areas where it is not yet established. It is important to acknowledge that complete eradication of *Phragmites* from the Lake Huron coastline is probably now impossible. This is because the plant is so widespread in adjacent areas (and aggressive and easily distributed by waves) that preserving existing areas of concern (e.g. those of high natural or social value, such as public beaches) is much more realistic.

In addition to continuing cutting at the locations where it has already been initiated, some very small patches in good quality habitat are **extremely high priority** for control. Although these may patches seem minor at the moment, the ability of this plant to spread rapidly means that “early containment,” especially in areas with good natural vegetation or a high social value, is critical in order to ensure wise use of limited resources.

Best results in invasive species management are obtained when, rather than beginning in the weediest area, weeds are removed from the best quality (and least weedy) areas [5], and native plants are permitted to reestablish. Typically, invasive species (including *Phragmites*) thrive and spread most easily in open mineral soil that is produced by disturbances, or in this case, low water levels. Then, once the best natural areas are protected and the seed bank of native species is maintained, the core of the established areas can be undertaken.

From south to north, priority areas for control of *Phragmites* in good quality natural habitat (including open sand beach and other ELC communities) are shown in Table 1. It should be emphasized that the rare sand beach and dune habitat, as well as locations with rare dune grasses American Beachgrass and Great Lakes Wheatgrass, have been prioritized here, although the biodiversity values of coastal marshes may also be high.

Table 1 Additional High Priority Areas for control of *Phragmites*

Location	Patch No.	Municipality
South of Amberley Beach	#65	Ashfield-Colborne-Wawanosh
Mouth of Clark Creek	#61	Huron-Kinloss
Lakeside Trail & Sunrise Ave.	#66	Huron-Kinloss
Bruce Beach	#10, 11, 12, 71	Huron-Kinloss
End of Conc. Rd. 6	#70	Huron-Kinloss
McAskill Rd. Beach (from end of McAskill Rd south for about 300m)	#57 to #58 (continuous)	Kincardine
Near Dawson Dr. beach access	#55 and #56	Kincardine
South of Conc. Rd. 5	#53 and #54	Kincardine
Horseshoe Bay	#27	Town of Saugeen Shores

French Bay	#31	Chippewas of Saugeen First Nation
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Other areas may be considered for important social or economic values, or may be taken on by individual landowners or concerned citizens. The list above is not meant to discourage additional efforts at control but to highlight areas where it is important to protect good quality natural vegetation.

Priority areas for additional survey

A few areas have been suggested for some additional survey. These are areas without many public access points, where it would be valuable to walk the coastline, checking for *Phragmites* establishment. This does not have to be very onerous and could easily be completed by volunteers familiar with *Phragmites*. It may be possible to take secateurs, small clippers, or a whippersnipper and remove some of the smallest patches, and then simply report any larger areas for further consideration.

Areas suggested for some additional survey work are:

- Pine Rivermouth to Clark Creek Rivermouth (#61 to #66 check – Township of Huron-Kinloss)
- North of Kincardine:
 - from the Dawson Drive access point to the wooden lookout at Saugeen St.
 - McLeod Point south to Conc. Rd. 5
- Eidt's Grove to Gobles Grove – walking this shoreline may result in finding further small patches.
- Chantry Beach and Dunes. Fortunately, there was no *Phragmites* observed along Chantry Beach or in the dunes, but these areas have very good quality natural sand dunes, with rare flora, and should be monitored closely.
- Beaches between the townline of Saugeen Shores and Sauble Beach. This is a large area leased to cottagers by the Chippewas of Saugeen and would require partnership with the First Nations community and several cottagers in order to gain enough access to the beach to make survey efficient. From scanning the shoreline at the few access points, much of this looks to be sandy beach of varying quality and disturbance levels. At a minimum, it would be wise to alert cottagers in this area to *Phragmites* and offer assistance in control if possible.

In addition, near Brucedale CA at #45, more intensive surveys of the dune habitat could help to determine whether control is warranted. This area is surrounded by extensive populations of *Phragmites*, although the dunes appear to be suboptimal habitat and they are not yet extensively colonized. Further

surveys of the flora and dune quality here would help to determine whether to control here, and if so, how best to approach it.

Control methods

Cutting

Phragmites was observed being cut at several locations. Several working days were organized by both the Town of Saugeen Shores and the Township of Huron-Kinloss. In most cases, *Phragmites* was cut using commercial mowers or tractors, and volunteers (including stewardship rangers) gathered and bagged plants for disposal. This represents a significant input of time and expense in order to control this species – these efforts need to be encouraged.

It is too early to know the results of cutting *Phragmites australis*. All cut sites should be monitored carefully early in the season. Follow-up cutting will almost certainly be required: *Phragmites* is a very tough plant with many resources stored in the rootstock, which will need to be exhausted. Repeated cutting over several seasons has been effective in controlling *Phragmites* in some studies [2]. Studies indicate that cutting alone is a very time-intensive method of controlling *Phragmites* and that needs to be repeated for at least two seasons, with complete coverage, to have an effect [6]. Others have found that only repeated cutting throughout the growing season, over several seasons, provides substantial decrease in *Phragmites* density [7]. It is very difficult to attain complete coverage using machinery, as the shoreline is too soft for machine cutting. It is possible that several years of cutting will be required to be considered successful. However, one local volunteer reported that cutting at his site last year had resulted in about a 30% reduction in regrowth.

There are some concerns with the use of heavy machinery to mow *Phragmites* on soft substrates. It may break up the stolons and contribute to *Phragmites* spread. Machinery can also transmit other non-native and/or invasive species from outside the area or habitat (e.g. agricultural weeds tolerant of wet places), or even between sites (e.g. seeds of Purple loosestrife). It also certainly disrupts and possibly destroys nests of some birds (e.g. Red-winged blackbirds were observed, and it is possible that rails, bitterns or even ducks may already be using some of these areas). It is also non-discriminatory (i.e. all plants are mown, even native ones).

Obviously, the extent of area covered by *Phragmites* could never be cut cost-effectively by hand. Control of invasive species always entails some risk, and the fact that some native species (e.g. native plants or nesting birds) may be destroyed must be weighed with the long-term risk that *Phragmites* itself poses to the habitat.

However, it would be a good idea to observe areas mown with machinery in 2007 for establishment of other invasive species and compaction of the substrate. Depending upon the success of the 2007 cutting, hand cutting of resprouting plants may be possible in some places.

In 2007, plants were cut in the third week of July. This was to ensure that flowering heads had not emerged for the season yet, and that seed spread was minimal. Research suggests that experimenting with a slightly later cutting date may be effective. Studies in the United States suggest that cutting the plant after the flowers have emerged but before seeds have set (in southern Ontario in 2007 this was around the first or second week of August, but it may range from late July to early August) provides the most effective control [2]. This is because plants have invested the maximum potential resources in the flowering head once it has emerged, and so cutting at this time (and eliminating their means of photosynthesis) depletes the rootstock faster. There is also evidence that in some cases, unlike some other invasive species (e.g. Purple Loosestrife), *Phragmites* seeds are not strongly viable and once establishment has occurred, the main mode of spread is via rhizomes and stolons [2].

However, it should be emphasized that if volunteers are only available in mid-July, it is still preferable to cut at that time than postpone cutting for a season because of a shortage of labour or equipment.

Cutting and herbicide

From a review of the scientific literature, by far the most frequently recommended control approach for *Phragmites* uses a combination of cutting plants (often by hand!), followed by application of a regulated herbicide [2, 6, 8]. In the United States, the herbicide most often used is a glyphosate treatment that is specially designed and regulated for use over water. Trade names for these include “Rodeo” (manufactured by Monsanto) and “Accord” (manufactured by Dow); it is possible that there are other trade names of a similar treatment by other manufacturers. Although glyphosate itself acts upon the chloroplasts of plants and therefore has no effect on animals, aquatic applications have special surfactants (effectively detergents) that help the application to stick to plant surfaces but do not have negative effects on other aquatic life, especially amphibians, reptiles and fish, which are particularly sensitive to these. Toxicity tests by Monsanto have indicated that glyphosate is virtually non-toxic to all aquatic animals, although it is non-selective and will kill all plants it contacts[2]. Unlike many herbicides, it is formulated so that it does not persist in the soil.

In Canada, there is currently no regulated glyphosate-based herbicide that is regulated for use over water. Neither Rodeo nor Accord is licensed for use in Canada. Unfortunately, this means that the most effective (and probably the only cost-effective) known treatment for one of Canada’s most invasive plant species is virtually impossible in most of the areas where it dominates.

However, where *Phragmites* is growing on sand, it is possible to experiment with other glyphosate treatments in combination with cutting. As long as the water dries up at some point in the season (i.e. the herbicide is not sprayed over standing water), it is possible to use other glyphosate-based herbicides. Application of commercially available Roundup and WeatherMAX have been used at St. Clair National Wildlife Area and at Rondeau Provincial Park ([9], Jeff Robinson, pers. Communication 2007). Experimenting with cutting in combination with a glyphosate application is recommended for the 2008 season as long as this is undertaken by a licensed applicator approved and authorized by the local municipality. Permits may be required and notices posted before and after application. **Cottagers and concerned volunteers should not experiment with application of any herbicide without professional advice relevant to their site.** If an experiment is successful and there is public acceptance of such herbicide application, evidence from the international scientific literature (as well as from reputable organizations such as The Nature Conservancy) suggests that this may be the most effective and cost-effective method of containing (if not eliminating) *Phragmites* from natural areas. There is abundant technical information on this approach, including methods of herbicide application (including wicking, spot spraying, and dabbing) that minimize overspray and effects on native plants in sensitive areas, effective concentrations, etc. Further information and references on these studies will be forwarded with this report.

Due to understandable environmental concerns about the use of herbicides in the environment, other “ecologically friendly” herbicide treatments have been suggested for use to control *Phragmites* (e.g. including tradenames of EcoClear, and others). These are mainly 25% acetic acid or citric acid treatments. Designed for use on annual weeds in backyard gardens, they are not appropriate for (or intended for) use near water due to their acidity. The strongly acidic treatments (stronger than vinegar) may have a detrimental effect on sensitive aquatic animals such as amphibians and fish. Because they act only the foliage of plants (as opposed to glyphosate, which is transported to kill the root), they are also unlikely to be very effective against a plant as robust as *Phragmites australis*.

Herbicide can also be applied without prior cutting of *Phragmites australis*. This method was used effectively at Rondeau Provincial Park in 2005 – 2006, where two applications of the glyphosate herbicide WeatherMAX (manufactured by Monsanto) within ten days of each other in June and July effectively controlled *Phragmites*, at least for one year of monitoring [9]. Controlled studies in Europe show that cutting *Phragmites* prior to herbicide application (even up to a year prior to application) provides a more effective long-term control than the herbicide application alone [10]. Several sources suggest that herbicide application is preferable in autumn, for two reasons. First, the plants have “tasseled” or set seeds by this time, and they are directing energy to the roots [2] so herbicide will be directly transported to kill the underground rhizome. Secondly, at this point

other native plants are dormant, and it improves the ability of native plants (e.g. *Typha* sp.) to recolonize habitats from the seed bank in the next season [6]. So in summary, the best approach seems to be a summer cut (second week of August) to exhaust the rootstock, followed by a late September or October herbicide application. However, it is worth experimenting with various timing.

In particularly sensitive areas (such as those with species at risk), or those where the density of *Phragmites australis* is low, it is possible to apply herbicides by dabbing them on cut stems or by wicking them up the stem, rather than by wand spraying. These methods can be highly effective, although require significantly more intensive effort.

Black plastic

In two locations, *Phragmites* plants had been cut, and black plastic placed on the cut stalks, so that solar heating would cause the roots to die. At Eidt's Grove, this was a woven geotextile that had been placed over the plants in autumn 2006. At Cottager's Beach in MacGregor Point Provincial Park's, opaque black plastic had been placed over cut stems.

Black geotextile did not appear to be effective at Eidt's Grove in controlling *Phragmites*. Long runners were visible escaping from underneath the plastic and establishing at edge of the tarp. Beneath the geotextile cloth, green leaves and stolons were observed, and young, sharp shoots of *Phragmites* sprouted up through textile at a density of approximately 2-3 plants /m². The woven geotextile permitted some light through, and its success at killing plant material appeared greater in areas where two layers of fabric overlapped.

Where black plastic was used at Cottager's beach in MacGregor Point PP (black plastic), there appeared to be less photosynthesis occurring in the plant material (stolons, leaves) remaining under the plastic. Active green runners emerged at the edge of the plastic. Young shoots occasionally sprouted through the plastic but less frequently than with the geotextile, although this may be related to the amount of time the plastic had been in place. The black plastic had not been quite as tightly secured as the geotextile and in places it had shifted due to wind and wave action.

Overall, the use of black textiles and plastic does not appear to have been very effective given the cost in materials and time, and the difficulty in using this method over large, publicly accessible areas. *Phragmites australis* has large rootstocks upon which it can draw for nutrients, even in the absence of sunlight for photosynthesis. Solar heating did not appear to be able to kill stolons. Stolons are robust and are easily able to escape out from under the covered area. It is possible that black plastic may be more successful for smaller, or more newly established areas, although it is clearly non-selective and will also destroy plants of other species.

In trials at Rondeau Provincial Park, clear plastic was successful in controlling *Phragmites* growth for one season, but the effects were no longer evident in the second year. It was concluded that it was not an effective method of control due to its lack of persistence, combined with the time required to install it and materials costs [9]. An American researcher concluded that to be effective, black plastic must stay in place for at least three growing seasons, which is likely to be difficult in open beach situations.

Summary of Recommendations

Phragmites is extensively established along the Lake Huron shoreline to such a degree that it is likely impossible to eradicate it. A more realistic approach is to identify high quality natural areas (and areas of social value, such as public beaches) where it can be removed, or (even better) prevented from establishing.

- Urgent cutting is required at several high quality sites with small infestations as listed above.
- Continue cutting where previously cut in 2007 and monitor success.
- Consider cutting *Phragmites* at a later date (late July or early August), when flowers have emerged but seeds have not yet set, and observe whether this makes cutting more effective.
- Attempt trial with glyphosate herbicide (e.g. Rodeo) in 2008 where *Phragmites* grows on sand (using licensed contractor).
- Studies suggest best results when *Phragmites* is cut in August as above, and sprayed in late September or October, so that the effects of the herbicide on native vegetation are minimized. However, if logistics prevent two visits, experimenting with the timing is valid as well.
- Monitor results of glyphosate use carefully and consider expanding use in future years if successful.
- Where resources are limited, it is better to completely eliminate *Phragmites* from one area than to partially eliminate it from many.
- Monitor possible effects of heavy machinery along soft shoreline (e.g. additional invasive species, compaction) and minimize use of machinery wherever this is possible.
- Complete a walking survey of a few remaining areas within the study area that were difficult to access through public access routes within the time permitted.
- Investigate further the area around Sunset Drive to determine which portions are considered a provincially significant ANSI, and if so, where (if at all) control may be most successful.
- Obtain partnership with cottagers and the First Nations community to survey north from Southampton to Sauble Beach in greater detail, to identify high quality areas and priorities for control.
- Undertake additional surveys of the sensitive coastal fens to the north of Sauble Beach to determine the level of establishment of *Phragmites* within

these, and possibly to determine the best approach to prevent the destruction of these rare habitats.

Finally, in the absence of a safe, licensed, glyphosate-based herbicide for use in aquatic settings, Canada appears to be completely without any cost-effective means of controlling one of its most aggressive invasive plant species. The Canadian regulation process can be lengthy and costly. A long-term action for concerned conservationists could also be to lobby the federal government (specifically Health Canada and Environment Canada) to complete its required studies and to regulate these herbicides that are specifically designed for environmental applications in aquatic settings.

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Appendix 1: Detailed Locations
Appendix 2: Maps

Please see additional attached files.

Appendix 1 : Detailed Locations

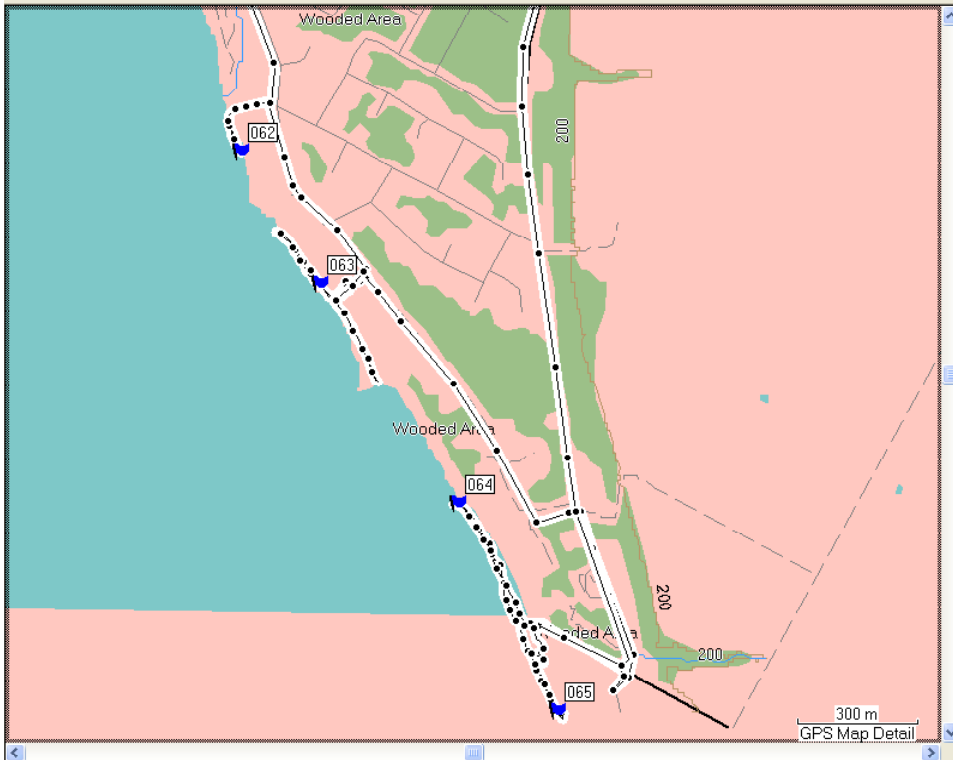
Field No.	Easting	Northing	Priority for Control	Muni-cipality	Location Name/Directions	Patch size (m)	Sub-strate	Comments
10	444500	4886342	High	Huron-Kinloss	1km N of Hwy 6 on Bruce Beach	20X10	sand	-Additional small vegetative stand coming up, about 50m N of here -Expanding stand with flowering heads
11	449603	4886466	High	Huron-Kinloss	Bruce Beach	30m linear	sand	-Mostly 10-15m from waterline
12	444816	4886734	High	Huron-Kinloss	Bruce Beach (2 patches)	10X20, 20X20	sand	-2 large patches, second patch is about 30m N of waypoint
13	466752	4919576	Continue	Town of Saugeen Shores	Corner of Saugeen Beach Rd & Bruce Rd 25	7X15	sand	-Black tarp site -No flowering heads found at this site -Note that several patches are along beach toward town from here on shoreline edge
14	461586	4918298	High	Town of Saugeen Shores (Provincial Park)	Cottager's Beach, MacGregor Point Provincial Park	200X20	sand	-See Judith Jones' plant list for this site
15	464042	4918783		Town of Saugeen Shores	End of Concession Rd. 4, adj. MacGregor Pt PP (2 patches)	2X1, 10mX2	rock	-larger infestation is close to shore at water's edge -emerging in wet meadow habitat in bay just to N of waypoint, esp in standing water
16	464349	4918732		Town of Saugeen Shores	On Saugeen Beach Rd	10X10	sand	-very tall stand visible from road but is on disturbed beach (private?) -wood chipping and laying flagstones adjacent
17	464348	4918889		Town of Saugeen Shores	End of Smith Lane	100X30?	rock, sand	
18	464766	4918774	Continue	Town of Saugeen Shores	Eidt's Grove	200m linear	sand	-Area cut on day of visit, very extensive -appears to be more vegetative growth on the rocky spit to the N
19	465571	4919143	Continue	Town of Saugeen Shores	N end of Eidts Grove	200m linear		-Extensive along shore here (200-300m), in both directions from waypoint
20	466154	4919169		Town of Saugeen Shores	Wet swale by road	20X20	sand	-Note that about 500m S of here across small sandy bay is an extensive patch along what looks like sand beach
21	466363	4919419	Continue	Town of Saugeen Shores	Gobles Grove	20X50	sand	-Extensive, currently being cut and cleaned up
22	467613	4920158	Continue	Town of Saugeen Shores	Queen's Bush Beach, off Shipley Ave	20X20	sand	-Looking N another patch is visible between public park and white cottage with flagpole in Port Elgin (could possibly access by Izzard Rd.)
23	467752	4921663		Town of Saugeen Shores	N of Port Elgin Marina (2 patches)	20X20, 20X20	rocky, we	-another patch evident at base of point, about 300m north
24	467801	4922701		Town of Saugeen Shores	Along North Shore Rd (2 patches)	10X5, 10X5		-New patches? No flowering heads 'lower diversity site but very open
25	468380	4923671	Continue	Town of Saugeen Shores	Miramichi Bay	500m + along	rock	-Extensive stand, basically continuous thru bay to 026
26			Continue	Town of Saugeen Shores	Miramichi Bay			-025 is continuous to here
27	469049	4924360	High	Town of Saugeen Shores	Horseshoe Bay	10m?	fine silt, m	-A few vegetative shoots just establishing here and possibly elsewhere in bay
28	470039	4927343		Town of Saugeen Shores	Southampton waterfront near war memorial and flag	3X3	rock	-Growing around a willow tree
29	471166	4928436		Town of Saugeen Shores	Along County Rd 13	5m linear		-No flowering material
30	476211	4935747		First Nations	2nd Ave. near Sauble Beach South	2m linear		-red stemmed specimen to check with Paul Catling

30	476211	4935747		First Nations	2nd Ave. near Sauble Beach South	2m linear		-red stemmed specimen to check with Paul Catling
31	476490	4936234	High	First Nations	French Bay south of Sauble Beach	30X50	Sand	-Another big patch is evident on S end of bay, about 500m from here -NB.some stems are red
32	478586	4938521		Township of South Bruce Peninsula?	Along County Rd 13	30m linear		
33	471526	4929523		Town of Saugeen Shores	Off Blanchfield Rd, Southampton (2 patches within area)	50X20	Sand (dry)	
34	470788	4928461		Town of Saugeen Shores	Off Blanchfield Rd.(at least three patches)	20X5, 10X10,	rock	-also a few very small patches to S of here
35	470738	4928414		Town of Saugeen Shores	Off Blanchfield Rd, about 50m S of above	10X10	sand	
36	470659	4928256		Town of Saugeen Shores	Near 175 Blanchfield Rd.	5X1	rock	-Very small new patch, near bend in road
37	470457	4927979		Town of Saugeen Shores	Near 101 Blanchfield Rd.	25X25	rock	-Note another small patch is just to north of here -on rocky, disturbed shoreline next to road -patch is very dense and tall, ~3m tall?
38	459518	4916584		Kincardine	South of MacGregor Pt PP at Park Boundary	20X10	rock,clay	-A few other small patches are scattered within 100m of this to the south
38a	459488	4916376		Kincardine	Bay off Richardson Rd.		rock	-establishing at about 10 discrete locations all around this rocky bay -not a dune site but possibly a bird migratory stopover, several sheltered areas for migrating birds
39	460884	4913443		Kincardine	Near corner of Richardson Rd. and Concession 12	12m linear		
40	458467	4914925		Kincardine	End of Concession Rd. 12	?	rock, sand	-establishing on rocky/sandy point
41	458605	4915094		Kincardine	Sunset Dr. North of Conc 12	?	silt	-several small patches, >20 patches -adjacent bay to N has what looks like a few small young patches but nothing with seed heads
42	458303	4914634		Kincardine	Sunset Drive	Abundant, ext	rock (bou	-Mostly young shoots, possibly from this year, but abundant over a large area
43	458236	4914362		Kincardine	Sunset Drive, bay by Brucedale CA	1.4km?	rock (bou	-huge established patch in this bay, is worst at N end, large dense patches throughout
44	457685	4913677		Kincardine	Sunset Drive continued		rock, sand	-continuous between 42 & 43
45	457777	4913239	Possibly high	Kincardine	Sunset Dr, razed site	continuous with	dry sand	-site has been dug (roto-tilled?) to open sand here; no evidence of who has done this -invading back dunes here - no rare dune grasses observed here but a very cursory survey in interesting habitat
46	456394	4912192		Kincardine	End of Sunset Dr.			-virtually continuous between 042 and here (about 3km along coast) -much worse than Eids grove or Miramichi Bay- sometimes more sparse, but extremely widespread
47	452480	4903558		Kincardine	Lake St., south of Inverhuron	10X10	rock	
48	451976	4902816		Kincardine	Across bay (N) from chimney (kiln?) on point (2 patches)	2X10, 2X2	rock	
49	5E+06	4902315		Kincardine	200 m S of this waypoint	20mX?	?	-actual patch is 200m to S of here but there is a rocky steep beach from this point south
50	451937	4901105		Kincardine	End of Upper Lorne Beach Rd.	30X30	rock/muck	-2 discrete patches viewed to N of here along shore, about 500m (hazy)
51	451652	4899916		Kincardine	End of Lorne Beach Rd., public access point	>700m linear	rock/muck	
52	451170	4898035		Kincardine	Lorne Beach, at end of Conc Rd 7 (from public access walk N 250m)	20m linear		
53	450398	4895522	High	Kincardine	200m S along beach from end of Conc Rd 5	dense for app	dry sand	-patch is in dry sand on flat beach -some P. australis with red stems
54	450305	4895337	High	Kincardine	About 200m S of 53	see above	dry sand	-053 is continuous to here, gets sparser for another 150m south

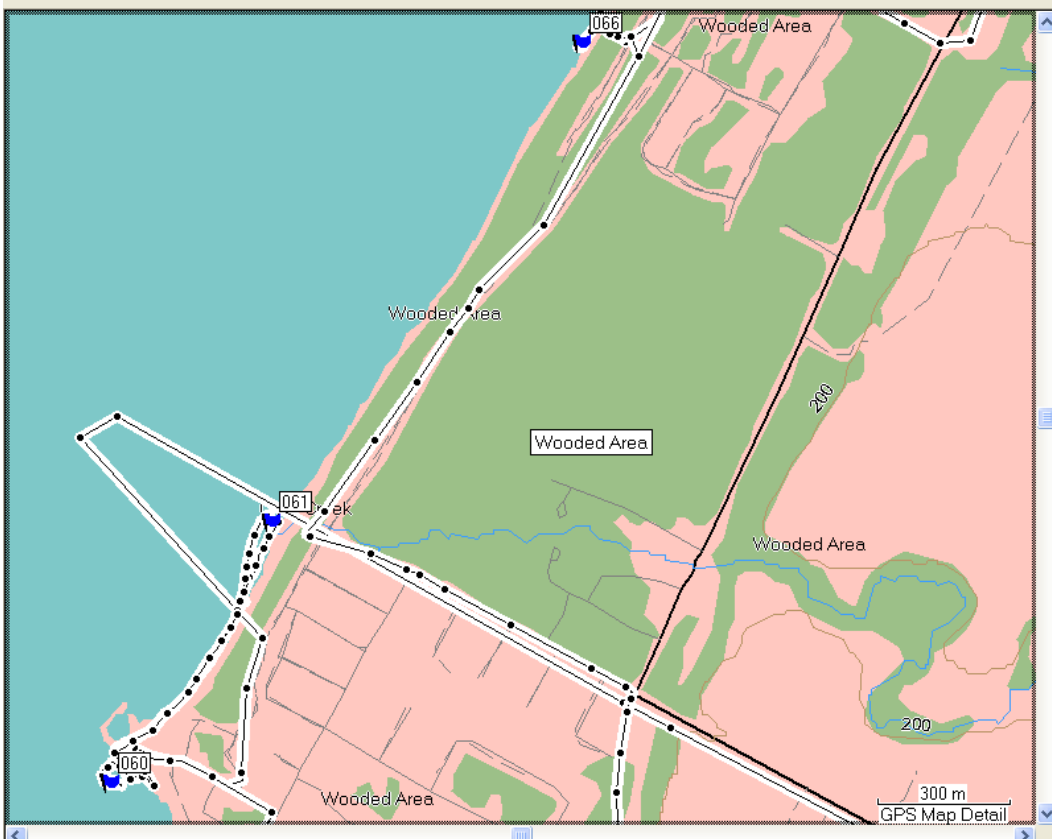
54	450305	4895337	High	Kincardine	About 200m S of 53	see above	dry sand	-053 is continuous to here, gets sparser for another 150m south
55	450115	4894954	High	Kincardine	Near access point at Dawson Dr.	20X20	sand on u	-small spot but could spread -probably more about 300m to N or 055 along sandy point - this is probably close to 054
56	449954	4894605	High	Kincardine	200m S of 055	10m linear	dry sand	-walked about 100m S of 056 and could not see any up to 200m along shore but hazy.
57	449390	4893745	High	Kincardine	Beach off McAskill Rd, Kincardine	approx 100m	sand	
58	449208	4893533	High	Kincardine	200m S of above	30m linear	sand	-point approx 200m to S is very dense with <i>P. australis</i>
59	448959	4892810		Kincardine	Off Saugeen St., Kincardine	50m linear	sand/rock	-do not see any with binocs from here S to jetty, 150m
60	439255	4880211		Huron-Kinloss	South of Point Clark Lighthouse	at least 200m	rock/muck	-can't see much further S than 200m (fog)
61	439629	4880801	High	Huron-Kinloss	At mouth of Clark creek	5X5	sand	
62	439560	4879328		Huron-Kinloss	Off Huron Road, public walkway	?	muck/rock	
63	439756	4878994	Continue	Huron-Kinloss	Beach near 155 Huron Rd	about 400m?	muck/rock	-is basically continuous in similar habitat around point to 062
64	440095	4878440	Continue	Huron-Kinloss	Between 155 Huron Rd & Amberley Beach	50m linear	muck/rock	-some of this has been cut -note Garlic mustard in this patch!
65	440340	4877918	High	Ashfield-Colborne-Wawanosh	Amberley Beach, S. of Amberley Road (2 patches)	20m linear, 10	sand	-otherwise good sand habitat, rest of beach looks OK south for about 300m
66	440345	4881879	High	Huron-Kinloss	South of public walkway off Lakeside Trail and Sunrise Ave	5m linear	sand	-Did not see more looking S along coast for about 100m, or N to Pine River mouth.
67	441054	4882897	Continue	Huron-Kinloss	End of Bell Dr.	2m linear	sand	-No flowering stems, just a few stems in good beach habitat -continuous to 069
68	441107	4882970	Continue	Huron-Kinloss	Lurgan Beach	continuous w	sand	-large cut site continuous with above -note that cut is incomplete, have left strip next to beach, have also cut many other species.
69	441346	4883290	Continue	Huron-Kinloss	Lurgan Beach	continuous w	sand	-continues to here, had to turn back
70	442315	4884054	High	Huron-Kinloss	At end of Conc Rd 6	5m X 5m	?	-can see another small patch to S, none to the N where cottages are -not a major problem here
71	445103	4887074	High	Huron-Kinloss	Just S of Bruce Beach Rd and Conc 6	sparse over 5	sand	-looks to be some on point about 600m to N -beach north from this access generally looks good - some disturbance but mostly beach grasses
72	445605	4887667		Huron-Kinloss	Off Boiler Beach Rd. S of 101A	-	-	-viewed from road, private access, very tall stand
73	445662	4887844		Huron-Kinloss	101A Boiler Beach Rd.	continuous w	muck/rock	-continuous on point in thicket marsh habitat, not yet established on sand
74	445756	4887968		Huron-Kinloss		continuous w	muck/rock	-very dense patch, continuous
75	445930	4888132	Continue	Huron-Kinloss	Boiler's Beach Rd and Heritage Drive.	continuous w	sand	-partially cut from front of beach.
76	no data recorded, skipped this number by accident							
77	446262	488831		Huron-Kinloss	Boiler's Beach Rd and Kennedy Dr	continuous	sand	-stops about 200m to N of here, then no Phrag for at least another 300m or more -beach looks good at end of Conc Rd 12
Note that between 77 & 78 is good sand beach, no visible Phragmites!								
78	447270	4889544	Continue	Huron-Kinloss	Boiler's Beach Rd and Huronville Rd (approx)	10-40m X 300	sand	-large cut area, continuing 10-40m wide and about 300m along beach
79	447372	4889818		Huron-Kinloss	N of above	continuous w	sand	-continuous to here and about 200m beyond at least.
80	447687	4890114		Huron-Kinloss	93 Bruce St	continuous w	sand	-continuous from 78 to here, about 1 km -About 50m N from here, changes to steep rocky bank, no Phrag for several hundred metres

Appendix 2: Maps

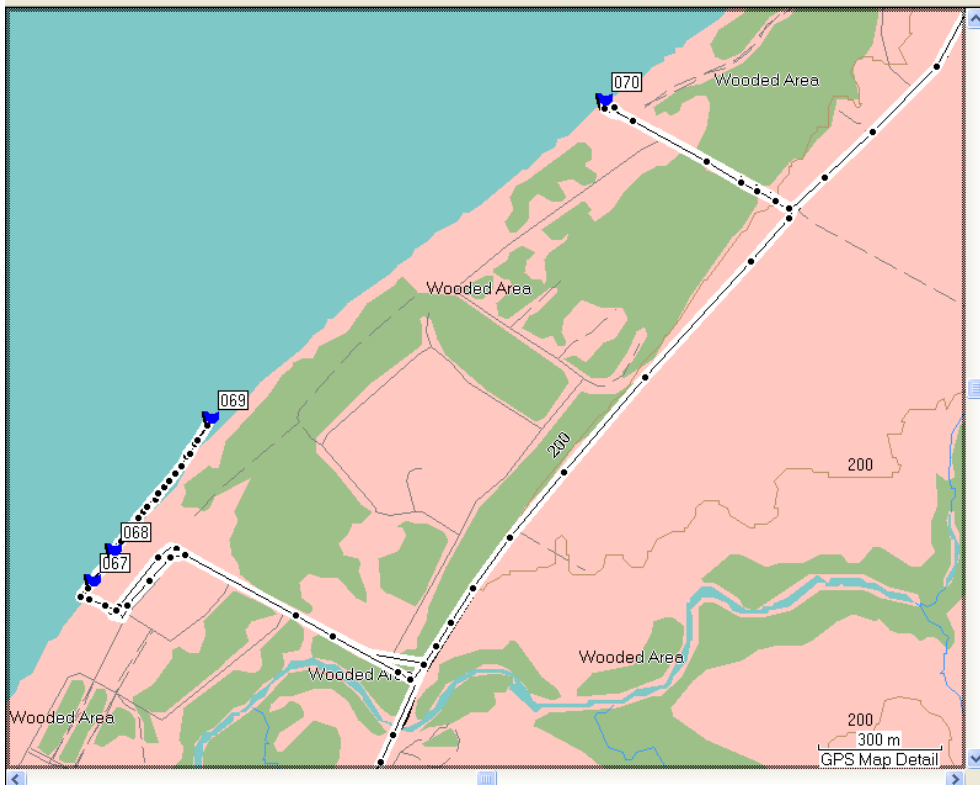
Map 1: Amberley Beach to Point Clark



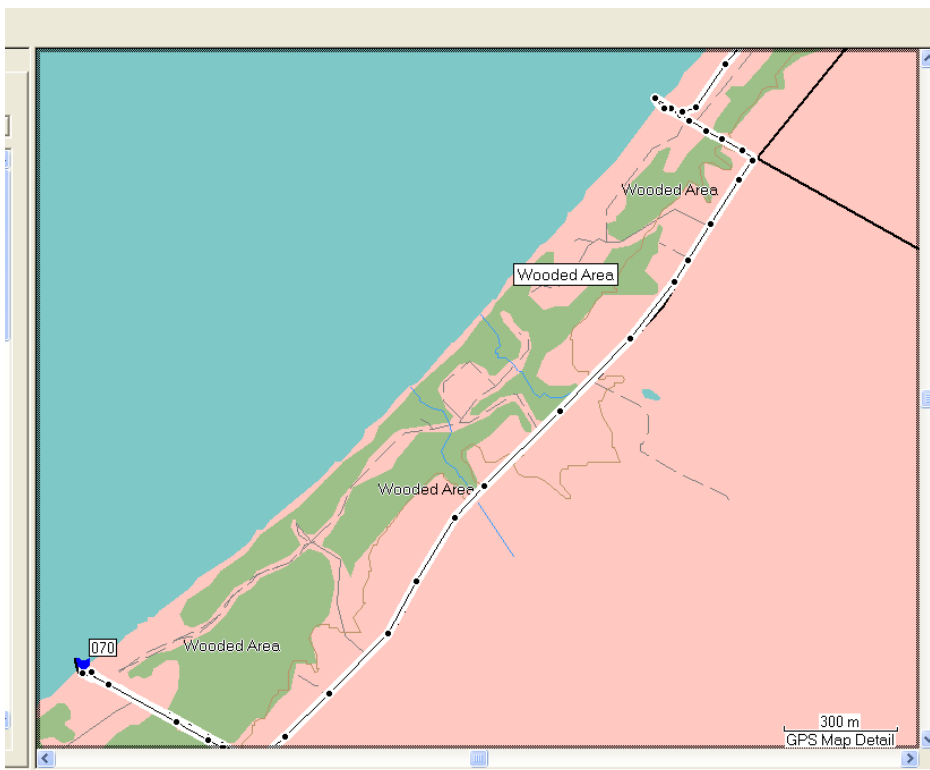
Map 2: Point Clark area



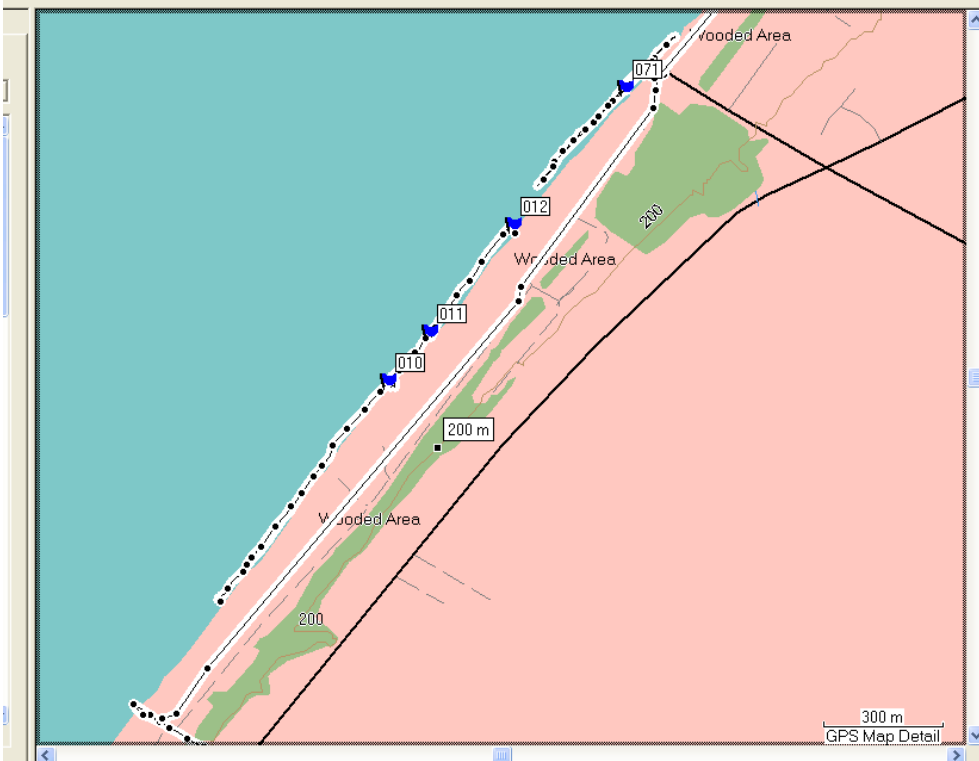
Map 3: Lurgan Beach



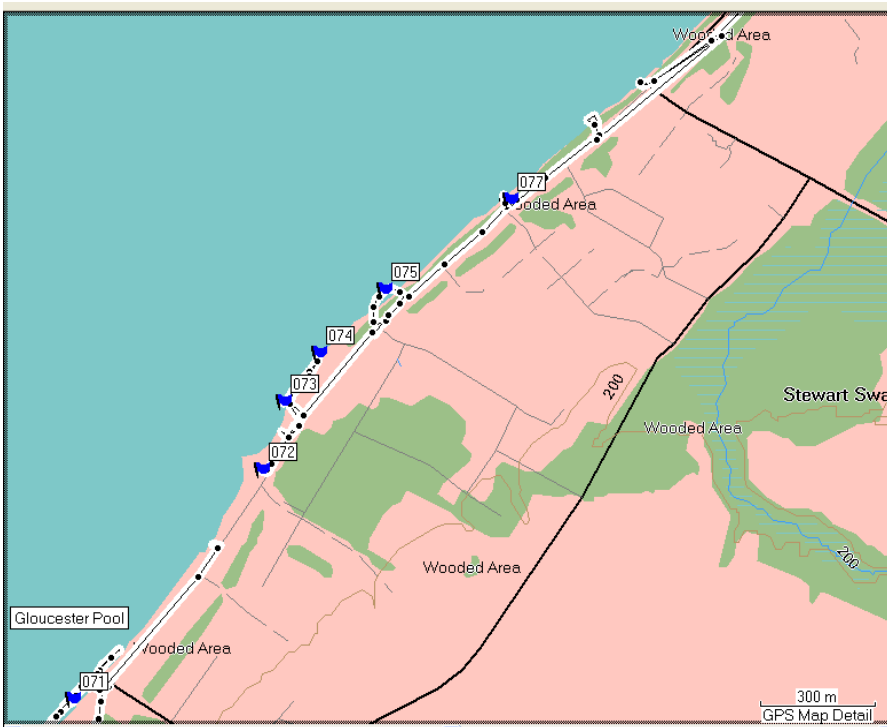
Map 4: Concession Rd 6W to Concession Rd 8



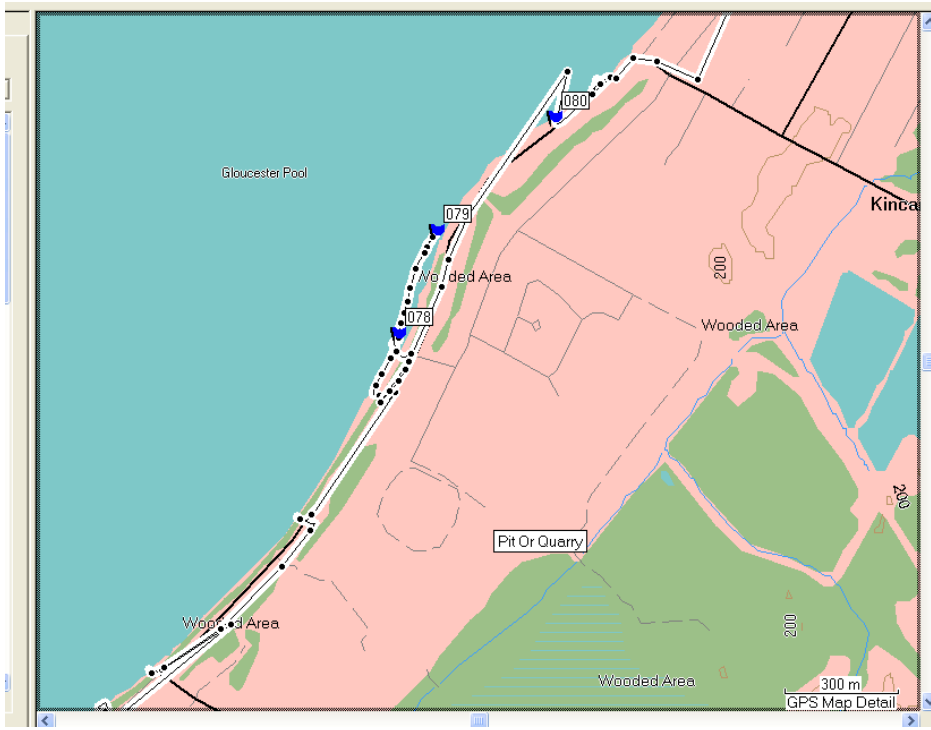
Map 5: Bruce Beach (Conc. Rd 8 to Hwy #6)



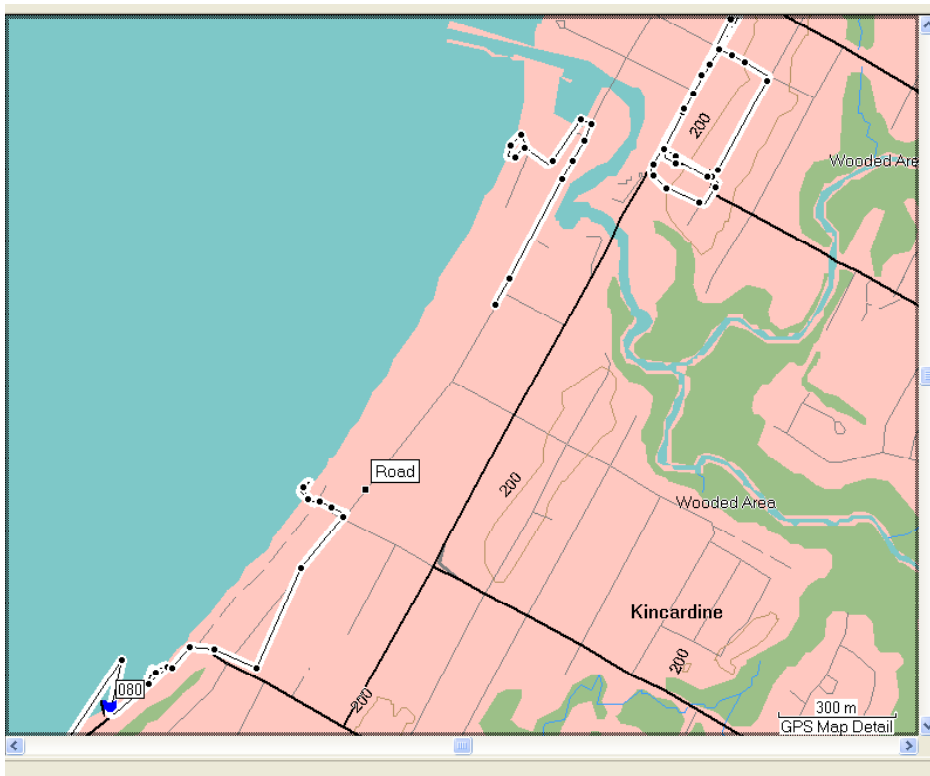
Map 6: Boiler Beach area



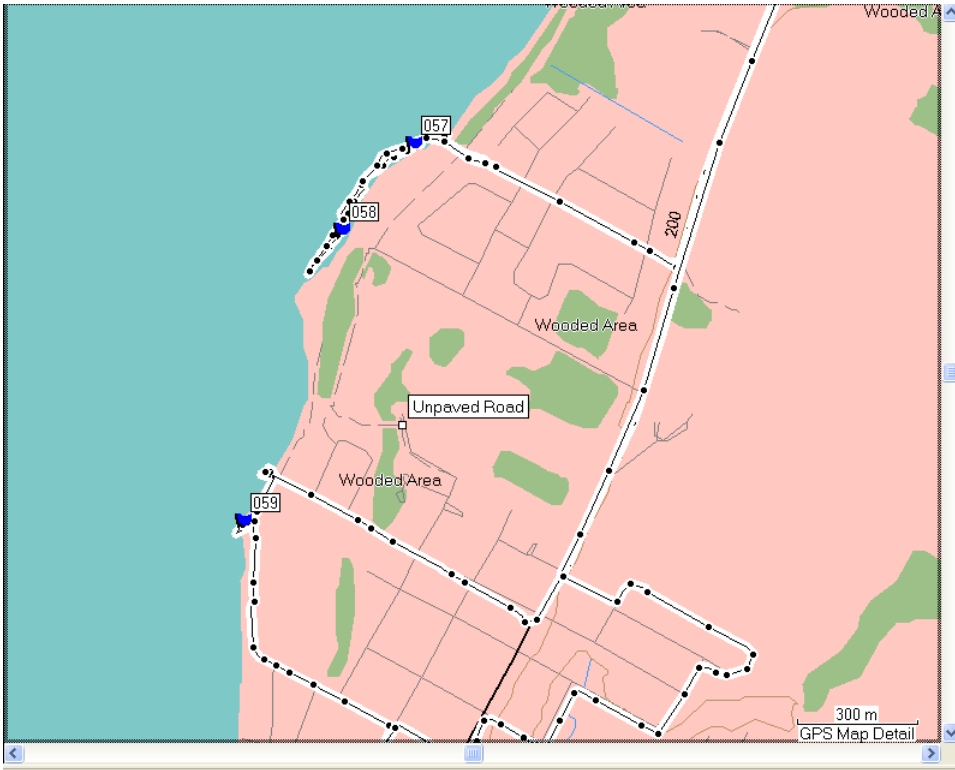
Map 7: Boiler Beach to Kincardine



Map 8: Town of Kincardine (south of pier)



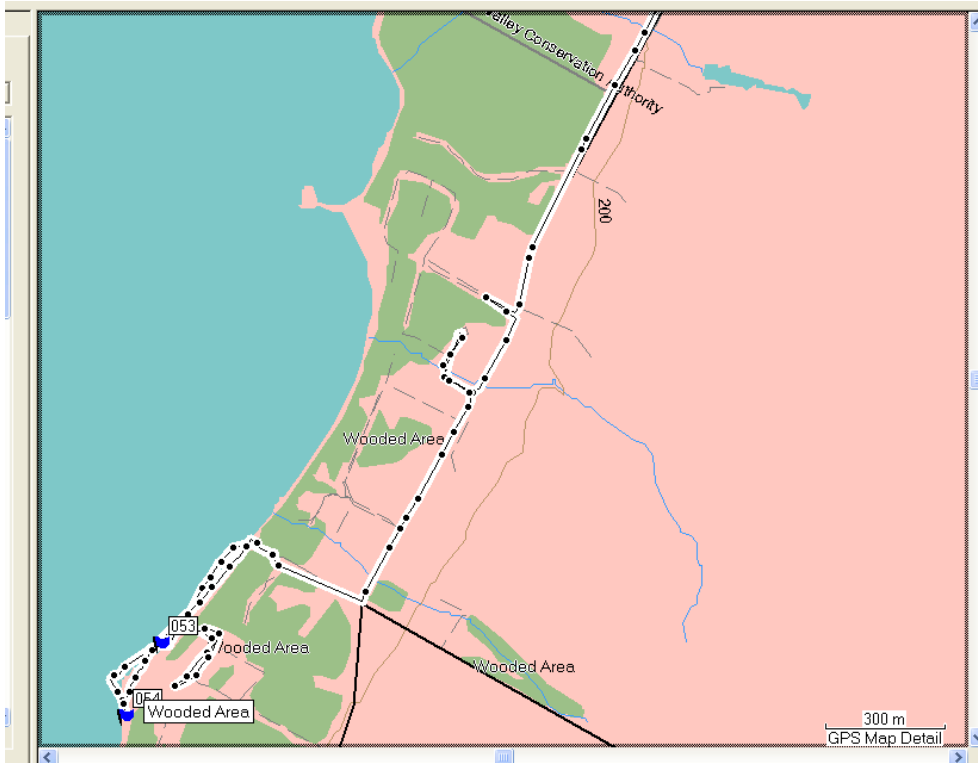
Map 9: Town of Kincardine (north of pier)



Map 10: North of Kincardine (McAskill Rd. to Conc. Rd. #5)

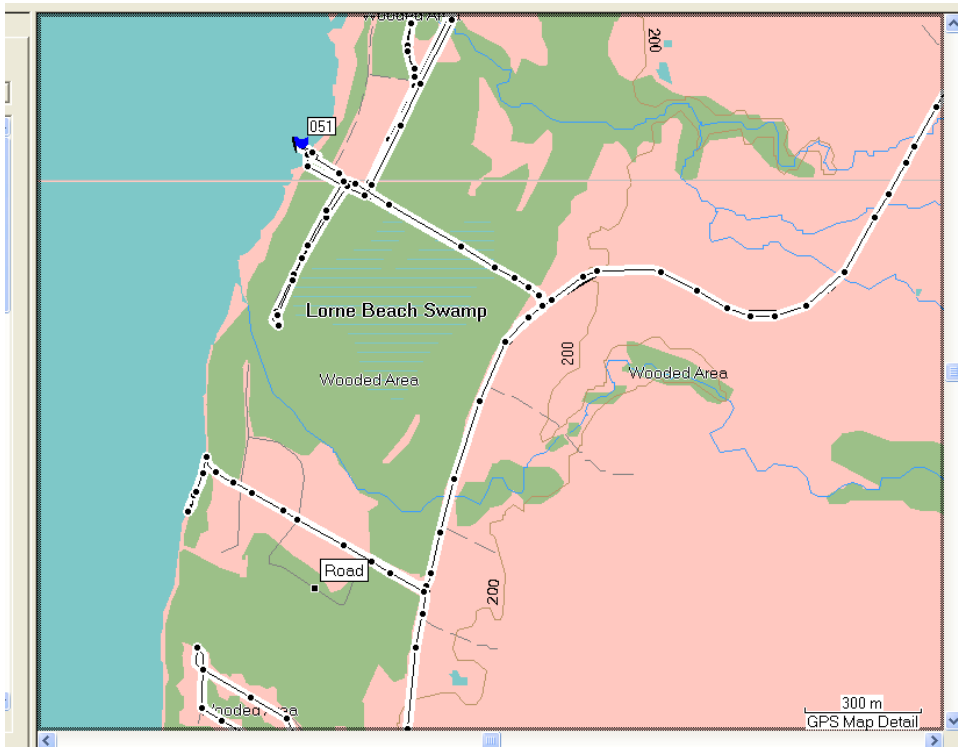


Map 11: Conc. Rd. #5 to Stoney Island Conservation Area

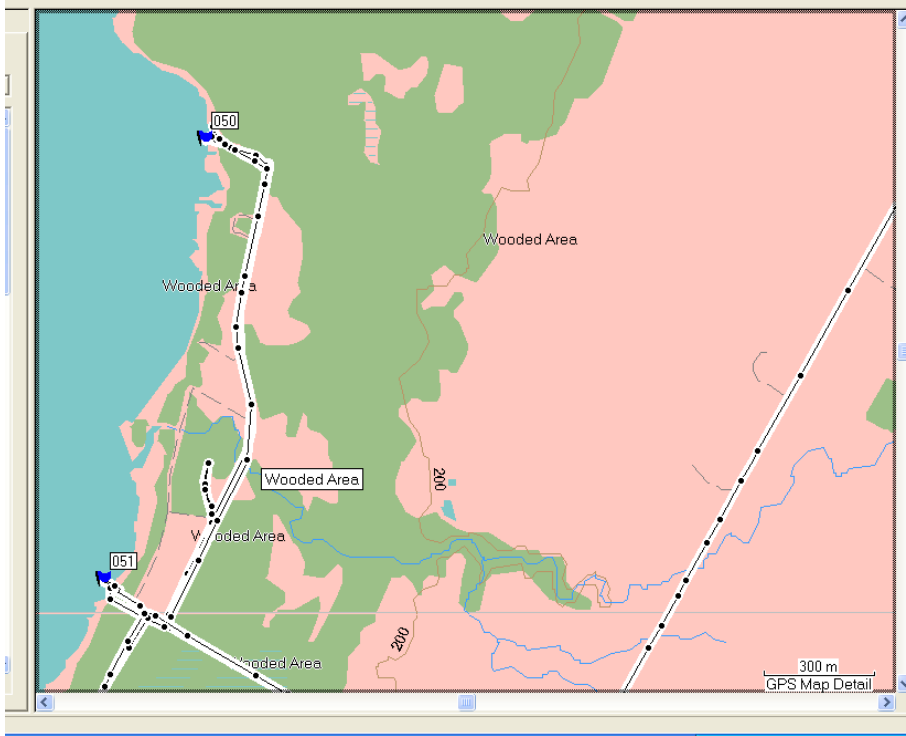


Map 12: Lorne Beach area (Conc. Rd. 7)

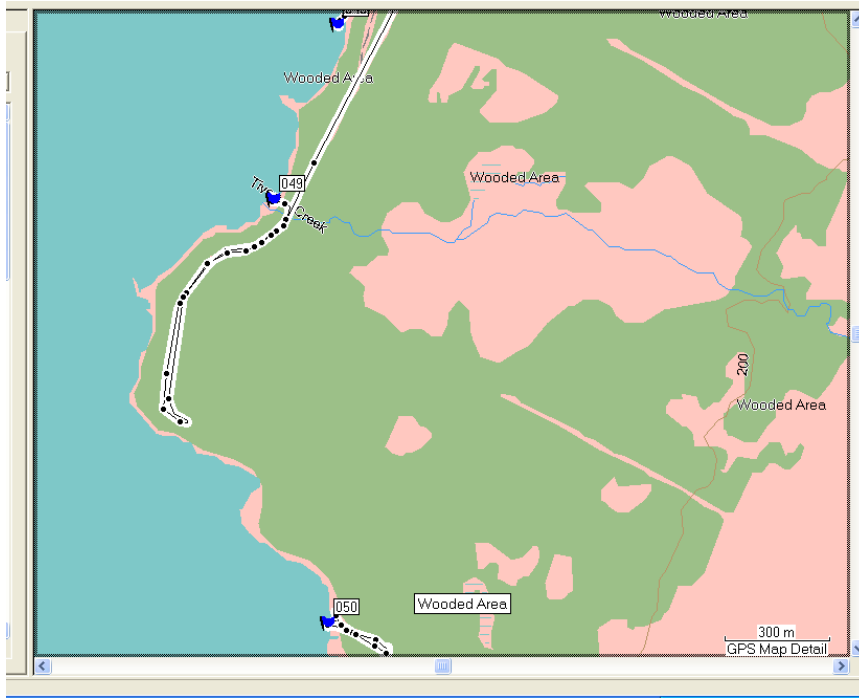




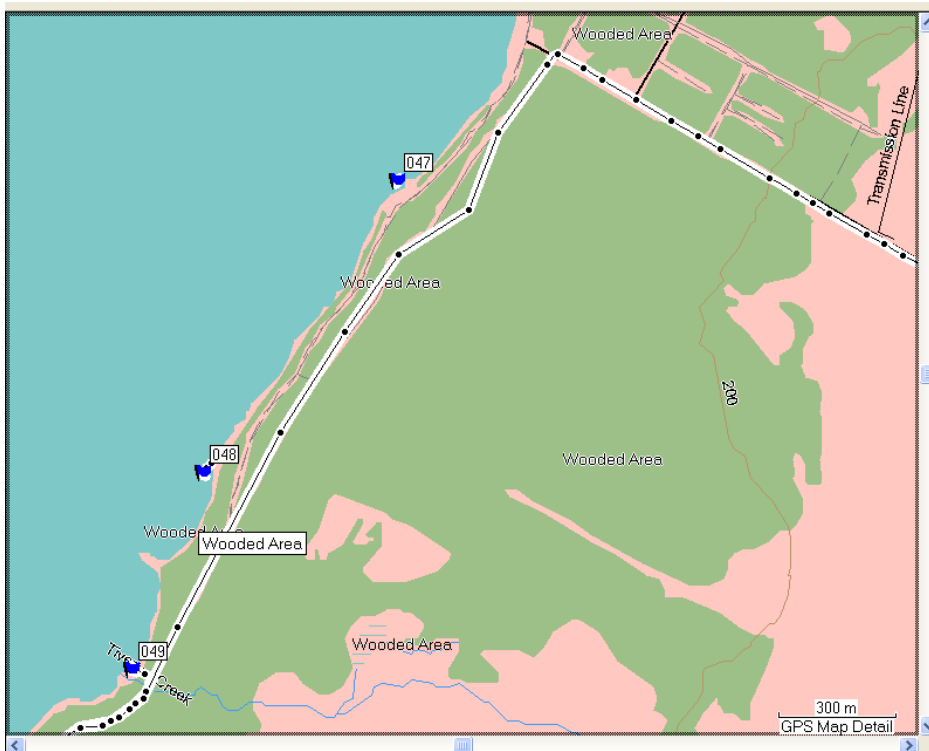
Map 14: Lorne Beach to Upper Lorne Beach



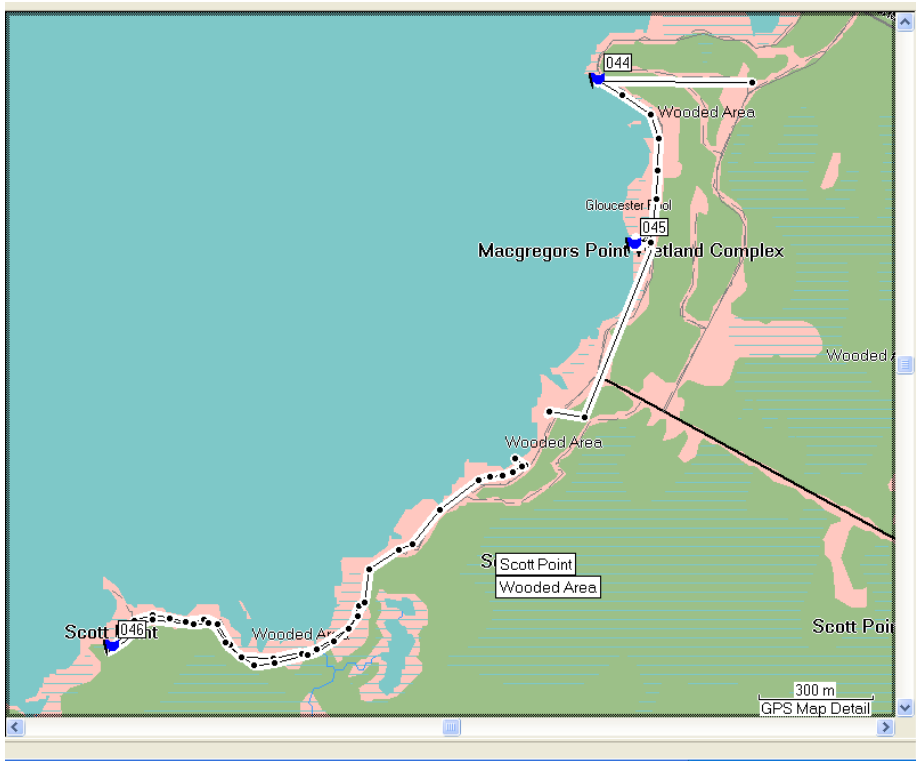
Map 15: Upper Lorne Beach Rd to Victoria St.



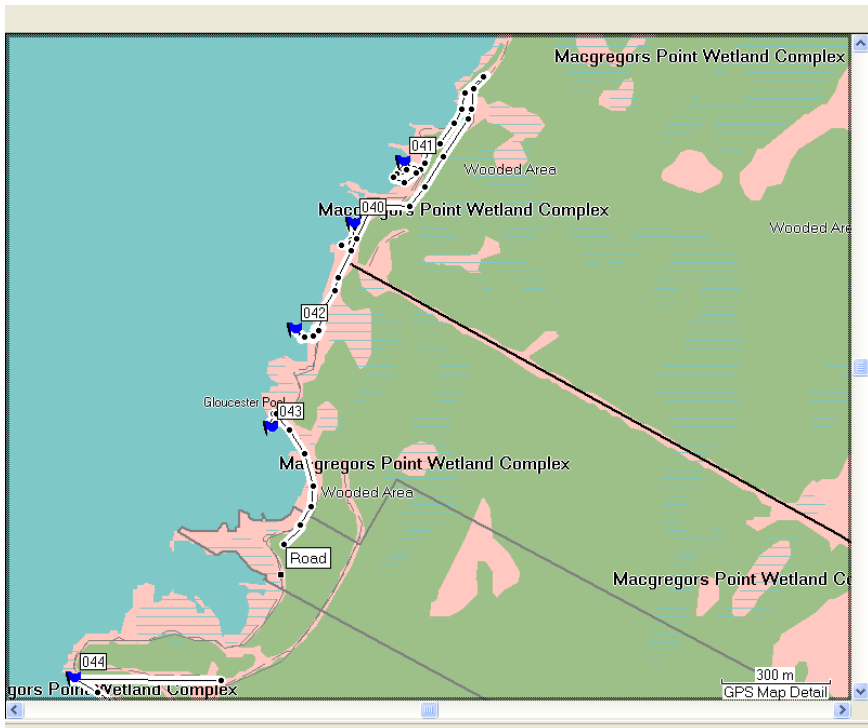
Map 16: South of Inverhuron along Albert St. (parallel to Victoria St.)



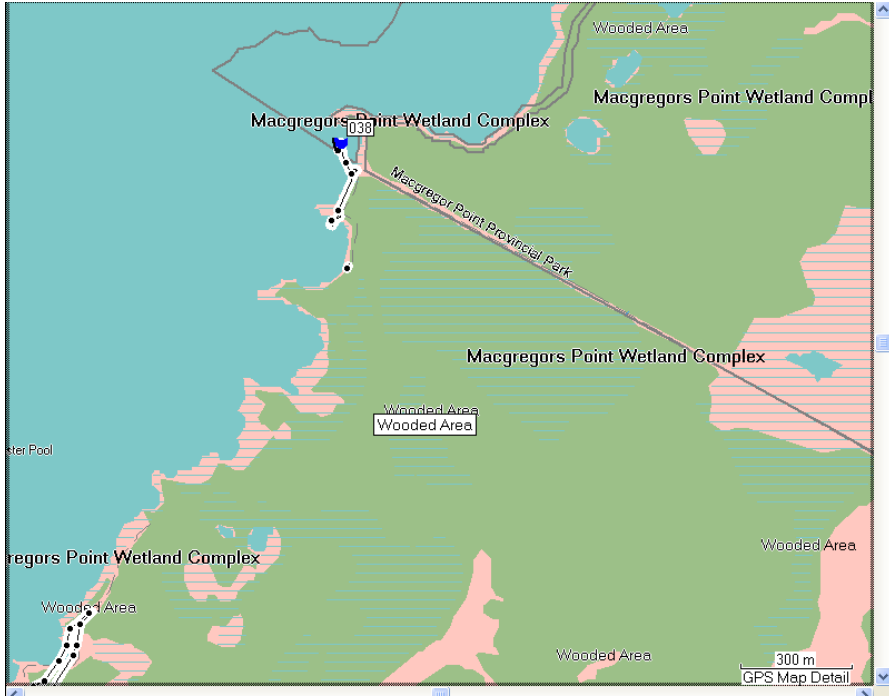
Map 17: Along Sunset Drive (N of Inverhuron PP, S of MacGregor Pt PP)



Map 18: Sunset Dr. – north and south of Conc. Rd. #12



Map 19: Southern boundary of MacGregor Pt. PP (End of Richardson Rd)



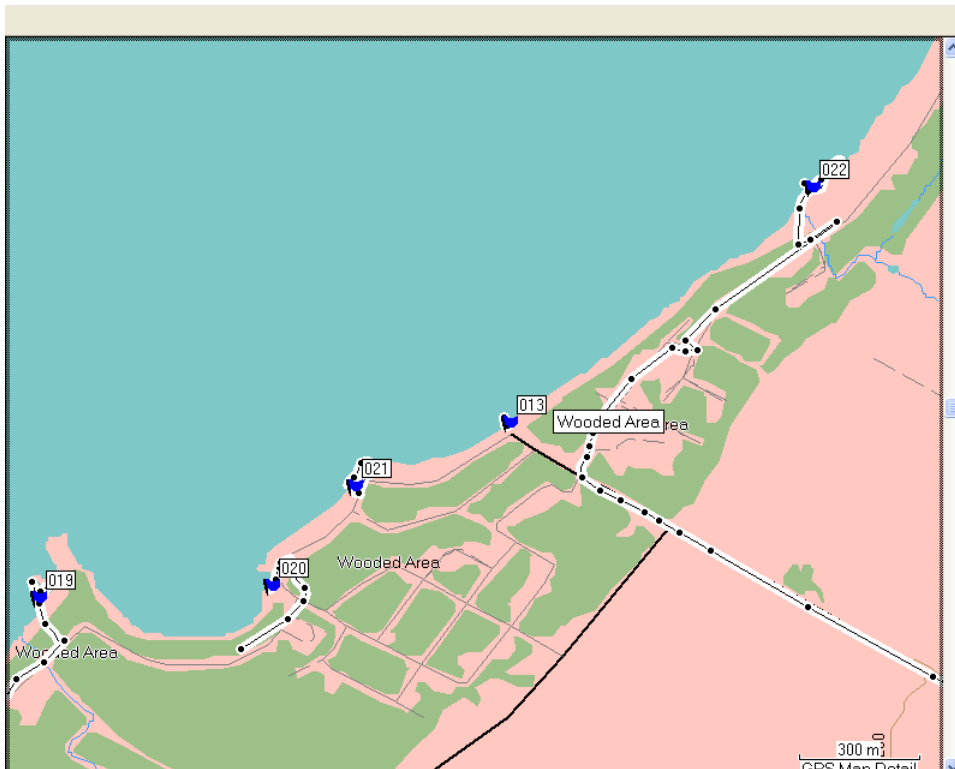
Map 20: MacGregor Pt. PP



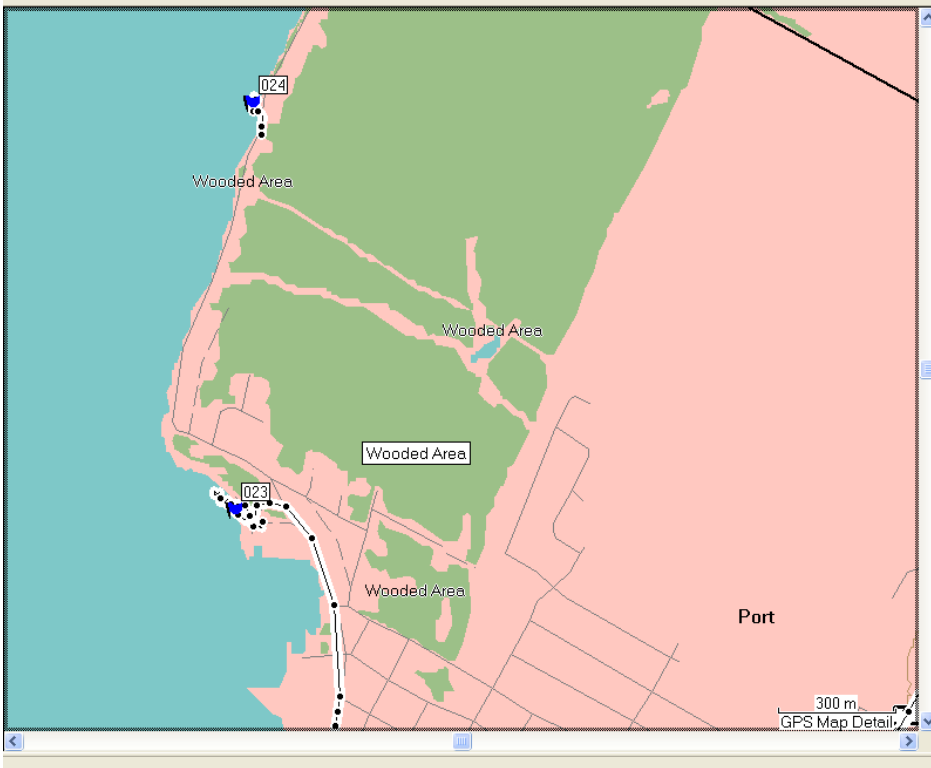
Map 20: Eidt's Grove area (Port Elgin - northern boundary of MacGregor Pt PP)



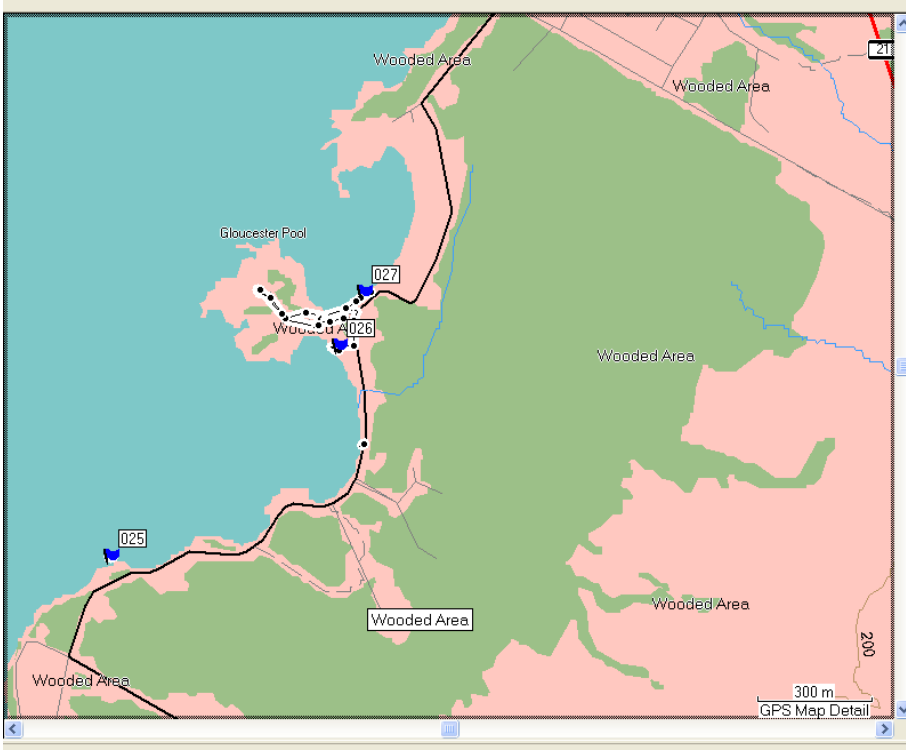
Map 21: Goble's Grove area and Queen's Bush beach (Port Elgin)



Map 23: Port Elgin marina area to North Shore Rd.



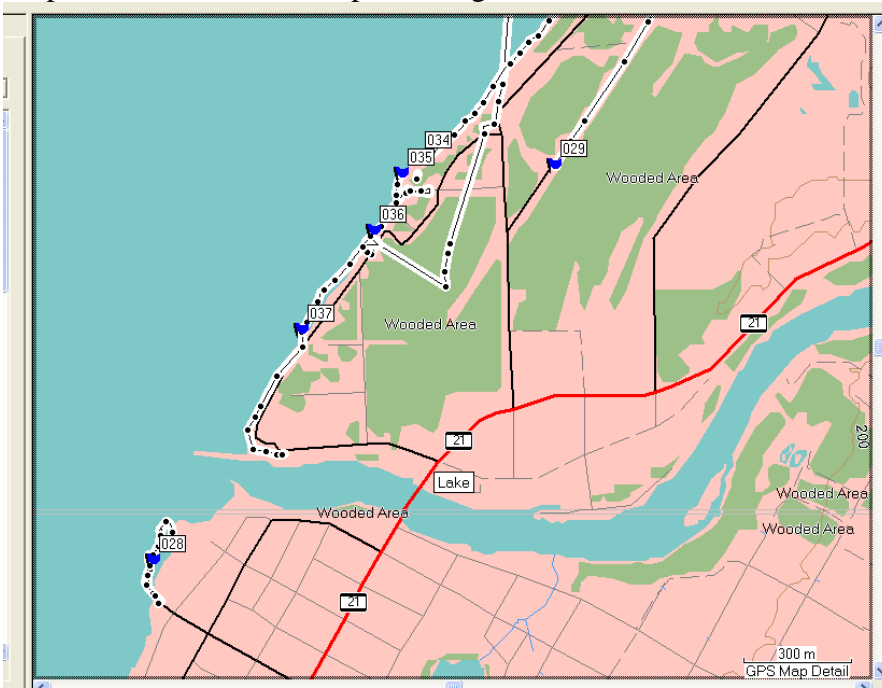
Map 23: Miramichi Bay and Horseshoe Bay



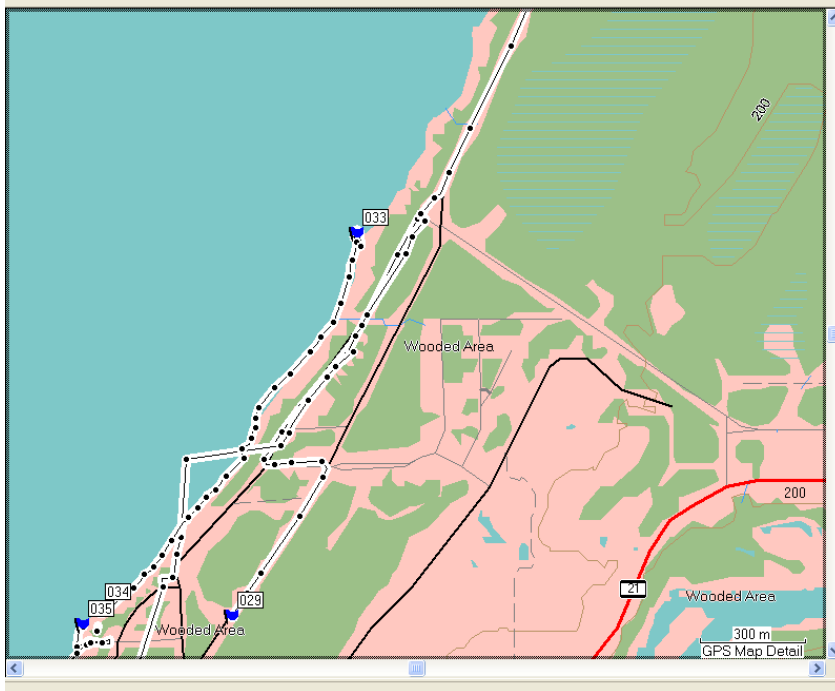
Map 25: Chantry Dunes area (no Phragmites)



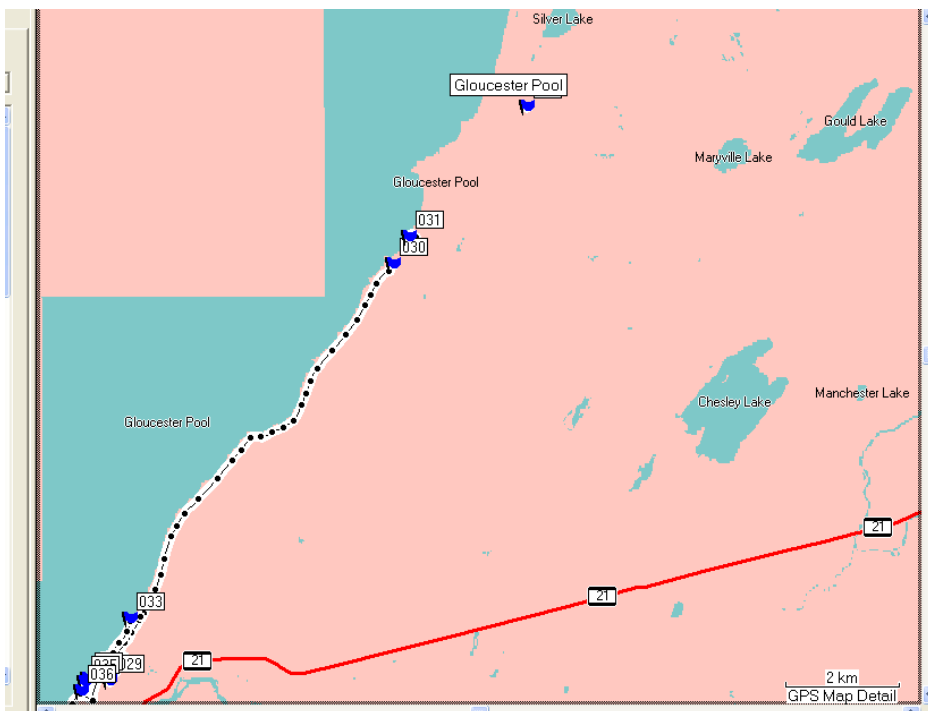
Map 25: north of Southampton along Blanchfield Rd.



Map 26: Along Blanchfield Rd. to Town of Saugeen Shores Boundary



Map 27: north of Southampton towards Sauble Beach (French Bay) – note different scale



Note that some flags represent single occurrences, and some are start or end points of continuous patches. Please use these maps in combination with the detailed table (Appendix 1) that accompanies the report.