Torbay – Stormwater Management Plan
Priority List & Implementation Plan
Town of Torbay, NL

PREPARED FOR:

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October 7, 2020

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1.0 Introduction

In the spring of 2019, the final copy of the Stormwater Management Plan prepared by Progressive Engineering & Consulting Inc. was submitted to the Town of Torbay and a presentation was delivered to Council and staff outlining some of the key aspects of the report. An important task that arose from the discussion surrounding the recommendations of the report was to develop a priority list of all recommended upgrades for the Town so they can appropriately plan for the upgrades moving forward. It was agreed that the proposed cost and scale of some of the remedial upgrades are too large for the Town of Torbay to tackle all at once and that significant budgeting and planning would be required. To provide some sense of direction, and to provide the Town with an idea of where they should focus their attention in the immediate future with regards to detailed planning and applying for the appropriate funding for these upgrades, it was agreed that an implementation plan and priority list would be created. Many of the upgrades proposed in the Stormwater Management Plan could be completed efficiently with little or no requirement for provincial or federal funding. Some of the more costly and complicated upgrades will require long term planning and outside funding to move forward.

Improvements to several of the catchment areas discussed in the Stormwater Management Plan have total upgrade costs over $500,000. In these instances, the remedial upgrades required in each of the catchment areas will be broken down into less costly and more easily manageable phases so that the Town can plan appropriately for these works. The catchment areas that required review under this criteria are;

- Skipper's Landing
- Island Pond Brook
- The Gully

The Gully catchment area, in this report, has been re-analyzed using the most up-to-date and current climate change storms used by the City of St. John's. Previous analysis of this catchment area was completed in 2018, prior to development of the 2019 Stormwater Management Plan.

Recommended improvements in the remaining catchment areas were below the $500,000 threshold. Generally, the upgrades required in these catchment areas involve simple replacement of CSP culverts and, at most, placement of earth berms. This work can easily be done at the Town's discretion as long as they follow the logical order that is presented in this document. With the exception of the Watt's Pond catchment area, the extents of flooding and damage in these catchment areas is relatively minor when compared to the three key catchment areas described above.

From reviewing the results in the Stormwater Management Plan, it is clear that there are a number of areas in the Town that should be placed as an immediate priority to alleviate flood risks across the town. These items should be placed at the top of the priority list as they immediately mitigate the risk of thousands and potentially millions of dollars of property damage if an extreme weather event should occur. This is becoming more and more pertinent as the effects of climate change begin to worsen as years pass and extreme weather events happen much more frequently and with greater intensity. Once these immediate areas have been addressed, the Town can begin planning for the major construction initiatives, such as the regional detention ponds proposed in the original stormwater management plan.

The Town has implemented a Zero Net Runoff policy for all developers that wish to develop within the Town of Torbay. This means that prior to approval from the Town, all developers must incorporate some form of stormwater detention into their development design to ensure that peak runoff rates for the post development scenarios do not exceed peak runoff rates for the pre development scenarios. This means that developers may have to sacrifice lot space and will incur a cost to incorporate this requirement into their designs. From the Town's perspective, once implemented, there will be many small detention systems that will require maintenance by Town staff. The Stormwater Management Plan provided concepts for large regional detention ponds that could enforce the Town of Torbay's Zero Net Runoff policy while reducing overall maintenance costs by eliminating many smaller systems in place of one large detention system. While these regional detention ponds are high in capital cost, the cost could potentially be recuperated by enforcing a detention levy on developers who wish to use

the detention pond. This levy would be calculated based on the percentage usage of the pond by the developer. For example, if two developers wish to use the detention pond, the developer who contributes more runoff to the detention pond would be charged with a higher levy than the other developer

The following implementation plan will break down the work required for the recommended upgrades into manageable phases so that the Town can properly plan for these upgrades moving forward. The catchments are prioritized based on their entry in this document. The prioritization is based on the urgency required for upgrades to prevent flooding in the areas discussed, as well as the required amount of funding and the complexity of the upgrades planned. For example, a catchment area with a large detention pond structure in an area where flooding is known to be an issue will take higher precedent over an area where some culverts need replacing and where little or no flooding occurs.

It is strongly recommended that in certain catchment areas where the threat of flooding is less urgent and where improvements include culvert replacements and/or stream modifications, that these upgrades be completed starting at the most downstream point and proceed towards upstream locations to prevent any damages to downstream infrastructure. It is also strongly recommended that all culverts proposed for replacement be aluminized or HDPE. There appears to be very aggressive soil and vegetation conditions in the various streams and rivers that convey runoff throughout the Town of Torbay. This is causing the existing CSP structures to rust and degrade. Placing HDPE and aluminized storm sewer infrastructure will prove to be advantageous in the long run as these materials typically have a longer life span in these conditions.

It is important to note that this priority list is to be used as a guide. In the event that site conditions change and it is observed that a culvert has deteriorated to the point of failure, then that particular upgrade will take precedence over the other upgrades as it immediately poses a risk to flooding in the surrounding areas. An example of this is the collapsed culvert crossing Hickey’s Lane and Shea’s Lane. These culverts posed an immediate risk to safety of residents and flooding, thus they required immediate attention.

It's also important to note that the Class 'D' estimates provided in this package serve as guidance for replacement and upgrades of infrastructure. The Town may choose to upgrade an entire street that a piece of infrastructure is on, or complete some road upgrading in the vicinity of the piece of infrastructure. In this event, the replacement or upsizing of infrastructure may be done in conjunction with other upgrades in the area.

In addition to this priority list, PEC has developed a master plan illustrating the key pieces of storm sewer infrastructure, which can be seen in Appendix B. This master plan can be used by Town staff to analyze which infrastructure is in critical condition and which is in good condition and operating properly. This will also go hand in hand with the Towns asset management plan which will soon be developed. The implementation plan and priority list should be used as a long term guide to address any issues noted in the Stormwater Management Plan and to plan accordingly for runoff from future developments in the years to come.

2.0 Skipper's Landing

Skipper's Landing is an area in the Town of Torbay that has experienced significant flooding over the years. It was one of the focal points of the Stormwater Management Plan as there has been observable flooding conditions frequently in this area.

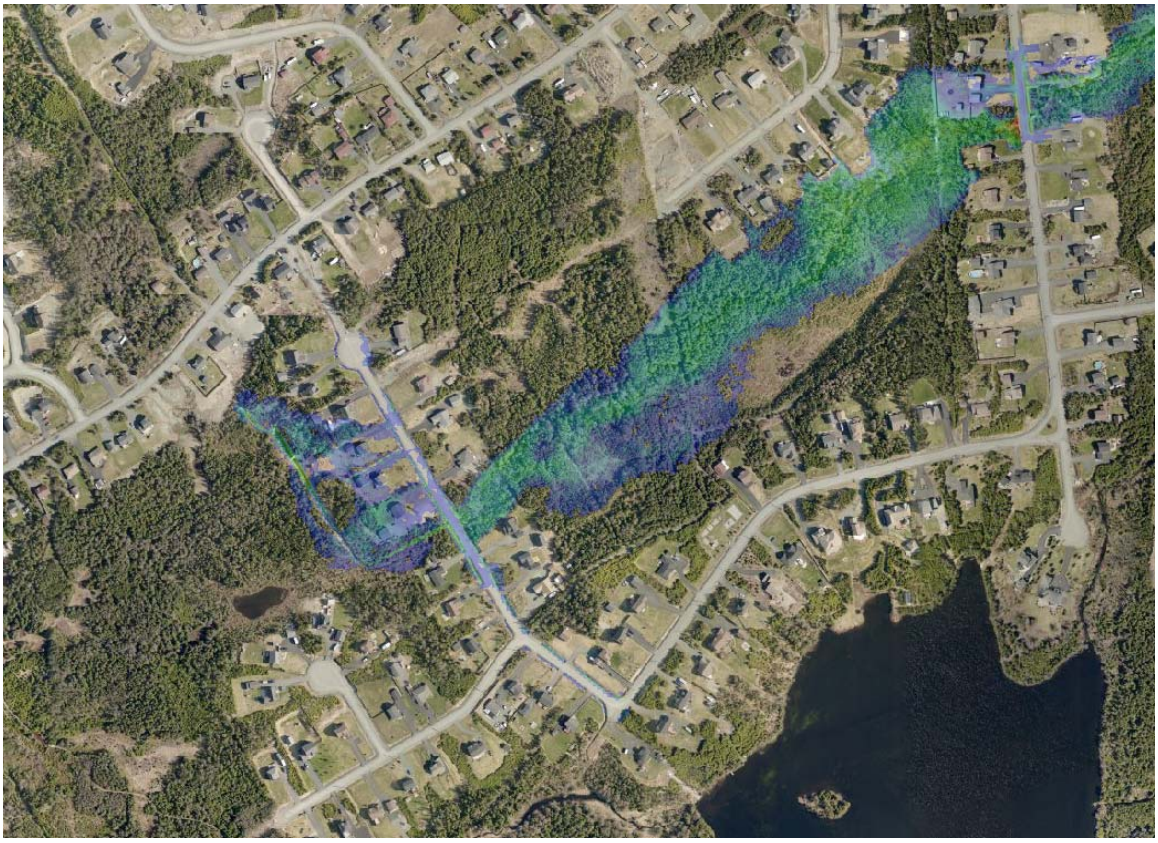


Figure 1: Extents of Flooding - Skipper's Landing - 100 Year - 6 Hour Storm

It's important to note that Skipper's Landing is actually a small sub-catchment of a much larger catchment area within the Town known as Island Pond Brook Catchment which is another high priority catchment area for the Town of Torbay. These two areas combined contain the majority of the Town of Torbay's development and ultimately the majority of the stormwater problems in the town. One of the key issues with this catchment area was the presence of reverse graded roadside ditches and basement elevations that are below the bottom elevations of these ditches. As a result, during heavy rainfall, water pools in these ditches and eventually leads to the flooding of basements in the area. One of the first recommendations regarding this catchment area from the original stormwater management plan was to correct these reversely graded roadside ditches as well as

upgrade the cut-off ditch at the rear of the properties on Skippers Landing by deepening and widening the ditch as noted in Appendix C. This work should be done immediately to help rectify the immediate issue of the basements flooding in the area.

This work will allow for positive drainage in the catchment and appropriately convey runoff into the downstream wetland area, away from homes along Skipper's Landing. **The originally proposed estimate for this construction was $110,048.10 including HST.**

This item should be the first to be completed out of the recommendations proposed in the stormwater management plan as it immediately improves and prevents the floodplain extents in the area without compromising any downstream infrastructure. It will provide immediate relief for residents along the street that experience basement flooding on a frequent basis. It is recommended that no upstream development take place that will contribute to runoff in the cutoff ditch that is located at the rear of Skipper's Landing as this is a sensitive area with regards to storm drainage. These upgrades will not seriously impact any of the downstream infrastructure in the catchment area.

In the long term, it is recommended that a large detention pond structure be placed downstream of Skipper's Landing to help reinforce a zero net runoff policy on developers who wish to develop upstream of the area. This can potentially encourage developers to develop in the area as they no longer need to design their developments to include smaller detention systems, as the zero net runoff policy will be enforced by the large detention pond structure. It also reduces the overall maintenance of smaller detention systems, meaning that with a larger detention system, maintenance is only required for a single large detention pond. This detention pond concept at the time was developed for a full build out scenario, assuming that developments do not implement any local detention systems in their developments. To assist the town for appropriately applying for funding and to prepare accordingly for this large piece of infrastructure, a phased approach is proposed in this implementation plan. This can coincide with development upstream as it becomes more clear the extents of development as well as approval of such developments.

One of the issues noted in the original floodplain extents presented in the Stormwater Management Plan was that there was overland flooding on Civic # 30 on Western Island Pond Drive due to the low elevation of this property compared to the surrounding topography. To prevent this, and to begin working on the detention pond, an earth berm perimeter can be set along the boundary of this particular property as shown in Appendix C in this document. This in conjunction with the upgrades upstream to the cut-off ditch and roadside ditches will help rectify the immediate issues within the Skipper's Landing catchment area. To accommodate further development upstream or within the Skipper's Landing catchment area, the Town has essentially two options when dealing with runoff from new developments upstream. Either strictly enforce and monitor developers as they implement their own detention systems to enforce a zero net runoff policy, or to construct a large communal detention pond as detailed within the Stormwater Management Plan. Each of these options comes with their own set of pros and cons that the Town should consider.

By enforcing developers to make their own detention system it reduces the total capital cost to enforce zero net runoff. However, as development begins to become more evident and more developments are constructed, the Town will have to maintain each of these smaller systems which will increase maintenance costs over time. It will also require development reviews by the Town to ensure that developers are in fact constructing detention systems properly and that they function as they should.

While a large regional detention pond system will come at a higher capital cost, it now reduces the overall maintenance cost on the Town's behalf as now there is just one central detention system. It addition to this it may be appealing and encouraging to developers in the Town as they do now not have to account for a detention system in their design, zero net runoff policy will be accounted for by the large detention system. As development becomes clear and the exact amount of runoffs rates from individual developments can be computed, a levee can be implemented on developers to use the detention system, which in turn can be used to compensate the total construction cost for expanding the detention system. For example, if a new development is proposed that generates a substantial amount of runoff compared to another catchment, then that

developer will be charged with a higher levee to use the detention pond. The detention pond will be designed such that, where possible, existing downstream infrastructure can be utilized.

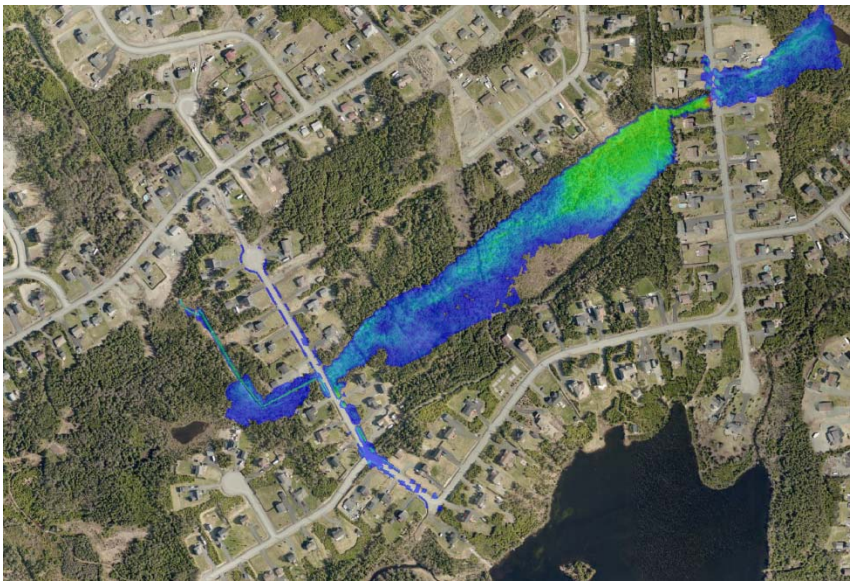


Figure 2: Skipper's Landing with Upgraded Ditches & Detention Pond Perimeter

If the regional detention pond is to be pursued, a reasonable next step once the perimeter berm is placed along the property line of Civic # 30 Western Island Pond Road, would be to finish constructing the earth berm perimeter as detailed. This will serve as the footprint of the detention pond system and in the meantime confine runoff to the wetland area itself and prevent risk for flooding on Cherrywood Drive and Western Island Pond Drive. As development designs are submitted and become clearer, expansion for the detention pond can be planned in more detail. The updated floodplain for the Skipper's Landing area, which includes the upgraded ditches and the detention pond perimeter can be seen in Figure 2.

By closely monitoring the extents and amount of runoff associated with these new developments, a more detailed design and estimate for a finalized detention pond system can be determined. The Town of Torbay's zoning map currently indicates that the area surrounding Cherrywood Drive is currently zoned for Residential Large Lot. This area would certainly contribute runoff to the large detention pond structure proposed in the stormwater management plan.

This detention pond structure can be built upon as areas of development upstream become more evident and thus budgeted for over a number of years such as to reduce the immediate cost of implementing a large detention structure. The actual extents and

immensity of the detention pond system will be dependent on the extents of development and how much runoff is contributed to the detention system. It is recommended that at the time of development, the Town monitor the amount of runoff leaving each development to determine the required expansion of the detention pond, as well as implementing a levee for developers to use the detention pond. Given that the models for the entire Town are available in XPSWMM, concepts for expansion of the detention pond can be made as development becomes more evident.

Long Term Goals

In the long term the Town of Torbay should monitor the amount of development that is expected upstream. Once the earth berm perimeter has been placed, the next steps to expanding the detention pond can be made. To compensate the construction cost of expanding the detention pond, a detention pond levee policy can be developed to enforce on new development. This can create a scenario where the Town can recuperate the initial capital cost associated with expanding the detention pond, and in the meantime reduce the overall amount of detention structures that the Town has to maintain on a regular basis. It will also encourage development as developers are now no longer responsible to design their own detention systems and increases the amount of available lots or lot sizes in the development, meaning it is more profitable for the developer as well. The exact size and immensity of the detention pond structure will depend on the amount of runoff upstream and the extents of development. Constructing a detention pond sized or current day scenarios would likely result in increased upgrades in the years to come.

The following is a breakdown of the prioritization of work in the catchment area;

1) Complete recommended upgrades to cut-off ditch and road-side ditches as previously detailed in the Stormwater Management Plan and previously submitted design. The total estimated construction cost for this work including HST was estimated to be $110,048.10.
2) Construct the perimeter of the detention pond. This will serve as the basis of the footprint for the detention pond and in the meantime correct flooding issues for Civic # 30 Western Island Pond Drive.

3) As development progresses and becomes more defined in the area, expand the detention pond as required to capture this runoff or strictly enforce developers to include a zero net runoff policy on their own developments. Full scale design of the detention pond system should be considered a long term goal as development becomes more evident

PRIOITY #1: Total Estimated Cost for Correction of Reverse Grade Roadside Ditches and Cut-off Stream (Including Engineering + HST): $110,048.10

PRIORITY #2: Total Estimated Cost for Construction of Berm Perimeter along Civic # 30 Western Island Pond Drive (Including Engineering + HST): $156,996.62

PRIORITY #3: Total Estimated Cost for Construction of Full Detention Pond Perimeter Berming (Including Engineering + HST): $343,334.09

3.0 Island Pond Brook Catchment

The Island Pond Brook Catchment is one of the largest catchment areas within the Town of Torbay. A number of issues were noted in the Stormwater Management Plan. This is also one of the catchments with the most anticipated development upstream.

A number of issues were noted in the existing conditions models, which means that they pose existing threats to flooding in the catchment area. In the area of Forest River Road, there is a natural stream that weaves its way between and parallel with Forest River Road and Streamside Lane. This river system surpasses its banks and results in flooding for properties on both sides of the stream on Forest River Road and Streamside Lane.

Upstream of this, there are two 1500mm CSP culverts that cross Rattling Brook Drive that are surcharging under numerous 100 year storm events. These culverts have sufficient capacity to handle runoff with some of the 100 year storm events, however due to the shallow slope of the inlet stream and poor conveyance to these culverts, a washout is likely under a 100 year storm event scenario. These issues can be seen in Figure 3.

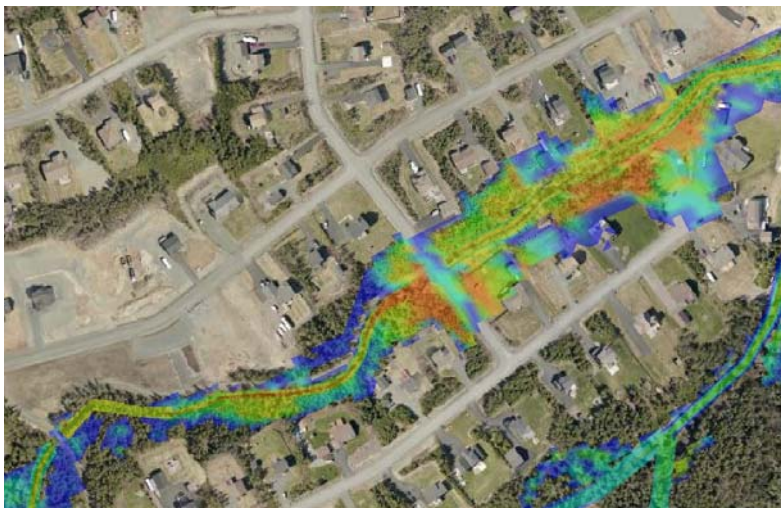


Figure 3: Flooding Occurring on Rattling Brook Drive

As a result it was recommended that these culverts be replaced with two 2500mm HDPE culverts and to place earth berms along the perimeter of the river system at a minimum height of 2.3m and side slopes of 2 to 1. Alternatively, a single arch bottomless culvert could be used to reduce the amount of cover and potential regrading of the road required. This can be done by replacing the existing two 1500mm CSP culverts with a single arch bottomless culvert. This will help prevent the possibility of regrading Rattling Brook Drive at the location of the new culverts. Alternatively, as proposed in this document, two arch culvert can be placed with gabion end treatments to help minimize cost but provide sufficient drainage in the area. These two arch bottomless culverts are measured by 2800mm span x 1950mm rise. This helps reduce or even eliminate the amount of regrading of the existing street as well.

Another major remedial upgrade proposed in this section was to widen the stream section near the property on Bridge Road, to help properly convey runoff away from Civic # 20 Bridge Road, as there have been reported flooding issues in this area on numerous

occasions. The existing flood conditions can be seen in Figure 4, flood waters encroach onto a new property on Bridge Road.

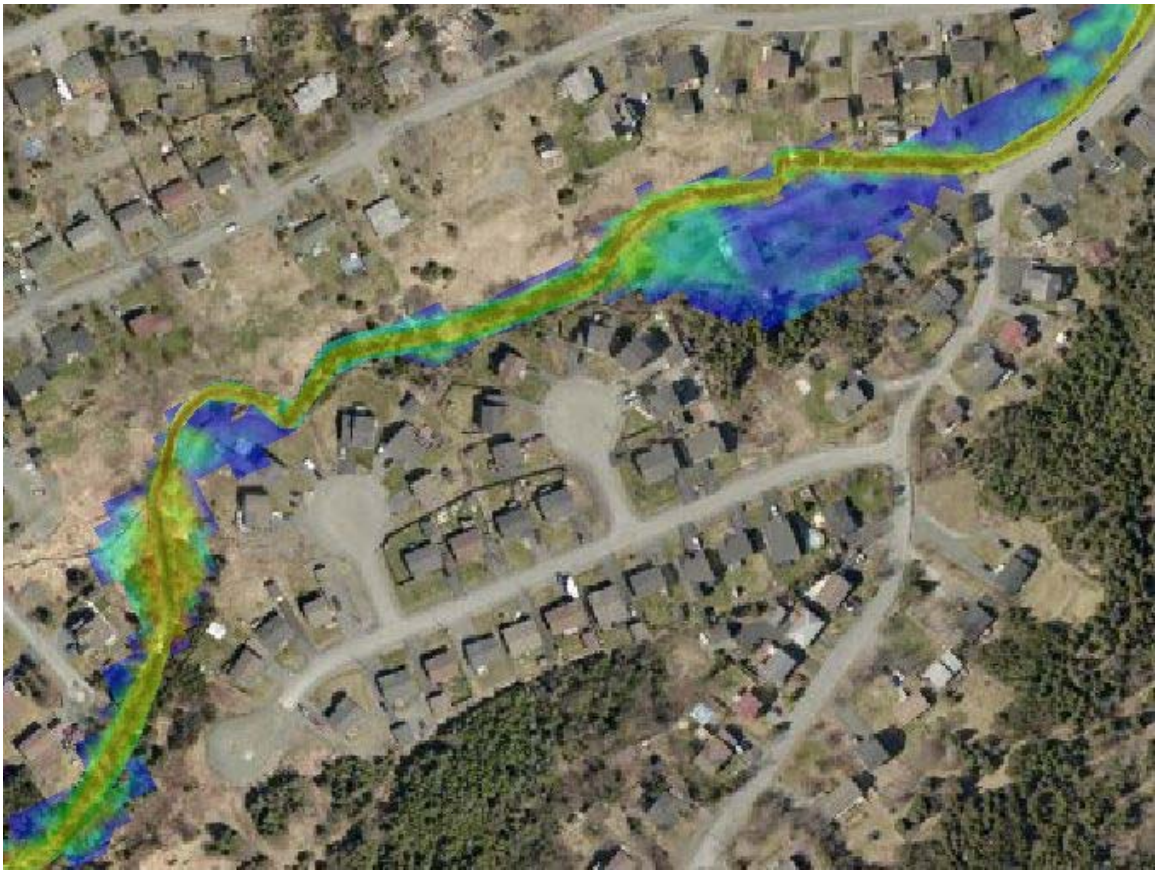


Figure 4: Flooding Occurring on Property on Bridge Road

The widening of this stream was intended to coincide with the detention pond as the total amount of flow permitted to leave the detention pond was to match the capacity of the new modified stream section. Given that the only major piece of infrastructure downstream is the large concrete bridge structure which has lots of additional capacity, this stream modification can be performed to provide additional stream capacity in this area, without compromising any important pieces of infrastructure downstream or affecting properties downstream.

Further upstream there is a small Gully that can be widened to allow for some additional storage within the catchment area. This will help reduce the amount of runoff downstream at Rattling Brook Drive. In conjunction with this, a small berm should be constructed at the rear property boundaries of Barkwood Lane to prevent runoff from encroaching onto the rear of these lots.

Under the existing conditions models, there currently exists the risk of flooding along Rattling Brook Drive, Forest River Road and Bridge Road. It is recommended that these upgrades take priority over the large detention pond structure as it is meant to contain future runoffs and to enforce a zero net runoff policy. Given that Bridge Road is the most downstream problem area in this catchment area, it is recommended that stream modification as proposed in the stormwater management plan take place first. This will help convey runoff away from the property on Bridge Road and in the event that a 100 year the new stream cross section will have sufficient cross-sectional area to handle the amount of runoff associated with a 100 year storm event. After this, moving further upstream, the earth berms can be placed along the perimeter of the natural river section between Forest River Road and Streamside Lane. This will confine runoff to the stream itself and prevent the risk of flooding on Forest River Road and Streamside Lane.

The large detention pond structure, similar to the detention pond structure in Skipper's Landing, will require extensive planning and funding to implement. It will require monitoring future development to again monitor the extents of development as well as how much runoff is leaving each new development. The detention pond structure will act as a communal detention structure that enforces a zero net runoff policy while reducing the amount of maintenance required by the town to maintain smaller, individual storm detention systems that developers would otherwise require. The construction of this detention pond should not take precedent over the more immediate remedial upgrades required of replacing the culverts crossing Rattling Brook Drive, placing earth berms along Forest River Road and modifying the stream section near Bridge Road as these areas pose existing threats to flooding for residents in this area.

If the Town should pursue the detention pond initiative, a reasonable step would be to construct earth berms along the perimeter.

Similar to the Skipper's Landing catchment, the Town has two options on how to regulate runoff from upstream developments in this catchment area. Either strictly enforce a zero net runoff policy

Long Term Goals

Similar to the Skipper's Landing Area, a long term goal of this catchment area would be to plan accordingly for placement of a large regional detention pond just upstream of the Torbay Bypass Road as mentioned in the Stormwater Management Plan. This would involve monitoring the amount of residential development upstream and planning accordingly to implement a zero net runoff policy by developing a regional detention pond structure. A detention pond levee policy can be developed to enforce developers upstream who wish to use the detention pond. The size and immensity of this detention pond will again depend strictly on the amount of development upstream.

Priority List of Upgrades within the Island Pond Brook Catchment Area

1) Modify Stream Section just upstream of Civic # 20 Bridge Road as detailed in the Stormwater Management Plan.
2) Replace existing 1500mm CSP culverts crossing Rattling Brook Drive with two new 2800mm span x 1950mm rise aluminized CSP culverts and place earth berms on downstream section of stream between Forest River Road and Streamside Lane. The replacement of the two 1500mm CSP culverts with two larger diameter culverts is an item that may require additional funding and planning.
3) Plan in the long term for placement of a regional detention pond just upstream of the Torbay Bypass Road by monitoring development upstream.

PRIORITY #1: Total Estimated Cost for Stream Modification and Placement of berms along Forest River Road, Widening of Gully Area and Placement of Berm along Rear Lots of Barkwood Lane (Including HST + Engineering): $243,888.84

PRIORITY #2: Total Estimated Cost for Culvert Replacement Across Rattling Brook Drive (Including HST + Engineering): $411,293.47

4.0 "The Gully"

In 2017, PEC was engaged to complete the floodplain analysis of a natural wetland area in the Town of Torbay known as "The Gully". The goal of the investigation was to determine the extents of flooding within the wetlands and whether or not some new properties along Mahon's Lane could potentially be affected during a major storm event. The model was built using the 100 year design storms available to PEC at the time, which were updated shortly after the report was delivered to the Town. There were several notable areas of concern within this catchment. The most glaring being the amount of flow that could potentially make its way over Lynch's Lane, affecting Civic #3 Lynch's Lane. The existing arch bottomless culvert that crosses Lynch's Lane was also surcharging under the 100 year storm events at the time. This can be seen in the floodplain extents shown in Figure 5.

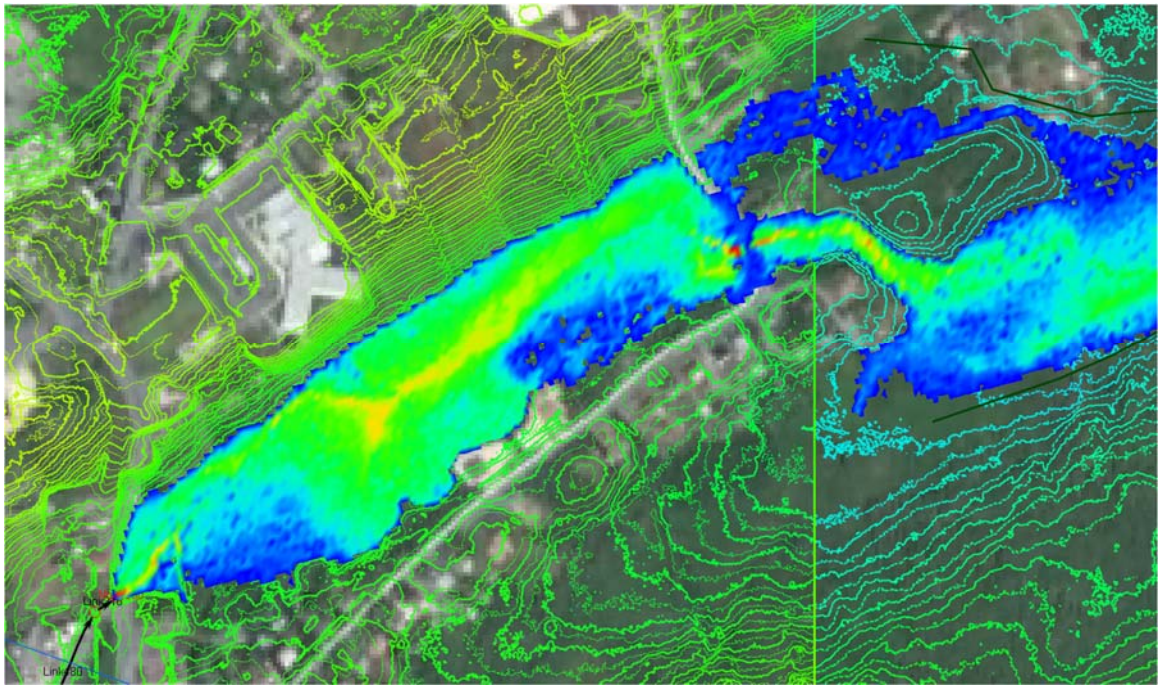


Figure 5: Floodplain Extents - "The Gully" - 100 Year - 24 Hour Storm Event

The recommendations at the time of the report submission were to construct a berm along portions of Lynch's Lane and Mahon's Lane with a minimum height of 1.5m with side slopes equal to 2 to 1, as well as upsizing the arch bottomless culvert crossing Lynch's Lane to the largest allowable size of 6.198m span x 1.372m rise. To aid in conveying runoff away from the area, a parcel of land downstream was recommended to be widened

to aid in drainage and to prevent runoff from affecting property on Civic #3Lynch's Lane.

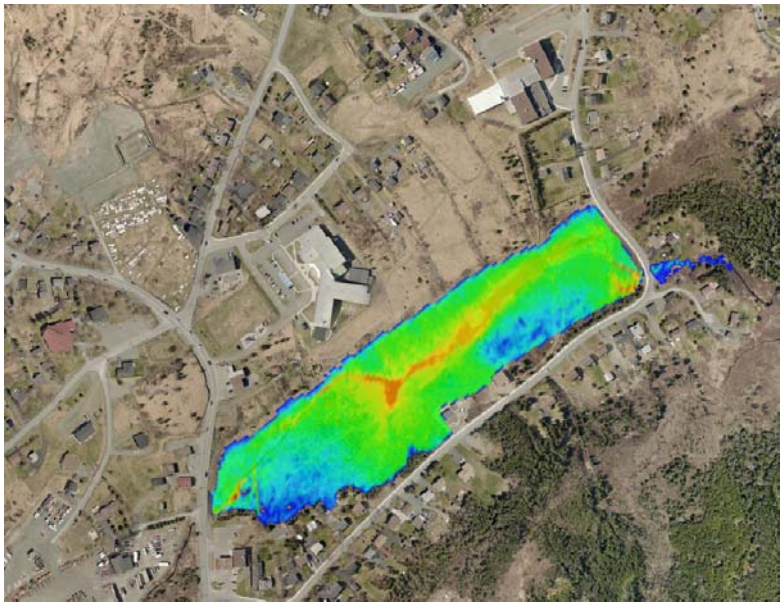


Figure 6: "The Gully" Floodplain with New Climate Change Storm

In this submission, the model has been subjected to the new climate change storms and the Town of Torbay's zoning map has been reviewed to determine areas of potential growth in the area. The suggested upgrades were then analyzed to determine their validity and whether or not further upgrades are required based on the above discussion. The updated floodplain images can be seen in Appendix A. Under existing conditions, and modelling the new climate change design storms, several results were noted. The first being that the new design storms induce deeper water depths within the wetland itself. The recommended culvert size is full for the majority of the storm events. The berms along Lynch's Lane and Mahon's Lane are all sufficient in preventing runoff from leaving the wetland and entering the property of Civic #3 Lynch's Lane.

Fortunately, the new properties being constructed along Mahon's Lane are still unaffected by the floodwaters in the area.

The cross-section of the upsized arch bottomless culvert can be seen in Figure 7.

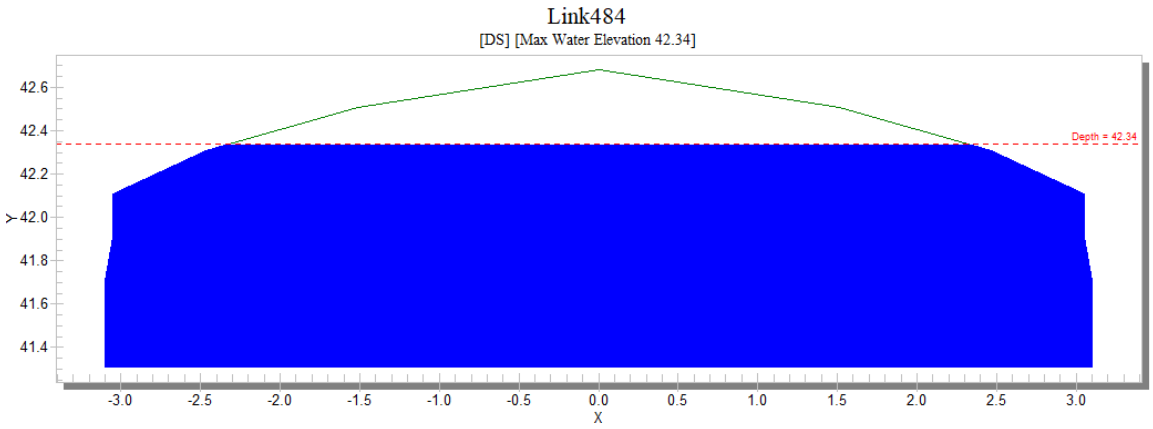


Figure 7: New Arch Bottomless Culvert Cross - Section - 100 Year - 6 Hour Climate Change

Given that the maximum size of arch bottomless culvert is currently selected for replacement, and the fact that this new culvert is currently full under the new design storms, some form of stormwater detention is required upstream. No increase in overall flow should be allowed to enter this wetland as the amount of remedial options available have reached its maximum potential.

There are areas within the catchment area that are noted for potential residential expansion. In particular, one area currently zoned for Residential Subdivision Area to the North of Quigly's Lane, could potentially contribute significant additional flows to the wetland area depending on the systems in place.

There is also little available footprint in this area to implement a larger detention pond type structure similar to what was discussed in the Skipper's Landing area as well as the Island Pond Brook catchment, given the amount of existing residential development and the watershed and conservation zoning areas. The only available area to place a sizeable detention structure would be between Quigley's Lane and Convent Lane. This area is zoned currently as a residential suburban area and to incorporate a large detention pond would significantly reduce the amount of development that could potentially take place in this area. It's also pertinent to remember that upstream from this is the Town's water supply, North Pond. Placing a detention pond downstream of this pond may potentially alter the characteristics of the Towns sole water supply, North Pond. Given that the characteristics of this water supply have already been strained, it's advisable to not make

any upgrades that could potentially affect the characteristics of North Pond. Due to the complexity of the stream system in this area and the fact that this area of As a result, its strongly recommended that the Town of Torbay's zero net runoff policy be strictly enforced for any new development that is to take place that will contribute runoff to "The Gully". This will aid the previous recommendations in performing as they should and will reduce remedial costs on the Town's behalf. It will also eliminate the possibility for future runoff entering "The Gully".

In order to reduce the annual budgeted cost for this catchments remedial works, the work in the area can be broken into two phases. The first being replace the existing arch bottomless culvert to a new 6.198m span x 1.372m rise aluminized arch bottomless culvert and widening/excavation of a downstream area . The widening of the downstream parcel of land should coincide with the placement of the new, larger culvert as there will now be more runoff discharging through the culvert. It has been shown under current day storm events that this culvert can at times be very near capacity, as a result it is recommended that this piece of infrastructure be upsized so as to meet the new climate change storm standards.

Figure 8: Existing Capacity Issues - Arch Bottomless Culvert Mahon's Lane

There have been no instances of flood waters overtopping the asphalt at Mahon's Lane to date, as indicated in The Gully floodplain analysis report. Therefore, placing the berms as shown can be placed after the existing culvert has been removed and upsized to the new arch bottomless culvert as a preventative means to eliminate the possibility of flooding occurring on Mahon's Lane or Civic #3 Lynch's Lane

In addition to these urgent replacements and upgrades, it was noted at the time of "The Gully Floodplain Analysis" that two culverts crossing Quigley's Lane were in deplorable condition and will need to be replaced immediately. These culverts can be seen in Figure 8. These culverts have since been reaplced with a 1200mm HDPE pipe structure as shown in Figure 10

Figure 9: Culverts Crossing Quigley's Lane in Poor Condition

Figure 10:New 1200mm HDPE Pipe - Quigley's Lane

Priority List of Upgrades

1) Replace undersized arch bottomless culvert with new aluminized 6.198m span x 1.372m rise arch bottomless culvert crossing Lynch's Lane. Widen parcel of land downstream as per the Stormwater Management Plan. These upgrades have to be completed in conjunction with each other to ensure that the new culvert does not compromise any downstream areas as the new culvert will convey more flow.
2) Construct earth berms along perimeter of Mahon's Lane and Lynch's Lane as detailed in this document.
3) Strictly monitor upstream development to ensure that a zero net runoff policy is strictly enforced.

PRIORITY #1: Total Estimated Cost for Replacement of Arch Bottomless Culvert & Stream Modification (Including HST + Engineering): $537,304.64

PRIORITY #2: Total Estimated Cost for Placement of Earth Berms along Perimeter of Mahon's Lane and Lynch's Lane: $100,435.94

5.0 Watt's Pond

The Watt's Pond catchment area has had notable cases of flooding in the past. Recently however, the reports of basements flooding have essentially been eliminated. However, given the results of stormwater management plan, it is clear that the consequences of not mitigating drainage issues in the area are severe. A large number of residents could potentially be impacted by floodwaters associated with a 100 year storm event, as shown in Figure 11. If this flood event should occur, it could result in potentially thousands of dollars of property and infrastructure damage.

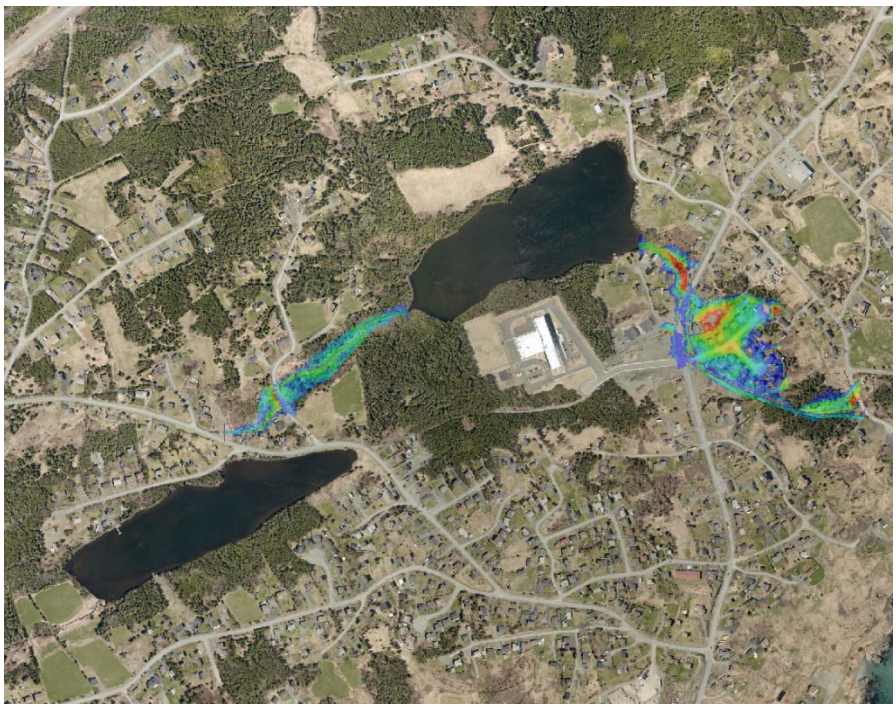


Figure 11: 100 Year - 12 Hour CC Storm Event - Watts Pond Catchment

Given the complexity of this particular catchment area, the options for mitigation methods are limited. It was previously proposed that an earth berm be placed adjacent to the runoff stream that eventually crosses Anstey's Cove Lane. This berm prevents runoff from entering a marshy area at the rear of properties along Anstey's Cove Lane and Davalan place as shown in Figure 12

Figure 12: Previously Constructed Berm to Prevent Overland Flooding

This recommendation was based on the previous design storms which were not adjusted to compensate for recent impacts seen from climate changes they had not yet been released by the City of St. John's. This upgrade has prevented floodwaters from entering the rear of properties during rainfall events. When these new design storms were implemented in the Stormwater Management Plan it was clear that this catchment area has extensive drainage and floodplain extents issues. The complexity of making recommendations in this catchment area is that there is very little room to implement any sizeable infrastructure upgrades and the catchment area itself is very flat.

There does exist the option to lower both water levels of Watt's Pond and Withrod Pond by one foot to allow for storage within the catchment area. This type of upgrade requires significant attention to detail and engineering design which will require approval from the Department of Environment and Municipal Affairs and Department of Fisheries and Oceans. It is recommended that further investigation of this catchment area is pursued prior to making any upgrades within this catchment area. Further investigation of both Withrod and Watt's Pond is require to determine the exact parameters of both ponds as well as to fully assess the feasibility and potential impacts of lowering both pond levels. If the Town should pursue the option to adjust the pond levels in both Watt's Pond and

Withrod's Pond, then significant design will be required. Therefore it takes priority over some of the other catchment areas discussed

It is recommended that the Town of Torbay pursue this catchment area by further analyzing the characteristics of both Withrod Pond and Watts Pond. It is pertinent that the Town investigate further means to prevent flooding for residents along Anstey's Cove Lane and Davalan Place.

Priority List of Upgrades

- Perform detailed engineering analysis regarding adjusting both top water elevations of Watts Pond and Withrod Pond by one foot. This will include investigation into the properties of both ponds
- If feasible, perform detailed engineering design to lower top water elevations of both Withrod and Watts Pond to allow for storage within the Watts Pond Catchment Area.

7.0 Whiteway Pond Catchment

In this catchment area, the majority of the issues stem from undersized culverts and culverts that have significantly deteriorated overtime

Figure 13: Existing Culverts In Poor Condition - Compressed by Jersey Barrier

The one area that requires immediate attention is the two culverts that currently cross Cannon Marsh Road. As discussed in the final stormwater management plan, these two culverts are being significantly compressed by a concrete jersey barrier which has

reduced their capacity. These culverts have since been replaced with pipe arches. Construction is expected to be completed early in the fall of 2020.

Figure 14: Partially Collapsed Section of Storm Pipe - Country Drive/Hickey's Lane

Other than these upgrades which require immediate attention, there were other remedial actions the Town should pursue to address flooding issues in the area. There are currently two 600mm culverts crossing Country Drive, just downstream of Whiteway Pond that are surcharging under the 100 year storm events. These should be upsized from twin 600mm CSP culverts to twin 750mm HDPE culverts. Just upstream from this, earth berms should be placed along the perimeter of Whiteway Pond. This will mitigate the original flooding issues as shown in Figure 15

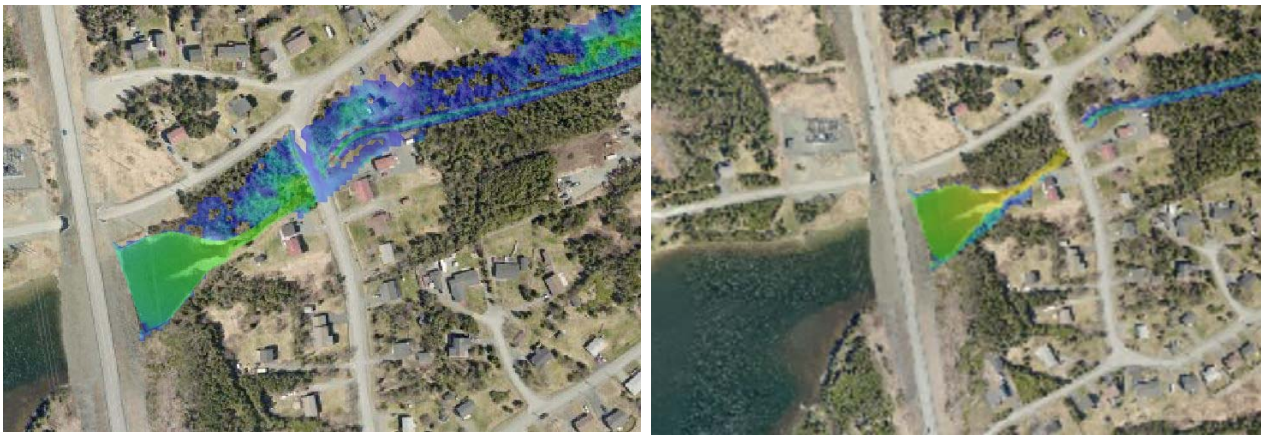


Figure 15: Before and After Upgrades - Whiteway Pond & Country Drive

Downstream from this area, there is a 1200mm CSP culvert crossing Russworthy Place that appeared to be in slightly poor condition upon inspection during the summer of 2018. It is recommended that this culvert be monitored and further inspected to ensure that the culvert is operating properly and has not deteriorated further. If it has deteriorated it should be replaced with an equivalent sized HDPE culvert

In summary, the majority of the issues within this catchment area stem from damaged infrastructure that has deteriorated overtime and needs significant attention to mitigate flood risks for residents in the area.

Priority List of Upgrades

1) Replace twin culverts crossing Country Drive, near Whiteway Pond with two new
2) Construct Earth Berms along perimeter of Whiteway Pond as detailed in the Stormwater Management Plan.

PRIORITY #1: Total Cost of Replacing Twin Culverts crossing Country Drive, Placing Earth Berms along perimeter of Whiteway Pond as Detailed in the Stormwater Management Plan (Including HST + Engineering): $139,852.39

6.0 Big River

This catchment area experienced little in the way of catastrophic flooding when modelled under the 100 year climate change storms. Most of the remedial upgrades in this catchment area consist of upsizing local culverts and widening stream cross-sections to provide additional capacity. The majority of the failures within this catchment area are local washouts where culverts surcharge which do not affect any properties along Bauline Line or side streets. This catchment area, according to the Towns zoning map, also has the least amount of expected residential development in the future.

This catchment should take precedent over the remaining two catchments because it contains one area of notable concern. Floodwaters encroach onto the northern portion of a new development along

Figure 16: Floodwaters Encroaching on New Property Along Bauline Line

Bauline Line and part of the remedial upgrades proposed was placing a berm around the northern perimeter of this new development to prevent overland flow from encroaching onto the new development. The berm could easily be constructed by Town's forces and would be a preventative measure to lower the risk of property damage on this new development. The excerpt from the stormwater management plan depicting flooding on the new development can be seen in Figure 16. Many of the localized culverts that cross Bauline Line at various points need replacing based on their ability to convey runoff from a 100 year storm event. These culverts can be upsized at the Towns leisure to account for potential impacts of climate change. None of these culverts run in series, meaning that replacing one of these culverts will not affect any infrastructure downstream, except for the massive bridge structure crossing the Torbay Bypass Road, which has a tremendous amount of capacity.

Again, this catchment area is not necessarily at risk for immediate flooding concerns, as a result it is ranked lower in the priority list.

The town should review the undersized culverts as detailed in the stormwater management plan and replace them accordingly. The earth berm along the perimeter of the new development along Bauline line should be the highest priority upgrade within this catchment area as it will prevent the risk of future flooding under a 100 year storm event.

One important thing to note for this catchment area is that all runoff from the major river systems in this catchment area flows towards Flatrock. The extents of the Stormwater Management Plan analyzed the Town of Torbay up to and including all areas within the border of the Town. If future development is to take place, without a zero net runoff policy, it could be detrimental to any key pieces of storm sewer infrastructure in the Town of Flatrock. It is recommended that the Town of Torbay work in conjunction with the Town of Flatrock to ensure that by placing

Priority List of Upgrades

1) Construct earth berm along northern perimeter of the new development along Bauline Line.

2) Upgrade culverts as detailed in the Stormwater Management Plan.

Total Cost of Upgrades, Culvert Removals, Placement of Earth Berm along New Development (Including Engineering + HST): $429,005.78

7.0 Kennedy's Brook Catchment

The one area of notable concern in this catchment area was the culvert that crosses Rosebud Street. To correct this issue it was recommended that the damaged culvert be replaced to prevent current flood risks. In addition, it is recommended that a berm be constructed along the upstream portion of the river prior to the culvert to properly channel the floodwaters through the new culvert. This will help prevent the risk of Rosebud Street washing out and potentially causing issues for the adjacent resident and the playground. The area in question can be seen in Figure 16.

Figure 15: Flooding Occurring on Civic # Rose Budstreet and Adjacent Playground

Figure 16: Flooding Prevented on Rosebud Street by Placement of Berms and Replacing Damaged Culvert

The Town's zoning map indicated that there was the potential for a commercial development that borders on the City of St. John's. There does exist the potential for this development to significantly increase the amount of runoff entering the Kennedy's Brook Catchment. However, when this was analyzed in the

XPSWMM model, there was no significant impacts yielded from the increase in runoff associated with this development. It was also determined through a separate review process that runoff from this commercial development will be discharged into the main storm sewer system therefore the discharge will not affect the Kennedy's Brook catchment area.

Based on the findings of PEC's analysis, this catchment is the lowest on the priority list. In essence, these upgrades can be made at the Town's discretion as pieces of infrastructure deteriorate overtime.

It is important to note that the majority of runoff in this catchment area that ends up being conveyed through the major river systems, eventually passes onto the community of Logy Bay – Middle Cove – Outer Cove where it discharges near Middle Cove Beach. Similar to the Big River Catchment, development in this catchment area should be monitored closely in conjunction with the Town of Logy Bay – Middle Cove – Outer Cove to ensure that if future development is to occur upstream, it does not place any critical structures downstream at risk for flooding.

Priority List of Upgrades

- Construct earth berms with minimum height of 1.4m with 2 to 1 side slopes along natural river system as shown in drawing PR141 in the Stormwater Management Plan report.
- Replace damaged culvert crossing Rosebud Street to original diameter HDPE pipe.

Total Cost of Upgrades Upgrading of Culverts, Placement of Earth Berms (Including Engineering + HST) = $174,419.40

8.0 Conclusion

This document will assist the Town of Torbay in budgeting for the upgrades proposed in the Stormwater Management Plan as adopted by the Town in 2019. The catchment areas have been ranked based on their urgency for implementing such upgrades, excluding

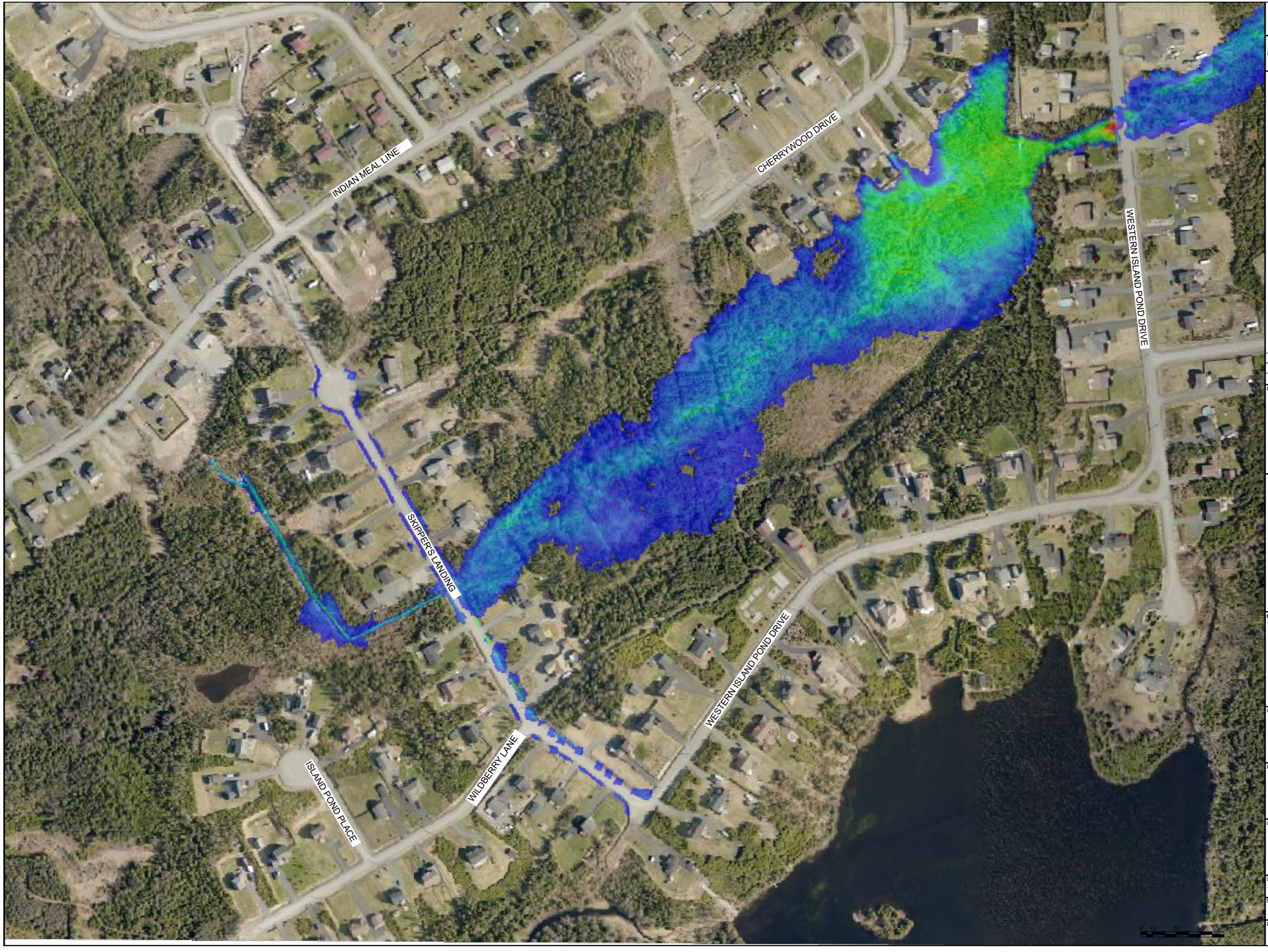
emergency scenarios whereby immediate intervention is required from damaged culverts or other pertinent pieces of storm sewer infrastructure.

As development becomes more evident and the extents of development is known, this document can be used as a guide to prioritize which areas within the Town of Torbay require attention before other areas.

The Town of Torbay should use this document as well as the original Stormwater Management Plan to firstly address issues that are current. This includes any issues that have had notable cases of flooding in the past that have been documented during rain storms, any culverts that are significantly deteriorated, blocked or damaged, or any significant issues that were noted during the modelling process in the Stormwater Management Plan. The floodplain mapping drawings contained within the original stormwater management plan can also be used by the town for planning and development purposes to ensure that new developments do not occur within floodplain extents. By doing so, the Town will have taken a proactive approach to addressing residents' concerns regarding flooding and potentially mitigating thousands of dollars of property damage. This is becoming more important given the future impacts of climate change and the fact that extreme weather events will become more prominent in the years and decades to come.

By closely monitoring future development within the town and enforcing a zero net runoff policy, the Town will be taking a proactive approach to preventing flooding issues downstream of new developments.

APPENDIX 'A' UPDATED UPGRADES FLOODPLAIN MAPS



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SKIPPER'S LANDING CATCHMENT
FLOODPLAIN MAPPING
100 YEAR - 24 HOUR CC

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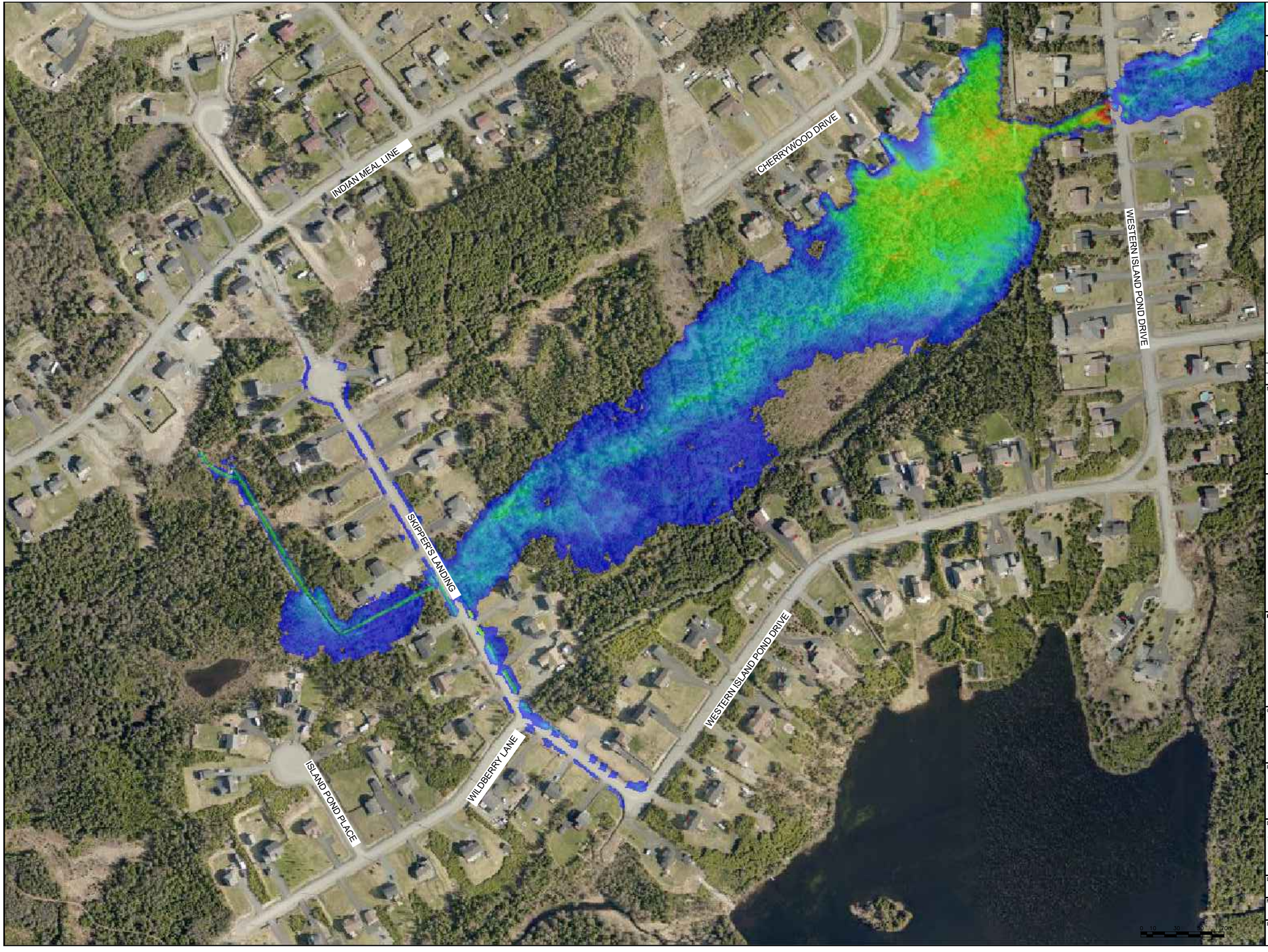

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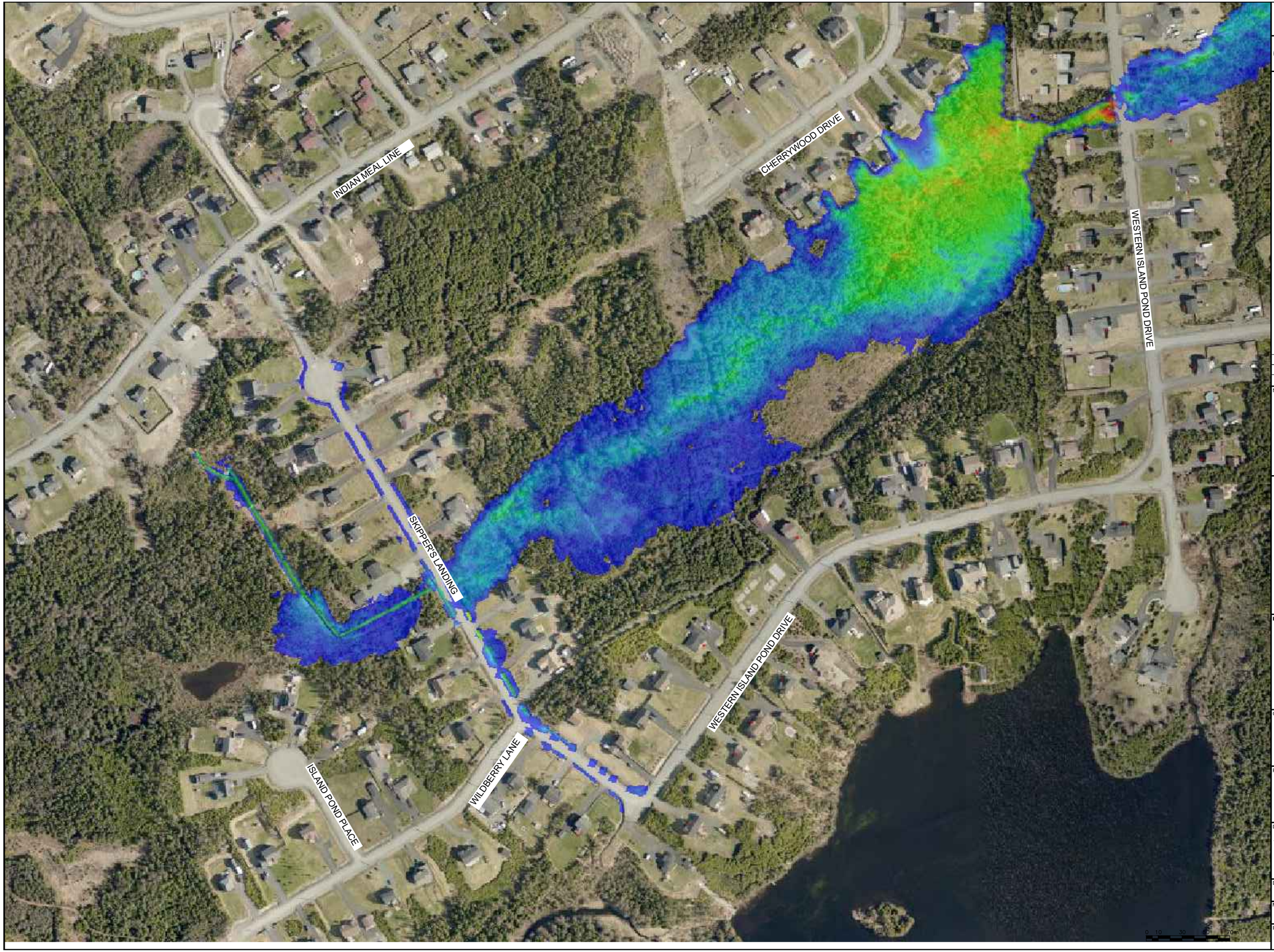

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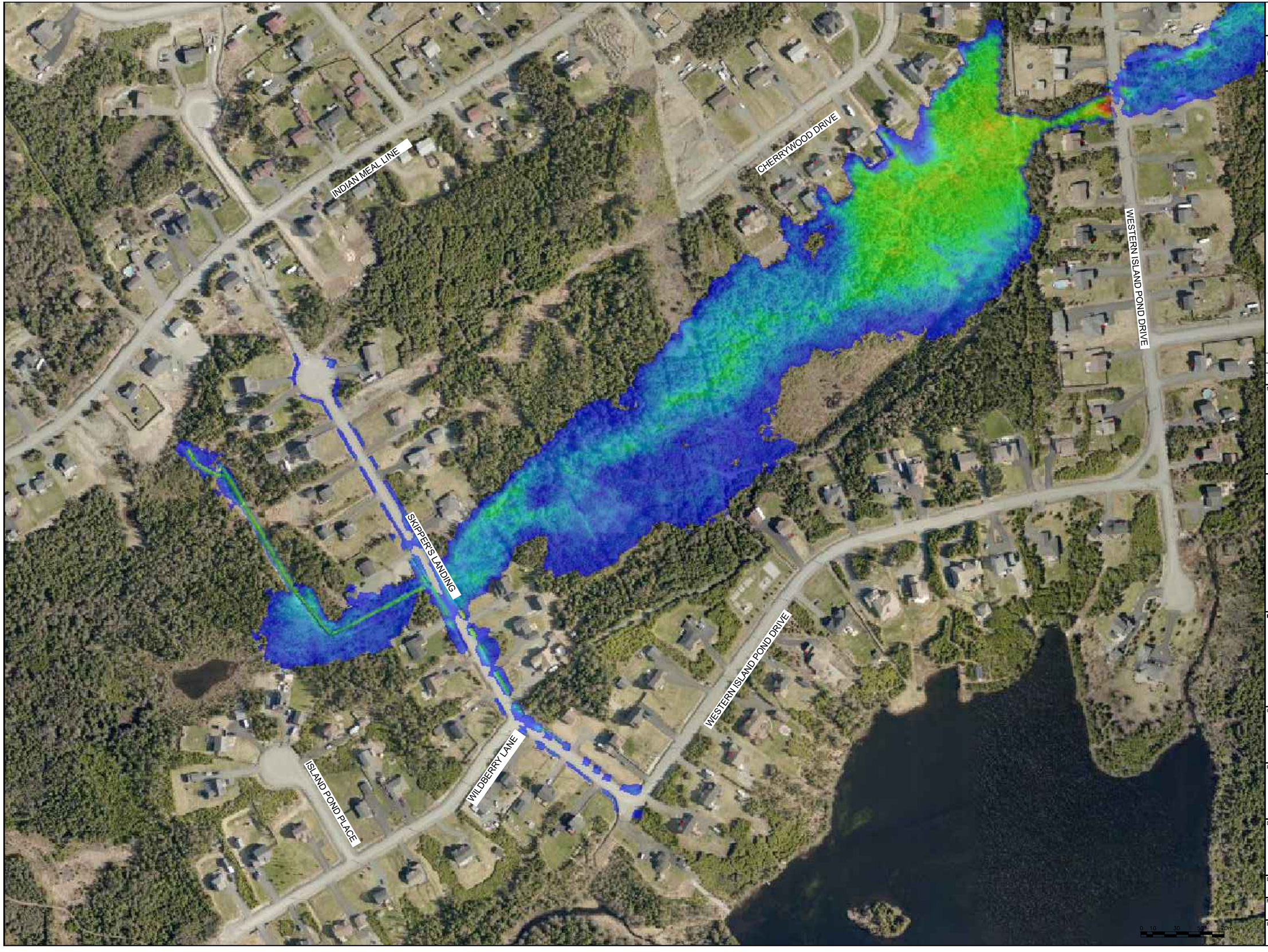

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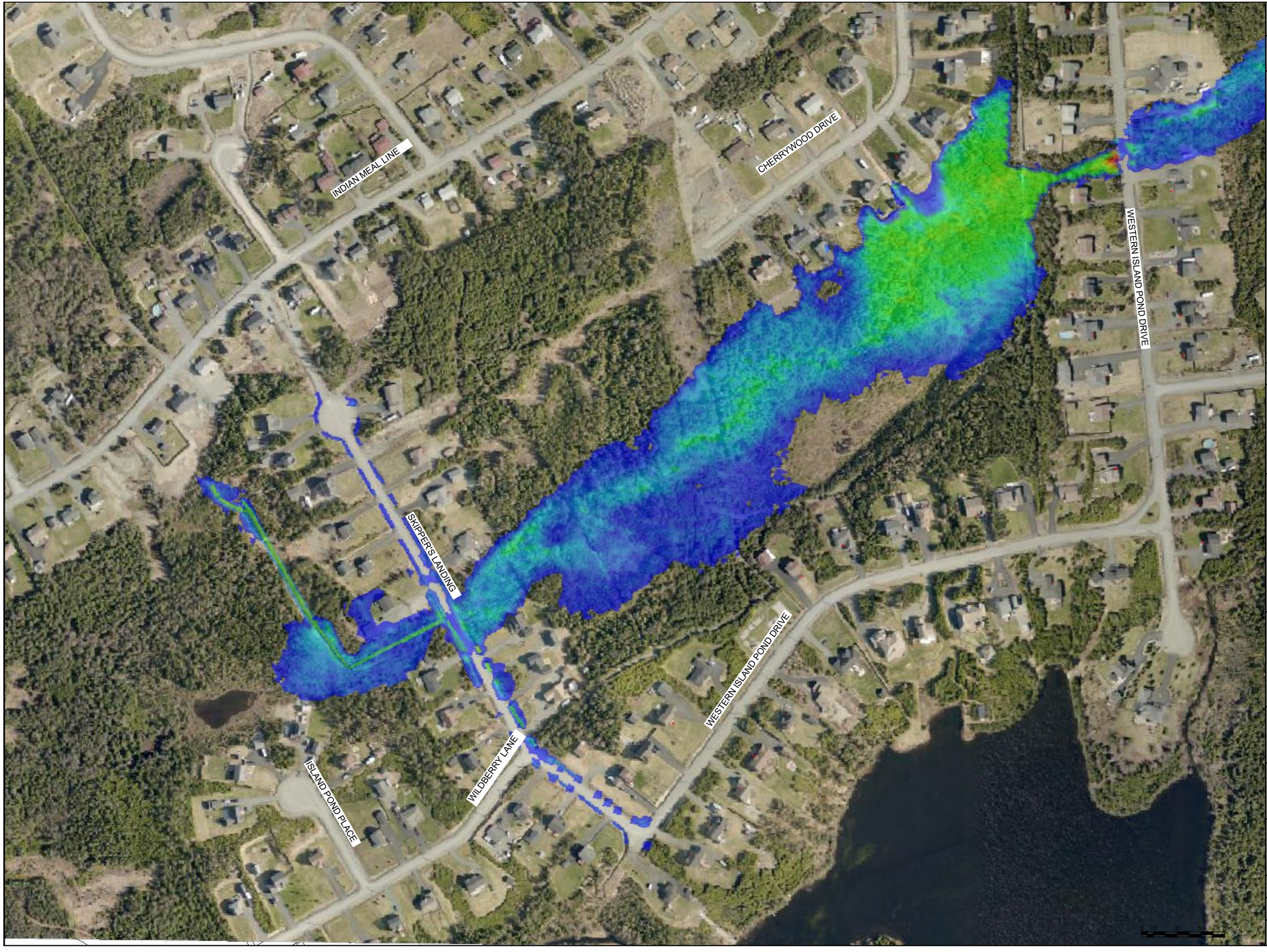

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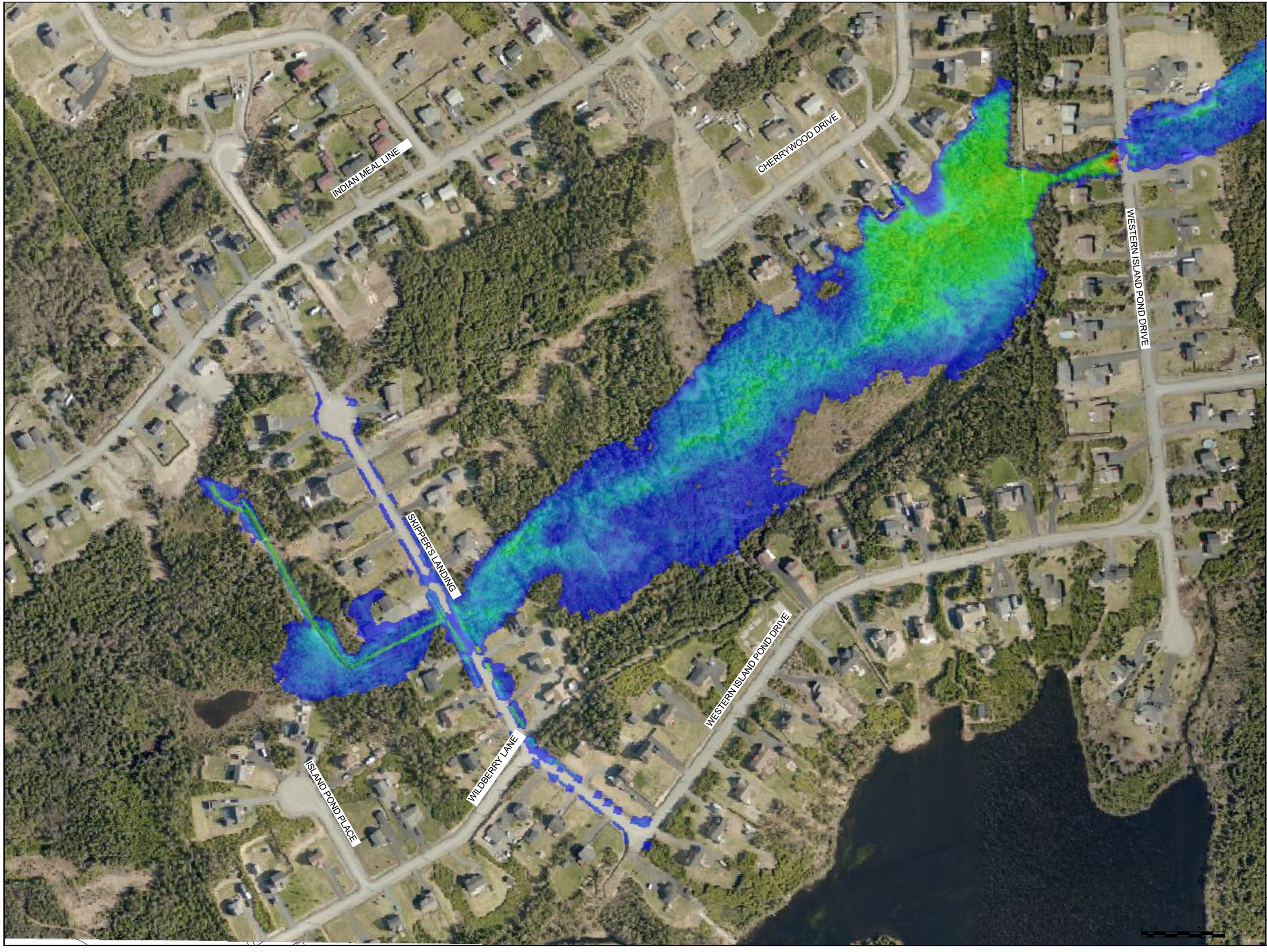

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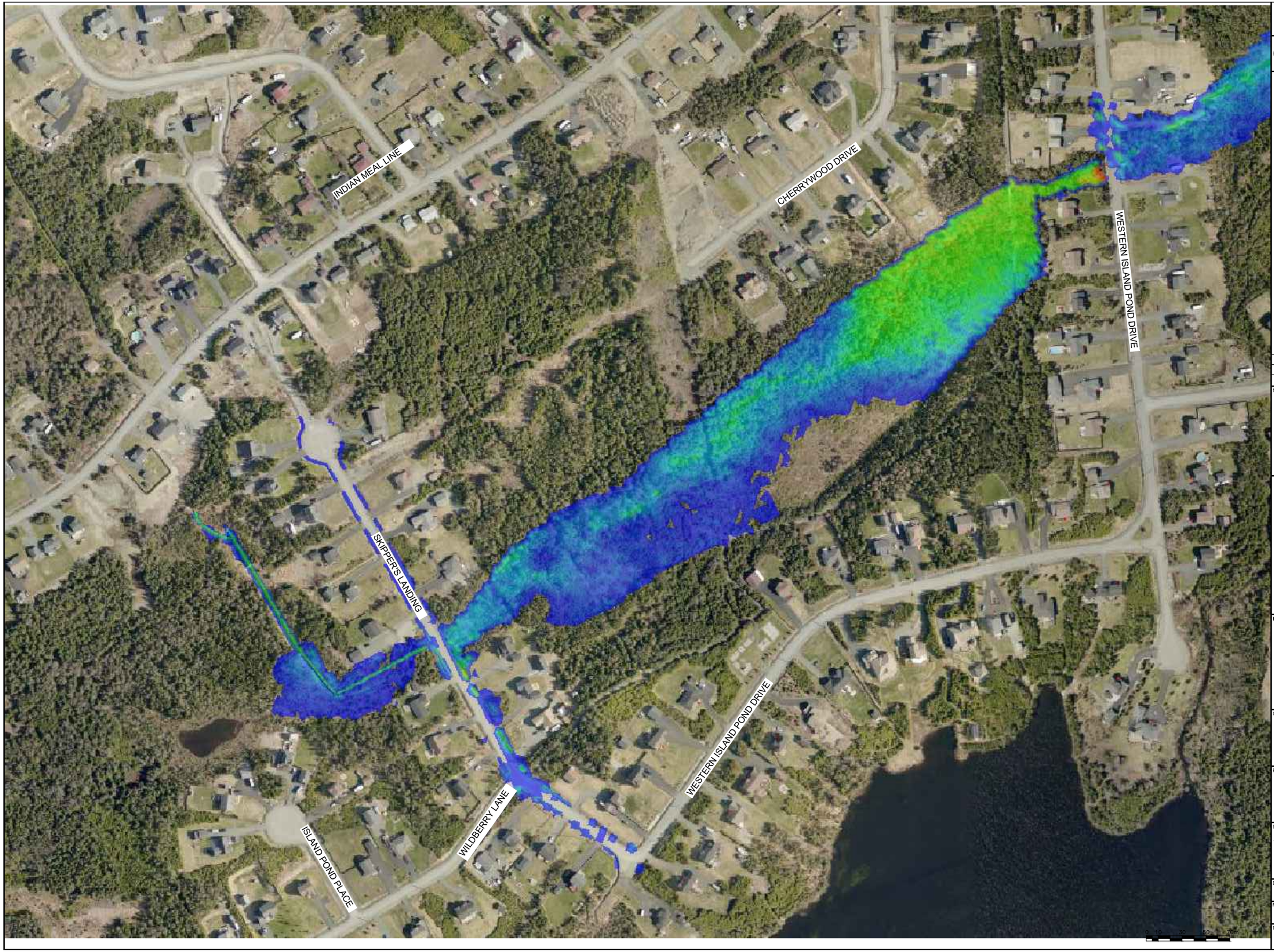

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100 YEAR - 12 HOUR CC (2 of 2)

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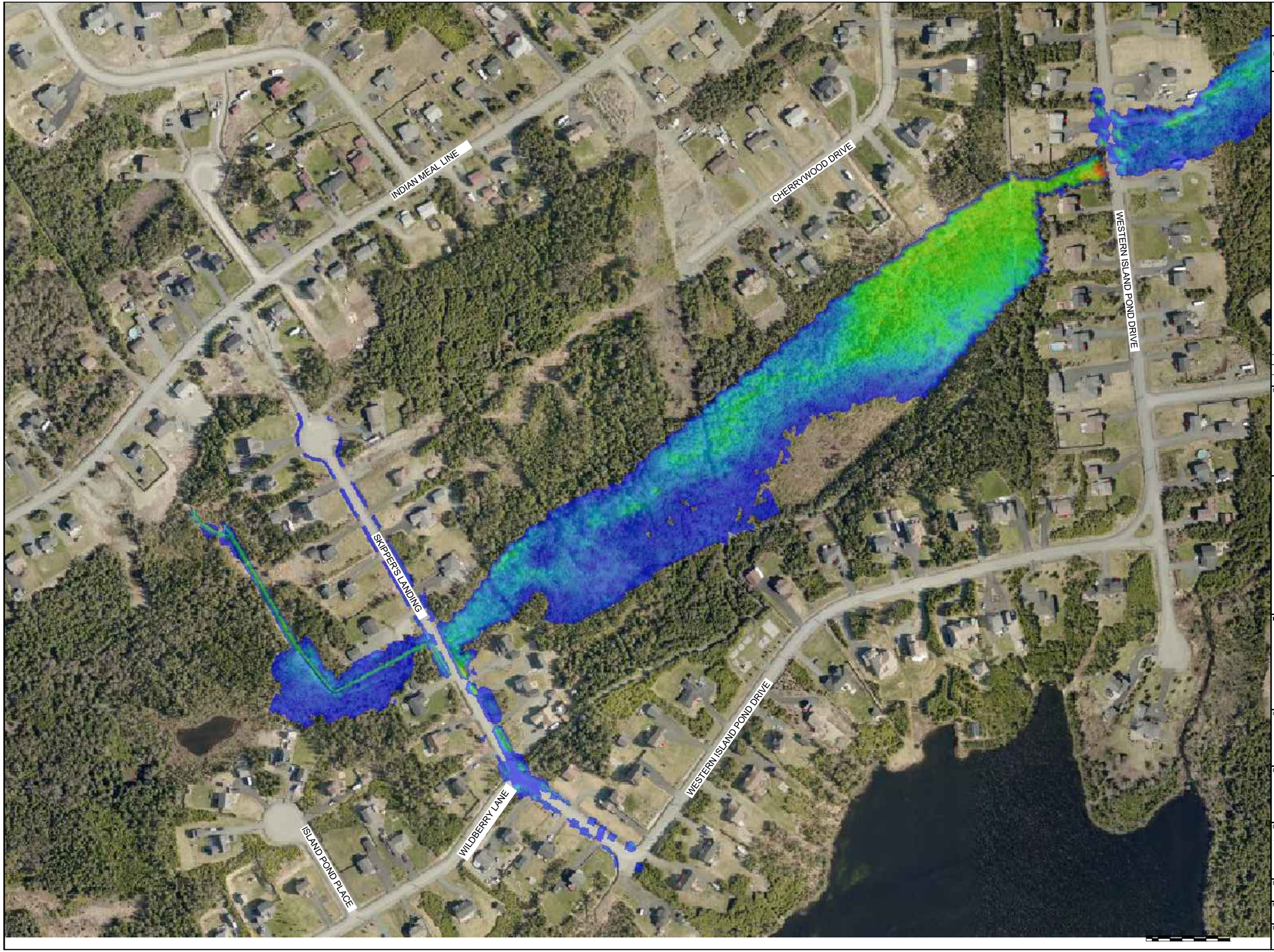

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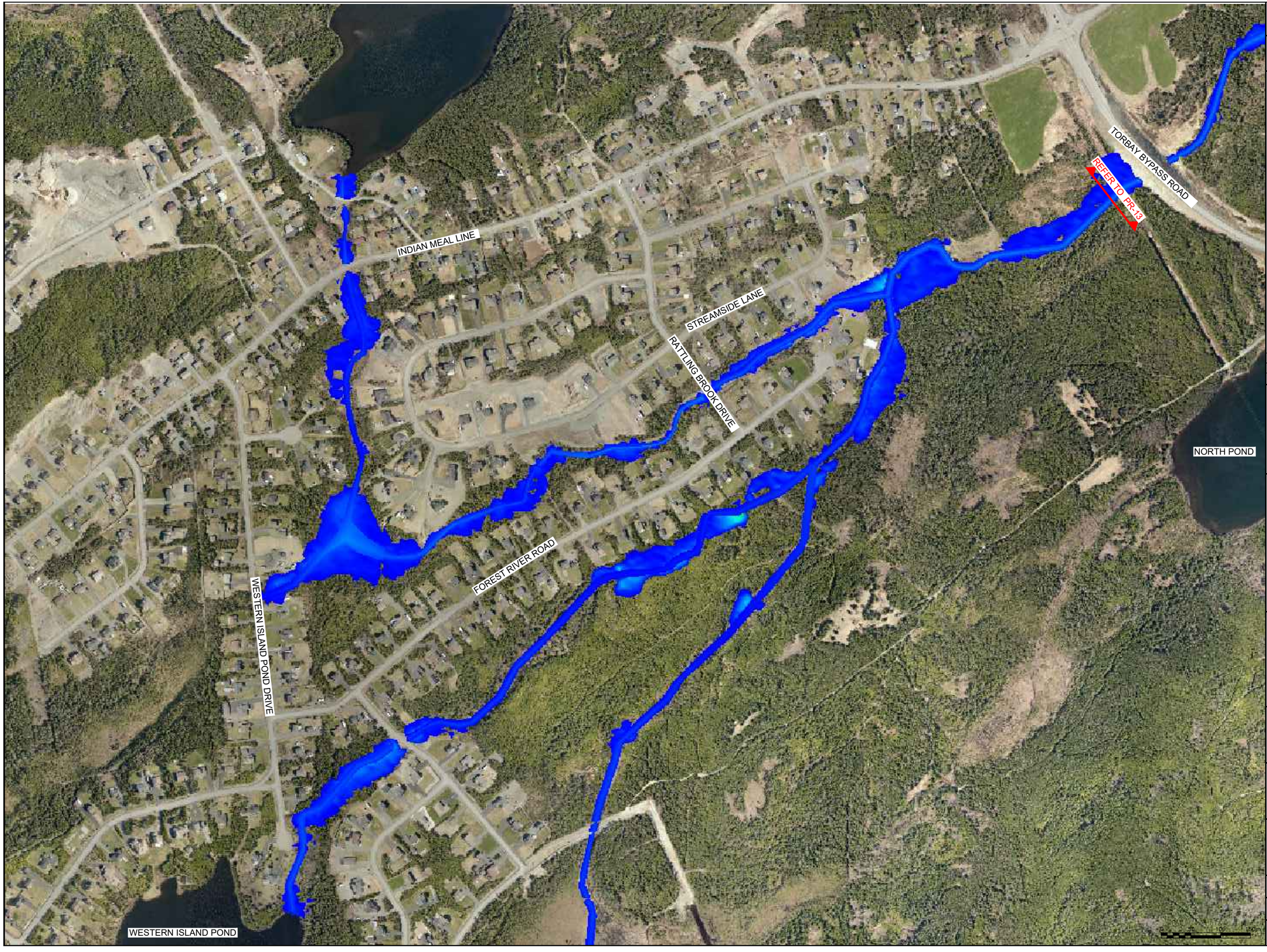

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OWNER/CLIENT NAME:

TOWN OF TORBAY

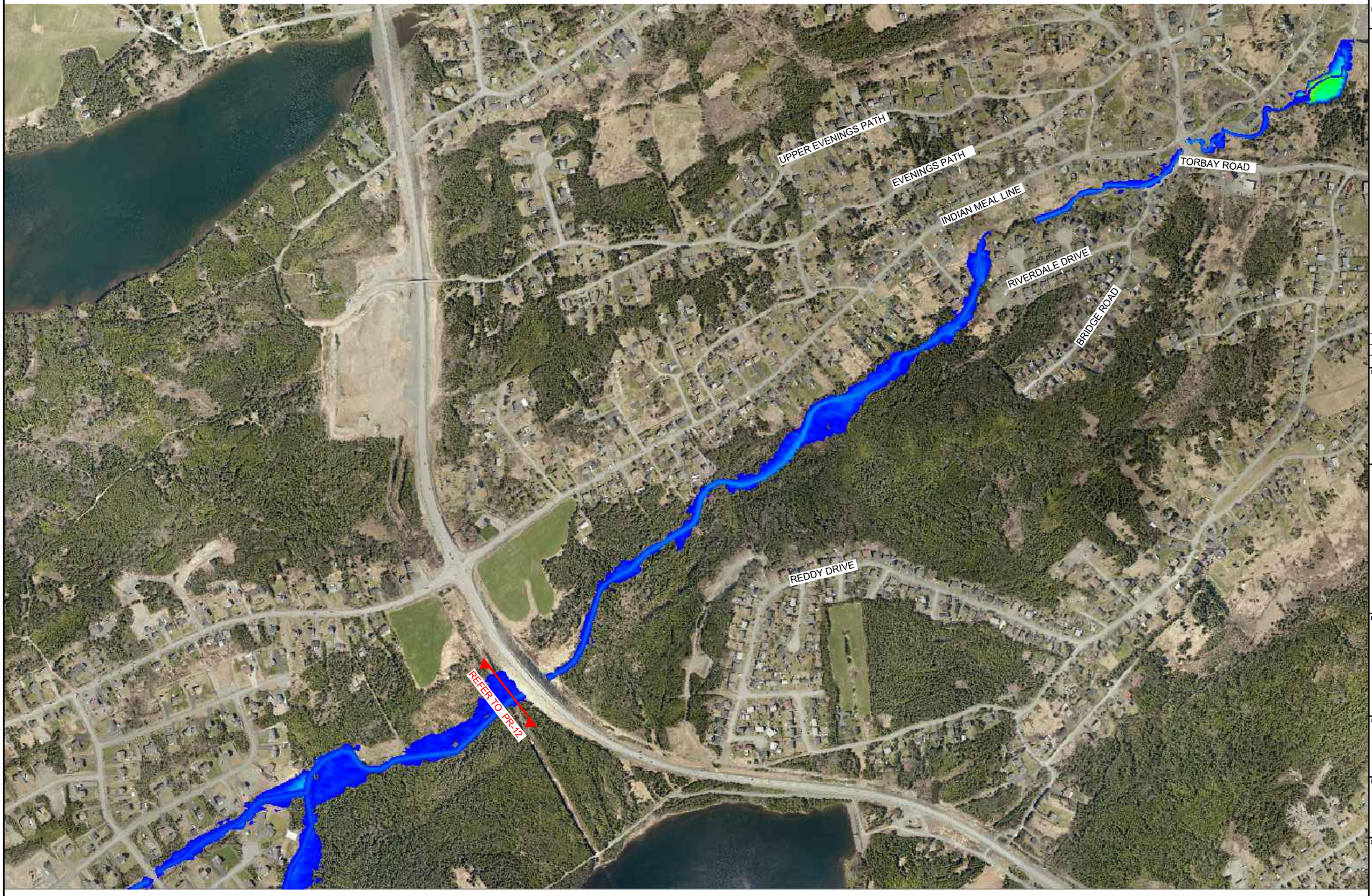
PROJECT TITLE:

STORMWATER MANAGEMENT IMPLEMENTATION PLAN PRIORITY LIST

DRAWING TITLE:

ISLAND POND CATCHMENT FLOODPLAIN MAPPING 100 YEAR - 24 HOUR CC (1 of 2)

DRAWN BY:	DESIGNED BY:	APPROVED BY:
C.L.	C.L.	VB
MAE No:	DATE:	SCALE:
N/A	FEB 2020	AS SHOWN
PROJECT No:	DRAWING No:	REV:
2019-047	PR-12	A



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OWNER/CLIENT NAME:

TOWN OF TORBAY

PROJECT TITLE:

STORMWATER MANAGEMENT IMPLEMENTATION PLAN PRIORITY LIST

DRAWING TITLE:

ISLAND POND CATCHMENT FLOODPLAIN MAPPING 100 YEAR - 24 HOUR CC (2 of 2)

DRAWN BY:	DESIGNED BY:	APPROVED BY:
C.L.	C.L.	VB

MAE No:	DATE:	SCALE:
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PROJECT No:	DRAWING No:	REV:
2019-047	PR-13	A

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TOWN OF TORBAY

PROJECT TITLE:
STORMWATER MANAGEMENT IMPLEMENTATION PLAN PRIORITY LIST

DRAWING TITLE:
ISLAND POND CATCHMENT FLOODPLAIN MAPPING
100 YEAR - 12 HOUR CC (1 of 2)

DRAWN BY:	DESIGNED BY:	APPROVED BY:
C.L.	C.L.	VB
MAE No:	DATE:	SCALE:
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PROJECT No:	DRAWING No:	REV:
2019-047	PR-14	A

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PROJECT TITLE:

STORMWATER MANAGEMENT IMPLEMENTATION PLAN PRIORITY LIST

DRAWING TITLE:

ISLAND POND CATCHMENT FLOODPLAIN MAPPING
100 YEAR - 12 HOUR CC (2 of 2)

DRAWN BY:	DESIGNED BY:	APPROVED BY:
C.L.	C.L.	VB
MAE No:	DATE:	SCALE:
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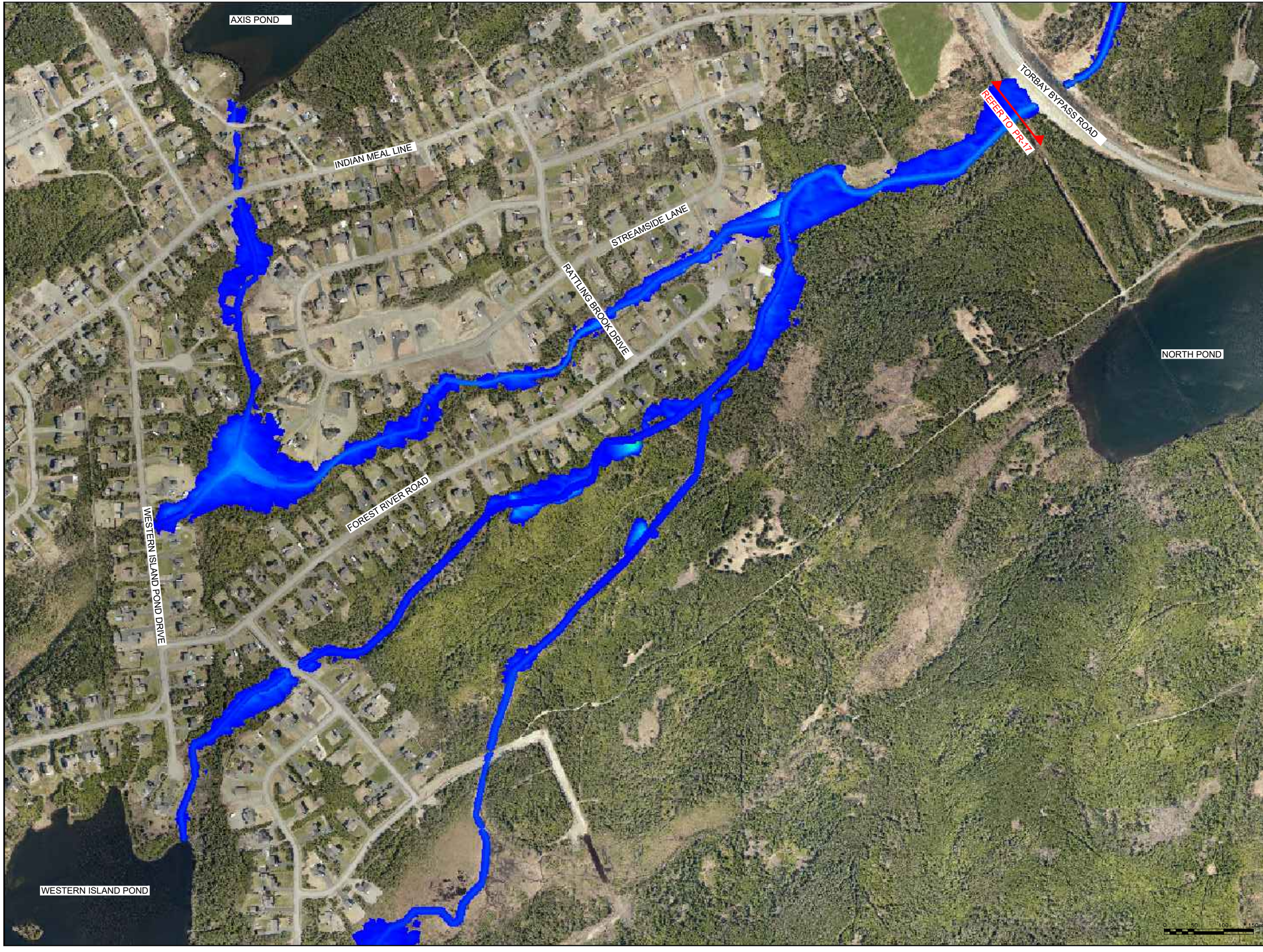
PROJECT No:	DRAWING No:	REV:
2019-047	PR-15	A



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PROJECT TITLE:

STORMWATER MANAGEMENT IMPLEMENTATION PLAN PRIORITY LIST

DRAWING TITLE:

ISLAND POND CATCHMENT FLOODPLAIN MAPPING 100 YEAR - 6 HOUR CC (1 of 2)

DRAWN BY:	DESIGNED BY:	APPROVED BY:
C.L.	C.L.	VB
MAE No:	DATE:	SCALE:
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PROJECT No:	DRAWING No:	REV:
2019-047	PR-16	A

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PROJECT TITLE:
STORMWATER MANAGEMENT IMPLEMENTATION PLAN
PRIORITY LIST

DRAWING TITLE:
ISLAND POND CATCHMENT FLOODPLAIN MAPPING
100 YEAR - 6 HOUR CC (2 of 2)

DRAWN BY:	DESIGNED BY:	APPROVED BY:
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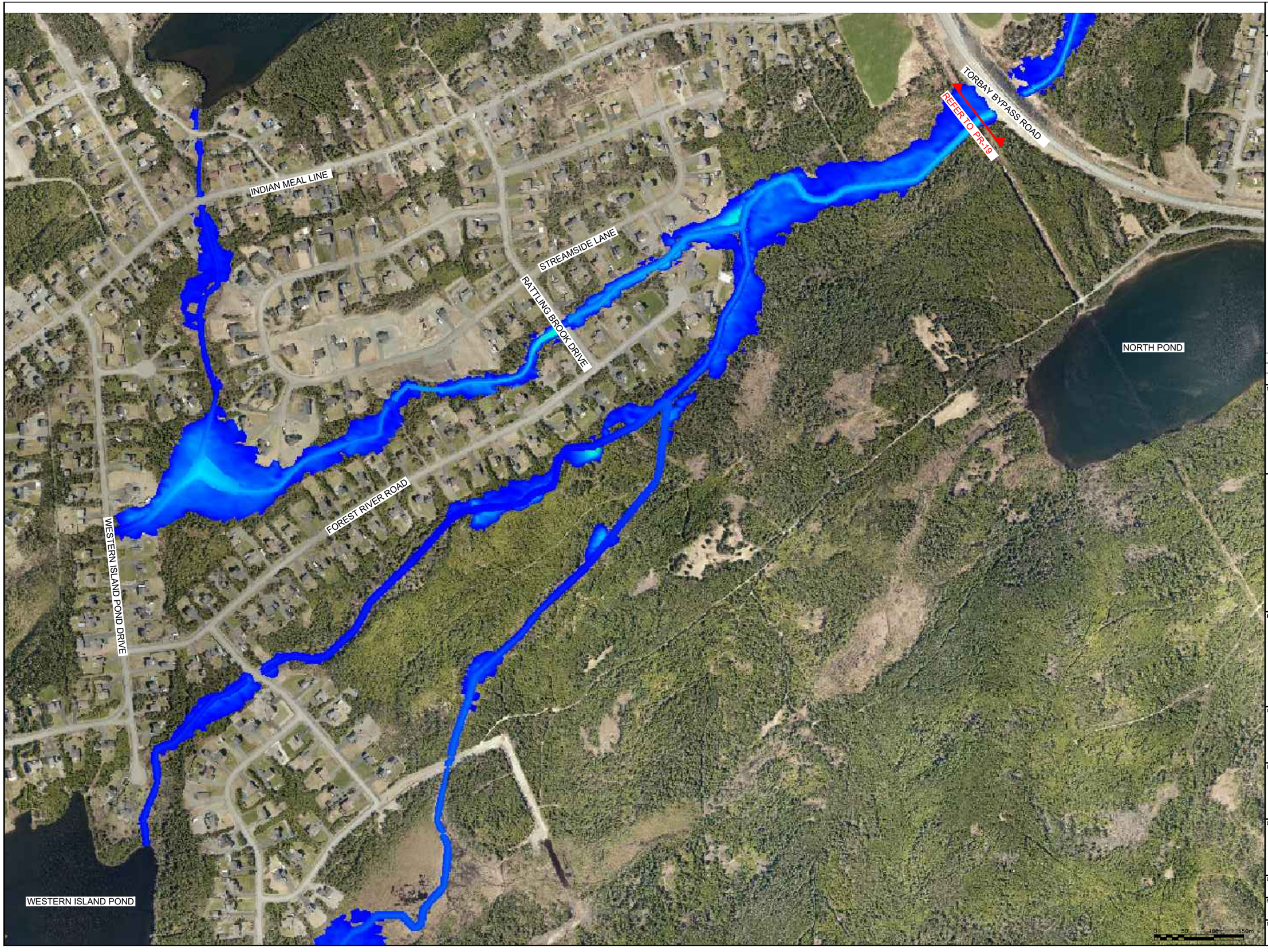
PROJECT No:	DRAWING No:	REV:
2019-047	PR-17	A



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PROJECT TITLE:

STORMWATER MANAGEMENT IMPLEMENTATION PLAN PRIORITY LIST

DRAWING TITLE:

ISLAND POND CATCHMENT FLOODPLAIN MAPPING
100 YEAR - 2 HOUR CC (1 of 2)

DRAWN BY:	DESIGNED BY:	APPROVED BY:
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MAE No:	DATE:	SCALE:
N/A	FEB 2020	AS SHOWN

PROJECT No:	DRAWING No:	REV:
2019-047	PR-18	A

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STORMWATER MANAGEMENT IMPLEMENTATION PLAN
PRIORITY LIST

DRAWING TITLE:
ISLAND POND CATCHMENT FLOODPLAIN MAPPING
100 YEAR - 2 HOUR CC (2 of 2)

DRAWN BY:	DESIGNED BY:	APPROVED BY:
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TOWN OF TORBAY

PROJECT TITLE:

STORMWATER MANAGEMENT IMPLEMENTATION PLAN PRIORITY LIST

DRAWING TITLE:

ISLAND POND CATCHMENT FLOODPLAIN MAPPING 100 YEAR - 1 HOUR CC (1 of 2)

DRAWN BY:	DESIGNED BY:	APPROVED BY:
C.L.	C.L.	VB
MAE No:	DATE:	SCALE:
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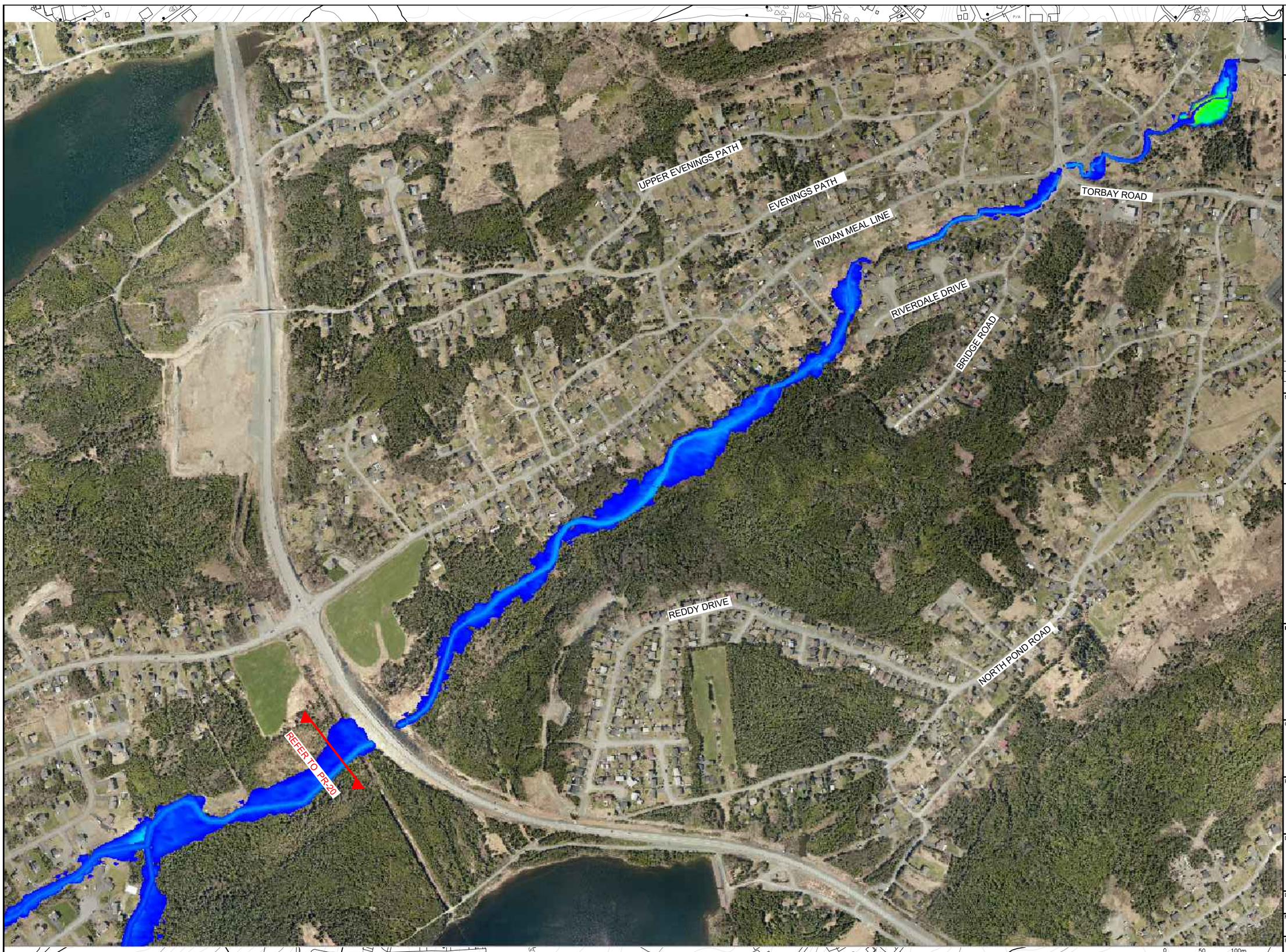
PROJECT No:	DRAWING No:	REV:
2019-047	PR-20	A



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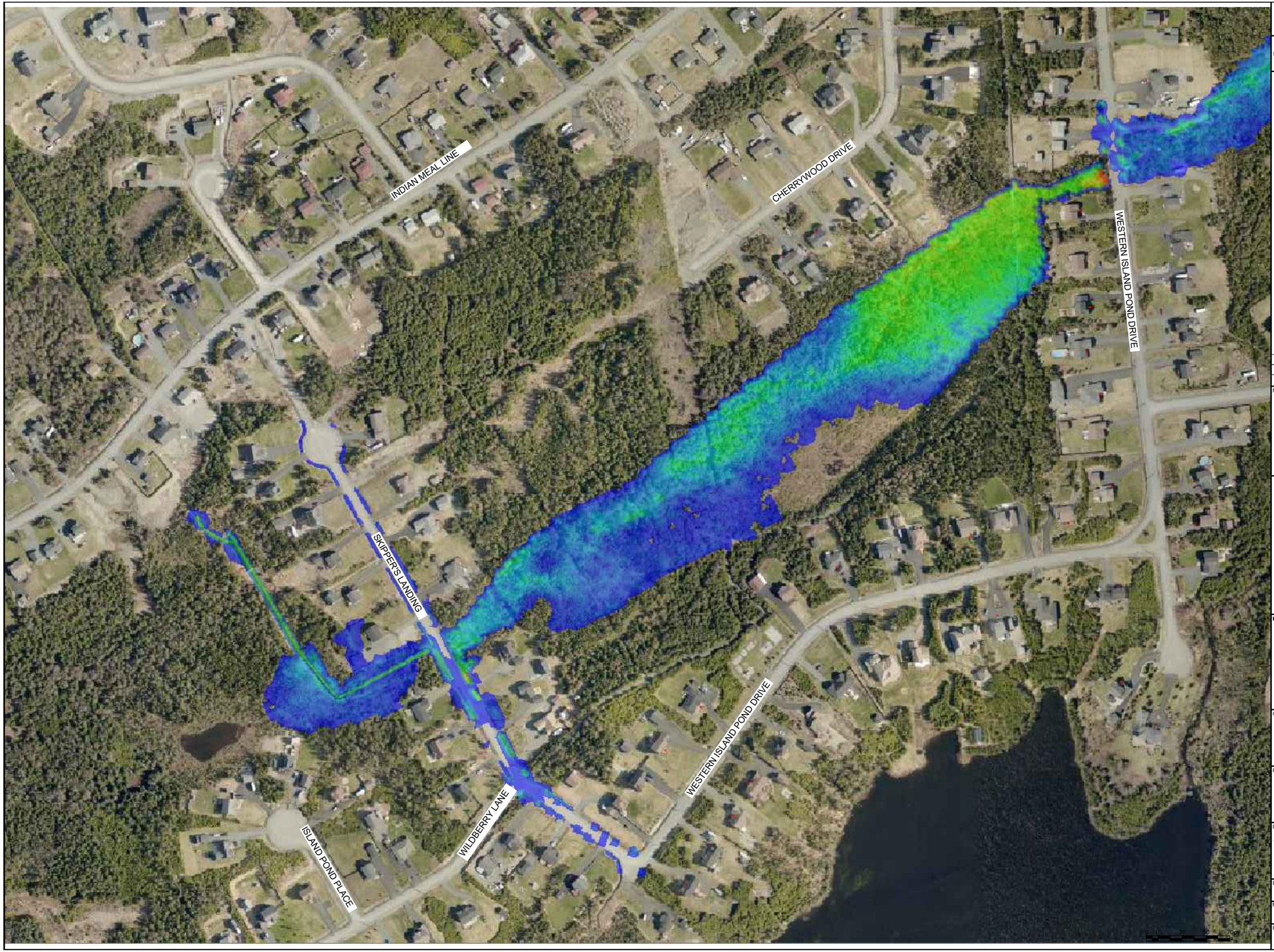
STORMWATER MANAGEMENT IMPLEMENTATION PLAN PRIORITY LIST

DRAWING TITLE:

ISLAND POND CATCHMENT FLOODPLAIN MAPPING 100 YEAR - 1 HOUR CC (2 of 2)

DRAWN BY:	DESIGNED BY:	APPROVED BY:
C.L.	C.L.	VB
MAE No:	DATE:	SCALE:
N/A	FEB 2020	AS SHOWN
PROJECT No:	DRAWING No:	REV:
2019-047	PR-21	A



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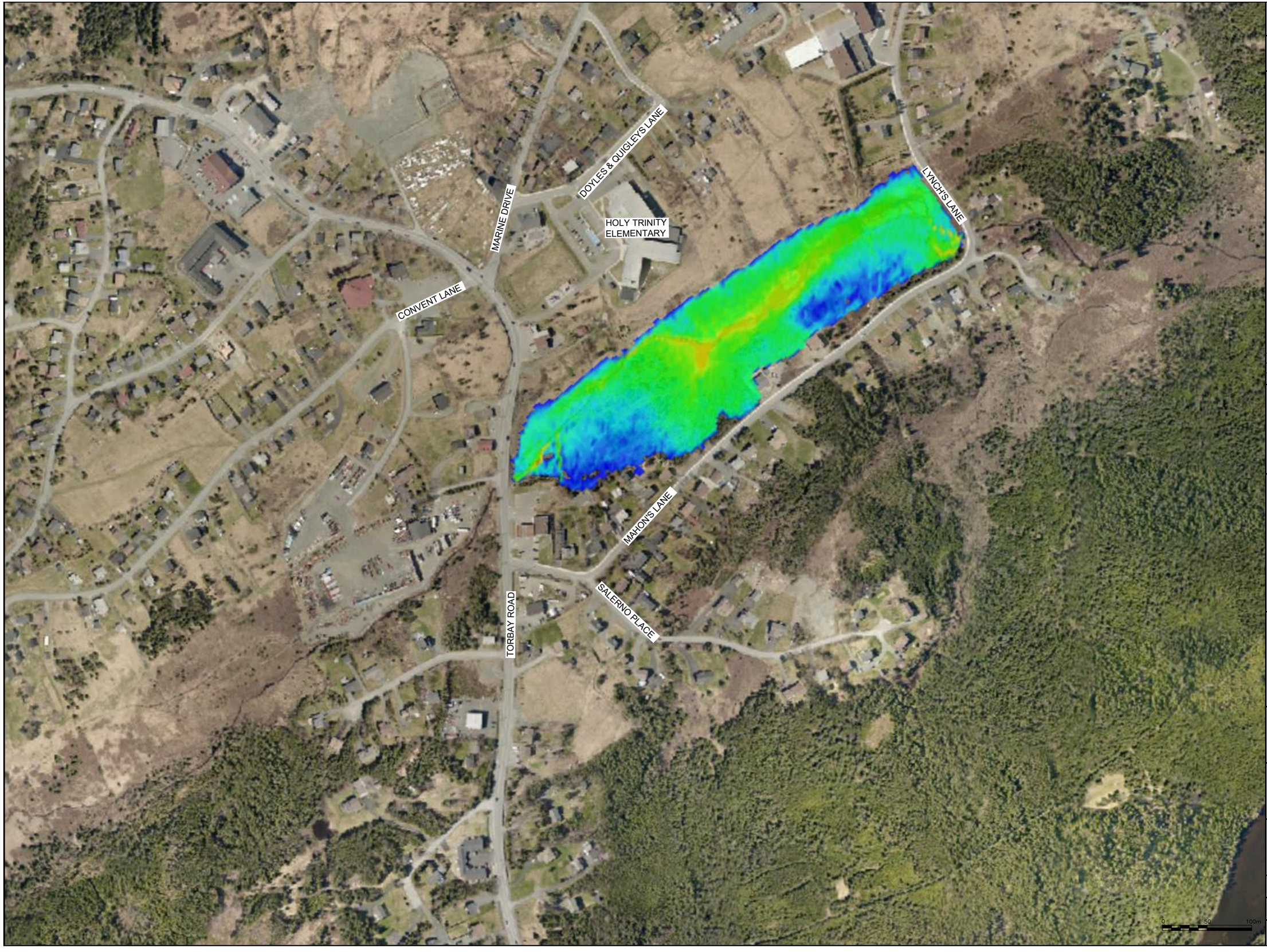
PROJECT TITLE:

STORMWATER MANAGEMENT IMPLEMENTATION PLAN PRIORITY LIST

DRAWING TITLE:

SKIPPER'S LANDING CATCHMENT FLOODPLAIN MAPPING
100 YEAR - 2 HOUR CC (2 of 2)

DRAWN BY:	DESIGNED BY:	APPROVED BY:
C.L.	C.L.	VB
MAE No:	DATE:	SCALE:
N/A	FEB 2020	AS SHOWN
PROJECT No:	DRAWING No:	REV:
2019-047	PR-10	A



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TOWN OF TORBAY

PROJECT TITLE:

STORMWATER MANAGEMENT IMPLEMENTATION PLAN PRIORITY LIST

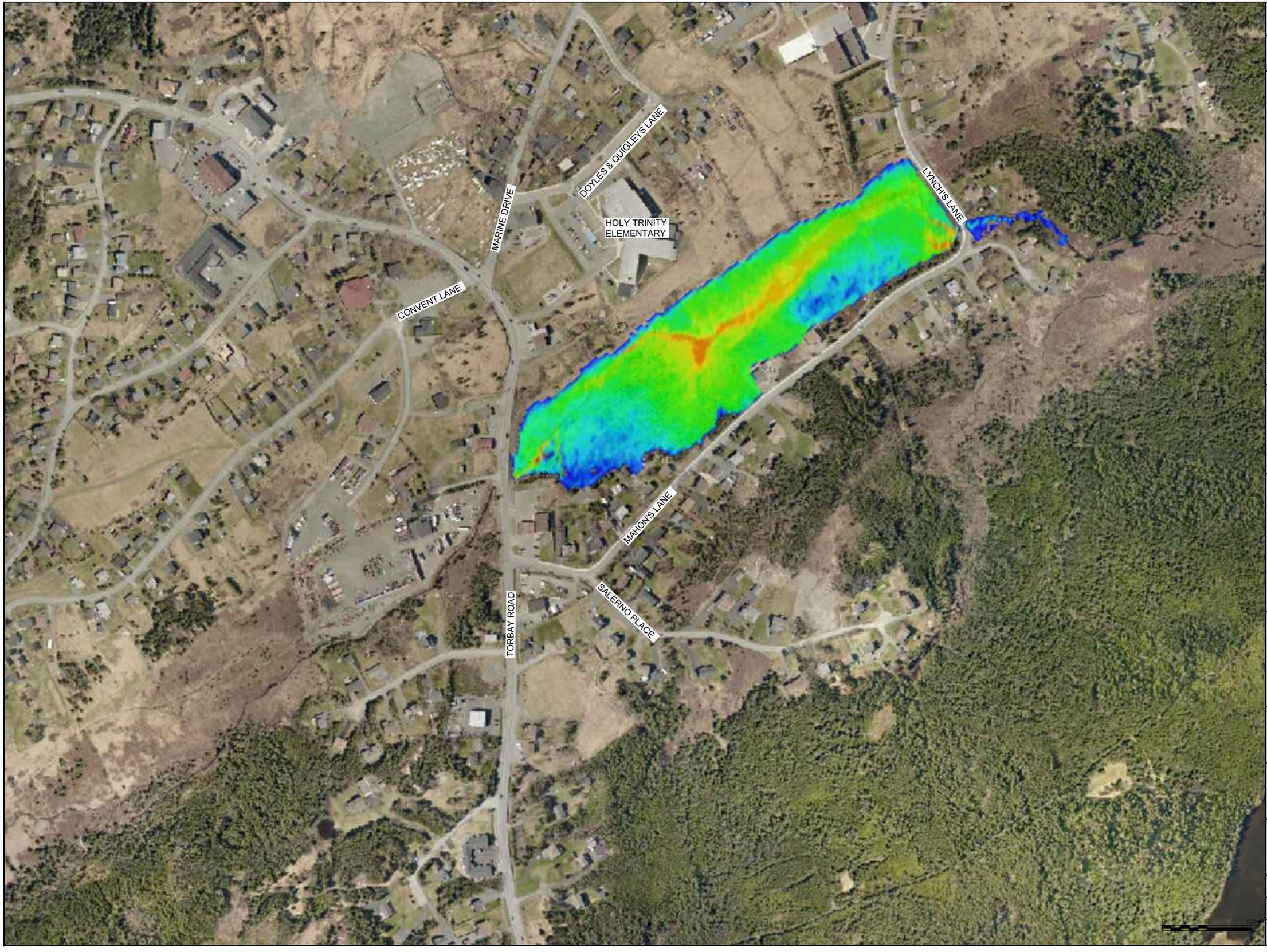
DRAWING TITLE:

"THE GULLY" CATCHMENT FLOODPLAIN MAPPING 100 YEAR - 24 HOUR CC

DRAWN BY:	DESIGNED BY:	APPROVED BY:
C.L.	C.L.	VB

MAE No:	DATE:	SCALE:
N/A	FEB 2020	AS SHOWN

PROJECT No:	DRAWING No:	REV:
2019-047	PR-22	A



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STORMWATER MANAGEMENT IMPLEMENTATION PLAN PRIORITY LIST

DRAWING TITLE:
"THE GULLY" CATCHMENT FLOODPLAIN MAPPING 100 YEAR - 12 HOUR CC

DRAWN BY:	DESIGNED BY:	APPROVED BY:
C.L.	C.L.	VB
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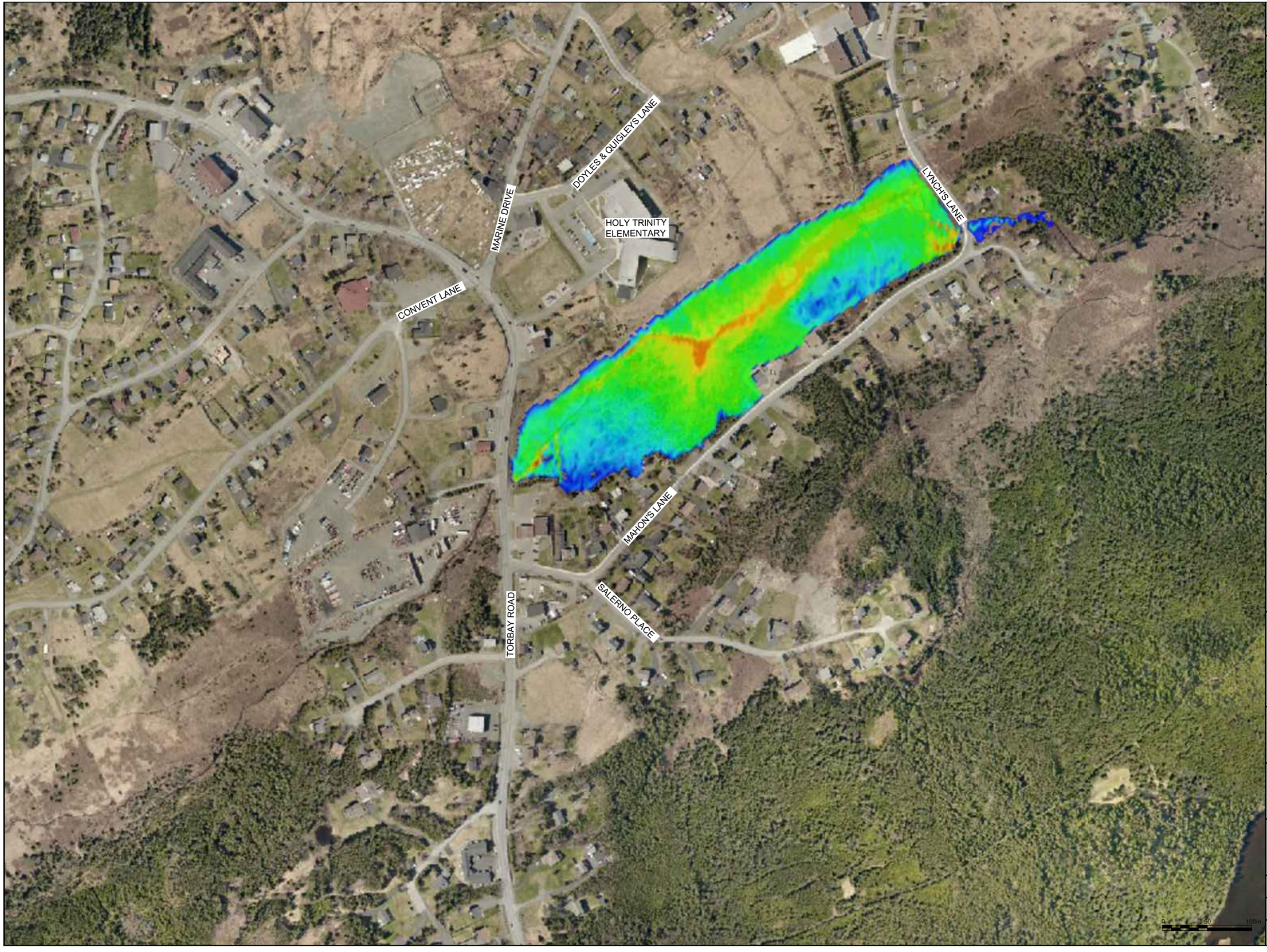
2019-047	PR-23	A



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STORMWATER MANAGEMENT IMPLEMENTATION PLAN
PRIORITY LIST

DRAWING TITLE:
"THE GULLY" CATCHMENT FLOODPLAIN MAPPING
100 YEAR - 6 HOUR CC

DRAWN BY:	DESIGNED BY:	APPROVED BY:
C.L.	C.L.	VB
MAE No:	DATE:	SCALE:
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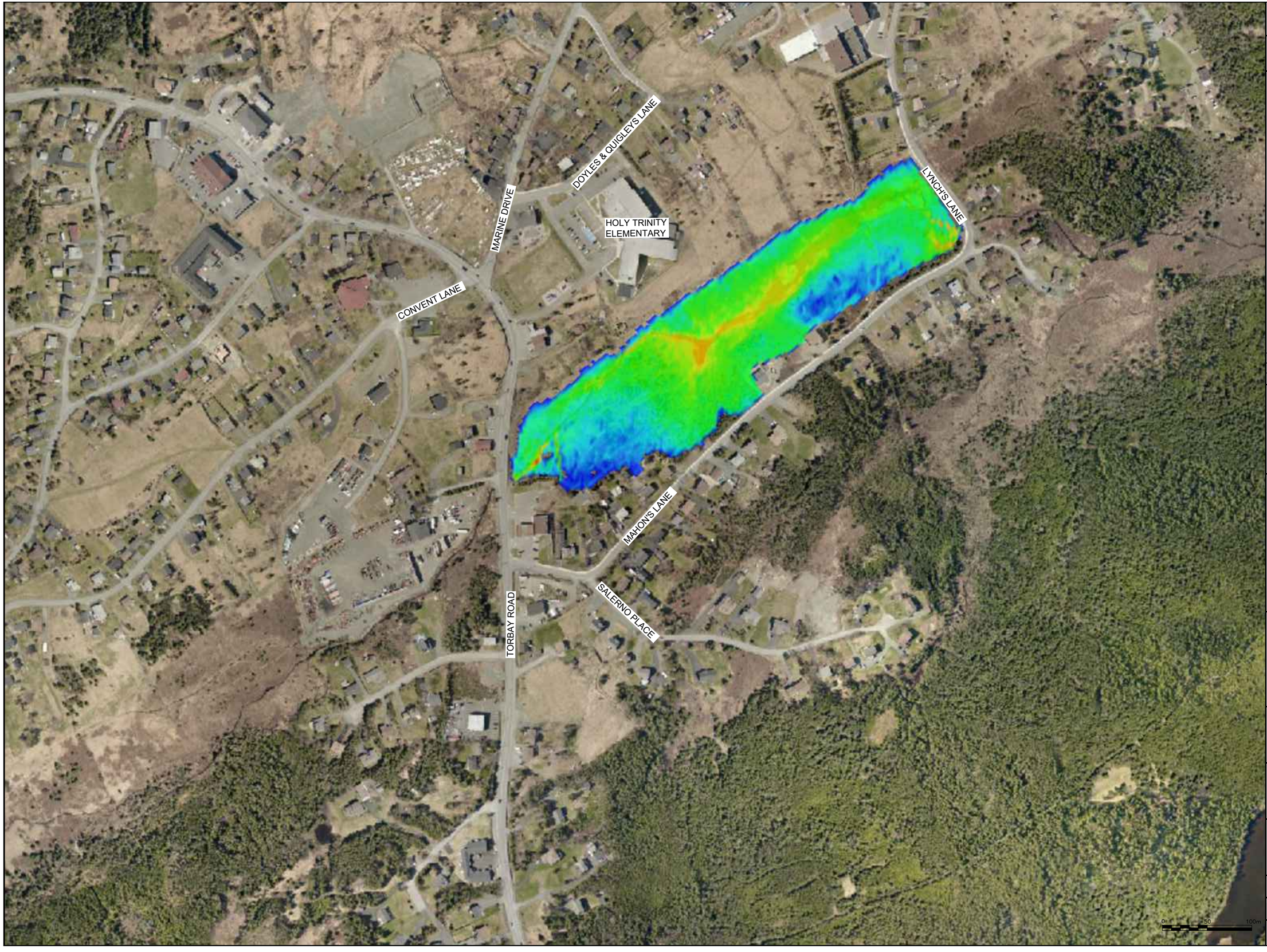
PROJECT No:	DRAWING No:	REV:
2019-047	PR-24	A



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TOWN OF TORBAY

PROJECT TITLE:

STORMWATER MANAGEMENT IMPLEMENTATION PLAN PRIORITY LIST

DRAWING TITLE:

"THE GULLY" CATCHMENT FLOODPLAIN MAPPING 100 YEAR - 2 HOUR CC

DRAWN BY:	DESIGNED BY:	APPROVED BY:
C.L.	C.L.	VB
MAE No:	DATE:	SCALE:
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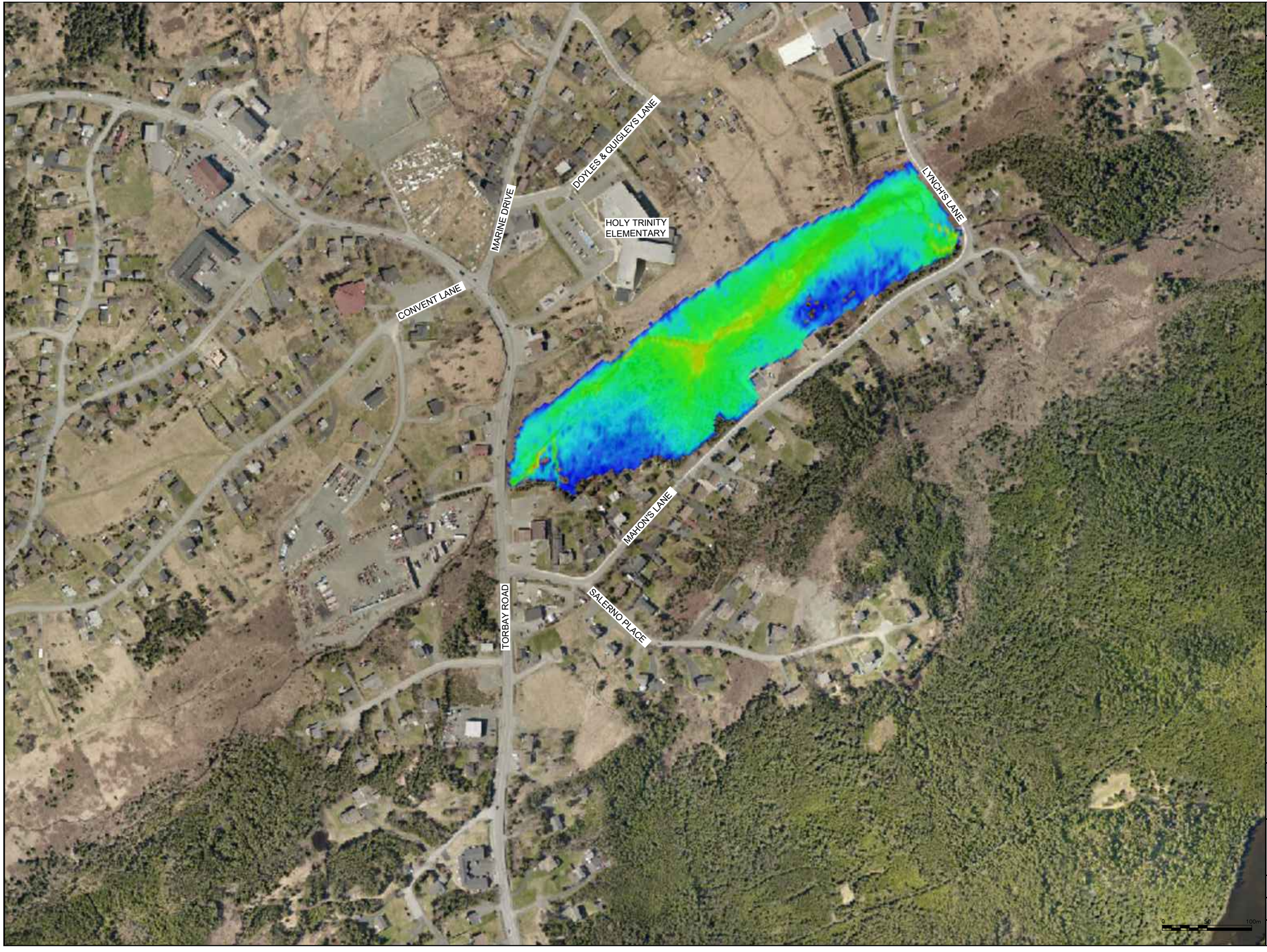
PROJECT No:	DRAWING No:	REV:
2019-047	PR-25	A



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PROJECT TITLE:
STORMWATER MANAGEMENT IMPLEMENTATION PLAN
PRIORITY LIST

DRAWING TITLE:
"THE GULLY" CATCHMENT FLOODPLAIN MAPPING
100 YEAR - 1 HOUR CC

DRAWN BY:	DESIGNED BY:	APPROVED BY:
C.L.	C.L.	VB
MAE No:	DATE:	SCALE:
N/A	FEB 2020	AS SHOWN
PROJECT No:	DRAWING No:	REV:
2019-047	PR-26	A

APPENDIX 'B' STORM SEWER INFRASTRUCTURE MASTERPLAN

EXISTING 1200mm Ø CSP - BAULINE LINE
CULVERTS IN GOOD CONDITION - SURCHARGING FOR 100 YEAR STORM EVENTS - MONITOR CLOSELY

EXISTING 1200mm Ø CSP - BAULINE LINE
CULVERTS IN GOOD CONDITION - NO CAPACITY ISSUES

900mm Ø CSP ARCH - HICKEY'S LANE
CULVERT IN VERY POOR CONDITION AND PARTIALLY COLLAPSED - UPGRADE IMMEDIATELY

TWIN 600mm Ø CSP CULVERTS - CANNON MARSH ROAD
CULVERTS REPLACED IN 2020

CULVERT - TORBAY ROAD
CULVERTS IN GOOD CONDITION - WITHIN FLOODPLAIN EXTENTS - MONITOR CLOSELY

TWIN CULVERTS - ANSTEYS COVE LANE
CULVERTS IN GOOD CONDITION - WITHIN FLOODPLAIN EXTENTS - MONITOR CLOSELY

TWIN 1200mm Ø CSP CULVERTS - DUNPHY'S LANE

TWIN 900mm Ø CSP CULVERTS - SHEAS LANE
CULVERTS REPLACED IN 2020

CONCRETE BRIDGE STRUCTURE - TORBAY ROAD
BRIDGE HAS EXCESS CAPACITY AND IS IN GOOD STRUCTURAL CONDITION

2200mm RISE X 3100mm SPAN ARCH CULVERT - TORBAY ROAD
CULVERT IN GOOD CONDITION - NO SIGNS OF FLOODING

WATERFALL INFRASTRUCTURE - TORBAY ROAD

COUNTRY DRIVE

TWIN 1200mm Ø CSP CULVERTS - MOORE'S VALLEY ROAD

900mm Ø CSP ARCH - HICKEY'S LANE
CULVERTS REPLACED IN 2020

TWIN 600mm Ø CSP CULVERTS - COUNTRY DRIVE
CULVERTS IN GOOD CONDITION - FLOODING DURING 100 YEAR STORM EVENTS

TWIN 900mm Ø CSP WOODFINES LANE
CULVERTS IN GOOD CONDITION - NO CAPACITY ISSUES

EXISTING 1200mm Ø CSP - INDIAN MEAL LINE
CULVERTS IN GOOD CONDITION - NO CAPACITY ISSUES

600mm & 900mm Ø CSP CULVERTS - QUIGLEYS LANE
CULVERTS IN POOR CONDITION - REPLACE IMMEDIATELY

ARCH BOTTOMLESS CULVERT 4000mm SPAN x 1240mm RISE
CULVERT UNDERSIZED - MONITOR

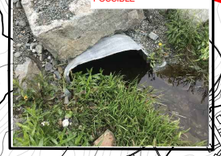
2000mm Ø CSP - TORBAY ROAD
CULVERT IN GOOD CONDITION

2000mm Ø CSP - TORBAY ROAD
CULVERT IN GOOD CONDITION

EXISTING 600mm & 700mm Ø CSP CULVERTS - SKIPPER'S LANDING - TO BE REPLACED

TWIN 1500mm Ø CSP CULVERTS - RATTLING BROOK DRIVE
CULVERTS FLOODING FOR 100 YEAR STORM EVENTS - PLAN TO REPLACE

900mm Ø CSP - ROSEBUD STREET
CULVERT IN POOR CONDITION - COMPRESSED - REPLACE AS SOON AS POSSIBLE



1200mm Ø CSP CULVERT - WESTERN ISLAND POND ROAD
CULVERT IN GOOD CONDITION - IS UNDERSIZED MONITOR CLOSELY

3600mm SPAN x 2000mm RISE ARCH BOTTOMLESS CULVERT - CAPTAIN MATTHEW DAVIS DRIVE
CULVERTS IN GOOD CONDITION - NO CAPACITY ISSUES

GREAT POND

WITHROD POND

WITHROD POND

AXIS POND

NORTH POND

SOUTH POND

WESTERN ISLAND POND

BAULINE LINE

INDIAN MEAL LINE

TORBAY ROAD

TORBAY BYPASS ROAD

MARINE DRIVE

MAHON'S LANE

0 100 300 500mm

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CULVERT IS IN POOR CONDITION OR POSES A FLOOD RISK - REPLACE AS SOON AS POSSIBLE

CULVERT SHOWS FLOODING FOR SOME 100 YEAR STORM EVENTS - NO EVIDENCE OF HISTORICAL FLOODING - CULVERT IS OTHERWISE IN GOOD STRUCTURAL CONDITOIN

CULVERT SHOWS NO SIGNS OF FLOODING - IS IN GOOD CONDITION

CULVERT HAS BEEN REPLACED AND UPGRADED

TOWN OF TORBAY MUNICIPAL BORDER

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TOWN OF TORBAY

PROJECT TITLE:
STORMWATER MANAGEMENT IMPLEMENTATION PLAN PRIORITY LIST

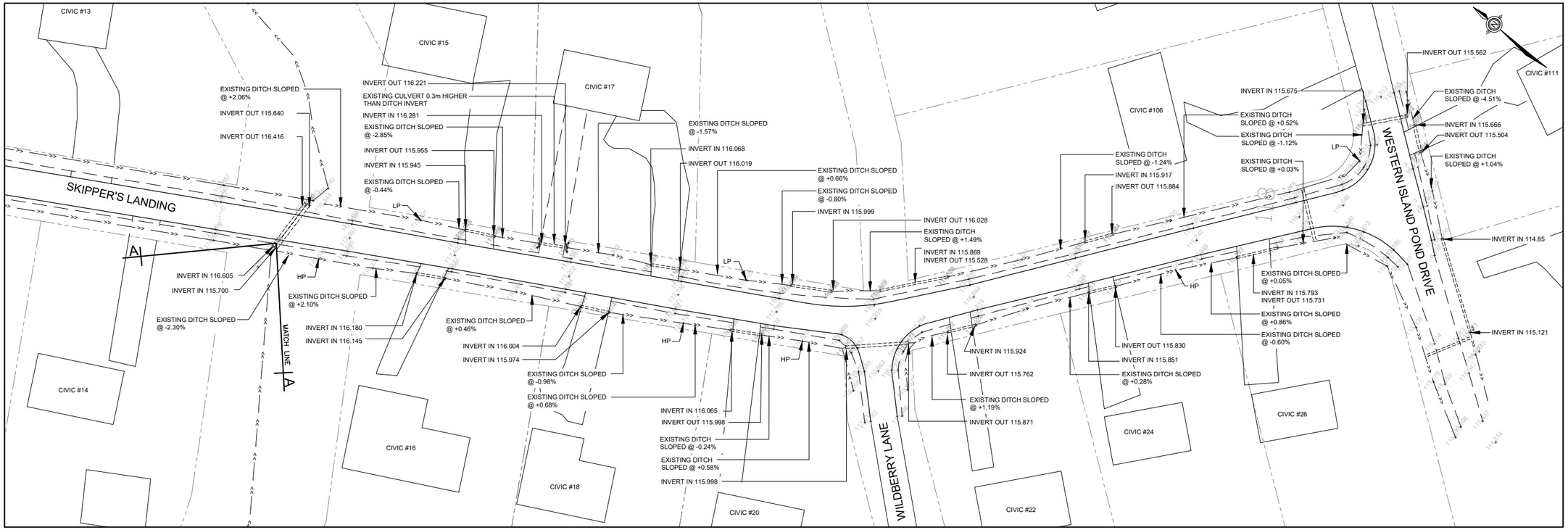
DRAWING TITLE:
STORM SEWER INFRASTRUCTURE MASTER PLAN

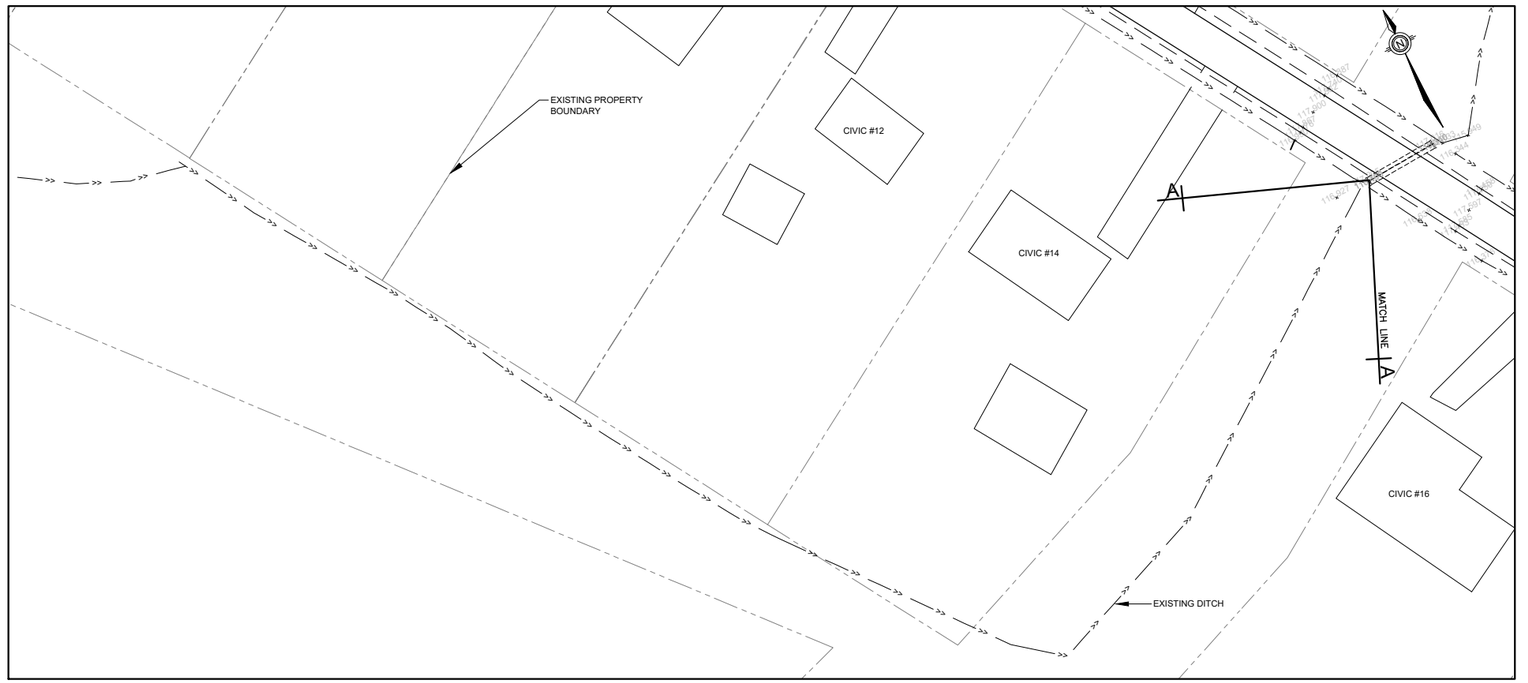
DRAWN BY:	DESIGNED BY:	APPROVED BY:
C.L.	C.L.	V.B.

MAE No:	DATE:	SCALE:
N/A	JAN 2020	AS SHOWN

PROJECT No:	DRAWING No:	REV:
2019-047	PR-21	

APPENDIX 'C' UPGRADES CONCEPTS





0 5 15 25m

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LEGEND	
SYMBOL	DESCRIPTION
HP	HIGH POINT
LP	LOW POINT
	EXISTING CULVERT
	EXISTING DITCH

No.	REVISIONS	APP	DWN	DATE
0	ISSUED FOR APPROVAL	DM	RM	18/03/05

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DARRYL MILLS
SIGNATURE
18/03/05
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TOWN OF TORBAY

PROJECT TITLE:
TORBAY STORMWATER MANAGEMENT PLAN

DRAWING TITLE:
EXISTING SITE PLAN (1 OF 4)

DRAWN BY:	DESIGNED BY:	APPROVED BY:
T.P.	T.P.	D.M.
MAE No:	DATE:	SCALE:
N/A	JULY 2016	AS SHOWN
PROJECT No:	DRAWING No:	REV:
2018-021	PR-23	0

NOTES:
1) REGRADE EXISTING DITCHES AND EXISTING DRIVEWAY CULVERTS TO ENSURE POSITIVE DRAINAGE. INSTALL NEW CULVERTS AS NOTED AND REINSTATE ALL DRIVEWAYS AND DISTURBED AREAS.
2) ALL CULVERTS WITH NEW INVERTS MUST BE CAREFULLY REMOVED AND REPLACED AT THE NEW INVERTS. ALL CULVERTS DAMAGED DURING REMOVAL MUST BE REPLACED WITH A COMPLETELY NEW CULVERT.

BENCH MARK:

MONUMENT - 83G3308
NORTHING - 5278658.656
EASTING - 322053.380
ELEVATION - 116.891

EXISTING BOUNDARY PROPERTY

CIVIC #94
CIVIC #101
CIVIC #103
CIVIC #918
CIVIC #104
CIVIC #107
CIVIC #13
CIVIC #15
CIVIC #17
CIVIC #106
CIVIC #111
CIVIC #16
CIVIC #18
CIVIC #20
CIVIC #22
CIVIC #24
CIVIC #26
CIVIC #3

WESTERN ISLAND POND DRIVE
SKIPPER'S LANDING
WILDBERRY LANE

RE-GRADE EXISTING 31.58m DITCH FROM UPSTREAM CULVERT (NW) TO DOWNSTREAM CULVERT (SE) AT +0.50%. ENSURE POSITIVE GRADE.

INSTALL A HYDRAULIC BREAK IN DITCH LINE USING APPROXIMATELY 3.0 m^3 OF IMPERMEABLE USM FROM THE NEW DITCH EXCAVATION WORKS. TOP ELEVATION TO BE 200mm BELOW ASPHALT

REPLACE EXISTING 600mmØ AND 700mmØ CSP CULVERTS WITH 2 NEW 12m LONG 750mmØ HDPE CULVERTS @ MIN. 2.5%. ENSURE POSITIVE DRAINAGE OF WATERCOURSE DOWNSTREAM OF NEW CULVERTS.

RE-GRADE EXISTING 9.87m DITCH FROM UPSTREAM CULVERT (NW) TO DOWNSTREAM CULVERT (SE) AT +0.50%. ENSURE POSITIVE GRADE.
NEW INV. OUT = 116.13m
NEW INV. IN = 116.16m

NEW INV. IN = 116.08m
NEW INV. OUT = 116.05m

RE-GRADE EXISTING 18.90m DITCH FROM UPSTREAM CULVERT (NW) TO DOWNSTREAM CULVERT (SE) AT +0.50%. ENSURE POSITIVE GRADE.
NEW INV. IN = 115.96m
NEW INV. OUT = 115.93m

RE-GRADE EXISTING 24.85m DITCH FROM UPSTREAM CULVERT (NW) TO DOWNSTREAM CULVERT (SE) AT +0.50%. ENSURE POSITIVE GRADE.
NEW INV. IN = 115.81m
NEW INV. OUT = 115.76m

RE-GRADE EXISTING 10.66m DITCH FROM UPSTREAM CULVERT (NW) TO DOWNSTREAM CULVERT (SE) AT +0.50%. ENSURE POSITIVE GRADE.
NEW INV. IN = 115.71m
NEW INV. OUT = 115.63m

RE-GRADE EXISTING 23m DITCH FROM UPSTREAM CULVERT (NE) TO DOWNSTREAM NEW CULVERT (NW) AT +2.00%. ENSURE POSITIVE GRADE.
RE-GRADE EXISTING 31.26m DITCH FROM UPSTREAM CULVERT (NW) TO DOWNSTREAM CULVERT (SE) AT +0.50%. ENSURE POSITIVE GRADE.
NEW INV. IN = 115.47m
NEW INV. OUT = 115.44m

RE-GRADE EXISTING 3.41m DITCH FROM UPSTREAM CULVERT (N) TO DOWNSTREAM CULVERT (S) AT +0.50%. ENSURE POSITIVE GRADE.
NEW INV. IN = 115.53m
EX INV. OUT = 115.50m TO REMAIN
NEW INV. IN = 115.22m
12m - NEW 600mmØ HDPE CULVERT
NEW INV. OUT = 115.16m
EXISTING CULVERT TO REMAIN

RE-GRADE EXISTING 31.40m DITCH FROM UPSTREAM CULVERT (NW) TO DOWNSTREAM CULVERT (SE) AT +0.68%. ENSURE POSITIVE GRADE.

EX. INV. IN = 116.18m
EX. 450mmØ CSP CULVERT @ +0.54%
EX. INV. OUT = 116.15m
EX. 30.58m DITCH SLOPED @ +0.46%
EX. INV. IN = 116.00m
EX. 450mmØ CSP CULVERT @ +0.46%
EX. INV. OUT = 115.97m
RE-GRADE EXISTING 27.16m DITCH FROM UPSTREAM CULVERT (NW) TO DOWNSTREAM CULVERT (SE) AT +0.50%. ENSURE POSITIVE GRADE.
NEW INV. IN = 115.83m
NEW INV. OUT = 115.80m
RE-GRADE EXISTING 18.97m DITCH FROM UPSTREAM CULVERT (NW) TO DOWNSTREAM CULVERT (SE) AT +0.50%. ENSURE POSITIVE GRADE.
NEW INV IN = 115.71
EX. DITCH INV. 116.07m
EX. DITCH INV. 115.99m

RE-GRADE EXISTING 25.99m DITCH FROM UPSTREAM CULVERT (NW) TO DOWNSTREAM CULVERT (SE) AT +0.50%. ENSURE POSITIVE GRADE.
NEW INV. OUT = 115.56m
EXISTING 450mmØ CSP TO BE REPLACED WITH NEW 600Ø HDPE CULVERT
NEW INV. IN = 115.59m
RE-GRADE EXISTING 9.19m DITCH FROM UPSTREAM CULVERT (NW) TO DOWNSTREAM CULVERT (SE) AT +0.50%. ENSURE POSITIVE GRADE.
NEW INV. OUT = 115.64m

RE-GRADE EXISTING 27.41m DITCH FROM UPSTREAM CULVERT (NW) TO DOWNSTREAM CULVERT (SE) AT +0.50%. ENSURE POSITIVE GRADE.
NEW INV. OUT = 115.40m
NEW INV. IN = 115.43m
EXISTING 450mmØ CSP TO BE REPLACED WITH NEW 600Ø HDPE CULVERT

NEW INV. OUT = 115.21m
NEW INV. IN = 115.26m
NEW INV. IN = 115.12m
NEW INV. OUT = 114.96m
EXISTING DITCH TO BE FILLED IN
10m - NEW 450mmØ HDPE CULVERT. LOCATION TO BE CONFIRMED WITH THE TOWN OF TORBAY AND SITE REPRESENTATIVE

CONTRACTOR TO VERIFY DITCH GRADE AND LINE APPROX. 25m OF NEW DITCH WITH 150mm MINUS ROUND COBBLE STONE AND TO ENSURE POSITIVE DRAINAGE

EXISTING ELEVATION OF DITCH AT THIS POINT = 114.87m. CONTRACTOR TO ENSURE POSITIVE DRAINAGE TO EXISTING DITCH

REFER TO DWG# C5 MATCH LINE

0 5 15 25m

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LEGEND	
SYMBOL	DESCRIPTION
≻═══≺	EXISTING CULVERT
—>>—	EXISTING DITCH

No.	REVISIONS	APP	DWN	DATE
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DARRYL MILLS
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PROJECT TITLE:
STORMWATER IMPLEMENTATION PLAN PRIORITY LIST

DRAWING TITLE:
SKIPPER'S LANDING NEW SITE PLAN (2 OF 4)

DRAWN BY:	DESIGNED BY:	APPROVED BY:
T.P.	T.P.	D.M.
MAE No:	DATE:	SCALE:
N/A	JULY 2016	AS SHOWN
PROJECT No:	DRAWING No:	REV:
2018-021	PR-24	0

NOTE: DEPTH AND TOTAL WIDTH OF DITCH WILL VARY DEPENDING ON SURROUNDING EXISTING LANDSCAPE. MAINTAIN 1250mm BOTTOM WIDTH AND 2:1 SIDE SLOPING.

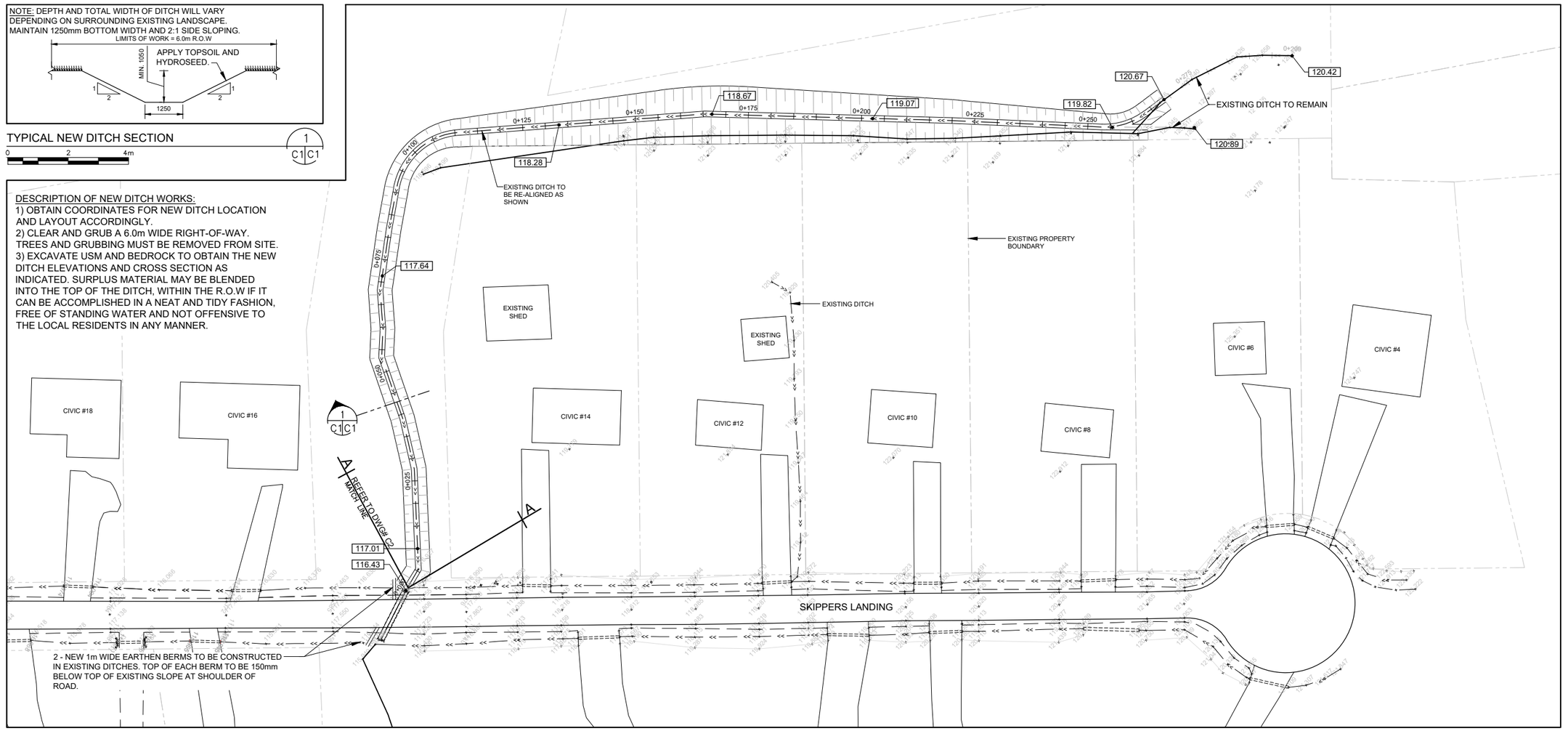
TYPICAL NEW DITCH SECTION

0 2 4m

1 C1 C1

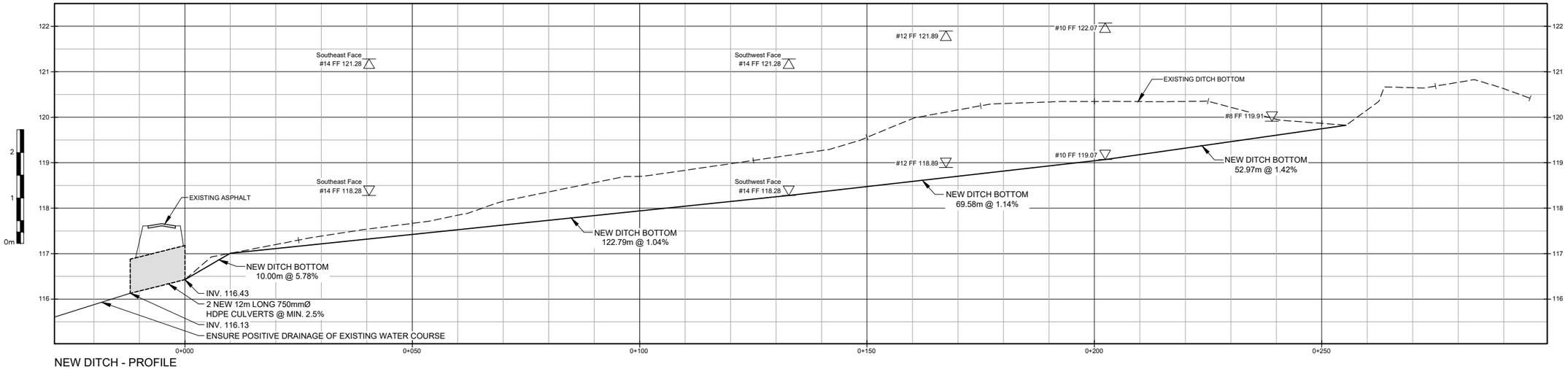
DESCRIPTION OF NEW DITCH WORKS:

1) OBTAIN COORDINATES FOR NEW DITCH LOCATION AND LAYOUT ACCORDINGLY.
2) CLEAR AND GRUB A 6.0m WIDE RIGHT-OF-WAY. TREES AND GRUBBING MUST BE REMOVED FROM SITE.
3) EXCAVATE USM AND BEDROCK TO OBTAIN THE NEW DITCH ELEVATIONS AND CROSS SECTION AS INDICATED. SURPLUS MATERIAL MAY BE BLENDED INTO THE TOP OF THE DITCH, WITHIN THE R.O.W IF IT CAN BE ACCOMPLISHED IN A NEAT AND TIDY FASHION, FREE OF STANDING WATER AND NOT OFFENSIVE TO THE LOCAL RESIDENTS IN ANY MANNER.



NEW DITCH - PLAN

0 5 15 25m



NEW DITCH - PROFILE

0 5 15 25m

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LEGEND	
SYMBOL	DESCRIPTION
HP	HIGH POINT
LP	LOW POINT

No.	REVISIONS	APP	DWN	DATE
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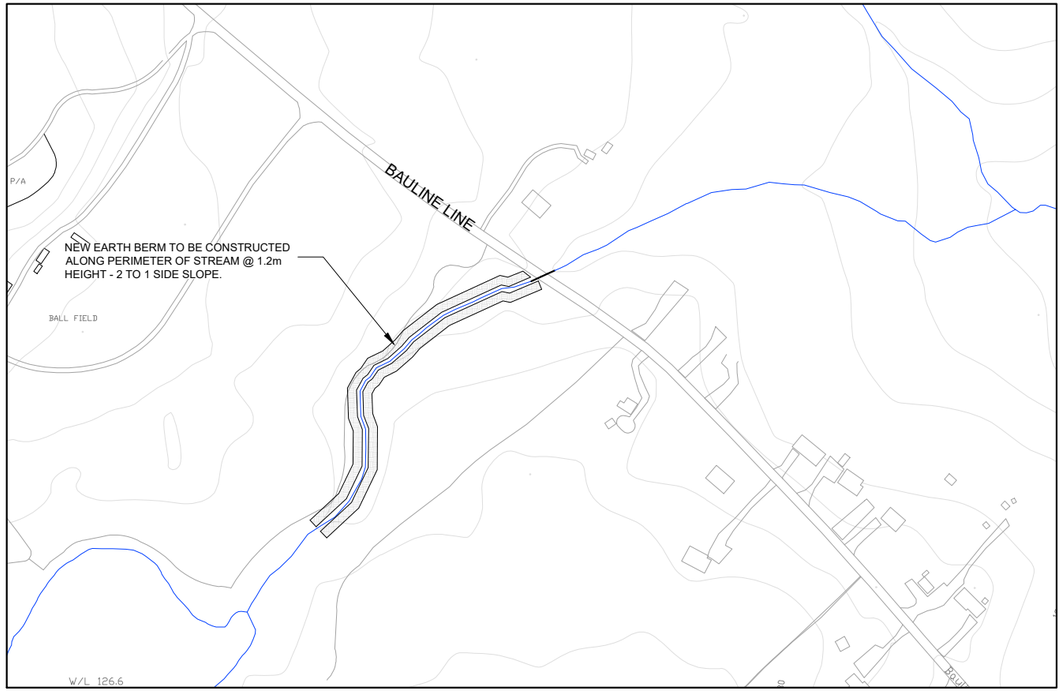
STORMWATER IMPLEMENTATION PLAN PRIORITY LIST

DRAWING TITLE:

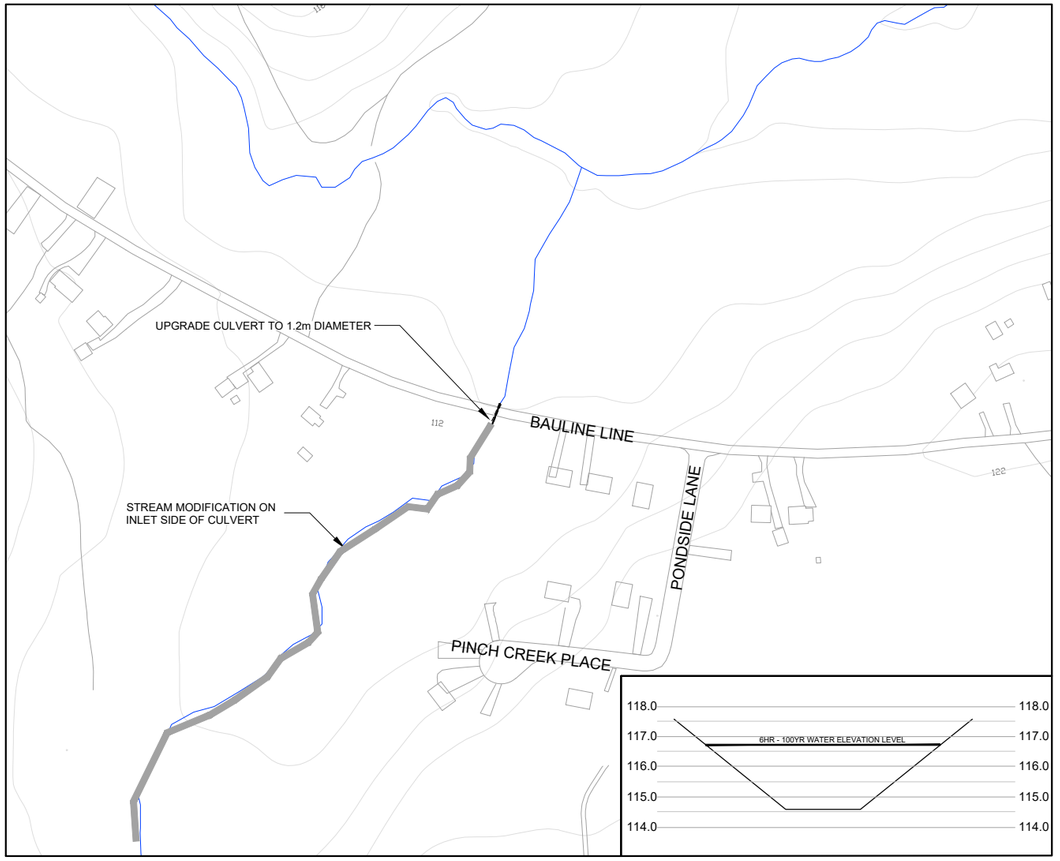
NEW DITCH PLAN AND PROFILE (3 OF 4)

DRAWN BY:	DESIGNED BY:	APPROVED BY:
J.P.P.	J.P.P.	D.M.
MAE No:	DATE:	SCALE:
N/A	OCT. 2017	AS SHOWN
PROJECT No:	DRAWING No:	REV:
2018-021	PR-25	0



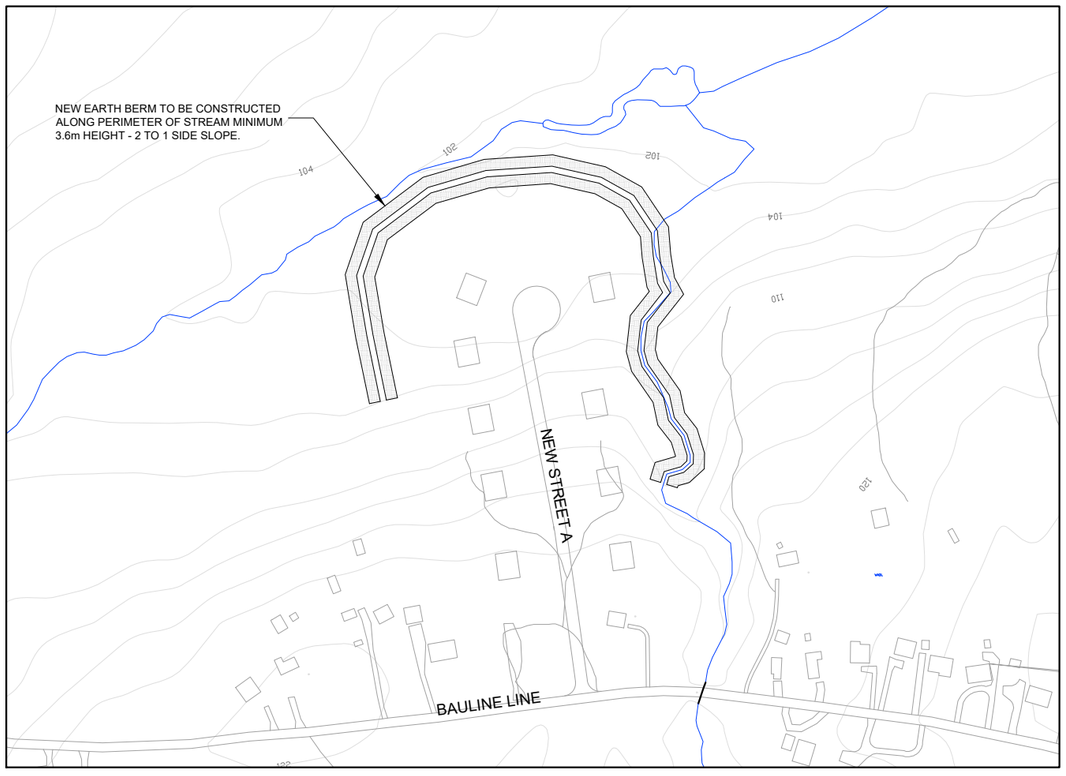
EARTH BERMS PERIMETER OF STREAM

0 50 100m



STREAM MODIFICATION AND UPGRADE EXISTING CULVERT

0 50 100m



EARTH BERMS AROUND PROPERTIES

0 50 100m

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PROJECT TITLE:

STORMWATER IMPLEMENTATION PLAN PRIORITY LIST

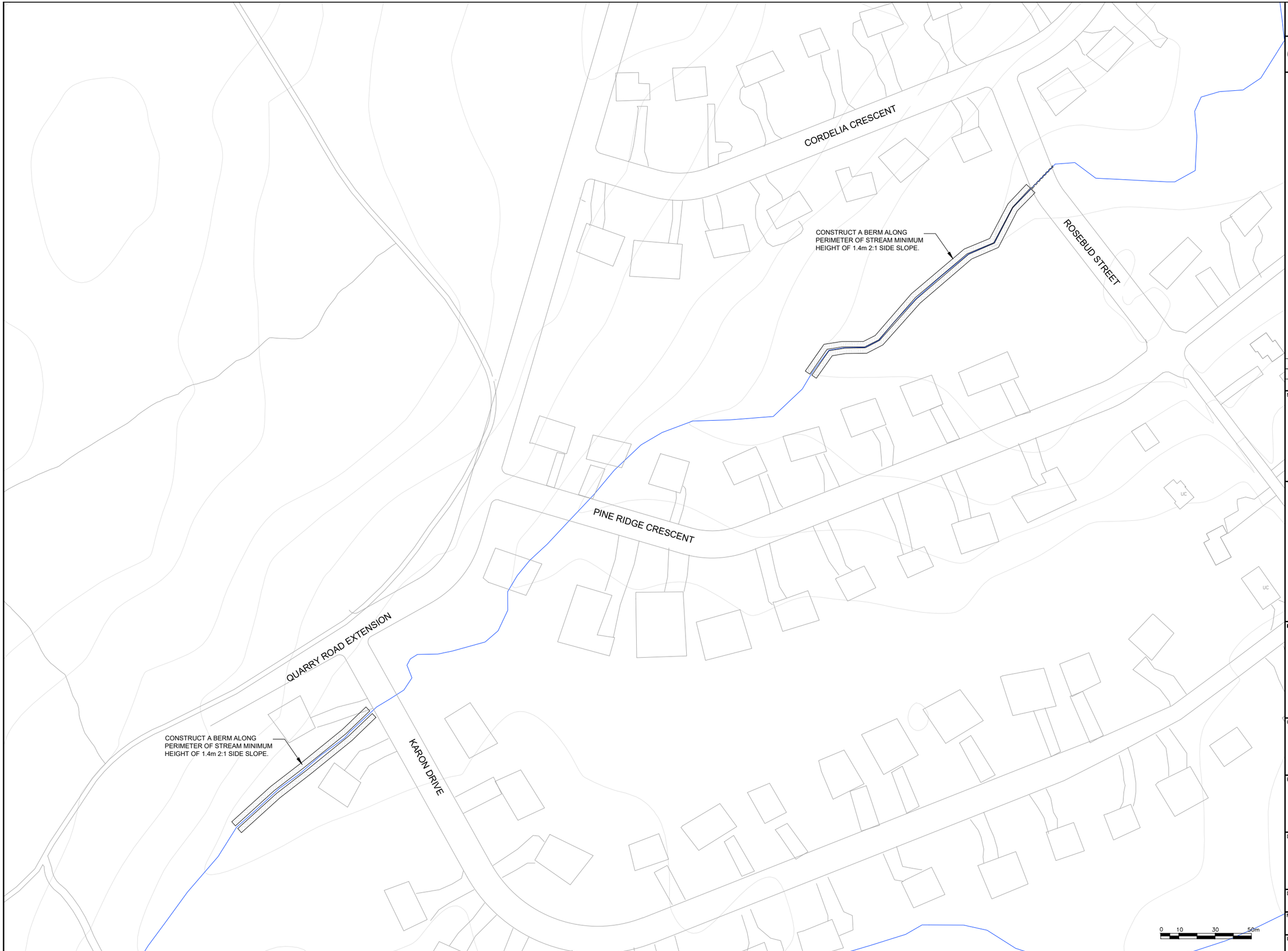
DRAWING TITLE:

BIG RIVER CONCEPT UPGRADES

DRAWN BY:	DESIGNED BY:	APPROVED BY:
C.L.	C.L.	VB

MAE No:	DATE:	SCALE:
N/A	FEB 2020	AS SHOWN

PROJECT No:	DRAWING No:	REV:
2019-047	PR-30	A



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C - No. OF DRAWING WHERE 'A' IS DETAILED

No.	REVISIONS	APP	DWN	DATE
A	ISSUED FOR CLIENT REVIEW	VB	CL	20/02/19

NORTH:

STAMP:

REGISTERED PROFESSIONAL ENGINEER
VANESSA BARRY
SIGNATURE
20/02/19
DATE
PROVINCE OF NEWFOUNDLAND

PEC
Progressive Engineering & Consulting Inc.

PERMIT STAMP:

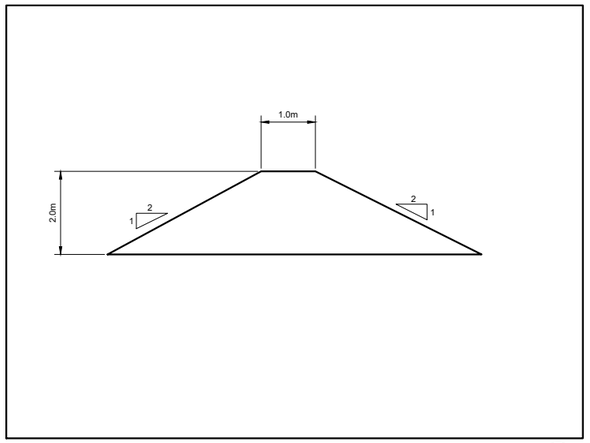
PROVINCE OF NEWFOUNDLAND AND LABRADOR
PEGNL Engineers and Geoscientists Newfoundland and Labrador
PERMIT HOLDER
This Permit Allows
PROGRESSIVE ENGINEERING & CONSULTING INC
To practice Professional Engineering in Newfoundland and Labrador.
Permit No. as issued by PEG N0566
which is valid for the year 2020

OWNER/CLIENT NAME:
TOWN OF TORBAY

PROJECT TITLE:
STORMWATER IMPLEMENTATION PLAN PRIORITY LIST

DRAWING TITLE:
KENNEDYS BOOK CONCEPT UPGRADES

DRAWN BY:	DESIGNED BY:	APPROVED BY:
C.L.	C.L.	VB
MAE No:	DATE:	SCALE:
N/A	FEB 2020	AS SHOWN
PROJECT No:	DRAWING No:	REV:
2019-047	PR-31	A



BERM SECTION 2 OF 2

0 2 4m

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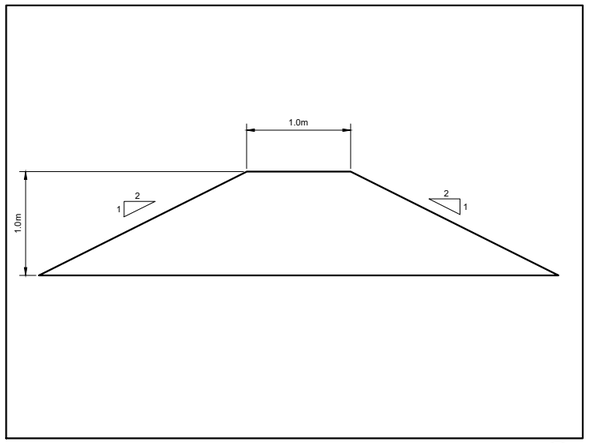

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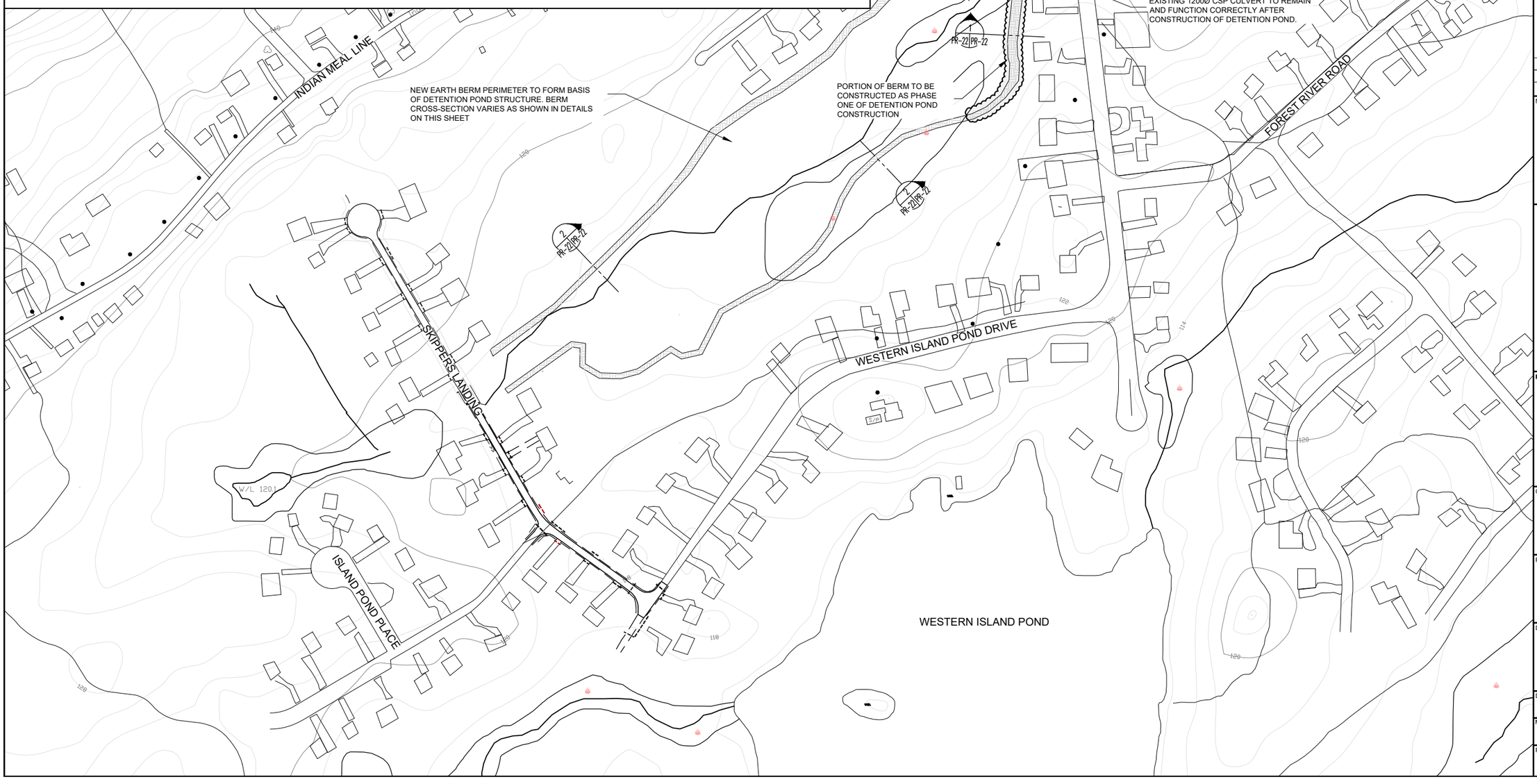
2 PR-22 PR-22



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SIGNATURE
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DATE
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OWNER/CLIENT NAME:
TOWN OF TORBAY

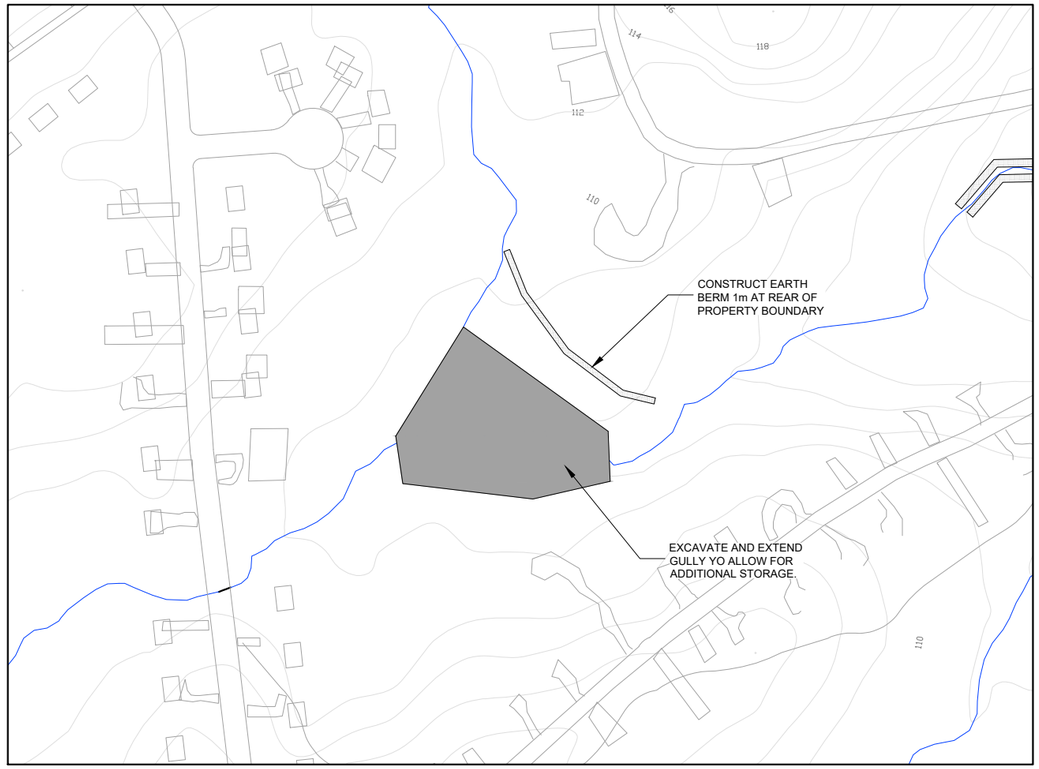
PROJECT TITLE:
STORMWATER IMPLEMENTATION PLAN PRIORITY LIST

DRAWING TITLE:
SKIPPERS LANDING DETENTION POND EARTH BERM PERIMETER

DRAWN BY:	DESIGNED BY:	APPROVED BY:
CL	CL	VB

MAE No:	DATE:	SCALE:
N/A	FEB 2020	AS SHOWN

PROJECT No:	DRAWING No:	REV:
2019-047	PR-22	A



DETENTION POND
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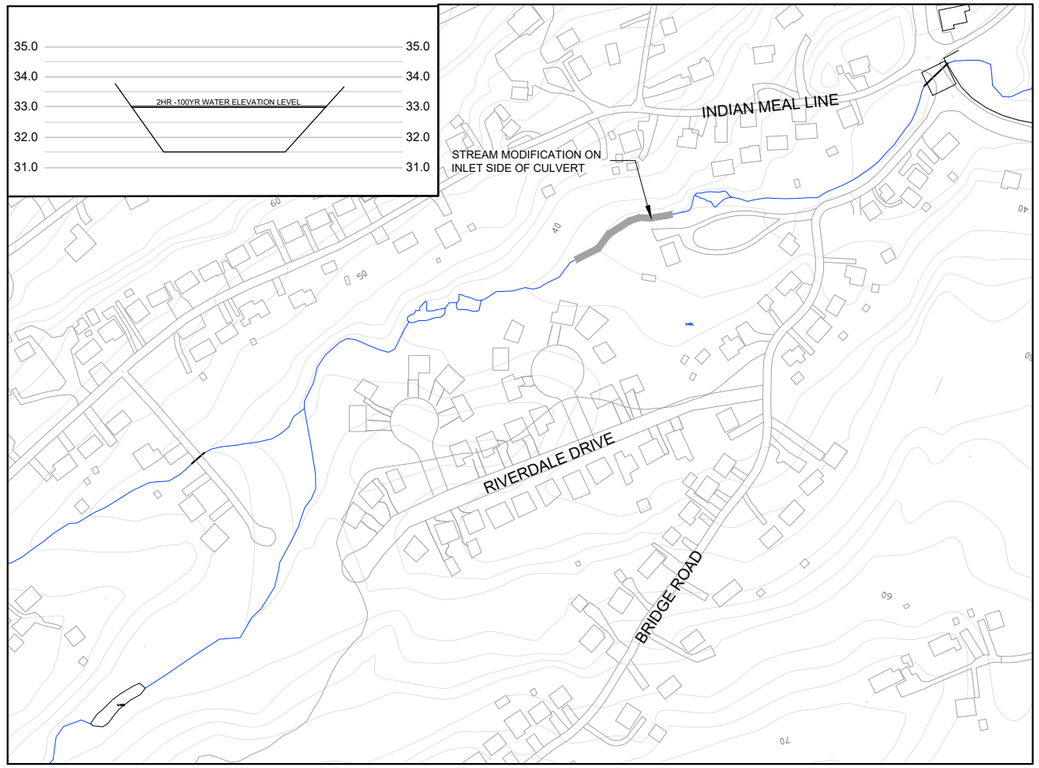

STREAM MODIFICATION
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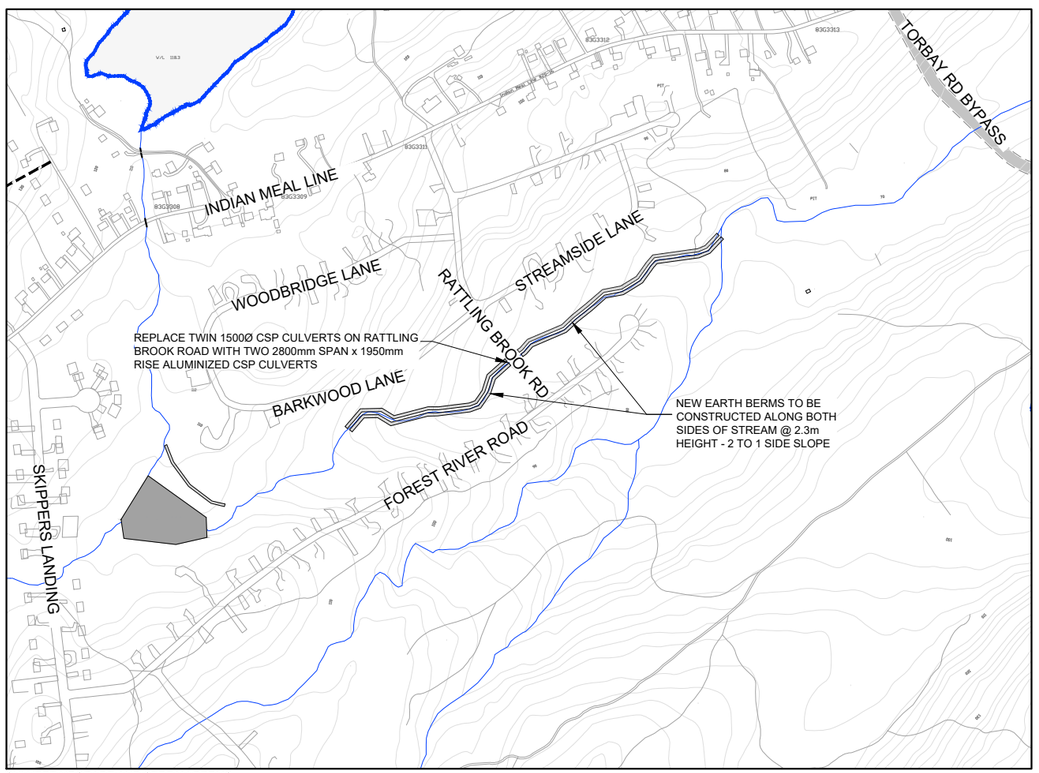

CULVERT UPGRADE AND STREAM BERMS
0 50 150 250m

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A	ISSUED FOR CLIENT REVIEW	VB	CL	20/02/19

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VANESSA BARRY
SIGNATURE
20/02/19
DATE
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Progressive Engineering & Consulting Inc.

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PEGL Newfoundland and Labrador
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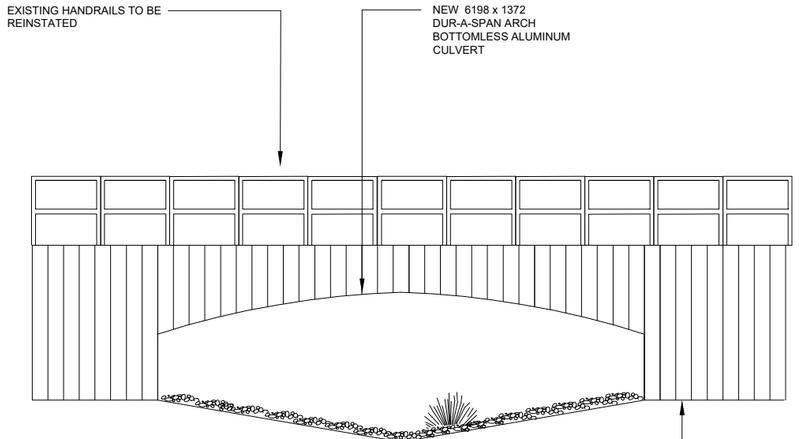
OWNER/CLIENT NAME:
TOWN OF TORBAY

PROJECT TITLE:
STORMWATER IMPLEMENTATION PLAN PRIORITY LIST

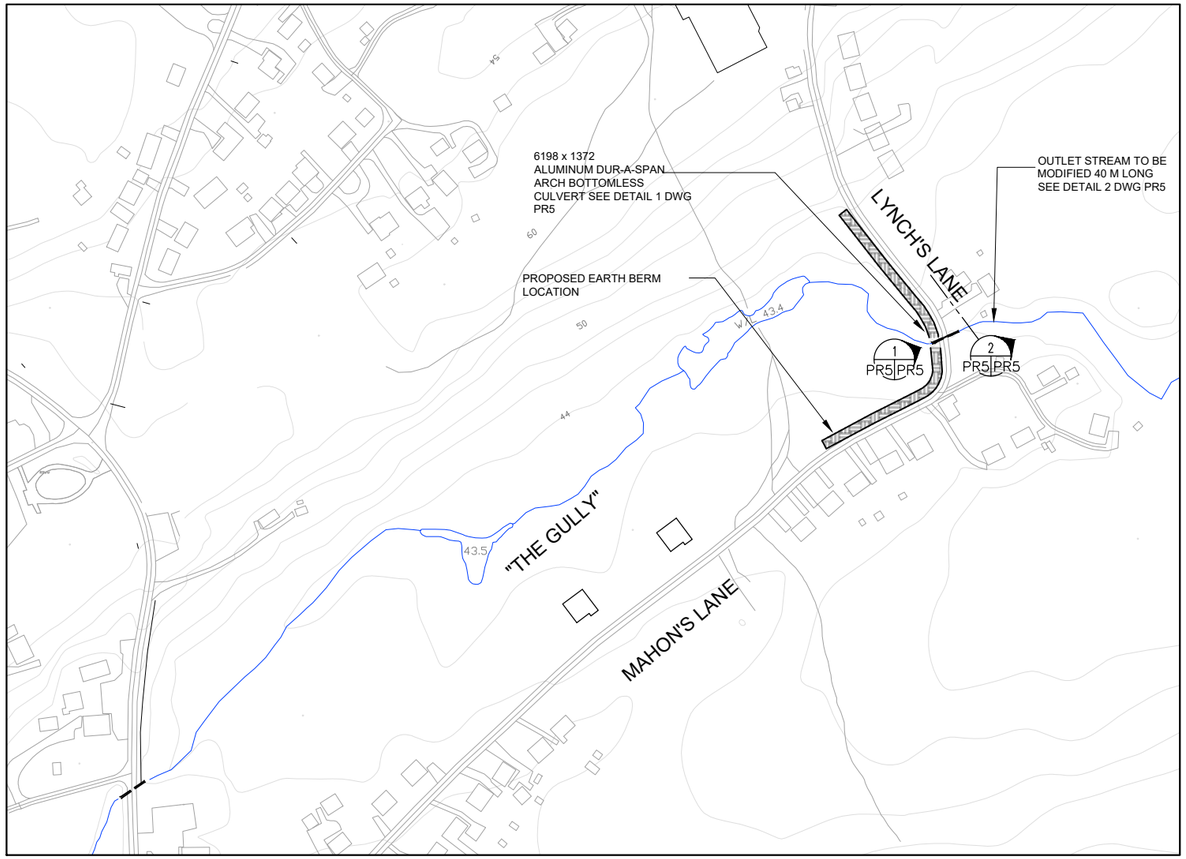
DRAWING TITLE:
ISLAND POND BROOK UPGRADES

DRAWN BY:	DESIGNED BY:	APPROVED BY:
C.L.	C.L.	VB
MAE No:	DATE:	SCALE:
N/A	FEB 2020	AS SHOWN
PROJECT No:	DRAWING No:	REV:
2019-047	PR-26	A



DUR-A-SPAN ARCH BOTTOMLESS CULVERT ELEVATION - N.T.S

1 PR6 PR6



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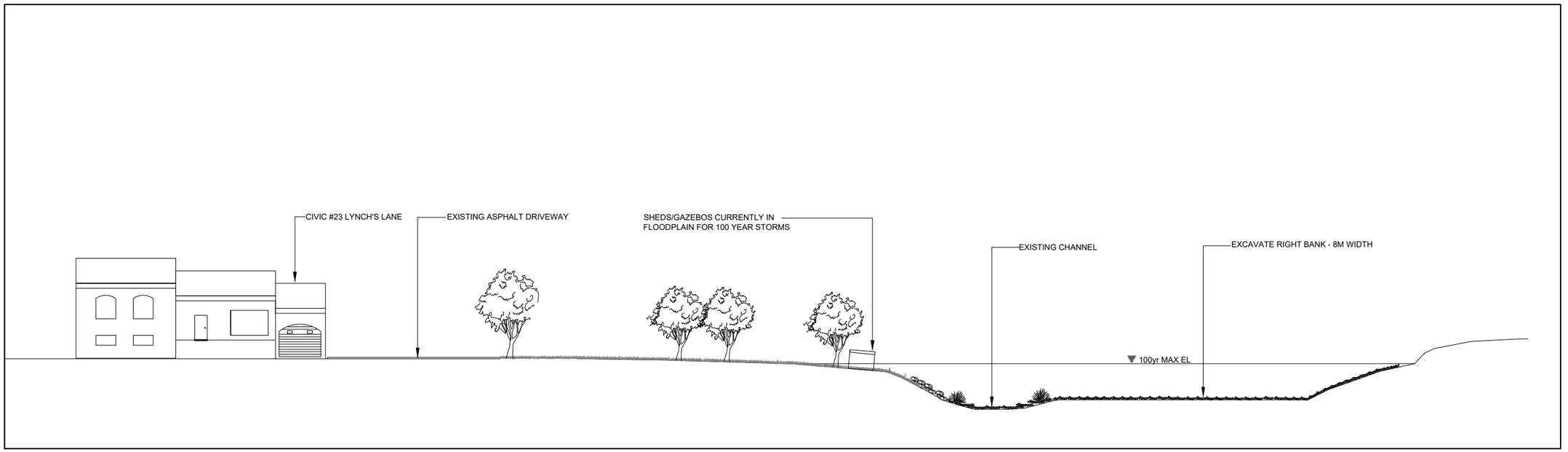

MODIFIED OUTLET SECTION - N.T.S

2 PR6 PR6

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OWNER/CLIENT NAME:
TOWN OF TORBAY

PROJECT TITLE:
STORMWATER IMPLEMENTATION PLAN PRIORITY LIST

DRAWING TITLE:
"THE GULLY" CATCHMENT UPGRADES

DRAWN BY:	DESIGNED BY:	APPROVED BY:
C.L.	C.L.	VB
MAE No:	DATE:	SCALE:
N/A	FEB 2020	AS SHOWN
PROJECT No:	DRAWING No:	REV:
2019-047	PR-27	A

APPENDIX 'D' CONCEPT ESTIMATES

PROJECT: TORBAY STORMWATER MANAGEMENT PLAN

JOB #:2019-047 PRELIMINARY COST ESTIMATE - ISLAND POND CATCHMENT CHANNEL EXCAVATION AND BERM PLACEMENT

BUDGET ESTIMATE: $243,888.84

SECTION	DESCRIPTION	UNITS	QUANTITY	UNIT PRICE	TOTAL
REV:A	ISSUED FOR APPROVALS	DATE:	29-Jan-20	APPROVED BY:	VB
				CONSTRUCTION COST:	$212,077.25
				ENGINEERING:	$31,811.59
				TOTAL:	$243,888.84
	DIVISION #1				
01010	MOBILIZATION & DEMOBILIZATION (Not greater than 5% if on the Island. Or 10% if in Labrador, of Item a. "sub-total" on last page)	LS	UNIT	$5,000.00	$5,000.00
01020	CASH ALLOWANCE				
	Misc Works as Directed by Owner	Allowance	Allowance	$20,000.00	$20,000.00
01570	TRAFFIC REGULATIONS				
	Flagperson's Wages	HOUR	80.00	$20.00	$1,600.00
	DIVISION #2				
02104	LANDSCAPING, SEEDING AND TREE PRESERVATION				
	Supply & Placing Topsoil	M^2	3200	$8.00	$25,600.00
	Hydraulic Seeding & Mulching	M^2	3200	$6.00	$19,200.00
02111	CLEARING & GRUBBING				
	Clearing	HA	0.70	$10,000.00	$7,000.00
	Grubbing	HA	0.70	$10,000.00	$7,000.00
02215	SITE WORK & SITE GRADING				
	Imported Glacial Till	M3	7400.00	$10.00	$74,000.00
02481	CHANNEL EXCAVATION, CLEARING & DEEPENING				
	Channel Excavation				
	Common	M^3	350.00	$20.00	$7,000.00
	Cleaning and Deepening of Existing Channels	M	50.00	$25.00	$1,250.00

a) SUB TOTAL	**$167,650.00**
b) CONTINGENCY (10%)	**$16,765.00**
b) H.S.T. 15% of a & b.	**$27,662.25**
c) GRAND TOTAL	**$212,077.25**

PROJECT: TORBAY STORMWATER MANAGEMENT PLAN

JOB #:2019-047 PRELIMINARY COST ESTIMATE - ISLAND POND CATCHMENT CULVERT REPLACEMENT

BUDGET ESTIMATE: $411,293.47

SECTION	DESCRIPTION	UNITS	QUANTITY	UNIT PRICE	TOTAL
REV:A	ISSUED FOR APPROVALS	DATE:	29-Jan-20	APPROVED BY:	VB
				CONSTRUCTION COST:	$357,646.49
				ENGINEERING:	$53,646.97
				TOTAL:	$411,293.47
	DIVISION #1				
01010	MOBILIZATION & DEMOBILIZATION (Not greater than 5% if on the Island. Or 10% if in Labrador, of Item a. "sub-total" on last page)	LS	UNIT	$5,000.00	$5,000.00
01020	CASH ALLOWANCE				
	Misc Works as Directed by Owner	Allowance	Allowance	$20,000.00	$20,000.00
	Trail Reinstatement	Allowance	Allowance	$20,000.00	$20,000.00
01570	TRAFFIC REGULATIONS				
	Flagperson's Wages	HOUR	80.00	$20.00	$1,600.00
	DIVISION #2				
02070	REINSTATEMENT AND CLEANING				
	Remove Culverts	M	40	$10.00	$400.00
02111	CLEARING & GRUBBING				
	Clearing	HA	0.20	$10,000.00	$2,000.00
	Grubbing	HA	0.20	$10,000.00	$2,000.00
02272	GABIONS				
	Supply & Placement of Gabions incl Fill by Hand	M3	3.00	$200.00	$600.00
02233	SELECTED GRANULAR BASE & SUB-BASE MATERIALS				
	Class "A" Granular Base	tonne	134.00	$24.00	$3,216.00
	Class "B" Granular Base	tonne	200.00	$24.00	$4,800.00
02552	HOT MIX ASPHALT CONCRETE PAVING				
	Surface Course	tonne	72.00	$150.00	$10,800.00
02434	PIPE CULVERTS				
	Supply & Placement of Aluminized or HDPE Culvert Two Aluminized 2800mm x 1950mm x 2.5mm Type 2 Aluminum Arch Culvert	M	30.00	$7,000.00	$210,000.00
02574	RESHAPING & PATCHING ASPHALT PAVEMENT				
	Removal of Asphalt Pavement	M^2	405.00	$2.50	$1,012.50
	Cutting of Asphalt Pavement	M	23.00	$2.00	$46.00
02481	CHANNEL EXCAVATION, CLEARING & DEEPENING				
	Cleaning and Deepening of Existing Channels	M	50.00	$25.00	$1,250.00

PROJECT: TORBAY STORMWATER MANAGEMENT PLAN

JOB #:2019-047 PRELIMINARY COST ESTIMATE - ISLAND POND CATCHMENT BUDGET ESTIMATE:

SECTION	DESCRIPTION	UNITS	QUANTITY	UNIT PRICE	TOTAL
REV:A	ISSUED FOR APPROVALS	DATE:	29-Jan-20	APPROVED BY:	VB

a) SUB TOTAL	**$282,724.50**
b) CONTINGENCY (10%)	**$28,272.45**
b) H.S.T. 15% of a & b.	**$46,649.54**
c) GRAND TOTAL	**$357,646.49**

PROJECT: TORBAY STORMWATER MANAGEMENT PLAN

JOB #:2019-047 PRELIMINARY COST ESTIMATE - SKIPPER'S LANDING DETENTION POND PERIMETER

BUDGET ESTIMATE: $343,334.09

SECTION	DESCRIPTION	UNITS	QUANTITY	UNIT PRICE	TOTAL
REV:A	ISSUED FOR APPROVALS	DATE:	29-Jan-20	APPROVED BY:	VB
				CONSTRUCTION COST:	$298,551.39
				ENGINEERING:	$44,782.71
				TOTAL:	$343,334.09
	DIVISION #1				
01010	MOBILIZATION & DEMOBILIZATION (Not greater than 5% if on the Island. Or 10% if in Labrador, of Item a. "sub-total" on last page)	LS	UNIT	$5,000.00	$5,000.00
01020	CASH ALLOWANCE				
	Misc Works as Directed by Owner	Allowance	Allowance	$20,000.00	$20,000.00
	Trail Reinstatement	Allowance	Allowance	$20,000.00	$20,000.00
01570	TRAFFIC REGULATIONS				
	Flagperson's Wages	HOUR	400.00	$20.00	$8,000.00
	DIVISION #2				
02104	LANDSCAPING, SEEDING AND TREE PRESERVATION				
	Supply & Placing Topsoil	M^2	3781	$8.00	$30,248.00
	Hydraulic Seeding & Mulching	M^2	3781	$6.00	$22,686.00
02111	CLEARING & GRUBBING				
	Clearing	HA	2.30	$10,000.00	$23,000.00
	Grubbing	HA	2.30	$10,000.00	$23,000.00
02215	SITE WORK & SITE GRADING				
	Mass Common Excavation	M3	1747.00	$5.00	$8,735.00
	Mass Rock Excavation	M3	750.00	$20.00	$15,000.00
	Imported Glacial Till	M3	6034.00	$10.00	$60,340.00

a) SUB TOTAL	**$236,009.00**
b) CONTINGENCY (10%)	**$23,600.90**
b) H.S.T. 15% of a & b.	**$38,941.49**
c) GRAND TOTAL	**$298,551.39**

PROJECT: TORBAY STORMWATER MANAGEMENT PLAN
JOB #:2019-047 PRELIMINARY COST ESTIMATE - SKIPPER'S LANDING
BUDGET ESTIMATE: $156,996.62

SECTION	DESCRIPTION	UNITS	QUANTITY	UNIT PRICE	TOTAL
REV:A	ISSUED FOR APPROVALS	DATE:	29-Jan-20	APPROVED BY:	VB
				CONSTRUCTION COST:	$136,518.80
				ENGINEERING:	$20,477.82
				TOTAL:	$156,996.62
	DIVISION #1				
01010	MOBILIZATION & DEMOBILIZATION (Not greater than 5% if on the Island. Or 10% if in Labrador, of Item a. "sub-total" on last page)	LS	UNIT	$5,000.00	$5,000.00
01020	CASH ALLOWANCE				
	Misc Works as Directed by Owner	Allowance	Allowance	$20,000.00	$20,000.00
	Trail Reinstatement	Allowance	Allowance	$20,000.00	$20,000.00
01570	TRAFFIC REGULATIONS				
	Flagperson's Wages	HOUR	200.00	$20.00	$4,000.00
	DIVISION #2				
02104	LANDSCAPING, SEEDING AND TREE PRESERVATION				
	Supply & Placing Topsoil	M^2	1105	$8.00	$8,840.00
	Hydraulic Seeding & Mulching	M^2	1105	$6.00	$6,630.00
02111	CLEARING & GRUBBING				
	Clearing	HA	0.60	$10,000.00	$6,000.00
	Grubbing	HA	0.60	$10,000.00	$6,000.00
02215	SITE WORK & SITE GRADING				
	Mass Common Excavation	M3	490.00	$5.00	$2,450.00
	Mass Rock Excavation	M3	200.00	$20.00	$4,000.00
	Imported Glacial Till	M3	2500.00	$10.00	$25,000.00

a) SUB TOTAL	**$107,920.00**
b) CONTINGENCY (10%)	**$10,792.00**
b) H.S.T. 15% of a & b.	**$17,806.80**
c) GRAND TOTAL	**$136,518.80**

PROJECT: Town of Torbay - Skipper's Landing Drainage Upgrades

JOB #: 2018-012

APPENDIX "A" - QUANTITIES AND PRICES

The quantities set out in this schedule are estimated quantities only and are not to be taken as final quantities by the contractor. The unit price bid shall include all labour, plant, materials, overhead, duties, and profit and all other obligations and liabilities under the contract. H.S.T. is to be applied in accordance with SGC 1.0. Totals shall be determined by multiplying the quantity by the tendered unit price.

SECTION	DESCRIPTION	UNITS	QUANTITY	UNIT PRICE	TOTAL
REV:	ISSUED FOR APPROVALS	DATE:	28-Mar-18	APPROVED BY:	D. Mills
			CONSTRUCTION COST:		$110,048.10
	DIVISION #1				
01010	MOBILIZATION & DEMOBILIZATION (Not greater than 5% if on the Island. Or 10% if in Labrador, of Item a. "sub-total" on last page)	LS	UNIT	$2,000.00	$2,000.00
01570	TRAFFIC REGULATIONS				
	Flagperson's Wages	HOUR	240.00	$20.00	$4,800.00
01710	REINSTATEMENT AND CLEANING				
	Hydraulic Seeding & Mulching (6.0m wide easement)	M^2	1500.00	$3.00	$4,500.00
	Supply & Placing Topsoil	M^2	1500.00	$3.00	$4,500.00
	DIVISION #2				
02111	CLEARING & GRUBBING				
	Clearing	HA	0.18	$2,000.00	$360.00
	Grubbing	HA	0.18	$8,000.00	$1,440.00
02223	EXCAVATION, TRENCHING & BACKFILLING				
	Main Trench Excavation				
	Rock	M^3		$50.00	$0.00
	Common	M^3	92.00	$13.00	$1,196.00
	Granular Pipe Bedding				
	Type 3	M^3	110.00	$40.00	$4,400.00
02233	SELECTED GRANULAR BASE & SUB-BASE MATERIALS				
	Class "A" Granular Base (shouldering and gravel driveways)	tonne	72.00	$24.00	$1,728.00
02434	PIPE CULVERTS				
	Supply & Placement of Aluminized or HDPE Culvert				
	750mm Aluminized CSP 2.8mm or 320Kpa HDPE	M	24.00	$250.00	$6,000.00
	600mm Aluminized CSP 1.6mm or 320Kpa HDPE	M	12.00	$175.00	$2,100.00
	450mm Aluminized CSP 1.6mm or 320Kpa HDPE	M	10.00	$70.00	$700.00
	Raise/Lower Existing Culvert, Incl Backfilling and Bedding	M	102.00	$55.00	$5,610.00

PROJECT: Town of Torbay - Skipper's Landing Drainage Upgrades

JOB #: 2018-012

APPENDIX "A" - QUANTITIES AND PRICES

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SECTION	DESCRIPTION	UNITS	QUANTITY	UNIT PRICE	TOTAL
REV:	**ISSUED FOR APPROVALS**	**DATE:**	**28-Mar-18**	**APPROVED BY:**	**D. Mills**
02481	CHANNEL EXCAVATION, CLEARING & DEEPENING				
	Channel Excavation				
	Rock	M^3	415.00	$50.00	$20,750.00
	Common	M^3	610.00	$20.00	$12,200.00
	Cleaning & Deepening of Existing Channels	M	300.00	$20.00	$6,000.00
02574	RESHAPING & PATCHING ASPHALT PAVEMENT				
	Removal of Asphalt Pavement (2.5m pay width)	M^2	370.00	$4.00	$1,480.00
	Patching of Asphalt Pavement (2.5m pay width)	M^2	370.00	$40.00	$14,800.00
	Cold Planing 0.3m each side of road culvert cuts	M^2	28.00	$1.50	$42.00
	Cutting of Asphalt Pavement	M	272.00	$4.00	$1,088.00

a) SUB TOTAL **$95,694.00**

b) H.S.T. 15% of a. **$14,354.10**

c) GRAND TOTAL **$110,048.10**

(Carry forward to page 1 of the Tender Form)

DEPT. OF MUNICIPAL AND PROVINCIAL AFFAIRS
Spec Set No. (Found on inside cover of Master Spec.) _____

PROJECT: TORBAY STORMWATER MANAGEMENT PLAN JOB #:2019-047 "THE GULLY"
PERIMETER BERM PLACEMENT - MAHON'S LANE & LYNCH'S LANE
BUDGET ESTIMATE: $100,435.94

SECTION	DESCRIPTION	UNITS	QUANTITY	UNIT PRICE	TOTAL
REV:A	ISSUED FOR APPROVALS	DATE:	29-Jan-20	APPROVED BY:	
				CONSTRUCTION COST:	$87,335.60
				ENGINEERING:	$13,100.34
				TOTAL:	$100,435.94
	DIVISION #1				
01010	MOBILIZATION & DEMOBILIZATION (Not greater than 5% if on the Island. Or 10% if in Labrador, of Item a. "sub-total" on last page)	LS	UNIT	$5,000.00	$5,000.00
01020	CASH ALLOWANCE				
	Misc Works as Directed by Owner	Allowance	Allowance	$20,000.00	$20,000.00
01570	TRAFFIC REGULATIONS				
	Flagperson's Wages	HOUR	400.00	$20.00	$8,000.00
	DIVISION #2				
02104	LANDSCAPING, SEEDING AND TREE PRESERVATION				
	Supply & Placing Topsoil	M^2	640.00	$8.00	$5,120.00
	Hydraulic Seeding & Mulching	M^2	640.00	$6.00	$3,840.00
02111	CLEARING & GRUBBING				
	Clearing	HA	0.20	$10,000.00	$2,000.00
	Grubbing	HA	0.20	$10,000.00	$2,000.00
02215	SITE WORK & SITE GRADING				
	USM Removal	M^3	200.00	$30.00	$6,000.00
	Imported Glacial Till	M^3	427.00	$40.00	$17,080.00

a) SUB TOTAL	**$69,040.00**
b) CONTINGENCY (10%)	**$6,904.00**
b) H.S.T. 15% of a & b.	**$11,391.60**
c) GRAND TOTAL	**$87,335.60**

PROJECT: TORBAY STORMWATER UPGRADES & PRIORITY LIST
JOB #:2019-047 "THE GULY"
CULVERT REPLACEMENT & CHANNEL EXCAVATION
BUDGET ESTIMATE: $537,304.640

SECTION	DESCRIPTION	UNITS	QUANTITY	UNIT PRICE	TOTAL
REV:A	ISSUED FOR APPROVALS	DATE:	29-Jan-20	APPROVED BY:	
				CONSTRUCTION COST:	$467,221.43
				ENGINEERING:	$70,083.21
				TOTAL:	$537,304.64
	DIVISION #1				
01010	MOBILIZATION & DEMOBILIZATION (Not greater than 5% if on the Island. Or 10% if in Labrador, of Item a. "sub-total" on last page)	LS	UNIT	$5,000.00	$5,000.00
01020	CASH ALLOWANCE Misc Works as Directed by Owner	Allowance	Allowance	$20,000.00	$20,000.00
01570	TRAFFIC REGULATIONS Flagperson's Wages	HOUR	40.00	$20.00	$800.00
	DIVISION #2				
02111	CLEARING & GRUBBING				
	Clearing	HA	0.20	$10,000.00	$2,000.00
	Grubbing	HA	0.20	$10,000.00	$2,000.00
02233	SELECTED GRANULAR BASE & SUB-BASE MATERIALS				
	Class "A" Granular Base	tonne	34.22	$20.00	$684.40
	Class "B" Granular Base	tonne	51.30	$22.00	$1,128.60
02552	HOT MIX ASPHALT CONCRETE PAVING Surface Course	tonne	7.64	$150.00	$1,146.00
02528	CONCRETE WALK, CURB & GUTTERS				
	Supply & Place Grannular Base Material	M^3	1.90	$30.00	$57.00
	Concrete Walks	M	17.00	$100.00	$1,700.00
02434	PIPE CULVERTS Supply & Placement of Aluminum Arch Bottomless Culvert 6,198mm x 1,372mm Dur-A-Span Culvert with Aluminum Headwa	EACH	1.00	$325,122.00	$325,122.00
02574	RESHAPING & PATCHING ASPHALT PAVEMENT Removal of Asphalt Pavement	M^2	152.80	$2.50	$382.00
02283	SUPPLY & INSTALLATION OF HAND RAIL Standard Steel Pipe Posts & Rail	M	17.00	$125.00	$2,125.00
02481	CHANNEL EXCAVATION, CLEARING & DEEPENING Channel Excavation Common	M^3	360.00	$20.00	$7,200.00

PROJECT: TORBAY STORMWATER UPGRADES & PRIORITY LIST
JOB #:2019-047 THE GULY CULVERT REPLACEMENT
BUDGET ESTIMATE:

SECTION	DESCRIPTION	UNITS	QUANTITY	UNIT PRICE	TOTAL
REV:A	ISSUED FOR APPROVALS	DATE:	29-Jan-20	APPROVED BY:	

a) SUB TOTAL	**$369,345.00**
b) CONTINGENCY (10%)	**$36,934.50**
b) H.S.T. 15% of a & b.	**$60,941.93**
c) GRAND TOTAL	**$467,221.43**

PROJECT: TORBAY STORMWATER MANAGEMENT PLAN
JOB #:2018-021 PRELIMINARY COST ESTIMATE - WHITEWAY POND
BUDGET ESTIMATE: $139,852.39

SECTION	DESCRIPTION	UNITS	QUANTITY	UNIT PRICE	TOTAL
REV:A	ISSUED FOR APPROVALS	DATE:	29-Jan-20	APPROVED BY:	VB
				CONSTRUCTION COST:	$121,610.78
				ENGINEERING:	$18,241.62
				TOTAL:	$139,852.39
	DIVISION #1				
01010	MOBILIZATION & DEMOBILIZATION (Not greater than 5% if on the Island. Or 10% if in Labrador, of Item a. "sub-total" on last page)	LS	UNIT	$5,000.00	$5,000.00
01020	CASH ALLOWANCE				
	Misc Works as Directed by Owner	Allowance	Allowance	$20,000.00	$20,000.00
01570	TRAFFIC REGULATIONS				
	Flagperson's Wages	HOUR	400.00	$20.00	$8,000.00
	DIVISION #2				
02104	LANDSCAPING, SEEDING AND TREE PRESERVATION				
	Supply & Placing Topsoil	M^2	335.00	$8.00	$2,680.00
	Hydraulic Seeding & Mulching	M^2	335.00	$6.00	$2,010.00
02111	CLEARING & GRUBBING				
	Clearing	HA	0.84	$10,000.00	$8,400.00
	Grubbing	HA	0.84	$10,000.00	$8,400.00
02215	SITE WORK & SITE GRADING				
	Import Glacial Till	M^3	450.00	$40.00	$18,000.00
	Mass Excavation				
	Common	M^3	151.90	$55.00	$8,354.50
	Rock	M^3	65.10	$25.00	$1,627.50
02233	SELECTED GRANULAR BASE & SUB-BASE MATERIALS				
	Class "A" Granular Base	tonne	42.00	$20.00	$840.00
	Class "B" Granular Base	tonne	84.00	$22.00	$1,848.00
02552	HOT MIX ASPHALT CONCRETE PAVING				
	Surface Course	tonne	22.50	$150.00	$3,375.00
	Base Course	tonne	22.50	$150.00	$3,375.00
02434	PIPE CULVERTS				
	Supply & Placement of Aluminized or HDPE Culvert				
	800mm Aluminized CSP 2.8mm or 320kPa HDPE	M	12.00	$300.00	$3,600.00
02574	RESHAPING & PATCHING ASPHALT PAVEMENT				
	Removal of Asphalt Pavement	M^2	250.00	$2.50	$625.00

PROJECT: TORBAY STORMWATER MANAGEMENT PLAN

JOB #:2018-021 PRELIMINARY COST ESTIMATE - WHITEWAY POND

BUDGET ESTIMATE: $532,792.92

SECTION	DESCRIPTION	UNITS	QUANTITY	UNIT PRICE	TOTAL
REV:A	ISSUED FOR APPROVALS	DATE:	29-Jan-20	APPROVED BY:	VB

a) SUB TOTAL	**$96,135.00**
b) CONTINGENCY (10%)	**$9,613.50**
b) H.S.T. 15% of a & b.	**$15,862.28**
c) GRAND TOTAL	**$121,610.78**