





REGULAR MEETING OF THE ASSET MANAGEMENT ADVISORY BOARD

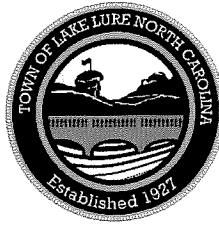
March 27, 2018

9:30 a.m.

Lake Lure Municipal Center

AGENDA

1. Call to Order
2. Adoption of the Agenda
3. Approval of Minutes: February 27, 2018
4. Disclosure of Potential Conflicts regarding Agenda Items by Board Members
5. Status Report for TOLL Property Holdings (*inventory last updated 4/20/15*)
 - a. Potential acquisitions
 - b. Property identified for disposition
 - c. Property development activity
6. Old Business
 - a. Continue review of all abstracts for TOLL Land Assets (# 33)
7. New Business
 - a. Beach Peninsula Removal Feasibility Study – Clint Calhoun
8. Adjournment



Minutes of the Regular Meeting of the
Asset Management Advisory Board
February 27, 2018
Lake Lure Municipal Center

Present: Charlie Ellis, Chair
Bob Wald
Linda Turner
Mike Holden

Also Present: John Moore, Commissioner
Ron Nalley, Town Manager
Dean Givens, Lake Operations

Absent: Tom McKay
Andy Bell

CALL TO ORDER

Chairman Ellis called the meeting to order at 9:30 a.m. and welcomed those present.

APPROVAL OF THE AGENDA

Chairman Ellis requested that the Board add a closed session to discuss potential property acquisition. Linda Turner made a motion to approve the amended Agenda. Mike Holden seconded and the motion carried 4-0.

APPROVAL OF THE MINUTES

Linda Turner made a motion to approve the January 23, 2018 minutes. Bob Wald seconded and the motion carried 4-0.

DISCLOSURE OF POTENTIAL CONFLICTS

Chairman Ellis asked if any Board members had any potential conflicts with the items on the Agenda. There were none.

STATUS REPORTS

1. Potential Acquisitions – No properties have been identified for acquisition.
2. Properties Identified for Disposition – No properties have been identified for disposition.
3. Property Development Activity – No additional development activity was reported.

UNFINISHED BUSINESS

Continue Review of all Abstracts for TOLL Land Assets – Continued review of the Asset Abstract will be carried over to the Board's next meeting.

NEW BUSINESS

Marina Bay Presentation – Mr. Nalley reported that during the last Board Retreat, Town Council expressed interest in expanding the Marina to accommodate 40 new slips. While developing the project scope, it was brought to the Town's attention that a new fire code regarding the need for a fire suppression system on the docks was now required. This increased the project cost by approximately \$85,000. Based on the increased cost, the Board requested that the Dean Givens, the Lake Operations Director, evaluate other areas of the lake for the potential development of new docks whose expansion would not trigger the new fire code requirements. That evaluation is now completed and the results were submitted to Town Council. At the request of Chairman Ellis, Mr. Givens was asked to give the same presentation of the results to the Asset Management Advisory Board. Mr. Givens then summarized his evaluation report, reviewing each potential site, the site plan scores, the parameters used to develop the scores and a final summary for each site. Following the summary, Mr. Givens reported that staff recommends incorporating the dock expansion project into the boardwalk project. The proposed configuration and expansion could potentially create up to 94 additional slips for a total of 168 slips and generate approximately \$200,000 in additional revenue. The Board discussed the proposed layout of the docks, the capacity of the lake to handle the additional boat slips, the proposal to relocate the gas tanks, boat ramp and boat parking spaces. Commissioner Moore stated that the plan will continue to be reviewed and discussed as it works its way through the public process of revising the Town Center Plan. In a response to a question from Mr. Wald, Mr. Givens stated that the Buffalo Shoals Road site scored lowest due to the steepness of the terrain, lack of utilities and lack of a sufficient parking area making the return of revenue quite low when compared to the development costs.

Destination by Design Tourism Plan Concept Review – Mr. Nalley gave a brief summary on the Tourism Master Plan being developed in conjunction with the Rutherford County Tourism Development Authority. The tourism plan looks at Marina Bay and contemplates the impact of a revised Town Center Plan focusing on the lake as a main destination point as well as serving as the future entrance to Chimney Rock State Park. The Board reviewed the current plans produced by Destination by Design for Marina Bay and the Town Center. Chairman Ellis stated that the current Town Center Plan has a lot of mass and that this plan takes that and puts them into bite size projects, making implementation easier. Chairman Ellis also stated that removing the parking from the highway and directing it into the Town Center puts focus on the water and is another positive aspect of the plan. The Board discussed other positive aspects of the plan including the "eyelash" marina design, Town Green area, parking layout, mixed use development areas, and the redevelopment area surrounding Pool Creek Picnic Park. The Board then discussed the peninsula at the beach and questioned whether or not it could be removed or redesigned. Mr. Givens suggested and the Board agreed, to have Clint Calhoun look at the area and report back to them at their next meeting. Mr. Nalley then announced that the stakeholder committee for the Tourism Master Plan was meeting tomorrow, February 28th at 1:30 p.m. and invited those interested to attend.

ABC Store Lease Agreement – Chairman Ellis reported that the current lease agreement with the ABC Store contains an automatic renewal unless either party gives written notice sixty days prior to the end of the lease period, which is on October 11th. Based on that, Chairman Ellis made a motion that Town Council ask the Town Manager to draft a notice to the ABC Board that in October, the term will not automatically renew and that their tenancy will become month to month. Bob Wald seconded and the motion carried 4-0.

CLOSED SESSION

Bob Wald made a motion to enter into Closed Session in accordance with G.S. 143.318.11(a)(5) for the purpose of discussing property acquisition. Linda Turner seconded and the motion carried 4-0. While in Closed Session, the Board discussed a potential purchase under consideration by the Town Council. Bob Wald made a motion to leave Closed Session. Mike Holden seconded and the motion carried 4-0. No action was taken while in Closed Session.

ADJOURNMENT

There being no new or further business, Linda Turner made a motion to adjourn the meeting. Mike Holden seconded and the motion passed 4-0. The meeting was adjourned at 10:39 a.m.

ATTEST

Charlie Ellis, Chair

Michelle Jolley, Interim Town Clerk

Lake Lure Beach Peninsula Removal Feasibility Study

Executive Summary

By: Clint Calhoun, Environmental Management Officer

The peninsula separating the Town of Lake Lure Beach and Pool Creek has in recent years been the subject of debate as a potential cause for the fecal coliform issues that plague the swimming area at the beach almost annually. The peninsula is a mostly man-made physical landmass that was most likely created as a means to reduce the impact of accumulating sediment in the swimming area of the beach. An unintended consequence was the restriction of circulating flow generated by the currents of Pool Creek as it entered the waters of Lake Lure.

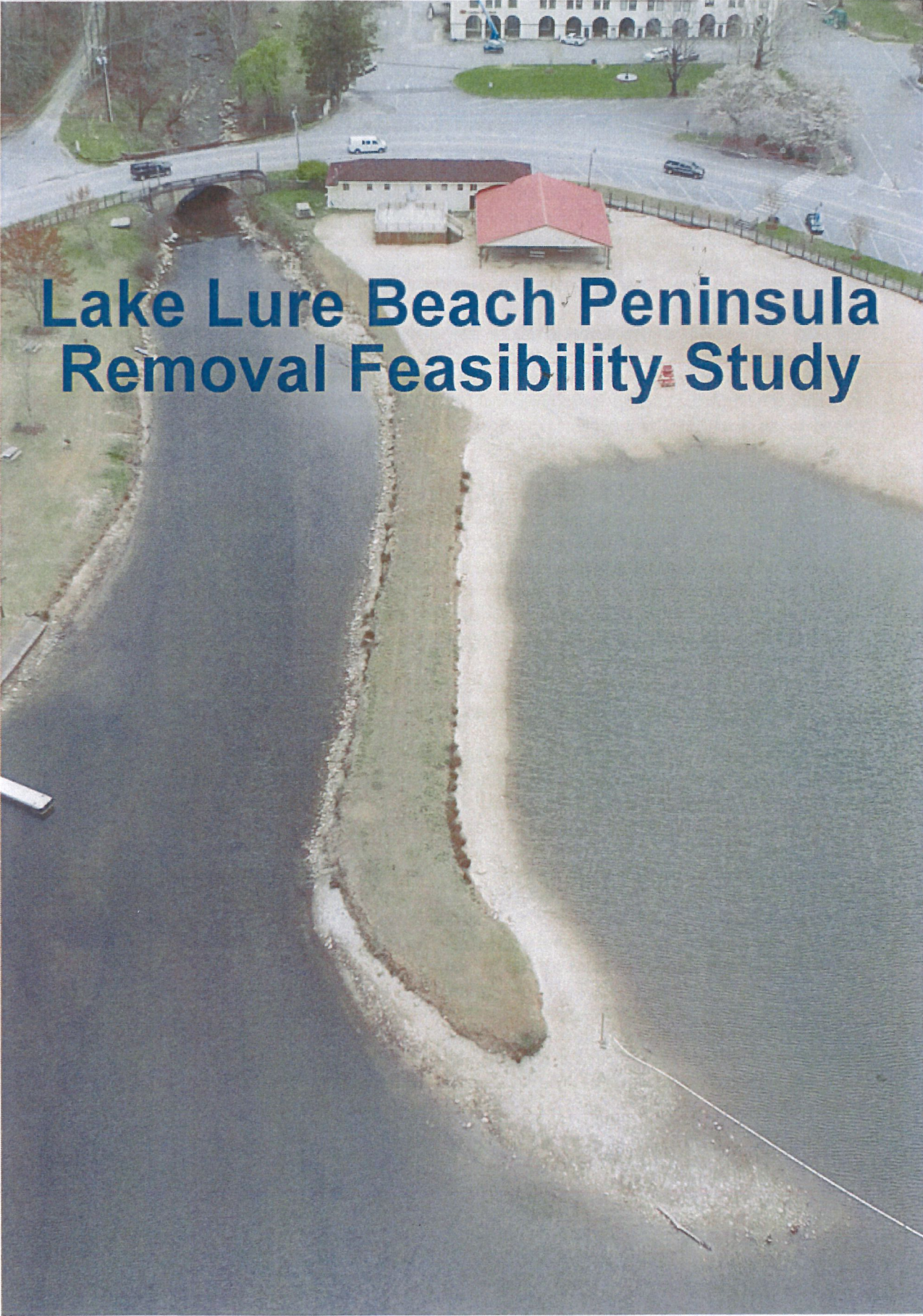
The Lake Operations Department was given the task of studying the feasibility of removing, altering, or relocating the peninsula or providing options that would aid in the reduction of fecal coliform numbers, as well as improve the aesthetic appearance of the beach by eliminating or enhancing a landmass that either has no practical use or has qualities that make it undesirable for visitors to the beach. Before any plan is developed for this site, there are some key questions that should be considered:

- What is the ultimate goal of altering the shape, relocating, or removing the peninsula? Is the goal to improve water quality or does it have more to do with improving aesthetics and usability? Could it be a combination of the two?
- What is the vision for what this landmass should look like and what will its function be?
- If the purpose of this project is solely to improve water quality in the beach swimming area, will altering or removing the peninsula achieve this goal? What alternatives exist?
- What are the possible impacts that will result from altering or removing the peninsula (positive and negative)?
- What will be needed in terms of engineering, study, and permitting?
- Does the project protect health and human safety and protect water quality?

This study provides a general description of the landmass as well as what could be characterized as an oral history of how the peninsula was created, its function, and changes that have occurred after its creation. There is also a great deal of information pertaining to water sampling and data that has been collected from both Pool Creek and the beach swimming area.

Before any project can be undertaken regarding the peninsula, in addition to the level of study that may be needed to properly design an alternative measure, there are numerous permits at the local, state, and federal level that must be acquired before moving forward with actual project implementation. Information is provided in the study detailing the various permits that are necessary and the process for acquiring them.

Lastly, this study includes four possible scenarios for the removal, relocation or alteration of the peninsula. These scenarios are in line with the task that was given to the Lake Operations Director by the Town of Lake Lure Asset Management Board to study as possibilities for the peninsula, potential outcomes, and considerations that might make a particular scenario more or less desirable.

An aerial photograph showing a peninsula at the top of the frame, connected to a larger landmass by a narrow strip of land. The peninsula features a large building with a red roof and a smaller building with a brown roof. A parking lot with several cars is visible to the right of the buildings. A road with a bridge crosses a small stream or canal to the left of the peninsula. The water body is dark blue, and the surrounding land is green with some trees. The text "Lake Lure Beach Peninsula Removal Feasibility Study" is overlaid in a large, bold, blue font across the middle of the image.

Lake Lure Beach Peninsula Removal Feasibility Study

Lake Lure Beach Peninsula Removal Feasibility Study

Project Purpose:

The purpose of this feasibility study is to look at the potential for removing or relocating the narrow peninsula that currently separates the Lake Lure Beach from Pool Creek. Removal or alteration of the peninsula is viewed as a possible way of improving the appearance of the beach, as well as improving the water quality at the beach area which has experienced issues with high bacteria numbers many times over the last few years. This feasibility study will provide information regarding viable options, permitting requirements, water quality data, suggestions for moving forward with planning, and will pose some questions that need to be considered as part of the plan development process.

Project Rationale:

On more than one occasion since 2008, the idea of altering the peninsula has been discussed. Changing the peninsula by either creating a channel or adding a culvert was discussed as a possible option by the Parks and Recreation Board shortly after that board was created, the belief being that cutting a channel through the peninsula would divert cold water into the beach swim area, lower the water temperature and thereby reduce fecal coliform levels. In theory this seems like a good idea, but opinions are mixed as to whether or not this would achieve the objective. Those opinions and reasoning behind them will be discussed more in depth as part of the study. More recently, the aesthetic value and lack of use of the peninsula has raised questions as to whether or not it truly serves a purpose, and if it does, can that purpose be achieved in some other way, either by reducing the size or by completely re-designing it into a more functional landmass? Some key questions that should be asked as part of any development plan for this site are as follows:

- What is the ultimate goal of altering the shape, relocating, or removing the peninsula? Is the goal to improve water quality or does it have more to do with improving aesthetics and usability, or is it a combination of the two?
- What is the vision for what this landmass should look like and what will its function be?
- If the purpose of this project is solely to improve water quality in the beach swim area, will altering or removing the peninsula achieve this goal? What alternatives exist?
- What are the possible impacts that will result from altering or removing the peninsula, positive and negative?
- What will be needed in terms of engineering, study, and permitting?
- Does the project protect health and human safety and protect water quality?

There may be other questions as well, but the ones presented should suffice as a starting point to direct the conversation as to what the desire is, whether or not it's achievable, and what may be required in order to execute the project.

Site Description:

The watershed draining Pool Creek is rather small, but steep and can carry fairly large sediment loads during extreme storm events, but in general Pool Creek has the best water quality in the larger Upper Broad River Watershed, compared to all other streams in the watershed. This is due mostly to the land cover being mostly forested with very little residential development. In fact most of the Pool Creek drainage is within the boundaries of Chimney Rock State Park, so the likelihood that this drainage will remain fairly pristine is quite high and therefore extremely beneficial to the overall water quality of Lake Lure. The soils within the drainage, even though covered in dense forest are highly erodible and when exposed by landslides or other weather events, those soils eventually make their way into the streams of the watershed. Those soils get deposited in the lake when the fast moving waters of Pool Creek meet the slow-moving impounded waters of Lake Lure.

The peninsula is a land form that presently separates the Lake Lure Beach from Pool Creek. The landmass is the result of what appears to be a combination of factors, including accretion from sedimentation from the Pool Creek drainage, and actual placing of dredge spoil material to further build up the landmass. Based on current sediment deposits in the Washburn Marina Bay from Pool Creek, it is evident that the peninsula would have formed on its own over time as sandbars grew and joined together. Knowing this, and given the probable appearance of other sandbars at the mouth of Pool Creek, it would have been logical to go ahead and enhance the landmass and make it functional, similar to the way Morse Park was created.

The peninsula as it exists today is approximately 304 feet long from the sand on the beach to its tip. The total land area is approximately 6,630 feet or 0.15 acres. The landmass measures 30.5 feet at its widest point and 18.5 feet at its narrowest point. Ground cover is predominately grasses that have naturalized the area over time and do get frequently mowed during the warm weather growing season. There are occasional clumps of large aquatic sedges that somewhat enhance the erosive effect of high storm flows from Pool Creek as there is no consistent woody shoreline vegetation to substantially hold the soil. On the Pool Creek side, the bank drops off quite steeply to the water due to erosion of the shoreline. Water depths in Pool Creek range from 1 to 4 feet. At the point of the peninsula, there is a fairly substantial amount of sediment accumulation. Over time, if no dredging occurred, the peninsula would likely continue to elongate towards the northwest, eventually forming more of a curve at the end of the landmass. The end of the peninsula is also somewhat rocky and the last time the beach area was dredged, the contractor got into a lot of rock; further evidence that the original stream channel likely flowed through where the peninsula is located today. On the beach side of the peninsula, the slope is very gradual to the water which would be expected in an area where flows are low and water depths are relatively shallow. Water depths in the beach swim area range from less than one foot to approximately 4 feet.

Soil type of the peninsula is classified as UoA—Udorthents, loamy, 0 to 3 percent slopes, rarely flooded. These soils are typical along floodplains where the natural soil has been greatly altered by cutting, filling, mining, or shaping. These soils are dominantly loamy

with lower percentages of sand and silt, typically well-drained and are most often used for borrow pits or urban development, according to the *Soil Survey of Rutherford County, North Carolina*. Other examples of this soil type are the Town Center, the Lake Lure Beach, Morse Park, Boys Camp Road spoils area, municipal golf course, etc. This is consistent with the theory that the peninsula was created using spoils material dredged from either Pool Creek or Washburn Marina Bay.

Site History:

Before Lake Lure was constructed, it was surveyed with elevations of the lake bed and locations of the streams that flowed into the Broad River prior to impoundment. In the area where the beach and Town Center area would be constructed were Pool Creek and a small stream that flowed into Pool Creek. This small stream currently is piped and flows under the parking lot of the Town Center. A portion of this survey is shown as **Figure 1**.

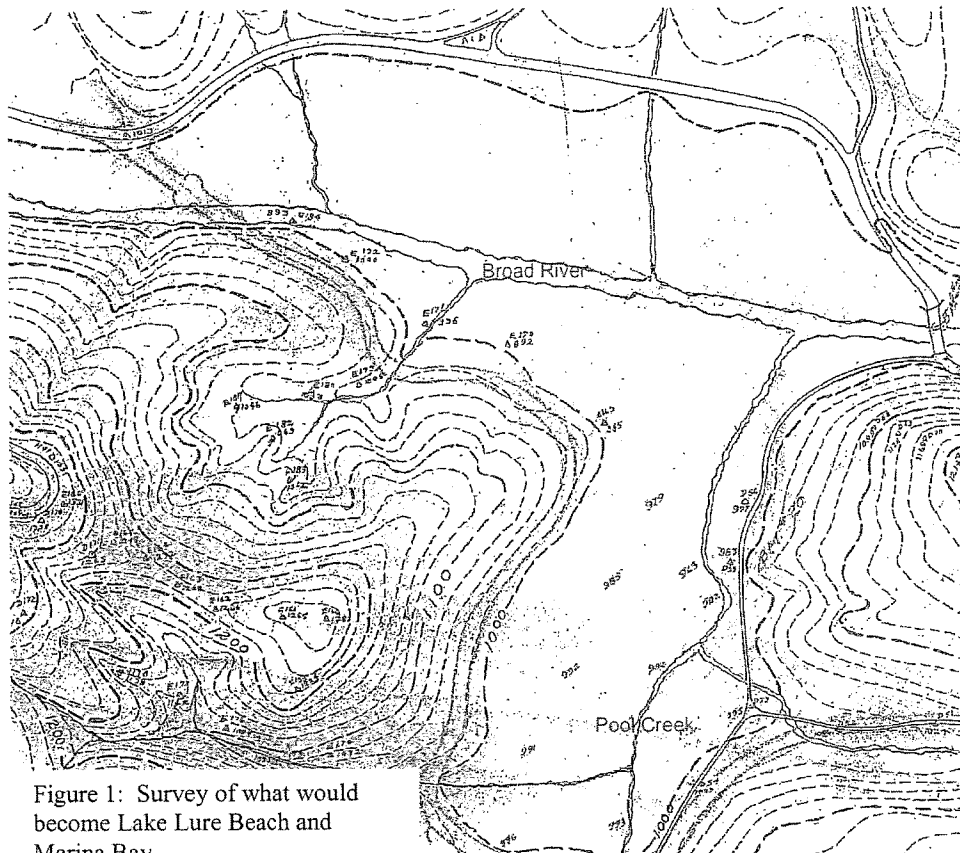


Figure 1: Survey of what would become Lake Lure Beach and Marina Bay.

Based on personal conversations that staff has participated in with long-time residents of Lake Lure, the general consensus is that the peninsula was built using the sediment that was being deposited in the bay by Pool Creek, similar to the way Morse Park was constructed. An aerial photo from the 1950s shows that there was no peninsula early in the lake's history and the beach was substantially smaller than it is today. At that time, Pool Creek flowed along a slightly different course angled more westerly from its present

course. This is purely speculation, but based on what is visible on the following 1955 aerial photo (Figure 2), it is very likely that the beach area was being impacted by delta formation from Pool Creek, requiring frequent dredging.

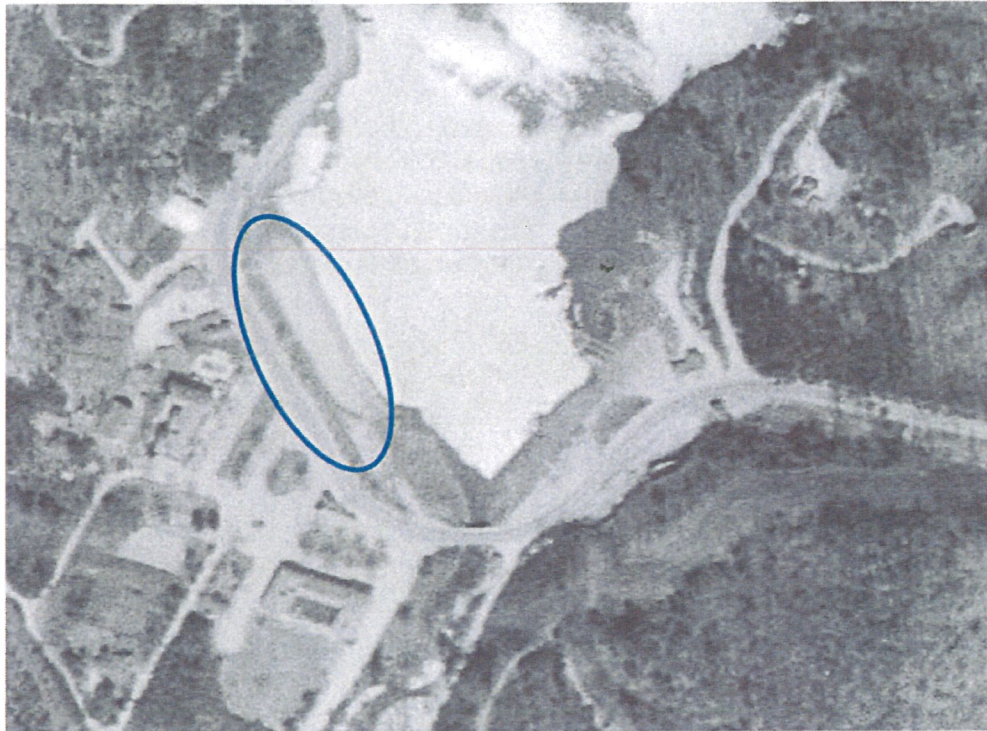


Figure 2: Location of the beach in 1955. No peninsula is visible in this aerial photo.

Most likely, the peninsula would have formed on its own given enough time, and was likely in the process of forming when the Town decided to take action to build the landmass. This move would have also contributed to the expansion of the beach area. At some point, possibly in the 1960s (based on conversations with life-long residents), the peninsula was constructed, although likely not in the same configuration as today, and there was a culvert installed to import water from Pool Creek into the beach area. According to these personal communications, the water coming into the beach swim area was really cold and perhaps there were complaints from visitors because each interviewee recalled water temperature as being a primary reason for removing the culvert. Another reason cited was that significant amounts of debris would wash through the culvert during storms creating issues in the bay and on the beach.

Since its creation, the peninsula has gone through various levels of use, even having lifeguard stands on it at different times during its history, as well as a sliding board at the corner between the beach and the beginning of the peninsula. The sliding board was removed in the late 90's. Currently, the beach concessionaire doesn't allow beach-goers to use the peninsula. This is due primarily to complaints of "people getting sandspurs in their feet". Sandspurs are the fruiting bodies of certain types of grasses that naturalize in sandy soils and are generally considered undesirable in lawns and areas of high foot

traffic. Another reason the peninsula is not used is that it's a favorite grazing area of resident Canada geese and has also been a favorite nesting location for up to two pairs of geese. The result is significant amounts of goose droppings which people step in and then carry into the water, further adding to fecal coliform issues at the beach. Nesting geese also are fearsome defenders of their turf and get quite agitated and defensive when people approach their nest area. A Canada goose can cause considerable damage by biting as well as causing blunt trauma injuries with their wings, especially to children who wander too close and can't get away quickly enough, so this is certainly worth making the area off-limits to visitors.

Water Quality Issues:

In the early 2000's, the beach operation expanded with the construction of the water park which included the water slides, the fun park and an enclosed pool for bumper boats. Shortly after construction of the water park, the area experienced a drought and warmer than normal summer temperatures. This coupled with low circulation of the water in the bay caused the fecal coliform numbers to spike, resulting in a shutdown of the beach. Subsequently, the bumper boats were removed and the enclosed pool, where fecal numbers soared well above 2000 cfu/mL, was opened up to try to improve water circulation. Since that time, there have been numerous other occasions where fecal numbers have been extremely high requiring the water to be treated with potassium permanganate, sometimes on a daily basis.

The fecal issues have never been pinpointed but likely stem from multiple sources. Typically when the Town records high fecal coliform levels, the causes are one or more of the following:

- Significant rain prior to sample collection. Heavy rains increase runoff, typically increasing bacteria levels due to their attachment to suspended particles in the runoff.
- Increased goose activity on the beach. The beach is a favorite roosting area of the geese at night and the grass on the peninsula is a potential food source. When the beach is groomed in the mornings, if the fecal material is not physically removed, it gets plowed into the sand. This can then get carried into the water from runoff as well as from sand coming into contact with the water through beach use activities.
- High temperatures and low oxygen levels. The peninsula between the beach and Pool Creek severely limits Pool Creek's ability to send cleansing and cooling waters into the beach area and the larger part of the Washburn Marina Bay. Warm water tends to contribute to anoxic conditions. Couple this with high particulates in the water from re-suspension, the uncirculated water creates a perfect medium for bacterial growth.
- Presence of muck in the swim area. Muck is sediment that has a significant amount of organic material within it, most of which comes from runoff. The still water of the bay allows for layers of muck to accumulate and fecal bacteria are often found within this layer. Fecal bacteria are anaerobic, meaning that they thrive in low-oxygen environments, so the muck provides an excellent growth medium where the bacteria feed on the organic matter

within the muck. As the muck is stirred up from wading and swimming, the bacteria are released back into the water column.

Lake Operations took over the lake sampling and monitoring from the Lake Advisory Board volunteers in 2008 and have been keeping records of the fecal numbers since that time. Fecal samples are collected from 10 locations around the lake. The samples pertaining to the beach area are taken from Pool Creek, downstream of the Memorial Highway Bridge; in front of the beach between the peninsula and the lifeguard stand; and in front of the waterslide. (Figure 3)



Figure 3: Sample collection sites at the beach and Pool Creek.

Between 2008 and 2014, fecal coliform numbers were incredibly high for most of the season in these three locations. No beach closings occurred but the Town came close on a couple of occasions due to excessive numbers for consecutive weeks. The following tables (Tables 1-9) reflect fecal coliform numbers during the swimming season.

Table 1:

Fecal Coliform Analysis - 2008

		date collected 4/28/2008	date collected 5/26/2008	date collected 6/30/2008	date collected 7/14/2008	date collected 7/28/2008	date collected 8/25/2008	date collected 9/29/2008
site #	site name	CFU/100ml	CFU/100ml	CFU/100ml	CFU/100ml	CFU/100ml	CFU/100ml	CFU/100ml
1	Pool Creek	184	92	>600	313	27		33
2	Beach - swim	>536	18	>1160	237	266	103	168
3	Beach - slide	92	17	170	260	83		214

Green-good (0-99 CFU/mL); Orange-caution (100-199 CFU/mL); Red-action required (200 and greater)

Table 2:

Fecal Coliform Analysis - 2009

site #	site name	date collected	date collected	date collected	date collected	date collected	date collected	date collected
		4/27/2009	5/25/2009	6/2/2009	6/29/2009	7/27/2009	8/24/2009	9/28/2009
		CFU/100ml	CFU/100ml	CFU/100ml	CFU/100ml	CFU/100ml	CFU/100ml	CFU/100ml
1	Pool Creek	35	120		132	21	>252	25
2	Beach - swim	18	659	29	112	39	236	37
3	Beach - slide	5	216	66	85	25	102	>260

Green-good (0-99 CFU/mL); Orange-caution (100-199 CFU/mL); Red-action required (200 and greater)

Table 3:

Fecal Coliform Analysis - 2011

site #	site name	date collected	date collected	date collected	date collected	date collected	date collected
		5/9/2011	5/30/2009	6/27/2011	7/25/2011	8/29/2011	9/26/2011
		CFU/100ml	CFU/100ml	CFU/100ml	CFU/100ml	CFU/100ml	CFU/100ml
1	Pool Creek	34	164	>628	540	94	540
2	Beach - swim	55	261	112	312	82	>785
3	Beach - slide	50	48	>372	350	195	>640

Green-good (0-99 CFU/mL); Orange-caution (100-199 CFU/mL); Red-action required (200 and greater)

Table 4:

Fecal Coliform Analysis - 2012

site #	site name	date collected	date collected	date collected	date collected	date collected	date collected
		4/30/2011	5/28/2012	6/25/2012	7/30/2012	8/27/2012	9/24/2012
		CFU/100ml	CFU/100ml	CFU/100ml	CFU/100ml	CFU/100ml	CFU/100ml
1	Pool Creek	20	>308	171	49	70	60
2	Beach - swim	47	127	115	104	90	160
3	Beach - slide	9	78	112	56	192	230

Green-good (0-99 CFU/mL); Orange-caution (100-199 CFU/mL); Red-action required (200 and greater)

Table 5:

Fecal Coliform Analysis - 2013

site #	site name	date collected	date collected	date collected	date collected	date collected	date collected	date collected	date collected	date collected
		4/29/2013	####	####	####	7/29/2013	8/6/2013	8/12/2013	8/19/2013	####
		CFU/100ml	CFU/100ml	CFU/100ml	CFU/100ml	CFU/100ml	CFU/100ml	CFU/100ml	CFU/100ml	CFU/100ml
1	Pool Creek	57	48	20	44				70	28
2	Beach - swim	225	2	42	25	123	90	110	44	52
3	Beach - slide	212	36	48	25	>440	>4,600	>728	450	60

Green-good (0-99 CFU/mL); Orange-caution (100-199 CFU/mL); Red-action required (200 and greater)

Table 6:

Fecal Coliform Analysis - 2014

		date collected	date collected	date collected	date collected	date collected	date collected	date collected
		4/28/2014	5/26/2014	6/30/2014	7/8/2014	7/28/2014	8/25/2014	9/29/2014
site #	site name	CFU/100ml	CFU/100ml	CFU/100ml	CFU/100ml	CFU/100ml	CFU/100ml	CFU/100ml
1	Pool Creek	6	192	40		270	102	25
2	Beach - swim	6	236	823	27	320	68	56
3	Beach - slide	12	176	230	45	280	80	62

Green-good (0-99 CFU/mL); Orange-caution (100-199 CFU/mL); Red-action required (200 and greater)

Due to consistently high fecal counts, particularly during the hot summer months, the Town worked with a lake contractor to devise an aeration plan for Washburn Marina Bay. The initial plan called for installing 6 aerators, mostly in front of the beach area, with an additional 5 to be installed at some point in the future. The idea was to see how the initial installation would perform and what the impact would be with regard to fecal coliform levels. The first 6 aerators were installed in July of 2014 so there were only three months of data collected in 2014 after installation. The second phase has not been implemented. The following tables are the fecal coliform data collected since installing the aerators, showing full season data beginning in 2015.

Table 7:

Fecal Coliform Analysis - 2015

		date collected	date collected	date collected	date collected	date collected	date collected
		4/27/2015	5/25/2015	6/29/2015	7/27/2015	8/24/2015	9/28/2015
site #	site name	CFU/100ml	CFU/100ml	CFU/100ml	CFU/100ml	CFU/100ml	CFU/100ml
1	Pool Creek	24	16	80	43	280	200
2	Beach - swim	21	53	56	86	140	555
3	Beach - slide	30	70	90	60	145	203

Green-good (0-99 CFU/mL); Orange-caution (100-199 CFU/mL); Red-action required (200 and greater)

Table 8:

Fecal Coliform Analysis - 2016

		date collected	date collected	date collected	date collected	date collected	date collected
		4/25/2016	5/30/2016	6/27/2016	7/25/2016	8/29/2016	9/26/2016
site #	site name	CFU/100ml	CFU/100ml	CFU/100ml	CFU/100ml	CFU/100ml	CFU/100ml
1	Pool Creek	6	42	68	68	80	27
2	Beach - swim	7	84	42	57	160	80
3	Beach - slide	5	62	27	27	78	44

Green-good (0-99 CFU/mL); Orange-caution (100-199 CFU/mL); Red-action required (200 and greater)

Table 9:

Fecal Coliform Analysis - 2017

		date collected	date collected	date collected	date collected	date collected	date collected	date collected	date collected
		4/24/2017	5/29/2017	6/26/2017	7/24/2017	8/1/2017	8/8/2017	8/28/2017	9/5/2017
site #	site name	CFU/100ml	CFU/100ml	CFU/100ml	CFU/100ml	CFU/100ml	CFU/100ml	CFU/100ml	CFU/100ml
1	Pool Creek	101	111	31	>792	24	200	430	18
2	Beach - swim	170	103	58	150	18	106	650	104
3	Beach - slide	224	76	36	>309	27	104	820	40

Green-good (0-99 CFU/mL); Orange-caution (100-199 CFU/mL); Red-action required (200 and greater)

Circled area represents dates when rainfall data was tracked. Rainfall tracking became part of the sampling routine in July, 2017.

After installation of the aerators, 2016 was the best year in terms of fecal counts. That year was relatively dry compared to 2017 which was considerably wetter and demonstrated significant spikes in numbers, even with aeration in place. Since we are now tracking rainfall data as part of our sample collection, it's now possible to see the trends and better identify reasons for spikes. From late July to late August in 2017, with the exception of 8/1/17, over ½ inch of rain fell within 24 hours of collecting samples, with the most significant spikes being on 8/28/17.

There is not enough consistent data at this time to suggest that the aerators are reducing fecal coliform levels; at the same time there is nothing to suggest that they aren't working either. It is the opinion of staff that there is likely some benefit, but probably not at the level that was expected. More data is needed, particularly with respect to samples collected when no rainfall occurred 24 hours before the sample was taken. When the variables can be isolated, the likelihood of determining effectiveness should be considerably higher.

It is important to note that during those sampling events, Pool Creek frequently had high fecal levels. The cause for these high numbers has been a mystery because there is no specific source for fecal coliform in Pool Creek and samples collected upstream are considerably lower than those collected at the monthly sample site. There are some theories however that while unproven, may explain possible sources. One source may be the storm water network under the parking lot of the Town Center which is also capturing a small stream. Additionally, according to the Town's former Public Works Director, there is a network of old terra cotta sewer lines under the Town Center that are badly deteriorated, unmapped, and possibly leaking into the stream flowing under the parking lot as well as possible ground water seepage. No samples have ever been taken at the storm drain outlet, so this should be a priority to isolate this as a potential fecal coliform source, especially given the consistently high numbers for 2017. The numbers in Pool Creek are not always high and it's very hard to predict when the numbers will be high other than when there are significant rainfall events, which pretty consistently yield higher counts.

Permitting:

Before the purchase of the aerators, the idea of cutting a channel into the peninsula to introduce cooling water into the beach swim area was popular among Parks and Recreation Board members. Staff met with officials from the US Army Corps of Engineers and NC Division of Water Resources to discuss the possibilities of cutting a channel or installing a culvert. Both agencies said that the project could be permitted easily enough, but had doubts about the desired results and recommended closely studying the issue before requesting permits. The reason for their doubts was that the volume of water that would be diverted via a culvert or channel would likely not be enough to sufficiently improve circulation or lower temperature due to the lack of perceptible current on the Pool Creek side. Nevertheless, the project as described was something the agencies said they would permit if the Town chose to move in that direction.

Regardless of what action is taken to remove or alter the peninsula, most assuredly permits are required. Any type of stream alteration, culvert installation, or placement of fill in jurisdictional waters of the U.S. or North Carolina requires Section 404/401 approval. This involves acquiring a Nationwide Permit from the US Army Corps of Engineers, which is then certified by the NC Division of Water Resources and given concurrent approval by the NC Wildlife Resources Commission. Town regulations may require permits as well, depending on the scope of work, such as Land Disturbance Permit, Floodplain Development Permit, and Shoreline Stabilization Permit. The application process also requires consultation with agencies such as the US Fish and Wildlife Service and NC Office of Cultural Resources regarding identification of endangered species or cultural and historical resources that may be impacted by a specific project. The following table describes the permitting requirements (**Table 10**).

Table 10: Permitting Table

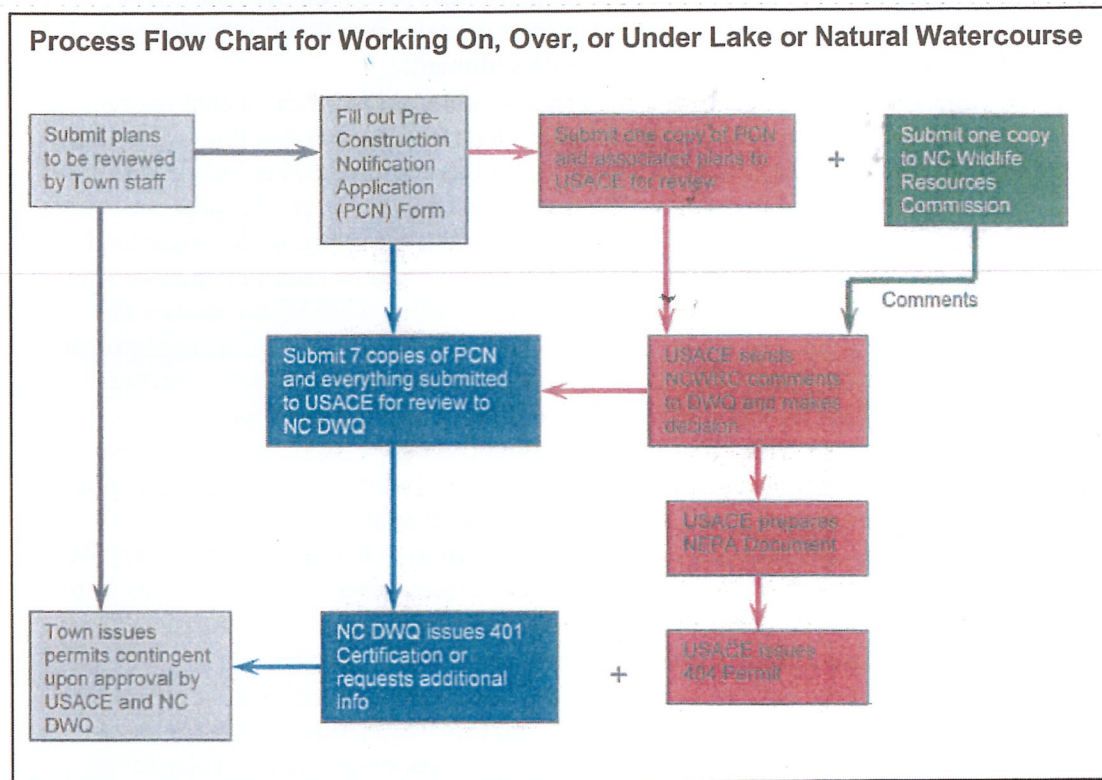
Agency	Land. Dist/ Buffer	Shoreline Stab.	Dredging	Filling	Floodplain	Review/ Consult
US Army Corps of Engineers		X	X	X		
NC Div. of Water Resources	X	X	X	X		
*NCDEMLR, Land Quality Sec.	X					X
**NC Wildlife Resources						X
US Fish and Wildlife						X
NC Office of Cultural Res.						X
Town of Lake Lure	X	X			X	

* NCDEMLR, Land Quality Section only has jurisdiction over land disturbance projects that are one acre or greater, but are the agency with authority to issue trout buffer waivers when 10% or more of the buffer zone must be disturbed as part of a land disturbing activity.

** NC Wildlife Resources Commission must give written approval for all 404/401 projects so application is sent directly to this agency for concurrent review.

The process for applying for permits related to lakes and natural watercourses is detailed in the following flowchart (Table 11):

Table 11: Permitting Flow Chart



Scenario #1: Installation of Culvert

As explained previously, this scenario has been discussed before as a possible solution to the fecal issues plaguing the beach. The idea is that placement of a culvert (this was done many years ago) would channel cold water from Pool Creek into the beach swim area, thereby lowering water temperatures and inhibiting bacterial growth. How well this worked in the past is unknown.

On the surface this seems like a logical solution, but there are things to be considered with this scenario:

- Pool Creek often has bacterial issues as well, with sources that have not been sufficiently located or identified. A culvert could potentially increase the concentration of fecal bacteria in the swim area, especially during large storm events.
- One of the reasons cited for removal of the original culvert, aside from cold water, was the accumulation of debris from Pool Creek after storms. With the current configuration, any debris that stays within the main current of Pool Creek gets pushed farther into lake and eventually into the main channel. Anything that gets caught in the eddy beyond the peninsula, pushes out into the main part of

Washburn Marina Bay, but far enough away from the beach that it doesn't cause any issues. Re-installing a culvert will most certainly increase the amount of debris coming into the beach and increase the amount of sediment dumping into the swim area. It might be possible to put a debris screen on the Pool Creek side of the culvert, but this will require someone to make sure that it gets cleaned off after storms and doesn't get clogged with sediment.

- A large amount of water from Pool Creek would need to be channeled in order to cool the entire swim area enough to inhibit bacterial growth, but this still would not entirely solve the bacteria problem. A culvert would need to be properly sized and properly located in order for the water diversion to occur. Because the water on the Pool Creek side of the peninsula is the same elevation as the water on the beach side of the peninsula, the water exchange would be minimal unless it was located in such a way as to capture the current, which would force more water through the culvert. Because of water elevations being the same, without proper location and significant water flow from Pool Creek into the beach swim area through the pipe, the static hydrology would be sustained, with the only noticeable change in temperature being around the pipe itself. A comparative example of this is the Morse Park Pond, whose only two water sources are ground water from lake seepage and surface water from the lake that comes in via a single culvert. Because the water surface elevation is the same, there is very little flushing or circulation of the smaller body of water, other than what comes from wave action, and as a result the pond gets very warm and hypereutrophic. There are no external forces to move water from one point to another.
- Assuming that the culvert installation was successful and sufficient water could be diverted, it would be unwise to think that this would totally solve the fecal coliform problem. First of all, the bacteria problem exists on both sides of the peninsula and seems to increase with storm events. If temperature were the limiting factor, then fecal numbers should be consistently low in Pool Creek since the water is cooler. The beach's problem stems more from lack of circulation than high temperatures. It is also highly likely that there is a fair amount of bacteria locked up in the lake bottom that get mixed into the water column when users of the beach are swimming, wading, etc. Compare the fecal coliform numbers at the Town-owned beach to the beach at Rumbling Bald. The numbers at Rumbling Bald are considerably lower. This is due to the fact that there are two streams coming into either side of the beach area, providing continuous fresh water; the bay at Rumbling Bald is not geographically landlocked; usage of the beach is much lower by comparison to that of the Town-owned beach; and circulation is created from waves generated by boats beyond the no-wake zone.
- A hydrologic study would be recommended to determine how best to install such a culvert to achieve the desired result. This would take into account stream flow and volume, changes in volume due to storm water inputs, thalweg (deepest part of the stream channel) location, and predictors for where sediment will be most likely to accumulate. Such a study would give the Town the needed information to properly size, locate, and install the culvert to get the desired result. Based on greatest flow potential, locating the culvert at the neck (the connection point

between the beach and the peninsula) would probably be the most effective location.

- Instream measures such as rock vanes may need to be constructed in order to shift the thalweg of the creek closer to the peninsula as opposed to the middle of the channel or closer to Pool Creek Park, influencing the stream current towards the beach swim area.
- Identifying the sources of fecal contamination should be a priority. If it is true that there are old leaky lines under the Town Center area, these lines should be prioritized for replacement as part of the contamination could be coming from ground water seepage.
- Will require permits to construct.

Scenario #2: Removal of the Peninsula

This is a new idea stemming from the fact that the peninsula is seldom used for anything and doesn't seem to have much of a purpose beyond what has already been stated. Some things to consider with this scenario are:

- Removal of the peninsula will most certainly bring the cooler water of Pool Creek into the beach swim area and would most likely improve overall circulation within the bay as a whole, but some stream manipulation would most likely be necessary to move the thalweg of the channel westward to maximize the effect.
- Pool Creek is still going to continue to drop its sediment load where it always has. With no peninsula in place, the delta will begin to form within the swim area itself so the need for frequent dredging will increase in the bay. In the current configuration, dredging has only been necessary about once every decade. Consider that the Town already has significant dredging costs maintaining the river channel and entrance to Washburn Marina Bay, the additional dredging cost for maintaining the beach swim area may unnecessarily add costs that may not be worthwhile. Consider that Rumbling Bald is spending quite a bit of money every three years to dredge the area in front of their beach due to sediment coming from Trout Stream. There is no peninsula at Rumbling Bald to force the current and sediment load further out into the lake so the delta begins to build where the running water meets the still water.
- A hydrologic study would be recommended to look at stream flow and volume, changes in volume due to storm water inputs, currents, and predictors for where sediment will be most likely to accumulate. Such a study would give the Town the needed information to determine if instream measures or armoring would be needed and determine appropriate locations.
- It may be necessary to add to the shoreline at Pool Creek Park in order to push the current towards the beach. The material from the peninsula could likely be used to add to the existing shoreline. Significant amounts of armoring would be needed to ensure that Pool Creek remains in what would be essentially a new channel. Hydrologic study and engineered design would be necessary.
- Fecal issues may be diminished due to the overall improvement of circulation and possible reduction in water temperature, but there is no analytical data to fully support this conclusion. It is merely an assumption because the sources of

contamination are still present. Identifying the sources of fecal contamination should be a priority. If it is true that there are old leaky lines under the Town Center area, these lines should be prioritized for replacement as part of the contamination could be coming from ground water seepage.

- Will require permits to construct.

Scenario #3: Enhance What Currently Exists

While the issues for why the peninsula is currently unused have been previously stated, this doesn't mean that the strip is unusable. The peninsula has been used in the past as part of the beach operation and the aforementioned issues are certainly not insurmountable in terms of preventing use if appropriate enhancements were made. Considerations for this scenario are as follows:

- Armoring the Pool Creek side of the peninsula with rip rap would reduce scour that occurs on the bank during high storm flows. The fact that the channel is straight where Pool Creek flows into the lake accelerates flow which is partly why the delta is forming further out into the lake as opposed to within the stream channel. The same effect occurs with the river and is why the larger area of the lake is filling in. Accelerated flow increases bank erosion, increasing the amount of sediment being carried into the lake. Armoring would reduce the amount of cut along the shoreline on the Pool Creek side and may help to decrease some of the sedimentation occurring in the bay.
- Adding woody vegetation such as some native shade trees and shrubs would provide some much needed shade, particularly in the mornings, as well as provide much needed stability on the Pool Creek side.
- To address the "sandspur" issue, the existing peninsula could be re-graded and re-vegetated with an appropriate turf grass to prevent erosion and prevent unwanted grasses and weeds from invading. An attractive lawn type grass on the peninsula would improve the overall aesthetic of the peninsula and make its use more desirable.
- Grass, while being necessary for vegetative cover and erosion control, unfortunately attracts Canada geese that use it for their grazing grounds. A greater effort is needed to harass the geese and prevent them from roosting and grazing on the beach and peninsula. Goose harassment is a labor intensive effort but pays off fairly quickly as geese realize they aren't welcome. This may help (not cure) some of the fecal coliform issues that plague the swim area.
- Making an intensive effort to address all potential sources of fecal bacteria by locating and replacing leaky sewer lines where they interface with storm water systems would go a long way towards reducing fecal coliform numbers at the beach. There are also additional treatment methods that can be employed to treat the bottom sediments with healthy bacteria that will feed on the harmful bacteria. Pairing this method with aeration could help bring those numbers down significantly.
- One suggestion offered to staff was the idea of building a small gazebo on the point of the peninsula. A structure may encourage a greater level of use, but some enlargement of the peninsula may be necessary and it also may be necessary to

- construct a hardened pathway to prevent general use and foot traffic from damaging the vegetative cover established on the peninsula.
- Any structure built on the peninsula would have to be built to the standards of the Floodplain Development Regulations, requiring the structure to either be elevated or floodproofed.
- Some engineering and design work may be needed with regards to shoreline armoring and structure design if it is agreed that some type of structure is needed.
- Permits will be required to make alterations to what is existing.

Scenario #4: No Change

This scenario involves leaving things as they currently are in terms of the physical structure of the peninsula, but take steps to curb the fecal coliform issues by implementing some of the measures suggested in Scenario #3. Shoreline stabilization measures should also be considered, even if no other changes are implemented. Things to consider with this scenario:

- Leaving things the same will not do anything to improve circulation. Increasing the number of aerators in the bay or possibly adding a large decorative fountain might be something to consider as artificial means of moving more water.
- Using products such as “*Muck Away*” and other anti-muck products would help with reducing bacteria trapped in the bottom sediments in the swimming area at the beach.
- Track down sources of fecal contamination.

Other Options:

Obviously, this study is meant to rationalize some of the ideas that have been offered to staff. There may be other options and scenarios that have not been considered or offered. If there are other ideas for the use of the peninsula, it is recommended that a similar rationale be used to guide the decision-making process. A key objective for all options must be to protect water quality and protect health and human safety. No decision should be made without considering what’s necessary to ensure the health and safety of residents and visitors and protection of water quality is an inherent part of that objective.

Conclusion:

The fact that the peninsula exists speaks to the fact that sedimentation can pose a real problem for the Washburn Marina Bay section of the lake, particularly the swim area of the beach. Because the peninsula is in place the frequency and cost of dredging in the bay and swim area has been reduced due to the hydrologic changes that resulted from its construction. At the same time, having the peninsula in place inhibits water circulation in the backwater areas of the bay, including the swim area. Washburn Marina Bay’s location in a No Wake Zone, and being mostly landlocked isolates it from fast-moving boat traffic which also serves to help move water. This allows fecal coliform levels to spike, especially during hot weather when beach activity is at its highest. Certainly there are options that exist for the peninsula’s use as well as ways of managing the fecal coliform issue and each one has advantages and disadvantages. The purpose of this study was to provide possible options and solutions and to provide information that can be used in the decision-making process. Staff in no way asserts that any option is better than

another, nor does staff endorse a particular method over another. The considerations for each option are based on fundamental knowledge of facts and data that has been collected. There may be other considerations that could be added to each scenario that were not thought of, but staff has attempted to think of every possibility based on the available information.

Attachments:

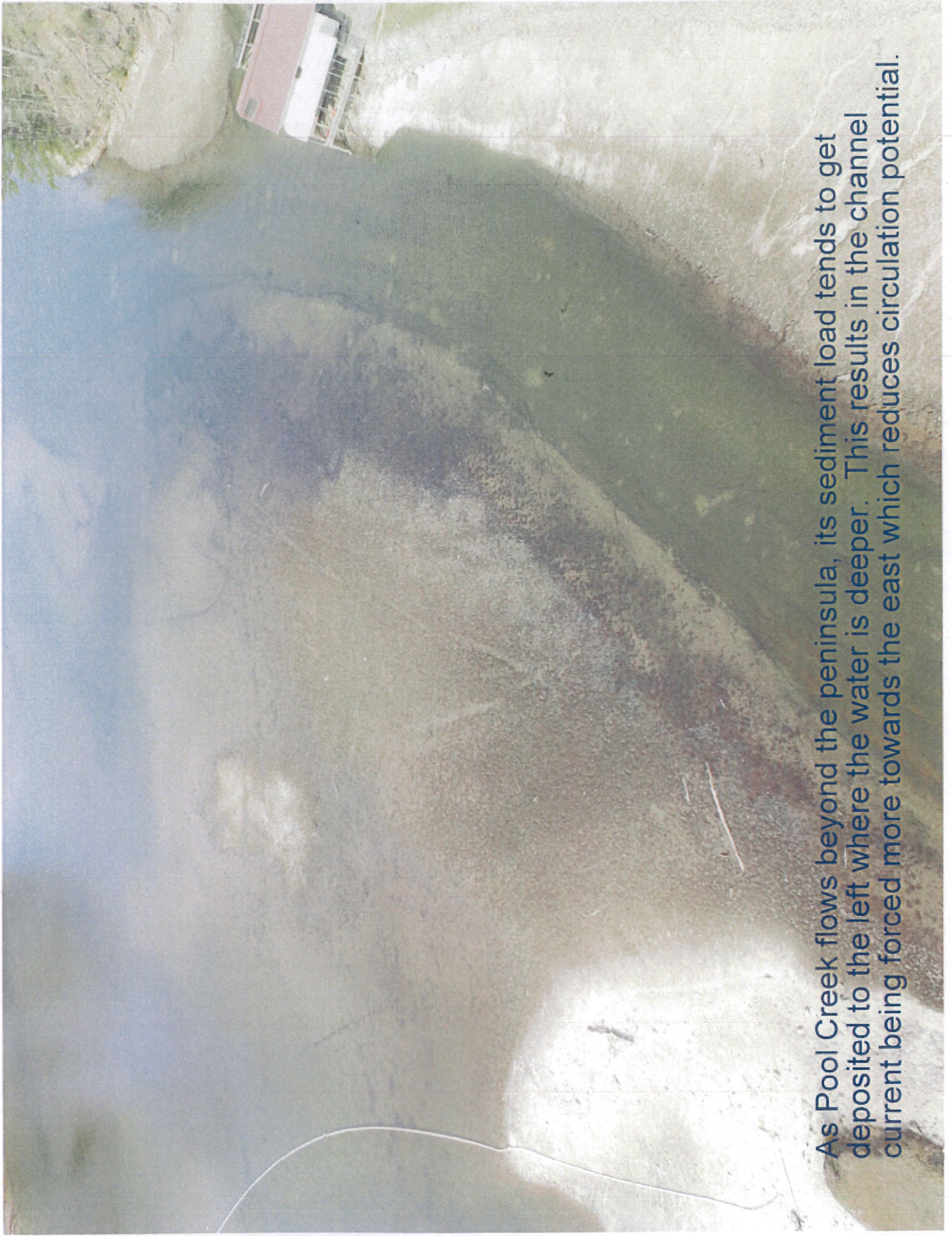
Additional photos of Pool Creek and the peninsula are attached as an addendum for reference.



Aerial view showing the location of the Pool Creek channel and the delta formation occurring beyond the peninsula.



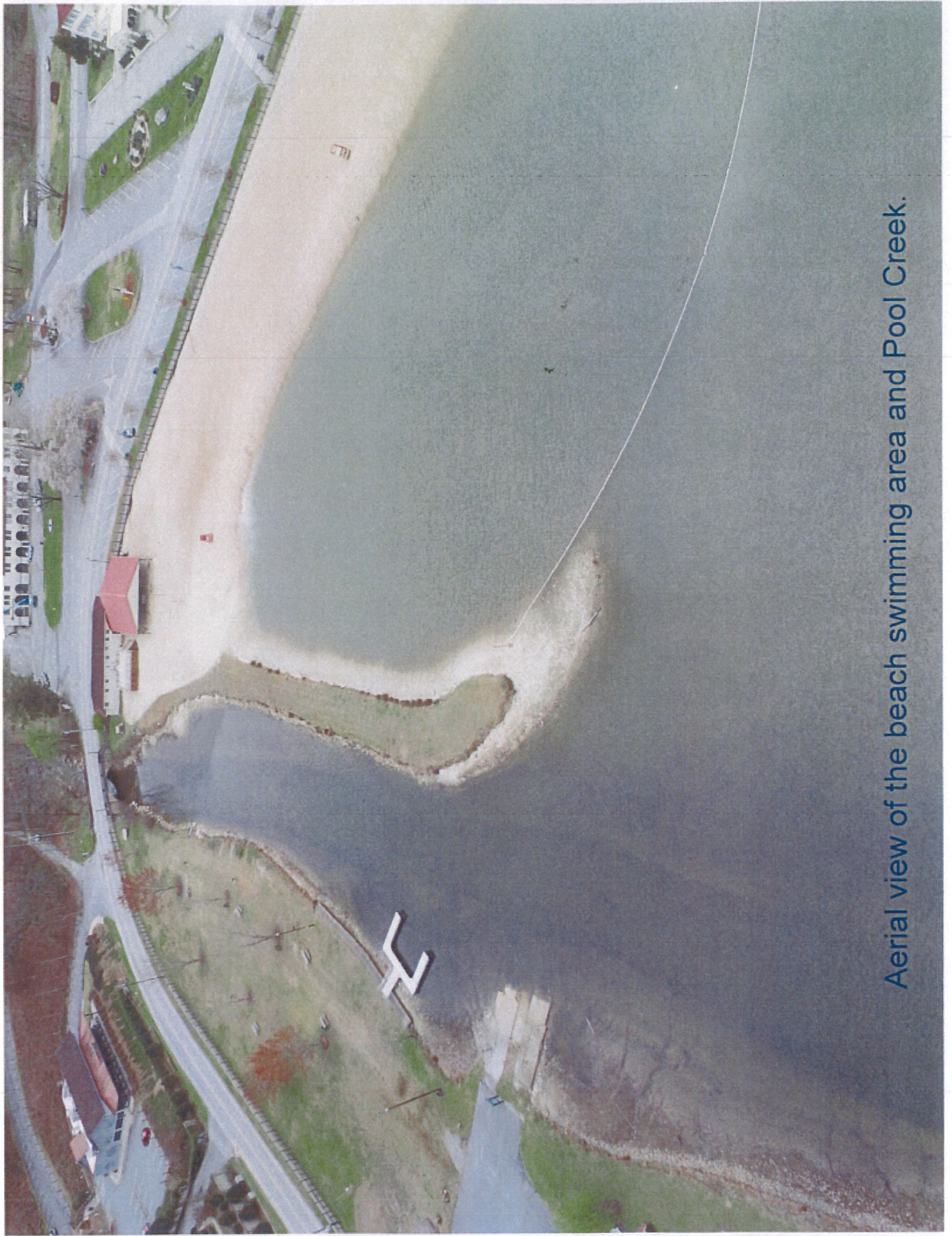
Aerial view showing areas of sediment accumulation.



As Pool Creek flows beyond the peninsula, its sediment load tends to get deposited to the left where the water is deeper. This results in the channel current being forced more towards the east which reduces circulation potential.



Aerial view looking south, showing the Pool Creek channel.



Aerial view of the beach swimming area and Pool Creek.