# Douglas Pond and S. Bingham Pond Land Use and Water Quality Assessment Cornwall, Vermont



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### 1.0 Introduction

The Cornwall Conservation Commission (CC), as part of a town wide inventory of natural communities, hired Landslide Natural Resource Planning (LNRP) to review existing Stream Geomorphic Assessment (SGA) data to make recommendations for improving water quality in the Town. The scope of this project was limited and intended to help the CC focus on a few specific projects that could improve water quality.

LNRP reviewed the existing SGA data, identified undersized bridges and culverts within the already assessed area and mapped potentially lost wetlands throughout the town. This information was brought to a meeting with the CC where the work plan was updated. The CC decided to focus on developing management recommendations, in order of priority, on Douglas Pond and South Bingham Pond areas of town. Additionally, if time remained, they asked LNRP to look at the Beaver Brook crossing of Vermont 125.

# 2.0 Review Existing Data

### 2.1 Stream Geomorphic Assessment (SGA) data

In March of 2006 LNRP completed a Phase 1 SGA for the entire Lemon Fair Watershed. A Phase 1 SGA relies on remote sensing and existing data to evaluate geology, soils, slope, and watershed size to establish provisional reference stream type for each river reach (what the river would look like without human development or land use). The Phase 1 study also quantifies human impacts in the watershed, and assigns a provisional impact rating to each reach based on the following parameters:

2.1.1 Table 1. Parameters included in impact scores.		
Step Number	Parameter	
4.1	Watershed Land Cover/Land Use	
4.2	Corridor Land Cover/Land Use	
4.3	Riparian Buffer Width	
4.4	Groundwater and Small Tributary Inputs	
5.1	Flow Regulations and Water Withdrawals	
5.2	Bridges and Culverts	
5.3	Bank Armoring or Revetments	
5.4	Channel Straightening	
5.5	Dredging and Gravel Mining History	
6.1	Berms and Roads	
6.2	River Corridor Development	
6.3	Depositional Features	
6.4	Meander Migration / Channel Avulsion	
6.5	Meander Width Ratio	
6.6	Wavelength Ratio	
7.1	Dominant Bedform / Material	
7.2	Bank Erosion – Relative Magnitude	
7.3	Debris and Ice Jam Potential	

The Phase 1 information helps set the stage for understanding what the major watershed impacts are and can assist in identifying areas to focus additional assessment resources. The Phase 1 SGA data is limited to the Lemon Fair Watershed. See map below.



#### 2.1.2 Undersized Structures

A Bridge and Culvert Inventory was completed as part of the Lemon Fair Watershed Phase 1 SGA. This assessment includes field observations, measurements and photos of the inventoried structures. A total of 36 structures were inventoried – 22 bridges and 14 culverts. Of these, there is one culvert and one bridge identified as undersized. The culvert is located on Vermont 125 at the Beaver Brook and the Bridge is on Park Lane at the first tributary of the Beaver Brook (Map 2). The bankful channel width of the Beaver Brook is 24' and the structure width is 8'. The channel width at Park Lane is 10' and the structure width is 5'. The use of the channel forming (bankful) width to size structures allows for the passage of both water and sediment.

When structures are too small to pass the bankful width, they can cause an increase in stream velocity that leads to downstream scour

during high flow events. Additionally, undersized structures can function like a dam upstream, obstructing the natural flow of sediment and starving the downstream reaches of sediment, exacerbating downstream bed and bank erosion. The Beaver Brook in this area is a low gradient, meandering stream type with good access to floodplain which provides storage of flood water and sediment on the east side of 125, periodically flooding the road but eventually passing the floodwater after an event. The likelihood of a structural failure due erosion is low here but a properly sized structure would prevent the inundation of the road and allow for better water, sediment and aquatic organism passage.

#### 2.1.3 Other SGA Data

Straightening, channel migration, erosion and a lack of riparian buffers can all negatively impact water quality and generally correspond in this watershed. Riparian buffers are important for slowing channel migration and erosion and filtering runoff from adjacent land uses. Any efforts to restore riparian buffers along the streams in Cornwall will improve water quality. In order to make the map of SGA data more legible, only riparian buffer widths are included but these are generally the same areas that were identified as having been straightened and migrating (Map 2).

#### 2.2 Beaver Brook Watershed Conservation Plan

In 2010 LNRP was contracted by the Middlebury Area Land Trust to develop a conservation plan for the Beaver Brook Watershed. The goal of the plan is to identify and prioritize land areas that are important to the ecological health of the watershed and the region so that interested landowners may work toward long term conservation and improved management of these resources. The plan:

- Compiles existing natural resource information into a watershed-based structure that is accessible to watershed residents;
- Places the watershed in the larger context of Vermont and the Champlain Valley;
- Prioritizes conservation areas to assist the Middlebury Area Land Trust with outreach efforts in the watershed; and
- Provides management recommendations for private landowners.

### 2.3 Inventory of lost or degraded wetlands

A review of hydric soils is the first place to identify the potential presence of wetlands because hydric soils are permanently or seasonally saturated with water. Wetlands are important for maintaining water quality, storing flood waters during major rain and snow melt events and for providing important wildlife habitat. Development and cultivation of wetlands can degrade water quality and lead to increased stormwater runoff and reduce important wildlife habitat areas. Cornwall is 18,391 acres of which 6,348 acres (35%) are identified by the Natural Resource Conservation Service as having hydric soils. Of these, 39% have land uses with varying degrees of human cultivation and development. Table1 below summarizes hydric soils by land use. Table 2 further consolidates human impacted lands as developed with the remaining land categorized as undeveloped. Map 3 shows that there are three main clusters of cultivated hydric soils – the largest near the confluence of the Beaver Brook and the Lemon Fair, in the northeast corner of town along "Ledge Brook" and at the northern end of the Cornwall Swamp. Focused land use evaluation and subsequent implementation of best management practices in these areas will have a positive impact on water quality.

Hydric Soils Land Use	Acres
Commercial	0.0
Coniferous Forest	73.3
Deciduous	191.5
Forested Wetland	2,979.5
Hay/Pasture	1,026.3
Mixed Forest	39.4
Non-forested Wetland	248.2
Orchard	1.2
Other Agriculture and Mixed Open	0.0
Residential	126.7
Row Crop	1,320.8
Transportation/Utilities	28.2
Water	313.1
Total	6,348.1

Table 1. Hydric Soils Land Use

Table 2.Developed & Cultivated HydricSoils

Hydric Soils	Acres	Percentage
Developed	2,503	39%
Undeveloped	3,532	56%
Water	313	5%
Total	6,348	100%

## 3.0Meeting with Conservation Commission

On June 10<sup>th</sup>, 2014 LNRP met with members of the Cornwall Conservation Commission to review the existing reports and data and focus the efforts of this study. The work plan was refined to exploring water quality issues in the following geographic areas of interest in order of priority:

- 1. Douglas Pond
- 2. South Bingham Pond
- 3. Beaver Brook at Route 125





### 4.0Douglas Pond 4.1 Background



Douglas Pond November, 2014

The Town of Cornwall owns Douglas Pond, located west of Douglas Road at the south end of town, approximately three quarters of a mile from the Whiting town line. The one acre pond is fed by two streams and a spring and drains east into a stream that flows north into the Cornwall Swamp. The watershed is approximately 334 acres in size. The dominant land-use is mixed forest (152.6 acres) followed closely by active agricultural land (128.7 acres). The soil in the pond is Swanton Fine Sandy Loam, a hydric soil that is rated as a prime agricultural soil. The

presence of hydric soil implies the historic presence of a wetland at this site.

The watershed of the western feeder stream is almost entirely comprised of a permanent forest (never clear cut) with a variety of forest types, ledges and springs (M. Lapin).

A small pond is shown on the 1904 USGS map with a road that runs east and parallel to the stream out to Route 30 also shown (this road also appears on the Beers map). By 1946 the pond is mapped much larger and the road is gone. On the 1980s map the pond appears identical to the 1946 version. Valerie Ringey Calzini reports that her mother says that Douglas, listed as a 'farmer and dairyman' on the Beers atlas, dug the pond. Douglas Pond is dammed at the outlet where the Cedar Swamp Tributary goes under Douglas Road. Originally there was a bridge at this location but in the late 1960's it was replaced with a stonewall dam and drop inlet. The original 2'culvert was replaced, due to frequent flooding, less than ten years ago with a 4' high by 4.8'wide culvert that is below the height of the dam (drop inlet). It has not flooded since that time. The pond was historically used to cut ice. (Personal communication with Stu Johnson, Road Commissioner.)

Land Use Category	Acres
Brush/Transitional	0.681826
Residential	16.26236
Transportation	7.821319
Other Agricultural	6.159099
Mixed Forest	152.6015
Non-forested Wetland	22.22907
Crop/Hay	21.70792
Hay/Crop	106.7399
Total	334.203

Table 3.	Land	Use	Douglas	Pond
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Many Cornwall residents have fond memories of recreating at the pond – summers swimming and winters ice skating. 30 years or so ago the town would dump a load of clean sand at the east end of the pond each summer to make a beach. There was a raft anchored in the deepest area of the pond and it was considered swimmable into the 1980s. More recently, the pond has undergone eutrophication – the process by which a pond or lake begins to fill in and aquatic plants become abundant and swimming and even boating become impossible. People still ice skate on the pond but parking is limited. (Personal communication with Valerie Ringey

Land Use	Acres	Percentage
Developed/cultivated	158.7	47.49%
Undeveloped	175.5	52.51%
Total	334.2	100.00%

Calzini, August 5<sup>th</sup>, 2014 and phone call with Eric Mortensen, June 30, 2014).

### 4.2 Current status

Residents have voiced a concern over the observed filling in of the pond and the seasonal growth of aquatic vegetation that makes boating and swimming difficult. In August, 2014 the pond was observed to be clogged with plants. Eutrophication – the process by which a pond or lake gradually fills in - can be a natural process or it may be caused by human land uses or exacerbated by them. In order to inexpensively quantify and assess the water quality and swim ability of Douglas Pond, water depths were measured and plant samples from the pond were taken and sent to the State lab for analysis. Measured water depths ranged from 1.4' at the northwest end of the pond to 4.2'at the east end in the vicinity of the raft that the town used to put out for swimming. See Map 5 below. Valerie Ringey Calzini also reported that the leach species in the pond has changed over time from a small black to a larger brown type.

Table 4 lists aquatic plants that were collected in August and sent to the State Lab where they were identified by Ann Bove, of the Aquatic Invasive Species Management Program at the Vermont Agency of Natural Resources.



### Map 4. Land Use Douglas Pond Watershed

Map 5.	Water Depths Douglas Pond
Table 4.	Aquatic Plants found in Douglas Pond





Photo by Amy Sheldon.	<i>Ceratophyllum demersum</i> (coontail) This underwater rootless perennial plant has branched stems with stiff whorls of forked olive-green to almost black leaves. The leaves are sometimes coated with lime, giving them a crunchy feel. Coontail refers to the thick and bushy growth of leaves (similar in appearance to a raccoon's tail) that occurs at the stem tips. In nutrient rich water, coontail tends to form dense colonies either anchored in the mud or floating freely near the surface. http://www.ecy.wa.gov/programs/wq/plants/plan tid2/descriptions/cerdem.html
Photo from aquaplant website.	<i>Chara</i> sp. (muskgrass or skunkweed) Chara is often called muskgrass or skunkweed because of its foul, musty almost garlic-like odor. Chara is a gray- green branched multicellular algae that is often confused with submerged flowering plants. However, Chara has no flower, will not extend above the water surface, and often has a "grainy" or "crunchy" texture. Chara has cylindrical, whorled branches with 6 to 16 branchlets around each node. Submerged portions of all aquatic plants provide habitats for many micro and macro invertebrates. These invertebrates in turn are used as food by fish and other wildlife species (e.g. amphibians, reptiles, ducks, etc.). After aquatic plants die, their decomposition by bacteria and fungi provides food (called "detritus" for many aquatic invertebrates. Chara is consumed by many species of ducks. http://aquaplant.tamu.edu/plant-identification/alphabetical- index/muskgrass/
Photo by Marie Lovit for www.gobotany.	Likely Potamogeton epihydrous (submersed leaves degraded) (ribbon leaved pondweed) Ribbon-leaved pondweed is a common species throughout the northern United States and southern Canada, and it is found throughout New England. The submersed leaves are narrow and ribbon-like, thin and transparent, with prominent bands of lacunar cells 1–2 mm wide on each side of the midrib. The floating leaves are broad and elliptical. <u>https://gobotany.newenglandwild.org/species/pot</u> <u>amogeton/epihydrus/</u>

According to Anne Bove all of these plants are common and none of them are invasive and they are typical of natural, nutrient rich ponds (M. Lapin). They are important to aquatic habitat and they take up nutrients when growing but when they die they contribute to the nutrient load. These plants are indicative of mesotrophic water bodies (see sidebar below for definitions). It is unclear whether the eutrophication of Douglas Pond is natural or human induced.

#### Lake Terminology

**Mesotrophic:** Describing a body of water, such as a lake, that is intermediate between a <u>eutrophic</u> lake and an <u>oligotrophic</u> lake in the amount of nutrients contained within it.

**Oligotrophic:** Describing a body of water (e.g. a lake) with a poor supply of nutrients and a low rate of formation of organic matter by photosynthesis.

**Eutrophic:** Describing a body of water (e.g. a lake) with an abundant supply of nutrients and a high rate of formation of organic matter by photosynthesis. Pollution of a lake by <u>sewage</u> or <u>fertilizers</u> renders it eutrophic (a process called *eutrophication*). This stimulates excessive growth of algae (see <u>algal bloom</u>); the death and subsequent decomposition of these increases the <u>biochemical oxygen</u> <u>demand</u> and thus depletes the oxygen content of the lake, resulting in the death of the lake's fish and other animals. <u>http://www.encyclopedia.com/doc/</u> Map 6. Overland Flow Douglas Pond Watershed



## 4.3 Management Options

The following management options are possible to improve recreational opportunities at the pond and improve water quality. **For aquatic plant management:** 

- 1. Hand removal this is a low cost option that does not require a permit from the state. There is also historic precedent as Valerie Calzini's mother used to pull cattails .It could become a community event. Temporary.
- 2. Chemical removal herbicide application requires a permit and is also temporary.
- 3. Mechanical removal there are out of state contractors available to come and harvest pond weeds. This is an expensive option but could be coordinated with others in Vermont to reduce costs. Requires a permit.
- 4. Benthic matting applying a layer of artificial mulch to the bottom of the pond to kill rooted plants.

# To reduce the overall nutrient load and slow eutrophication:

- 5. Watershed Management There are 2,700' of stream in cultivated agricultural fields that have no riparian buffer. Maintaining riparian buffers slows and filters water runoff and also slows erosion. Regardless of the other management goals, if nutrients and sediment are allowed to flow unchecked into the surface water, aquatic vegetation will continue to be present.
- 6. Planting grass swales along agricultural runoff channels identified on Map 7 will reduce and slow runoff into the stream channel.

# To improve swim-ability:

- 7. Dredging many pond owners in Vermont periodically have to remove accumulated sediment in order to maintain pond depths. If residents want to swim in this pond again, dredging will be required.
- 8. Installation of a seasonal dam to allow spring flows to move sediment through the system (suggested by Brian Howlett).



Summer view 2014, Doulas Pond. Amy Sheldon

# 5.0 South Bingham

The CC asked LNRP to evaluate stormwater runoff and potential sources of erosion in the South Bingham/Beaver Brook Pond area.

### 5.2 Background

The watershed around the South Bingham pond is 348 acres and is the headwaters of the Beaver Brook. Land use is dominated by hardwood and coniferous forest on the east side, with row crops (corn this year) on the west side being the next major land use followed by orchard in the southwest and residential and hay land to the south. The dominant soil in the cornfield is Elmwood fine sandy loam, which is listed as potentially highly erodible and is also a national prime agricultural soil. The rest of the watershed is comprised of a number of Addison county soils which support a diversity of forest habitats. Because of this diverse collection of soils and



their location at the headwaters of the Beaver Brook, this area is a priority for conservation in the Beaver Brook Conservation Plan.

The pond was created for irrigation purposes (John Derrick personal communication) in 1966 when the Norinberg dam was constructed. No pond is shown on historic maps of Cornwall. In 1995 the area currently planted in corn was all orchard. By 2006 the orchard trees on the west side were gone, replaced by corn crops.

# 5.3 Existing Condition

On November 11, 2014 a field assessment was completed after the corn had been cut. A cover crop of winter rye had been planted in the corn field and was ~2" high. There is a Vermont Association of Snow Travelers (VAST) trail traversing the property and there is evidence of ATV use on the west side of the pond. The former orchard on the west side above the pond is no longer being managed and provides a good buffer from potential agricultural runoff at the north

end of the west side corn field. Buckthorn is starting to invade. Fresh beaver activity was observed at the south end of the pond. On the day of the site visit, in addition to evidence of beaver, ducks, geese, deer, turkey and crows were observed at the site. On the east side and adjacent to the pond, there are two paths/slides down to the pond, presumably from beaver, that



are eroding (head cutting) at their east end. It may be a combination of shallow ground water and surface water flowing in the animal paths during high flow events is causing this erosion. The deciduous forest on the east side of the pond is fairly even aged and comprised of a mix of beech, birch and oak. An old duck blind was observed down by the water in this area as well. There is a small tributary entering the pond on the east side where mounds of soil near the mouth were observed which may indicate historic dredging. The water was clear of aquatic

vegetation on the day of the site visit. *View north from east shore* 

The VAST trail

continues east, out of the watershed and up into another cornfield, where surface water flows had eroded the road/trail. These flows likely end up in a ditch running along the south end of the VAST trail and into the pond.

A close examination of current aerial photos indicates that aquatic vegetation similar to that observed in the Douglas Pond also accumulates in this pond seasonally. By November the water in the pond was mostly clear, with minor algae observed in the shallowest areas. Aerial photo analysis and 2' contours derived from LIDAR data indicate that there are flows accumulating on the cultivated fields and draining into the stream that feeds the pond. (Map 7 below).

### 5.4 Management Recommendations

The erosive nature of the soils and the slope of the fields make this area vulnerable to stormwater runoff.

- 1. Cover cropping observed in both the east and west side corn fields in 2014 is a good step toward slowing runoff into adjacent surface waters.
- 2. Riparian and agricultural buffers Planting perennial buffers along the drainages and increasing the riparian buffer areas along the Beaver Brook before it enters the pond will reduce erosion by slowing flows and will retain nutrients. An example of best management practices on a sloping cornfield adjacent to a wetland/stream is north of Lime Kiln Road in New Haven on the east side of the road.



1 Erosion on VAST trail

#### Map 7. South Bingham Field Notes

November, 2014

Field Notes 11/11/14 South Bingham Pond Cornwall, VT



November, 2014

Agricultural Runoff South Bingham Pond Cornwall, VT



# 6.0 Beaver Brook Culverts at Route 125

The limited resources available for this work did not allow for the collection of additional data on these culverts. I spoke with Stuart Johnson about these culverts and he indicated that the undersized culverts on the Beaver Brook at Vermont Route 125 cause the water to back up over the road during high flows. The CC should reach out to VTRANS to be sure that when the time comes, these are replaced with larger capacity structures.

# 7.0 Next Steps

# 7.1 Undersized Structures

- Work with VTRANs to insure replacement structures at the Beaver Brook/VT Route 125 are sized to the bankful width; and
- Work with the Town to insure any replacement of the bridge at Park Lane is sized to the bankful width.

# 7.2 Lack of Riparian Buffers

- Utilize Stream Geomorphic Assessment data for riparian buffers to identify specific areas in need of planting; and
- Identify funding sources based on land management type and reach out to individual landowners to implement planting plans.

# 7.3 Implementation of Beaver Brook Management Plan

- Continue to work with the Middlebury Area Land Trust to conserve priority areas identified in the plan;
- Consider adopting a wildlife zoning overlay to limit development of priority conservation areas; and
- Work with landowners to implement additional management practices recommended in the plan including:
  - 1. Maintenance and enhancement of hedgerows;
  - 2. Re-establishment of stream bank vegetation; and
  - 3. Removal of exotic invasive plants with cultivation of natives.

# 7.4 Inventory of Lost or Degraded Wetlands

- Refine identification of potential lost wetlands by digitizing current land use in those areas; and
- Prioritize this list for wetland restoration projects.

# 7.5 Douglas Pond

- Facilitate a town wide conversation about management goals for the pond; and
- Work with agricultural land managers to establish riparian buffers along perennial streams and plant grass in adjacent runoff areas.

# 7.6 South Bingham

- Work with landowner to conserve the headwater forest of the Beaver Brook;
- Work with agricultural land managers to establish riparian buffers along perennial streams, the farm pond in the eastern cornfield and to plant grass in adjacent runoff areas.