

Crescent Lake Watershed-Based Protection Plan



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1. Background Information

A. Document Purpose and Scope

The purpose of this Watershed Based Plan, herein after referred to as the “plan”, is to lay out a strategy and schedule for NPS mitigation and water quality protection efforts for the Crescent Lake watershed over the next ten years (2013 to 2023).

The plan was developed to satisfy national watershed planning guidelines provided by the US Environmental Protection Agency (EPA). The EPA requires *nine-element* plans for all impaired watersheds, but allows *alternative* plans in several cases including for protection of high quality or unimpaired waters. The Maine Department of Environmental Protection (MDEP) accepts alternative plans for unimpaired lakes that have completed a recent watershed survey (or similar assessment). Since Crescent Lake meets both criteria, this plan follows EPA and MDEP guidance for alternative plans and includes the five required planning elements (the five elements correspond to sections 2 through 6 in the plan).

Raymond Waterways Protective Association (RWPA) prepared the plan, and Crescent Lake Watershed Association (CLWA) provided assistance with input and plan review. Information collected during the 2000 watershed survey, 2011 survey update and Phase I Implementation project forms the basis for much of the plan. The plan is not intended to be a detailed tactical work plan, such as a two year work plan for a NPS watershed implementation project. As with any watershed plan, this document should be revisited and adjusted periodically to incorporate new information.

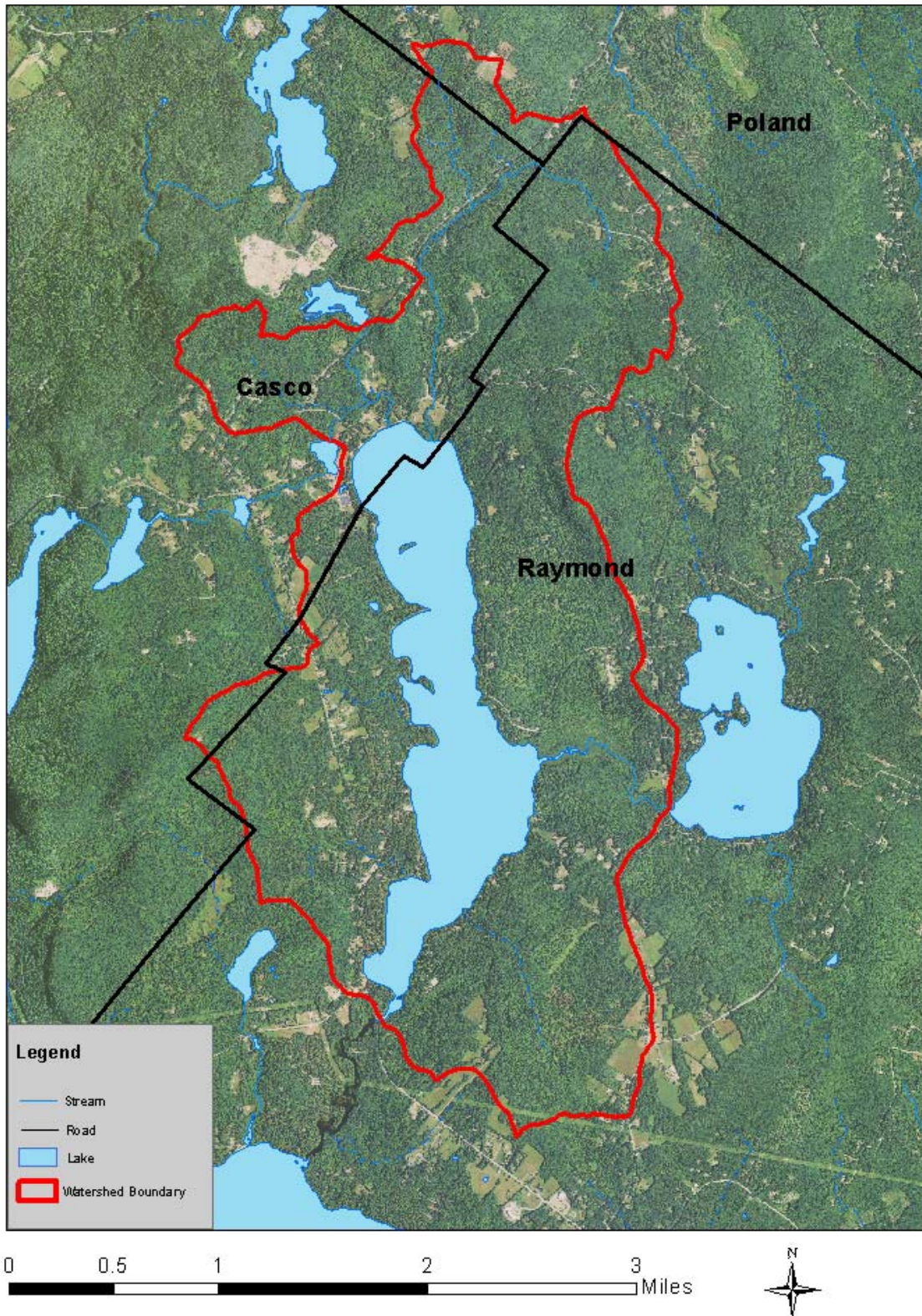
B. Watershed Background

The Crescent Lake watershed is located in the Towns of Raymond (74%), Casco (23%) and Poland (3%) in central Cumberland County, Maine (Figure 1). Crescent Lake is 703 acres and the immediate watershed is 6.1 square miles. The Lake flows into Panther Pond, which, in turn, empties into Sebago Lake. The Maine Department of Inland Fisheries and Wildlife manages the lake for both cold and warm water fisheries. Crescent Lake is known for its excellent bass fishing and several fishing tournaments are held on the lake each year. The current watershed boundary delineation has raised concerns among watershed residents and the CLWA. The CLWA has supplemental information to support this and suggests a completely updated drainage analysis.

Crescent Lake has 8.9 miles of shoreline, most of which is privately owned. The Lake’s shoreline is developed with over 290 seasonal and year-round homes, a large commercial campground, four private youth camps, two small public beaches, one formal boat access and an extensive network of unpaved camp roads. RWPA completes a Level III Plant Survey on Crescent Lake each summer. There are no known infestations. In addition, RWPA employs courtesy boat inspectors to inspect boat entering and exiting the lake to educate boaters and prevent the introduction of invasive plants.

Figure 1 – Crescent Lake Watershed

Crescent Lake Watershed



C. Summary of Prior Watershed Work

The Raymond Conservation Commission organized the Crescent Lake Watershed Survey (2000) in which volunteers identified 139 erosion sites. The 2001-2004 Raymond Pond and Crescent Lake Demonstration Project, a 319 project, sponsored by the Cumberland County SWCD, stabilized 13 identified sites and provided technical assistance to 12 landowners in the Crescent Lake Watershed. In the fall of 2009 RWPA staff and Crescent Lake residents conducted a shoreline survey to identify potential LakeSmart properties and candidate erosion sites for a 319 grant proposal. In 2011, the Town of Raymond received a 319 grant to conduct the Phase I Crescent Lake Watershed project. As part of the Phase I 319 grant, staff and volunteers conducted a watershed survey in May 2011 to check on the sites from the 2000 and 2009 surveys to determine which sites continued to impact the lake. The Town of Raymond has provided in-kind match to support conservation projects on many of the lakes and ponds in Raymond.

The Crescent Lake Watershed Association (CLWA) was formed in 2009 and has since effectively partnered with RWPA to protect and improve the quality of Crescent Lake. In their first year of existence the CLWA worked with RWPA to update the 2000 Watershed Survey, complete a shoreline survey and successfully ran the Maine DEP LakeSmart program. Through LakeSmart, eighteen properties were evaluated and eleven LakeSmart Awards presented. In addition, CLWA has developed an effective communication network with landowners and the six road associations on the lake; established a website and newsletter; and ~100 people attended their first annual meeting in 2009.

2. Identification of the Causes or Sources of the NPS Threat

A. Water Quality Summary

The Maine DEP and the Volunteer Lakes Water Monitoring Program have collaborated in the collection of lake data to evaluate water quality, track algae blooms, and determine water quality trends. Water quality monitoring data has been collected on Crescent Lake since 1974.

Monitoring parameters include Secchi Disk Transparency (SDT), Chlorophyll-a (Chla), phosphorus and dissolved oxygen (DO). MDEP staff also periodically conducts baseline monitoring on the lake. There are 13 years of basic chemical information in addition to SDT. DEP summarizes Crescent Lake water quality as follows:

MDEP considers water quality of Crescent Lake to be above average water quality. The lake is a non-colored (average color 13 SPU) with an average SDT of 6.5 m (21.3ft). The range of water column TP for Crescent Lake is 3-9 parts per billion (ppb) with an average of 6 ppb. Chla ranges from 1.4 – 5.2 ppb with an average of 2.7 ppb. Recent dissolved oxygen (DO) profiles indicate high DO depletion in deep areas of the lake. The potential for phosphorus to leave the bottom sediments and become available to algae in the water column (internal loading) is moderate to high. Oxygen levels below 5 parts per million (ppm) stress certain

cold water fish and a persistent loss of oxygen may eliminate habitat for sensitive cold water species.

B. Threatened Status

Although it currently meets state water quality standards, Crescent Lake is listed in Chapter 502 of the Maine Stormwater Law as “Most at Risk from New Development” as well as the State’s “Nonpoint Source Priority Watersheds” list. Crescent Lake and the other unimpaired lakes were placed on this list because it was identified by MDEP as being particularly sensitive to eutrophication based on current water quality, potential for internal recycling of phosphorus, potential as a cold water fishery, volume or flushing rate, or projected growth rate in the watershed.

Recent trend analysis indicates that water quality appears stable over all, although, the loss of dissolved oxygen levels in the bottom waters is a concern and indicates the moderately high potential for phosphorus to be released from the bottom sediments.

C. Watershed NPS Threats

Crescent Lake’s water quality problems can be attributed to polluted runoff – namely eroded soil –that washes into the lake from its surrounding watershed. Phosphorus is the nutrient that controls the level of algae production in lakes. Small increases in phosphorus cause lake algae populations to increase and water clarity to decline. High levels can cause dense algae blooms, which can also create a biological and chemical reaction that depletes the oxygen from the bottom of the lake and results in the loss of cold water fisheries.

Phosphorus, which is typically attached to soil particles and organic matter, mostly reaches the lake in the stormwater runoff from the lake’s watershed. Phosphorus runoff increases significantly in developed landscapes. Maine researchers studied two watersheds and found that phosphorus export from the developed watershed was up to 10 times greater than the forested one (Dennis, 1985). Stormwater flows across roads, driveways, residential properties and other developed areas and picks up phosphorus in soluble form or attached to eroded soil particles.

The Raymond Conservation Commission (RCC) organized the Crescent Lake Watershed Survey in 2000 which volunteers identified 139 erosion sites. The survey followed MDEP guidance described in *Volunteer Lake Watershed Surveys: How to Conduct a Nonpoint Source Phosphorus Survey* (MDEP, 2011).

The project was managed by the RCC, and technical support was provided by, Portland Water District, Cumberland County Soil & Water Conservation District and MDEP staff. In April 2000, the technical leaders and 15 trained volunteers surveyed all developed portions of the watershed and documented soil erosion sites. Surveyors documented the location, nature and extent of each site’s erosion and runoff problems, recommended maintenance and pollution fixes, and rated the impacts to the lake and the cost to fix. The ***Crescent Lake Watershed***

Survey Report (2000) includes a summary of survey findings, including maps and a spreadsheet of NPS sites (Appendix A).

The 2000 Crescent Lake Watershed Survey report identified 139 erosion sites (11 high, 43 medium, and 85 low impact sites). Residential shorefront sites accounted for 46%, driveways 14%, private roads 16%, state and town roads 10%, commercial camps 8% and public beach and access 5%. The 2001-2004 Raymond Pond and Crescent Lake Demonstration Project, addressed 13 sites (4 high, 8 medium, and 1 low impact sites).

In 2009 the CLWA and Raymond Waterways Protective Association conducted a shoreline survey to potential LakeSmart properties and erosion sites. A more comprehensive watershed survey was conducted as part of the Phase I grant project in May 2011. Nine volunteers worked with four technical leaders to visit all sites from the 2000 and 2009 surveys. The status of these sites was evaluated, and new sites were also documented.

A total of 78 erosion sites were confirmed and/or identified in the 2011 watershed survey (Figure 2, Figure 3 and Table 1). This included 7 high, 28 medium, and 43 low impact sites. Although many of the 2000 survey sites were no longer problems, the 2011 watershed survey showed there are still many active erosion sites that need to be addressed to reduce the pollutant load into Crescent Lake. A list of problem sites and recommendations were added to a spreadsheet and the NPS Site Tracker (Appendix B). Aside from soil erosion, no other significant sources of phosphorus were observed during the survey.

It is anticipated that the Phase I Conservation Project will address a total of 20 sites (3 high, 7 medium, and 10 low impact sites). Future efforts will address the remaining high (4), medium (21) and low (33) impact sites.

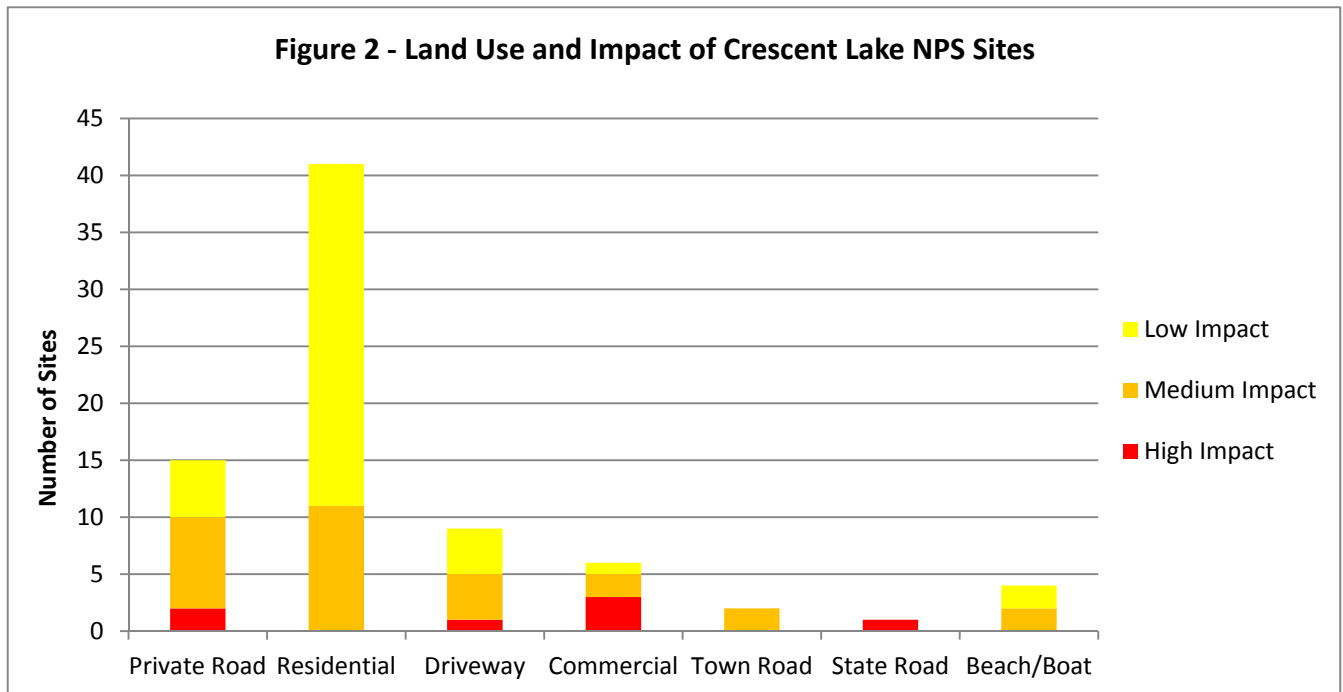
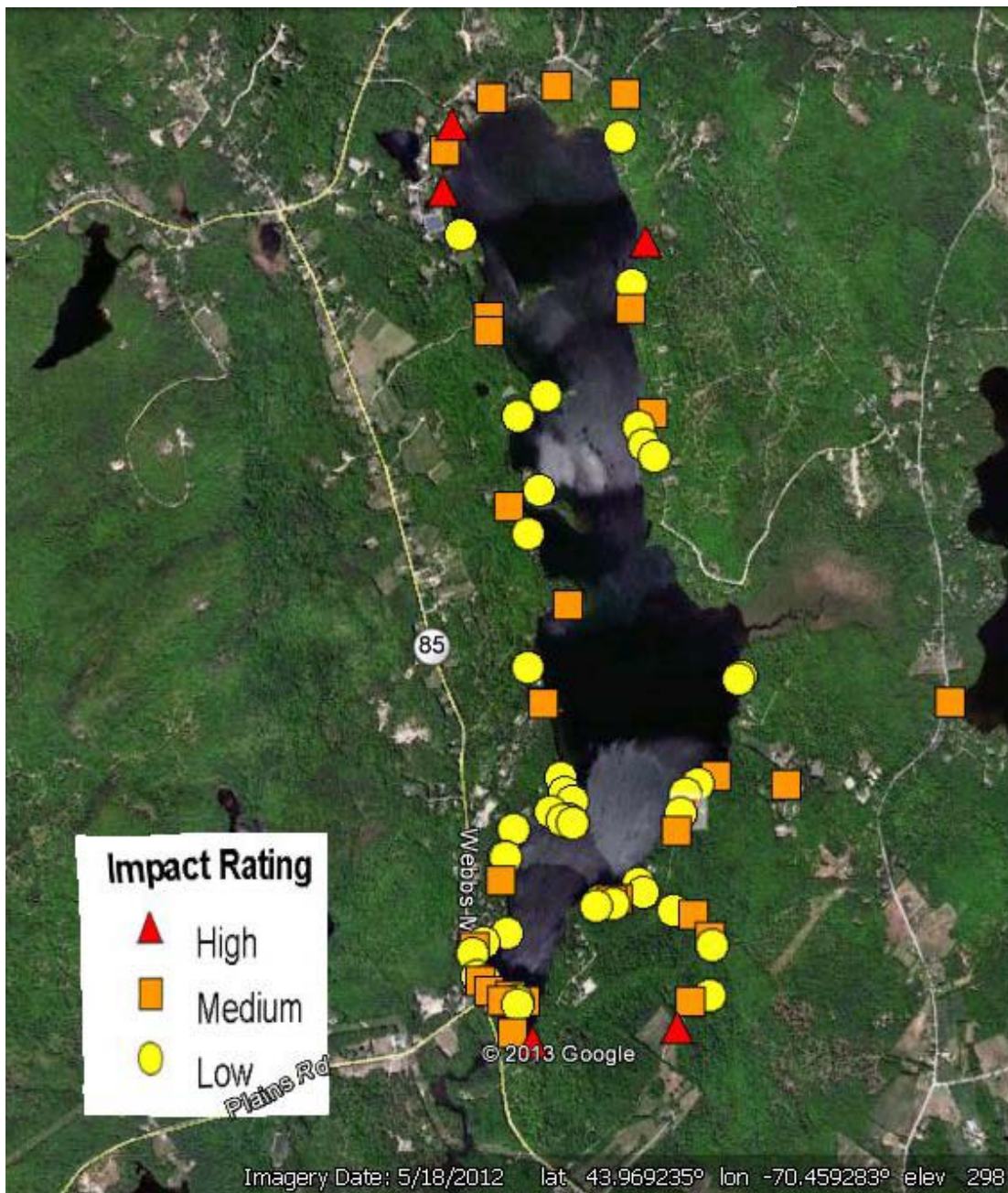


Table 1 – Land Use and Impact of Remaining Crescent Lake NPS Sites

Land Use	High Impact	Medium Impact	Low Impact	Total Sites
Private Road	2	7	5	14
Residential	0	11	30	41
Driveway	1	4	5	10
Commercial	3	2	1	6
Town Road	0	2	0	2
State Road	1	0	0	1
Public Beach & Boat Launch	0	2	2	4
Total	7	28	43	78

Figure 3 – 2011 Crescent Lake Watershed Survey Sites and Impact



D. Other Potential Impacts

In recent years, sedimentation and associated adverse impacts have occurred along the northern shore of Crescent Lake. The sedimentation has caused the formation of sand bars near the mouths of Robinson Brook and Edwards Brook. Residents from the area report that the rates of sedimentation have increased; a decrease in water clarity has occurred and an increase in aquatic plant growth (FB Environmental, 2008). Additional data collection and analysis is required to understand the problems and to support the appropriate actions to achieve restoration.

3. Watershed Plan Goals and Objectives

Overall Goal: The overall plan goal is to maintain or improve Class GPA water quality standards in Crescent Lake by reducing phosphorus and sediment loading to the lake. This will be achieved through the following actions over the coming ten year period (2013-2023):

- **Reduce current sources of phosphorus loading** by fixing 24 of the remaining 78 sites identified in the watershed survey. This takes into account the 20 sites already fixed through the Phase I Project. This will be achieved by providing targeted outreach, technical assistance and cost-sharing assistance to install conservation practices at erosion sites identified in the watershed survey. The remaining 34 sites are low cost/impact with one beach site that is not eligible for 319's mitigation, will be fixed independently by the landowners after the problem and recommended solutions are brought to their attention through targeted outreach and/or technical assistance visits.
- **Prevent new sources of phosphorus loading** by facilitating improved land use practices. This objective would be met by conducting outreach and providing technical assistance to residents, road associations, youth camps and municipal officials. This includes continuing to promote and implement the LakeSmart Program.
- **Build local capacity** for watershed stewardship in the existing lake association and raising funds for mitigation work.
- **Conduct ongoing assessment of lake and watershed conditions** by monitoring lake water quality and maintaining the NPS Site Tracker.

4. Schedule and Milestones to Guide Plan Implementation

A. Action Plan and Schedule

Action items and milestones (Table 1) were developed to address NPS sites with the highest impact and phosphorus loading to Crescent Lake. The number and types of sites targeted in the plan was based on local knowledge about potential funding sources, landowner cooperation and other considerations. Other actions in the plan were included because they have proven to be cost-effective and successful in the region. The plan will be implemented over a ten year period, and an estimated schedule is provided for each action (Table 2).

Table 1 – Action Items and Milestones	Schedule	Who	Potential Funding Sources
<i>Reduce current sources of P loading to the lake by addressing NPS sites identified in the watershed survey</i>			
Landowner initiative to fix problems following outreach and technical assistance			
Private Roads & Driveway sites (10 low impact sites)	2014-2019	landowners	Private, CLWA
Residential sites (22 sites)	2014-2019	Landowners	Private
Shoreline stabilization near boat launch (2)	2014-2016	MDOT	MDOT
<i>Provide opportunity for cost sharing to install conservation practices at NPS sites</i>			
Private Roads & Driveways (9 high/medium impact sites)	2014-2023	Private	319, private, PWD
Commercial Youth Camps (3 sites)	2014-2019	Private	319, private
Town Road Site (1 site)	2014-2016	town	319, town, PWD
Residential sites (9 sites)	2014-2016	volunteers	319, private
Public Beach Sites (2 sites)	2014-2016	town, volunteers	319,private
Conduct technical assistance for lake residents	Ongoing	RWPA, PWD	RWPA, PWD
Notify landowners with watershed survey sites	2013-2014	CLWA	CLWA
<i>Prevent new sources of phosphorus loading to the lake</i>			
Construction site inspections and buffer delineation	Ongoing	RWPA	RWPA
Hold tours to highlight conservation practices	2014-2020	CLWA	319
Continue to promote and implement LakeSmart Program	2013-2016	CLWA/RWPA	LakeSmart/COLA/319
<i>Build local capacity for watershed stewardship</i>			
RWPA/Town applies for 319 Watershed Implementation Grant	2013	RWPA	RWPA/CLWA
Conduct CLWA annual meetings	Ongoing	CLWA	NA
Raise funds to support lake stewardship work	Ongoing	CLWA	private, town
<i>Conduct ongoing lake and watershed assessment</i>			
Ground truth lake watershed boundary delineation	2014-15	CLWA	CLWA
Conduct lake water quality monitoring	Ongoing	RWPA, CLWA, VLMP	CLWA
<u>Conduct ongoing monitoring of sedimentation from Robinson Brook & Edwards Brook</u>	Ongoing	CLWA	CLWA
<u>Continue to update NPS Site Tracker and train CLWA to use</u>	2013-2014	RWPA-CLWA	NA
NPS Site Tracker annual use and maintenance	Ongoing	CLWA	NA

Table 2 – Implementation Schedule

2013 – 2014	<ul style="list-style-type: none"> • Apply for 319 Phase II grant. • Notify landowners about NPS sites on their properties. • Continue to implement LakeSmart Program
2014 – 2016	<ul style="list-style-type: none"> • Conduct Phase II 319 project (if funded) with targeted cost sharing and matching grants for high and medium priority sites. • Maintain NPS Site Tracker.
2013 – 2023	<ul style="list-style-type: none"> • RWPA, CLWA & VLMP conducts Technical Assistance, monitoring, municipal assistance for development projects. • Crescent Lake Watershed Association conducts annual meetings, outreach, maintains NPS Site Tracker and raises funds for ongoing stewardship. • Landowners fix NPS sites independently following notification and technical assistance.

B. Plan Oversight and Partner Roles

The Crescent Lake plan will be carried out by Crescent Lake Watershed Association with support from Raymond Waterways Protective Association. If the Phase II 319 Implementation grant is awarded, RWPA and CCSWCD will assist with the implement that project. Ongoing support to the CLWA by RWPA will be provided for plan oversight and implementation. Partners include RWPA, MDEP, the Town of Raymond, Portland Water District, MDOT, Camp Agawam, Camp Nashoba North, road associations and private landowners.

- **CLWA** will oversee and lead Plan implementation, conduct outreach activities and raise funds for stewardship work.
- **USEPA** will provide guidance and potential 319 funding.
- **MDEP** will provide technical assistance and guidance.
- **RWPA** will support CLWA with Plan implementation; provide technical assistance through its Technical Assistance program; conduct water quality monitoring; promote watershed stewardship through its website, newsletters and presentations; and work with the Town to provide property inspections and buffer delineation services for new development.
- **MDOT, Youth Camps, Road Associations and private landowners** will address NPS issues on their properties.
- The **Town of Raymond** will provide some funding support for the Plan and water quality monitoring and also work to address NPS problems on town road sites.
- **Portland Water District (PWD)** will provide technical assistance and potentially cash match for grant projects.

C. Plan Outputs and Milestones

Organizational Outputs

- RWPA updates NPS Tracker and local coordinator trained to use
- RWPA will develop and submit 319 grant proposal
- Contact made with all property owners and road associations with sites identified in watershed survey

NPS Mitigation Outputs

- Number of high, medium and low impact NPS sites fixed by voluntary landowner initiative
- Number of high and medium impact NPS sites fixed with cost sharing assistance
- Number of technical assistance visits
- Estimated pollutant load reductions achieved by installed BMPs

Water Quality Outcomes

- Meets lake GPA standards in MDEP's biennial 303d reports
- Stable or improved trend for lake water clarity and dissolved oxygen

5. Proposed Management Measures

The ***Crescent Lake Watershed Survey Report*** lists specific management measures recommended for each of the NPS erosion problems identified during the survey. Recommendations follow guidelines found in MDEP publications including the ***Gravel Road Maintenance Manual, Conservation Practices for Homeowners*** fact sheet series, and ***Erosion and Sediment Control Manual***. The recommended BMPs accomplish the plan's goal of reducing phosphorus and sediment loading to the lake by stabilizing of bare soil and erosion and diverting, infiltrating or filtering polluted runoff before it reaches the lake. Typical problems and management measures for the most common land use problems identified in the watershed survey are described below and in the ***Crescent Lake Watershed Survey Report*** (Appendix A).

In addition to structural BMPs recommended for each problem, public education and outreach efforts will also be needed to promote responsible stewardship and ongoing maintenance activities. The NPS Site Tracker will be maintained and used by the Crescent Lake Watershed Association with support from RWPA on an ongoing basis to identify new problems and prompt maintenance on sites fixed through the plan.

A. Residential Shoreline Development

The watershed survey identified 41 residential erosion sites. Of these, none were high impact, 11 were medium impact and 30 were low impact residential sites. Common problems include lack of vegetated buffers, bare soil and erosion on footpaths, along roof driplines and adjacent to the lake. Based on the survey results, the most common BMPs will include vegetated buffers, erosion control mulch and runoff diverters on paths, infiltration trenches along roof dripline and stabilization of bare soil. The Phase I project in 2011 fixed two medium impact and eight low impact sites leaving 31 remaining sites.

The plan aims to address all 31 of the remaining residential erosion problems identified in the watershed survey. Nine (9) sites (medium impact) will be fixed by providing landowners with small matching grants for plants, erosion control mulch or other materials. Since many of the low impact sites are low cost and easy to fix, another 22 sites will be fixed independently by the landowners after the problem and recommended solutions are brought to their attention through targeted outreach and/or technical assistance visits.

B. Private Roads and Driveways

The 2011 watershed survey identified 14 private road sites and ten (10) driveway sites. They are discussed together since the management techniques will be similar for both. Impact ratings are relatively higher for these sites compared to other problems in the watershed. For private roads, there were two (2) high impact, seven (7) medium impact and five (5) low impact sites. For driveways, there was one (1) high impact, three (4) medium impact and five (5) low impact sites.

Common problems included poor shaping, moderate to severe ditch or road surface erosion, and grader/plow berms trapping surface runoff on the road surface. The most common BMPs recommended in the survey included reshaping (crowning) the road survey, removing berms and installing waterbars to divert water off the road; cleaning, enlarging and stabilizing ditches; and armoring culverts. The Phase I project fixed four (4) medium impact private road sites, and one (1) low impact driveway (Site #2-16) were addressed.

The plan aims to address the remaining high and medium impact private road (5 sites) and driveway (4 sites) by providing cost sharing funds to road associations and landowners to fix these sites. Similar to the low impact residential sites, targeted outreach and technical assistance will be provided to landowners and road associations associated with the ten (10) low impact sites. It is anticipated that voluntary action will result in three (3) of these problems being fixed.

Ongoing maintenance (e.g., grading, removing accumulated sediment from sediment basins and turnouts) is critical to long term performance of these BMPs. As a result, the plan calls for periodic inspections of implemented BMPs through the NPS Site Tracker. Follow up contact will be made to road associations and landowners for any maintenance needs.

C. State and Town Roads

There were only two (2) town road sites and one (1) state road site identified in the watershed survey. Both town road sites were medium impact, and the state road site was high impact. The Phase I Implementation Project anticipates fixing one town road site and the high impact state road site.

The remaining town site will be addressed in the plan. The plan aims to provide cost sharing assistance and engineering oversight to help the town with a site design and construction costs. If the state road site is not fixed in the Phase I project, it will be addressed in future efforts.

The NPS Site Tracker can be used to prompt periodic inspections of the state road site and communication with MDOT about future maintenance needs.

D. Commercial Summer Youth Camps

Six erosion sites were identified at the lake's four youth summer camps. (Note that some of these sites were large in size and could be broken into additional sites.) Of these, three sites were rated as high impact, two were medium impact, and one was low impact sites. Problems were associated with the camp access roads (e.g., road surface and culvert inlet/outlet erosion) as well as the heavy use areas adjacent to the lake (e.g., beach erosion, inadequate buffers). Recommendations include armoring culverts, installing plunge pools below culverts, crowning road, installing shoreline buffers, defining footpaths, and stabilizing bare soil with erosion control mulch or vegetation. Phase I Conservation Project did address three sites (2 high and 1 medium impact sites).

The plan aims to fix the remaining three (3) commercial sites. All camps have year-round maintenance staff, equipment and expertise to implement recommendations. Some of the projects will be completed independently by the camp staff. Cost sharing for materials will be provided to help purchase materials needed for the remaining sites.

In addition, a "Summer Youth Camp Collaborative" will be established to promote water quality education to campers and staff alike. Campers will participate and join forces with other campers in the area to install conservation practices at their camp and/or another camp. Examples will include roof drip line trenches, buffer plantings and path stabilization. Campers will be encouraged to explain why and how the conservation practice was installed. A Summer Camp BMP tour will be conducted by the camper's at the camps to explain what they have

learned. Another aspect of the Camp Collaborative will be aimed at the camp directors, maintenance and grounds keeping crews to address erosion sites at their camps. RWPA and CLWA will provide BMP/water quality workshops to provide the knowledge needed for installation which ultimately protects the lake water quality.

E. Beach/Boat Access

Although three public beach sites and one public boat ramp were identified only two of the beach sites would be eligible for 319 funding. Prior implementation of best management practices on the one beach site utilized 319 funding in the past but was unsuccessful in mitigating the problem. The sites remaining include the two beach sites, one medium impact and one low impact and the only public boat ramp is documented as a low impact.

The plan aims to address two public beach sites and the only public boat ramp site. The plan aims to provide cost sharing assistance and engineering oversight if needed to help the town with a site design and construction costs.

F. LakeSmart Program

The Crescent Lake Watershed has had a successful LakeSmart Program over the past 3 years. The program was initiated by MDEP and is now being administered by Congress of Lake Associations. The program reflects Maine law and expert knowledge about protecting water quality, recreational use, wildlife habitat, and the vitality of lake communities. Better Management Practices (BMP's) are lake friendly techniques to slow, spread, capture and infiltrate stormwater. The plan aims to promote and implement the LakeSmart Program in the Crescent Lake Watershed.

6. Water Quality Results Monitoring

A. Water Quality Monitoring

Maine water quality criteria require that lakes and ponds have a stable or improving trophic state and be free of culturally induced algal blooms. RWPA, CLWA and VLMP will continue to monitor Crescent Lake biweekly from May – September for parameters including Secchi disk transparency, temperature, Chlorophyll-a, dissolved oxygen and total phosphorus. MDEP also conducts baseline monitoring on Crescent Lake about every five years for these and other parameters.

Both VLMP and MDEP analyze this data for long term trends. MDEP conducts Secchi disk trend analysis every two years as part of their Integrated Water Quality Monitoring and Assessment report. Trend reporting (positive, negative or stable) will assist in determining whether the plan meets its goal of having stable or improving water quality over time.

7. Pollutant Load Reductions

A. Pollutant Load Reductions

Pollutant load reductions will be estimated for many NPS sites to help demonstrate the value of BMPs to reduce the amount of sediment and phosphorus entering the pond. Pollutant load reductions will be estimated and reported to MDEP for any work funded by 319 grants.

Pollutant load reduction will be made using methods approved and recommended by the MDEP and EPA. Preliminary estimates were already made during the watershed survey process of the pollutant loading prior to watershed mitigation efforts. These estimates can be used to further prioritize projects in the watershed.