Land Development Risk Around Southern Sebago Lake, Maine:

Identifying at-Risk Parcels

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Introduction

The Sebago Lake watershed supplies drinking water to more than 200,000 people in the Greater Portland area (PWD 2013). The Portland Water District (PWD) is currently able to supply water from their intake at the south end of the lake with only minimal treatment to remove bacteria due to the very high water quality of the lake. The district has a strong interest in preserving water quality, which is dependent on the filtering effect of forest and other vegetation surrounding the lake and its watershed. However, the district owns only about 1% of the watershed land, and most of the rest is in private hands, leading to a significant potential for development (PWD 2013).

Many factors have been identified as impacting development potential of land (Lee 1979; Cho and Newman 2005). These vary depending on the type of development and local characteristics of the land, as shown by the differences in factors used by Helmer (2004) to analyze farmland development in Puerto Rico and those used by Cho and Newman (2005) to analyze an urban fringe. This analysis attempts to identify those parcels of undeveloped land in the Town of Standish, ME, near Sebago Lake that are most likely to be developed and reduce water quality using factors potentially important for residential or light commercial development.

Methods

This analysis uses GIS to determine a numeric value between 1 and 100 for an undeveloped land parcel's relative risk for development and reduction in water quality. The analysis includes parcels in the Town of Standish that are within a 5km radius of the PWD intake pipes and within 1km of the lake shore. The development risk is calculated for each undeveloped parcel that is not currently under indefinite conservation by the PWD.

The analysis uses the Maine Office of GIS land parcel map (GISVIEW.MEGIS.Parcels_new), and development status from the Standish assessor's 2015-16 owners list (http://www.standish.org/assessor). Sebago lake, roads, and elevation are represented by the Maine Office of GIS lake and pond layer (water_poly), road layer (gisview.E911.NG_ROADS), and a Lidar slope raster (Maine DEM 2 SLOPE). Additionally a map of future growth areas produced by Standish was digitized to create "growth area," "transition area" and "critical area" designations (http://www.standish.org/sites/standishme/files/uploads/generalized_future_land_use_map.pdf). The PWD intake location was approximated from the street address and its location in the 1971 amendment to the law governing water quality in Sebago Lake (Maine State Legislature 1971).

Land use type was classified as developed, undeveloped, or conserved by PWD, and converted to a raster with 2m pixels. Raster layers were generated for distance from roads, distance from the lake, location in a growth, transition, or critical area and distance from the nearest developed pixel. A summary layer was generated to combine and weight all factors (Table 1). The values of all cells in each undeveloped land parcel were averaged. Parcels were further weighted by distance to the lake shore and to the PWD intake. Pixels within 0.5km of either were multiplied by three, and pixels between 0.5km and 1.0km were multiplied by two to determine parcel risk values (Table 2). The map is projected in UTM zone 19N using NAD83.

Table 1: Variables and their contribution to the development risk score for parcels.

Variable	Classification	Contribution to Final Score
Distance to Road	0-50m	6
	50-100m	5
	100-150m	4
Distance to Developed Parcel Edge	150-200m	3
	200-500m	2
	500m +	1
Slope	0-10%	3
	10-20%	2
	20-50%	1
	50-100%	0
Town Growth Zones	Growth Area	2
	Transition Area	1
	Critical Area	-1

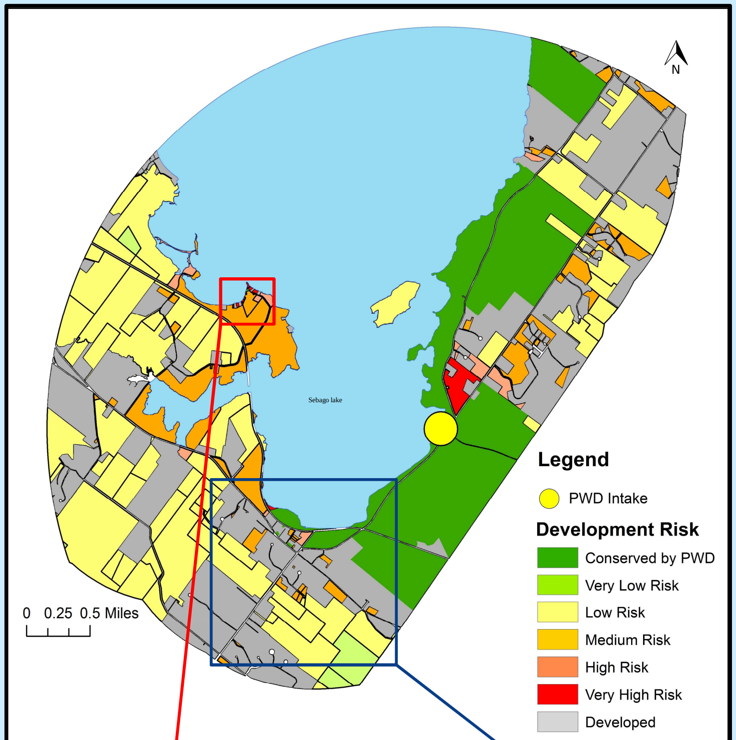

Figure 1: Development Risk for land parcels in the Town of Standish, Maine within 2km of Sebago Lake.

Figure 2: Example of "very high risk" parcels located along the lakeshore.

Figure 3: Example of parcels located in downtown Standish.

Table 2: Classification of overall parcel risk values into categories displayed in figures 1, 2, 3.

Development Risk Class	Overall Parcel Risk Values in Class
Very low Risk	1-6
Low Risk	6-12
Medium Risk	12-18
High Risk	18-24
Very High Risk	24-28

Source: mainelakesandmountains.com

Results and Discussion

The areas containing the most at risk parcels are the most built-up parts of Standish and those near other shore-line development. These parcels are close to developed parcels and roads, and are relatively flat, making them very likely parcel to be developed. The largest "very high risk" parcel it is located very close to the lake and the PWD intake (just north) showing that its development poses a greater risk to water quality (Figure 1).

A total of 35% of the parcels at "medium" or higher risk are located in the downtown area (Figure 3). Fifteen percent of such parcels were lakefront (Figure 2). All parcels with a "medium risk" or higher are located adjacent to a developed parcel. The two parcels that are "very low risk" are adjacent only to other undeveloped parcels. A total of 0.04km2 are very high risk parcels, and 496km2 at medium or higher risk. The factors with the highest weight in the analysis, distance to developed parcels and distance to roads, are usually spatially auto correlated (Hawbaker et al. 2005). These factors help explain why development risk is also generally correlated with developed areas.

Not only are many of the medium risk parcels located near, or surrounded by developed parcels, but the fact that many are located in the most developed areas of Standish means that they may play an outsized role in water quality (a factor not explicitly accounted in the model), as they provide storm water control in areas that would otherwise have dramatically more runoff. This is an important service of green space in built-up areas (Young 2010; Figure 3).

The "low risk" and "very low risk" parcels are generally large parcels with much of their area father from roads and developed parcels. Although the model accounts for the increased risk to water quality from development close to the shoreline, the vast majority of the undeveloped eastern shoreline is classified as "conserved by PWD." This is a hopeful sign that past conservation efforts, such as those described in PWD (2013) have been effective at preventing direct shoreline development. The western shoreline, however, especially the northern side of the point, has a higher risk (Figure 2). It may be valuable to investigate conservation potential along that western shore to ensure continued good water quality.

No model is able to include all relevant factors, and some have been identified in the literature that were not feasible to include in this model due to a lack of data, yet may have an impact on development risk. Examples include formal zoning laws, landowner preferences, and developer initiative (Lee 1979).

This analysis is intended to serve as a starting point only to identify potentially at risk land parcels and is not comprehensive. Risky parcels can be farther examined for owner intentions, such as an active desire to build on or sell the land. If the owner is interested in sale, that may be a priority area for programs like the PWD land conservation program, which contributes up to 25% of the cost of conserving land by partnering with governments or conservation organizations (PWD 2013).

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