Environmental Site Assessment for the Sustainable Development of Treasure Valley Scout Reservation's West Camp

A Major Qualifying Project Submitted to the Faculty of

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Abstract

Treasure Valley Scout Reservation is looking to increase use of the West Camp by developing new facilities and restructuring the property. An Environmental Site Assessment was conducted using ArcGIS to ascertain locations for development, preserving natural features and the camp's character. Environmental and manmade features were mapped, displaying the various assessment criteria, and suitable sites chosen to guide future development choices. Development of TVSR will benefit the Boy Scouts and increase renown of TVSR within the Mohegan region.

Acknowledgements

I would like to thank the stakeholders of Treasure Valley Scout Reservation for their many accommodations and assistance to this project, namely Tom Chamberland and Ray Griffin for acting as liaisons. Professor LePage deserves great thanks for her constant support, patient advising, and rapid editing, and of course the wonderful librarians of WPI deserve my gratitude for their assistance and kindness.

Table of Contents

Abstract i

Acknowledgements iii

1. Introduction 1

2. Background 2

2.1 Basic Geography of Treasure Valley Scout Reservation 2

2.2 Ownership History 4

2.3 Previous Use of the Grounds 5

2.4 Current Use of the Grounds 6

2.5 2013 MQP at Treasure Valley Scout Reservation 7

2.6 Environmental Site Assessments 8

2.6.1 Cornell Site Assessment Checklist 8

2.6.2 MEPA Environmental Notification Form Checklist 11

2.7 Using ArcGIS 11

3. Methods 12

3.1 Identifying Project Needs 13

3.2 Developing an Environmental Site Assessment Checklist 14

3.3 Collecting, Correcting, and Evaluating Required Data 14

3.3.1 TVSR zoning 14

3.3.2 Soil 15

3.3.3 Tree stands and forest management 16

3.3.4 Wetlands 16

3.3.5 Hydrography 17

3.3.6 Elevation contours 17

3.3.7 Roads 17

3.3.8 Parking 18

3.3.9 Well 18

3.3.10 Power Lines 18

3.3 Performing Data Analysis 18

3.4 Evaluate and Present Results 19

4. Results and Analysis 20
4.1 Stakeholder needs 20
4.2 Environmental Site Assessment Component Maps 21
4.3 Potential site locations 23
5. Further Recommendations 31
6. Conclusions 33
References 34
Appendix A: Important Email Correspondence 36
Appendix B: Cub Scout Day Camp Projects List for Engineering Study 10/23/13 39
Appendix C: Tree Stand Descriptions 40
Appendix D: Additional Soil Structure Information 43

Table of Figures

Figure 1: Map of TVSR present day 3
Figure 2: Original map of the West Camp addition 6
Figure 3: Cornell Site Assessment Checklist 10
Figure 4: GIS project flow diagram 12
Figure 5: TVSR West Camp Water Features Map 24
Figure 6: TVSR West Camp Infrastructure Map 25
Figure 7: TVSR West Camp Tree Stand Suitability Map 26
Figure 8: TVSR West Camp Elevation Contours and Soil Slope 27
Figure 9: TVSR West Camp Slopes with Water Features Buffer 28
Figure 10: TVSR West Camp Unsuitable Area Buffer 29
Figure 11: TVSR West Camp Suitable Development Areas 30

1. Introduction

Treasure Valley Scout Reservation (TVSR) is a 1600-acre campground in central Massachusetts used by the Mohegan Council of the Boy Scouts of America (BSA). TVSR is looking to expand the use of the property to better accommodate the growing interest from the Boy Scouts and other organizations. The focus of this expansion will be at the west part of camp, known as West Camp but labeled on the map Treasure Valley West. This Major Qualifying Project (MQP) produced an Environmental Site Assessment (ESA) that will help TVSR to grow sustainably, focusing specifically on the placement of a future welcome center and the adjustment of the layout of the West Camp to better use the property.

In fulfillment of an Environmental Studies MQP, this project will be helping the West Camp of TVSR grow and develop. Preliminary steps must be taken in the form of an environmental site assessment. A site assessment collects all of the information about the property and enables the most informed decision to be made, so that there is minimal environmental impact and maximum environmental consideration.

In the best of ways, this project applied an Environmental Studies education to a real-life application by conducting an ESA tailored to the West Camp to minimize the environmental impact of development and aid planning to make better use of the camp. Treasure Valley's commitment to the environment and its sustainable use is obvious in their vision statement. It expresses that TVSR and BSA are "advocates for sustainable lifestyles" and "are making a national effort to take their sustainable principles to the next level" for the future generations of TVSR visitors (Chris Girouard, 2013). Treasure Valley strives to be considerate about the impact they make on the environment as an organization promoting appreciation and respect for nature and trying to foster that appreciation and respect in a group of young people.

The results of the environmental site assessment include several maps displaying important features of the property to guide development, as well as a final map showing site with optimal characteristics for development. The digital GIS files created during the ESA were made available for use by the stakeholders of TVSR to aid siting activities for future developments as well.

2. Background

This section covers many background topics associated with the Treasure Valley Scout Reservation and Environmental Site Assessments (ESA). Relevant information about TVSR includes the geography of the camp, basic history of its ownership, and the previous and current usage of the camp. Some information from a previous MQP on improving TVSR is also included for perspective on the needs of the reservation. Last is a summary of environmental site assessments and examples of standard ESAs for reference.

2.1 Basic Geography of Treasure Valley Scout Reservation

The Treasure Valley Scout Reservation covers 1600 acres in Central Massachusetts. It is for the use and benefit of scouting groups under the jurisdiction of the Mohegan Council, Inc., Boy Scouts of America (BSA). The main entrance is located in Rutland, Massachusetts at the northeastern corner of the property, but the full area of the reservation extends over several towns: Spencer, Oakham, Paxton, and Rutland. In the center of the property, there is a sizable water body nearly a mile long lengthwise, known as Browning Pond. During the summer the reservation hosts Boy Scouts between the ages of 7-17 for summer camp, both overnight and day camps. They have water activities, like sailing canoeing and swimming in the lake, and practicing scouting skills.

Browning Pond acts as a dividing line between the two main sections of the reservation, East Camp and West Camp. The East Camp houses the summer overnight, or resident, camping for Boy Scouts, ages 11-17 and Webelos Scouts, ages 9-10. The West Camp houses summer day camp for the Cub Scouts, ages 7-10 and some Webelos Scouts, ages 9-10. Most of the facilities, such as camp sites, shelters, bathrooms, and dining are located on the East side of camp, while the West side of the camp has fewer facilities to offer, due to the different nature of its development.

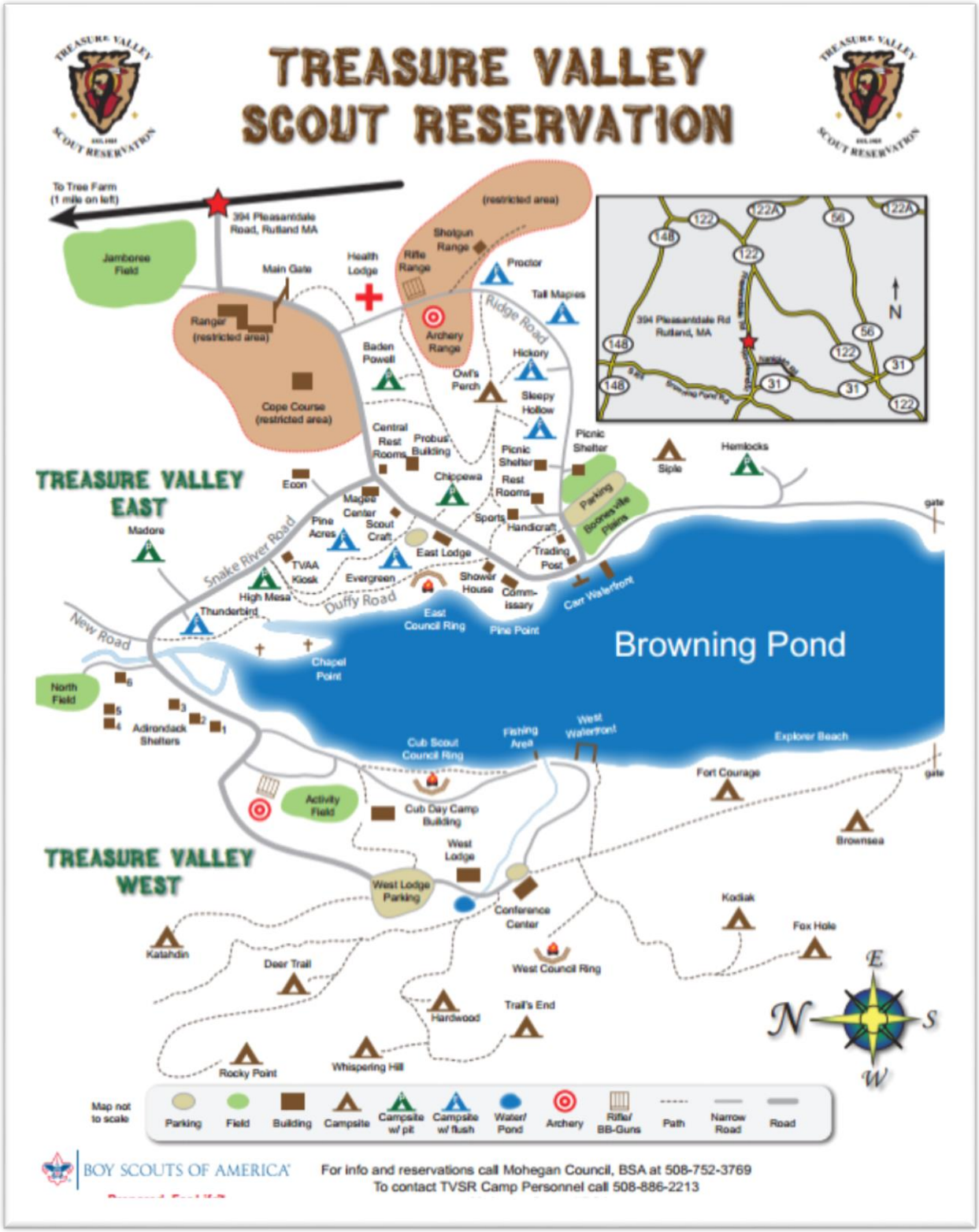

Figure 1: Map of TVSR present day

2.2 Ownership History

Treasure Valley Scout Reservation was established in 1926. The Scouts of Worcester Council wanted to provide the scouts with a summer camp. Before TVSR's inception, other properties were used but none were permanent. Thus, the Scouts of the Worcester Council went in search of a more permanent solution. By 1925, the council was working with nine other civic groups in Worcester to raise money and find land. The Browning homestead, about 525 acres, was purchased for $17,000. The property was purchased as a gift from these civic organizations for the Worcester Council of the Boy Scouts of America, presently known as the Mohegan Council. Now, the property is held in trust by the Board of Trustees of Treasure Valley for the use and benefit of scouting groups under the jurisdiction of the Mohegan Council, Inc., Boy Scouts of America (BSA). As of 2000, the Trustees of Treasure Valley were Austin Keene, Frederick Aspinwall, and Edwin Coghlin Jr (McQuaid, 2000).

Aside from the trustees there are other important groups with vested interests worth mentioning. The Camp Committee is in charge of ensuring that the reservation is fit for use and ready for summer camp. They handle any permitting, licensing, and general camp tasks, such as turning on the water and heat in the buildings. The Camp Committee also contributes their vision of TVSR's future to advise development. This vision may include making the camp more handicap accessible, attempting to reach a broader audience by updating TVSR's website and social media, applying for grants to build more camp facilities, or finding ways to make use of the property when not camp is not in session to ensure TVSR is sustained financially.

The Friends of Treasure Valley is a group of retirees, scouts and non-scouts, who assist with the operations of the reservation. They offer their services by helping with the yearly maintenance of the reservation and improvement projects of the buildings and grounds. As volunteers they contribute their time and labor, which are invaluable for a reservation of TVSR's size, which is in need of constant upkeep.

2.3 Previous Use of the Grounds

When the council acquired the homestead, a great deal of work was accomplished to be ready by the summer. Reforestation was a priority project as was building campsites and installing a water system. The camp was opened in the summer of 1926. That first summer, TVSR looked a great deal differently than it does today. Most of the 525 acres were undeveloped. The main buildings were the farm house and the barn, with the barn serving as the dining hall, auditorium, and craft shop. The buildings were all located near the farmhouse at the top of the hill. The campsites had been readied at the bottom of the hill near the waterfront. Washing was done in the pond, latrines were dug by hand and drinking water had to be carried back to the campsites by the campers from a hand pump well on Pine Point, located near the current commissary. One hundred boys were in attendance that summer.

The main camp was divided into 5 smaller camps: one for those studying forestry, two for general camp craft, one for those studying nature lore, and one for first class scouts. Canoe trips were taken, bridges were built, and trails were cleared. This excerpt from the History of Treasure Valley shows the daily schedule of the camp during the summer of 1927 (McQuaid, 2000). Though the reservation has changed quite a bit since those days, scouting and the continuation of scouting has always been the central importance to Treasure Valley.

CAMP SCHEDULE

Interesting and Instructive
Program Planned for
Scouts at Camp

This year the camp program has been worked out to include a greater variety of activity than ever before. Each Scout is expected to play, work, study, train, rest and always to be helpful. This is the out-line for the day's activities.

6:30 Reveille, setting up, dip.
7:10 Inspection, Waiters, Sick call.
7:50 Breakfast, Colors, Notices.
9:10 Three Scout Adventure Training Periods.
11:10 Water-work.
11:50 Camps police up. Waiters.
12:30 Noon Mess. Reminders.
1:10 Store. 5 cent Candy limit.
1:50 Siesta. Group reading letters, healthcraft.
2:30 Scout Games, M.B. advance, Craftwork, Boating, Hiking, etc.
3:50 General Swim.
4:30 Waiters.
5:10 Supper.
5:50 Evening Colors. Notices. Store.
6:30 Tent Meetings, Evening Program.
9:10 Taps. Lights out.
9:50 Officers' lights out.

In *Camp Echoes*, May 1, 1928.

2.4 Current Use of the Grounds

After the first summer, the camp's development was quite organic. There are 10+ buildings on the now 1600-acre property. There are 13 campsites and many program areas covering mountain biking, archery, conservation, handicraft, scout skills and aquatics (Mohegan Council, BSA, 2014). The East camp sufficed for approximately 44 years, then in the 1970's the West camp was developed due to an anticipated baby boom "echo" and anticipated increases in Scouting participation and summer camp enrollment. The West camp offered a more unique and rustic scouting experience, quite different from the more established east side of camp. For this reason the west side is sparser in terms of facilities and developments. There are fewer roads but more walking trails; fewer buildings but more campsites, most of which are off in the woods. There are three permanent structures in the West Camp: the Conference Center, West Lodge, and the Cub Day Camp Building. Two of these structures, the Conference Center and the West Lodge, have heating throughout the winter. The Cub Day Camp Building does not have heat in the winter, which limits its use to the warmer months.

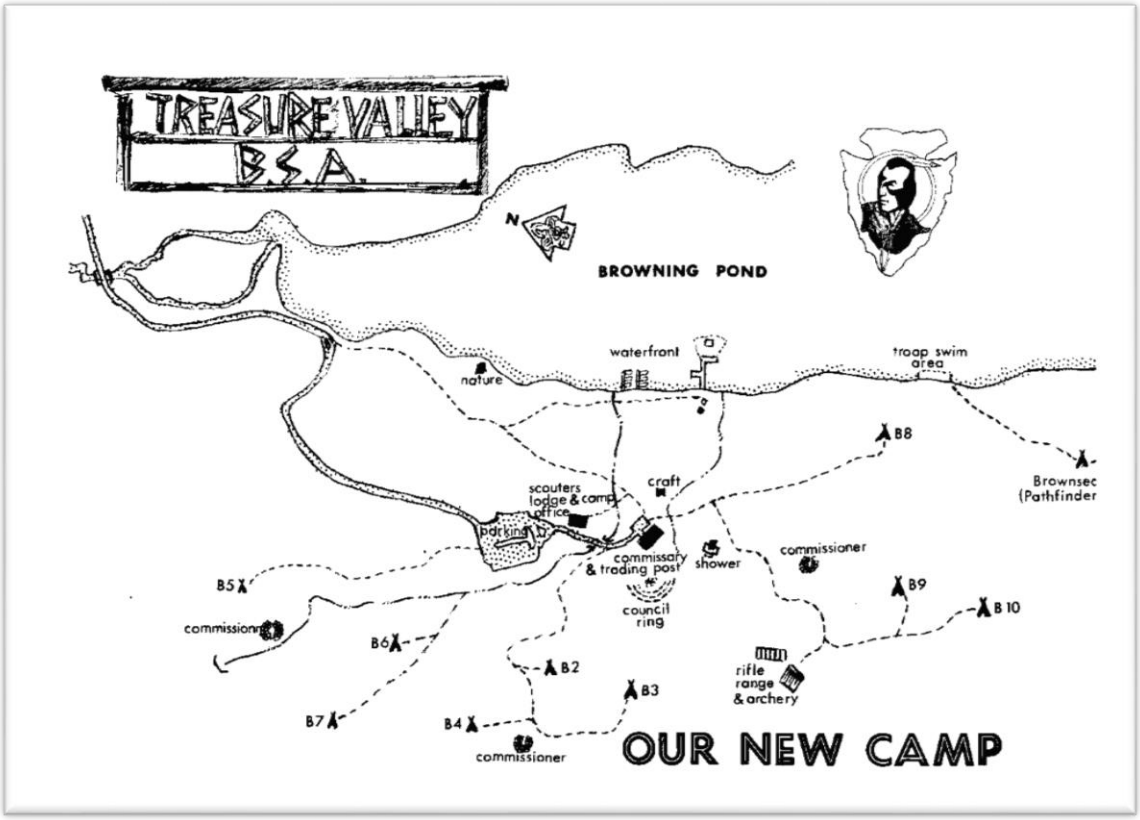

Figure 2: Original map of the West Camp addition

In addition to summer camp, TVSR has begun hosting external organizations to make use of the property during the off season. The Rainbow Child Development Summer Camp rents West Camp facilities during the summer. The Rainbow Summer Camp operates separately but alongside the Cub Scouts (Chamberland T. , Site visit with BSC Group, 2014). At the end of the summer TVSR hosts an event called Sober in the Sun. Sober in the Sun is a week-long alcohol and drug-free festival, featuring camping, music, workshops, and dances. The organization rents the property for the event. And in 2014, they hosted a Mountain Biking Expo for the first time.

2.5 2013 MQP at Treasure Valley Scout Reservation

The previous MQP, *Sustainable Development for Treasure Valley Scout Reservation*, was completed during the 2012-2013 academic year by Lindsey Machamer, Chris Girouard, Joe Szafarowicz, and Peter Aspinwall. They were advised by Professors Fred Looft and Suzanne LePage. Their abstract reads as follows:

> "This project worked towards the development of a comprehensive plan for Treasure Valley Scout Reservation that included the framework of a large scale sustainability plan with focuses in solar energy development, future land use planning, and educational development. The solar energy component created a design and prototype of an off-grid solar powered lighting system for night time use on the campsites. The land use component of the project consisted of a constraints analysis to produce land use zoning recommendations along with three conceptual designs for a specific program development. The education piece was focused on creating a learning tool to facilitate STEM learning using solar power as a medium. The hope is that future projects will endeavor to develop and update the sustainability plan, ensuring that it remains a living document that Treasure Valley and future projects can utilize" (Chris Girouard, 2013).

Though the solar work they did was not applicable to this site assessment, the land use information from their work was invaluable. The zoning they developed made it easier to focus

in on the Cub Scout area of the West Camp and the GIS files that they developed were also a significant contribution. They laid the foundation for this MQP to continue the sustainability planning of TVSR.

2.6 Environmental Site Assessments

To achieve the goal of the project, the method of an environmental site assessment will be used to guide decision making. An environmental site assessment is broadly defined, but can be simplified for description and tailored for the goals of this project. An environmental site assessment (ESA) is loosely defined by the US Environmental Protection Agency (EPA) as a report prepared for a real estate holding or piece of property that identifies any potential or existing hazards or liabilities. This MQP looked at many of the same areas of interest as a typical ESA, but focus less on the hazards and liabilities and more on the existing conditions of the property. The areas of interest were generally the physical characteristics of the landscape, both natural and manmade. Other information, such as locations of endangered plant species, can also be included in an ESA.

This project seeks to provide a base layer of information, a platform from which to make informed decisions. That would mean creating a site assessment checklist unique to this project; one that would suit TVSR's specific needs. Research found some checklists that were useful but either lacking in some areas, like wetland proximity, or too detailed in areas which were not useful to this project. The two lists that contributed the most were the Cornell Site Assessment Checklist and the Massachusetts Environmental Policy Act (MEPA) Environmental Notification Form.

2.6.1 Cornell Site Assessment Checklist

Cornell University provides a checklist for farmers, agriculturalists and gardeners, shown on the following page. It is meant to provide them with a starting point. It addresses things like soil characteristics and microclimates. An example of a microclimate could be a wind tunnel between two buildings. While useful, it does not provide the thorough list necessary for siting something larger than a garden, let alone a variety of future developments. Nonetheless it was instrumental when starting the process as it is laid out in an easy checklist format. Going

through it did highlight some of the challenges the West Camp was up against, namely the variety of soil texture and slopes. The three soil textures listed, clayey, loamy, and sandy, all exist throughout the property, as detailed in Appendix D.

The sun levels are important to consider for the aesthetic value of the future development, but not necessary to include in an assessment. Similarly, the hardiness zone and pH levels are important to be cognizant of, but they are not something that will restrict development potential in this case. That is garden or agriculture specific, while this site assessment is broader.

SITE ASSESSMENT CHECKLIST

1. Site Location _____

2. Site Description _____

3. Climate

a. *USDA Hardiness Zone*

__6b __5b __4b __3b
__6a __5a __4a __3a

b. *Microclimate Factors*

__Re-reflected heat load
__Frost pocket
__Wind
Other _____

4. Soil Factors

a. *Range of pH Levels* _____
(Note actual readings on sketch)

b. *Texture*

__Clayey
__Loamy
__Sandy

c. *Compaction Levels*

__Severely compacted
__Moderately compacted
__Somewhat compacted
__Uncompacted

d. *Drainage Characteristics*

__Presence of mottled soil
__Low-lying topography
Indicator plants suggest site drainage:
__wet __well-drained __dry
Percolation test results (in./hr.)
__poorly drained (< 4"/hr.)
__moderately drained (4"- 8"/hr.)
__excessively drained (> 8"/hr.)

5. Structural Factors

a. *Limitations to above-ground space*

__Overhead wires (height:_____)
Proximity to buildings/structures:
Other_____

c. *Sunlight Levels*

__Full sun (6 hrs. or more)
__Partial sun or filtered light
__Shade

d. *Irrigation Levels*

__No supplemental irrigation
__Automatic irrigation system
Irrigation amount and rate:
_____

e. *Other Soil Considerations*

__Indications of soil layer disturbance
__Evidence of recent construction
__Presence of construction debris
__Noxious weeds present:
_____
_____
_____
_____
__Evidence of excessive salt usage
__Erosion of soil evident
__Evidence of soil contamination
__Usage that compacts soil

f. *Specific Soil Problems*

_____
_____
_____
_____
_____
_____
_____

b. *Limitations to below-ground space*

__Utilities marked and noted on sketch
Approximate rooting volume for site
Length:__ Width: __ Depth: __

6

Figure 3: Cornell Site Assessment Checklist

2.6.2 MEPA Environmental Notification Form Checklist

The Massachusetts Environmental Protection Act (MEPA) focuses on minimizing damage to the environment. It "requires that state agencies study the environmental consequences of their actions, including permitting and financial assistance. It also requires them to take all feasible measures to avoid, minimize, and mitigate damage" (Executive Office of Energy and Environmental Affairs, 2011). One of the first steps in the MEPA process is the completion of an Environmental Notification Form (ENF). It is a 22-page document that must be filled out if there is potential for environmental impact due to development. It reads like a checklist, though a very thorough and specific one. While it includes many areas of concern, one must refer to the actual MEPA Regulations to see more specific information like buffer distances and thresholds. When the ENF is used in conjunction with the regulations, it becomes a useful, definitive resource for this project.

The ENF has 10 sections: Land; Rare Species; Wetlands, Waterways and Tidelands; Water Supply; Wastewater; Transportation (Traffic Generation); Transportation (Roadways and other Transportation Facilities); Energy; Air Quality; Solid and Hazardous Waste; and Historical and Archaeological Resources. Each of these sections covers a great deal of information. This document is comprehensive as it should be, but not all of these areas are applicable to this property. The development at TVSR would not need an ENF because it is unlikely that the any MEPA defined thresholds requiring an ENF will be broken, such as the land review threshold that states if there is "alteration of 50 or more acres of land, unless the Project is consistent with … [a] forest cutting plan" an ENF and an Environmental Impact Report would be mandatory (Executive Office of Energy and Environmental Affairs, 2009). But striving to reach the appropriate standards will only benefit future development at TVSR.

2.7 Using ArcGIS

A large part of this project relied heavily on the use of Geographic Information Systems (GIS). GIS is the spatial representation and analysis of data. While GIS can be many things-from Google Maps to Spatial Analysis, in this project it refers to a software program, ArcMap, developed by ESRI and the data that goes along with it. ESRI develops the software and is considered the standard in this technology. It is also conveniently what is provided by WPI.

3. Methods

The following section covers the methods that were used to conduct the Environmental Site Assessment for determining suitable development sites at the Treasure Valley Scout Reservation West Camp. The methods are structured according to a flow diagram for GIS projects adapted from Mastering ArcGIS by Maribeth Price, seen below (Price, 2014).

An advanced way to conduct an ESA in ArcGIS is to conduct a suitability analysis. A standard suitability analysis is generally conducted by assigning suitability values to every layer type, but this assumes that raster data is available, while all of the data in this case is vector data. While creating vector data from raster data is straightforward, the opposite task is complex, and was not considered for this project. Thankfully, a makeshift suitability analysis can still be completed with a more manual approach and good presentation of the available information.

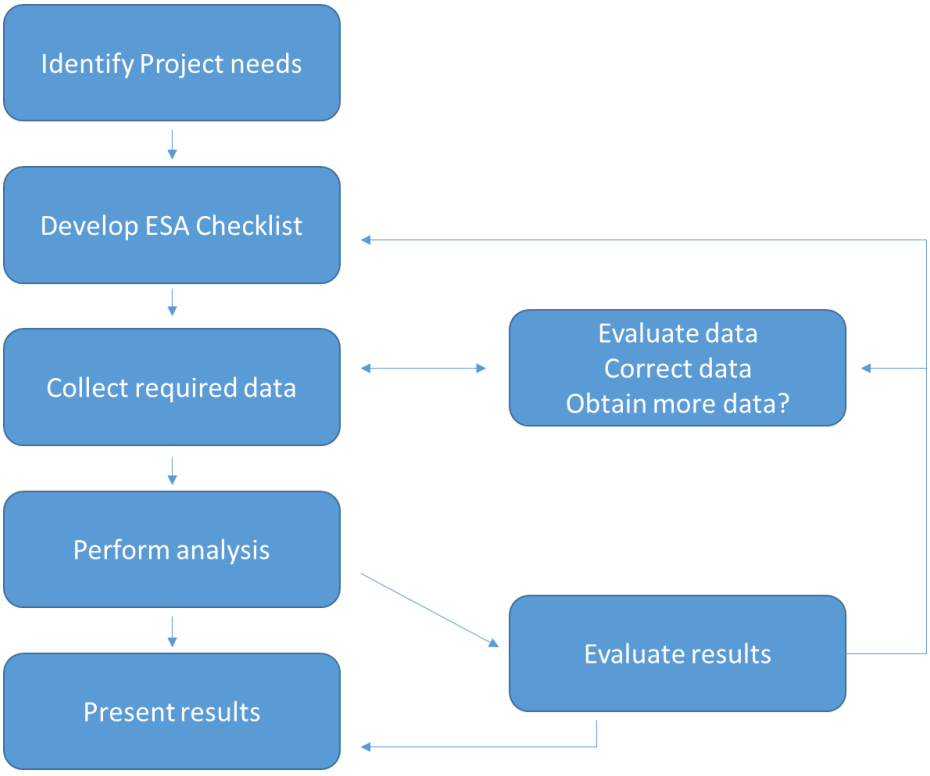

Figure 4: GIS project flow diagram

3.1 Identifying Project Needs

The first step in this project, before a site assessment was even decided on, was determining the needs of the stakeholders. This meant meeting up and discussing what they want and the direction they want to see TVSR go in. Initially, there were two people who acted as liaisons, Ray Griffin and Tom Chamberland, though Tom was the main contact. Tom Chamberland is Vice President of the Camp and Outdoor Programs and Ray Griffin is the Vice President of Innovative Programs.

Throughout this project there were several meetings, essentially once a month from January through March. Each meeting met with different groups of stakeholders. Email correspondence filled in the communication gaps between meetings. The most useful email correspondence was kept for reference and can be seen in Appendix A.

The first meeting was also a TVSR site visit along with the BSC Group. Tom Chamberland was the TVSR liaison present. After speaking for several hours about the projects they would like to see in the future, we toured the West Camp. It was obvious that the west camp had not been built as much as the East Camp. Tom distributed a description of the work they would like to have done on the West Camp, which is included in Appendix B.

At the same time of this project, TVSR was looking to hire a company called BSC Group, an engineering and planning company. TVSR was interested in hiring BSC to have planning, surveying, and administrative organization done for the development of the West Camp. This project was meant to accompany the work they would do, should TVSR decide to work with them further.

The final step in deciding the direction of this project was to consult the 2013 MQP. They included their own recommendations in addition to a list provided by Ray Griffin. The need for a site assessment was evident as many of the recommended projects required a foundation of information that needed to be assembled.

3.2 Developing an Environmental Site Assessment Checklist

Research on previous environmental site assessments led to the choice of including the following categories in this MQP: soil, hydrography, wetlands, tree stands, elevation contours, wells, power lines, roads, flood zones, TVSR zones as denoted by the 2013 MQP, and parking. Notably omitted from this list of categories are structures, of which there are 3 in the West Camp. While a structure layer was previously created by the 2013 MQP project, this layer has been lost in the intervening time and other options were unfeasible for this project due to lack of experience in data manipulation.

3.3 Collecting, Correcting, and Evaluating Required Data

The following paragraphs will consider the details of how each layer was sourced and used in GIS. The age and quality of layers is detailed, as well as the exact information that can be retrieved from the layer that might be useful for the environmental site assessment. Succinctly, the parking, tree stands, TVSR zones, power lines, and wells data layers were all developed by the previous MQP group. The rest, including the flood zones, roads, hydrography, soil, elevation contours, and wetlands, were obtained from Mass GIS.

3.3.1 TVSR zoning

The TVSR zoning layer was developed by the 2013 MQP. This layer breaks up TVSR into functional zones. These zones delineate both current and potential future uses for areas of the reservation, such as buffer zones to limit development density, educational zones to site scout programs, and the Boy Scout and Cub Scout areas, among some others. This project was concerned only with development at the West Camp, so the Cub Scout Camp zone was the only region of interest for this project.

All following datalayers were clipped to the Cub Scout Camp zone to focus only on the area of interest.

3.3.2 Soil

The soil layer, NRCS SSURGO-Certified Soils**,** was downloaded from MassGIS though it was developed by the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS). SSURGO-Certified means that all of the soils have been reviewed and approved by the NRCS to be included in the officially released data. The layer was adapted from the soil survey and released in 2012, so the quality is good and current. Though this layer contains a lot of information, the soil survey is a good supplement to explain what the various symbols and soil types are. The soil survey is available in many different media. Hard copies can be obtained by going to the regional NRCS office in Amherst, MA. Digital copies are available on the NRCS website, but only the 1927, 1985, and 1998 Worcester County soil surveys were available. The current soil survey is also on the NRCS website, but it is an interactive webpage where an area of interest can be entered to find all of the information about that area (USDA, 2013). The interactive webpage was very useful, but the older soil surveys generally have more detailed explanations.

Also included in the soil layer data was some basic information on the slopes of the soil areas. This slope information can be used for siting as well as the soil type information also in the layer, though the soil type regions are quite large so local variation in slope from this data can be significant. A summary of the different slopes characterized in this layer is below. Some additional information on the soil structures of TVSR West Camp can be found in Appendix D.

Slope Type	% Slope
A	0-3%
B	3-8%
C	3-15%
D	15-25%
E	15-45%

3.3.3 Tree stands and forest management

The forest management layer was developed by the 2013 MQP group. The layer itself only displays where the tree stands are and their ID number, but this can be supplemented with the Forest Management Plan. The Forest Management Plan was completed in 2004. It is a 10-year management plan for 2005-2015, written by Gerrish Forestland Management. There is an electronic copy as well as a paper copy. The ID numbers correspond with the stand numbers given in the plan. It is not of the same quality as the layers downloaded from MassGIS but it is still informative. Each tree stand region that suggested forest conservation was given a 100-foot buffer zone; this was determined from the forest management plan and can be seen in Appendix C. This buffer zone was applied to maintain consistency with other protected natural features such as wetlands.

3.3.4 Wetlands

The wetland layers are two feature types, a polygon file and a line file. "The wetlands are interpreted from 1:12,000 scale, stereo color-infrared photography (CIR) by staff at UMASS Amherst. The interpretation is field checked by Department of Environmental Protection (DEP) Wetlands Conservancy Program (WCP). Completed interpretations are then scanned and converted into rectified polygons and lines using standard photogrametric techniques by a consultant under contract to the WCP. Final quality control is performed by WCP GIS staff" (Office of Geographic Information, 2009). It was developed in 2009 and downloaded from MassGIS in 2014. There are other wetlands files that can be downloaded, one is the National Wetlands Inventory (2007) and the other is a wetlands change layer (2011), which is about the changes that have happened in the wetlands since 2001 and reasons why it might have happened. The layer, MassDEP Wetlands (1:12,000) used was the most appropriate for the purposes of this project

In addition to being clipped to the Cub Scout Camp zone, this layer was given 100 foot buffers, in accordance with the Massachusetts Wetlands Protection Act (310 CMR 10.00) regulations which specify 100 foot protective buffers surrounding most wetlands (Executive Office of Energy and Environmental Affairs, 2009).

3.3.5 Hydrography

This datalayer was developed by MassGIS by enhancing old data from the USGS 1:25,000 Hydrography layer. The layer was released in 2010 and, similar to the wetlands data, there is a line file and a polygon file. A 100-foot buffer was created for these files as well, in accordance with the Massachusetts Wetlands Protection Act.

3.3.6 Elevation contours

The elevation contours, released in 2005, can be downloaded from MassGIS. This datalayer was created using a Digital Terrain Model for elevation using data points collected while black and white Ortho-images were being produced, replacing the previous datalayer made from USGS data. It is downloaded by town, which means the layers needed to be merged, which creates one file from the separate data sources. Because the focus is on just the West Camp, only the Oakham and Spencer town layers needed are used. The quality is good and no supplemental material is needed. While the topographical information is accurate, showing contour lines for every 3 meters, determining slope from this data in GIS is a difficult task requiring the creation of raster data from the vector data. So instead this was used primarily as a reference layer for understanding the layout of the property, especially to visualize steep slopes.

3.3.7 Roads

The roads data layer can be downloaded from MassGIS. It was released in 2003 from as the Census 2000 TIGER Roads datalayer (Topographically Integrated Geographic Encoding and Referencing). Though the data is on the older side it is suitable, especially since there are not many roads throughout the West Camp. There was no need for supplemental information. A 50-foot buffer was added to the road layer to support development that maintains the more natural character of the West Camp by blocking noise and vision of the roads from any new structures or facilities. There was no strict source guiding this choice, but 100 feet seemed excessive and might too strictly limit suitable development sites.

3.3.8 Parking

The parking layer was developed by the 2013 MQP project. They layer include the size and locations of the impervious surfaces used for parking, and also has information on the car capacity.

3.3.9 Well

The well layer was developed by the 2013 MQP project. This layer simply has the location of the well, which is used as the main water source by the West Camp. A 100-foot buffer was applied to the well, though this fit within the wetlands buffer zone, so it was removed for simplicity.

3.3.10 Power Lines

The power lines layer was developed by the 2013 MQP. This layer shows the location of power lines, as well as providing information for whether they are above or below ground. A 100-foot buffer was applied to the power lines to prevent accidental damage during development, as most of the power lines in the West Camp are underground.

3.3 Performing Data Analysis

There are many ways to perform a suitability analysis using GIS. This project performs a manual analysis, which could be performed by anyone with an introductory understanding of or experience with GIS. Various layers were processed by using overlay tools, such as union, buffer, and dissolve, to create contiguous maps that showcased different components of the ESA. The final map was created by showing the most important criteria as a single overlay of several disparate buffer layers, and then highlighting promising regions for development.

The union and dissolve tools made comparison between layers manageable, by combining buffers. Specifically the wetlands, flood zones, and hydrography were combined and buffered to create one simple ‘water’ buffer. Similar actions were performed on the roads and power lines layers, to create an ‘infrastructure’ buffer. For both instances, the original buffer output was dissolved to create a continuous buffer. Buffers were put around the tree stands in need of protection, especially if the forest management plan notes it as a rare species habitat and dissolved to create a continuous buffer.

Promising sites for future development were determined using overlays to create one all-encompassing buffered region, and qualitatively determining low slope regions using the elevation contour lines as the slope data from the soil datalayer was too general, and therefore too restrictive.

3.4 Evaluate and Present Results

Multiple maps (Figures 5-11) were created from the many layers that were collected. Several maps are required to display the many different components that were analyzed in the ESA in an understandable manner. These maps each include a couple different layers. A water map (Figure 5) contains wetland, wells, flood zone, and hydrography layers. An infrastructure map (Figure 6) contains roads, power, and parking. A tree-stand map (Figure 7) displays the various regions and shows where tree cutting is acceptable throughout the camp. A soil and slope map (Figure 8) displays the soil types, slope classes from the soil layer, and the elevation contours. After the several component maps, a final site selection map (Figure 11) was made that displays the optimal site locations against a layer showing the combined ESA requirements. In this way the map appears far less busy, regions unsuitable for development can be classified as one restricted area, and the potential development sites are more obvious. The final buffered area contains the wetlands, flood zone and hydrography, as well as the vulnerable tree stands, power lines, and roads. All maps were polished and labeled in ArcGIS, taking into account basic principles of cartographic presentation.

4. Results and Analysis

This section presents the results of the project and offers some analysis as well. The first part of the project was to ascertain the needs of the stakeholders through various meetings and correspondence. Following are the many maps created to visually represent the developmental needs of TVSR and the required considerations for siting. These considerations were taken from several environmental site assessments, such as that by MEPA.

4.1 Stakeholder needs

Like in the 1970's, expansion at Treasure Valley West is needed to keep up with the growing number of scouts. This need was identified by many including the Mohegan Council, the Camp Committee, and Friends of Treasure Valley (Griffin, Introductory Meeting, 2014; Chamberland T. , Site visit with BSC Group, 2014; Chamberland & Toohill, 2014). The Treasure Valley Cub Scout program has been growing in recent summers, so much so that another week of programs were added to accommodate the growth. Further planned improvements to the reservation aim to accommodate even more children and provide improved services. The Friends of Treasure Valley hope that improvements to the camp will enable it to be a more significant presence in local and regional community. Outside of scouting, improvements and expansion could make it more desirable for other organizations, like Sober in the Sun, to host events. The added income would be helpful for maintaining the reservation and the property would be getting use year round instead of just the five weeks in the summer.

For the West Camp there is great need of more building space, to be used as program and administrative space in the summer, storage in the winter, and to make the property more attractive to those looking to rent for events and gatherings. Presently there is one grounded building available to the scouts in the summer, the Cub Scout Day Camp Building, which can house about 100 individuals in case of storms or other emergencies. The camp averages over 100 cub scouts plus staff, equaling well over the capacity of the building, so they will not be adequately prepared for emergencies if use of the camp increases. On days where indoor activities are scheduled or preferred due to weather, the program space would be cramped

with the number of occupants as well. The other buildings are grounded but they are used by the Rainbow Child Development Summer Camp, making them unavailable for Cub Scout use.

There is currently no clear indication of the beginning of the West Camp at TVSR, and no clear administrative building upon visiting the site. To better accommodate all parties, there is a need for a separate building which can serve as a welcome center, rendezvous and entrance point, emergency safety zone, Cub Scout headquarters, and all around useful building for campers, visitors, and staff. Since the camp is currently bursting with children and programs, the development of a new welcome center to serve these roles is needed. This is one of several identified improvements desired by parents, campers, and TVSR for the benefit of the Day Camp.

This space could also be beneficial if the camp decided to rent it out to other private organizations looking to host events, much like the Sober in the Sun event. More space enables larger events to be conducted on the property, which could bring in more revenue. Finally, the additional building would make it simpler to separate the Cub Scouts and Rainbow Summer Camp's facilities, simplifying their future use of the Treasure Valley West reservation. The arrangement between the Cub Scouts and the Rainbow Summer Camp has been successful in the past, and the income appreciated, so the only thing limiting the continuation is that it competes with the Cub Scout program for space. Since the Cub Scout program has priority, it is necessary to expand to keep the arrangement intact without creating friction over close quarters.

4.2 Environmental Site Assessment Component Maps

Several maps were created to support the chosen site locations. These maps demonstrate why these areas were chosen. The first of these maps is the Water map (Figure 5). It is a simple map showing only the well, wetlands, flood zone, hydrography, and their 100-foot buffer. This map is just to acquaint the viewer to the natural features of the property. The wetlands and other water features play a vital role in this little ecosystem and require protection. The 100-foot buffers are a standard recommendation in the MEPA regulations. Though it is possible to build within that 100-foot buffer, it would require a great deal of care to ensure that the wetlands are not disturbed to any damaging extent.

The next map (Figure 6) shows the infrastructure of the property. Like the Water map, this infrastructure map provides a basis upon which to orient to the manmade features of TVSR. It also displays the 50-foot road and 100-foot power line buffers. This buffer was inserted around the infrastructure to ensure steadfast rustic character throughout the West Camp in honor of the ideas that brought the original development to fruition. However, when considering optimum development, having nearby road access, and being on one of the more developed roads, is desired so these conflicting needs were balanced when considering siting locations.

The tree stands, shown in Figure 7, are outlined by the forest management plan due to expire in 2015. Until that expiration it serves as the standard, as well as a wonderful resource of TVSR-specific information. Within the West Camp there are several different tree stands. By consulting the management plan, three different classifications were developed. The first, in red, are the protected areas which should not be disturbed. The pale yellow is a discretionary area. It can withstand a little disturbance or tree harvesting. Green is the preferred area for future development, based only on the descriptions of the tree stands from the Forest Management Plan. Roads and parking infrastructure are provided on the map for orientation purposes.

Slope was a major limiting factor on this hilly property. With anywhere between 0-45 percent slopes, these conditions are far from ideal for building. Instead of struggling with these issues, the best approach is to plan around them or with them in mind. To visualize the slopes and elevations of the camp landscape, a map (Figure 8) was created with the soil type regions displayed by slope class with the elevation contours superimposed. Slope classes are displayed with green being most suitable for development, yellow and orange being moderate, and red being the least suitable. This map demonstrates why it is important to consider other features in an environmental site assessment. The red area covering most of the map could easily rule out a large amount of the property because of the challenges associated with building on slopes steep. But by displaying the elevation contour lines it is evident that the slope classification, taken from the soils layer, is far too general. The greater detail of the elevation contours allows

for a more precise, though qualitative, analysis and the slopes of the landscape are not nearly as limiting.

With only the elevation contours and slope classes, there appear to be many suitable regions for development at the north and an especially suitable region in the south. However, when the water buffer is displayed simultaneously, many of these low slope regions are already off-limits. Another map (Figure 9) was formed that displays the water buffer to highlight the necessity of thorough consideration to the multiple requirements for a suitable site.

4.3 Potential site locations

Limiting factors considered, there were a number of locations about the property that would serve as suitable locations for development. Figure 10 shows the elevation, infrastructure and the one all-encompassing buffer. It is shaded red due to its prohibitory nature. This does not show the suitable development locations. It is mostly for understanding that there are certain off limits areas, which should be protected and respected for the good of the property and environment.

Figure 11 shows the recommended areas outlined in green. These areas are within suitable tree stands, lay on regions with relatively low slope, and avoid the buffer zone. Building in these areas would not eliminate environmental impact, but they would mitigate it by protecting natural features and the character of TVSR. Region 1 would make the best location for the welcome center as it is near both entrance roads and the border of the Cub Scout Camp zone. This makes it the most easily accessible location for development and the most logical site for the welcome center.

The other regions would not be as suited to a welcome center due to their distance from the entry roadway, but they might make excellent development for campsites, parking, and archery and BB-gun ranges. These regions offer a wonderful amount of variety for development and future projects. Region 2, while smaller than the others and relatively close to a wetland area, is nearest to Region 1 and could be used to develop a nature observation area based on its proximity to the wetlands and infrastructure. Region 3 lies at quite high elevation, and is accessible by a secondary road. Its elevation could be capitalized on by using the region for a fire pond or a water holding tank, letting gravity provide water pressure. Currently there is

almost no development in the southern region of TVSR, so Regions 4 through 6 offer plenty of room for expansion and renewal of campsites.

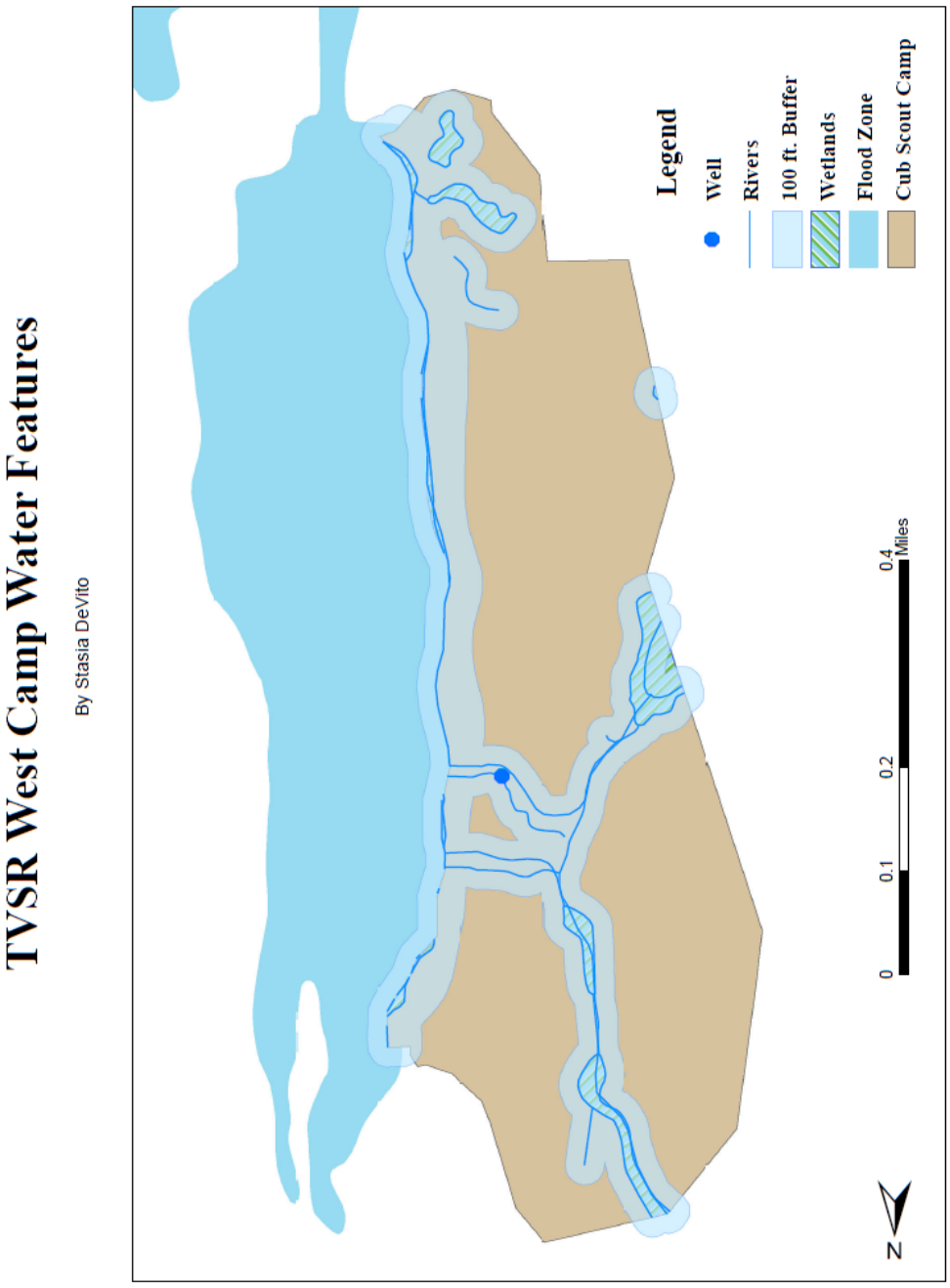

Figure 5: TVSR West Camp Water Features Map

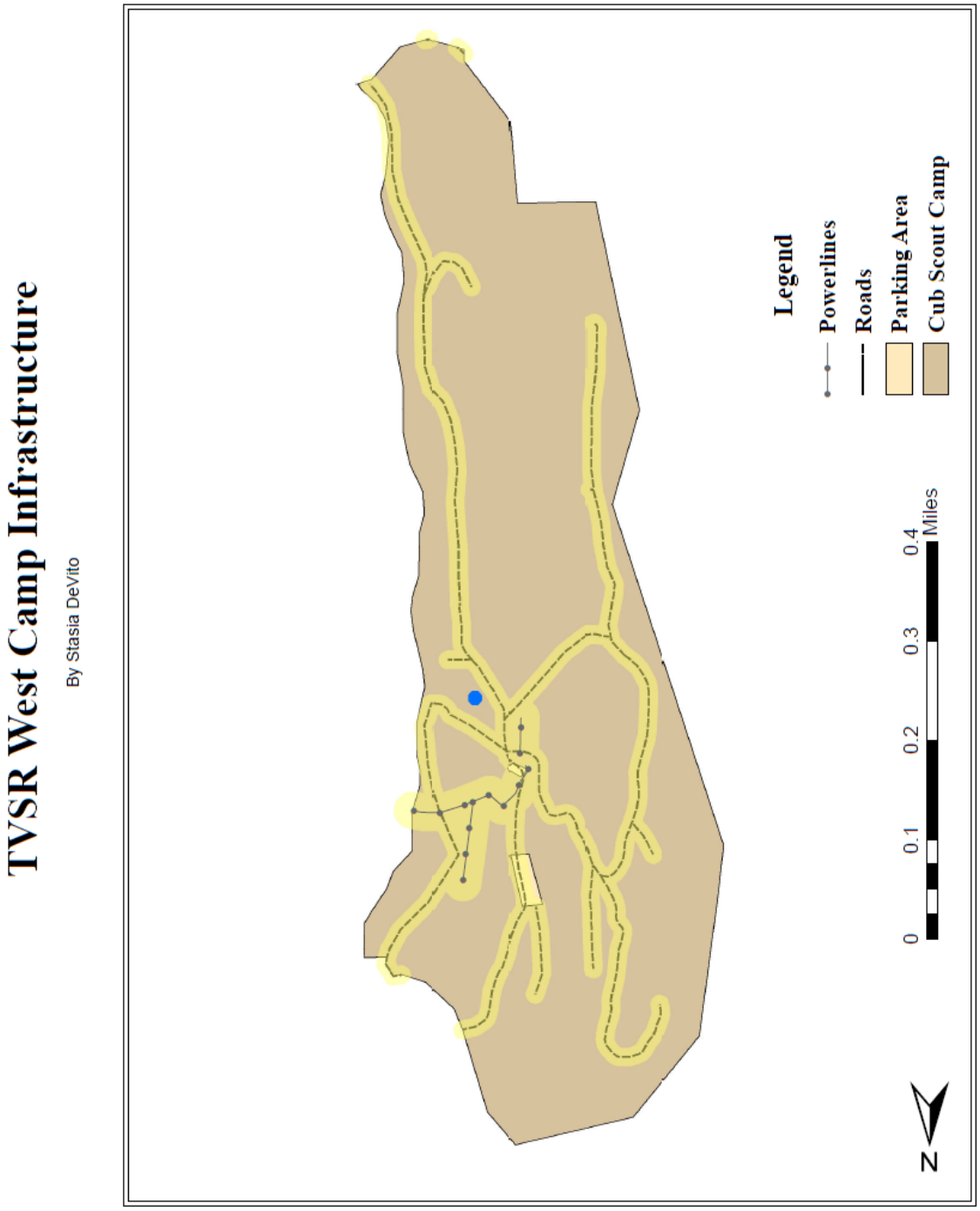

Figure 6: TVSR West Camp Infrastructure Map

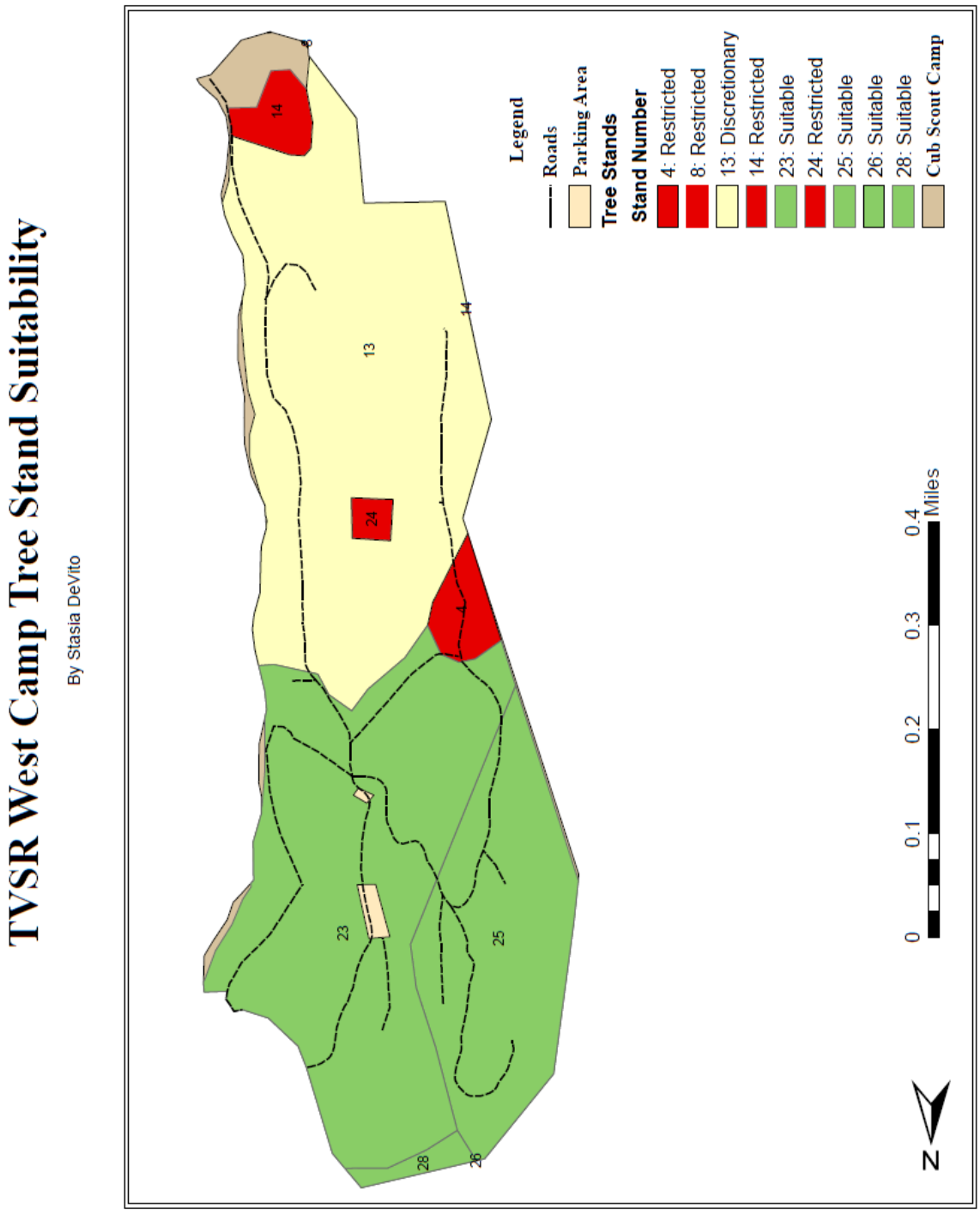

Figure 7: TVSR West Camp Tree Stand Suitability Map

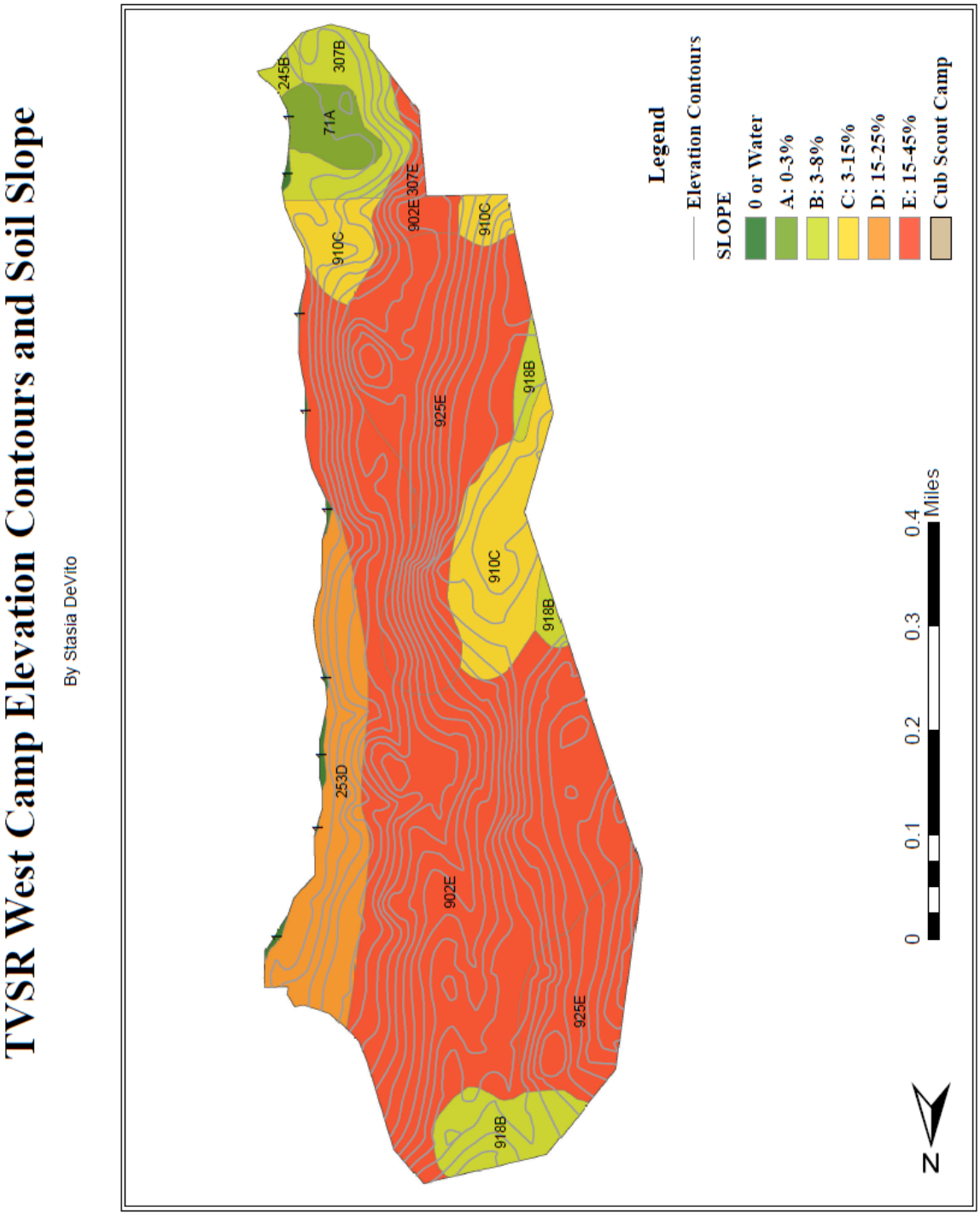

Figure 8: TVSR West Camp Elevation Contours and Soil Slope

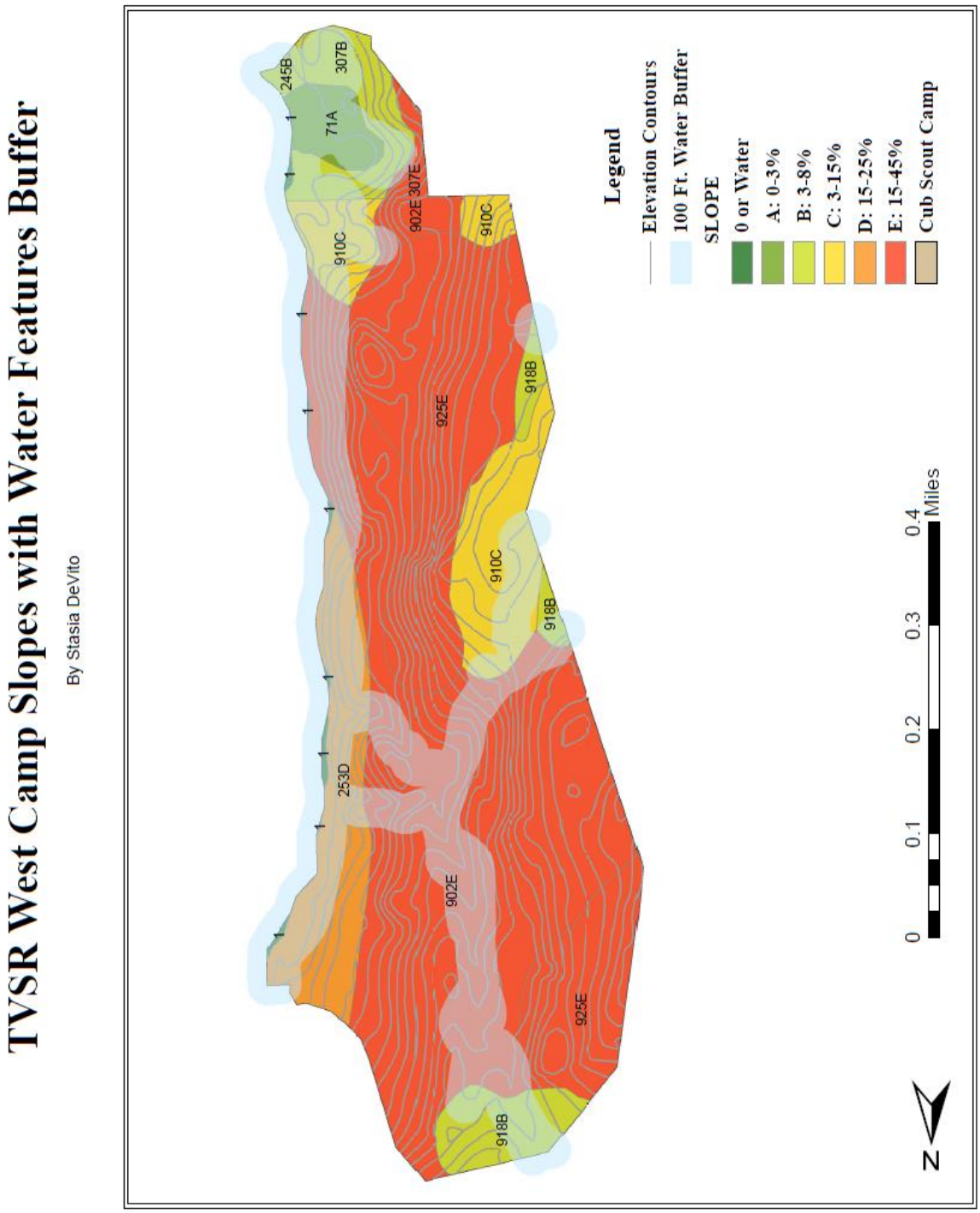

Figure 9: TVSR West Camp Slopes with Water Features Buffer

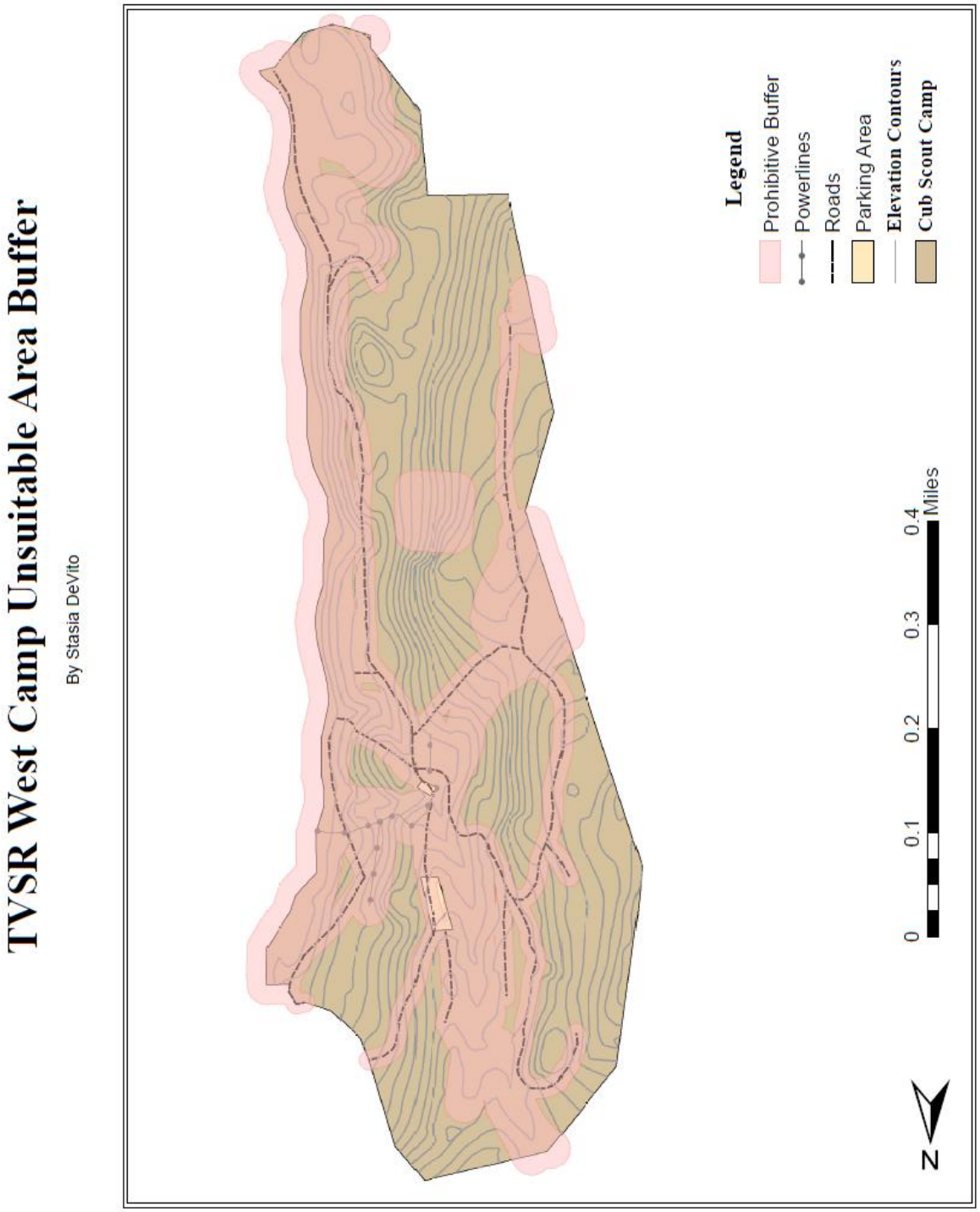

Figure 10: TVSR West Camp Unsuitable Area Buffer

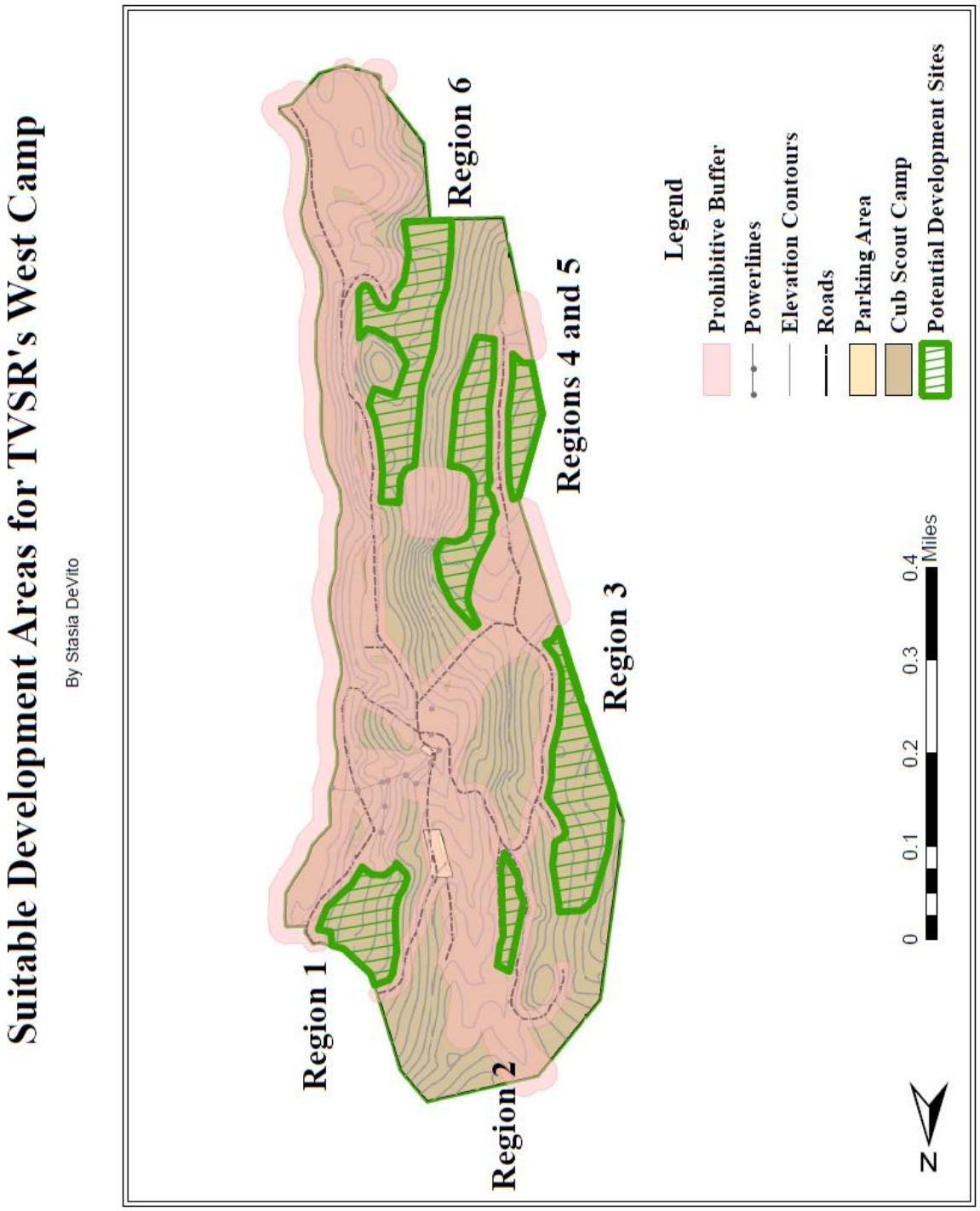

Figure 11: TVSR West Camp Suitable Development Areas

5. Further Recommendations

Since Treasure Valley Scout Reservation is looking to develop and expand the West Camp, the area of impervious surfaces, such as parking, buildings, and roads will increase. Though it may not be increasing by colossal proportions, any surface increases runoff and requires consideration of storm water/waste water management. Since TVSR and the BSA are committed to promoting environmental conscience and conservation, this is an opportunity to explore 'greener' alternatives, for example, rain water collection. Though it will most likely not meet their current usage, it can definitely contribute and help lighten the impact of development. Collected rainwater can be used as a grey water source for planters, cleaning outdoor surfaces, or toilets.

Another sustainable initiative that TVSR could undertake would be to source lumber for construction from trees at TVSR. Throughout the Forest Management Plan, there are recommendations for each tree stand. Some of these recommendations mention felling trees that are lumber quality. This resource could be used as a building material for expansion projects at TVSR. It would be keeping in line with their environmentally friendly values and it would be a wonderful teachable moment for the scouts (Gerrish Forestland Management, 2004). The forest management plan allows for a specific amount of board feet to be felled from certain tree stands during allotted time periods; refer to the plan for specifics. With some planning, the lumber could be felled with enough time to cure before it needed to be used for building.

The greatest negative for this plan would be the expense. There are places nearby for timber milling and the travel time of this lumber would be significantly less than most conventional materials, but because this diverts from the normal production of lumber it would come at increased cost to TVSR. The second negative would be the quality/type of the lumber provided by the property. Some of the trees on the property that can be used as lumber serve as an excellent habitat of the local insects and smaller species, such as bats and mice. This is obviously problematic as it will affect the lifespan of the building. Despite these negatives, it is hoped that the example of sustainable resource use provided by lumber sourced from the

reservation will be considered for future developments. Discussion of this recommendation was conducted with Tom Chamberland, and can be seen in Appendix A.

Other issues for future development, which could be addressed in future IQPs or MQPs, include:

- The lack of a fire pond
- Questionable physical access for fire trucks and other emergency vehicles
- Handicap accessible parking
- Determining if there are siltation and conservation issues at the waterfront
- Rare species habitat expansion/protection based on the forest management plan suggestions.

Additional recommendations for future MQP or IQP work with TVSR can be found in the 2013 MQP project.

6. Conclusions

Treasure Valley Scout Reservation has the potential to increase use of the West Camp by the development of new facilities and restructuring of the property. This project focused on the use of an Environmental Site Assessment approach, conducted using ArcGIS, to ascertain the optimal locations for sustainable development, preserving natural features and the camp's historical character. Sustainable development was identified by stakeholders of TVSR as an important goal, because environmental protection and sustainable practices are a central philosophy held by the Boy Scouts of America.

A manual approach was used to conduct the ESA. The first work was to identify the specific needs of the stakeholders to see if there were any specific criteria that were important to development, which resulted in a strict adherence to maintaining the camp environment and character, noted above. GIS data was then collected from a 2013 MQP on TVSR as well as from MassGIS. In full, the collected datalayers were soil, elevation contours, wetlands, roads, hydrography, flood zones, parking, tree stands, TVSR zones, power lines, and wells. These layers were then used to create several maps displaying, respectively, wetland and flood zones, infrastructure, tree stand zones, and soil slopes and elevation contours. Key datalayers were combined using geoprocessing tools to create one large prohibitive zone, and then suitable sites were chosen from the remaining camp area. A map of the suitable development locations was made with the hope that it will enable TVSR to make informed decisions for the future. Hopefully, the development of TVSR will not only benefit the scouting community, perpetuating the mission of TVSR, but also improve the presence of the reservation with the communities of the Mohegan region.

Other recommendations for improving TVSR West Camp were developed during research and correspondence with stakeholders throughout the project. These recommendations include the development of a fire pond, improving handicap and emergency vehicle access, and rare species habitat protection. Some potential sustainability initiatives include rainwater collection and sourcing of construction timber for new developments from TVSR itself.

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Appendix A: Important Email Correspondence

On some further recommendations for TVSR development:

From: Chamberland, Thomas A NAE

Sent: Tuesday, March 18, 2014 7:04 AM

To: Devito, Stasia LeighMcClancy; Ray Griffin; Tom Chamberland

Cc: LePage, Suzanne; Scott Gerrish

Subject: RE: A few questions

Stacia:

Lumber: Thanks to a highly regulated market lumber used for building "structure" has to meet certain certifications, and species, also the time from harvesting to actual use, if not properly dried (read $) is at least 6-8 months. Also I'm not aware of any real local lumber mills that could properly address these issues, so one would have to factor in transportation costs. ON the Good side, you will note we do use natural edge white pine boards for some of the outside sheathing, this is obtained locally/we have supplied logs in the past for this. If you want to explore this a bit more, please do, possible talking to our forester, Scott Gerrish he may advise you as to the current "market" for our saw logs. I have added his email above.

One final note on the white pine natural edge is we have found that is excellent "habitat" for a number of small animals (read > mice & bats) and insects (ants & spiders) and squirrels and chipmunks like to chew thru and also nest. Not conducive for "off season storage" and up "close with young scouts" in summer

Weather station: we may have a station in the ECON area, I will check as we offer weather Merit Badge. If we do, I'm not sure what it has.

Noxious weeds can be invasive species, I'll defer to Scott for a more detailed answer. We do have Japanese Barberry, bitter sweet and multi flora rose on the property. (we have learned

that the Japanese barberry was planted by scouts many years ago for wildlife food!
Tom C

-----Original Message-----
From: Devito, Stasia LeighMcClancy [mailto:]
Sent: Monday, March 17, 2014 5:53 PM
To: Chamberland, Thomas A NAE; Ray Griffin; Tom Chamberland
Cc: LePage, Suzanne
Subject: [EXTERNAL] A few questions

Hello,

I had a few ideas I wanted to run by you. After looking over the forest plan it occurred to me that, since the plan allows for tree felling specifically to be used as lumber, it might be possible to used said lumber for the welcome center or any building on the property, such as the waterfront storage shed/lifeguard stand. Would this be considered as a possibility? Do you know of any local lumber mills that you would consider going to (or is there any mill in particular) and where I could find pricing information?

I was also wondering if there is a weather station already on the property anywhere? Nothing big, just a portable personal weather station that would have the temperature, wind velocity, humidity, etc I was just wondering because it would be helpful for discerning and understanding the micro-climates of the west camp. If not, I could go about trying to find one.

Finally, the forest management plan mentions noxious weeds. Are these the same as invasive species? If so, besides Milfoil, are there any major problems with invasive species/noxious weeds on the west camp? It didn't seem like it from the plan, but it was done a number of years ago and I wanted to make sure.

Thank you.
Sincerely,

Stasia

On key people of TVSR:

From: Chamberland, Thomas A NAE []

Sent: Friday, February 28, 2014 9:24 AM

To: Devito, Stasia LeighMcClancy

Cc: Charles Thompson; Daniel Moroney; Jeff Hotchkiss; Jeremy Ahearn; Michael McQuaid; 'Raymond Griffin'; WBock

Subject: Key People

Stacia: as requested here are the Key people for your MQP: They consist are the Properties Committee of Mohegan Council:

Dan Moroney: Executive Board Mohegan council: Email redacted

Jeremy Ahearn: Executive Board Mohegan council: Email redacted

Ray Griffin: VP of innovative Programs: Email redacted

Jeff Hotchkiss: Council Executive: Email redacted

Charles Thompson; Council President: Email redacted

Warren Bock: Trustee: Email redacted

Mike McQuaid: Member, Fr of TV member: Email redacted

Tom Chamberland, VP Camping & Outdoor program: Email redacted

Tom C

Appendix B: Cub Scout Day Camp Projects List for Engineering Study 10/23/13

1: Increase Archery Range: currently only 4 shooting stations are set up, range needs to be wider to accommodate 8 shooting stations, comfortable for Cub Scouts; benefit of this is we add 2nd den to this activity each hour (more program ability without staff increase. NOTE: see Item 5A below may require a relocation of archery)

2: Shooting Sports: double in size (more program area/time) this will require at least 1 more staff person, due to span of control for scouts (8:1) rebuild existing and expand?

3: Waterfront Revitilization: identified needs/program expansion:

A. Build a life guard chair (parents? Why no chair, one is not BSA required) Chair can be designed to have a "shed" built in for waterfront use equipment thus eliminating the need for the separate shed.
B. Expand waterfront area to:
    1. Add 30+ feet to swim area
    2. Create a beach area for paddle boats and
    3. A dock for row boats – relocate to Nature area – move nature area to current camp fire area (see 5D below)
C. Improve upper waterfront area:
    1. Paint/rehab existing change house to be more cub friendly
    2. Add 1 more change house, north end of leach field area
    3. Improve/define all walkways to more suitable "water front" material (sand?)

4: New entrance/welcome area:

A. Located just north of cub field to include: Parking 50 cars, bus loop: expand area from "main road" towards cub field (level area) creating a loop road for bus drop off and parking for 50 cars (?) this may require relocation of archery area.
B. Build a "Welcome Center" Off of this new bus circle, similar to Magee in main camp, serves as office, health lodge (?) with bathrooms, full basement w/ garage door (program area summer/storage in winter).
C. Depending on layout/use of welcome center, reduce current "admin area" in Columbus building to about ½ current size, (keep health lodge/TP in remaining area, open remainder to program use (expand occupancy of this building?))
D. Relocate camp fire area to North West of current archer range, to be now closer and more visible to potential "parking bus loop area"
E. Construct a hard roof shelter, located off east central side of cub field, similar to HRS in campsites

Appendix C: Tree Stand Descriptions

According to the 10 year Forest Management Plan performed in 2004, there are 9 different tree stands within the Cub Scout Camp Zone (the zone was identified in the previous MQP). These stands represent defined areas where a "group of forest trees of sufficiently uniform species composition, age, and condition to be considered a homogeneous unit for management purposes" (Maryland Department of Natural Resources, 2007). It is important to note that though the stands have been assigned a numeric value they do not go in order. Stand 14 does not have to be near stand 13.

Stand 4 is marsh land ranging from shallow to deep. It is rich with a good number of species, especially beaver. Though this land could be very productive for growing profitable trees, it is more valuable to the ecosystem as marsh land because it supports the species.

Stand 8: At the time of the survey, this stand was one where change would benefit. The trees growing there were not ideally suited for the soil type and as a result were not renewing quickly. It was suggested the less suited trees be sawed for firewood. This would create an opening for the better suited trees making it more likely for them to regenerate.

Stand 13: This stand is made up of a diverse collection of trees. They are renewing growth well and due to previous thinning, there was no need to alter this stand in anyway at the time of this plans inception. The founders of the camp forested the property over the years after purchase. When the property was acquired it was bare farmland. They had the ecological conscience to return it to its native state, forest. This is an ideal report for a tree stand, proof that they made the right choice all of those years ago.

Stand 14: poorly draining soils, potential vernal pond (may need buffering), and red maple growth not doing well. *These features rule this stand out as a potential development site.*

Stand 23: Since this stand is near to the more developed areas of camp, no action was prescribed. Though forest management is important for the property it should not disturb the camp in any way. Therefore the plan left it up to the camp since it depends on the needs/desires of the camp. Bad case of exotic species taking over.

Stand 24: site of a recent forest fire. Mostly dead trees, saplings and shrubs. The surveyor found that though it was burned it served as an important wildlife habitat, and

actually suggests that this be repeated elsewhere on the property for those species that need it.

Stand 25 A diverse stand with good regeneration, and no invasive exotic species, in need of some thinning to keep it healthy and promote further regeneration.

Stand 26 Very wet soil supporting a copse of red maple trees. In need of thinning, but would only be possible around the outskirts of the stand.

Stand 28: This final stand is very interesting in that it provides a glimpse into the history of the property. Along with being populated by a great number of different tree species, it is also home to fruit bearing trees and elderberry shrubs, which suggests that it was once an orchard. There is also a vernal pool which will limit development of this area. In addition to all of these interesting features, there are invasive plants here as well. This stand has potential but it in need of tending.

Tree Stand Map

Appendix D: Additional Soil Structure Information

Within the Cub Scout camp zone of TVSR, there are nine different soil types. Each one is has a unique profile that provides a great deal of information about the area of the property it covers. Soil classification is an interesting field with a unique classification system. The soils are given names based on their structure, slope, ability to drain, average bedrock depth and so on. Because it is such an extensive field, it would be easy to go into great and unnecessary detail. Here though it is most necessary to understand that there are different soils on the property and they affect where a building and its accompanying infrastructure will go.

Soil is a combination of mineral and organic matter, air and water. The organic matter is mostly topsoil, and it only contributes 1-6% overall. The mineral matter can vary a great deal in size and texture. There are four mineral components of soil: gravel, sand, silt, clay. Gravel and sand have larger particle sizes, while silt and clay's particles sizes are a fraction of the size. The structural capacity of soil depends on what it is made up of. Larger particle sizes tend to be able to support more. For example, fine sized particles can support less while gravel, with its large chunks, can support 6 times more than wet clay. Hard rock makes the most stable foundation because it can support a load of 80,000 pounds per square foot (lbs/ft^2). Soft clay and wet sand are the least stable foundations, as they can between 2,000-4,000 lbs/ft^2. Dry clay and dry sand are somewhere in between at 6,000-8,000 lbs/ft^2.

The largest soil type, Charlton-Paxton association, covers about 44% of the camp. It has steep slopes ranging from 15-45% and is extremely stony. It is a well-drained mostly loamy soil. Loam is a soil mixture, comprised of primarily sand and silt, about 40% of each, and a little clay, about 20%. The second most abundant soil type is a Charlton-Paxton-Hollis association, which covers about 25% of the camp. It is a fine sandy loam which drains well and is very rocky. The remaining 31% of the camp is covered by the other seven soil types, which cover less than 10% per type. They are generally extremely stony, well drained, and less than 25% slopes.