TRAIL MAPS AND ASSESSMENT

MAR 18TH, 2021

C-TERM

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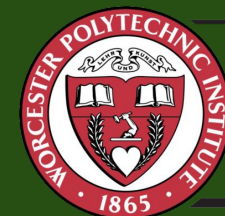
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TREASURE VALLEY
SCOUT RESERVATION
EST. 1925

WPI
WORCESTER POLYTECHNIC INSTITUTE
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Abstract

When hiking a trail, awareness of your precise location and direction is essential to your safety. The accuracy of mapping is crucial in ensuring that patrons can have a safe and enjoyable experience on a trail. The goal of this project was to work with staff of Treasure Valley Scout Reservation (TVSR), a Boy Scout reservation and campground founded by the Boy Scouts of America (BSA), to update their official map of the camp. TVSR is a private reservation in Rutland, Massachusetts that frequently sees a variety of scouts hiking its trails. We worked closely with TVSR staff to ensure their trail maps were accurate so scouts remain safe while hiking at Treasure Valley. We also investigated the geocaching opportunities at TVSR and compiled them into a set of web pages that can be accessed by scouts who seek to further explore the reservation. Lastly, we looked into handicapped accessibility and provided TVSR staff with a condensed report consisting of guidelines, research, and case studies to help staff implement changes in the future.

Preface

This project was initially planned to take place in London, England, in C-Term of the 2020-2021 school year. Unfortunately, the COVID-19 pandemic still has a major impact on the world. In a response to the ongoing pandemic, WPI has suspended all off-campus travel, and our project shifted accordingly. This project was conducted entirely remotely, with all team members working from home. All on-site work at TVSR was conducted by Professor Fred Looft, our liaison for this project and a member of the Treasure Valley Property Board, and Michael McQuaid, Facilities Committee Chair at TVSR.

A large challenge of this project was mapping out a location that three of the four team members have never been to, and we ask that readers keep that in mind as we detail our processes for collecting data.

An Accessible Reservation

As a reservation that is frequently visited by young audiences, the importance of accessibility cannot be overstated. Before starting this project, we identified key aspects of the reservation to improve as well as the importance of each.

Our primary goal of this project was to improve the accessibility of TVSR, so we began by defining what "accessibility" means, particularly in the context of a privately owned reservation.

Accessibility refers to catering to the needs of all individuals. Basic principles of universal design were applied to this project to ensure our work helped TVSR become more accessible to the average patron.

We identified key aspects of the reservation to improve to make it more accessible. We started by looking at the camp's maps, then looked into geocaching opportunities available at TVSR. Finally, we assembled a report of handicapped guidelines to assist Treasure Valley's future endeavours.

Image taken at TVSR in February 2021

Re-Mapping Treasure Valley

Before starting this project, our discussions with staff at Treasure Valley sought to identify key aspects of the reservation to improve. Their main focus was on the improvement of the maps available to patrons.

The image to the right is the map that was available to all patrons of the reservation before we started this project. Michael McQuaid, Facilities Committee Chair, and WPI professor Fred Looft, a member of the Property Board at TVSR, both identified a variety of issues with this map. In particular, many of the denoted trails are incorrectly positioned and many locations are named incorrectly. There are also several trails that are marked as the incorrect type of trail that needed to be adjusted.

The focus of this project became updating this map to allow patrons to safely navigate the reservation. This was particularly difficult to accomplish because COVID-19 restrictions prevented us from traveling to the reservation.
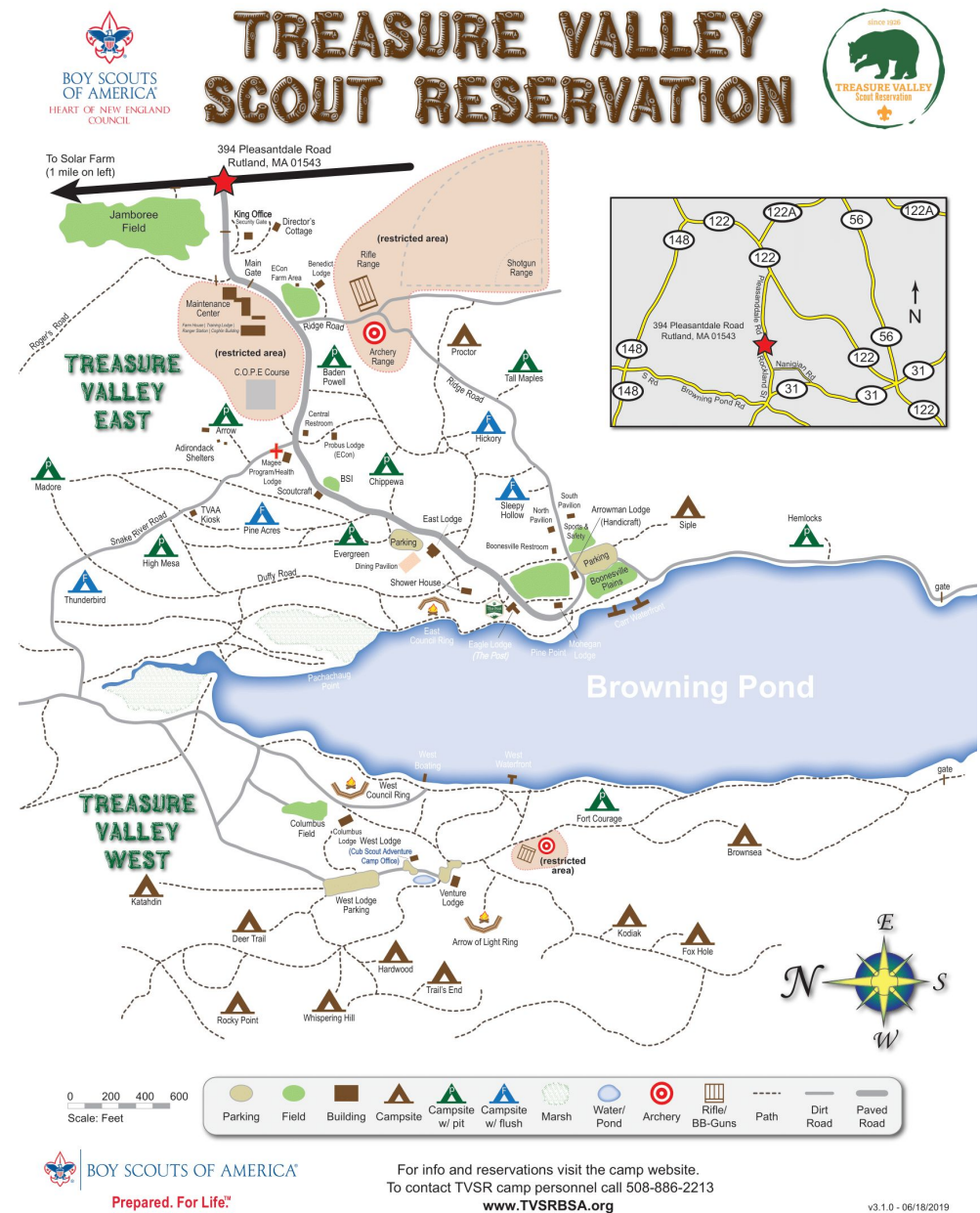
The Importance of Accurate Mapping

It is imperative to take into account the diverse audience that any given trail might serve when thinking about mapping. The adequate mapping of a trail, whether through a digital or physical medium, must be taken into account in its creation and management.

In particular, an accurately mapped trail system gives patrons the ability to easily navigate the reservation regardless of their experience with the region. A patron arriving at TVSR for the first time must be able to hike the trails using the available resources, whether a digital or physical map (Department of Conservation and Recreation, 2012).

We tried to focus on safety when planning this project, particularly because this reservation is frequented by minors in the Boy Scouts of America. Striving to ensure the maps at TVSR accurately reflect the current status of the trails is essential to ensuring these scouts remain safe.

An inaccurate map results in patrons getting lost, potentially resulting in injuries or stressful situations that leave a bad impression of the reservation. Ensuring that Treasure Valley's maps are accurate will help prevent patrons from getting lost, benefiting the reservation as a whole.
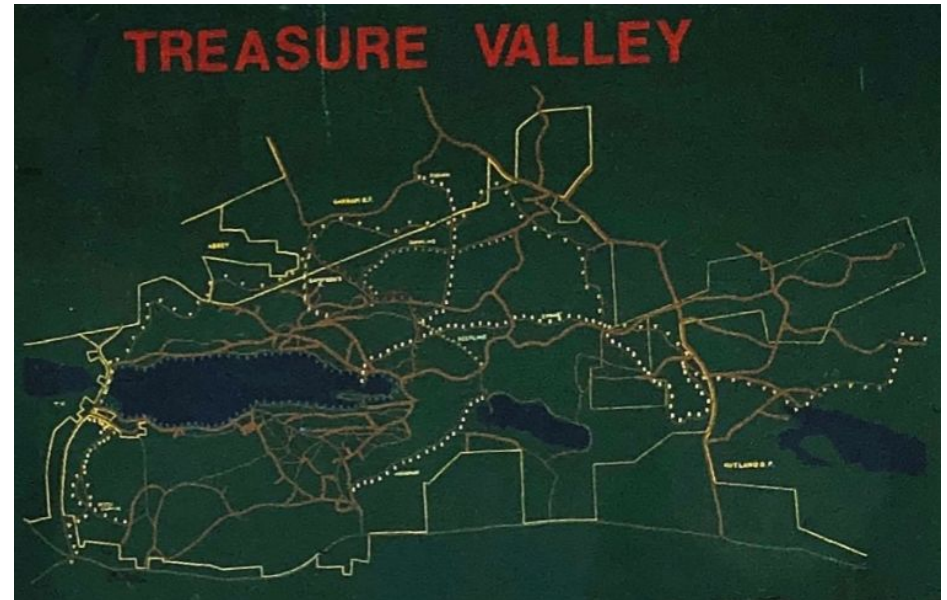
On-site map of TVSR as of February 2021

Our Initial Plan: Physical Surveying at TVSR

When we initially planned this project, we did so with a sense of optimism. Optimism that the global pandemic plaguing the world would be in a stable position by the time we began re-mapping Treasure Valley.

Our initial plan consisted of travelling to the reservation frequently during the early weeks of our project. While there, we would use the official map of TVSR as a guide and hike various trails. We would mark all problematic areas and use GPS data to accurately log the precise location of each trail.

Knowing that COVID-19 had the potential to significantly alter our plan, we ensured that every aspect of our plan could be completed remotely. Physically surveying trails at a reservation we had never been to was theoretically impossible, but we came up with enough potential solutions to ensure our success.

COVID-19 Disruptions

As we began working on this project, WPI was in "Campus Alert Level Yellow - Stay in Place." This status prevented project groups from leaving campus, severely limiting our ability to map the trails at TVSR. Fortunately, we had a series of back-up plans that we put in action during the early stages of our project.

Remotely Mapping Treasure Valley

Mapping a series of trails without physically hiking them is a very difficult task. Since we did not have permission for any of our group members to travel to TVSR, we had to rely on assistance from Treasure Valley staff. We began by discussing exact objectives for our map improvements. Namely, we wanted to focus on ensuring the digital copy of the map accurately reflected the current status of the reservation. Accomplishing this required assistance from Michael McQuaid and Professor Fred Looft.

Michael McQuaid has worked at Treasure Valley for an extended period of time and as a result has a strong sense of familiarity with the layout of the trails. We discussed the map with him to determine which trails needed improvements. He provided us with a series of recommendations based on his experience with the reservation. These recommendations consisted of precise edits to make to the map. Among suggested font sizes, Mike gave us specific instructions on how to accurately reflect the trails in the reservation.

The series of images above is an example of our process. On the left is the original, inaccurate map. The middle image consists of suggested edits from Michael McQuaid - adjusting the direction of the trail and updating the trail leading to Sleepy Hollow to a road. On the right is our revision, created to reflect Mike's suggestions.

	A	B	C	D	E	F	G	H	I	J
	INDEX	TAG	DATE	TIME	LATITUDE	LONGITUD	HEIGHT	SPEED	HEADING	PRES
1	T		210212	100813	42.321568	71.988808	286	0.5	203	992.4
2	T		210212	101028	42.321495	71.988876	288	5.6	209	992.3
3	T		210212	101037	42.321407	71.988976	288	5	225	992.4
4	T		210212	101044	42.321342	71.989059	289	1.8	264	992.4
5	T		210212	101054	42.321266	71.989128	289	5.4	219	992.4
6	T		210212	101102	42.321182	71.989243	290	5.3	222	992.6
7	T		210212	101111	42.321110	71.989365	290	4.6	219	992.7
8	T		210212	101128	42.321114	71.989365	291	5.1	39	992.7
9	T		210212	101135	42.321178	71.989265	291	6.2	42	992.5
10	T		210212	101143	42.321239	71.989143	292	4.9	71	992.4
11	T		210212	101154	42.321312	71.989044	294	3.6	43	992.3
12	T		210212	101203	42.321404	71.988945	296	5.7	31	992.3

**Sample GPS Logger data from Professor Fred Looft**

GPS Logger Data

The edits we make to the map need to be accurate so they reflect the current state of the reservation and improve the hiking experience for patrons. To accomplish this, we could not rely on input from a single source, regardless of their experience with the reservation. With the help of Professor Fred Looft, we were able to acquire GPS data to verify our changes to the map.

Fred was able to travel to TVSR on his own accord, as a member of the TVSR Property Board. He used his GPS logger, along with his smartphone and smartwatch, to acquire specific data about a set of trails. The data, shown in the image above, contains the coordinates of one of the paths he logged. Using this data, we were able to reconstruct his hiking path and use the information we obtained to verify our map changes.

Verifying Map Changes

We mapped the GPS data from Fred using Google Earth Pro, and the resulting path is shown in the left image. This image accurately reflects Fred's path while hiking major trails at the reservation. The picture on the right is our map after implementing changes suggested by Mike. The maps bear many similarities, allowing us to be very confident in the changes that we made.
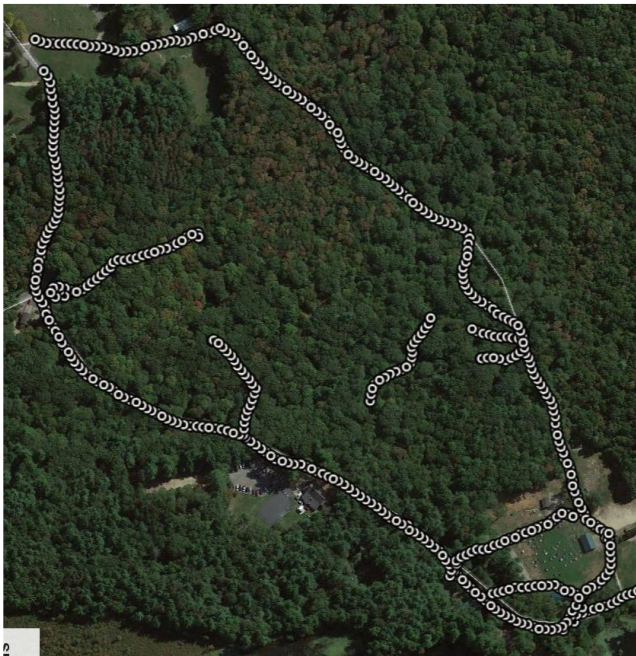
The two maps aren't perfectly aligned, however. Minor differences may be the result of snowfall covering officially marked trails, making them difficult to accurately navigate. Unfortunately due to COVID-19 restrictions, acquiring more data was beyond the scope of this project. We are confident in the changes we made as a result of Mike's suggestions, and Fred's data accurately reflects that.

The Final Map

Using suggestions from Michael McQuaid alongside data from Professor Fred Looft, we were able to completely re-map Treasure Valley Scout Reservation. While our changes are far from definitive, our discussions with TVSR staff suggest that this map is a significant improvement over the previous one. Facilities, camps, and trails have all been updated to accurately reflect the current state of TVSR.

We hope that our work improving this map greatly assists patrons of the reservation. Safety was a major consideration with our project, and having an accurate map will allow patrons of TVSR to safely hike the trails. Proper remapping of the existing roads, trails and amenities within the reservation ensures the safety and well-being of current TVSR patrons.
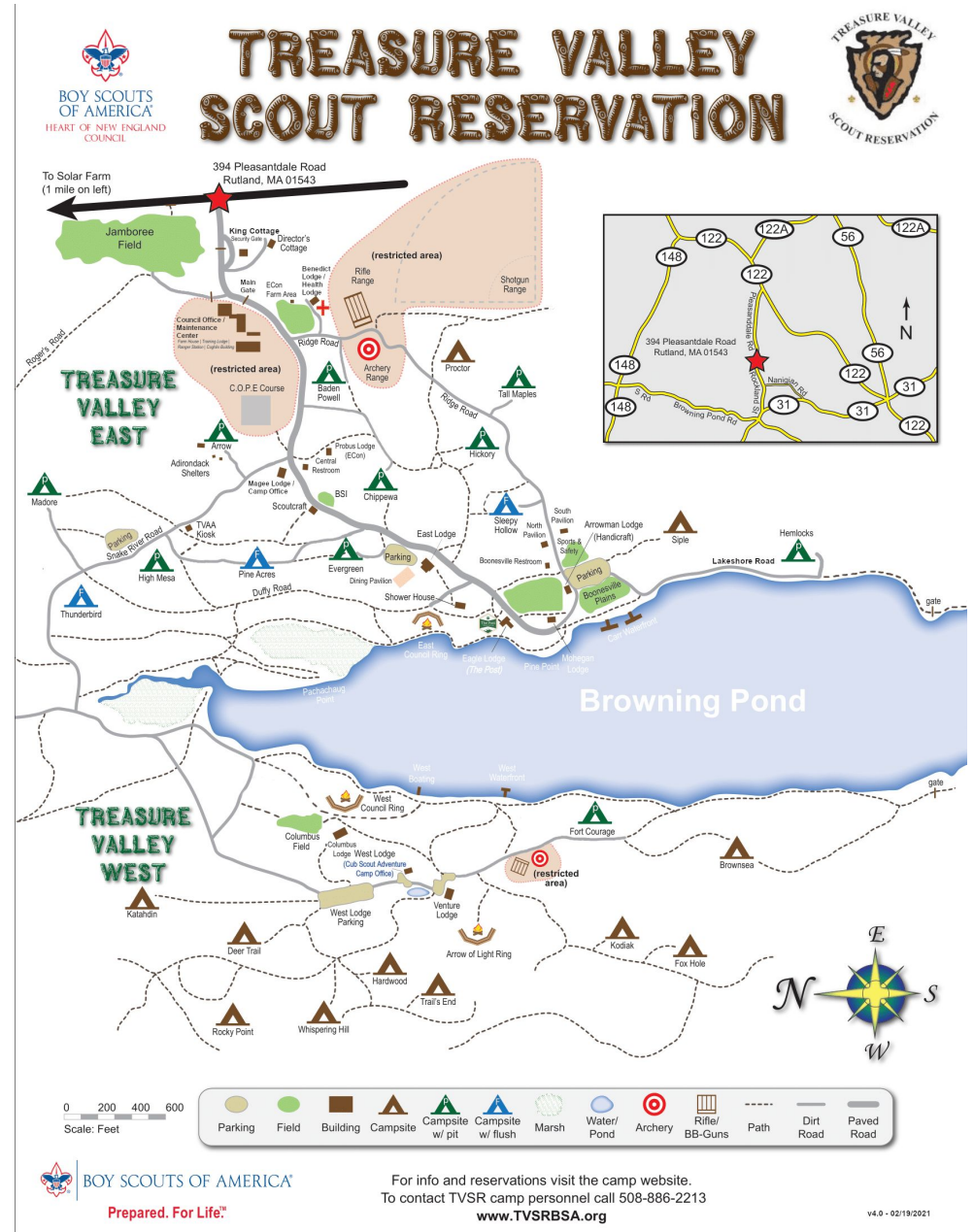
Accessible Geocaching Opportunities

Treasure Valley Scout Reservation has several opportunities for patrons to participate in geocaching, the worldwide treasure hunt. Opportunities are scattered throughout the reservation, allowing interested scouts to take part in the activity. However, we noticed that the geocaching system at TVSR wasn't particularly accessible.

TVSR has dozens of caches on-site, with three on public land bordering the reservation. Unfortunately, the lack of documentation accessible to TVSR patrons makes it difficult to participate in the treasure hunt at the reservation. We sought to create a system that makes the necessary information accessible to those taking part, allowing any patron to participate in geocaching.

Image taken at TVSR in February 2021

What is Geocaching?

Geocaching is a worldwide outdoor treasure hunt. It requires participants to travel to sets of GPS coordinates to locate hidden geocaches, which are often small containers with log books that players sign. Other caches have large containers with items left by other players.

There are over three million geocaches hidden worldwide, including some at TVSR. Geocaching provides patrons with an opportunity to spend more time outdoors and further explore the world around them (Burrell, 2020).

An example of a geocache (Burrell, 2020)

There are several geocaching opportunities at TVSR, many of which reside within the reservation itself. Unfortunately, the lack of accessible documentation makes it difficult for patrons to access this information and track down the geocaches. To address this, we decided to compile available geocaching opportunities at TVSR into an accessible format, allowing patrons to continue participating in the global treasure hunt.

Privacy Concerns

When working with maps, it's important to note that TVSR is a private reservation. While working on this project, we had to keep in mind the fact that a portion of our work, particularly in terms of specific geocache locations, will not be publicly accessible. This is to ensure the safety of Boy Scouts participating in these opportunities and hiking the trails at TVSR.

Current Geocaching Opportunities

Treasure Valley Scout Reservation currently has twelve geocaches located on the property, and three bordering the reservation. The twelve caches within the reservation are restricted for the use of Boy Scouts, while the bordering caches are publicly accessible. The picture to the right shows the approximate location of the three publicly accessible caches.

Despite having a number of geocaches, it is difficult to keep track of them in the reservation due to the lack of accessible documentation. While we have to keep in mind privacy concerns with this aspect of the project, we decided to create a series of web pages to display information about these caches.
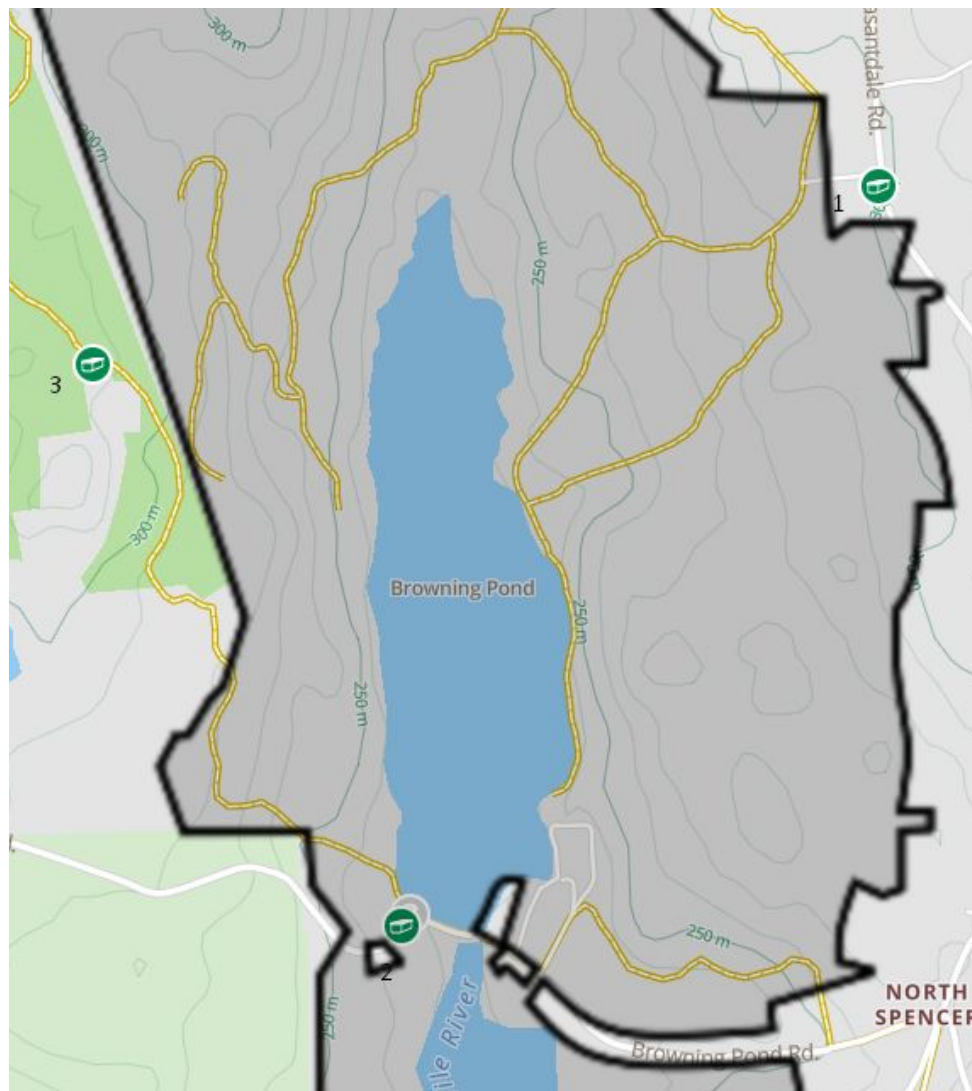
**Publicly accessible caches in or near TVSR
(TVSR property outlined in black)**

Constructing Web Pages

We created a series of simple web pages to showcase basic information about caches located in and around TVSR. The image below showcases a sample page with information about caches bordering the reservation. On this page, users can view essential information to help them locate these caches.

On this page, we display information about each cache, including the coordinates and a hint to locate it. Allowing this information to be accessible to interested individuals will present them with an easy opportunity to hunt for these caches.

Geocaches Around Treasure Valley

Aside from the geocaches within Treasure Valley that are limited to the use of scouts, there are three other geocaches available around the camp that are published on www.geocaching.com/ and are available for update.

1: GC293W4 – Mohegan Council, ToS: Cache to Cub Scouts

N 042° 19.307' W 071° 59.211'
Hint: Oruvaq fgbar jnyy

https://www.geocaching.com/geocache/GC293W4

2: Browning Pond PNG (Park 'n Grab)

N 042° 19.106' W 072° 00.403'
Hint: Zntargvp anab ba n gerr?

https://www.geocaching.com/geocache/GC7JC3D

3: GCHCE2 – Sampson's Pebble

N 042° 19.106' W 072° 00.403'
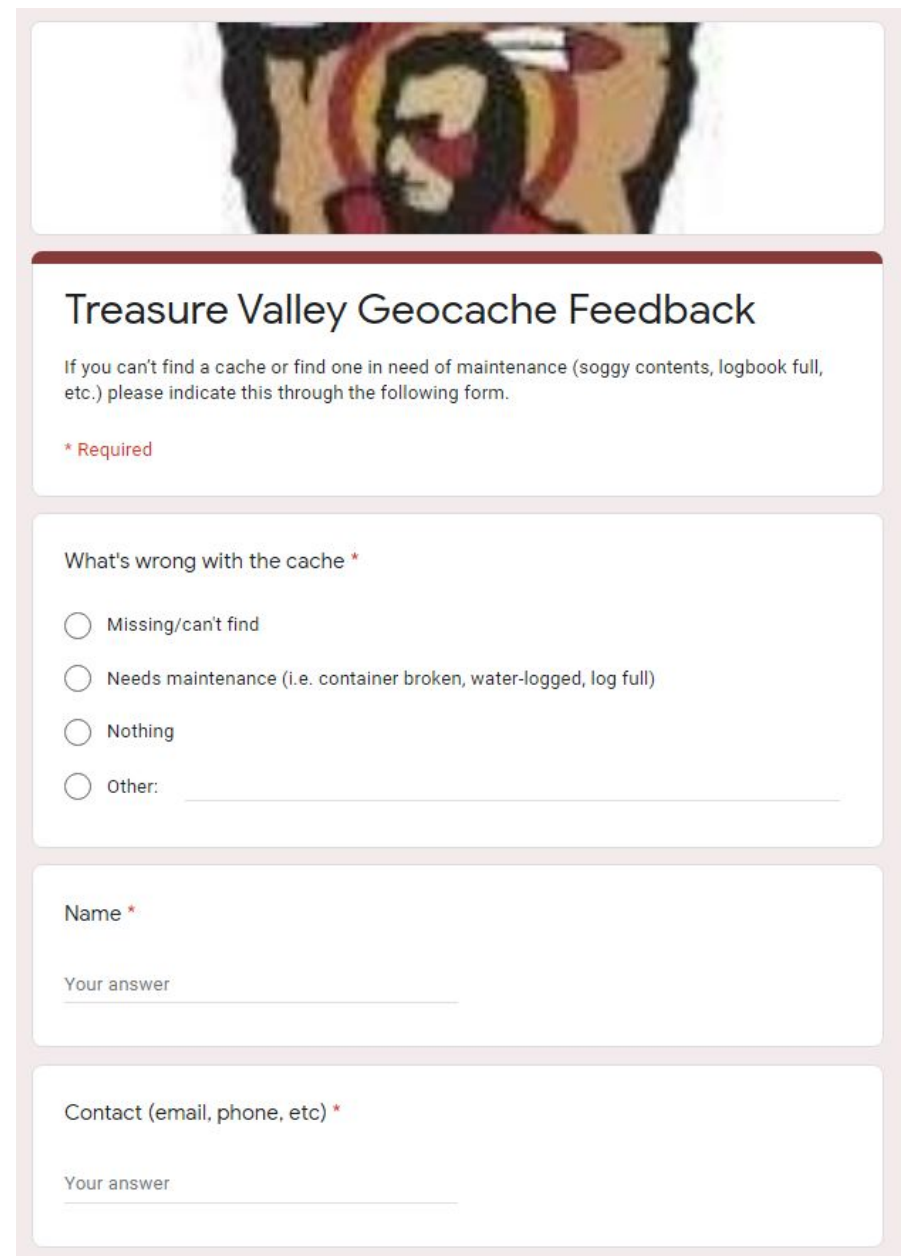Hint: jnyy. haqre ebpx

https://www.geocaching.com/geocache/GCHCE2

Geocaching Feedback

We created these web pages following a discussion with Keith MacNeal, a leader of a local Boy Scout Troop who assists in the coordination of geocaching. He relayed to us that some caches at the reservation have gone missing, but it is difficult for TVSR staff to take action due to the lack of an accessible feedback form.

The series of web pages we created includes a maintenance request form that allows patrons to report issues with caches available at TVSR. This simple form provides feedback to Treasure Valley staff, allowing them to handle necessary issues with caches at the reservation. Submissions are sent to staff, who are then able to handle the requests to improve the caches at the reservation. This also allows TVSR staff to establish trends over time if a given geocache has recurring issues.

Treasure Valley Geocache Feedback

If you can't find a cache or find one in need of maintenance (soggy contents, logbook full, etc.) please indicate this through the following form.

* Required

What's wrong with the cache *

○ Missing/can't find

○ Needs maintenance (i.e. container broken, water-logged, log full)

○ Nothing

○ Other:

Name *

Your answer

Contact (email, phone, etc) *

Your answer

Efforts to Improve Handicapped Accessibility

During the planning phase of this project, we had the opportunity to discuss the goals of Treasure Valley staff regarding the future of the camp. While our primary goal revolved around the improvement of the reservation's maps, staff members were also interested in handicapped accessibility. Improving the entirety of the reservation in this regard is a massive task beyond the scope of our project. Instead, we sought to compile a variety of recommendations, case studies, and guidelines to assist TVSR's efforts in improving handicapped accessibility.

In doing so, it was important to consider the official rules and regulations that describe the qualities that make a trail handicapped accessible. In order to make effective recommendations, we knew we needed an in-depth understanding of handicapped guidelines, particularly official guidelines governed by the state of Massachusetts.


Image taken at TVSR in February 2021

Before further discussing the topic, it's important to acknowledge the inherent bias that comes with this subject. Our group is comprised of four able-bodied individuals, forcing us to strictly focus on published guidelines rather than our personal feelings.

Complying with Handicapped Regulations

In an ever-advancing civilization, it's important to prioritize appealing to a wide audience. According to the National Park Service, over three hundred million people visited national parks in 2019. This same study estimated that roughly 9% of these visitors required additional accommodations to support their disabilities. This is a large portion of patrons that would not have a comfortable experience if handicapped regulations were not met.

Ensuring that a given trail meets handicapped regulations requires complying with the 2010 Americans with Disability Act Standards for Accessible Design. This federal act determined attributes including width, surface, slope, and other factors that are essential for accommodating disabled patrons. Federal and federally-funded facilities must also be in conformance with the Uniform Federal Accessibility Standards (Trieglaff & Labiak, 2016).

An estimate of National Park patrons that would greatly benefit from handicapped-accessible trails.
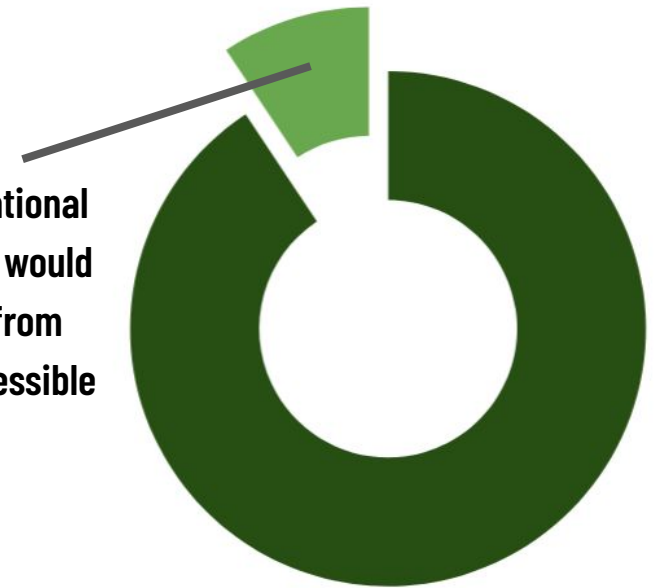
These national regulations are in place to emphasize the importance of carefully planning the design of a location in the modern era.

The implementation of handicapped-accessible trails can improve the perception of a park or campsite multifold through immediate benefits to current patrons who have the potential to spread awareness of the reservation to prospective new visitors.

Establishing Handicapped Guidelines

We consulted current handicap guidelines to direct the modifications that trails will be receiving. In particular, we focused on the Americans with Disabilities Act (ADA), which has an outline of a variety of guidelines for making a location handicapped-accessible. We looked into these guidelines to gain an understanding of what they are and how to implement them to trails.

The ADA has a series of guidelines pertaining to trails. Specifications about trail widths, slopes, and surfaces are all detailed in the ADA. There are also many classifications of trails based on how well developed they are, all of which are described in a series of tables in the ADA. We compiled all of these guidelines into a formal report, alongside information about universal design and a series of case studies.

Universal Design

Universal design refers to the process of creating products that are accessible to individuals with a wide range of abilities, disabilities, and other characteristics. This is a design concept where all products and environments should be accessible to all people, regardless of age, physical ability, or other factors. Our formal report compiles the main principles of universal design, which ensure a given space is accessible to the average patron.

ADA Accessible parking space with sign at the Rock Creek Trailhead on the Cumberland Trail

Case Studies

To conclude our report, we looked into similar projects at other locations where handicapped-accessible modifications were made to trail systems. In doing so, we noticed many similarities that we compiled for TVSR. In particular, we noticed that each project cited funding as a major issue. Constructing handicapped-accessible trails is expensive, especially because the trails require high levels of maintenance to retain their status.

The Middle Creek Trail in Pennsylvania, an example of a trail following ADA guidelines

Recommendation Report

After familiarizing ourselves with ADA guidelines, researching the fundamentals of universal design, and looking into similar projects, construction on our formalized report began. Doing so was recommended to us by Michael McQuaid. ADA guidelines are overwhelming due to their sheer scale, and the fact that only a small section relates to trail mapping.

Compiling essential information alongside other recommendations presented TVSR with simple goals to strive for when making trails handicapped-accessible. We also included a brief guide to assist in the selection of trails - focusing on making key trails accessible rather than outlying trails is an efficient way to make the reservation more accessible as a whole. We hope that our report proves useful for Treasure Valley when they begin the process of making their reservation more accessible to all patrons.

Why Privacy Matters

Privacy was a major consideration for us while working on this project, particularly when constructing the web pages for geocaching opportunities. This was initially the result of concerns raised by staff, which we further reflected on over time.

Treasure Valley Scout Reservation is a privately owned property that allows Boy Scouts to connect with nature. Due to the primary patrons of the reservation being minors, we sought to avoid including specific coordinates of locations on the property. Public access to TVSR is already very limited, but releasing this information would incentivise people to enter the reservation. This primarily applies to geocaches, as information regarding on-site geocaches is not publicly available. Continuing to hide this information protects TVSR's patrons from individuals that would not typically be on the reservation.

Image taken at TVSR in February 2021

Final Recommendations

Doing this project under COVID-19 restrictions was difficult, but we feel confident that the work we completed with have a positive impact on TVSR. However, the potential exists for future work, without limitations from COVID-19, to have an even greater impact on the reservation.

We found that using GPS logger data to verify suggested changes to the map we created was efficient and easy to do. Unfortunately, we were only able to do this for a subset of the reservation, leaving a portion of our edits unverified. Going forward, another project with TVSR would give students and staff the opportunity to verify our changes. Like Fred did for us, hiking the trails at the reservation and using GPS data to verify map changes would be very beneficial to the reservation as a whole.

We also spent time compiling information about handicapped accessibility. Due to COVID-19, implementing any changes to improve the accessibility of TVSR's trails was beyond the scope of our project. A future project that focuses on the implementation of even a single handicapped-accessible trail would greatly benefit the reservation.

We are proud of the work we completed this term under strict restrictions. We hope that our work positively benefits the reservation and acts as a baseline for future projects done with the reservation.

Acknowledgements

We want to acknowledge and thank the following people for making this project possible:

Professor Sarah Stanlick and Professor Bethel Eddy, for dedicating their time to helping us plan and execute this project, while keeping spirits up during a difficult time.

Professor Fred Looft, for helping us connect with TVSR and dedicating his time to hiking trails when we weren't allowed to do so, as well as providing all of the pictures seen throughout this booklet.

Michael McQuaid, for being our primary contact at TVSR, introducing us to new contacts, and providing us with maps and other data in a timely manner.

Keith MacNeal, for allowing us to access TVSR's private geocaching information to implement into our web pages.

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