Assessment of volcanic impacts of 186 A.D. Taupo eruption on current infrastructure of the Rangitaiki Plains, New Zealand

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Abstract

The Taupo Eruption of 186 A.D. was an intense, explosive eruption (Froggatt 2010) that covered the Rangitaiki Plains in the Bay of Plenty, New Zealand, with ash fall and inundated it with outwash in the following months and years (Manville et al. 2005). Were it to occur today, the eruption would cause major problems for the infrastructure of the Rangitaiki Plains. Through analysis of two core samples collected in the Rangitaiki Plains and extensive research, this report determines that 5 centimeters of ash fall would cover the area and create impacts lasting days to months on the local infrastructure, including the shutdown of transport systems, contamination of surface water supply, short-term power outages, telephone and radio frequency disturbances, and light building damage. Impacts on the infrastructure resulting from the outwash that would flow from the eruption site to the Rangitaiki Plains in the following months and years would be much more severe. Along the Rangitaiki River, these impacts include the shutdown of transportation networks, the inundation of factories and plants, building damage, loss of power, contamination of the water supply, and distribution of landfill waste. It would be the repeated outwash flows that create the most damage for the infrastructure, not the relatively easily cleaned ash deposits. These impacts would have heavy implications on the community.

Key words: Taupo Eruption; Rangitaiki Plains; Infrastructure; Impacts; Ash Fall; Outwash

1.0 Introduction

The Taupo Volcanic Zone (TVZ) in the North Island of New Zealand is one of the most frequently active volcanic zones on Earth (Smith 2005). Beginning at White Island off the coast of the Bay of Plenty and stretching southwest to Mt. Ruapehu in the center of the North Island, it is characterized by major calderas that explode intense rhyolitic volcanic eruptions (Smith 2005).

The largest volcano in the TVZ is the Taupo volcano, a caldera, or collapsed volcano, located in the central North Island. Formed 65,000 years ago, it is a frequently active rhyolitic volcano that is known to spread large amounts of pyroclastic flow and tephra fall (Froggatt 2010). It has been host to some of the world's largest and most destructive eruptions, including the hugely devastating Oruanui eruption from 26,000 years ago and the violent 186 A.D. Taupo eruption, the volcano's most recent activity (Froggatt 2010).

This volcano is still active today and will likely erupt again, although details of the next eruption, such as the date, time, and size, are impossible to predict. While the characteristics of the Oruanui eruption are unlikely to present themselves in a future eruption because of geological changes to the area (Froggatt 2010), the Taupo eruption of 186 A.D could conceivably occur again. Even though the details are unknown, it is important for the communities surrounding the volcano to understand and be prepared for the impacts that a future eruption could have.

If the Taupo eruption of 186 A.D. were to occur again, there would be serious consequences to many locations. One region that would be impacted is the Rangitaiki Plains. Located 150 km northeast of Taupo, the Rangitaiki Plains is home to over 25,000 people (Whakatane 2006). The main land use is for agriculture (Shaw 1983). Small townships and local factories provide employment opportunities, and close by are tourist attractions such as geothermal activity, volcanoes, kiwi plantations, and beaches.

There has been extensive research delving into determining the extent of the ignimbrite deposits and ash fall from this eruption, and a recent publication examines the outwash following the eruption (Manville et al. 2005), but there is a lack of knowledge concerning how an eruption similar to the 186 A.D. Taupo eruption would be handled in the future. Should an eruption of this magnitude occur again, serious consequences would arise. One main consequence would be to the infrastructure of the area.

This paper investigates the effect that ash fall and outwash from the 186 A.D. Taupo eruption would have on the current infrastructure in the Rangitaiki Plains by analyzing core samples taken along the Rangitaiki River to determine ash fall and outwash levels, analyzing how ash fall would impact the major infrastructure of the Rangitaiki Plains, creating a zone of impact along the Rangitaiki River from the volcanic outwash, and determining how the infrastructure within this zone would be impacted. It determines that there would be short-term effects (lasting days to months) on infrastructure from the 5 centimeters of ash fall. These include the short-term shutdown of transport systems, contamination of surface water supply, short-term power outages, telephone and radio frequency disturbances, and building damage. The main impacts on the infrastructure would be due to outwash in the months and years following the eruption. These impacts include the shut down and possible destruction of transportation networks, the inundation of factories and plants, building damage, loss of power, contamination of the surface water supply, and distribution of landfill waste.

2.0 Background

2.1 The Taupo Eruption

The Taupo eruption was an extraordinarily violent, complex, series of events that occurred around 186 A.D in present day Taupo. The beginning phases of the eruption consisted of tephra fall deposits of pumice and ash over much of the central North Island, especially east of Taupo (Froggatt 2010). The final phase consisted of hugely devastating pyroclastic flows that covered 20,000 km^2 around the vent and filled the North Island's major valleys with pumice and ash (Froggatt 2010). The pumice deposits can still be seen today, and many rivers continue to carry pieces of the pumice when they flood (Froggatt 2010). Areas close to the vent received meters of tephra fall and ignimbrite deposits, and areas further away on the east coast received between 5 and 10 cm of tephra fall (Froggatt 2010). Evidence suggests that the eruption vent was not within Lake Taupo, the body of water that fills the Taupo caldera, at the start of the eruption, as there is little sign in the early eruption deposits that the magma was mixed with water. However as the eruption continued, the lake breached the vent and water mixed with the magma. This caused greater fragmentation of the tephra into a fine ash that mixed with the often-heavy rain to create sticky ash deposits (Froggatt 2010).

2.2 The Rangitaiki Plains

The Rangitaiki Plains is 30,000 hectares of low-lying drained flood plains located in the eastern Bay of Plenty in the North Island of New Zealand, 150 kilometers northwest of the Taupo volcano (Read 2012). It consists of the semi-triangular flat land area that ranges from Whakatane to Matata along the coast, to Kawerau in the southwest, over through Awakeri and back to Whakatane (Read 2012).

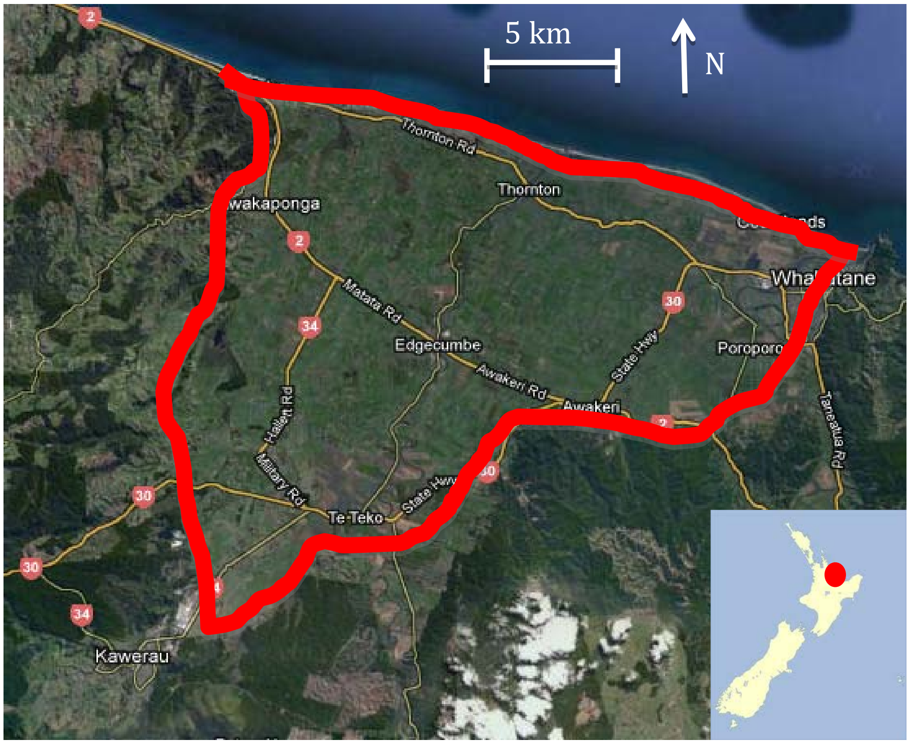


Fig 2.2 Map of the Rangitaiki Plains, outlined in red. The subset picture displays its relative location within New Zealand (Images from Google Maps)

Three major rivers flow north through the Plains and deposit into the ocean. The Tarawera River flows along the western edge of the Plains through Matata, the Rangitaiki River flows through the center of the Plains through Edgecumbe, and the Whakatane River flows along the eastern section of the Plains through Whakatane (Read 2012).

Since its drainage in 1910, the Rangitaiki Plains is mainly used for agriculture in the forms of dairy and crop farms and horticulture (Shaw 1983). Most of the towns encompassed by the Plains are small, with populations of fewer than 1,000 and lacking notable housing developments. The exception is Whakatane, which has a population of 18,000 people and includes numerous businesses, factories, and infrastructure (Whakatane 2006).

2.3 The Taupo Eruption Impacts on the Rangitaiki Plains

The Rangitaiki Plains was far enough from the source of the eruption that it avoided destructive pyroclastic flows, but it was not lucky enough to escape all damages. The eruption deposited 5 to 10 centimeters of sticky tephra fall throughout the Plains, as well as days of torrid rainstorms (Manville et al. 2005). Research shows that sediment outwash from the flooding of Lake Taupo reached the Plains as well, although none of the rivers that run through the Plains connected to the lake. Instead, the Waikato River, which sourced at Lake Taupo, experienced such extreme flooding that over the course of the months and years following the eruption its floodwaters traveled 70 kilometers to reach the Rangitaiki River (Manville et al. 2005). This sediment outwash slowly flowed downstream, eventually getting deposited along the Rangitaiki Plains. This was possible, in part, because the Rangitaiki River catchment had the optimal physical and geological conditions necessary to facilitate such extreme flows (Manville et al. 2005).

2.4 The Rangitaiki Plains Infrastructure

The main infrastructure of the Rangitaiki Plains are roadways, including multiple state highways and various rural roads (Dennis et al. Transport 2009); small clusters of houses; a large developed area in Whakatane including houses, businesses, and services; water supply and wastewater schemes, including water pipes and service lines, manholes, pump stations, hydrants, treatment plants, reservoirs, and oxidation ponds (Dennis et al. Water 2009); solid waste sites, including one active landfill, three closed landfills, and one recycle park (Dennis et al. Solid Waste 2009); telecommunication, radio, and television services; electricity generation and reticulation stations; factories and plants, including the Fonterra Dairy Factory and East Pack Kiwifruit Plant in Edgecumbe, the

Tasman Pulp and Paper Company in Kawerau; one airport in Whakatane; and one hospital in Whakatane.

3.0 Methods

3.1 Description of Core Sample Locations

Core samples were collected using virbocoring machinery at Orini Farms in Edgecumbe township, Bay of Plenty, North Island, New Zealand, at the corner of McLean Road and Eastern Bank Road. They were collected in the afternoon on 16 February, 2012, by the 2012 Frontiers Abroad Earth Systems students led by Dan Hikuroa.

Initially, the first site chosen (Site A in Fig 3.1.1) was along the public grounds on the eastern side of East Bank Road. This site was quickly abandoned due to the inability of the coring machine to cut an adequate distance into the earth. Directly following the abandonment, the owner of Orini Farms granted the collection team permission to collect samples from within his farm property boundaries. The collection sites were subsequently moved to within his property.

The second site visited, and first site to result in a core sample (Site 1 in Fig 3.1.1) was located inside of the farm boundary in a grassy paddock 24.35 meters from the centerline of East Bank Road and 22.65 meters from the centerline of McLean Road. It was about 300 meters east of the Rangitaiki River.

The third site visited, and second site to result in a core sample (Site 2 in Fig 3.1.1), was located three paddocks further down McLean Road from Site 1. It was about 500 meters east of the Rangitaiki River.

Within the Rangitaiki Plains, the general site locations were chosen due to their proximity to the Rangitaiki River and their locations within the center of the Rangitaiki Plains. Within the farm, the locations were chosen due to their accessibility from the roads. The choosing of the exact locations of both sites was not vitally important, and so was chosen at random.

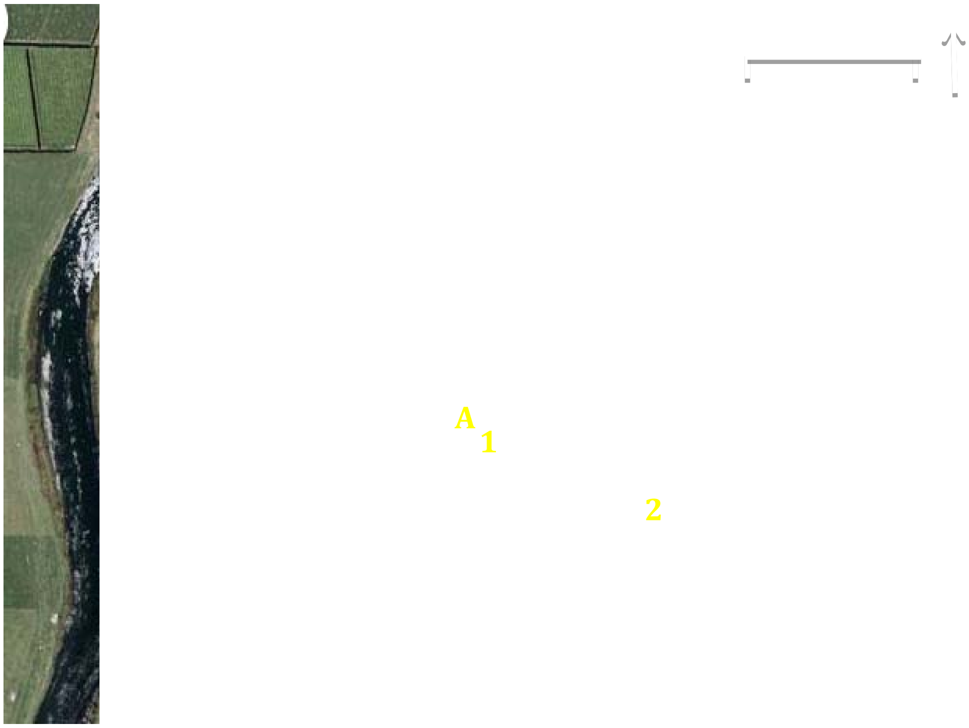


Fig 3.1.1 Locations of the sample sites at the corner of East Bank Road and McLean Road in Edgecumbe, Bay of Plenty. Site A did not result in a core sample and was abandoned. Sites 1 and 2 both resulted in core samples (Image from Google Maps)

The fact that the only two samples collected were in the same relative location was significant for this study. When determining the impacts of ash fall, it was allowable to extrapolate the core results to the entirety of the Rangitaiki Plains, because the ash fall was deposited from the sky and the area was small enough to assume even distribution. However, when assessing the outwash impacts, it was not viable to assume even distribution because the amount of outwash that reached different parts of the Plains would vary with the source of the outwash as it entered the Plains, the total amount of outwash that was released, the type of outwash, the slope of the ground, and the land type. This study was not extensive enough to delve into these issues, so a simplification was necessary, as detailed in Section 3.4.

3.2 Vibrocoring

A vibrocoring machine was used to collect two six-meter long core samples. The machine consisted of one six-meter aluminum pipe for each core, one motor, one clamp to connect the motor to the pipe, one metal tripod, and one large metal chain. The steps followed for using the machine were as follows:

1. Cut off the bottom of the pipe at a 45° angle
2. Assembled the tripod
3. Dug a small hole to break the grassy surface and reach sediment
4. Clamped engine connection to the pipe about 1.5 meters from the bottom of pipe
5. Held the pipe straight up so it was perpendicular to the ground
6. Turned on the motor
7. Held the pipe steady as it dug into the ground
8. Once the clamp reached the ground, turned off the motor and moved the clamp another 1.5 meters up the pipe.
9. Repeated steps 5-8 until the necessary length of pipe was inserted into the ground
10. Set up tripod over the pipe
11. Attached chain to pipe and tripod and pulled pipe out of the ground
12. Labeled, cut, and bound the pipe for transport

3.3 Sediment Lab

The two core samples were transported to the sediment lab at Auckland University. There, each section was cut open along the diameter using a wire cutting tool. At times, the wire was not strong enough to cut through the sediment so a sediment saw was used. The saw had an orange and blue coating on the blade, and some of the paint was transferred to the sediment on the surface of the cut inside the core. The halves were carefully separated while keeping all of the sediment in place, then wrapped with plastic wrap and labeled. One half of each section was stowed for archives, and the other half was used for analysis.

A complete analysis of the cores was completed by von Stein (2012).

3.4 Determining Outwash

Because the core samples were collected near the Rangitaiki River, this became the area of focus for the outwash analysis, and the outwash was assumed to originate from the Rangitaiki River.

Initially, the amount of outwash in the area from the 186 A.D. Taupo eruption was to be crudely determined by creating a linear relationship between the heights of outwash material from Site 1 and Site 2. However, as explained in Section 5.1, the core from Site 1 provided inadequate data on the amount of outwash at the site. As assessing the impacts of outwash is a main component of this paper, a set of arbitrary outwash heights at Site 1 was determined to create the relationship.

4.0 Results

4.1 Core Sample Results

The cores contained layers of sediment, organic material, pumice clusters, ash, and mud with laminations. Table 4.1.1 displays the core results from Site 1, and Table 4.1.2 displays the core results from Site 2. Photographs of the core samples are located in Appendix A.

Site 1	
Layer 1 (18 cm)	**Top soil; dark brown; vegetation present**
INTERCALATED CONTACT	
Layer 2 (145 cm)	**Mud; medium brown; oxidation; heterogeneous sand and pumice layer (5 cm)**
ABRUPT CONTACT	
Layer 3 (74 cm)	**Mud; medium-dark brown; grades from muddy to organic**
ABRUPT CONTACT	
Layer 4 (15 cm)	**Silt; light brown**
ABRUPT CONTACT	
Layer 5 (10 cm)	**Organic; black**
ABRUPT CONTACT	
Layer 6 (11 cm)	**Ash; light grey; pumice; loosely packed; coarse**
ABRUPT CONTACT	

Site 1	
Layer 7 (45 cm)	**Organic; black**
ABRUPT CONTACT	
Layer 8 (46 cm)	**Medium sand; medium grey; pumice cobbles dispersed throughout**
ABRUPT CONTACT	
Layer 9 (103 cm)	**Fine sand; light grey; dark grey mud laminations; cobble sized pumice concentrated at bottom**

Table 4.1.1 Geological descriptions of each layer of material from the core sample taken at Site 1 (von Stein 2012)

Site 2	
Layer 1 (17 cm)	**Top soil; dark brown; vegetation present**
GRADUAL CONTACT	
Layer 2 (45 cm)	**Mud; medium-dark brown; vertical ash lenses composed of both mud and pumice (39 cm)**
INTERCALATED CONTACT	
Layer 3 (29 cm)	**Organic; black**
ABRUPT CONTACT	
Layer 4 (251 cm)	**Fine sand; medium grey; dark grey mud laminations; cobble sized pumice placed sporadically; 11 cm wide log at bottom**
ABRUPT CONTACT	
Layer 5 (5 cm)	**Ash; light grey; pumice; loosely packed; coarse**
ABRUPT CONTACT	
Layer 6 (81 cm)	**Organic; black**

Table 4.1.2 Geological description of each core layer of material from the core sample taken at Site 2 (von Stein 2012)

4.2 Outwash Zone of Impact

Following the interpretation of the core samples, as detailed in section 5.1, it was determined that the outwash in layer 9 of the core from Site 1 was likely to be incomplete and actually continue further than the six meter collection sample. As the heights of outwash were to be used as a method of determining the affected areas, two arbitrary outwash heights were assumed at Site 1. For each assumed height, the zone of impact from the outwash was determined using a linear relationship between the assumed height and the known outwash height at Site 2. Although both samples were collected from the same side of the river, it was assumed that the outwash would be equal on both sides of the river. For simplification purposes, this spread was assumed to be constant along the river.

4.2.1 Scenario 1: Assumed Outwash Height of 2.60 meters.

Using an assumed outwash height of 2.60 meters at Site 1, the known outwash height of 2.51 meters at Site 2, and the known distance between the sites of 200 meters, a linear relationship of

$$outwash\ height = -.00045 * distance\ from\ Rangitaiki\ River + 2.735$$

was determined. All units are in meters. Using this formula, the zone of impact extends 6,077 meters on either side of the Rangitaiki River.

4.2.2 Scenario 2: Assumed Outwash Height of 2.70 meters.

Using an assumed outwash height of 2.70 meters at Site 1, the known outwash height of 2.51 meters at Site 2, and the known distance between the sites of 200 meters, a linear relationship of

$$outwash\ height = -.00095 * distance\ from\ Rangitaiki\ River + 2.985$$

was determined. All units are in meters. Using this formula, the zone of impact extends 3,142 meters from either side of the Rangitaiki River. Fig 4.2.1 displays the relationships created for both scenarios.

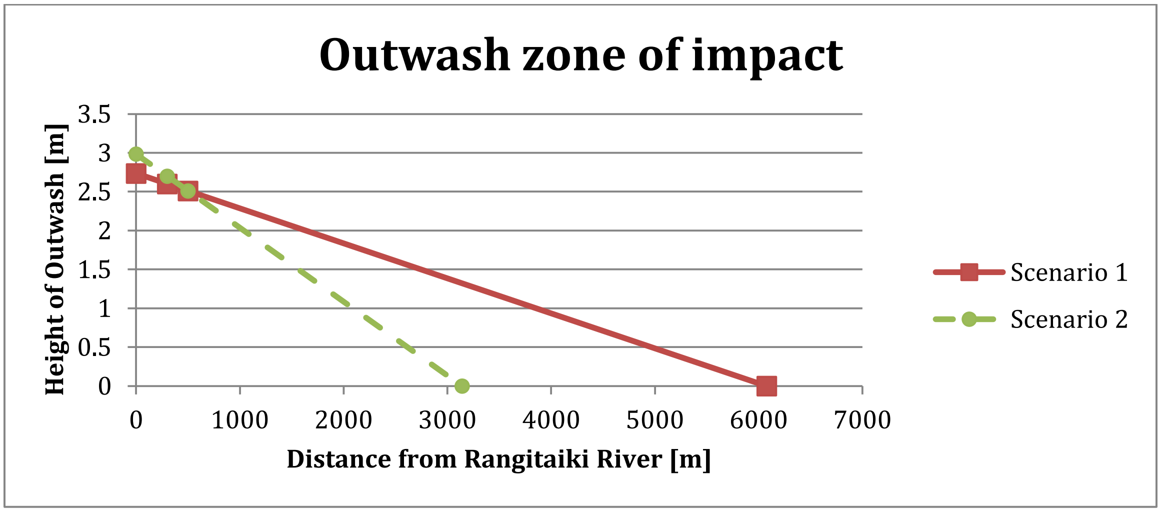


Fig 4.2.1 Visual of the assumed spread of outwash on one side of the Rangitaiki River based on both scenario 1 and scenario 2. Scenario 1 used the model *outwash height* = -.00095 * *distance from Rangitaiki River* + 2.985. The projection from this model shows that the outwash will reach 6,077 meters from the Rangitaiki River. Scenario 2 used the model *outwash height* = -.00045 * *distance from Rangitaiki River* + 2.735. The projection from this model shows that the outwash will reach 3,142 meters from the Rangitaiki River. Graph made in Microsoft Excel.

4.3 Affected Infrastructure

Based on the ash layer found in the sample and the previous research done on the subject, all of the infrastructure in the Rangitaiki Plains that was identified in section 2.4 would be affected by 5 centimeters of ash fall.

The main infrastructure that would be impacted by the outwash from the Rangitaiki River in scenario 1 is identified in Figure 4.3.1, and the impacted infrastructure from scenario 2 is identified in Figure 4.3.2.

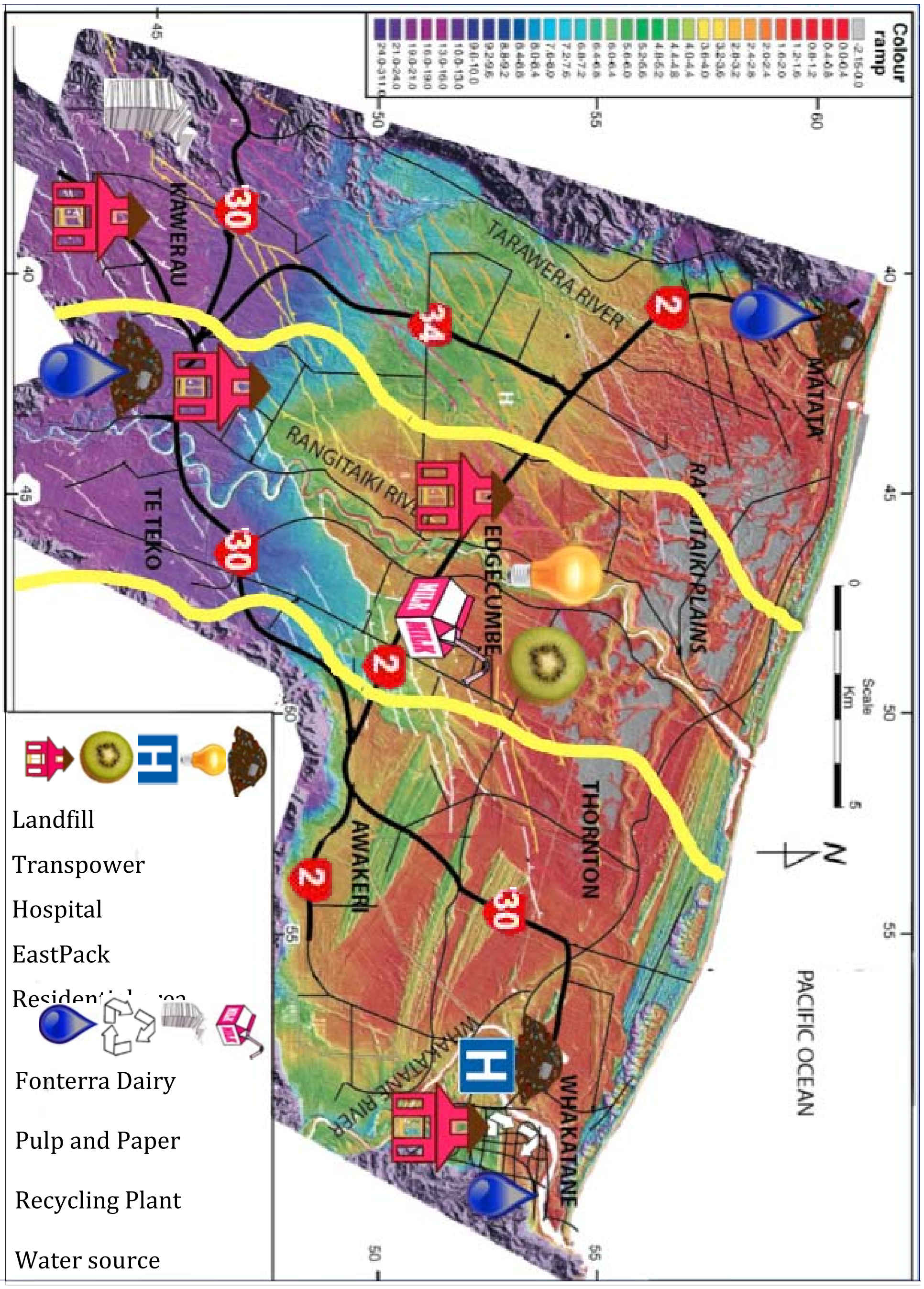
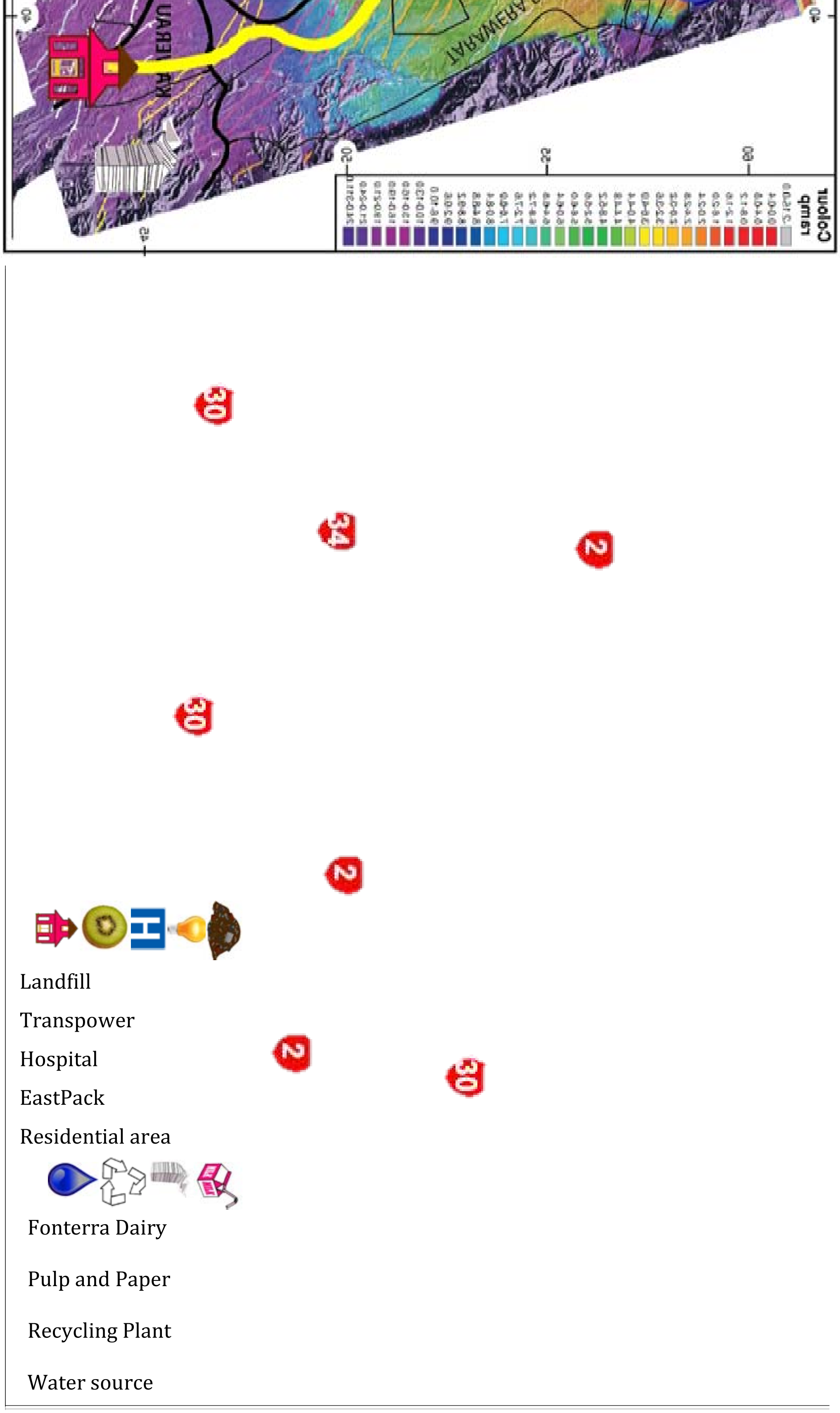


Fig 4.3.2 A depiction of the impacted infrastructure based on scenario 2 (a zone of impact reach of 6.077 kilometers). The two yellow lines represent the boundaries of the zone of impact and all of the infrastructure between them would be impacted by the outwash (Base map, Manville et al. 2009)

Figure 4.3.2 A depiction of the impacted infrastructure based on scenario 2 (a zone of impact reach of 6.077 kilometers). The two yellow lines represent the boundaries of the zone of impact and all of the infrastructure between them would be impacted by the outwash (Base map, Manville



5.0 Discussion

5.1 Interpretation of Core Samples

The material from the core samples was what would be expected from a flood plain located within a volcanic zone. There were multiple instances in which layers from the two core samples were matched through geological comparison as occurring from the same event. They included:

- Site 1, layer 6 matched with Site 2, layer 2. It was determined that the 1315 A.D. Kaharoa eruption from Mt Tarawera deposited this 11 cm layer of sediment and ash. There was no outwash layer preceding it.
- Site 1, layer 9 matched with Site 2, layer 4. It was determined that the Taupo eruption of 186 A.D. was responsible for this deposit. Initially this layer looked to be caused by a lake breakout flood, but upon further inspection, the sand and mud laminations showed a low-energy environment that is not indicative of such a high-energy event. Instead, it was determined that this layer was outwash deposited over a period of months to years following the eruption.

The determination that the outwash in layer 9 from Site 1 was matched with the outwash in layer 4 from Site 2 suggests that the core sample from Site 1 did not collect the entirety of the outwash layer, as the layer in Site 2 had almost 150 centimeters more material than its counterpart in Site 1. Had the sample continued, it is likely that another ash layer comparable to that of Site 2, layer 5 would be found.

These core results confirm previous research into the extent of the Taupo Eruption ash fall and outwash along the Rangitaiki Plains.

5.2 Impacts on Infrastructure: Ash Fall

5.2.1 Transport

All roads in the Rangitaiki Plains would be impacted by the eruption’s ash fall. They would be coated in 5 cm of sticky ash deposits that would be difficult to clean and destroy the natural friction between a vehicle and the road surface, reducing control and breaking ability for vehicles. Visibility would be very poor, as the ash and rain clouds would block both sunlight and street lamps, and moving vehicles would cause the ash on the roads to swirl up into low-lying clouds (Volcanic Ash 2010). These conditions, along with the inevitable vehicular accidents that would accompany them, would shut down the road system for a few days following the eruption. The airport in Whakatane would need to be shut down for a few days until the ash fall could be cleared from the runways, airplanes, and other machinery and the visibility in the air was restored (Johnston 1993).

5.2.2 Telecommunications

Wet ash in the atmosphere, as would be the case in this scenario, acts as a conductor and can become electrically charged. It would interfere with local radio waves and telephone systems. As there are few forests and trees in the Plains to fall on telephone lines, most telephone lines should be left intact. However, the telephone system may become overloaded with the amount of phone calls being placed at one time as people react to the event (Volcanic Ash 2010).

5.2.3 Water Supply

Volcanic ash would have an impact on the various water supplies for the region. The townships of the Rangitaiki Plains utilize both groundwater and surface water sources. Surface water sources, such as the rivers and supply ponds, would become coated in ash, which is highly acidic and may contain hazardous components such as mercury, arsenic, and lead (Volcanic Ash 2010). This could compromise the source's ability to provide sanitary drinking water for up to a year (Wilson et al. 2009). There would be a low risk to the groundwater system.

Any ash suspended in the water supply could clog and damage supply equipment such as pumps and filters. Damage to water supply pipes from ash will be low.

5.2.4 Power Facilities

The Transpower substation in Edgecumbe would experience power loss and would probably need to be closed for a short time period. Mechanical repairs would be necessary to reverse the effect of the ash on the insulators and machinery. The ash should be relatively easy to clean off, as the rain and wind would help remove it from surfaces (Volcanic Ash 2010).

5.2.5 Buildings

The buildup of 5 cm of ash should not be enough to cause roof damage due to loading to most buildings, depending on the building's construction, age, and maintenance. Because the ash is electrically conductive, it may cause damage to roof surfaces and exterior materials on buildings, especially metal (Volcanic Ash 2010).

5.3 Impacts on Infrastructure: Outwash

5.3.1 Transportation

The scenario 1 model, which projects a zone of impact of 3.142 kilometers on either side of the Rangitaiki River, shows many of the area's main roads would be impacted. East Bank Road and West Bank Road run along either side of the Rangitaiki River and are the two main roads that run north to south. Both would receive over 3 meters of outwash deposits. State Highways 2 and 30 also run through the area and sections of these roads would be impacted with varying amounts of outwash as well.

Scenario 2 projects a zone of impact of 6.077 kilometers from the river and would impact even more roads. Larger sections of State Highways 2 and 30 would be affected, and the entirety of State Highway 34 would be reached by the outwash.

These roads, along with multiple rural roads, would need to be closed after every outwash, and could face erosion or other destructive impacts. This would be an especially large problem because there are only a limited number of roads through the Plains, and if they all get shut down at once it could become very difficult to travel the area.

5.3.2 Industry

In either scenario, the same industries would be affected. The EastPack Kiwifruit packing plant and Fonterra Dairy factory in Edgecumbe would both be inundated with outwash that would impact its ability to function, as the parking lots and ground floors of the plants would be repeatedly flooded with outwash. This could destroy any products that were being made at the time of the outwash and would affect their ability to produce goods for a long period of time. Both buildings would receive damages from the outwash as well.

5.3.3 Buildings

Luckily there are not many building clusters along the Rangitaiki River, as most of the land is used for agriculture. However, each scenario would affect some small settlements. In scenario 1, outwash would reach houses along State Highway 2 in Edgecumbe and State Highway 30 in Te Teko. In scenario 2, the outwash would extend to include a cluster of houses in Kawerau as well. These houses, along with other buildings within the zone of impact, would be continuously inundated with flooding and outwash material. This could destroy basements and damage ground floors, as well as cause molding and disease.

5.3.4 Power Supply

The Transpower substation in Edgecumbe would be affected in either scenario. It would most likely lose power with each outwash, as the station would be inundated with debris and water. Machinery within the power station would be vulnerable to wear and water contamination and may need to be repeatedly repaired or replaced.

5.3.5 Water Supply

The water supply bore on Tahuna Road in Te Teko would be impacted by outwash in both scenarios. It would flood the pipelines and contaminate the water source with material. Because this would occur repeatedly over the course of the months and years following the eruption, a new water source would need to be found.

5.3.6 Land Fill

The closed landfill on Tahuna Road in Te Teko would be impacted by outwash in both scenarios. This could cause the waste to seep into the ground and further contaminate the water supply. It could also cause the top layers of waste to be mobilized, which would be made easier by its higher elevation in relation to the Rangitaiki Plains.

5.4 Importance

This study shows the main impacts that the Taupo eruption would have on today’s infrastructure would not result from ash fall, the immediate hazard to the area, but from the outwash that would descend upon the Rangitaiki Plains in the months and years following the eruption. Structures, roads, and facilities would be severely and repeatedly impacted, and recovery from such events would be continuous.

5.5 Future Study

Further research could create a more sophisticated model of the outwash impact zone by analyzing more core samples and taking into account the elevation of the Rangitaiki Plains. Another possible future study could determine the impacts of outwash along the rest of the Rangitaiki Plains. Core samples from along the Tarawera and Whakatane Rivers, as well as the areas between the rivers, would be useful in creating a more accurate depiction of what outwash would occur. Studies could also be carried out to determine how the outwash would impact smaller, everyday infrastructures, which time constraints prevented from being researched for this paper. An interesting addition to a future study would be an economic assessment of the damage that would be done to the area’s infrastructure.

6.0 Conclusion

The Taupo eruption of 186 A.D. was an intense, explosive, rhyolitic eruption within the Taupo Volcanic Zone in the central North Island of New Zealand. It erupted huge volumes of pyroclastic flow, tephra fall, and outwash throughout the surrounding area. This paper assessed the impacts that the Taupo eruption of 186 A.D. would have on the current infrastructure of the Rangitaiki Plains through the analysis of ash fall and outwash material found in two core samples.

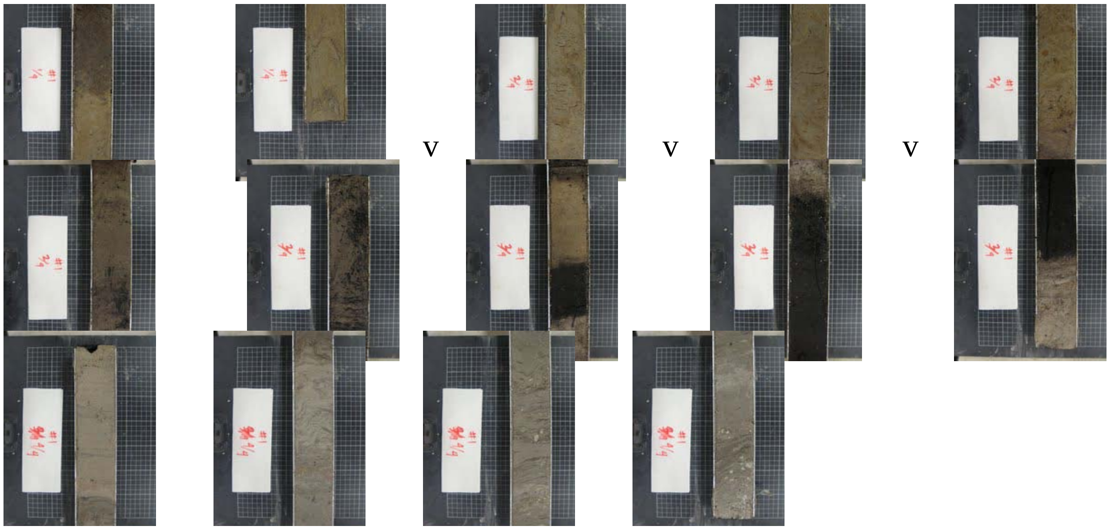
Should this eruption occur again, the Rangitaiki Plains community would have constant disruption for years, beginning with 5 cm of ash fall. The ash would cause the shutdown of transportation systems and major industries, contamination of water supplies, and damage to power facilities and buildings in the days and months following the eruption. The effects of the eruption would continue to be felt for years, as outwash from the Rangitaiki River would continuously be deposited along the riverbanks and surrounding area, each time affecting the transportation systems, water supplies, power supplies, buildings, and industry of the area.

The effects of the eruption on the Rangitaiki Plains community would be difficult to overcome, as the repetitive nature of the outwash deposits would require continuous repairs and reconstruction of the area’s infrastructure. This ongoing process could prevent the public from moving past the disaster and rebuilding their lives. While there is no way to completely prevent the devastation that would accompany an eruption the size of the 186 A.D Taupo eruption, with the research presented in this study the community within the Rangitaiki Plains will be better prepared for such an occurrence, and hopefully be able to take measures to protect itself.

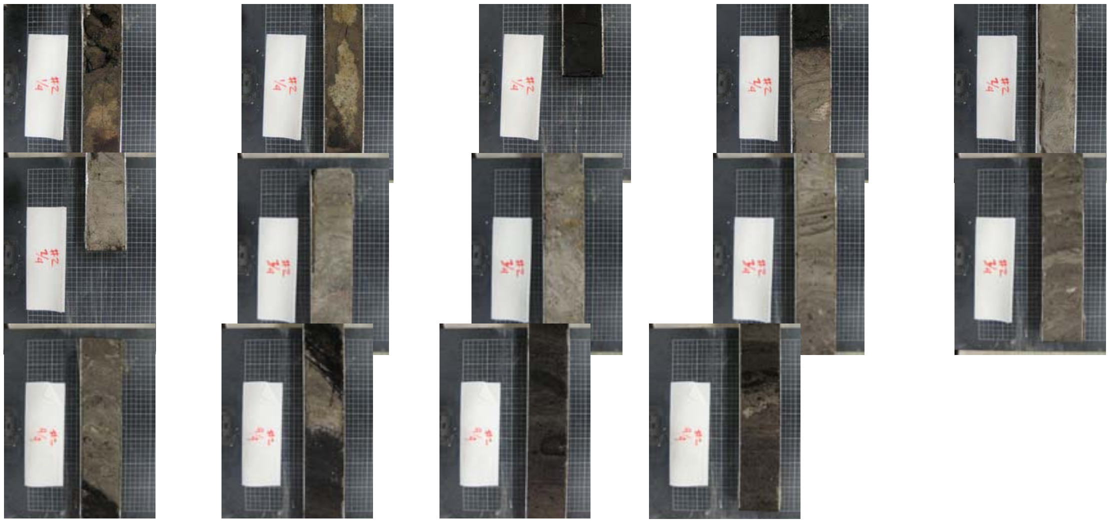
Appendix A

The following photographs show the two core samples that were collected from two sites for this study. They were all collected from Orini Farm, corner of East Bank Road and McLean Road in Edgecumbe, Bay of Plenty, New Zealand. Each photograph includes a label that identifies which section of which core the sample belongs to. The first photograph on the left of the first row is the top of core sample, and the last photograph on the right of the bottom row is the bottom of the core sample.

Site 1



Site 2



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