



National Certificate of Educational Achievement
TAUMATA MĀTAURANGA Ā-MOTU KUA TAEA

Exemplar for Internal Achievement Standard

Geography Level 3

This exemplar supports assessment against:

Achievement Standard 91433

Apply spatial analysis, with consultation, to solve a geographic problem

An annotated exemplar is a sample of student evidence, with a commentary, to explain key aspects of the standard. It assists teachers to make assessment judgements at the grade.

New Zealand Qualifications Authority

To support internal assessment

Grade: Achieved

For Achieved, the student needs to apply spatial analysis, with consultation, to solve a geographic problem.

This involves:

- collecting and presenting spatial data relevant to the geographic problem
- completing manipulations of the spatial data to produce a layout related to the problem
- explaining the manipulations
- proposing a solution to the geographic problem.

Spatial data has been collected and presented relating to the problem of where to create a new police station in Hamilton. The spatial evidence presented follows most geographic conventions, and data transformations are appropriate. These include the creation of buffer zones and time/distance zones and hotspots, relating to both the existing police stations and two potential stations.

The different data manipulations used have been simply explained, demonstrating understanding of the strategy and what information they wanted from the data. For example, *“Each of the stations have a 2km buffer that shows the area of service”*, and the time-distance manipulation *“takes into consideration roads unlike the buffers and provides a clearer view of the area easily covered from each police station”*.

A solution to the geographic problem has been proposed, using supporting evidence from the layout: *“A strength of this location is it services lots of different areas like Flagstaff, Huntington and Chartwell”* and *“it does not interfere with any of the three existing police stations.”*

For Merit, the student could collect spatial data relating to residential zones and proposed growth areas, as this is a key argument for the proposed solution. The use of a key would improve the accuracy of the layout and provide additional data, such as the numbers of crimes in the hotspot shading. A detailed explanation of the manipulations is also needed for Merit.

Introduction

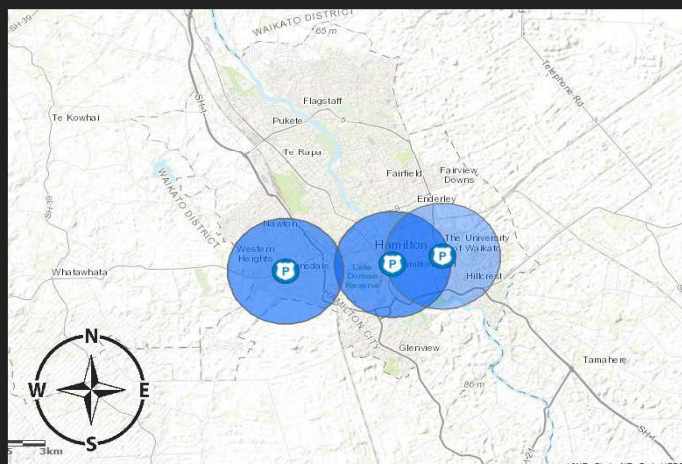
The geographic problem focuses on locating a new police station in Hamilton. The Hamilton Council wants an ideal location for a police station that will not interfere with other stations and will service at least 15,000 residents.

Parameters I will consider are

- Be at least 2 km from the next nearest station.
- Be able to reach at least 15,000 people within a 5 minute drive.
- Cater for an area of Hamilton where the majority of the area is not already catered for by existing stations (e.g. an area that is not already within a 5 minute drive of an existing station).
- Be within 2km from a 'crime hotspot' (an area where an increase of crime is clustered in Hamilton)

Current Hamilton Police Stations

This image shows the existing police stations located in Hamilton. Each of the stations have a 2km buffer that shows the area of service (Blue buffer/circle). This shows the 2km area where the police station can service. As you can see the three existing stations overlap one another which is not ideal because it doesn't maximize the amount of people who can be serviced. With these 2km buffer it lets me determine the location for a new police station. Looking at the map Hamilton North has no police stations within a 2km buffer.



5 Minute drive time from existing police stations.

This image shows the 5-minute drive time area within the 3 existing police stations. This technique takes into consideration roads unlike the buffers and provides a clearer view of the area easily covered from each police station. This helps determine where a new station can be located because it gives me the rest of Hamilton that is not highlighted in purple. This area is Hamilton North. No existing police stations are located here or with a 5-minute drive time.

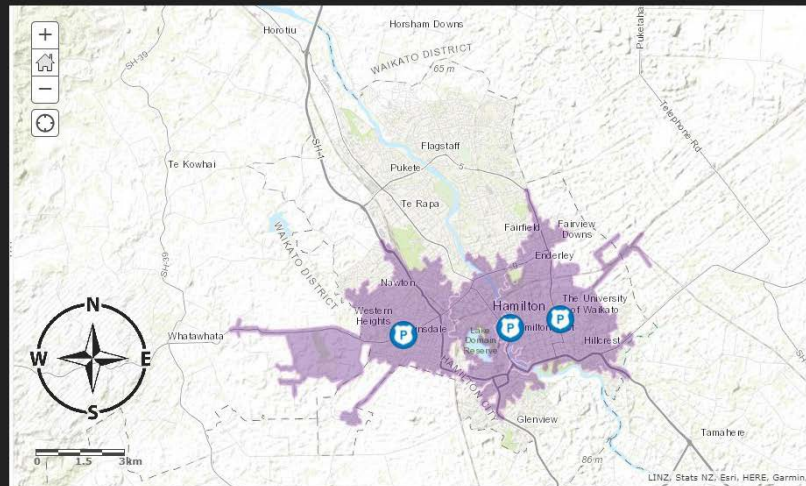
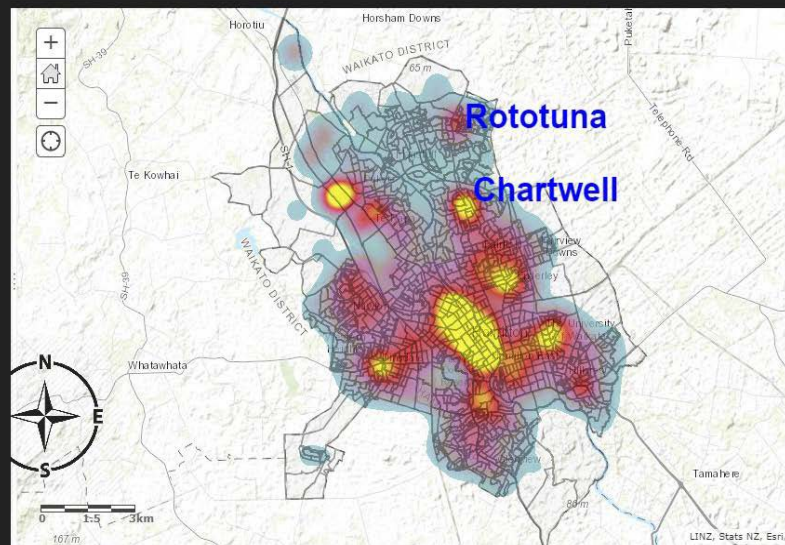


Image of crime hotspots in Hamilton.

In this image it shows the areas with highest number of crimes in Hamilton using a heat map. This map helps identify where police stations are needed.

I have chosen Rotoruna and Chartwell for police stations because of the crime indicated and to cover the northern zone.

On the South of the map has the most crime, which explains why three existing police stations already service these areas.

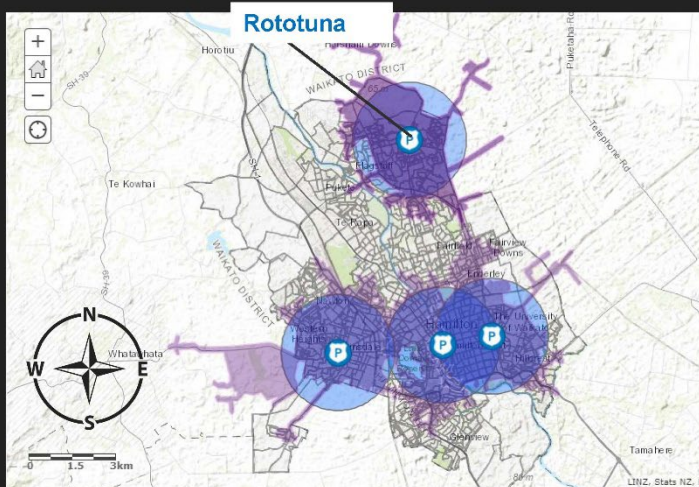


Location of new police station (1)

As shown in the image the location of new police station at Rototuna. The blue buffer surrounding the police icon is the 2km distance from it. It also does not overlap or interfere with any other existing police stations. The Purple area shows the 5-minute drive time from the set location. This also is not interfering with the existing police stations. The Police icon of the new police station also has the total population of the area within 2km (20,582). This location meets the parameters needed.

One weakness of this location is only services 20,582 residents but as more land in Hamilton North is be turned into residential areas the population will grow. Another weakness is it isn't located in a cluster of crime hot spots. This means more crime is committed away from this station.

A strength of this location is it services lots of different areas like Flagstaff, Huntington and Chartwell. This is a strength because it needs to service high residential areas like these. This also means the amount of people the station can service will increase. Another strength is doesn't take as long to assist people who need emergency services located in northern suburbs.

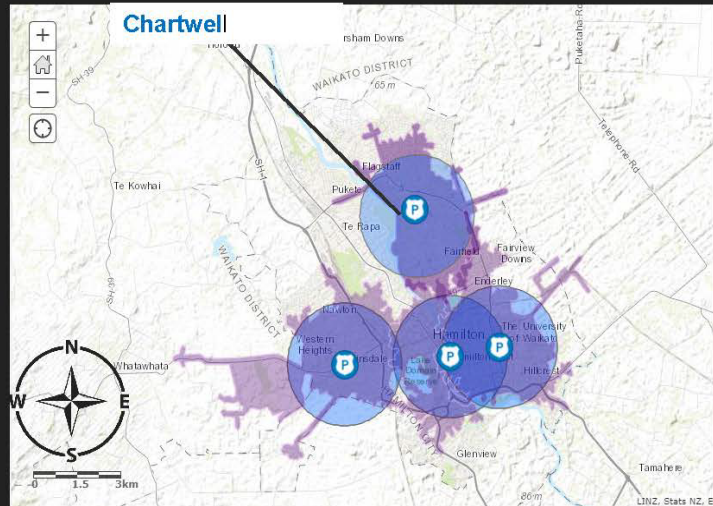


Location of police station (2)

This map shows the location of new police station at Chartwell. The blue buffer surrounding the police icon is the 2km distance from it showing that It also does not overlap or interfere with any other existing police stations. The Purple area is the 5-minute drive time from the set location. This also is not interfering with the existing police stations. The total population of the area within 2km is 26,056. This location meets all the parameters needed.

A weakness of this location is it is very close to the existing police stations, which means it won't maximize the amount of people who can be serviced.

A strength for this location is it services over 26,000 residents. This is ideal because the more this police station can service means more help for the public. Another strength is it located near a shopping centre which is a crime hotspot.



Most appropriate location

I believe the police station location (1) located in Rototuna should be added because it does not interfere with any of the three existing police stations. Its five-minute drive time and the 2km buffer clearly shows the distance between the existing stations. Whereas the 2nd location is very close to the existing stations, as shown on slide 10 which shows the 2km buffer and 5-minute drive time around the existing police stations.

This new station will be able to service people located in Flagstaff, Huntington and Chartwell. This is a strength because it needs to service high residential areas like these. This also means the amount of people the station can service will increase. This is one of the strengths of this new station. Another strength is that this new station can service over 20,582 residents. Hamilton North's land is also being turned into more residence areas. This means the population will rise, increasing the amount of people the station can service. This new station also is ideal because it will be fast to assist people who need emergency services in the 5-minute drive time. Whereas the three existing stations will take over 10 minutes to reach people in Rototuna and the Hamilton North region. This station could also cut down crime in the area because it won't take as long to get emergency services to get there. Although this location doesn't service as much as the police station (2) it is located near 2 different crime hotspots, and the population is increasing because of the land that is being used for residence. Another strength is it doesn't take as long to assist people who need emergency services located in this area because it's located with 5 minutes of driving time. This station is 8.8km away from the nearest police station which is a 14-minute drive, which is clearly shown on the maps.

In conclusion police station (1) should be developed. It has strong strengths and logical reasons on why this is the most appropriate location for a new police station in Hamilton.

Grade: Merit

For Merit, the student needs to effectively apply spatial analysis, with consultation, to solve a geographic problem.

This involves:

- collecting sufficient spatial data to address the geographic problem
- completing manipulations of the spatial data to produce an accurate layout related to the problem
- explaining the manipulations in detail
- justifying the solution to the geographic problem. The justification demonstrates why the chosen course of action is better than the alternatives.

The student has produced a layout which indicates that sufficient spatial data has been collected and manipulated to address the geographic problem of how to inform people in the Hutt Valley about the risks of tsunami and flooding. The maps are technically accurate, but greater clarity could be achieved by displaying the key beside, rather than on, the map. The production of a layout demonstrating the skills of selecting spatial data, manipulating it and displaying it in a way that supports problem solving, is a critical aspect of this standard.

The evidence explains the manipulations in detail with reference to the data. The detailed explanation shows clear understanding of several techniques for manipulating spatial data that have improved access and supported problem solving. These include altering transparency, changing symbols and adding a new coordinate system, etc.

An appropriate solution has been proposed and justified. The options listed in the introduction are considered and the preferred solution justified.

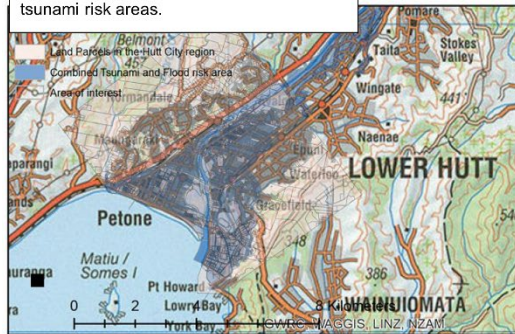
For Excellence, the manipulations to the spatial data need to be evaluated. While this is hinted at when making the decision to create Map 2 showing tsunami risk zones which were unclear on Map 1, and in the reasons for colour or transparency changes, at Excellence evaluative statements will be developed further, providing evidence of how manipulations strengthened or weakened the displayed data to support problem solving.

A full justification for the chosen solution will enable a more in-depth response. This could be achieved by discussing how the solution could support the community, civil defence, planning bodies, etc. Alternatively, further explanation of how the weaknesses of the alternatives could be solved by implementing the chosen solution.

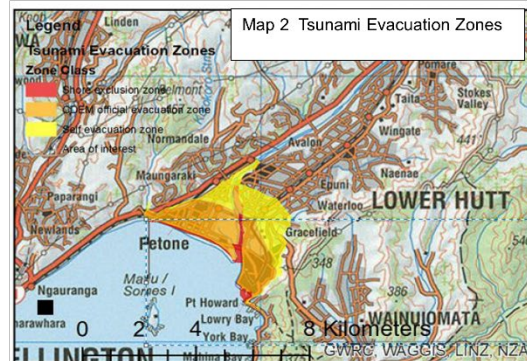
Merit

NZQA Intended for teacher use only

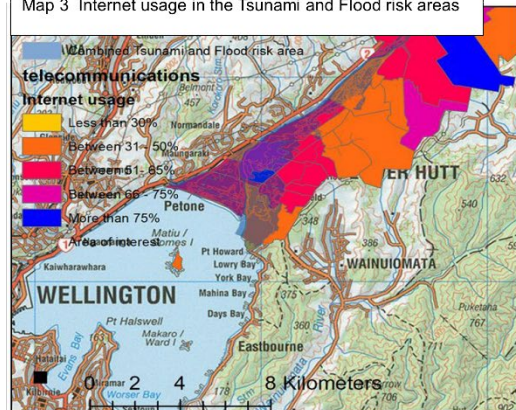
Map 1 Base Map showing the flood and tsunami risk areas.



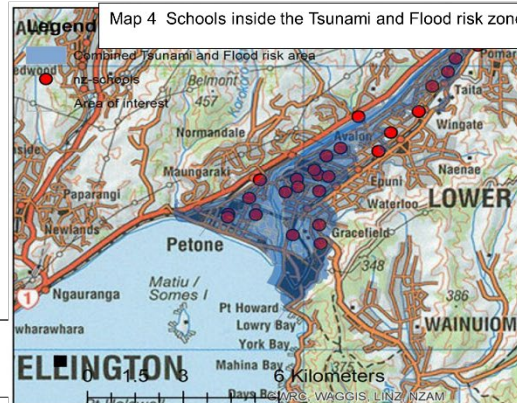
Map 2 Tsunami Evacuation Zones



Map 3 Internet usage in the Tsunami and Flood risk areas

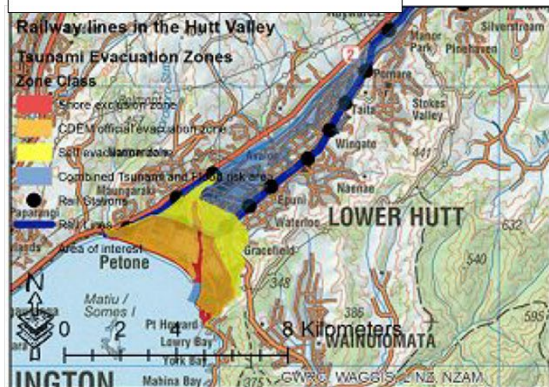


Map 4 Schools inside the Tsunami and Flood risk zones

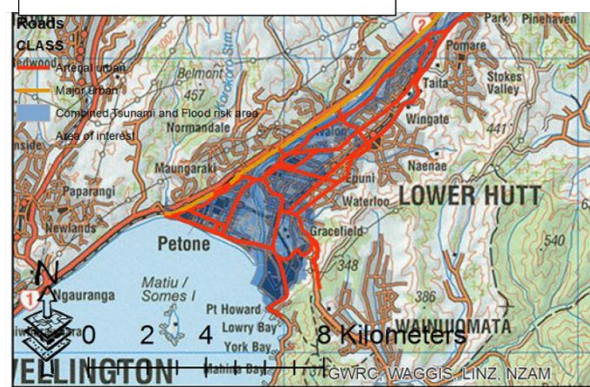


All maps are orientated

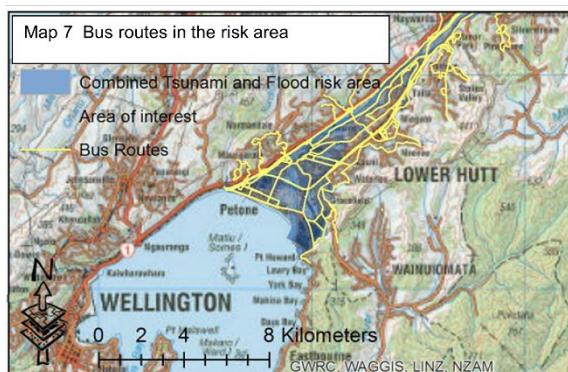
Map 5 Rail lines and stations in the risk area



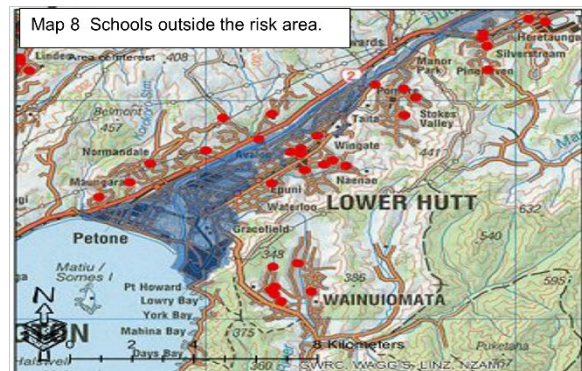
Map 6 Major roads in the risk area



Map 7 Bus routes in the risk area



Map 8 Schools outside the risk area.



Hutt Valley is at risk from flooding both from the river and from a tsunami.

GEOGRAPHIC PROBLEM: How to inform people of the flooding and tsunami risk for the Hutt Valley? Options to consider are

1. A media campaign - using local newspapers and the council website
2. A general mail out with the rate demand
3. An individualised mail out advising each property owner of the specific risks to their property

Map one shows the combined Tsunami and Flood risk area as well as the extent and relief of the study area. I will use this information to analyse the areas that need to be targeted so that we are not using excess money on areas that will not be affected by Flood and Tsunami risk. I preferred to use the combined risk rather than the just the individual risk of just the flood risk or just the tsunami risk as it doesn't show us the full picture. The purpose of the combined flood and tsunami risk is to identify tsunami evacuation zones for civil defence

emergency evacuation purposes and for the development of tsunami evacuation plans and routes for local communities at risk from tsunami inundation.

To create the combined flood and tsunami risk area I had to insert the 440 year flood data and the tsunami evacuation zones data and use the union tool and insert the two data sources into it. This created a union that I named Combined Tsunami and Flood risk area. I then deleted the 440 year flood data and tsunami evacuation zones flood the data frame as the union held their place. I then changed the transparency from 0% to 50% so I could see the area that I was looking at. Also I changed the colour from brown to lapis lazuli as I didn't want it to clash with the basemap which worked out well as you can still see the area's on the basemap.

Map 2 was created because the basemap didn't clearly show the tsunami risk area which has tended to be covered with the flood shading. The red symbolises the highest risk areas to tsunami and these are mainly by the shore as you would expect as well up the river as that is a channel for water to flush through during a tsunami. The orange symbolises the area with the second most amount of risk and yellow is self-evacuation and is the least amount of risk. Using this map with the base map shows the tsunami risk area to be quite densely populated. It has commercial and light industry areas which means there are going to be people coming to the area from places outside of the Tsunami risk area and they need to know how to properly evacuate. I inserted the Tsunami data into a new data frame as well as the Wellington Region Topographic map, then manipulated the Tsunami Zone areas transparency from 0% to 50% as it made it easy to see the area I was surveying. I left the colour scene the same as red, orange and yellow as this is a generally accepted way of showing different types of risk.

These two maps show that the tsunami risk information needs to focus a more targeted group than the flood data which is more extensive. This information will influence my decisions.

Map three relates to the option to use an online campaign focused on the advertising campaign using the council's website. I have created a map showing the internet usage of the Lower Hutt region. This is an important map as it shows us whether having an online media campaign is worth the cost of creating it. As you can see from the map most of the region where there is a combined Flood and Tsunami risk has internet usage of above 50% which means there is a good chance that people in the region will be able to go online and learn about the risks of tsunami. The manipulations I made to the data are that I added a new field to the data the telecommunications data set called internet_1 as using the internet field didn't show up on the map as it was a string type data source. I used the field calculator to copy and paste the string internet data into the internet_1 column and then change the data type from string to integer so that it was possible to see the internet usage of the areas on the map. I changed the colour ramp from purple, dark blue, blue, light blue and white to yellow, orange, dark pink, light pink blue as it didn't clash with either the map or the union. Unfortunately due to the transparency of the union different shades occurred as it went over different colours on the map. I normalised the internet usage from the amount of people with internet access in the area it by the total population of that area as this show's a more true figure that you can compare to other areas. I changed the values of the data ranges from 0-0.2978 to 0-0.3 , 0.2978-0.5204 to 0.31-0.5, 0.5204-0.6472 to 0.51-0.65, 0.6472-0.7568 to 0.66-0.75, 0.7568-0.9167 to 0.76-1 so that the data was cleaner and it makes the report look more professional. I changed the labels from 0.01 to 0.3 to less than 30% from 0.3001 - 0.5000 to Between 30 - 50%, 0.5001 - 0.6500 to Between 51% to 65%, 0.6501 - 0.7500 to Between 66 - 75%, and 0.7501 to 1 to Greater than 75% I was able to do this as if you multiply the original numbers by 100 you get the percentage.

Map 4 shows schools in the flood and tsunami risk areas and most of these have pupils from inside and outside of the risk areas for 8-9 hours per day. This map shows the potential risk if flooding or a tsunami happens during school hours. I examined the regions school data and removed schools outside the combined flood and tsunami risk area. This information was displayed on map 8 using the same manipulations as on map 4. This data could be used by civil defence to select evacuation centres. I changed the symbol from a triangle to a circle as the triangles were hard to see and I also increased the size of the circle from 1 to 10 so it would be easier for the naked eye as well I changed the colour of the circles from blue to orange so that the circles wouldn't clash with the union as the union's colour is a shade of blue.

The next 3 maps (5, 6, and 7) display transport which is important because as the maps show it will be seriously impacted, affecting safe evacuation, aid etc. The train route map (5) shows a good exit route from Petone to Ava to Woburn and then Waterloo as that is the safest route to evacuate. The train stations symbolised as black dots show areas for advertising tsunami and flood information sites as they are major areas where people will be each day. The manipulations that I did to this data were that I added a basemap from Arc Gis online called Wellington Region Topographic as the map we were given called topo_50 only showed the Hutt Valley and did not show the surrounding regions. I added a new coordinate system called NZGD_2000_Transverse_Mercator this was because the old co-ordinate system did not properly show the distance between areas. I then added train line and train station data. Increasing the train lines thickness from 1-4 and the train stations thickness from 1-12 as you could the information. I decreased the transparency

+++++ from 50% to 25% as you could barely see the red of the shore exclusion zone. I kept the colours the same as I believe nothing clashed. I also changed the scale from miles to kilometers as we live in New Zealand and use the metric system.

The manipulations I made to produce map 6 were adding a data source called roads as well as the basemap. From this data I removed footpaths, walking tracks, medium and minor rural roads and arterial rural routes. So I was just left with the arterial urban and the major urban symbolised as orange and red respectively. I changed the scale again from miles to kilometers on each of the transport maps. Similar manipulations were made to display bus routes (map 7). I though buses like trains would be useful places to advertise how to get data flood and tsunami information. I changed the data shown from many unique categories to a single category as there were too many bus routes shown on the map and I wasn't looking to show these different bus routes just where the bus routes were. I changed the colour from orange to bright yellow as the orange clashed with the basemap roads and you couldn't tell where the bus routes were.

SOLUTION TO THE GEOGRAPHIC PROBLEM.

I believe that the best way we could supply information to people is using a media campaign (newspapers and the council website). The data shows that most areas inside of the combined flood and tsunami risk area have at least 50% of people with access to the internet and people who do not have access to the internet generally read the paper, so all bases are covered.

Supplying information to schools is also very important. Learning about the tsunami and flood risks and passing this information onto their parents and families.

We can also include advertising on bus and train routes as a high amount of people will see and have constant reminders of the risk of flooding and tsunami. I don't like the option of

sending it out with the council rates as people will throw the information away as well as the fact that the information doesn't go to people who are renting.

The individualised mail out is good especially to target the tsunami risk area and provide posters for workplaces. Advertising is a constant reminder of the real threat of tsunami and flood risk. However it is easily thrown away by people as junk mail so might not be worth the effort required to implement it.

Grade: Excellence

For Excellence, the student needs to comprehensively apply spatial analysis, with consultation, to solve a geographic problem.

This involves:

- evaluating the manipulations
- fully justifying the solution to the geographical problem. The full justification is an in-depth response that uses clarity of argument and holistic understanding to demonstrate why one course of action is better than the alternatives.

Indicators in this exemplar that support a comprehensive spatial analysis include a clear geographic problem, identification and use of parameters to effectively use the spatial data, and the appropriate use of different manipulation techniques to display the spatial data with accuracy.

The student has addressed the problem of where to locate a new police station. The manipulations have been evaluated following an explanation of what was done and why. For example, the first map effectively uses buffer zones to show *“the areas within 2 km from each existing police station, this manipulation has made it easier and clearer to figure out the minimum distance my new police station can be from the existing stations.”* This map is developed further by using *“the proximity tool to create a drive time area on the ‘Existing Police Stations in Hamilton’ layer. It more precisely shows the areas of Hamilton that are catered for by the stations.”*

The use of hotspots *“gave me a clear idea of what parts of Hamilton are affected most by crime and further helped to inform my decisions of where the new station is needed.”* This layer continues to be refined by *“added pinpoints on the darker areas of colour, to represent the crime hotspots. This is to make the manipulation clearer than the last map.”*

Slide 9 shows the layers created to display spatial data for the first three parameters and *“Although there is a lot of information on this map, this step was effective in helping me solve the problem of where to put the police station.”*

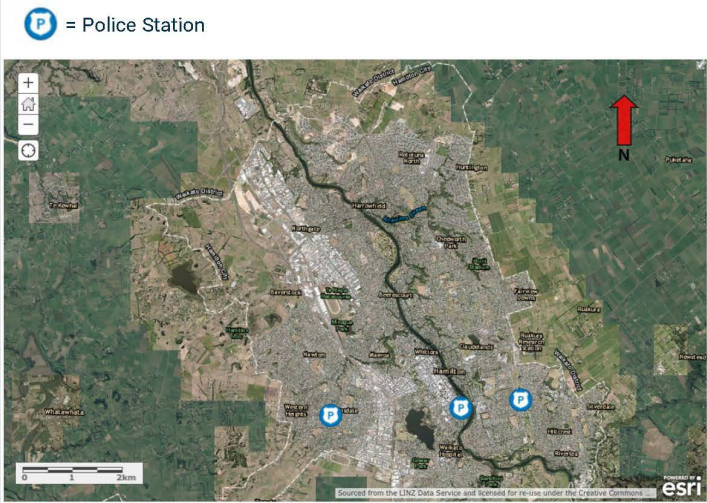
A solution to the geographic problem is provided and fully justified through evidence from the spatial data. The strengths and weaknesses of two potential sites are considered and assessed based on the spatial data for four key parameters. A final decision is made, with supporting data and reference to why alternative B was not chosen.

The evidence for this aspect provides a viable solution to the geographic problem which is fully justified, clearly argued and supported with detailed spatial data. The solution shows holistic understanding of both the problem and the city’s needs.

INTRODUCTION The New Zealand Government have decided that due to the drastic growth of Hamilton's population, it is now time to build a new Police Station to cater for the increase in people. Hamilton is a city located in the North Island of New Zealand. It is the most populated city of the Waikato Region, and encompasses a land area of 102 km². The main stakeholders in this analysis are the Hamilton City Council, as well as the people that will be affected by the new station.	In order for this new location to be suitable, I am using following parameters: 1. Be at least 2km away from the next nearest station. 2. Cater for an area of Hamilton where most of the area is not already catered for by existing stations (e.g. an area that is not already within a 5 minute drive of an existing station). 3. Be within 2km from a 'crime hotspot' (an area where an increase of crime is clustered in Hamilton). 4. Be able to reach at least 15,000 people within a 5 minute drive. The information / data needed to be able to make the decisions is a 5 Minute Drive Time from each existing police station, data showing the crime rate and number of victimizations in Hamilton, where the 'crime hotspots' are located based off the crime data, a 2km distance buffer around each crime hotspot and around each existing station, as well as the population within the 5 minute drive times from each potential location for the new station.
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Parameter 1: The location of the new Police Station must be at least 2km away from the next nearest station. In order to make sure that the new location will be at least 2km from the next nearest police station in Hamilton, I had to have the correct information about where the existing police stations in Hamilton are located. To do this, I researched and found out more information about the current police stations in Hamilton (via http://www.police.govt.nz). This gave me the exact addresses for each of the three existing stations in Hamilton, in which I then located on my new map by adding them to a new layer, and to show that they are police stations I used an appropriate symbol of a police badge on each location. This map shows the locations of the three existing police stations in Hamilton, and this layer will help me when solving each of the parameters.
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Map of Hamilton showing the Three Existing Police Stations Located in Hamilton



Parameter 1:

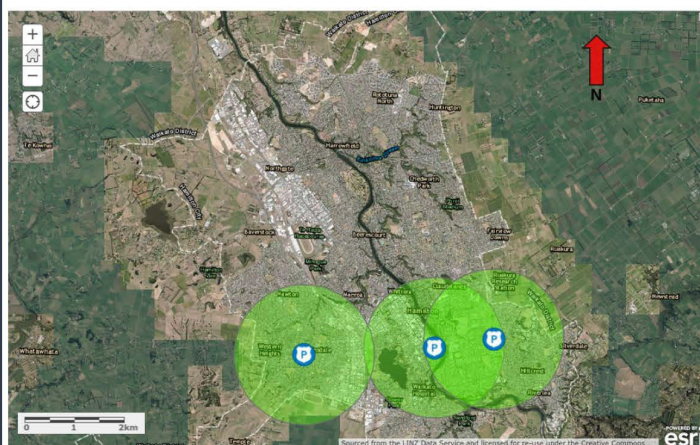
The location of the new Police Station must be at least 2km away from the next nearest station.

With the locations of each existing police station in Hamilton on my map, I then used that layer to run an analysis to show a 2km buffer around each of the existing stations.

On the map you can now see three large green circles around each of the existing stations. Each of these represent 2km of distance around each of the stations. This buffer is useful as it clearly shows me where the new police station cannot be located, as the first parameter requires it to be at least 2km away from the nearest stations, meaning the station cannot be within these buffers. As I am now able to see the areas within 2 km from each existing police station, this manipulation has made it easier and clearer to figure out the minimum distance my new police station can be from the existing stations. The green colour is different to other colours on this map, making the manipulation easy to read and understand.

Map of Hamilton Showing 2km Distance Buffers Around Each Existing Police Station Located in Hamilton

 = Police Station  = 2km Buffers



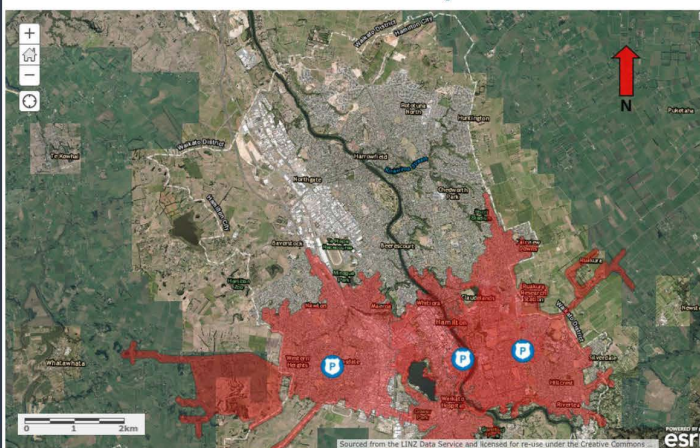
Parameter 2:

Cater for an area of Hamilton where the majority of the area is not already catered for by existing stations.

To make sure that the new station will cater for an area of Hamilton that is not already catered for by the existing stations, I used the proximity tool to create a drive time area on the 'Existing Police Stations in Hamilton' layer. The red area on this map represents the areas in Hamilton that can be reached from the current police stations within five minutes of driving. The use of the red colour makes the manipulation easy to see. I can see the red from the other items on the map. This analysis has made it clear where in Hamilton the three existing police stations can reach within five minutes of driving. It more precisely shows the areas of Hamilton that are catered for by the stations, and makes it easy to tell which areas are not catered for, and therefore are in need of a new police station. This analysis will further help me figure out the areas with potential for my new police station, as I will be able to tell if it is suitable if the drive times of the potential locations do not overlap with this drive time from the existing stations.

Map of Hamilton Showing Five Minute Drive Time Areas From Each Existing Police Station Located in Hamilton

 = Police Station  = area within a 5 minute drive from each existing station



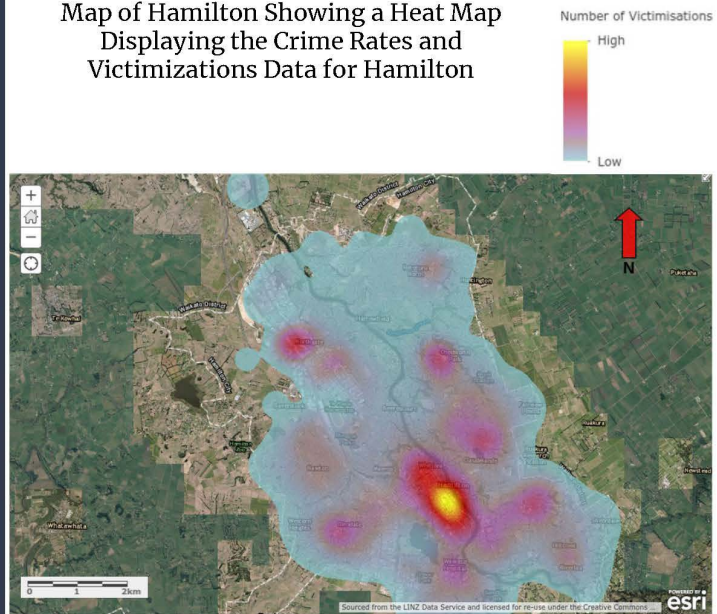
Parameter 3:

Be within 2km from a 'crime hotspot' (an area where an increase of crime is clustered in Hamilton).

The first step I took to solve this parameter was to create a new layer showing Hamilton's crime / victimizations data. To do this, I downloaded a summary of data called 'Victimisations Time and Place' off the New Zealand Police website (www.police.govt.nz) and converted the data into a new layer on my map in the form of a heat map.

On the map, the blue parts represent the areas with less crime and victimizations, and the red, orange and yellow parts represent areas with higher rates of crime. From this, I can see that a higher amount of crime occurs closer to the South of Hamilton, near the existing stations. However, I can also see multiple obvious hotspots towards the North of Hamilton as well, where there is a lack of police stations. The more obvious hotspots towards the North are located near the Base and Chartwell Shopping Centre. This gave me a clear idea of what parts of Hamilton are affected most by crime and further helped to inform my decisions of where the new station is needed / where it could potentially be built. This manipulation uses colours to show the number of victimizations. The gradient of the colour makes the specifics hard to read, but the general areas of yellow which is the high areas are clear.

Map of Hamilton Showing a Heat Map
Displaying the Crime Rates and
Victimizations Data for Hamilton



Parameter 3:

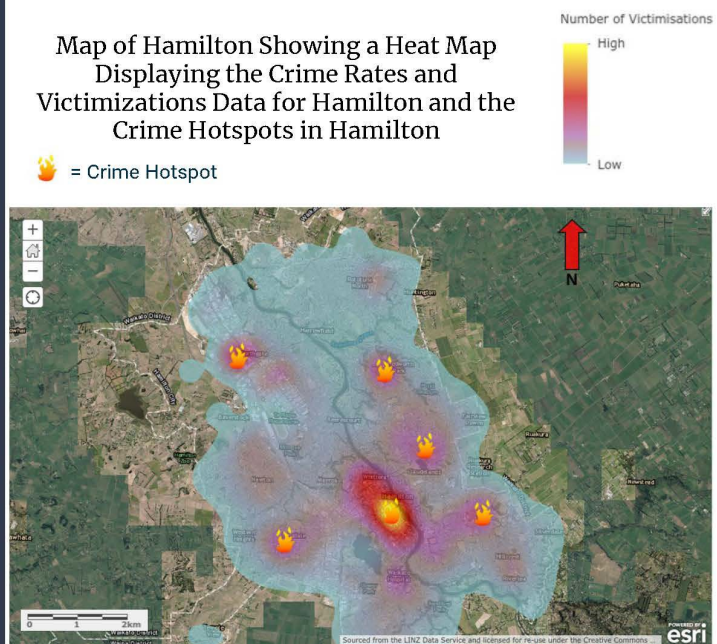
Be within 2km from a 'crime hotspot' (an area where an increase of crime is clustered in Hamilton).

After adding the heat map to my map, I then used the key to figure out what areas have the most crime happening. I created a new layer, and added pinpoints on the darker areas of colour, to represent the crime hotspots. This is to make the manipulation clearer than the last map. I then changed the points to more appropriate symbols that were easier to read. The fire symbols on the map represent these areas of high rates of crime.

By doing this, the manipulations made it a lot easier to locate the main areas where the most crime / victimisations happen, without having the entire heat map covering the other layers. I can now remove the layer of the crime data (heat map), (these manipulations were hard to read) which will leave me with only the crime hotspots, as these are all I need for this parameter. The new layer with only the hotspots will work as a base layer when creating a 2 km buffer around these hotspots, which will help me to solve the third parameter.

Map of Hamilton Showing a Heat Map
Displaying the Crime Rates and
Victimizations Data for Hamilton and the
Crime Hotspots in Hamilton

🔥 = Crime Hotspot



Parameter 3:

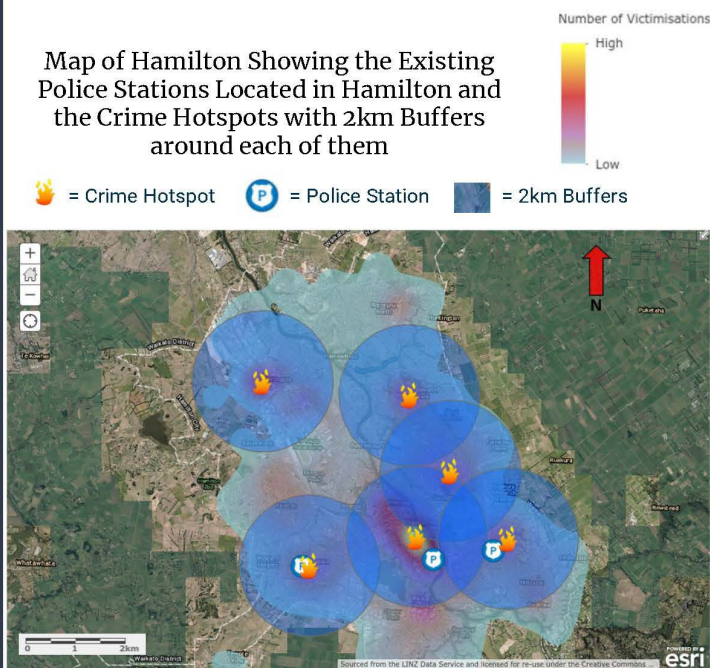
Be within 2km from a 'crime hotspot' (an area where an increase of crime is clustered in Hamilton).

The next step I took to solve the third parameter was to use the proximity tool to run an analysis to show a 2km buffer around each of the crime hotspots in Hamilton. I created a new layer by running the analysis on the 'crime hotspots' layer, which formed large circles around each hotspot, showing the 2km distance buffer around each of the crime hotspots.

The blue circles surrounding each hotspot represent the areas that are within 2km of each of these hotspots. This shows me where in Hamilton I can place my new station, as the parameter requires it to be within 2km from a crime hotspot, meaning it has to be located within one of these buffers. This narrows down my options for where to put the potential new station, therefore helping to make the decision easier. The different colours used make this layer of manipulations effective.

Map of Hamilton Showing the Existing Police Stations Located in Hamilton and the Crime Hotspots with 2km Buffers around each of them

🔥 = Crime Hotspot 📍 = Police Station 🔵 = 2km Buffers



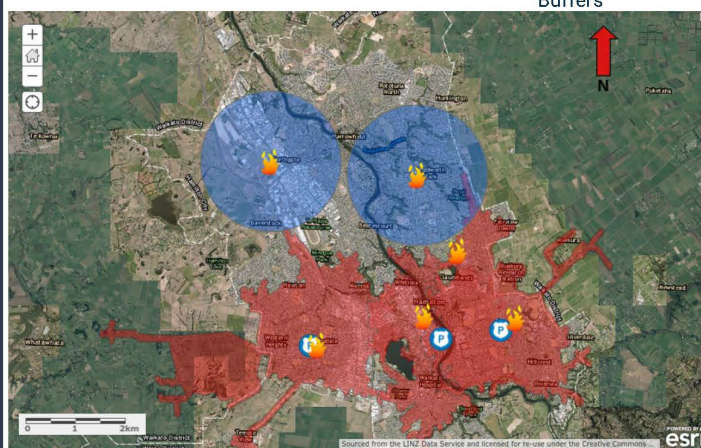
Parameter 3:

Be within 2km from a 'crime hotspot' (an area where an increase of crime is clustered in Hamilton).

I then added the layers of the existing police stations and the 5 minute drive time layer back on the map, and could clearly see that the 5 minute drive times from the existing police stations in Hamilton already catered for four of the crime hotspots on my map. This showed me that these crime hotspots were not as in need of a new station nearby as the two hotspots North of Hamilton, and therefore decided that I will put the two potential locations within these two buffers. I removed the 2km buffers around the four hotspots, as these manipulations were not needed, and left the buffers around the two North of Hamilton, so it is now clear to see what crime hotspots I am using to solve this parameter.

Map of Hamilton Showing Existing Police Stations and the Crime Hotspots with 2km Buffers

🔥 = Crime Hotspot 📍 = Police Station 🔵 = 2km Buffers



Parameter 4:

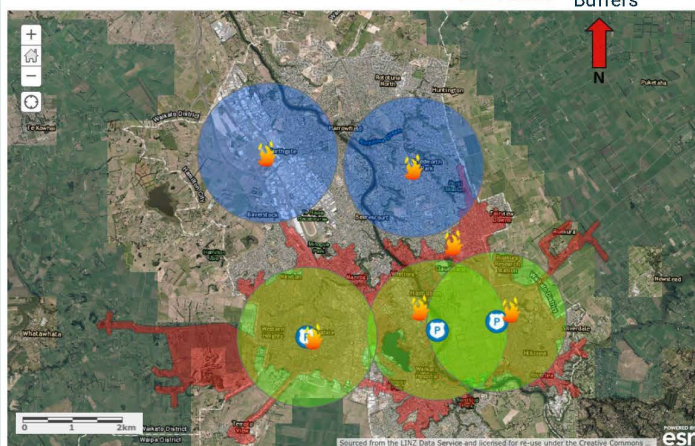
Be able to reach at least 15,000 people within a 5 minute drive.

The first step I needed to do before solving this parameter was to find two potential locations for where the new Police Station could be built. I used the limitations of the first three parameters as guidelines when choosing these two locations.

After solving the first three parameters, I could see that because the red area represents the areas that the current stations are able to cater for, the new potential locations for the police stations in Hamilton had to be located outside of the red area on this map, as it is required to cater for an area that is not already catered for by the existing stations. I could also see that they would have to be located outside of the green circles (the 2km buffer around the existing stations), because the first parameter requires it to be at least 2km from the nearest existing station. The third parameter then narrowed down my decision even more, as it requires the new station to be within 2km from a 'crime hotspot', meaning that I will have to locate the new potential station locations within the blue circles (2km buffers from the main crime hotspots that aren't already catered for by the existing police stations). Although there is a lot of information on this map, this step was effective in helping me solve the problem of where to put the police station.

Map of Hamilton Showing the Existing Police Stations, the Main Crime Hotspots, 2km Buffers Around the Existing Stations and Crime Hotspots, and a 5 Minute Drive Time

 = 5 Minute Drive Time
 = Crime Hotspot  = Police Station   = 2km Buffers



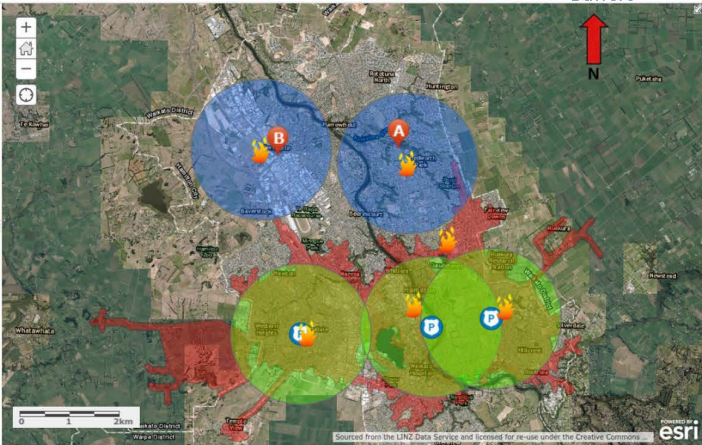
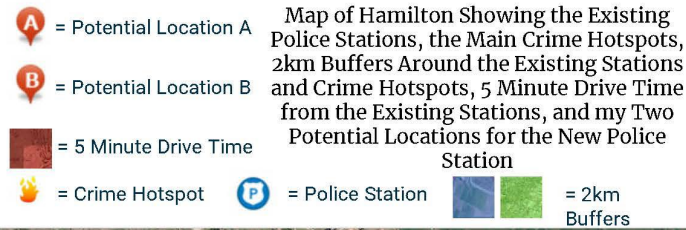
Parameter 4:

Be able to reach at least 15,000 people within a 5 minute drive.

Based off the requirements from the parameters, I was able to locate two potential spots on my map to potentially become the location of the new station.

Potential Location A is located in the area of Chartwell, not far from the Chartwell Shopping Centre. This location is within 2km of the nearest crime hotspot (the one located around the Chartwell Shopping Centre), and is more than 2km away from the nearest existing police station in Hamilton.

Potential Location B is located in the area of Te Rapa, near the Base Shopping Centre. This location is also within 2km of the nearest crime hotspot (the one located around The Base Shopping Centre), and is also more than 2km away from all existing police stations in Hamilton. These manipulations look good and were helpful in deciding where to put the police station.



Parameter 4:

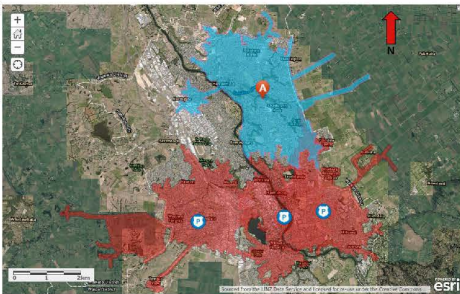
Be able to reach at least 15,000 people within a 5 minute drive.

After deciding on two potential locations based around the first three parameters, I then used the proximity tool on the layer containing the new potential locations to run a 5 minute drive time analysis on the two potential locations.

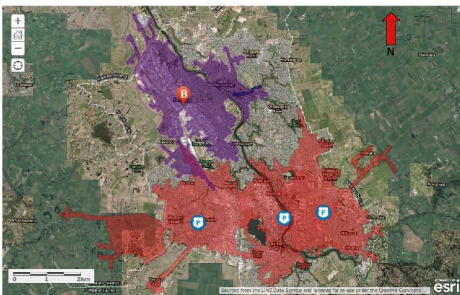
The top map shows the 5 minute drive time from the Potential Location A. The light blue area on the map represents the extent in which you can reach within five minutes of driving from location A. This shows me how much of Hamilton the new police station could potentially cater for, if it were to be built at location A. The bottom map shows the 5 minute drive time from the Potential Location B. The purple area on this map represents the extent in which you can reach within five minutes of driving from location B. This shows me the amount of Hamilton the new police station could potentially cater for, if it were to be built at location B.

From looking at these maps, I can see that the five minute drive time from the existing police stations in Hamilton caters for almost half of Hamilton, while the potential locations cater for approximately a quarter each. These layers will be the base layers for working out how many people each can reach.

Map of Hamilton Showing the Existing Police Stations in Hamilton and Five Minute Drive Time around the Existing Police Stations and Potential Location A



Map of Hamilton Showing the Existing Police Stations in Hamilton and Five Minute Drive Time around the Existing Police Stations and Potential Location B



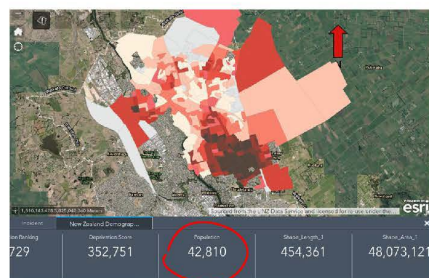
Parameter 4:

Be able to reach at least 15,000 people within a 5 minute drive.

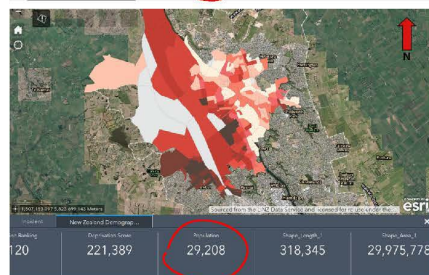
After deciding on two potential locations and running a five minute drive time analysis on each of them, I then worked out how many people each location could potentially reach within a five minute drive, in order to solve the fourth parameter. Firstly, I added a new layer into my map by searching for the layer 'New Zealand Demographics for Emergency Management'. This set me up with the appropriate data in order for the next tool to figure out how many people these locations' drive times could cater for. By sharing my map, using the Web Appbuilder, and adding a new widget (Situation Awareness), I was able to use the widget to outline each five minute drive time of the potential locations separately. By doing this, it gave me the data based off what was within the area. To the right, in the first screenshot, you can see that for Potential Location A, the population within the 5 minute drive time area is **42,810** people (circled). This means that if the new Police Station were to be built at this location, it would be able to cater for 42,810 people within a five minute drive. Below this, in the second screenshot, you can see that for Potential Location B, the population within the 5 minute drive time area is **29,208** people (circled). This means that if the new Police Station were to be built at location B, it would be able to cater for 29,208 people within a five minute drive. Both Location A and B now meet the requirements of the fourth parameter, as they both reach more than 15,000 people within a 5 minute drive.

Maps of Hamilton Showing the Web App-builder Tool Showing Data Within the 5 Minute Drive Time Areas from Each Potential Location

Potential Location A:



Potential Location B:



Strengths Of Location A

- ★ It meets the requirements of all parameters (see previous slides):
 - It is more than 2 km away from the nearest existing Police Station in Hamilton
 - It caters for an area in which the majority of the area is not already catered for by existing stations (not already within the 5 minute drive times from current stations)
 - It is within 2km of a crime hotspot in Hamilton (the one located around Chartwell Shopping Centre)
 - It reaches more than 15,000 people within five minutes of driving from the location
- ★ It isn't far from the Pukete Bridge - so the West side of Hamilton (opposite side of the river) won't be too difficult to access
- ★ It will cater for 42,810 people within a five minute drive, which is almost a third of the Hamilton population

Weaknesses Of Location A

- ★ The Waikato River could potentially become a barrier (It may take longer to get to places on the Western side of Hamilton because of the bridge - you have to detour to get to some places because you have to cross a bridge) and therefore means it does not cater for much of the Western side of Hamilton
- ★ It is located on a road prone to being busy, and therefore may be an obstacle during rush hours

Strengths Of Location B

- ★ It meets the requirements of all parameters (see previous slides):
 - It is more than 2 km away from the nearest existing Police Station in Hamilton
 - It caters for an area in which the majority of the area is not already catered for by existing stations (not already within the 5 minute drive times from current stations)
 - It is within 2km of a crime hotspot in Hamilton (the one located around Te Awa the Base Shopping Centre)
 - It reaches more than 15,000 people within five minutes of driving from the location
- ★ It will cater for 29,208 people within a five minute drive (more than 15,000)
- ★ It is close to the Pukete Bridge, which will make it easy to access some of the Eastern side of the Waikato River

Weaknesses Of Location B

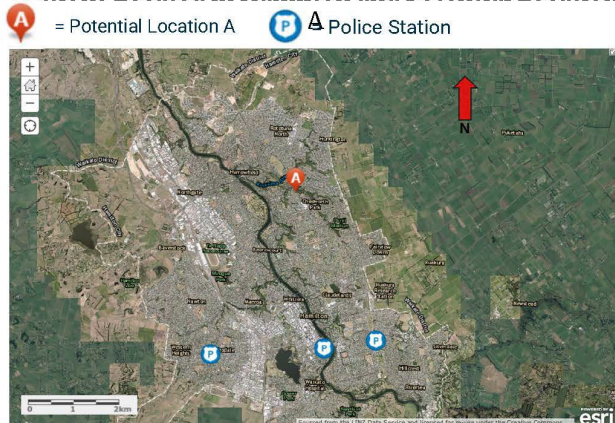
- ★ The Waikato River could potentially become a barrier (It may take longer to get to places on the East side of Hamilton because of the bridge - you have to detour to get to some places because you have to cross a bridge)
- ★ It is located near an intersection that is very prone to being busy, and therefore would be an obstacle during rush hours, and also from being located close to the shopping centre, it may also experience delays from traffic moving in and out of the centre

My Final Decision

I had to choose one of the two potential locations as my final decision on where I believe is the best place to build a new Police Station in Hamilton. I decided that, based on the parameters (specifically parameter 4), the Potential Location A is the best location for this new station to be built.

This decision was influenced mostly by the fact that from location A you can reach 42,810 people within a five minute drive, while location B can only reach 29,208 people within five minutes of driving. This influenced my decision to choose location A because although they both cater for the requirements of all four parameters, this station would be able to reach 13,602 more people than location B, therefore catering for a lot more of Hamilton within a five minute drive.

Map of Hamilton Showing the Existing Police Stations Located in Hamilton and Potential Location



Why I Believe this is the Best Site

Location A is the best option for where to build this new police station because it meets all requirements of the parameters asked of me. I believe it is the best site because it caters for an area of Hamilton that is not already catered for by the three existing Police Stations in Hamilton. From using the Web App-Builder tool, I was able to see that this location can reach 42,810 people within five minutes of driving, which is almost a third of Hamilton, while the other potential location (Location B) could only reach 29,208 people within five minutes of driving. I believe this is because the Potential Location A is located closer to Hamilton North, where areas such as Rototuna and Flagstaff are located. These areas are more densely populated than the areas around the Potential Location B, and because Location A is further away from the nearest bridge over the Waikato River (Pukete Bridge), it is closer to the suburban areas on the East side of the River, meaning that people are more accessible.

The alternative option was Location B, however I didn't choose this location mostly because it was not able to reach an area as big as Location A within five minutes of driving, meaning it could not reach as many people as Location A could. This option was also in close proximity to the Base Shopping Centre, which is prone to getting very busy, and because it is also located right next to the main intersection, it could pose as a potential harm to the police vehicles when pulling in and out of the potential station, thus why I believe this location was not as suitable as Location A.