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Mine Health and Safety Council

Project Number: SIM170301

Name of Project: *OPERATIONALISE THE SEISMOGRAPH NETWORKS IN AND AROUND THE MINING REGIONS*

08 November 2019

Council for Geoscience

M Grobbelaar and V Midzi
Council for Geoscience



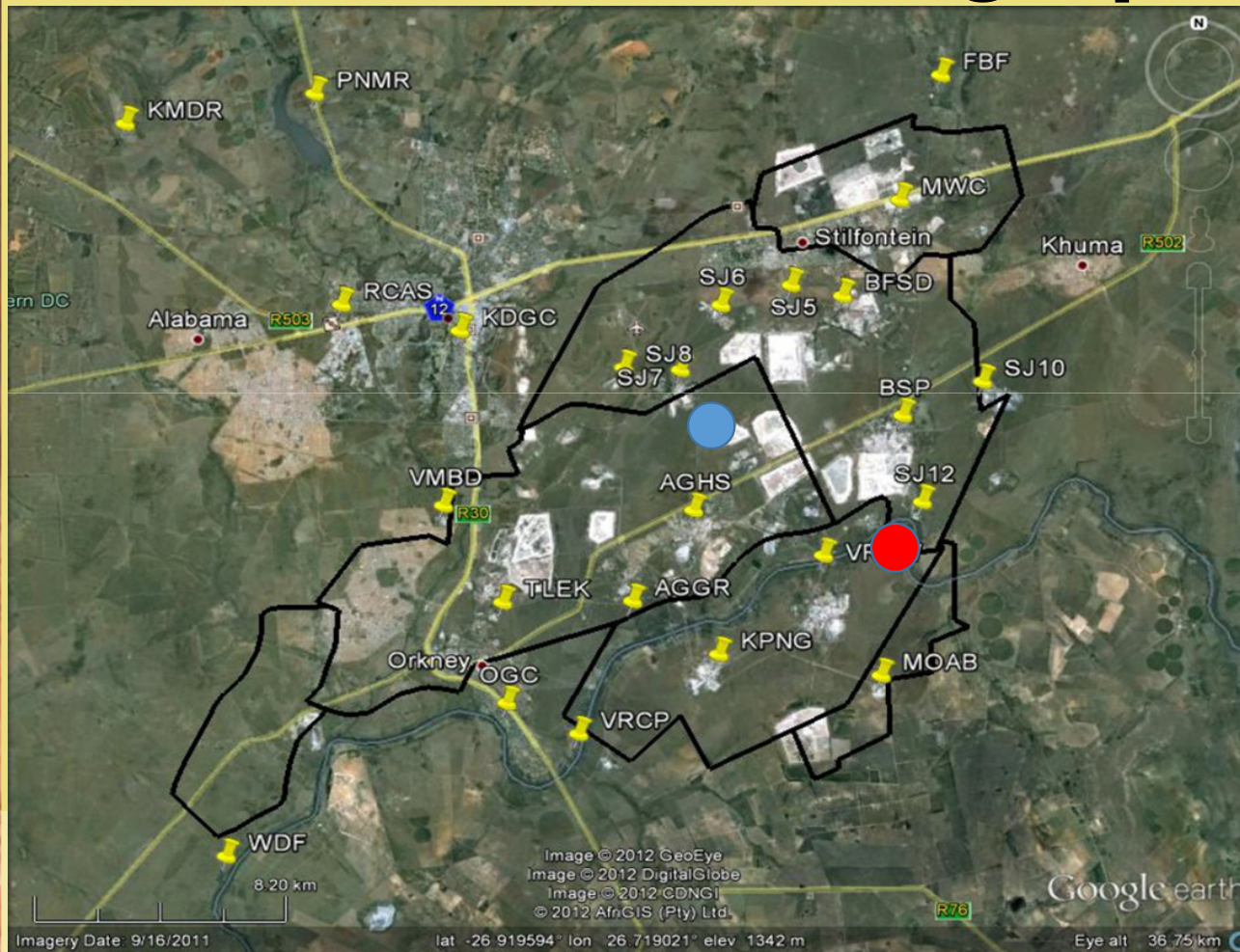
Council for Geoscience

Presentation Outline

1. Background
2. What did we hope to achieve?
3. What did we achieve?
4. What is the way forward?
5. Conclusions



Background: KOSH seismograph network



- **25 seismograph** stations were installed in and around the **KOSH** mining region due to the fact that it had experienced the **largest mining related** earthquake (magnitude **5.3**) in the country in **2005**.
- The **largest** mining related earthquake is **now** the one which occurred on **05 August 2014** with a magnitude of **5.5**.
- To improve monitoring in region and research....



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What did we hope to achieve?

Task 1: Dissemination of information and empowering of stakeholders to utilise the website system

- The CGS is cognizant of the fact that the stakeholders are not aware of and are not comfortable in using the website systems and that the information displayed may be quite specialized.
- A comprehensive programme focusing on disseminating information concerning the website and its many uses and empowering or training the users.

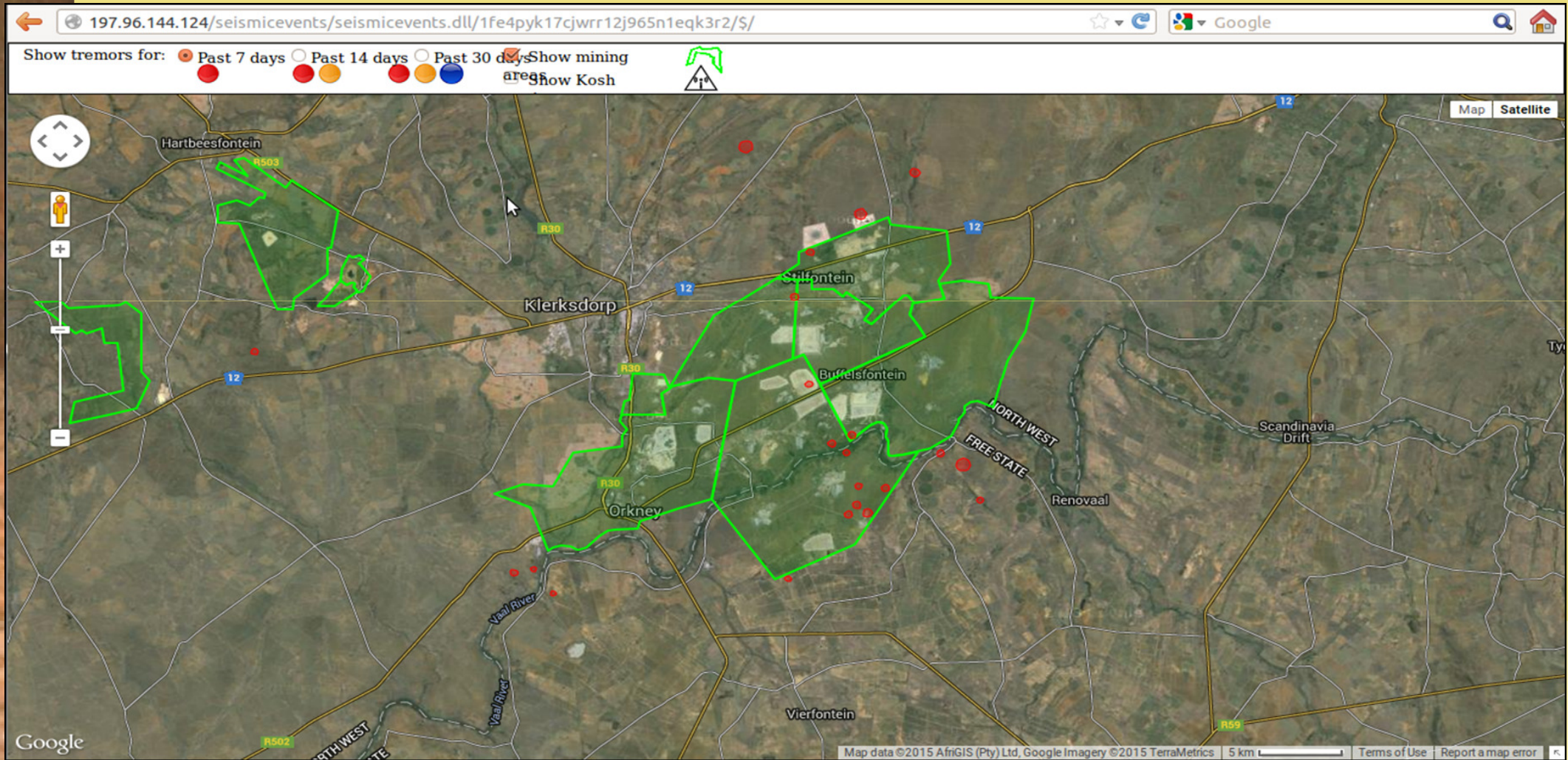
Task 2: Enhancement of the website system

- Currently, the website only displays the seismic events and the stations within the mine boundaries of the KOSH mining region.
- Enhance the system by improving the accuracy of locations and user-friendliness, as well as increasing the areas covered within the website to include the Johannesburg and Carletonville regions.



What did we hope to achieve?

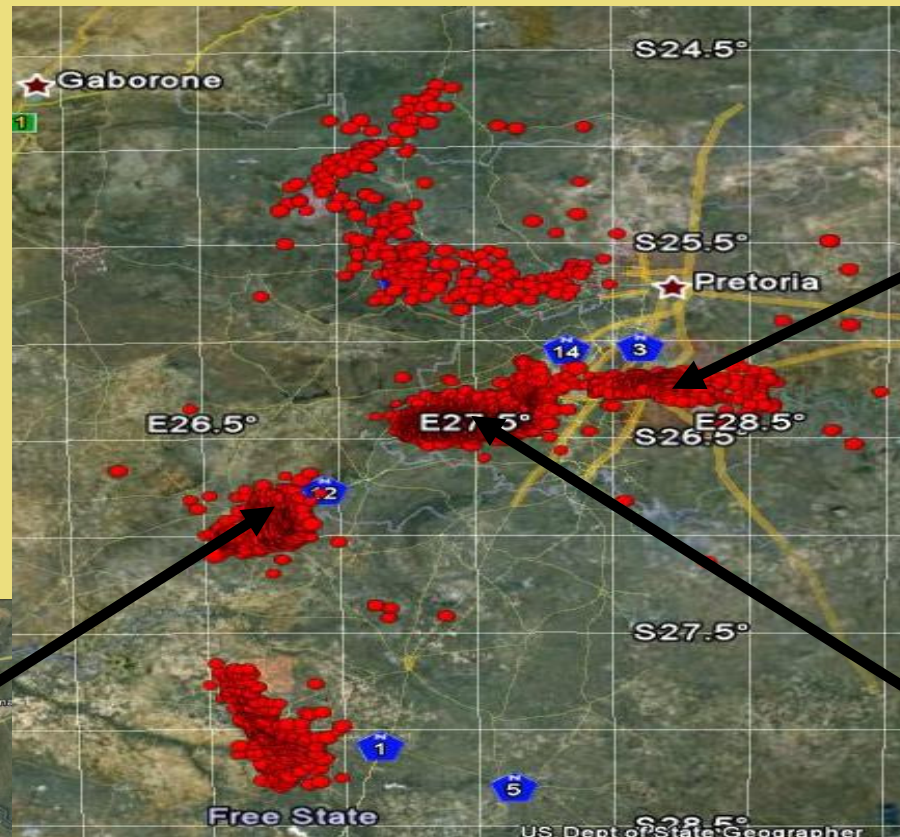
Upgraded website



What did we hope to achieve?

Incorporate other clusters in website

KOSH
25 stations

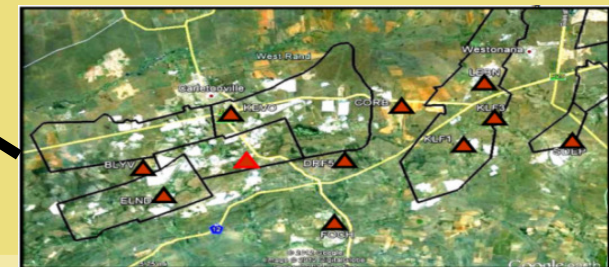


Central Basin Area



12 stations

Far West Rand Area



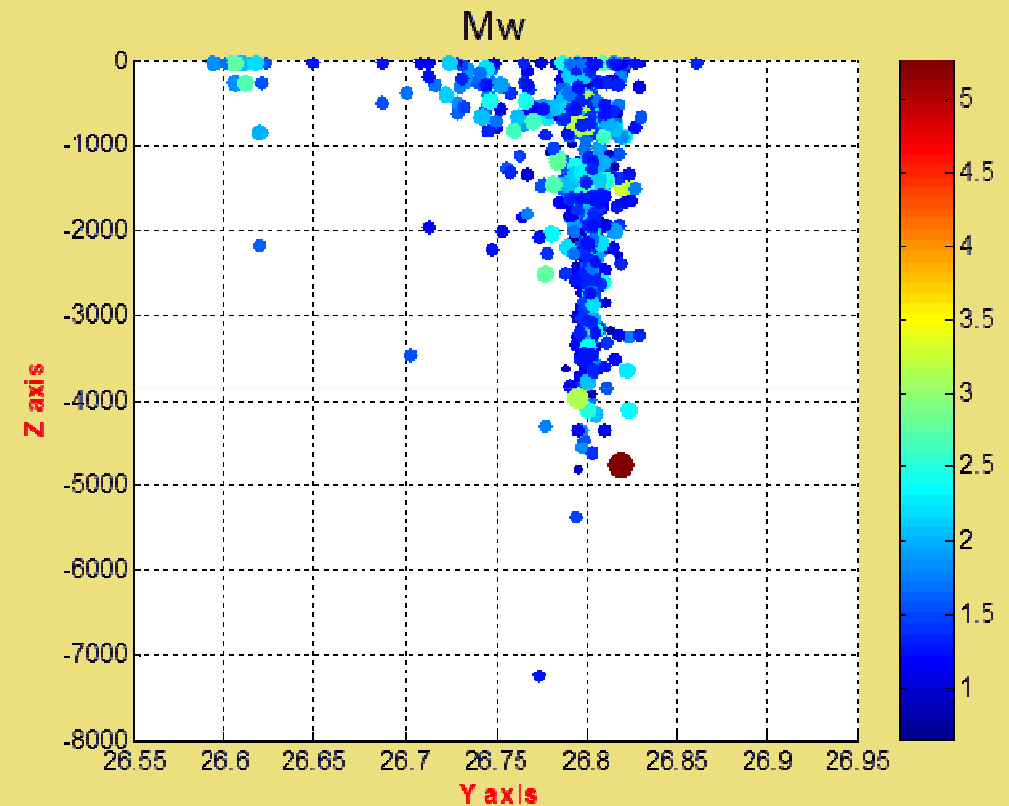
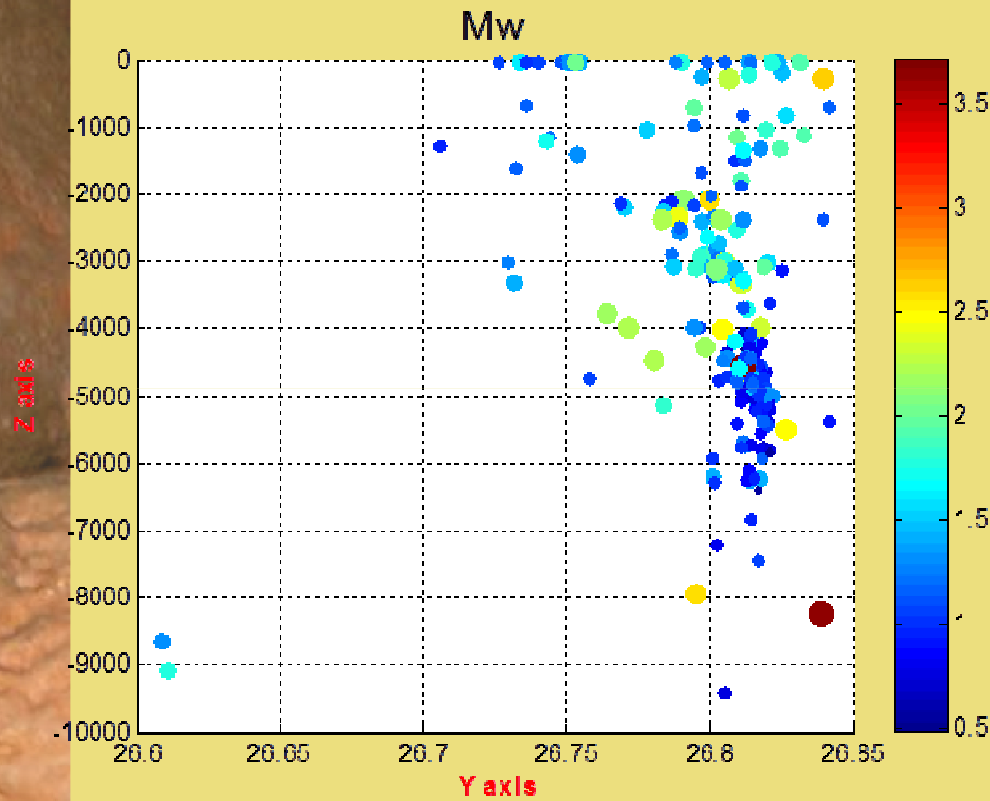
11 stations



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What did we hope to achieve?

Enhanced velocity model to improve location ability



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What did we hope to achieve?

Task 3: Proposal for Technical support, as well continuous (24/7) monitoring and verification of the website system

- The CGS does not currently operate 24/7.
- However, seismic events do not keep office hours and can occur at any time of the day.
- Although the system does operate 24/7 and the automatic locations provide a location of the seismic events within seconds of the event, the CGS, unfortunately can only verify the location and magnitude the next working day after the event.



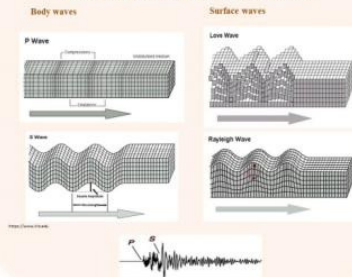
Council for Geoscience, 280 Pretoria Road, Silverton, Pretoria



(sudden rolling or shaking events caused by the movement of the earth's surface along faults)



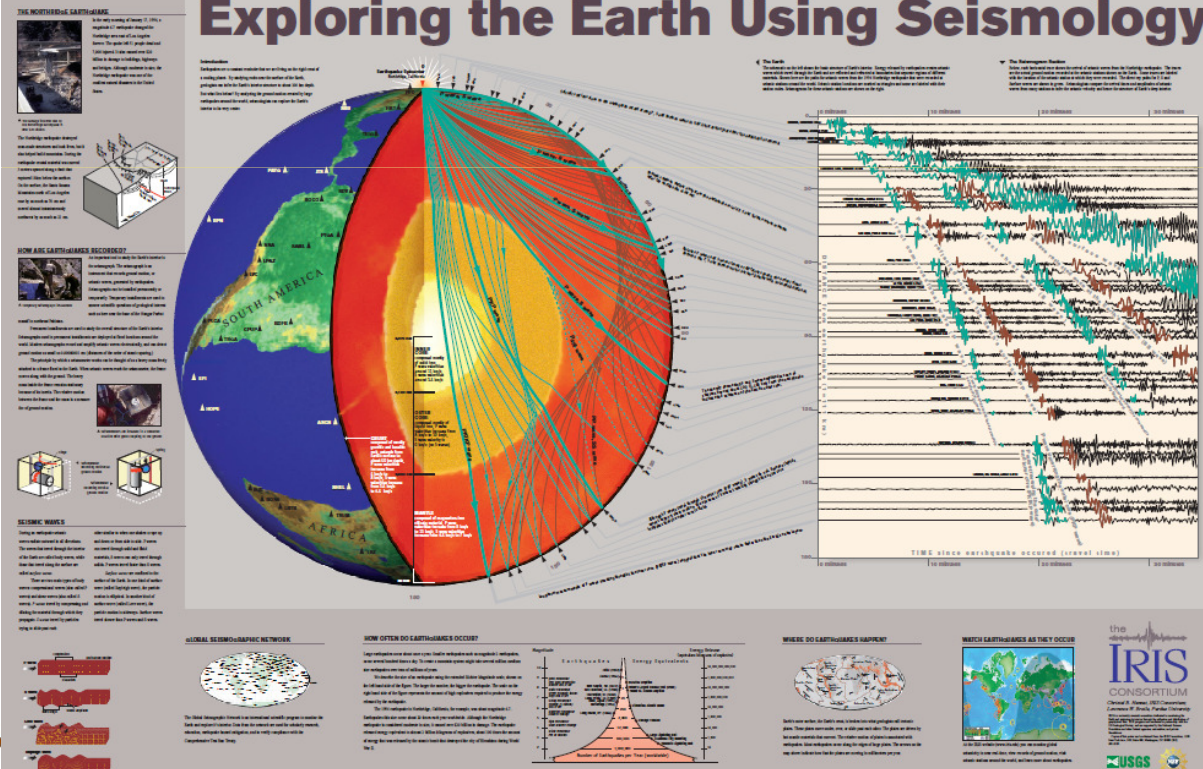
(b) backup battery pack (white) and data acquisition unit (orange).



Seismograph stations within a network record an earthquake displayed as a seismogram (left). During the location of the earthquake, the distance between the P waves and the S waves are utilised to determine the distance of the stations from the earthquake (right).



Exploring the Earth Using Seismology



What did we achieve?

End User Surveys and workshops



What did we achieve?

Presentations at other forums

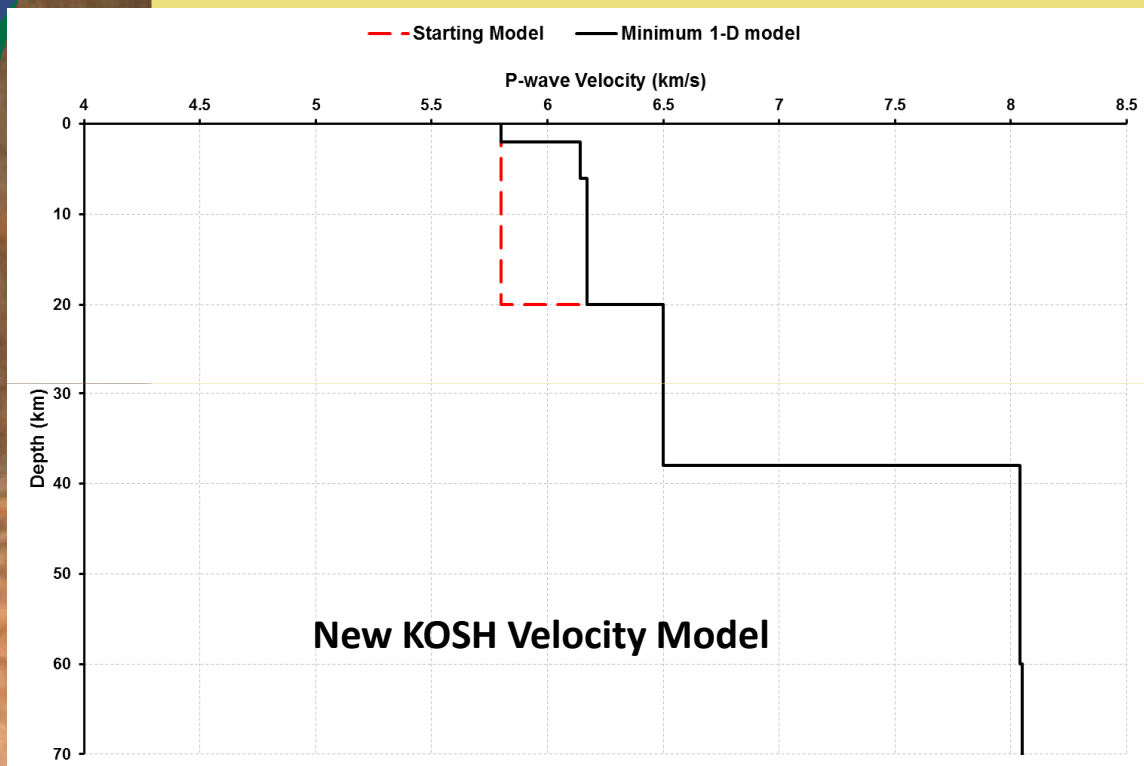
The project was presented at a number of forums, such as:

- Regional Tripartite
- Rockfalls and Rockbursts Task Team
- Vaal River Tripartite FOG Sub-Committee
- Etc..



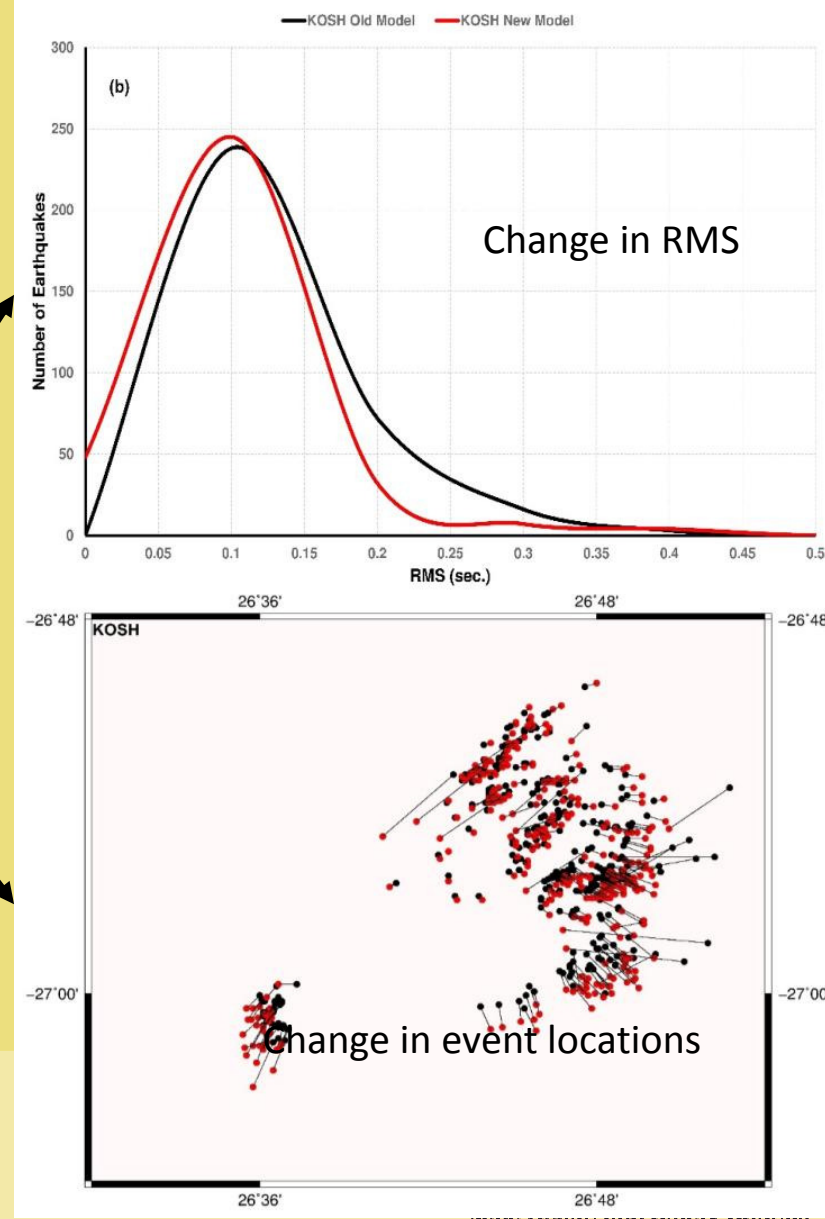
What did we achieve?

New Velocity Model

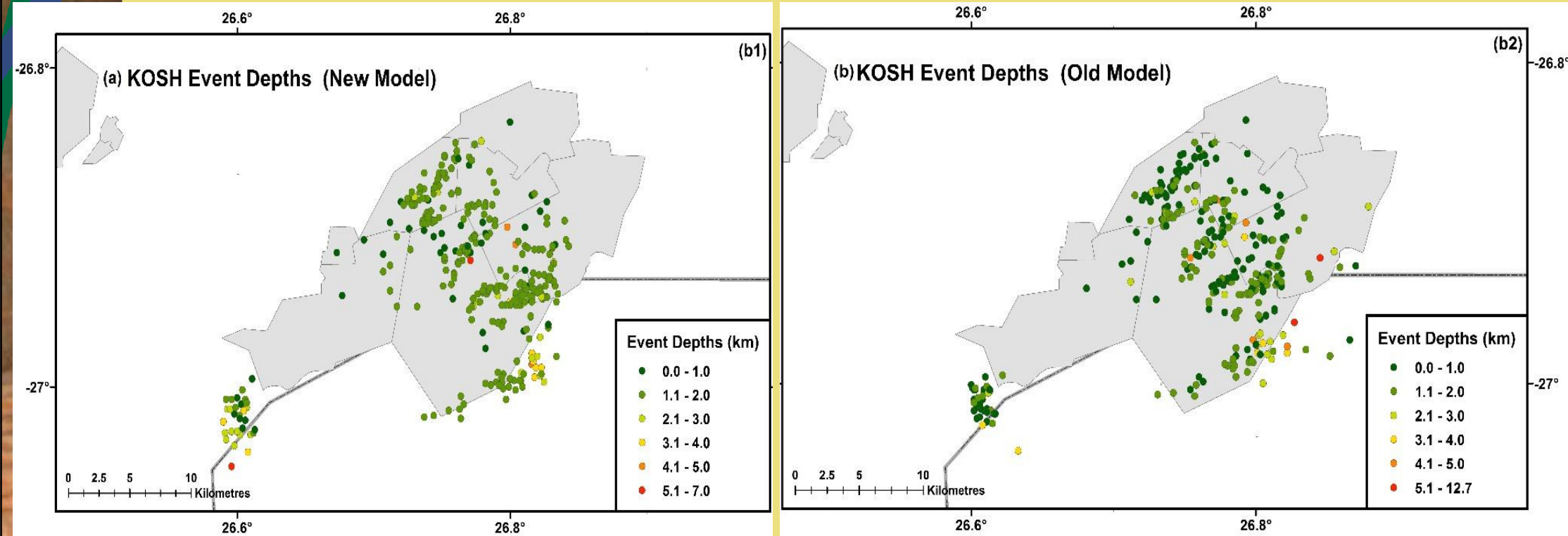


- New models for KOSH, Johannesburg and Carletonville regions now available.
- Tests show models resulted in improved locations.

Impact
of new
model



Implication of new models on locations



- More pronounced **clustering** of the newly obtained locations.
- New model events appear to be located at a slightly **deeper depth** as expected rather than on surface as in older events.



What did we achieve?

Technical support and 24/7 monitoring and verification

The staff member on call would be required to perform the following activities:

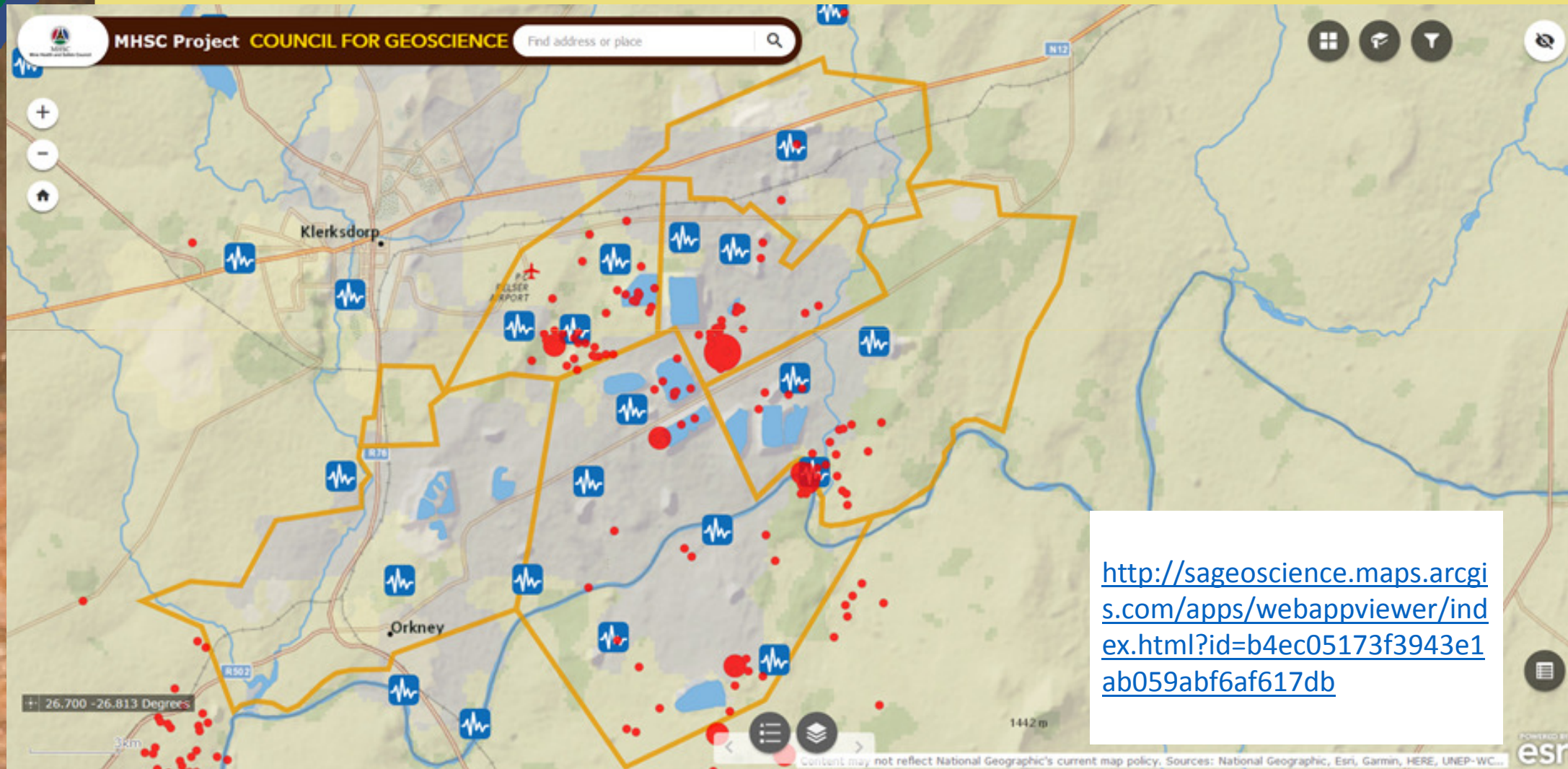
- Monitor the website of seismic events in order to insure constant uptime.
- Ensure that they are reachable on both phone and email 24/7.
- Ensure that they have internet access 24/7.
- Attend to any website/seismic event enquiries related to the project received on the phone and email from the stakeholders 24/7.
- Login remotely to the system and actively assess the seismic information which has been queried.
- Respond to the stakeholders as soon as possible with the verified information, preferably on both phone and email and alert the project leader of the query.
- Alert the relevant technical personnel of any station outages.



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What did we achieve?

Enhanced GIS based website





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The earthquake information published on this website provides automated assessment of the earthquake parameters. Viewers of the Website are cautioned that the parameters shown are considered preliminary, unless otherwise indicated.

Users are cautioned that the intended purpose and use is exclusively for information and that the Council for Geoscience and Mine Health and Safety Council do not accept liability arising from use of or inferences made from the information as published on this Website.

☐ I agree to the above terms and conditions

OK

Move mouse to get coordinates

6km

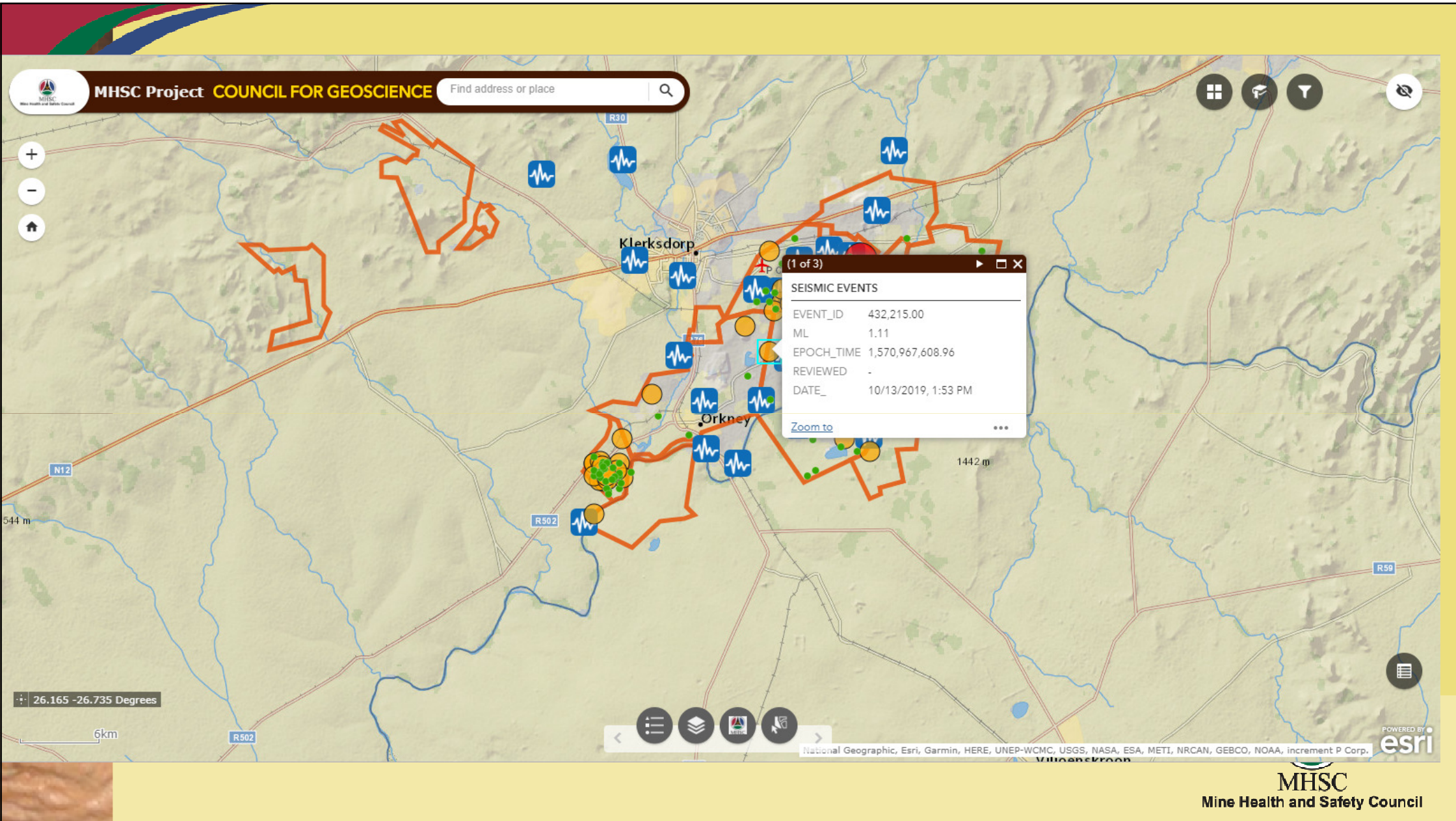
R502

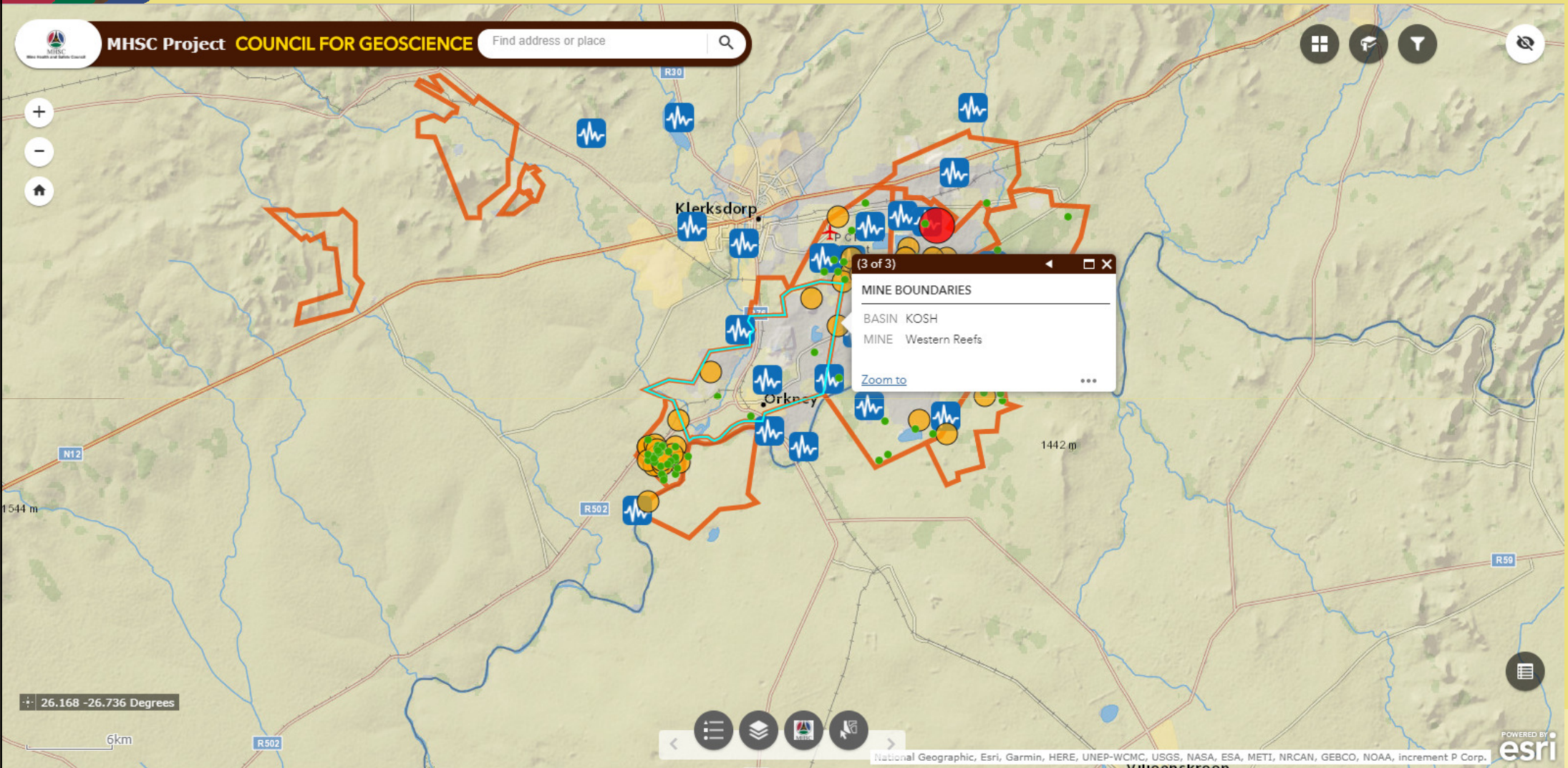
R50



National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, IGN, etc.

App State
Click to restore the map extent and layers visibility where you left off.







26.400 -26.857 Degrees
3km



National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp.



Klerksdorp

P.C. FELSER
AIRPORT

Orkney

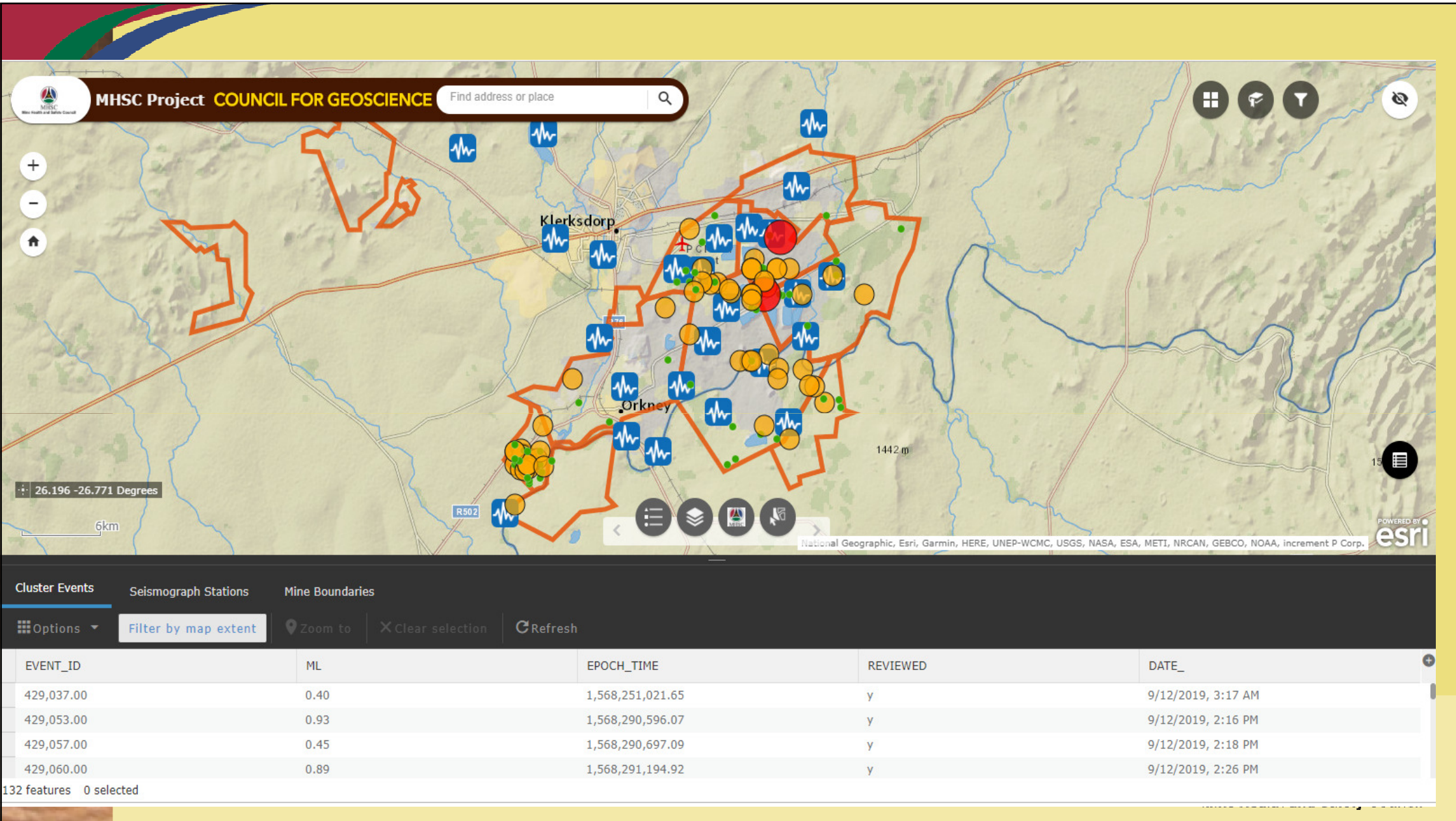
1442 m

(1 of 2)

STATION

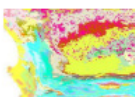
CODE	AGHS - KO
NAME	Anglo Gold Ashanti - Health&Safety Office, KOSH
NETWORK	KO

[Zoom to](#)





Basemap Gallery



RSA1M
GeologyBaseMap



OpenStreetMap



Imagery



Streets



National
Geographic

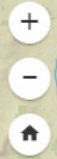
26.340 -26.695 Degrees

6km



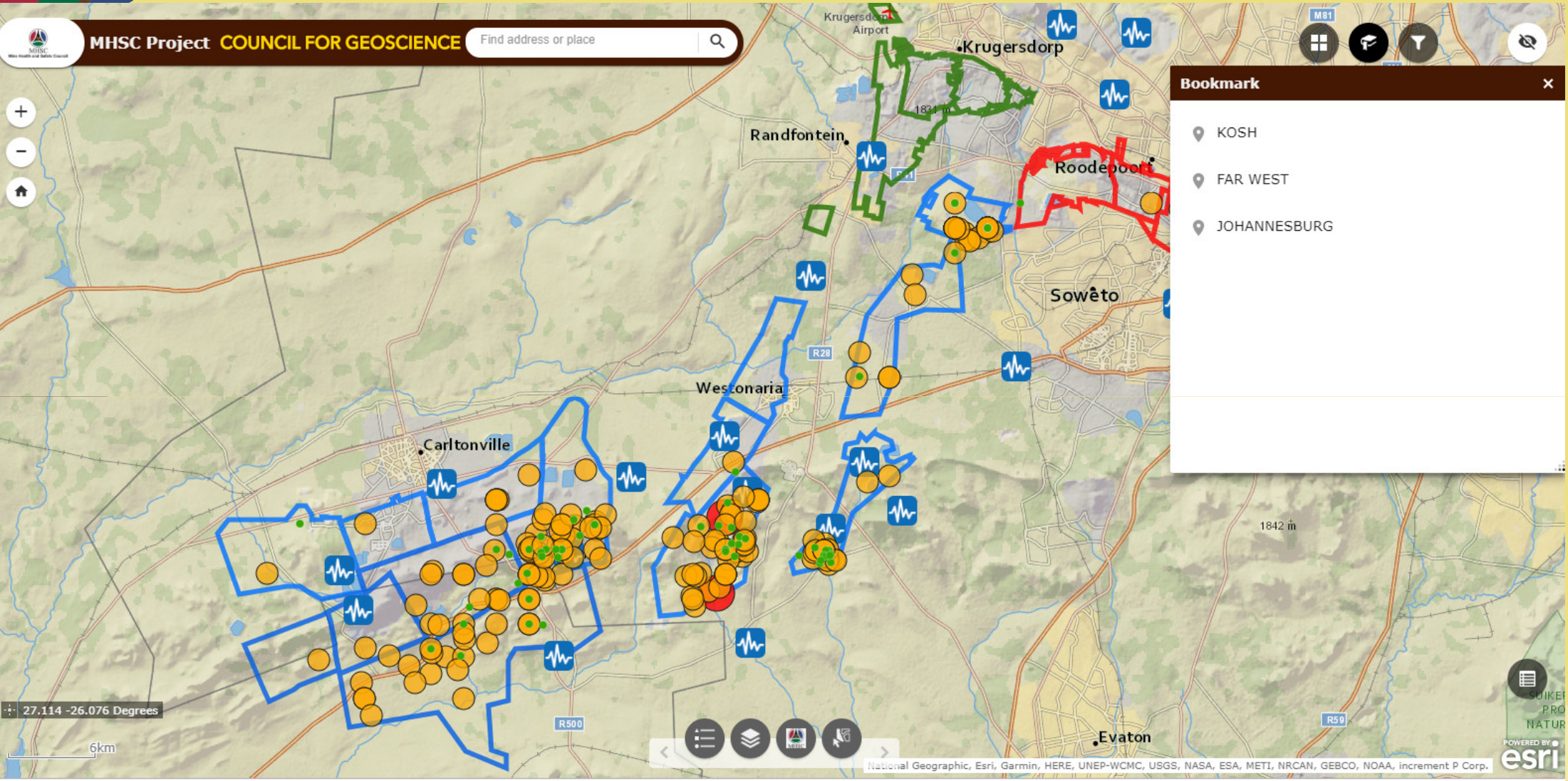
National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp.





27.114 -26.076 Degrees

6km



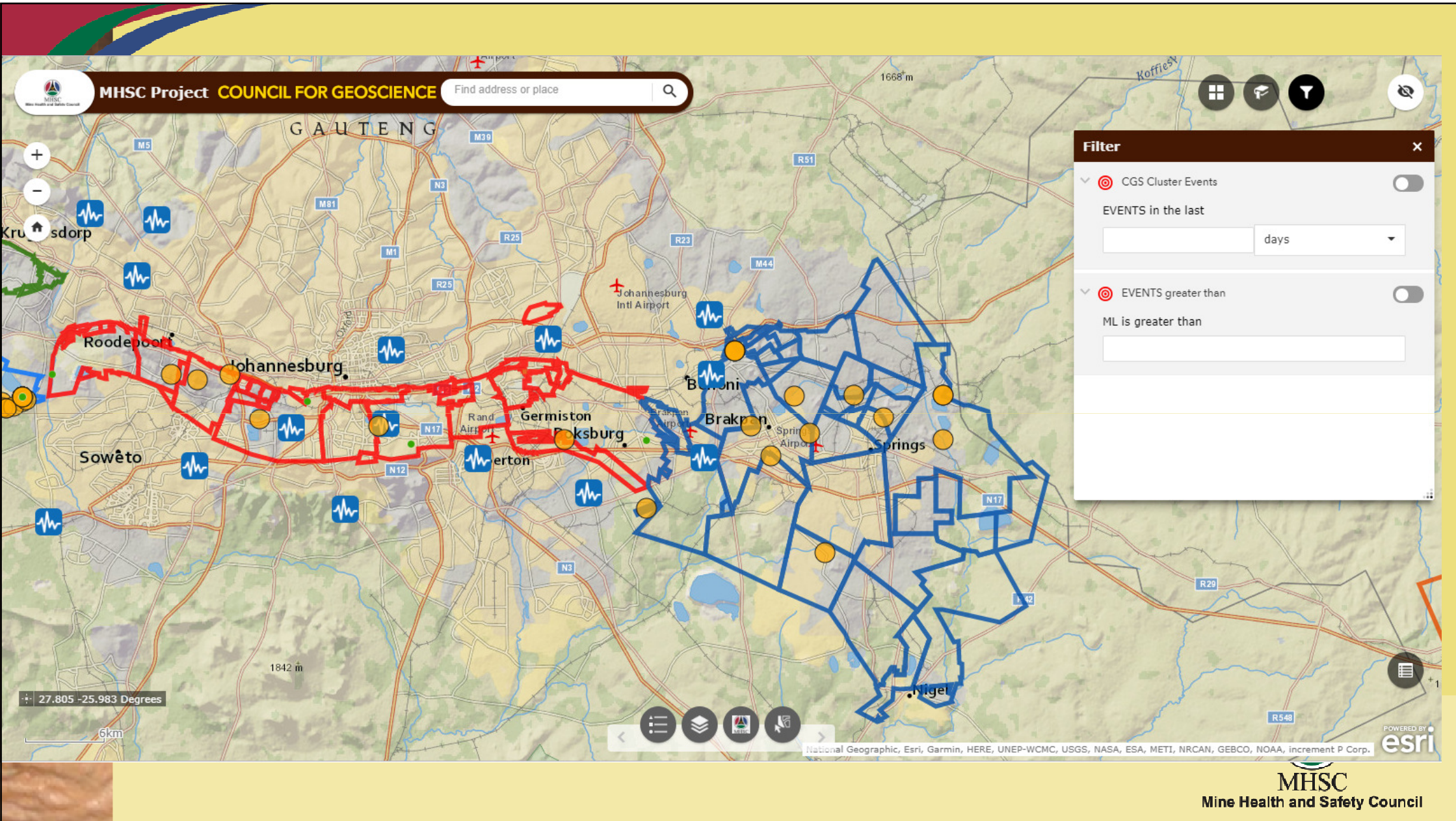
Bookmark

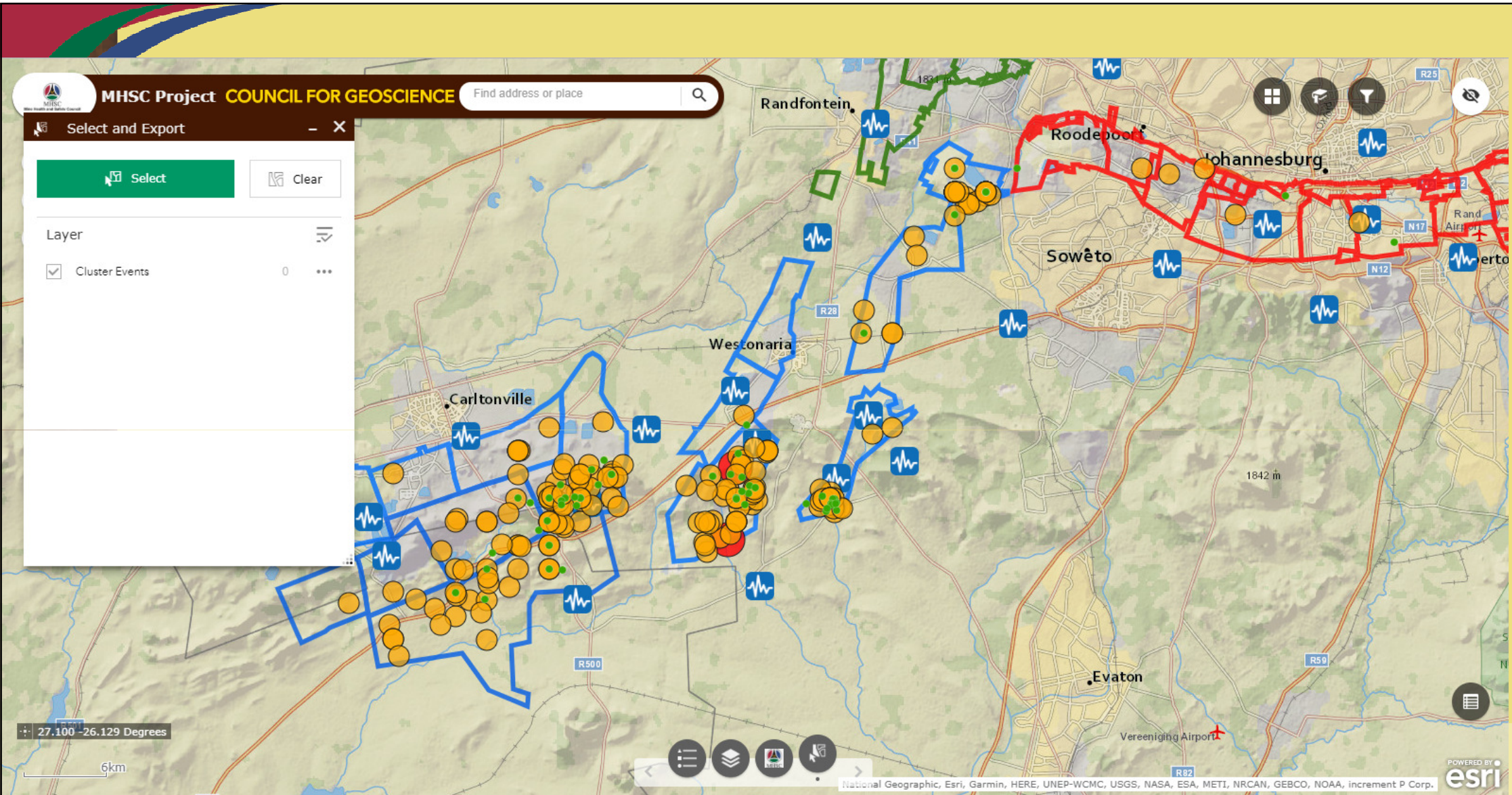
- KOSH
- FAR WEST
- JOHANNESBURG

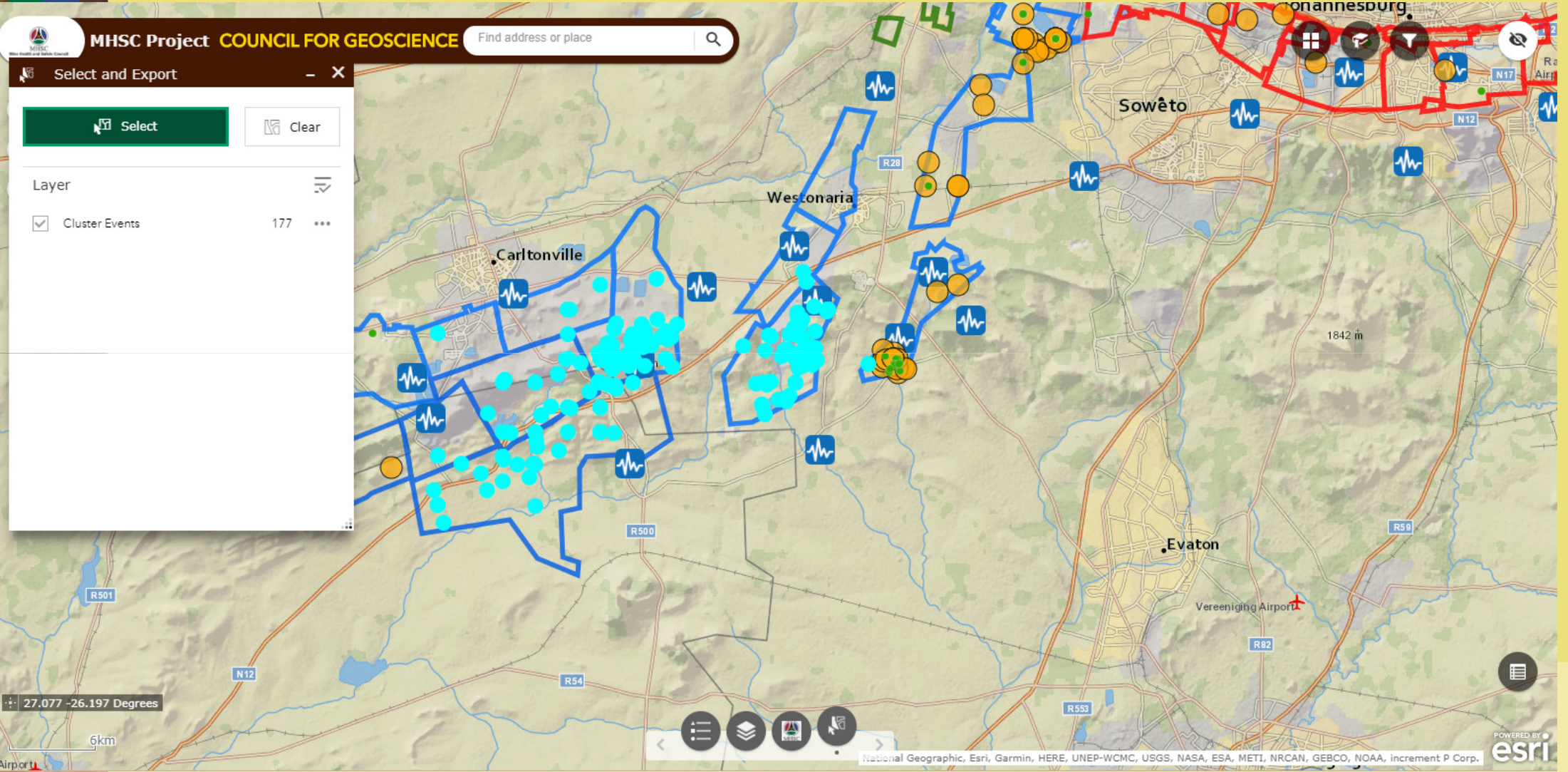


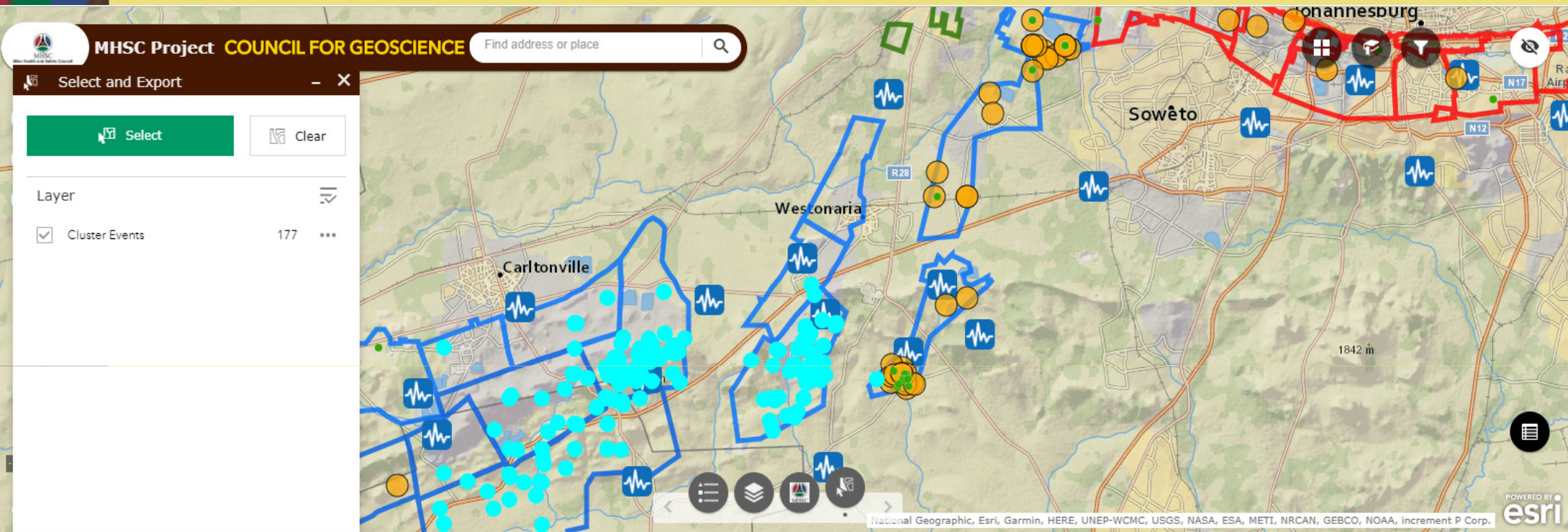
National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp.











Cluster Events Seismograph Stations Mine Boundaries

Options ▾

Filter by map extent

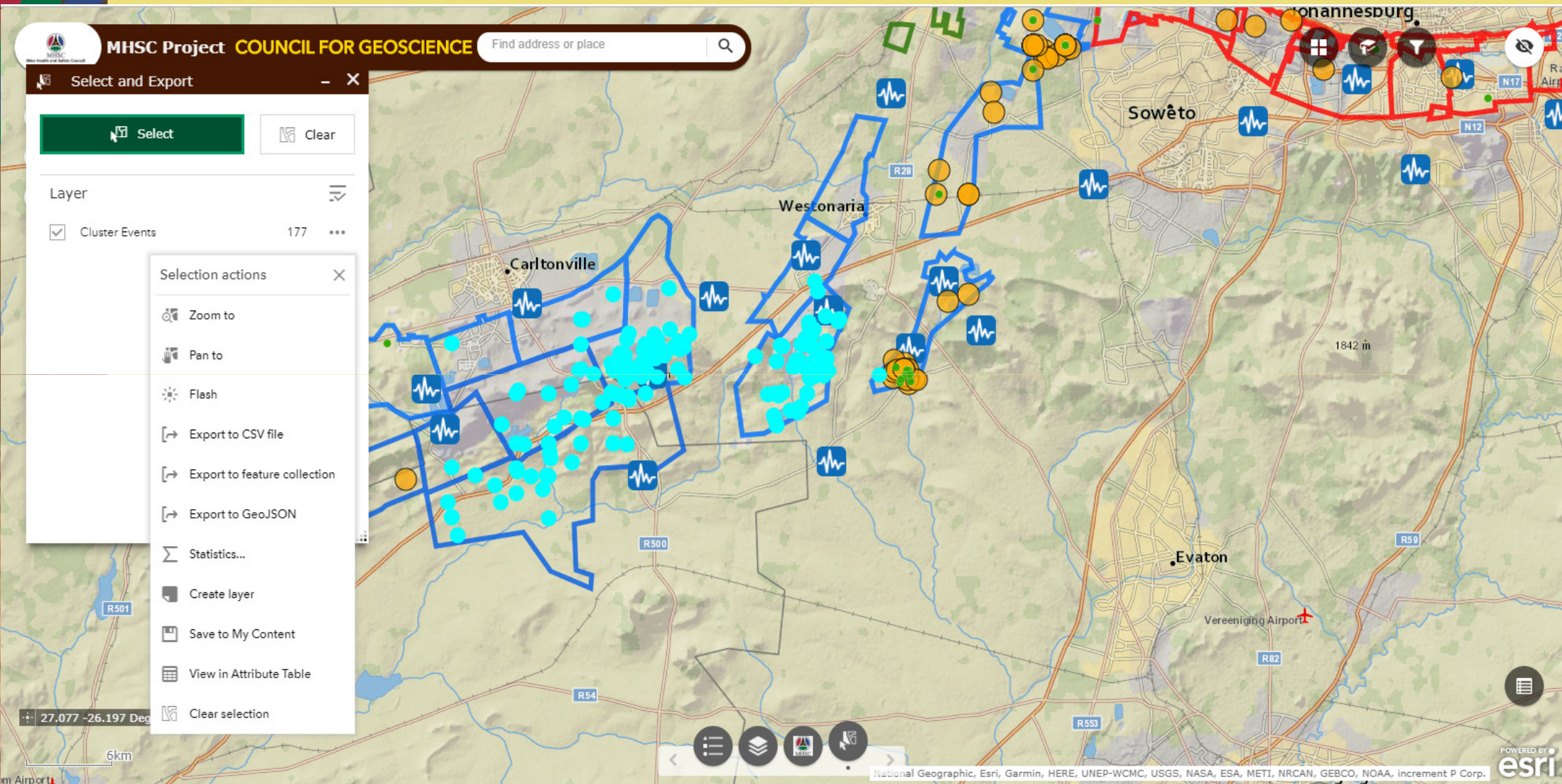
Zoom to

✕ Clear selection

↻ Refresh

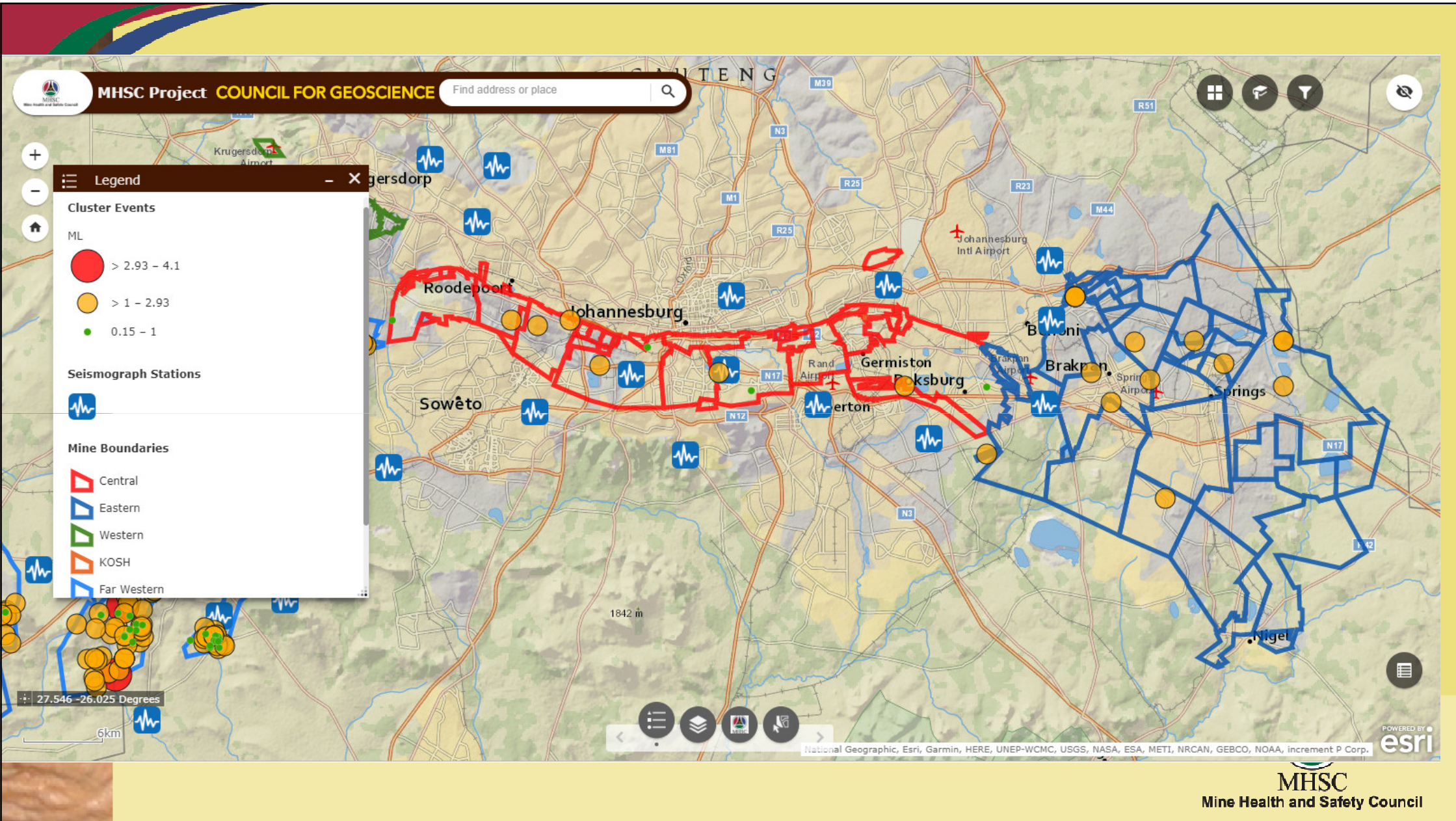
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430,342.00	2.10	1,568,240,573.09	y	9/12/2019, 12:22 AM
429,034.00	0.71	1,568,247,117.59	y	9/12/2019, 2:11 AM
429,048.00	1.09	1,568,288,769.45	y	9/12/2019, 1:46 PM

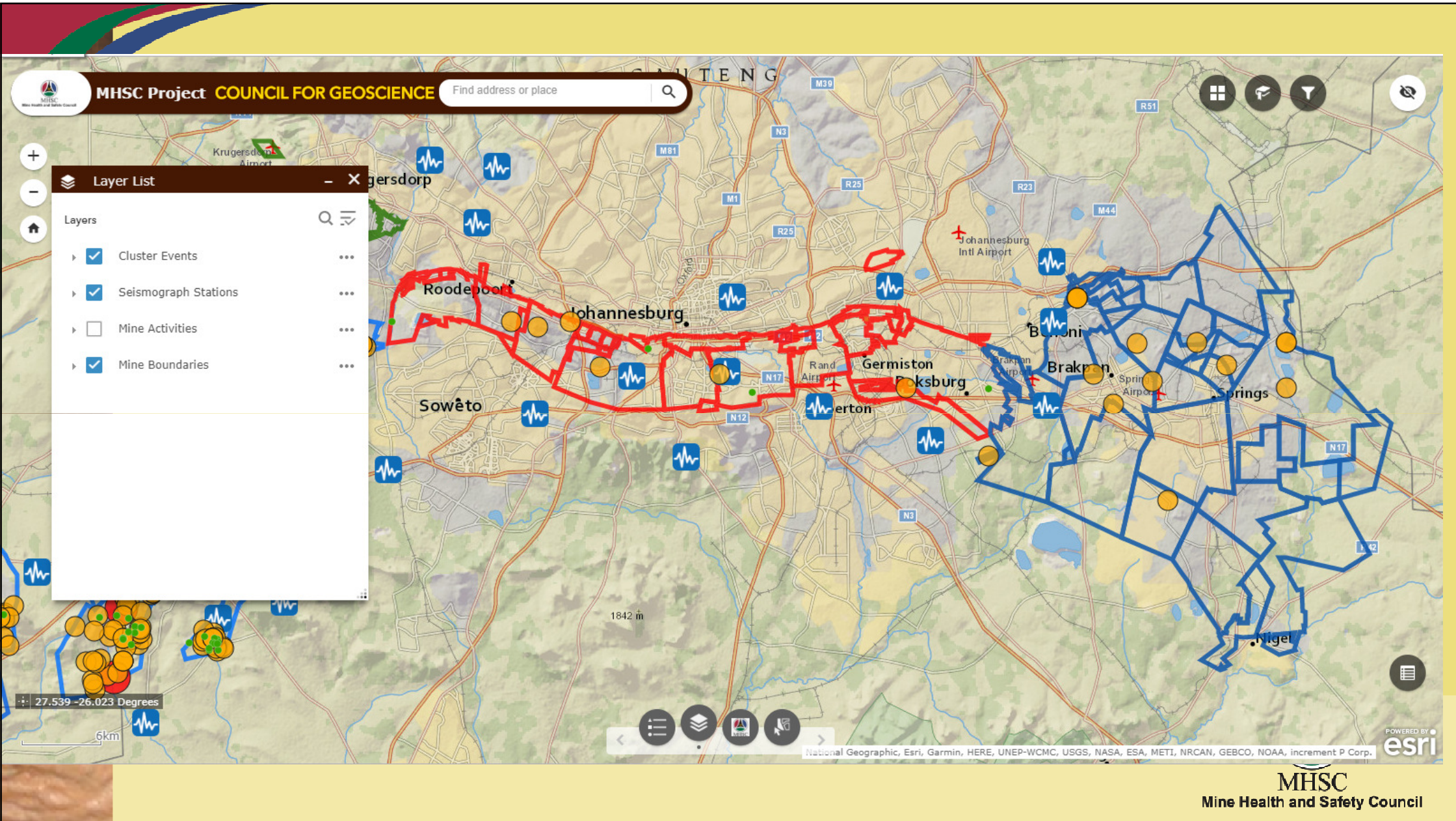
176 features 176 selected



OBJECTID	EVENT_ID	ML	LON	LAT	EPOCH_T	REVIEWED	DATE_	x	y	wkid
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2	430,342.00	2.1	27.45	-26.47	1,568,240	y	9/12/2019	3055420	-3057758	102100
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13	429,115.00	1.52	27.62	-26.39	1,568,307	y	9/12/2019	3074299	-3047552	102100
14	429,124.00	1.73	27.59	-26.45	1,568,309	y	9/12/2019	3071405	-3054948	102100
17	430,568.00	1.56	27.61	-26.42	1,568,360	y	9/13/2019	3074021	-3051355	102100
18	429,165.00	1.87	27.63	-26.39	1,568,360	y	9/13/2019	3076181	-3046918	102100
19	429,203.00	1.15	27.48	-26.42	1,568,391	y	9/13/2019	3058692	-3050697	102100
20	429,205.00	1.13	27.51	-26.42	1,568,391	y	9/13/2019	3062032	-3051181	102100
23	429,221.00	1.7	27.49	-26.43	1,568,408	y	9/13/2019	3059817	-3052908	102100
25	429,229.00	1.6	27.63	-26.41	1,568,421	y	9/14/2019	3075279	-3049714	102100
28	429,253.00	0.77	27.61	-26.4	1,568,435	y	9/14/2019	3073264	-3048695	102100
30	429,265.00	2.67	27.52	-26.4	1,568,441	y	9/14/2019	3063757	-3048459	102100
31	431,155.00	1.2	27.44	-26.45	1,568,454	y	9/14/2019	3054785	-3054351	102100
33	429,316.00	1.77	27.61	-26.41	1,568,472	y	9/14/2019	3073153	-3049876	102100
36	429,336.00	1.24	27.49	-26.43	1,568,479	y	9/14/2019	3059761	-3052685	102100
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42	429,354.00	1.6	27.59	-26.44	1,568,496	y	9/14/2019	3071160	-3054152	102100
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46	431,357.00	1.04	27.62	-26.38	1,568,512	y	9/15/2019	3075179	-3046496	102100
47	429,366.00	1.55	27.45	-26.42	1,568,543	y	9/15/2019	3055364	-3051778	102100
48	429,375.00	1.38	27.62	-26.39	1,568,552	y	9/15/2019	3074110	-3047888	102100
50	429,417.00	1.41	27.45	-26.46	1,568,646	-	9/16/2019	3056098	-3056291	102100
59	429,568.00	2.11	27.41	-26.46	1,568,732	y	9/17/2019	3051044	-3056278	102100
64	429,636.00	1.37	27.45	-26.38	1,568,798	-	9/18/2019	3056120	-3046732	102100
65	429,691.00	1.37	27.48	-26.41	1,568,823	-	9/18/2019	3058637	-3050560	102100
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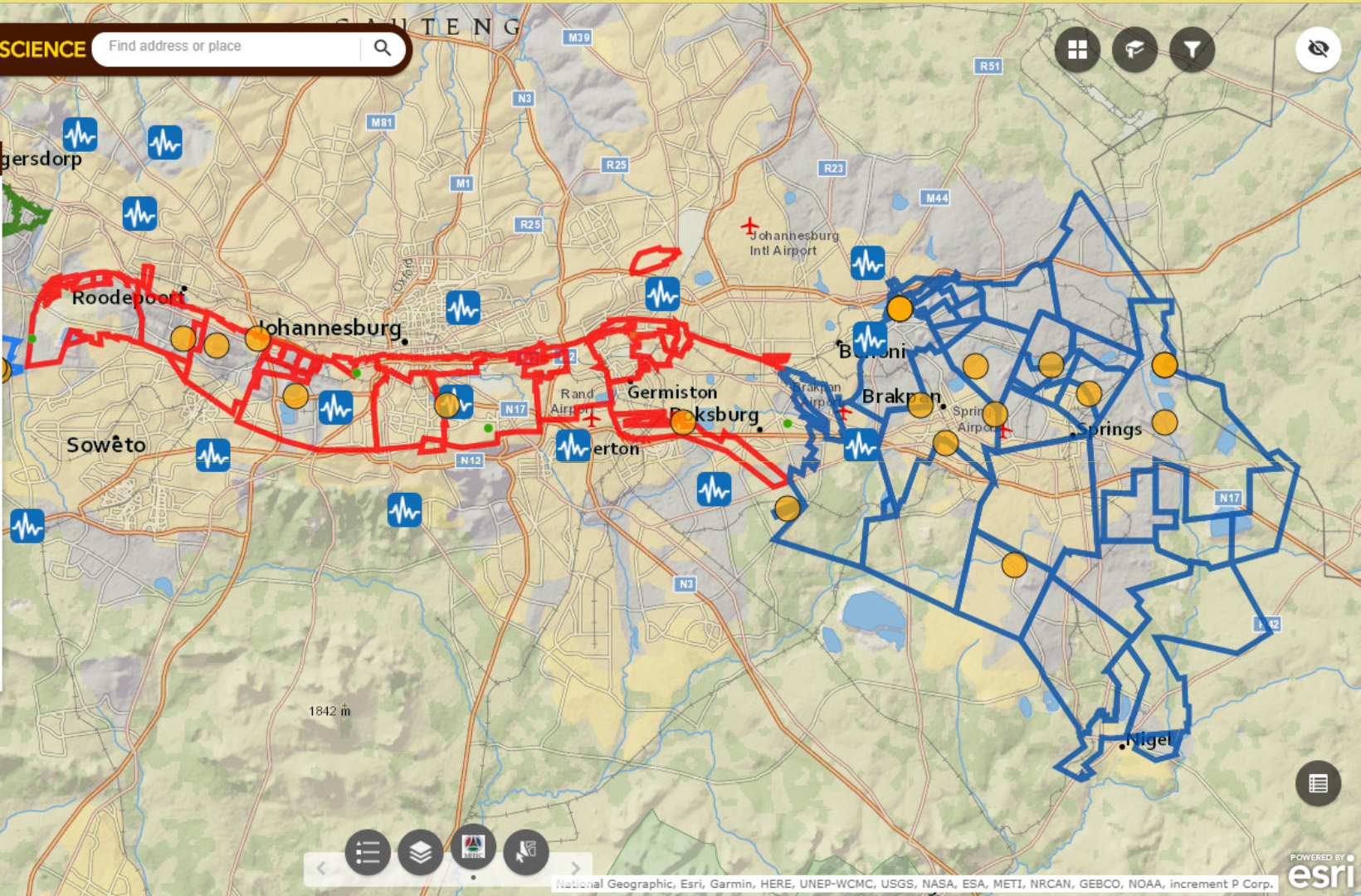


Procedures

Standard Operating Procedures

Operating Procedures for utilising the website of seismic events

This document is a reference document on the guidelines for utilising the website of seismic events and the procedures when lodging an enquiry.



27.518 -26.027 Degrees

6km



National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp.

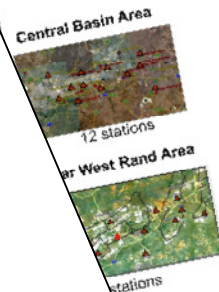


What did we achieve?

Standard operating procedures

Standard Operating Procedures for utilising the website of seismic events

Document Version: 01
Date: 23 October 2019



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What is the way forward?

It is recommended that the suggestions received from the stakeholders be considered during a second phase of the project.

However, the overarching recommendations from the stakeholders are:

- Increase the number of stations within the network to include other regions.
- Assess the improvements in location abilities with respect to those of the mining networks.
- Launch the website in real time.

In order to fully test the usefulness and functionality of the 24/7 monitoring and verification function, the CGS recommends a minimum of 6 months of operating at 24/7.



Conclusions

- Generally all participants and respondents of the workshops, meetings and surveys were very supportive of the project as a whole and felt that it could **benefit government, industry and employees.**
- In fact, they have also suggested that similar networks be implemented in other mining regions.



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Thank you



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