

About GPFA-AB_Risk_Factors Tier 2 Submission

DE-EE0006726, Low Temperature Geothermal Play Fairway Analysis for the Appalachian Basin

Abstract: This folder contains information used to compute the risk factors for the GPFA-AB project. The risk factors are natural reservoir quality, thermal resource quality, potential for induced seismicity, and utilization. The methods used to combine the risk factors included taking the product, sum, and minimum of the four risk factors.

The files are divided into images, rasters, shapefiles, and supporting information. The image files show what the raster and shapefiles should look like. The raster files contain the input risk factors, calculation of the scaled risk factors, and calculation of the combined risk factors. The shapefiles include definition of the fairways, definition of the US Census Places, the center of the raster cells, and locations of industries. Supporting information contains details of the calculations or processing used in generating the files. An image of the raster will have the same name except *.png as the file ending instead of *.tif. Images with “fairways” or “industries” added to the name are composed of a raster with the relevant shapefile added.

More details on each file are given in the spreadsheet “list_of_contents.csv” in the folder “Supporting_Information”.

Code used to calculate values is available at https://github.com/calvinwheaton/geothermal_pfa under the folder “combining_metrics”.

Key Words: Appalachian Basin, West Virginia, New York, Pennsylvania, district heating, low-temperature geothermal, combined risk segment map, geothermal play fairway analysis.

Citation: When referencing this data, please use the following:

Title: GPFA-AB_Phase1RiskAnalysisTask5DataUpload

Authors: Calvin A. Wheaton, Jared D. Smith, Kelydra Welcker

Date: October 2015

Contents of Submission:

File	Folder	Size
co_3_0_3_m_egs.tif	Rasters	4 MB
co_3_0_3_m_geo.tif	Rasters	4 MB
co_3_0_3_m.tif	Rasters	4 MB
co_3_0_9_s_egs.tif	Rasters	4 MB
co_3_0_9_s_geo.tif	Rasters	4 MB
co_3_0_12_s.tif	Rasters	4 MB
co_3_0_27_p_egs.tif	Rasters	4 MB
co_3_0_27_p_geo.tif	Rasters	4 MB
co_3_0_81_p.tif	Rasters	4 MB

co_5_0_5_m_egs.tif	Rasters	4 MB
co_5_0_5_m_geo.tif	Rasters	4 MB
co_5_0_5_m.tif	Rasters	4 MB
co_5_0_15_s_egs.tif	Rasters	4 MB
co_5_0_15_s_geo.tif	Rasters	4 MB
co_5_0_20_s.tif	Rasters	4 MB
co_5_0_125_p_egs.tif	Rasters	4 MB
co_5_0_125_p_geo.tif	Rasters	4 MB
co_5_0_625_p.tif	Rasters	4 MB
co_pfa_sd3_p_geo.tif	Rasters	4 MB
co_pfa_sd3_s_geo.tif	Rasters	4 MB
co_pfa_sd5_p_geo.tif	Rasters	4 MB
co_pfa_sd5_s_geo.tif	Rasters	4 MB
co_pfa_var3_p_geo.tif	Rasters	4 MB
co_pfa_var3_s_geo.tif	Rasters	4 MB
co_pfa_var5_p_geo.tif	Rasters	4 MB
co_pfa_var5_s_geo.tif	Rasters	4 MB
re_3_0_3_NA.tif	Rasters	4 MB
re_5_0_5_NA.tif	Rasters	4 MB
re_pfa_sd3.tif	Rasters	4 MB
re_pfa_sd5.tif	Rasters	4 MB
re_pfa_var3.tif	Rasters	4 MB
re_pfa_var5.tif	Rasters	4 MB
se_3_0_3_a.tif	Rasters	4 MB
se_5_0_5_a.tif	Rasters	4 MB
se_pfa_sd3.tif	Rasters	4 MB
se_pfa_sd5.tif	Rasters	4 MB
se_pfa_var3.tif	Rasters	4 MB
se_pfa_var5.tif	Rasters	4 MB
seEq_3_0_3_NA.tif	Rasters	4 MB
seEq_5_0_5_NA.tif	Rasters	4 MB
seEq_pfa_sd3.tif	Rasters	4 MB
seEq_pfa_sd5.tif	Rasters	4 MB
seEq_pfa_var3.tif	Rasters	4 MB
seEq_pfa_var5.tif	Rasters	4 MB
seSt_3_0_3_NA.tif	Rasters	4 MB
seSt_5_0_5_NA.tif	Rasters	4 MB
seSt_pfa_sd3.tif	Rasters	4 MB
seSt_pfa_sd5.tif	Rasters	4 MB
seSt_pfa_var3.tif	Rasters	4 MB

seSt_pfa_var5.tif	Rasters	4 MB
th_3_0_3_NA.tif	Rasters	4 MB
th_5_0_5_NA.tif	Rasters	4 MB
th_pfa_sd3.tif	Rasters	4 MB
th_pfa_sd5.tif	Rasters	4 MB
th_pfa_var3.tif	Rasters	4 MB
th_pfa_var5.tif	Rasters	4 MB
ut0_3_0_3_NA.tif	Rasters	4 MB
ut0_5_0_5_NA.tif	Rasters	4 MB
ut5_3_0_3_NA.tif	Rasters	4 MB
ut5_5_0_5_NA.tif	Rasters	4 MB
co_3_0_3_m_fairways.png	Images	844 KB
co_3_0_3_m_geo_fairways.png	Images	862 KB
co_3_0_3_m_geo_industries_fairways.png	Images	999 KB
co_3_0_3_m_geo_industries.png	Images	897 KB
co_3_0_9_s_geo_fairways.png	Images	866 KB
co_3_0_9_s_geo_industries_fairways.png	Images	1 MB
co_3_0_9_s_geo_industries.png	Images	901 KB
co_3_0_12_s_fairways.png	Images	855 KB
co_3_0_27_p_geo_fairways.png	Images	857 KB
co_3_0_27_p_geo_industries_fairways.png	Images	993 KB
co_3_0_27_p_geo_industries.png	Images	890 KB
co_3_0_81_p_fairways.png	Images	847 KB
co_5_0_5_m_fairways.png	Images	861 KB
co_5_0_5_m_geo_fairways.png	Images	890 KB
co_5_0_5_m_geo_industries_fairways.png	Images	1 MB
co_5_0_5_m_geo_industries.png	Images	911 KB
co_5_0_15_s_geo_fairways.png	Images	890 KB
co_5_0_15_s_geo_industries_fairways.png	Images	1 MB
co_5_0_15_s_geo_industries.png	Images	923 KB
co_5_0_20_s_fairways.png	Images	869 KB
co_5_0_125_p_geo_fairways.png	Images	888 KB
co_5_0_125_p_geo_industries_fairways.png	Images	1 MB
co_5_0_125_p_geo_industries.png	Images	921 KB
co_5_0_625_p_fairways.png	Images	868 KB
co_3_0_3_m_egs.png	Images	761 KB
co_3_0_3_m_geo.png	Images	754 KB
co_3_0_3_m.png	Images	735 KB
co_3_0_9_s_egs.png	Images	829 KB
co_3_0_9_s_geo.png	Images	760 KB

co_3_0_12_s.png	Images	745 KB
co_3_0_27_p_egs.png	Images	780 KB
co_3_0_27_p_geo.png	Images	749 KB
co_3_0_81_p.png	Images	738 KB
co_5_0_5_m_egs.png	Images	789 KB
co_5_0_5_m_geo.png	Images	770 KB
co_5_0_5_m.png	Images	751 KB
co_5_0_15_s_egs.png	Images	848 KB
co_5_0_15_s_geo.png	Images	782 KB
co_5_0_20_s.png	Images	760 KB
co_5_0_125_p_egs.png	Images	805 KB
co_5_0_125_p_geo.png	Images	781 KB
co_5_0_625_p.png	Images	760 KB
co_pfa_sd3_p_geo.png	Images	867 KB
co_pfa_sd3_s_geo.png	Images	865 KB
co_pfa_sd5_p_geo.png	Images	869 KB
co_pfa_sd5_s_geo.png	Images	865 KB
co_pfa_var3_p_geo.png	Images	839 KB
co_pfa_var3_s_geo.png	Images	857 KB
co_pfa_var5_p_geo.png	Images	847 KB
co_pfa_var5_s_geo.png	Images	857 KB
re_3_0_3_NA.png	Images	755 KB
re_5_0_5_NA.png	Images	770 KB
re_pfa_sd3.png	Images	792 KB
re_pfa_sd5.png	Images	785 KB
re_pfa_var3.png	Images	788 KB
re_pfa_var5.png	Images	785 KB
se_3_0_3_a.png	Images	944 KB
se_5_0_5_a.png	Images	1.1 MB
se_pfa_sd3.png	Images	1.8 MB
se_pfa_sd5.png	Images	1.9 MB
se_pfa_var3.png	Images	1.9 MB
se_pfa_var5.png	Images	1.9 MB
seeq_3_0_3.png	Images	763 KB
seeq_5_0_5.png	Images	799 KB
seeq_sd3.png	Images	934 KB
seeq_sd5.png	Images	878 KB
seeq_var3.png	Images	959 KB
seeq_var5.png	Images	922 KB
sest_3_0_3.png	Images	1 MB

sest_5_0_5.png	Images	1.2 MB
sest_sd3.png	Images	1.8 MB
sest_sd5.png	Images	1.8 MB
sest_var3.png	Images	1.9 MB
sest_var5.png	Images	1.9 MB
th_3_0_3_NA.png	Images	735 KB
th_5_0_5_NA.png	Images	764 KB
th_pfa_sd3.png	Images	1.2 MB
th_pfa_sd5.png	Images	1.2 MB
th_pfa_var3.png	Images	1.1 MB
th_pfa_var5.png	Images	1.1 MB
ut0_3_0_3_NA.png	Images	768 KB
ut0_5_0_5_NA.png	Images	784 KB
ut5_3_0_3_NA.png	Images	789 KB
ut5_5_0_5_NA.png	Images	810 KB
Industries	Shapefiles	178 KB
Inner_Fairway	Shapefiles	9 KB
Outer_Fairway	Shapefiles	9 KB
Places_of_Interest	Shapefiles	11 KB
Raster_Center_Locations	Shapefiles	134.2 MB
usCensusPlaces	Shapefiles	4.3 MB
GPFA-AB_combining_risk_factors.pdf	SupportingInfo	41.2 MB
list_of_contents.csv	SupportingInfo	16 KB

Sources: Primary sources of information referenced in preparation of this submission include:

See details in the following report. Most of the files are derived from the methods outlined in that document.

Low Temperature Geothermal Play Fairway Analysis for the Appalachian Basin: Final Phase 1 Research Report, U.S. Dept. of Energy Award No. DE-EE0006726. Principal Investigator Teresa Jordan. Submitted Oct. 16, 2015

Special Use Considerations:

The combined maps were calculated using R version 2.15.1 (2012-06-22, “Roasted Marshmallows”, The R Foundation for Statistical Computing) and packages sp, raster, rgdal, rasterVis, maps, maptools, xlsx, rgeos, RColorBrewer, and pracma.

Methods of Calculations and Assumptions:

The detailed calculations for risk factors are outlined in the document “GPFA-AB_combining_risk_factors.pdf” in the “Supporting_Information” folder. More information on the overall calculations required to obtain the input risk factors are available in the report:

Last Updated: October 28, 2015

About_GPFA-AB_Phase1RiskAnalysisTask5DataUpload.pdf

Low Temperature Geothermal Play Fairway Analysis for the Appalachian Basin: Final Phase 1 Research Report, U.S. Dept. of Energy Award No. DE-EE0006726. Principal Investigator Teresa Jordan. Submitted Oct. 16, 2015.

In all of the maps, red represents unfavorable conditions and green represents favorable conditions. Coloring of the rasters depends on whether there are 4 or 6 values given in the spreadsheet. If there are 4 values, then red regions are between the first and second thresholds, yellow regions are between second and third thresholds, and green regions are between the third and fourth thresholds. If there are 6 values, then red regions are between the first and second thresholds, orange regions are between the second and third thresholds, yellow regions are between the third and fourth thresholds, yellow-green regions are between fourth and fifth thresholds, and green regions are between the fifth and sixth thresholds. Values less than zero should be considered to have no data. For example, if the thresholds listed on the spreadsheet are “0,1,8,27”, then [0,1] would be red, (1,8] would be yellow, and (8,27] would be green.

The combined maps (begin with “co_*) are evaluated only when all of the risk factors in the calculation are defined for that raster cell. If there is missing information for any risk factor it is not given a color.

Code used to calculate values is available at https://github.com/calvinwheaton/geothermal_pfa under the folder “combining_metrics”.

Acknowledgement: The information, data, or work presented herein was funded in part by the Office of Energy Efficiency and Renewable Energy (EERE), U.S. Department of Energy, under Award Number DE- DE-EE0006726.

Disclaimer: “The information, data, or work presented herein was funded in part by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.”