Alaska Prioritization and Future Studies Sequencing Decision Support System

Overview

The Alaska Prioritization and Future Studies Sequencing Decision Support System is a ranking methodology intended to provide relative comparisons between watersheds based on a number of normalized factors in the State of Alaska. It provides an analysis of information gathered on a local, state, and nationwide basis to provide a prioritization list of Alaskan watersheds to be studied under FEMA's Risk MAP Program. The term "county" used throughout this report is synonymous with the State of Alaska's "borough" and "census area" classifications.

Building upon the concept of the Risk MAP 'trifecta' approach employed in the Fiscal Year 2011 (FY11) Algorithm, this solution incorporates several additional datasets, grouping them by type, and allowing users to assign customized weighting to each of the contributing factors. While the FY11 algorithm compares absolute values of one watershed to absolute values of another watershed for Flood Risk, Need and Topographic Coverage, this new approach leverages state and local considerations based on community input to develop a ranking of Hydrologic Unit Code (HUC) 8 watersheds within Alaska. It considers the local preferences for prioritization, such as climatological change, local hazard mitigation plans, planned future development, coastal exposure, etc. Special considerations are given to communities with plans in need of updating and with an expressed interest in plan improvement or development.

A total of sixteen (16) Indicators have been considered. Individual indicators have been grouped into one of the following three factors: Flood Risk, Needs, and Action Potential. The system is built in a robust and user-friendly environment that allows users to modify the contribution of each factor (or each indicator) based on local knowledge and preference.

Instructions for viewing and modifying the weights for the various ranking factors are embedded in the spreadsheet tool provided with this document.

Acquired/Standardized Data

Various datasets were identified, collected, assembled, and analyzed through the process. Data was obtained from different sources, such as federal, regional, and state agencies, as well as local communities. The focus of this effort was to collect the best available and most up-to-date data to optimize the accuracy of the information used in the decision making process. The table below provides a detailed list of datasets which were used in the prioritization process.

Each indicator was classified into one of three factors: Flood Risk, Needs, and Action Potential. These factors, as well as individual indicators, were incorporated into the algorithm after normalization by population or area weighting at the HUC8 level. This is critical when comparing watersheds as it allows for a fair comparison between entities when population numbers and total areas are different from one to another. This evaluation is performed primarily at the HUC8 level.

Factor	Indicator	Source	Data Collected Date	Resolution	Notes
Flood Risk	AAL	FEMA National Discovery Data Repository	June 2011	Nation-wide data on FIPS level	Not available for Alaska
	Population	FEMA	2010	Census blocks	
Needs	CNMS	FEMA (STARR)	Oct. 2010	Region-wide data on stream level	No complete dataset for Alaska available
	Coastal Miles	FEMA		Borough / Census block	FY10 sequencing
	Topographic Coverage	State of Alaska FEMA	Nov. 2011 May, 2010	State-wide data on community level Nationwide data on community level.	
	Community Identified Needs	State of Alaska	Nov. 2011	State-wide data on community level	
	Climatologic Change	State of Alaska	Nov. 2011	State-wide data on community level	
	LOMCs	FEMA MSC	Nov 2011	State-wide data on lat., long level	
	Planned Future Development	State of Alaska	Nov. 2011	State-wide data on community level	
Action Potential	Mitigation Plans	State of Alaska FEMA	Nov. 2011 June, 2011	State-wide data on community level Nationwide data on community level	
	Interest in New Community Plans	State of Alaska	Nov. 2011	State-wide data on community level	
	CRS	FEMA CRS	Oct. 2011	Nationwide data on community level	
	Disaster Declarations	State of Alaska FEMA CRS	Nov. 2011 Aug. 2011	State-wide data on community level Nation-wide data on county level.	
	FIA	FEMA	Dec. 2009	Nationwide data on county level	
	Mitigation Grants	State of Alaska FEMA RSS	Nov. 2011 May. 2011	State-wide data on community level Nation-wide data on county level	
	In-House GIS	State of Alaska	Nov. 2011	State-wide data on community level	

Data Processing

The different types of data provided lend themselves to inclusion in a prioritization algorithm in different ways. To prepare the tables, decisions must be made on data type and normalization method – keeping in mind a consistent ranking method. For the purposes of this analysis we will assume that the lower the rank (1 being the lowest) the more likely a unit (FIPS, CID, HUC) is to be recommended for study (meaning it is considered a higher priority by our system). Since the goal is to make prioritization recommendations, each data table should evaluate how one unit compares to another for the factor described by that data table to the extent possible.

Area / Population weighting

Depending on the resolution of the contributing datasets, each indicator was first ranked at a watershed (HUC8), County (FIPS), or Community (CID) level. For factors that existed at a HUC8 watershed level, the factor rankings transferred directly to the master ranking scheme. For factors ranked at the county or community level, the appropriate area or population weighting was applied to the data such that counties / communities with a large percentage of their respective area in a given watershed would contribute more to that watershed's eventual ranking for that factor than would the ranking of counties / communities which barely had a footprint in the watershed. The majority of the datasets used are available by political boundaries (CID or FIPS) rather than at the watershed level. The abovementioned method of ranking HUC8 watersheds based on the area of "influence" of constituent counties / communities ensures that this transition from political boundaries to watershed boundaries is made in a meaningful manner without over- or under-representing the representative strength of the constituent counties / communities.

Considering Types of Data Inclusion – Rank vs. Binary

The data sets which have been collected can contribute to a prioritization calculation in one of two ways; they can either be used to provide a relative ranking for each unit (FIPS or CID depending on the data), or they can provide a binary YES/NO (1/0) for each unit. An example of data lending itself to ranking would be the FIA data, where each unit has its own unique set of attributes (in that case rep loss, properties, etc.). An example of data lending itself to binary inclusion would be the Climate Change table, where each community listed simply as a YES/NO. Much of the locally collected data was processed as a binary data set including Planned Future Development, Topographic Coverage, Community Identified Needs, Mitigation Plans, Interest in New Community Plans, Mitigation Grants, In-House GIS, IAID, and Climatological Change.

Risk Factor

- Average Annualized Loss (AAL) Rank

The AAL Rank is a ranking, by watershed, of the total AAL. This starts with a Rank of 1 being the watershed with the highest AAL dollar amount. However, no AAL data analysis was available for Alaska to use on this project. Therefore, all the watersheds had the same ranking and no weighting factor is applied to this indicator. When the AAL data becomes available in the future, the indicator can be introduced to the algorithm. With proper weighting factor, AAL could contribute to the Risk factor.

- Population Rank

Population Rank rates the highest population with a value of 1 to indicate that it is the most important, and increases in order to the watershed of lowest population.

Needs Factor

- Coordinated Needs Management Strategy (CNMS)

This ranking uses the CNMS inventory to compare mileages within each watershed, which are considered Non-NVUE. New, Validated, or Updated Engineering (NVUE) is the FEMA standard that provides a basis for assessing the engineering analysis used to develop flood elevations. FEMA developed the standard to help mapping partners determine where new study data should be collected, where updates to existing flood hazard data should be performed, and whether previously developed flood study data could still be considered valid. The Non-NVUE category is composed of all paper inventory study miles, as well as any modernized NOT VALID and REQUIRES ASSESSMENT mileage. Higher priority can be given to watersheds with more mileage in this category. The CNMS data for Alaska currently shows that ALL stream miles are Non-NVUE compliant, thus all watersheds will have the same rank for this indicator. Additionally, FEMA's contractor STARR indicated that the only streams currently included in CNMS for the State of Alaska are those currently in DFIRM format. This excludes a large number of streams and makes this dataset incomplete. When the CNMS data is updated and some distinctions between the watersheds can be made, this indicator can be introduced to the algorithm at that time. Ultimately, CNMS should contribute heavily to the Needs factor.

- Coastal Miles

Since the CNMS inventory only includes riverine mileages, a significant amount of coastal shoreline mileages within the state of Alaska are not considered. The Coastal Needs indicator addresses the needs of floodplain studies for coastal communities. The indicator ranks all watersheds based on the linear distance of coastline within a watershed as it relates to the overall area of coastal communities within the state. Higher priority is given to watersheds that include more coastal communities.

- Topographic Coverage Rank

Topographic data availability was part of the FY11 algorithm and is considered here as an action potential. Here watersheds are ranked based on the percentage of their area that are covered by available topographic coverage (discounting the 30m resolution National Elevation Dataset- NED), with a Rank of 1 representing the watershed(s) with the highest percentage of topographic coverage. The base NED product was discounted based on the National Academy's findings on floodplain analyses and quality elevation data and the associated applicability of this particular dataset.

- Community Identified Needs Rank

Community Identified Needs ranking is a weighted value representing the needs which were previously unidentified. Several communities have expressed the need for new or updated flood studies. Higher priority was given to communities that have identified such needs.

- Climatological Change Rank

This ranking utilizes local input to identify any significant climatological changes observed in a community. Several communities have reported hydrological impact caused by climatological changes, such as rising sea level, glacier recessions, flooding introduced by glacial dam breaches, melting of permafrost, etc.

This factor evaluates the relative area of a watershed where the impact of significant climatological changes was reported. The watersheds are ranked based on the percentage of their area with significant climatological changes.

- LOMC Rank

The Letters of Map Change (LOMC) ranking is a combined weighted value representing the presence and number of LOMCs within communities located in specific watersheds. Higher priority was given to watersheds including communities with greater numbers of processed LOMCs.

- Planned Future Development Rank

This ranking utilizes the local inputs to identify any planned future development in a community. It evaluates the area of planned future development within a watershed as it relates to the overall area within the State of Alaska. A rank of 1 indicates a watershed which has seen the highest percentage of area that has planned future development. This is considered a Need because the planned future development is an indicator of future urbanization where the new physical environment is no longer being represented appropriately in the engineering model and on the map.

Action Potential Factor

- Mitigation Plan Rank

The Mitigation Plan ranking is a weighted value indicating the presence of active mitigation plans within communities located in a watershed. Higher priority was given to those watersheds of which higher percentages of their respective areas included communities with mitigation plans in place.

- Interest in New Community Plans

The Interest in New Community Plans ranking is a weighted value indicating the willingness of communities to either update their plans or develop new community plans. Higher priority was given to watersheds of which higher percentages of their respective areas included communities with community plans in place.

- Community Rating System (CRS) Rank

The Community Rating System ranking is a combined weighted value representing the CRS rating of communities located in each of the watersheds. Higher priority was given to watersheds that included communities with a better overall CRS rating. In essence, communities that are more in compliance and have a better CRS rating will contribute positively to achieving the goals of Risk MAP.

- Disaster Declarations Rank

The Disaster Declarations ranking is a weighted value indicating the presence of communities within the watershed that have a history of declared flood disasters. Higher priority was given to watersheds that have more disaster declarations with the thought that communities that have had disasters declared are more likely to value and implement mitigation action to limit the scope of the impact in the future. It also provides a part of the outreach communications.

- FIA Rank

The Flood Insurance Administration (FIA) ranking is a combined weighted value representing claims, policies, repetitive loss, and repetitive loss properties intersecting the watersheds using a per capita, per unit area normalization. Higher priority was given to watersheds that included communities with high occurrences of these factors per capita per unit area.

- Mitigation Grants Rank

The Grants ranking is a combined weighted value representing presence of ongoing / recent studies within the communities or portions thereof within each of the watersheds. Higher priority was given to areas receiving greater mitigation grants. This is based on the assumption that because these communities have received mitigation funding recently, they could be more likely to improve their communities in other ways.

- In-House GIS Rank

The In-House GIS ranking is an indicator of the community's capability to participate in the Risk Map program. A community with a strong in-house GIS program and proper supporting staff is more likely to carry out relevant aspects of the Risk MAP program. Higher priority was been given to watersheds, which have the higher percentages of their areas intersecting communities with a confirmed In-House GIS program.

How to use the Prioritization and Future Studies Sequencing Decision Support System

Overview

The ***Alaska_Prioritization_Final.xlsx*** spreadsheet has eight tabs: Factor_Weights, HUC8_Rankings, Scenarios, HUC_Rank, HUC_Summary, AK_Master, State_data_Summary, and NFIP.

The "Factor_Weights" tab allows the users to adjust the weighting factors based on community preferences. Initially, all editable fields (colored yellow) have been set to recommended weights. Users have the ability to evaluate the relative importance of three factors of Risk, Needs, and Action potential. In addition, users can adjust each indicator under subgroups if desired. Changing values in this tab will result in a new watershed prioritization within the 'HUC8_Rankings' Tab.

The "HUC8_Rankings" tab provides a summary of HUC8 watershed's prioritization based on the user-specified weighting factors that are shown in the "WorkSheet" tab.

The "Scenarios" tab allows the user to capture certain weighting factor scenarios and compares the prioritization results side-by-side. Four pre-rendered scenarios are provided. The four scenarios are titled: Typical, Need Heavy, Risk Heavy, and Action Heavy with the most weight applied to their respective primary factor. The watershed rankings are conditionally formatted to allow for quick identification of high priority watersheds and can be sorted in a variety of ways.

Scenarios can be added using the instructions found within the “Adding Scenarios” section of this report. Both the “HUC_Summary” and “HUC_Rank” tabs show the rolled up summary watershed scores and rank tables resulting from the “AK_Master” analysis.

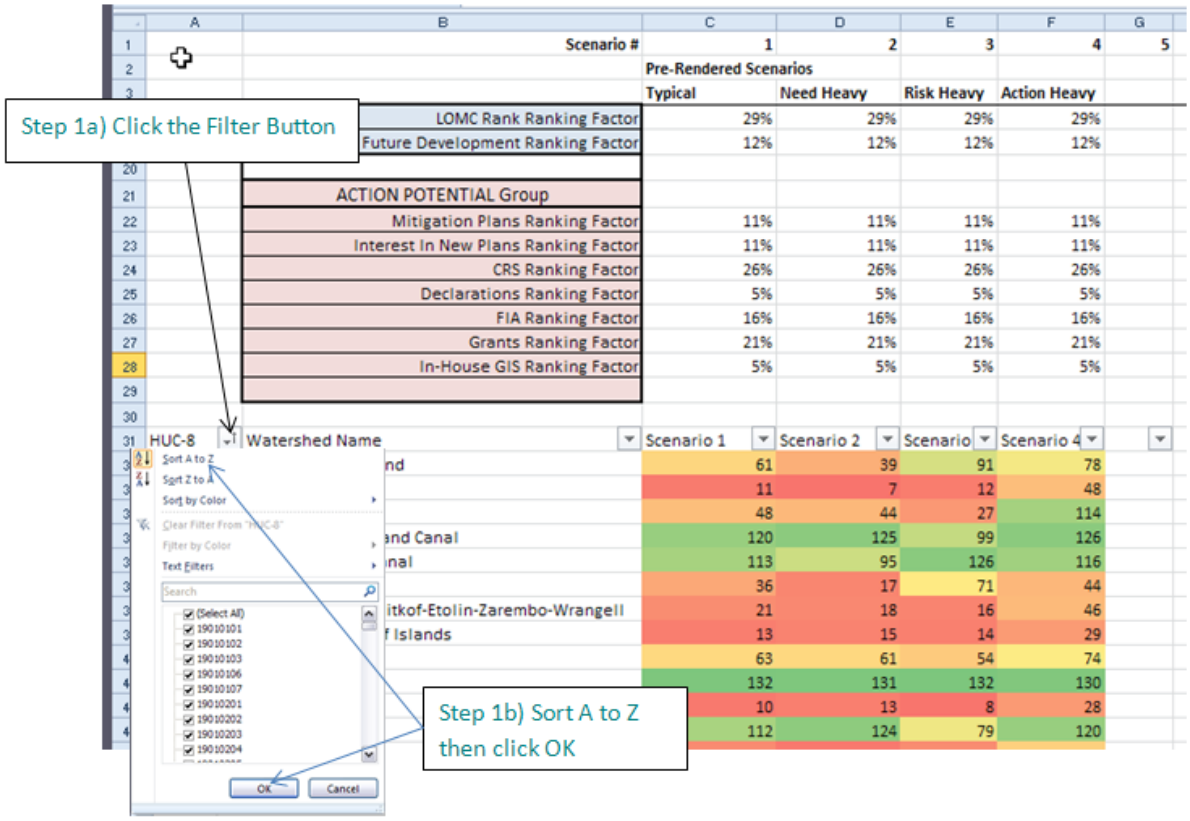
The “AK_Master” worksheet contains both the results of the GIS intersection of the Watershed, Community, FEMA borough, and Census boundaries as well as all of the required data manipulations to produce the required indicator scores.

The “State_data_Summary” worksheet contains the summary of the local data provided by those communities participating in the NFIP. It also contains the binary and relative ranking summary data for this local data used in the “AK_Master” worksheet.

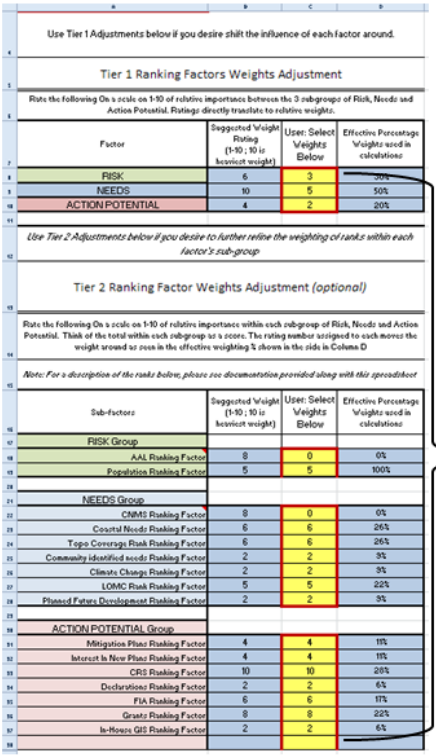
The “NFIP” worksheet summarizes the watershed rankings in relation to the NFIP participating community.

Adding Scenarios

Step 1: Ensure that the HUC-8 data and their respective rankings are sorted in ascending order. Clicking the filter tab button will generate a popup that will allow sorting in ascending order



Step 2 and 3) Adjust the weighting factors and copy them into the Scenario's work-tab to identify the weighting scheme for this particular scenario.



Use Tier 1 Adjustments below if you desire shift the influence of each factor around.

Tier 1 Ranking Factors Weights Adjustment

Rate the following On a scale on 1-10 of relative importance between the 3 subgroups of Risk, Needs and Action Potential. Ratings directly translate to relative weights.

Factor	Suggested Weight Rating (1-10 ; 10 is heaviest weight)	User: Select Weights Below	Effective Percentage Weights used in calculations
RISK	6	3	30%
NEEDS	10	5	50%
ACTION POTENTIAL	4	2	20%

Use Tier 2 Adjustments below if you desire to further refine the weighting of ranks within each factor's sub-group

Tier 2 Ranking Factor Weights Adjustment *(optional)*

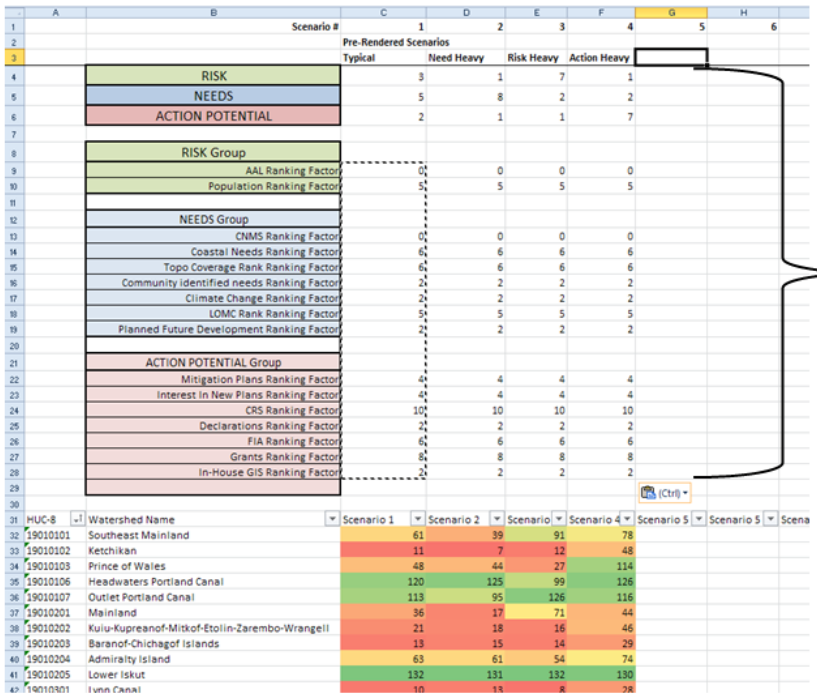
Rate the following On a scale on 1-10 of relative importance within each sub-group of Risk, Needs and Action Potential. Think of the total within each subgroup as a score. The rating number assigned to each moves the weight around as seen in the effective weighting % shown in the side in Column D

Note: For a description of the ranks below, please see documentation provided along with this spreadsheet

Sub-factors	Suggested Weight (1-10 ; 10 is heaviest weight)	User: Select Weights Below	Effective Percentage Weights used in calculations
RISK Group			
AAL Ranking Factor	8	0	0%
Population Ranking Factor	5	5	100%
NEEDS Group			
CNMS Ranking Factor	8	0	0%
Coastal Needs Ranking Factor	6	6	26%
Topo Coverage Rank Ranking Factor	6	6	26%
Community identified needs Ranking Factor	2	2	9%
Climate Change Ranking Factor	2	2	9%
LOMC Rank Ranking Factor	5	5	22%
Planned Future Development Ranking Factor	2	2	9%
ACTION POTENTIAL Group			
Mitigation Plans Ranking Factor	4	4	11%
Interest In New Plans Ranking Factor	4	4	11%
CRS Ranking Factor	10	10	28%
Declarations Ranking Factor	2	2	6%
FIA Ranking Factor	6	6	17%
Grants Ranking Factor	8	8	22%
In-House GIS Ranking Factor	2	2	6%

Step 2a) Adjust User Selected Weights to the desired weighting scheme (yellow cells)

Step 2b) Copy User Selected Weights for input into Scenario's Tab

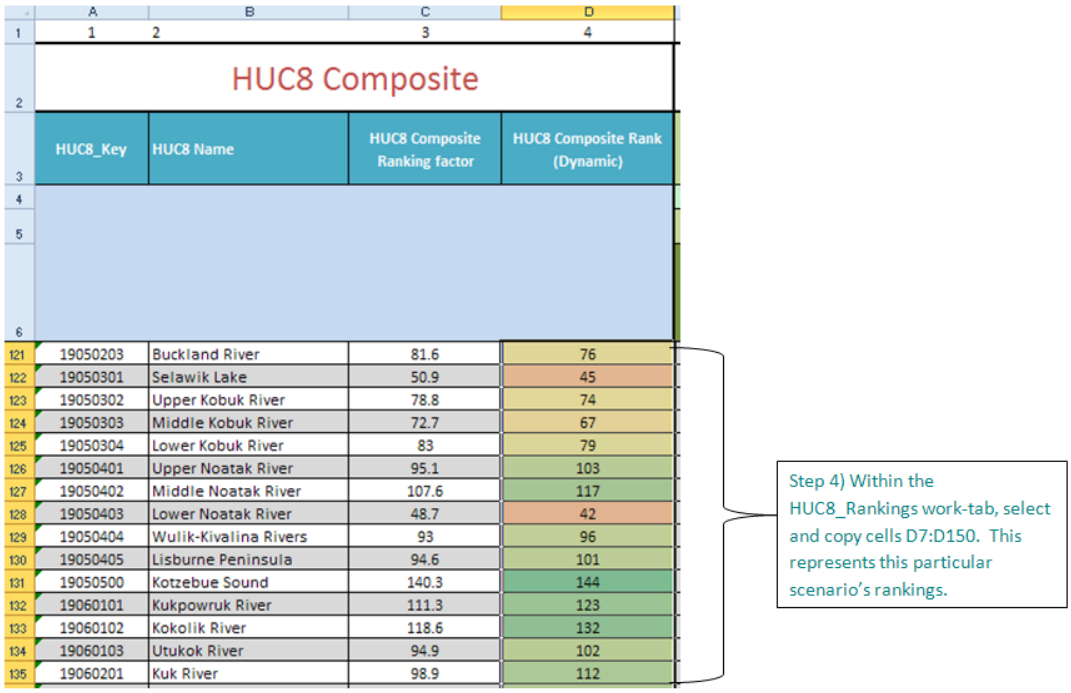


Scenario #	1	2	3	4	5	6
	Pre-Rendered Scenarios					
	Typical	Need Heavy	Risk Heavy	Action Heavy		
RISK	3	1	7	1		
NEEDS	5	8	2	2		
ACTION POTENTIAL	2	1	1	7		
RISK Group						
AAL Ranking Factor	0	0	0	0		
Population Ranking Factor	5	5	5	5		
NEEDS Group						
CNMS Ranking Factor	0	0	0	0		
Coastal Needs Ranking Factor	6	6	6	6		
Topo Coverage Rank Ranking Factor	6	6	6	6		
Community identified needs Ranking Factor	2	2	2	2		
Climate Change Ranking Factor	2	2	2	2		
LOMC Rank Ranking Factor	5	5	5	5		
Planned Future Development Ranking Factor	2	2	2	2		
ACTION POTENTIAL Group						
Mitigation Plans Ranking Factor	4	4	4	4		
Interest In New Plans Ranking Factor	4	4	4	4		
CRS Ranking Factor	10	10	10	10		
Declarations Ranking Factor	2	2	2	2		
FIA Ranking Factor	6	6	6	6		
Grants Ranking Factor	8	8	8	8		
In-House GIS Ranking Factor	2	2	2	2		

HUC-8	Watershed Name	Scenario 1	Scenario 2	Scenario	Scenario 4	Scenario 5	Scenario 5	Scena
19010101	Southeast Mainland	61	39	91	78			
19010102	Ketchikan	11	7	12	48			
19010103	Prince of Wales	48	44	27	114			
19010106	Headwaters Portland Canal	120	125	99	126			
19010107	Outlet Portland Canal	113	95	126	116			
19010201	Mainland	36	17	71	44			
19010202	Kuiu-Kupreanof-Mitkof-Etolin-Zarembo-Wrangell	21	18	16	46			
19010203	Baranof-Chichagof Islands	13	15	14	29			
19010204	Admiralty Island	63	61	54	74			
19010205	Lower Iskut	132	131	132	130			
19010301	Lynn Canal	10	13	8	28			

Step 3) Paste the weightings into the appropriate Scenario column for documentation and comparison

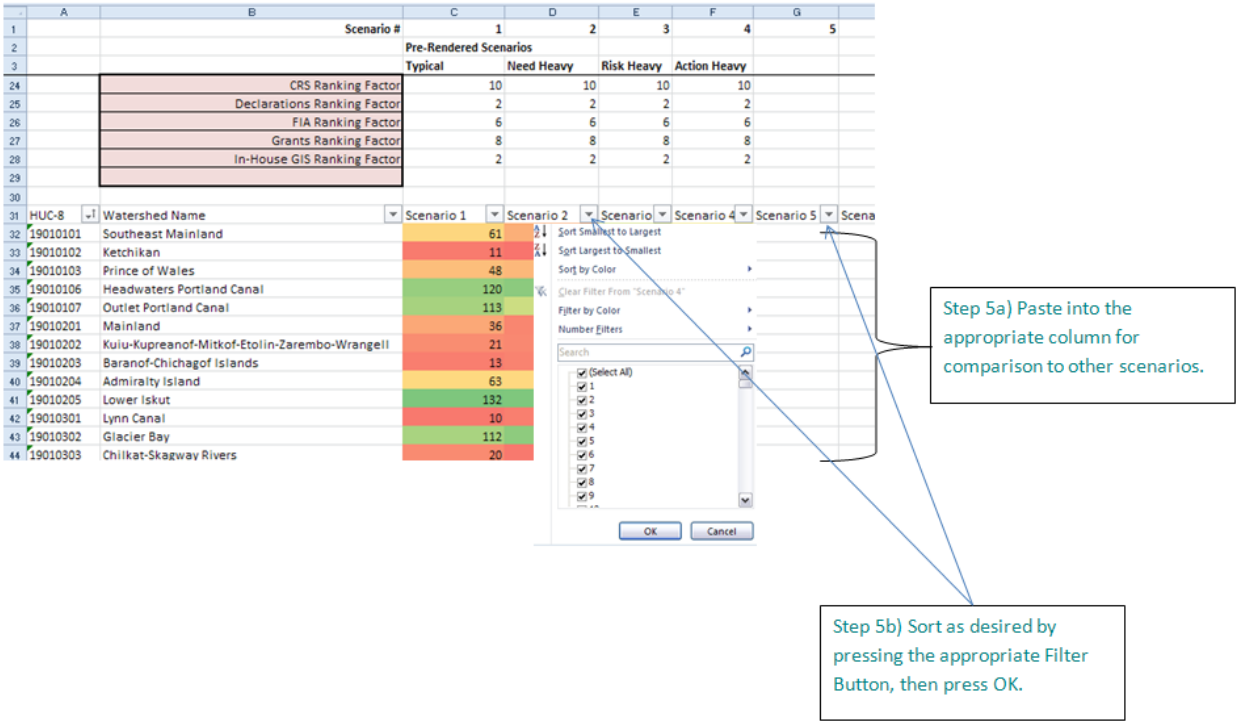
Step 4 and 5) Select and copy the watershed rankings then paste them into the Scenario worktab. Once pasted in, the results will be color coded according to the ranking. Sorting is performed by pressing the filter button and sorting as desired.



HUC8 Composite

HUC8_Key	HUC8 Name	HUC8 Composite Ranking factor	HUC8 Composite Rank (Dynamic)
19050203	Buckland River	81.6	76
19050301	Selawik Lake	50.9	45
19050302	Upper Kobuk River	78.8	74
19050303	Middle Kobuk River	72.7	67
19050304	Lower Kobuk River	83	79
19050401	Upper Noatak River	95.1	103
19050402	Middle Noatak River	107.6	117
19050403	Lower Noatak River	48.7	42
19050404	Wulik-Kivalina Rivers	93	96
19050405	Lisburne Peninsula	94.6	101
19050500	Kotzebue Sound	140.3	144
19060101	Kukpowruk River	111.3	123
19060102	Kokolik River	118.6	132
19060103	Utukok River	94.9	102
19060201	Kuk River	98.9	112

Step 4) Within the HUC8_Rankings work-tab, select and copy cells D7:D150. This represents this particular scenario's rankings.



Scenario #	1	2	3	4	5
	Pre-Rendered Scenarios				
	Typical	Need Heavy	Risk Heavy	Action Heavy	
CRS Ranking Factor	10	10	10	10	
Declarations Ranking Factor	2	2	2	2	
FIA Ranking Factor	6	6	6	6	
Grants Ranking Factor	8	8	8	8	
In-House GIS Ranking Factor	2	2	2	2	

HUC-8	Watershed Name	Scenario 1	Scenario 2	Scenario	Scenario 4	Scenario 5	Scena
19010101	Southeast Mainland	61					
19010102	Ketchikan	11					
19010103	Prince of Wales	48					
19010106	Headwaters Portland Canal	120					
19010107	Outlet Portland Canal	113					
19010201	Mainland	36					
19010202	Kuiu-Kupreanof-Mitkof-Etolin-Zarembo-Wrangell	21					
19010203	Baranof-Chichagof Islands	13					
19010204	Admiralty Island	63					
19010205	Lower Iskut	132					
19010301	Lynn Canal	10					
19010302	Glacier Bay	112					
19010303	Chilkat-Skagway Rivers	20					

Step 5a) Paste into the appropriate column for comparison to other scenarios.

Step 5b) Sort as desired by pressing the appropriate Filter Button, then press OK.

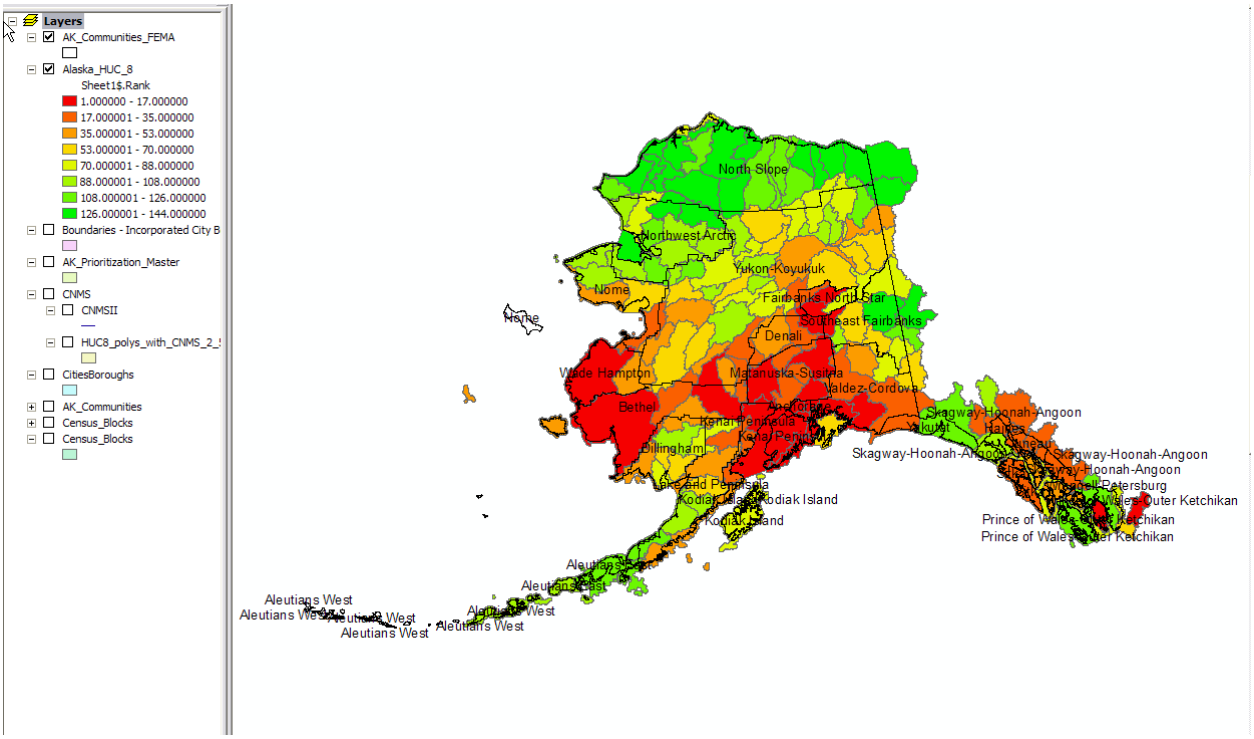
Summary / Recommendations

The focus of this work is to provide a baseline for prioritizing future study needs of Alaska's NFIP participating communities. The data collection and analysis results indicate that the Upper Kenai Peninsula (HUC 19020302) should be considered a high priority. The overall ranking for this watershed was insensitive to the weighting distribution scenarios that were tested. Adjacent watersheds also had high prioritization rankings.

The NFIP communities that are located in these high prioritized watersheds include Kenai Peninsula Borough, City of Kenai, Municipality of Anchorage, City of Soldotna, City of Aniak, City of Bethel, City of Kwethluk, City of Emmonak, City of Cordova, and the Kenai Peninsula Borough

In general the watershed rankings show that the south central portions (Anchorage, and Matanuska-Susitna Boroughs) should be given higher priority. The coastal areas for these Boroughs as well as the western Alaska coastal areas (including Bethel and Wade Hampton) also need focused Risk MAP studies.

Figure 1: Rankings of Watersheds based on Scenario 1



Completing the CNMS analysis is critical to accomplishing future analysis or updates to this activity. The current CNMS indicator for Alaska currently shows all watersheds will have the same rank. When the CNMS data is updated and some distinctions between the watersheds can be made, this indicator can be introduced to the algorithm at that time. Ultimately, CNMS should contribute heavily to the Needs Factor.

Also, a statewide risk analysis needs to be performed. The risk analysis will define the average annualized losses. When the AAL data becomes available in the future, the indicator can be introduced to the algorithm. With proper weighting factor, AAL could contribute to the Risk factor.