

### **Impact Adjustment Maps**

— A Handout for the National Flood Insurance Program Community Rating System —

The objective of the impact adjustment is to determine how much of the community's Special Flood Hazard Area (SFHA) or how many of the buildings in the SFHA are affected by a CRS-credited activity or element. The credit is ADJUSTED based on the IMPACT of the element on the community's flood problem.

This guide has five modules that explain the impact adjustment process. You can pick and chose which modules would be helpful based on the CRS activities relevant to your community.

Module 1. The impact adjustment base map (Activities 410, 420, 430, and 440)

Module 2. Impact adjustment for open space (Activity 420)

Module 3. Other impact adjustments based on area (Activities 410, 420, 430, and 440)

Module 4. Impact adjustments based on buildings (Activities 310, 520, 530, 610, 620, and 630)

Module 5. Impact adjustments based on watershed area (Activity 450)

Here are some key points about all impact adjustments.

- (1) There are two parts to calculating an impact adjustment: determining the total area (size) of the floodplain or the number of buildings in the floodplain, and determining the area or number of buildings that are affected by the activity.
- (2) The impact adjustment is a ratio between 0 and 1 where 50% = 0.5. For example, Modules 2 and 3 discuss impact adjustments based on the area of the SFHA. The numerator of the ratio is the area of the activity to be credited (e.g., the area of the lands preserved as open space) and the denominator is the area of the SFHA. For a community that has preserved 350 acres of its 1,000-acre SFHA, the impact adjustment ratio is 350/1,000 = 0.35. The community will receive 35% of the maximum credit for preserving open space.

#### Definition

The Special Flood Hazard Area (SFHA) is all zones on the Flood Insurance Rate Map with the "A" or "V" designation. It includes the floodway and the flood fringe.

- (3) Although most communities use data from a geographic information system (GIS), the staff should not spend an inordinate amount of time plotting or measuring areas or counting buildings if GIS is not available. Rough numbers or hand measurements can accurate enough to document and calculate CRS credit, especially for elements that are not worth a lot of points. See also the discussion on optional minimum values in Section 3.4.C, below.
- (4) A staff without access to GIS or a planimeter can use a manual method described in "403 How to use a grid overlay," found at www.CRSresources.org/400-2/.
- (5) Impact adjustments based on the area of the SFHA are explained in more detail in Sections 401–403 of the *CRS Coordinator's Manual*. Impact adjustments based on the number of buildings affected are explained in Sections 301–302.

- (6) Once the impact adjustment map and data are prepared, it is important to maintain them. The CRS requires a community to annually update data on its key buildings and areas, by updating the community's Program Data Table. These map(s) and data will also be needed at the next cycle verification visit.
- (7) It is also a good idea to record how the maps, areas, building counts, and calculations were prepared, so the ISO/CRS Specialist will understand the basis for the impact adjustment figures.

This guide uses the fictitious community of Tracitown, which has access to GIS maps and data. The referenced maps appear as the last four pages of this handout.



## Module 1. The Impact Adjustment Base Map [for Activities 410, 420, 430, and 440]

**1.1 Prepare the base map to include the entire community** (see Tracitown Map 1).

A. Show the corporate limits.

B. Show all the SFHA using the current Flood Insurance Rate Map (FIRM).

#### **1.2** Mark out areas to be excluded from the SFHA.

The objective of this step is to make sure the denominator accurately reflects the area of the SFHA that is (1) subject to development and (2) under the community's jurisdiction. In other words, under the impact adjustment, the community is not held responsible for areas shown as SFHA on the FIRM that are not developable or are beyond the community's authority to regulate.

This process refines the SFHA by eliminating areas where either there is no potential for development (because it's under water) or the community has no authority over development (because it is federal, tribal, or state land).

State land is a special situation. A community generally has no authority over state land, but because the CRS credits state activities in a community, if the community would receive more credit by counting state land, it can keep state lands as part of the SFHA.

Mark the following on the base map.

A. All bodies of water in the SFHA larger than 10 acres, e.g., lakes, reservoirs, and the channel of large rivers. Wetlands are not considered bodies of water.

See Tracitown Map 2. Tracitown Reservoir is larger than 10 acres.

B. All federally owned land in the SFHA larger than 10 acres.

There is a national forest noted in brown in the northeast part of Tracitown. However, it is outside the SFHA, so it is not counted.

C. All reservations and tribal lands in the SFHA larger than 10 acres.

*There are no reservations or tribal lands in the city limits of Tracitown.* 

D. All state lands in the SFHA larger than 10 acres. Differentiate between state open space and all other state properties.

#### Definitions

**Open space**—land without a building, pavement, or filling.

**Building**—A structure with two or more outside rigid walls and a fully secured roof and that is affixed to a permanent site. See also Section 2.1.A.

There are two large areas of state property in Tracitown: To the west is the State University campus, shown in orange. The southeast portion of the campus is in the floodplain, some of which is vacant now. However, the University has plans to expand its athletic facilities into the area, so it cannot be counted as open space. To the east is the Fort Ellis Research Farm, also owned by the University. The East Gallatin River runs through the north part of this land. The University will keep these farm lands as open space for the Research Farm.

- E. If you have the capability to easily identify federal, tribal, and state lands smaller than 10 acres, you are welcome to count all those lands, not just the ones larger than 10 acres. You will likely have a slightly better score if you do, but it may not be worth the effort to identify every post office or state garage in the SFHA on your maps. In either case, do not count small bodies of water, only those larger than 10 acres.
- **1.3 Calculate the acreage of the marked areas.** An Excel file can help with this. Determine the acreage of the entire SFHA as shown on the FIRM and
  - A. All bodies of water in the SFHA larger than 10 acres,
  - B. All federally-owned land in the SFHA larger than 10 acres,
  - C. All reservations and tribal lands larger than 10 acres,
  - D. All state lands larger than 10 acres that are open space, and
  - E. All state lands larger than 10 acres that are not open space.

#### 1.4 Subtract the following areas from the area of the SFHA.

- A. The area of the bodies of water larger than 10 acres,
- B. The area of the federally owned land larger than 10 acres,
- C. The area of the reservations and tribal lands larger than 10 acres, and
- D. and E. There are two ways to treat state lands in the SFHA, depending on whether they help your score for preserved open space (element OSP under Activity 420). If there is a significant amount of the state lands larger than 10 acres in open space, you will probably do better to not subtract the state lands. If there is a small amount of state land in open space, you will probably do better subtracting the state lands. After you calculate the areas and scores for OSP, you can determine which way gives a better score better and you can recalculate things accordingly. This is revisited with the calculations in Section 2.8.

Area		
All of the SFHA	890.45	
Subtract:		
A. Bodies of water in SFHA > 10 acres	411.74	
B. Federal land in SFHA > 10 acres	0.00	
C. Reservation/tribal land in SFHA > 10 acres	0.00	
D. State land in SFHA > 10 acres that is open space	16.56	
E. State land in SFHA > 10 acres NOT open space	11.28	
The remainder is either:		
With ALL state lands: All of the SFHA minus (A + B + C) or	478.71	
With NO state lands: All of the SFHA minus (A + B + C + D + E)	450.87	

Note that all CRS calculations are done to two places past the decimal point.

#### 1.5 Determine the SFHA for impact adjustment purposes.

The resulting area is the SFHA for the purposes of impact adjustments, i.e., the size of the SFHA shown on the FIRM minus the large bodies of water and minus the federal, tribal, and (sometimes) state lands. This area is the SFHA where there is development potential on lands under the control of the community government.

In CRS impact adjustment formulas, this area is shown as "aSFHA" and is usually expressed in acres.

The numbers for Tracitown are shown in the table on the next page.

Tracitown opts to base aSFHA on including the state lands in order to receive open space preservation credit for them. The aSFHA for Tracitown is 478.71 acres.

#### 1.6 CRS Program Data Table.

The resulting area (aSFHA) is entered in line 13 of the CRS Program Data Table (see page 210-13 of the *Coordinator's Manual*).

CRS Program Data		A. In the SFHA	B. In a regulated floodplain outside the SFHA	C. In the rest of the community
1. Last report's number of buildings in the SFHA (bSF) (line 6, last	report)			
2. Number of new buildings constructed since last report		+		
3. Number of buildings removed/demolished since last report		_		
4. Number of buildings affected by map revisions since last report (	(+ or –)			
5. Number of buildings affected by corporate limits changes (+ or -	-)			
6. Current total number of buildings in the SFHA (bSF) (total lines	1–5)			
7. Number of substantial improvement/damage projects since last re-	eport			
8. Number of repetitive loss properties mitigated since last report				
9. Number of LOMRs and map revisions (not LOMAs) since last report				
10. Acreage of the SFHA (aSFHA) as of the last report (line 13. last report)				
11. Acreage of area(s) affected by map revisions since last report (+ or -)				
12. Acreage of area(s) affected by corporate limits changes (+ or -)				
13. Current acreage of the SFHA (aSFHA) (total lines 10–12)				
14. Primary source for building data:				
15. Primary source for area data:				
16. Period covered: From Current F		IRM date:		
If available, the following data would be useful:				
17. Number of new manufactured homes installed since last report				
18. Number of other new 1 - 4 family buildings constructed since last report				
19. Number of all other buildings constructed/installed since last report				

## Module 2. Impact Adjustment for Open Space [for Activity 420]

Activity 420 (Open Space Preservation) is used as an example to show how the impact adjustment works. This activity has one of the highest maximum possible points. The only way to receive credit under Activity 420 is to have an impact adjustment map that shows the open space parcels to be credited and to calculate the area of each.

This module does not cover all the credit criteria for Activity 420. It includes only summary information to show the impact adjustment process. More information on Activity 420 credit is in the *Coordinator's Manual*.

- **2.1 "Open space" defined.** "Open space" is land without a building, pavement, fill, or the possibility of filling.
  - A. Building—A "building" is defined as "A structure with two or more outside rigid walls and a fully secured roof and that is affixed to a permanent site." A building on an open space area larger than 10 acres will not disqualify a parcel, provided that the building is "a necessary appurtenance" of the open space use (e.g., restrooms or a ranger station).
  - B. Pavement—Do not worry about paved trails, sidewalks, or pervious pavement, but don't count lands that are substantially paved over such as a parking lot.
  - C. Fill—Do not include parcels where filling or storage of materials is allowed.

More information on what qualifies for preserved open space credit (OSP) can be found in the credit criteria section on pages 420-4 through 420-7 in the *Coordinator's Manual.* 

- **2.2 "Preserved" open space.** The CRS only counts PRESERVED open space, i.e., open land that can be documented as being mandated to stay open into the future. Therefore, the following steps should be used to identify areas that can be documented to be kept as open space.
  - A Start with the CRS base map that was used to determine aSFHA (no large bodies of water, federal lands, etc., that have been excluded from the SFHA).
  - B. Mark all parcels in the SFHA from Module 1 that are public parks owned by a local government, including the city, county, or separate park district.
  - C. Do not include an area called a "park" that is mostly buildings, pavement, or otherwise does not meet the above definition of "open space," such as an amusement park or zoo.

Tracitown's GIS staff identified 15 parcels that qualify as city parks in the SFHA. They are listed as items 1–15 on Map 3.

D. Identify state parks and other state-owned open areas if you include all state lands in the SFHA for impact adjustment purposes. As noted above, you can run the numbers for open space preservation (OSP) with and without counting state open space lands to determine whether to include state lands in the SFHA for impact adjustment purposes (see Section 2.8).

- **2.3 Other preserved open areas.** Mark all other areas in the SFHA that are in public or institutional ownership that can be documented as preserved open space. Here are a few examples.
  - A. An athletic field for a public school or private university.
  - B. A nature camp owned by the Boy Scouts, YMCA, or similar organization.
  - C. A golf course owned by a non-profit association.

Site 21 on Map 3 is a golf course owned by a country club. The floodplain portions of the golf course are highlighted in the GIS map to the right.

2.4 Areas preserved by regulations. Mark open



space areas that are subject to land development regulations that prohibit buildings, filling, and storage of materials that obstruct flood flows or remove flood storage. Examples are very restrictive floodway regulations, zoning ordinances such as conservation districts, and subdivision ordinances that require dedication of open space in the floodplain or natural buffers. Mark only the undeveloped or vacant areas that are subject to these regulations.

Tracitown's GIS staff identified 12 parcels that meet the criteria as "other preserved open areas." For example, several of the sites numbered 16–27 are parcels that were dedicated to Tracitown when the subdivision was platted.

**2.5 Open areas not preserved.** Do not count areas unless you know they are preserved as open space. For example, do not count areas that you know will be sold for development. Do not count areas whose owners will not sign a statement that they intend to keep the areas open forever.

At first, Tracitown's staff thought it could count the vacant area in the University campus, so it was listed as site 19 on Map 3. After concluding that the University will not promise that the parcels will stay open, site 19 was dropped.

- **2.6 Total the open space acreage.** Total the acres of all the properties identified on the open space map.
  - A. Do not include any portion of an open space parcel that is outside the SFHA for impact adjustment purposes (delineated in Module 1).
  - B. Eliminate the areas of parking lots, tennis courts, and other impervious surfaces from the calculations.

Below are the numbers for Tracitown. The public parks are numbered 1–15 on Map 3. Other preserved areas are numbered 16–27. Sites 16 and 19 are the state university lands. After Tracitown staff had prepared the table, it was concluded that site 19 needed to be deleted.

Map #	PARKS	Acres	Map #	OTHER OPEN SPACE AREAS	Acres
1	Creekside Park	0.05	16	State University farm	16.56
2	Lindley Park	1.36	17	Dedicated subdivision land	1.13
3	Bogert Park	0.65	18	Dedicated subdivision land	0.82
4	Burke Park	1.20	19	State University campus	<del>11.28</del>
5	Gallagator Linear 2	4.63	20	Dedicated subdivision land	0.07
6	Hauser Park	1.76	21	Golf course	7.44
7	Westridge East	0.77	22	Dedicated subdivision land	0.34
8	Grafs East Park	3.96	23	Dedicated subdivision land	1.09
9	Sourdough Trail	3.97	24	Dedicated subdivision land	0.18
10	Allison Park	0.16	25	Dedicated subdivision land	2.68
11	Alder Creek, Phase 2, Park	0.82	26	Dedicated subdivision land	0.54
12	Addition to McLeod Park	0.04	27	Dedicated subdivision land	0.02
13	Tuckerman Park	1.89		Total acreage	30.87
14	Village Downtown Park	0.10			
15	Story Mill Park	7.04			
	Total park acreage	28.39			
	Total preserved op	en space	e (aOSP)	With state lands (28.39 + 30.87)	59.26
				Without state lands (- 16.56 acres)	42.70

#### 2.7 Calculate the open space impact adjustment ratio.

A. The resulting number is the total number of open space acres in the SFHA that the community can document will be preserved as open space. This is shown as "aOSP" in the CRS formulas.

aOSP in Tracitown = 59.26

B. The impact adjustment formula is the area of preserved open space (aOSP) divided by the area of the SFHA delineated in Module 1 (aSFHA). The "r" in the formula stands for "ratio."

$$rOSP = \underline{aOSP}$$
  
 $aSFHA$ 

**2.8 Decide how to count state land.** At this point, include the area of state lands in aSFHA and the area of state-owned open space in aOSP and see if this produces a larger ratio than excluding state-owned lands from both numbers. An Excel file can help run "what if" scenarios to see how

different arrangements affect the credits. Note that only state-owned open space areas are included in aOSP, but ALL state-owned land must be included in aSFHA.

Tracitown's options are shown below.

	With state lands	<u>Ratio</u>	Without state lands	<u>Ratio</u>
<u>aOSP</u> aSFHA	= <u>59.26</u> 478.71	= 0.12	<u>42.70</u> 450.87	= 0.09

Because the 16.56 acres of the University's Research Farm land account for such a large part of all of Tracitown's open space, the impact adjustment is higher when the state lands are included.

Twelve percent (12%) of Tracitown's SFHA is preserved as open space in city parks and as open areas preserved by other agencies and organizations.

If the state lands in Tracitown did not qualify as preserved open space, the table would look like this:

	With state lands	<u>Ratio</u>	Without state lands	<u>Ratio</u>	
<u>aOSP</u> aSFHA	$=\frac{42.70}{478.71}$	= 0.089	<u>42.70</u> 450.87	= 0.095	

If the state lands did not receive preserved open space credit, Tracitown would do better by excluding state lands from the SFHA used for impact adjustment purposes back in Sections 1.4 and 1.5.

**NOTE:** Each percentage point (0.01) difference means 14.5 points towards OSP credit. The difference between using .09 and .12 is  $3 \times 14.5 = 43.5$  points. This may help determine the amount of effort that a community puts into refining the impact adjustment numbers.

### Module 3. Other Impact Adjustments Based on Area [for Activities 410, 420, 430, and 440]

The same process used to determine the impact adjustment ratio for preserved open space is repeated for other credits that do not cover the entire SFHA.

#### 3.1 Regulatory Example.

Tracitown's ordinance requires all new construction and substantial improvement to be elevated two feet above the base flood elevation. This regulation is only in effect where there is a base flood elevation on the FIRM. Tracitown receives FRB credit under Activity 430 (Higher Regulatory Standards) for its freeboard requirement.

Tracitown needs an impact adjustment ratio calculated to reflect how much of the SFHA is impacted by this regulation. Base flood elevations are provided in AE Zones (see Map 1). Tracitown's GIS staff measures 256.06 acres of AE Zone and 222.65 acres of approximate A Zone where there are no base flood elevations.

As with many higher regulatory standards for construction of buildings, Tracitown's freeboard requirement has no effect in areas where no buildings will be constructed. Therefore, the impact adjustment excludes areas in the AE Zones that are credited as preserved open space under Activity 420 (Open Space Preservation).

Tracitown's open space areas are plotted on Map 3. Only one area, site 16, is in an approximate A Zone. The rest are in AE Zones. Using the data in the table on page 8, the area of the preserved open space parcels in the AE Zone is calculated to be 42.70 acres.

The formula to determine the impact adjustment ratio for requiring freeboard in Tracitown's AE Zones is

rFRB = <u>aFRB</u> = <u>area of the AE Zones</u> – <u>area of open space in the AE Zones</u> aSFHA aSFHA

> $= \frac{256.06 - 42.70}{478.71} = \frac{213.36}{478.71} = 0.4456978$ , rounded to 0.45 478.71

The freeboard regulation has an impact on 45% of Tracitown's SFHA. Tracitown will receive 45% of the credit for two feet of freeboard.

#### 3.2 Examples of other credits that need an impact adjustment based on the area of the SFHA.

- A. Other types of open space, such as natural functions open space (element NFOS under Activity 420) and low-density zoning (element LZ under Activity 420).
- B. A regulatory standard that is a minimum National Flood Insurance Program (NFIP) requirement in the V Zone, but enforced by the community in the A Zone. For example, under the NFIP, enclosed walls (other than breakaway walls) are not allowed under an elevated building in the V Zone. If a community prohibits enclosed walls everywhere in the SFHA, the impact adjustment ratio would be the area of the A Zones divided by aSFHA.

- **3.3 Impact adjustments based on other areas.** There are four instances in the 400 series where the impact adjustment is based on something other than the SFHA.
  - A. Activity 410 (Floodplain Mapping) credits new mapping. The impact adjustment is based on the area of the SFHA in effect at the time of the new map (aSFT). For example, if a community adopted a new map that covered 120 acres in the X Zone in 1998, the impact adjustment would be based on the area of the SFHA on the FIRM in effect in 1998. The area of the SFHA on the current FIRM would be different if a new FIRM was issued since 1998 that included annexations and the 120 acres. A community can use the current aSFHA if it does not have the data to calculate the areas of the SFHAs based on earlier FIRMs.
  - B. Element NSP—natural shoreline protection (under Activity 420) credits stream channels and shorelines currently in their natural state that are protected from being hardened. Instead of using the area of the SFHA, the impact adjustment is based on the total length of shoreline in the community (aSL).
  - C. Element PCF—protection of critical facilities (under Activity 430) credits regulations that require critical facilities to be protected to the 500-year flood level. The area of the 500-year floodplain (a500) is the denominator in the impact adjustment formula.
  - D. Under Activity 450 (Stormwater Management), the impact adjustment is based on the area of the watersheds that drain into the community. This is explained in Module 5.
  - E. Under Activity 540 (Drainage System Maintenance), the impact adjustment varies by community: total number of components, length of channels, number of storage basins, etc.
- **3.4 Credit where an impact adjustment map is not needed.** An impact adjustment map is not needed in three situations. Note that even though a map is not needed, there is still an impact adjustment ratio to be determined and applied.
  - A. If an element has an impact throughout the entire SFHA, no separate map is needed. The impact adjustment ratio is 1.0. An example would be the case in which all of a city's SFHA were mapped as an AE Zone with a floodway using the state's higher standard. Because 100% of the SFHA is affected by the credit, the ratio would be 1.0 and no impact adjustment map would be needed.
  - B. A regulation for new construction does not have an impact in areas that are credited as preserved open space (element OSP) under Activity 420. Therefore, if a regulatory standard is enforced throughout the SFHA, the impact adjustment formula simply subtracts the area credited for OSP, and the ratio = 1.0 rOSP. Although there needs to be a map to determine aOSP, there does not need to be a separate map showing the area affected by the regulatory standard.
  - C. If the area affected is very small compared to the denominator, the community can use an optional minimum value for the impact adjustment ratio for several elements. These values are shown in Table 403-1 on page 400-7 of the *Coordinator's Manual*. An excerpt appears on the next page.

Excerpt from Table 403-1. Impact adjustment maps.					
Activity	Affected Elements Denominator		<b>Optional Minimum</b>		
410 (Floodplain Mapping)	NS, SR, HSS, FWS	aSFT	0.10		
	OSP, DR, NFOS, LZ	aSFHA	none		
420 (Open Space Preservation)	OSI	aSFHA	0.10		
	NSP	total length of shoreline	0.10		
430 (Higher Regulatory Standards)	DL, FRB, FDN, CSI, LSI, PCF, ENL, OHS	aSFHA	0.10		
	CAZ	aSFHA	0.5 / 0.1		
440 (Flood Data Maintenance)	AMD	aSFHA	0.10		
450 (Stormwater Management)	SMR, WMP	area of the watershed	0.15		

Tracitown has one area that qualifies for natural shoreline protection, NSP, under Activity 420. Story Mill Park (open space ID #15 on Map 3) has less than a half mile of shoreline. There are more than 15 miles of shoreline in Tracitown. Instead of preparing an impact adjustment map that would result in an impact adjustment ratio of less than 0.04, Tracitown opts to use 0.10 as the impact adjustment ratio in its credit calculations. No impact adjustment map is needed to document this ratio.

#### 3.5 When a community regulates outside the SFHA.

Some communities administer their floodplain management regulations in a floodplain that is larger than the SFHA. They may treat the 500-year floodplain as their regulatory floodplain, they may enforce their ordinance on all lands lower than one or two feet above the base flood elevation, or they may have mapped and regulate streams that are not shown as SFHA on their FIRM.

The CRS recognizes communities that require new development in areas mapped as B, C, or X Zones to meet the same regulatory standards as enforced in the SFHA. This is done in the impact adjustment formulas by having the numerator equal the total regulated area (A, V, and X Zones). The denominator stays as aSFHA.

In these situations, the maximum impact adjustment is 1.5, not 1.0. This maximum could be attained when a community regulates an area larger than the SFHA marked up in Module 1 (i.e., larger than aSFHA).

## Module 4. Impact Adjustments Based on Buildings [for Activities 310, 520, 530, 610, 620, and 630]

This module discusses how to use GIS data to help determine impact adjustment ratios that involve buildings rather than acreage or areas.

#### 4.1 Count the number of buildings in the SFHA delineated in Module 1.

A. A building is defined as "A structure with two or more outside rigid walls and a fully secured roof, that is affixed to a permanent site." There is more information on how to count buildings

in Section 301 of the *Coordinator's Manual.* 

- B. Do not count structures that don't meet the definition but show up as building footprints or roofs on an aerial photograph, such as an open park pavilion (see the example at right).
- C. Do not count detached garages, storage sheds, or other accessory structures on a lot with a primary building (see the



In the GIS air photo, two rooftops appear to be two buildings, but . . .



one of the "buildings" is just a roof over gasoline pumps and does not qualify as a "building."

aerial photo). A typical lot with a single-family home, detached garage, and storage shed is counted as one building. If you have a neighborhood with such single-family homes, it may be

easier to just count the number of parcels with buildings.

However, if there are many parcels in the floodplain with buildings on high ground, outside the SFHA, a different approach should be used.

D. Do not count buildings that appear to be in the SFHA but have had Letters of Map Amendment (LOMA) stating they are not in the SFHA issued by the Federal Emergency Management Agency. If your maps have not changed since the date of a LOMA, consider a LOMA for a single-family home to be one fewer buildings in the SFHA.



Accessory buildings, such as detached garages and storage sheds, are not included when counting buildings for a CRS impact adjustment.

E. If there is a large number of buildings, exact counts are not required because being a little off will not have much impact on the credit points. Therefore, it is a judgment call whether to spend the extra time differentiating between buildings and roofs over gasoline pumps or checking every LOMA.

*Here are the GIS-produced numbers for Tracitown:* 

Buildings	Count
Buildings in A Zones	197
LOMAs—buildings removed since the aerial photography	21
Buildings not counted—too small, garages, etc.	54
Net number of buildings in SFHA (bSF)	122

# 4.2 "bSF" CRS impact adjustment formulas, the number of buildings in the SFHA is shown as "bSF."

- A. The number of buildings in the SFHA (bSF) is entered in line 6 of the CRS Program Data Table (see the *Coordinator's Manual*).
- B. The number of buildings in the SFHA (bSF) is also used in the impact adjustment calculations for Activity 520 (Acquisition and Relocation), Activity 530 (Flood Protection), and Activity 610 (Flood Warning and Response).
- **4.3 Community-owned buildings.** When inventorying buildings, it can be helpful to identify and list the buildings owned by the community in the SFHA.
  - A. These could include fire stations, waste water treatment plants, etc. They would not include schools or public housing or other buildings owned by a school district, housing authority, or other local government other than the NFIP community.
  - B. The list can be used to determine whether all community-owned buildings in the SFHA are covered by a flood insurance policy, which would help meet the fifth prerequisite for a CRS Class 9 (see the *Coordinator's Manual*).

### Module 5. Impact Adjustments Based on Watershed Area [for Activity 450]

Activity 450 credits stormwater management regulations (element SMR) and watershed management plans (element WMP), two stormwater management elements that affect runoff from the watershed through the community. These elements only affect all runoff if they cover all the watersheds that affect the community. Therefore, the impact adjustment denominator is the area of the watersheds that drain through the community, not the area of the floodplain.

#### 5.1 Watershed map.

A. Start with a map of all watersheds that drain into the community. Many states have GIS layers showing watersheds. They have also been cataloged by the U.S. Geological Survey as Hydrologic Unit Codes (HUC) (see http://water.usgs.gov/wsc/index.html). Refer to Tracitown Map 4.

# *Tracitown's GIS office prepared Map 4. Tracitown Watersheds.*

B. Eliminate all watersheds with a drainage area of more than 50 square miles at the upstream corporate limits. Studies have found that retention, detention, and other measures to manage stormwater runoff lose their effectiveness in larger watersheds.





	Area (square miles)			
Watershed	Inside	Outside	Total	
	Community	Community	area	
Lower Bridger Creek	0	21.2	21.2	
Traci Creek	7.5	44.4	51.9	
Bear Creek	0	20.3	20.3	
Rocky Creek	0	34.3	34.3	
Kelly Creek—East Gallatin	8.8	16.8	25.6	
Middle Cottonwood Creek—East Gallatin	2.0	34.6	36.6	

Although they are listed as separate watersheds, Bear Creek flows into Rocky Creek outside Tracitown's city limits. The two form a combined watershed of 20.3 + 34.3 = 54.6 square miles upstream of Tracitown. Therefore, these two watersheds are not counted.

Although the total area of Traci Creek exceeds 50 square miles, it is less than 50 square miles where it drains into the city limits. It needs to be counted.

**5.2 Calculate the total area of the watersheds that drain through the community.** In CRS impact adjustment formulas, this area is shown as "aW."

Lower Bridger Creek does not drain into Tracitown. Traci Creek and Kelly Creek–East Gallatin drain into Tracitown. Their total areas are 51.9 and 25.6 square miles.

Middle Cottonwood Creek drains north, out of Tracitown. Only the area of this watershed within the city limits is counted, i.e., 2 square miles.

For impact adjustment purposes, the total area of the watersheds that drain into the community is

51.9 + 25.6 + 2.0 = 79.5 square miles

# 5.3 Calculate the total area of the watersheds that are managed by the community under Activity 450 elements SMR or WMP, i.e., aSMR or aWMP.

Tracitown only has regulatory authority within its city limits. The area of its city limits is the same as the total area of the watersheds inside the community.

7.5 + 8.8 + 2.0 = 18.3 square miles

**5.4 Calculate the impact adjustment ratio.** The impact adjustment ratio is the total area managed by the community divided by the total area of the watersheds that drain into the community.

Tracitown manages stormwater runoff in 23% of the watersheds that affect the city. The numbers would be different if Tracitown regulated areas outside its corporate limits.

$$rSMR = \frac{aSMR}{aW} = \frac{18.3}{79.5} = 0.23$$



## Map 1. Tracitown Base Map





## Map 2. Tracitown Land Ownership









## Map 4. Tracitown Watersheds

