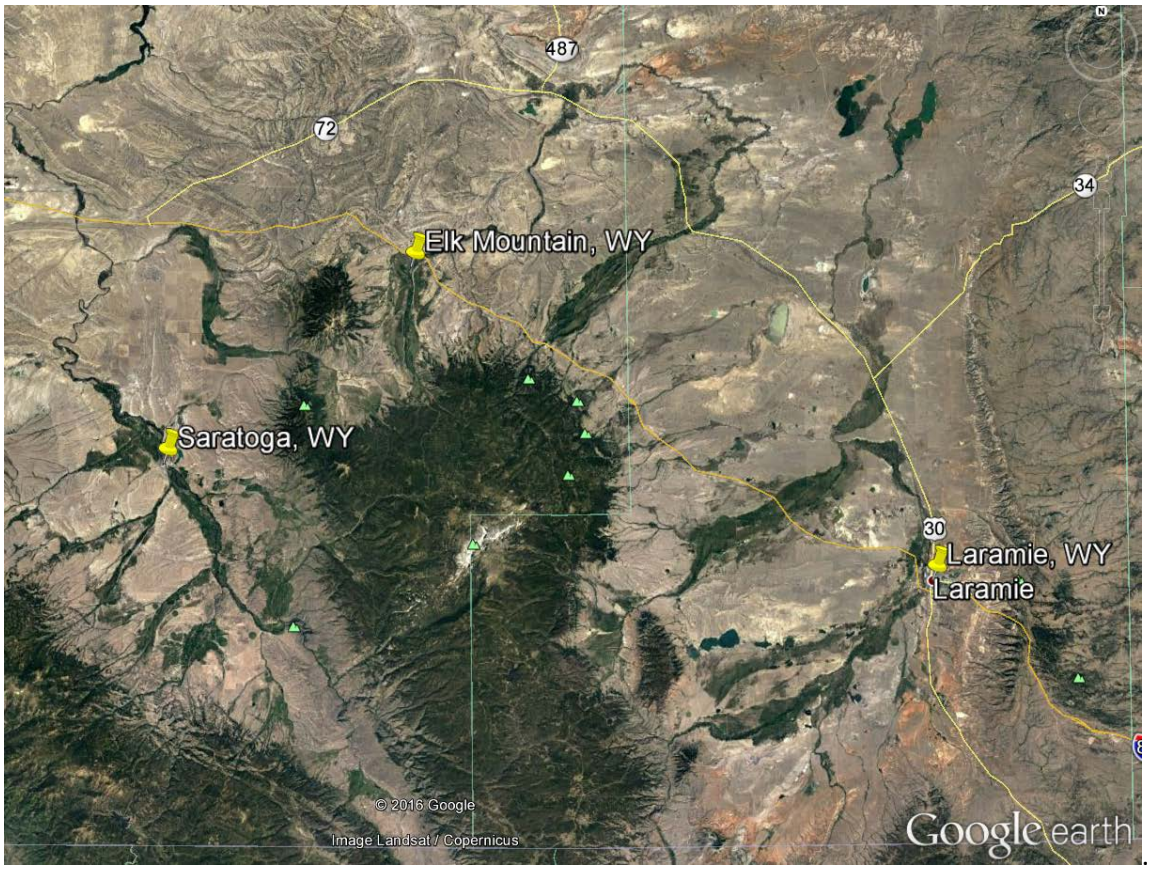
Saratoga, Wyoming

Advanced Measures Technical Assistance

March 2017



1. Introduction

In a letter dated 8MAR2017, The State of Wyoming, Office of Homeland Security requested Advanced Measures Technical Assistance in anticipation of potential flooding in Wyoming resulting from spring runoff. The letter specifically requested an in-person evaluation of the flood threat for hydrology along with engineering technical services for flood fighting to assess potential impacts and to make recommendations on selected areas of infrastructure protection.

The concern over potential flooding stems from the current snow water equivalent (SWE) accumulations as identified by the Natural Resources Conservation Service and the National Weather Service. The request noted that current data shows 189% of normal SWE in the Wind River Basin (182% as of 16MAR2017), 125% of normal SWE in the Upper North Platte and Little Snake River Basins, and 121% of normal SWE in the Laramie River Basin.

2. Locations

The letter requesting technical assistance specifically mentioned the following locations:

- Fremont County
    - Riverton (note that while Riverton was in the original request, discussion with County personnel indicates that there is only very minor concern at Riverton so there will be no further discussion herein)
    - Hudson
    - Lander
    - Wind River Reservation (Eastern Shoshone and Northern Arapaho)
- Carbon County
    - Saratoga
    - Elk Mountain
    - Baggs (note that the State decided not to visit Baggs)
- Albany County
    - Laramie

This report focuses on Saratoga, WY; separate reports detail the site visits and recommendations for the remainder of Carbon, Albany and Fremont Counties. During the initial meeting with the Wyoming Office of Homeland Security, the State decided that it was not necessary to visit Baggs because the flood threat was not as significant as originally anticipated.

Figure 1 is a location map showing a general overview of the area of Saratoga within the state of Wyoming.

Figure 1. Location Map of Saratoga, WY

3. Snow Pack Summary

The following information is based on available data from the NRCS. Figure 2 shows a general overview of the SNOTEL sites in the area and a comparison of the observed SWE vs. the median SWE for 1981-2010.

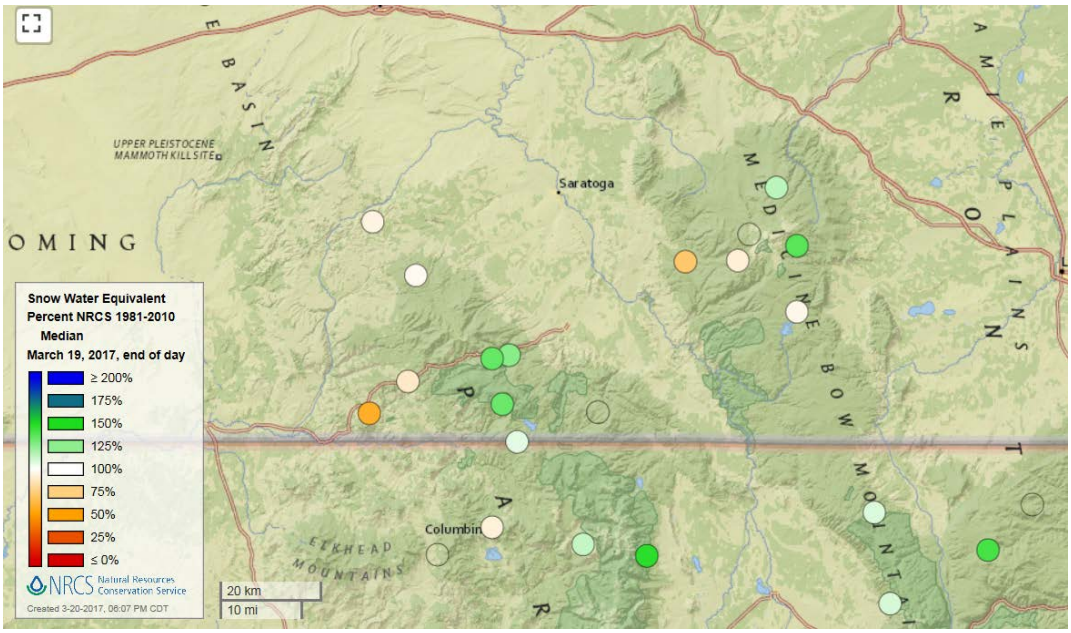


Figure 2. Snow Water Equivalent, Percent of Median at Relevant SNOTEL Sites as of March 19

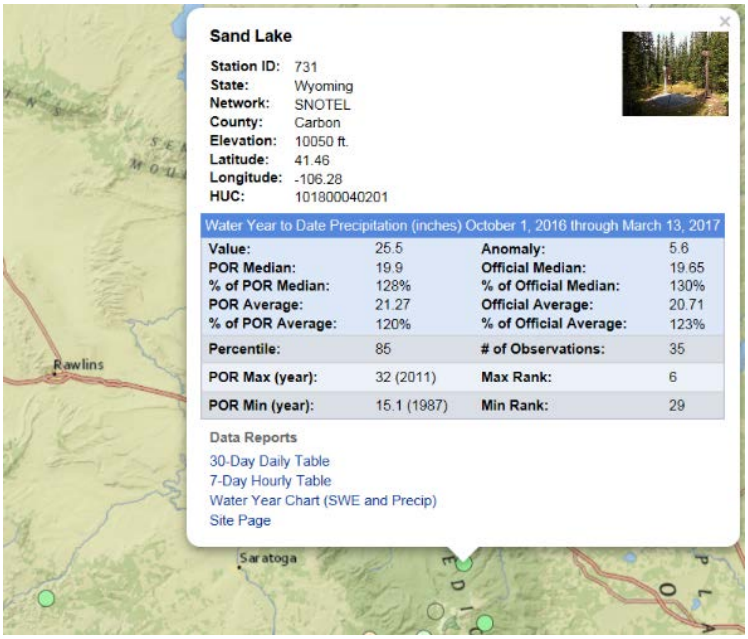


Figure 3. SNOTEL site data at Sand Lake

The NRCS SNOTEL site at Sand Lake in the Medicine Bow Mountains above Saratoga shows that the current snowpack as of March 13 is at 128% of normal, as shown Figure 3. The NRCS also provides monthly SWE and snow depth data for the past ten years at the Sand Lake SNOTEL site, as shown in Table 1.

As of 1March2017, the SWE is the same as 1March2014. Because 2014 snowmelt resulted in a moderate flood event in Saratoga, the community may be concerned that 2017 will be similar. However, Table 1 also shows that for the years where flooding occurred (2011, 2014, 2015, 2016) SWE continued to increase significantly through at least May 1 and in some years through June 1.

The trend in SWE should be monitored to evaluate the flood potential during spring runoff. The quantity of SWE as well as the timing of the snowmelt are important factors in evaluating the potential for flooding in Saratoga.

Sand Lake (731)
Wyoming SNOTEL Site - 10050 ft
Reporting Frequency: Monthly; Date Range: Period of Record

As of: Mar 14, 2017

Water Year	Date of Collection	Snow Depth (in)	Snow Water Equivalent (in)	Date of Collection	Snow Depth (in)	Snow Water Equivalent (in)	Date of Collection	Snow Depth (in)	Snow Water Equivalent (in)	Date of Collection	Snow Depth (in)	Snow Water Equivalent (in)
2008	1-Mar	75	22.6	1-Apr	98	28.4	1-May	86	33	1-Jun	67	30.4
2009	1-Mar	84	23.9	1-Apr	108	30.5	1-May	92	36	1-Jun	51	25.4
2010	1-Mar	81	23.3	1-Apr	99	29.4	1-May	109	35.9	1-Jun	81	34.7
2011	1-Mar	108	33.5	1-Apr	124	42.3	1-May	145	54.8	1-Jun	129	57.8
2012	1-Mar	85	21.9	1-Apr	65	22.7	1-May	57	22.6	1-Jun	20	5.9
2013	1-Mar	67	16.6	1-Apr	72	21	1-May	79	26.1	1-Jun	45	18
2014	1-Mar	87	25.6	1-Apr	109	34.3	1-May	103	37	1-Jun	72	37.3
2015	1-Mar	65	17.9	1-Apr	64	21.4	1-May	70	26.1	1-Jun	55	24.2
2016	1-Mar	64	18.9	1-Apr	103	26.6	1-May	108	34.1	1-Jun	67	28.9
2017	1-Mar	90	25.6									

Table 1. Monthly Data for Sand Lake SNOTEL Site

4. Flood Characteristics

The National Weather Service (NWS) has a stream gage at the Highway 130 Bridge over the North Platte River in Saratoga. The current flow hydrograph, as of 16March2017 for the North Platte River at Saratoga is shown in Figure 4 below.

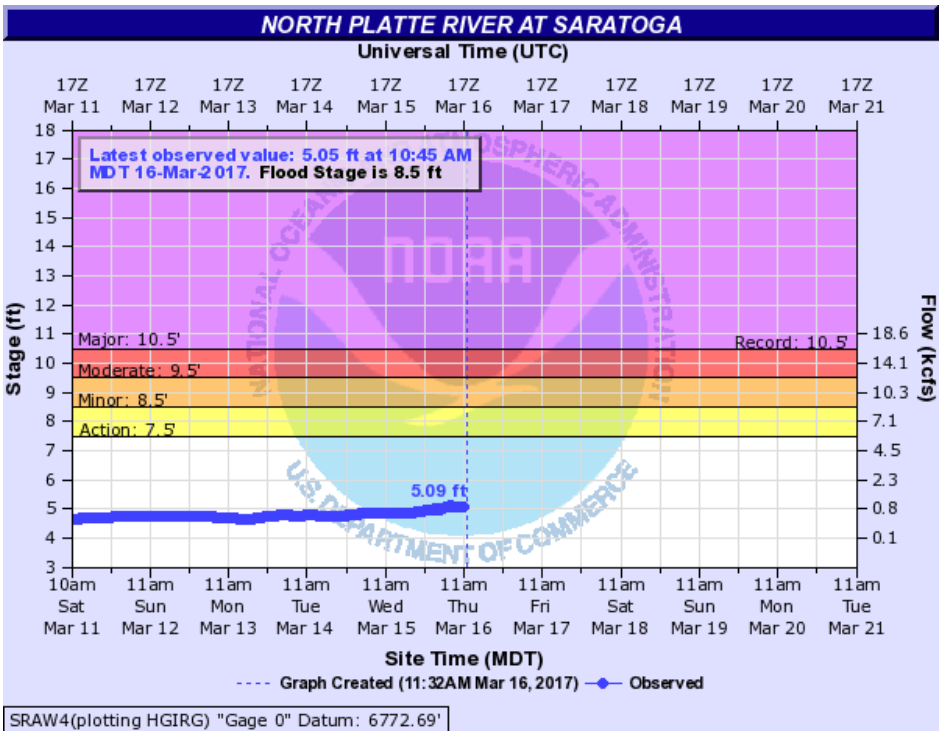


Figure 4. Hydrograph of flow on North Platte River at Saratoga

The NWS has established flood depths at which flooding may occur in the Town of Saratoga, as shown in Figure 5 and Table 2 below.

Flood Categories (in feet)

Major Flood Stage:	10.5
Moderate Flood Stage:	9.5
Flood Stage:	8.5
Action Stage:	7.5

Historic Crests
(1) 10.49 ft on 06/09/2011
(2) 10.40 ft on 06/20/1917
(3) 10.17 ft on 05/28/2014
(4) 10.16 ft on 06/13/2010
(5) 9.75 ft on 06/14/1957
Show More Historic Crests

(P): Preliminary values subject to further review.

Recent Crests
(1) 8.65 ft on 06/10/2016
(2) 7.70 ft on 06/12/2015
(3) 10.17 ft on 05/28/2014
(4) 6.66 ft on 05/18/2013
(5) 5.52 ft on 04/29/2012
Show More Recent Crests

(P): Preliminary values subject to further review.

Figure 5. Flood Categories as established by the National Weather Service

Stage (ft)	Impacts
10.5	Major flood. Widespread flooding occurs in Saratoga
10.49	Record stage established on June 9, 2011
9.5	Major flooding occurs at the Deer Haven RV Park just north of Saratoga. Minor flooding of homes along the left and right river banks in Saratoga. Veterans Island Park is inundated with flood waters. A majority of the golf course near the Saratoga Inn is underwater. Water approaches the base of the wooden steps at the NE corner of the Sierra Madre Trout Clubhouse.
9	Flooding of low lying areas in the Deer Haven RV Park intensifies and becomes more widespread. Standing water inundates yards of homes along the river in town. Flood water begin impacting access to Veterans Island Park. The golf course in Saratoga becomes inundated with water.
8.5	Flood stage. Low lying areas in the Deer Haven RV park begin to be impacted by flood waters. Water approaches low lying areas of homes along the river in town. Water enters low lying areas of Veterans Island Park.
7.5	Bankfull stage. Water approaches low lying areas with only minor flooding.

Table 2. Stage impacts in Saratoga of flooding on the North Platte River, as defined by the National Weather Service

Figure 6 and 7 show the probability of the North Platte River through the Town of Saratoga exceeding various flood stages and discharges during spring 2017.

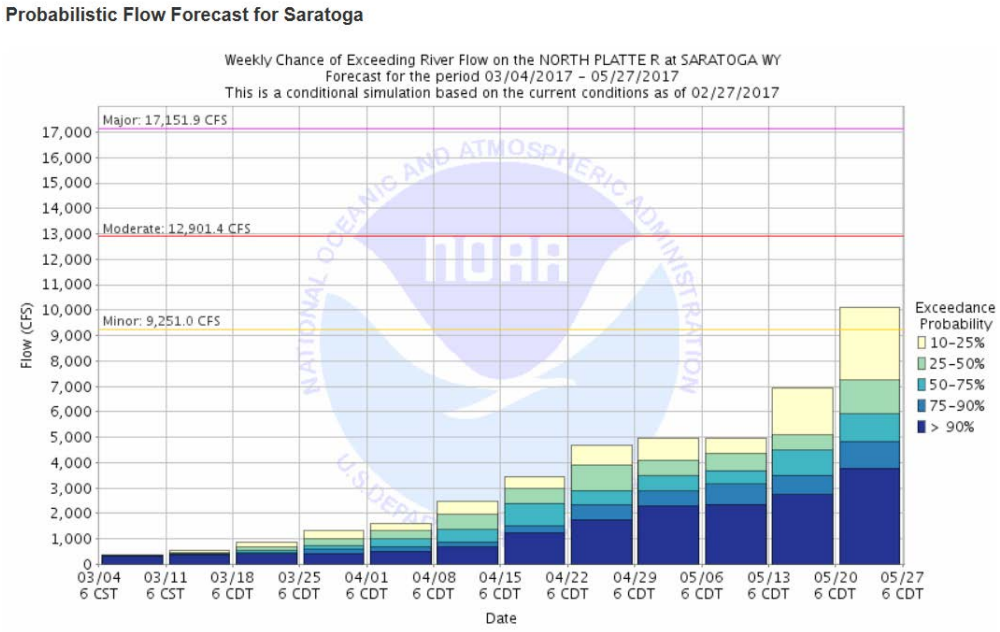


Figure 6. Weekly Chance of Exceeding River Flow on the North Platte River, from the National Weather Service

Stage Exceedance Forecast for Saratoga

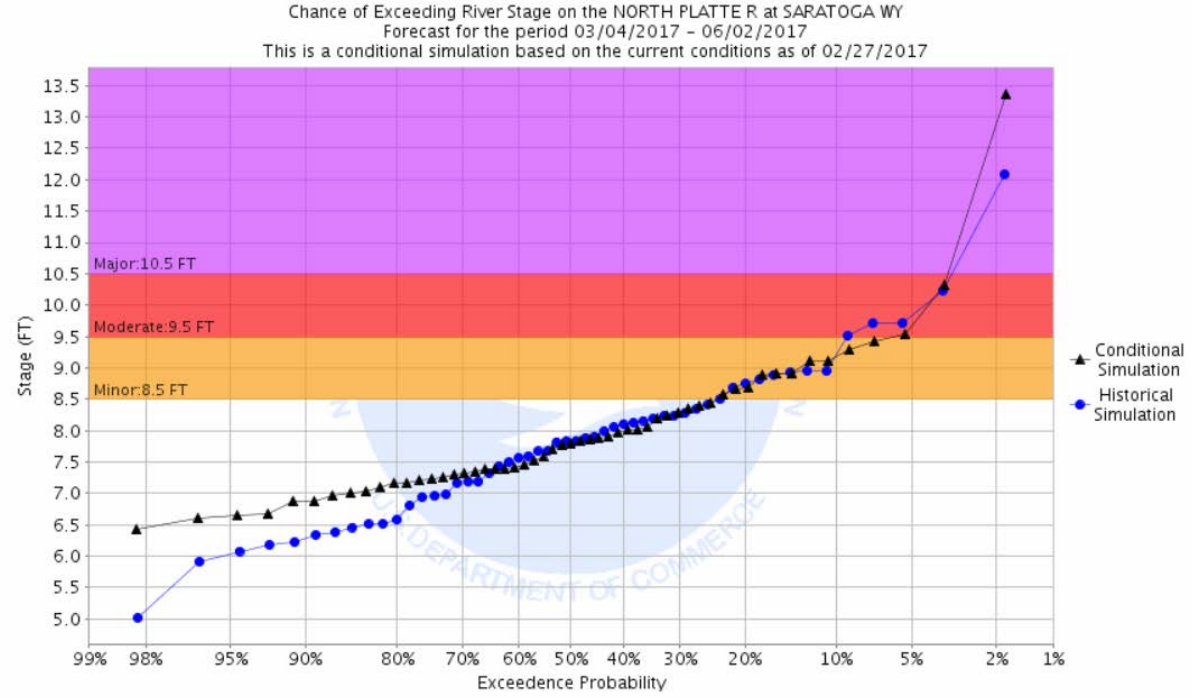


Figure 7. Stage Exceedance Forecast for Saratoga, from the National Weather Service

The 2014 Stantec and Wildland Hydrology North Platte River Conceptual Design report for the Town of Saratoga provides the discharges and predicated water surface elevation of various flood events, as shown in the table below.

Upstream of Hwy 130 Bridge		
Event	Flow (cfs)	Predicted water surface elevation
100-year flood	24,000	6788
2011 flood	16,900	6786.1
Top of low bank	13,200	6785

Table 3. Predicated Flow and Water Service Elevations on the North Platte River for various flood events, from a 2014 Stantec and Wildland Hydrology report

Discrepancies in the observed and predicted flood depths and elevations may be due to sedimentation or aggradation. Actual flood depths may also vary from predicted because of the effects of debris flow.

The calculated discharges correspond well to the flood stages expected at the stream gage at the North Platte River at Saratoga.

5. 2016 Flood Fight

5.1 Boozer Creek

In May 2016, a flood fight took place at the Boozer Creek embankment. Agencies involved included the Wyoming Department of Homeland Security, the Wyoming National Guard, Wyoming Department of Corrections, USACE-Omaha District providing technical assistance, Carbon County Emergency Management Agency, and various offices within the Town of Saratoga. This effort included plugging the upstream culvert at the site, which was required due to the headgate breaking loose from the conduit by floating debris; placing sand bags on the riverside slope, crest, and landside slope; and placing 1-ton sandbags on the embankment crest to serve as launchable riprap, if needed. The 1-ton sandbags placed on the crest and to plug the upstream conduit were placed with assistance of National Guard helicopters. For a detailed account of this flood fight effort, reference the USACE Saratoga Wyoming Technical Assistance Report, dated May 26, 2016.

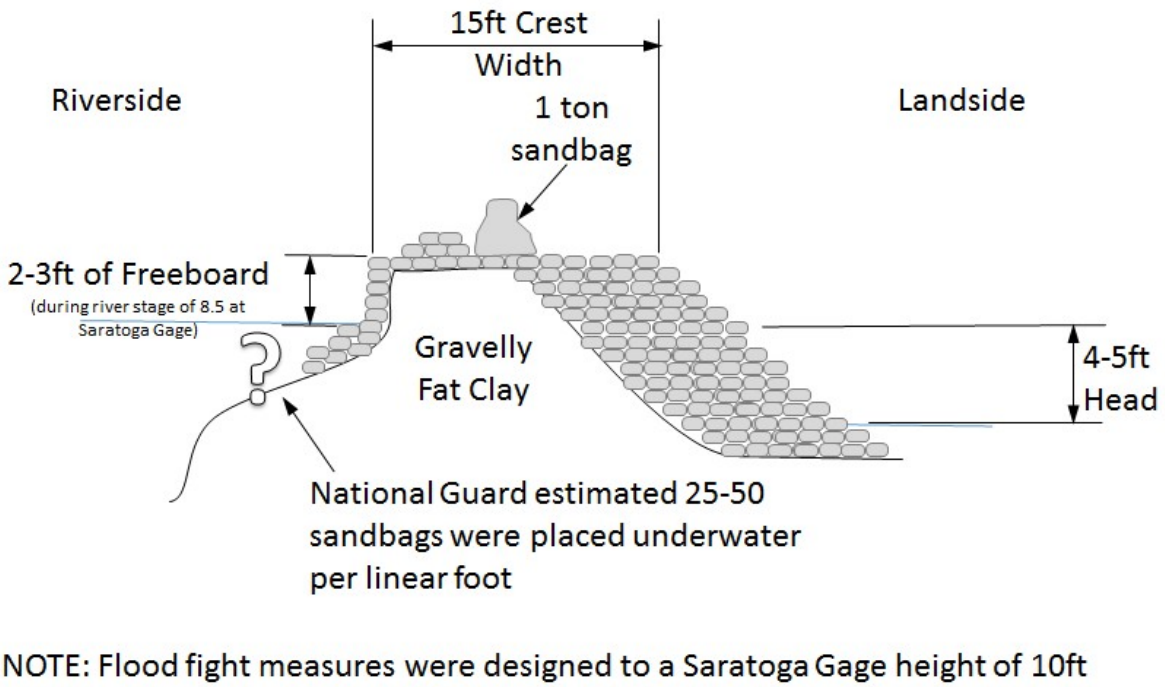
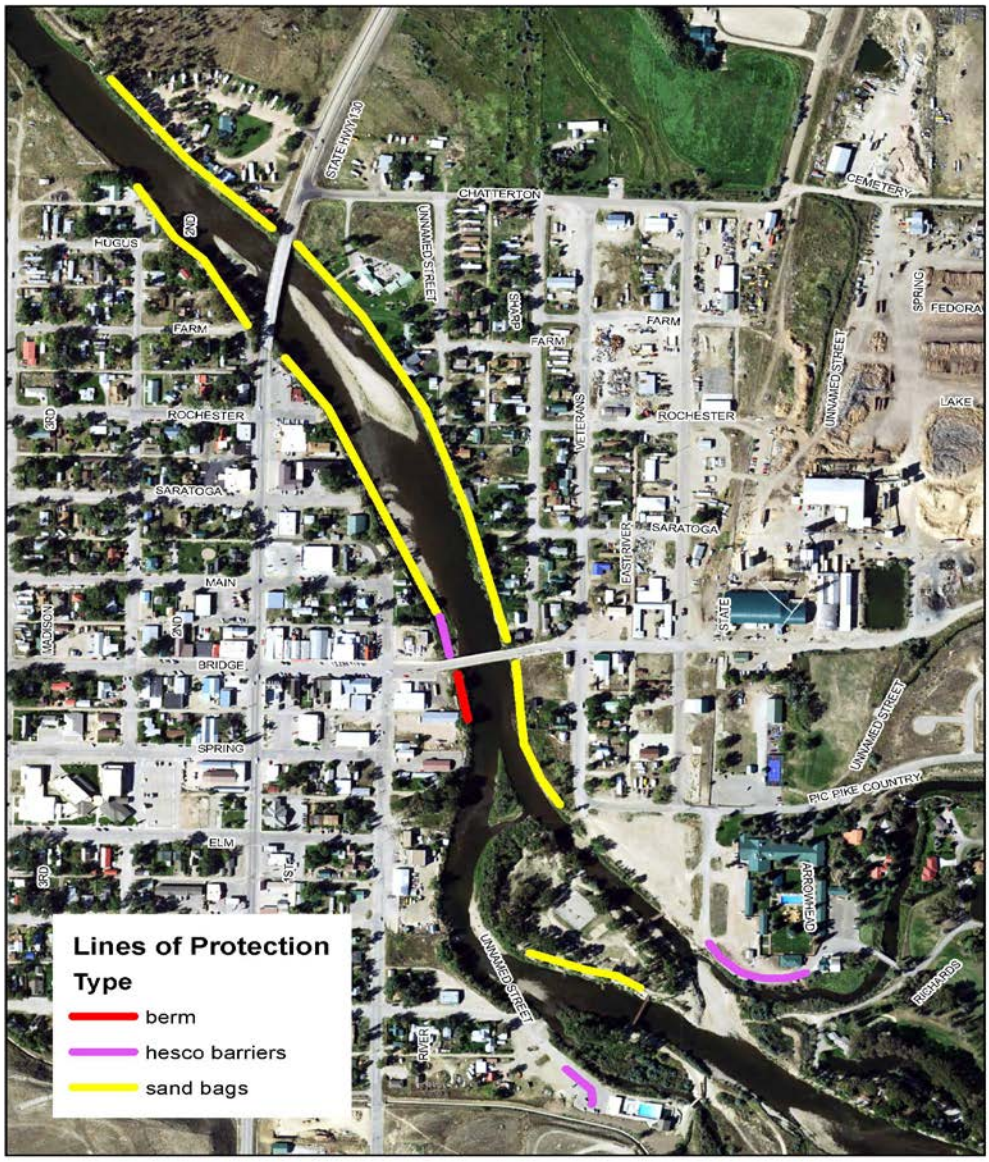


Diagram 1 - The above diagram was obtained from the USACE Saratoga Wyoming Technical Assistance Report, dated May 26, 2016.

5.2 Sandbags and HESCO Baskets: Sandbag berms and HESCO baskets were placed at various locations along the North Platte River left and right banks as shown on the attached map. The sandbags were built to 2 to 3 feet high. This map shows the location of sandbags and HESCO's placed during the 2016 flood and during previous floods in 2010 and 2011 by various agencies, including the Wyoming Office of Homeland Security, the National Guard, and local agencies.



Map 1. Saratoga Lines of Protection – 2016 Flood

6. Existing Conditions (March 2017)

6.1 Boozers Creek: No work has been performed to repair, replace, or properly abandon the two headgates. The downstream headgate shows no signs of damage; however, the gate at the upstream structure was knocked off during the 2016 high water event, leaving no control mechanism at this structure. There are 1-ton sandbags currently located at the conduit entrance, exit, and there is possibly one sandbag inside of the conduit. The sandbag at the downstream end of the conduit is shown in Photo No. 2. Many of the sandbags placed on the riverside, crest, and landside of the berm in 2016 have ripped and/or are deteriorating. See Photos No. 3 and 4. In addition to deteriorating sand bags on the riverside slope, the geotextile filter fabric has ripped at several locations and has been punctured at numerous locations. Movement of sandbags on the riverside vertical slope during the 2016 event and/or deterioration of the sandbags have resulted in areas of exposed, unprotected soil in the embankment. See Photo No. 4.

Photo No. 1 – View of the intact, downstream headgate. Riprap on the riverside face starts at this location on the embankment.

Photo No. 2 – View of the sandbags at outlet end of the upstream structure.

Photo No. 3 – General view of the embankment, looking downstream.

Photo No. 4 – View of the upstream face of the embankment, from near the upstream culvert, looking upstream. Note the vertical embankment face, deteriorating sandbags, and exp0sed embankment material.

6.2 Hesco's and Sandbags: All of the Hesco baskets placed in 2016 have been removed; however, the majority of the sandbags placed in 2016 are still in place. Some of these sandbags still appear to be in satisfactory condition, while others have deteriorated. It was noted during the site visit that the 2016 sandbags were placed along the same alignment and, in many cases, on top of sandbags that were placed during 2010 and 2011 flood fights. See Photos No. 5 and 6.

Photo No. 5 – View of 2016 sandbags that are still in satisfactory condition.

Photo No. 6 – View of 2016 sandbags that are badly deteriorating, and an adjacent area where a portion of the sandbags have been removed.

7. Boozer Creek - Consequences of Breach

In the May 26, 2016 Trip Report for the Saratoga Wyoming Technical Assistance, the USACE discussed potential consequences of a breach of the temporary berm on Boozer Creek. River stages throughout the flood fighting effort in 2016 were between 8 and 8.5ft at the Saratoga gage. The maximum predicted stage during 2016 was 10ft. Any predicted rise in stages beyond that level will increase the potential consequences of a Boozer Creek headgate breach beyond what was anticipated in 2016.

A breach of the temporary berm at Boozer Creek could send a significant amount of flow down the creek. The force of the flow combined with the location of the breach on the outside of a river meander, creates a high probability for a large portion of the river would reroute itself through Boozer Creek. If this were to occur, it could potentially result in significant flooding of the Town of Saratoga. Boozer Creek currently has very low peak flows during times of high flows on the North Platte River, because the only flow is through the headgate. The quick introduction of a large amount of water into this stream system would collect massive amounts of woody debris and cause bank erosion.

This debris and water would spread out across the fields and golf course. Debris would likely also collect on the narrow bridge at the downstream end of Boozer Creek, elevating river stages and causing severe flooding to any adjacent property owners. Water flowing through the golf course and down Boozer Creek would then intercept the North Platte River at nearly a perpendicular angle. Some of the flow may enter the North Platte immediately upstream of another bridge constriction. There would be potential for woody debris to collect along this bridge, pushing flows into adjacent neighborhoods.

If the flows are higher than those experienced in 2016, they would produce a higher head differential over the berm at Boozer Creek and increase the flow that would be sent down Boozer Creek. High flows would increase probability that the river would reroute itself and this would in turn amplify consequences downstream in Saratoga.

Based on field observations, there appears to be potential for flow in the North Platte to overtop or erode the banks at locations upstream and downstream of the temporary berm at Boozer Creek. A comprehensive analysis of the flood potential is needed to estimate the likely impacts of a high water event on the North Platte River.

8. 2017 Potential Solutions

8.1 Boozer Creek Embankment: Based on the current condition of the Boozer Creek embankment, if a high water event takes place as forecasted, the potential of failure exists. The alternatives provided below are considered to be emergency temporary measures that could be implemented in a relatively short period of time to provide protection of this embankment during the 2017 flood season.

8.2 Culverts: The two culverts are considered to be an extremely high risk for uncontrolled flows down Boozer Creek. The gate structure at the upstream culvert that broke off of the culvert has not been replaced since the 2016 flood. Currently this conduit is only partially blocked by two or three, 1-ton sandbags. Although the downstream gate structure is still in place, and functional, it also poses a serious risk. With the gate structure protruding into the channel due to scour along the bankline, and the location of the gate along the outside bend in the river, this gate is also subject to severe damage from debris strikes, similar to the upstream gate. To prevent flows through the upstream culvert, and uncontrolled through the downstream culvert should that gate structure be severely damaged or break off, it is recommended that both culverts be filled full with a lean concrete/flowable fill after discussing any permit requirements with the USACE Cheyenne Regulatory Office. Flowable fill is a low strength, high slump concrete mix with Portland cement, water, fine sand aggregate, and fly ash can be added. Mix design specifications can be obtained from Federal Highway Administration and State DOTs. This effort would require removing the sandbags from the upstream culvert; blocking off the downstream end of the culverts with plywood, or some other material; partially blocking the upstream end of the culverts in a manner that will prevent the flowable fill from exiting, but having an opening at the top where the flowable fill would be placed. Depending on the bracing at the ends of the conduits, it may be necessary to place the flowable fill in two lifts, with the second lift being placed after the first lift has started to set. In addition, filling of these culverts with flowable fill will also prevent the potential of embankment materials from piping into the conduits if there are any breaks in the corrugated metal pipe culverts due to corrosion or separation at the joints.

8.3 Embankment Riverside Slope: The upper three feet of the embankment riverside face is vertical and some of the sandbags that were placed in 2016 have fallen into the river, leaving exposed embankment material. At other areas on the riverside face, the sandbags have deteriorated to the point where they would be ineffective of protecting the embankment from erosive forces from river flows or from floating debris. Only placing additional sandbags on the riverside face will not provide adequate protection for the embankment due to the high probability that the sandbags will fall into the river after they are subject to high flow conditions (Reference Photo No. 4). Based on the short time frame available, in order to act prior to the anticipated high river flows, the following two alternative temporary measures are recommended:

- After discussing any permit requirements with the USACE Cheyenne Regulatory Office, stack, place, cover the riverside face of the embankment with sandbags as was performed in 2016, and then place riprap from the base of the embankment up the slope to the top of the embankment. The sandbags if continuously placed and in satisfactory condition, would be confined by the riprap to prevent movement of the sandbags, and would serve as a filter to prevent/limit fine grained soil particles from washing out. The riprap section would require a large base to allow

for sloping of the riprap at the angle of repose of the material to the top of the slope. The size of the riprap would need to be determined; however, previous designs or the gradation of effective riprap sections placed at other nearby areas along the North Platte River could be used as a basis.

- After discussing any permit requirements with the USACE Cheyenne Regulatory Office, remove all of the existing sandbags from the riverside face of the embankment and slope to a relatively smooth slope of no steeper than 1V:2H. This face should then be covered with a geotextile filter and riprap protected. With this alternative, the riprap section would still require establishing a base below water surface; however, the total amount of riprap required would be less since the riprap would be placed on a slope rather than a dumped section. With this alternative, the filter fabric would provide a more consistent layer of filtration.

8.4 Embankment Crest and Landside Slope: The crest and landside slope of the embankment is covered with the thick layer of sandbags placed in 2016. See Diagram 1 and Photo No. 3. Many of the sandbags on the surface are deteriorating; however, since the underlying sandbags have been protected from UV degradation, there is a possibility that they may still provide adequate protection. In addition, the row of 1-ton sandbags placed on the narrowest section of the embankment, to serve as launchable riprap should there be a riverside erosion related slope failure, are still in good condition. Based on the short time frame available, in order to act prior to the anticipated high river flows, the following two alternative temporary measures are recommended:

- Some of the sandbags on the crest and landside slope surface should be pulled back and the condition of the underlying sandbags evaluated. If the underlying bags still appear to be sound, an additional two rows of sandbags placed up the entire landside slope may be sufficient to provide stability and seepage resistance. Rows of additional sand bags should also be placed along the crest to assure that overtopping does not occur at this location. The 1-ton sandbags on the levee crest should stay in place.
- IF time permits, there would be a much higher comfort level and probability of the embankment holding during this pending high water event if all of the existing sand bags were removed and a widened levee section was constructed on the landside of the embankment. Prior to the 2016 Flood, the upper three feet of the embankment only had a thickness of approximately five feet. Currently, it can be assumed that the thickness of the embankment is now less than five feet in some areas. This potentially subjects the embankment to slope failures on the riverside face and/or an adverse through seepage condition resulting in piping of embankment material. By placing a full height levee section on the landward slope, the potential of embankment failure could be minimized. It is recommended that a 15 foot wide full height section of compacted clayey soil be placed on the landside slope. Fill material should also be placed on the crest to approximately six inches above the surrounding ground surfaces to limit the possibility of overtopping. This alternative would provide a sufficient embankment section even if some sloughing on the upper portion the riverside slope did occur, and resistance against through seepage piping concerns.

8.5 Downstream Channel Areas: If the culverts are abandoned with flowable fill, the potential for uncontrolled flow through the conduits and the piping of embankment material into the culverts will be reduced; however, piping of embankment/foundation materials around the outside of the conduits still

exist. After discussing any permit requirements with the USACE Cheyenne Regulatory Office, it is recommended that a sand berm be constructed in the channel areas, at the toe of the embankment, to reduce the potential of through seepage along the conduits and/or boil activity from developing in the channel bottom near the ends of the conduits. This sand berm should be a minimum of fifteen feet wide and to approximately two feet above the top of the two culverts. This berm should then be covered with one foot of cohesive soil.

8.6 Community Flood Preparedness: It is recommended that the community prepare a Flood Fight Plan to be prepared for a 2017 high water event. This would include:

- The majority of the sandbags placed in 2016 are still in place. It is recommended that the condition of these sandbags and the continuous line of protection are verified along both sides of the North Platte River. Areas of deteriorating sandbags may still be utilized by wrapping the existing sandbags with visqueen and anchoring the visqueen with new sandbags.
- Town officials indicated that the community currently has approximately 20,000 unfilled sandbags on hand. Sandbags should be filled and ready for placement prior to a high water event.
- It is recommended that the location of lines of protection be evaluated and may be modified to strategically protect infrastructure and structures. For example, the sandbag line of protection on Veteran's Island could be pulled back to protect only the historic structure.
- It is recommended that a survey is performed and survey stakes are placed to identify the line of protection elevations at various locations along both banks of the North Platte River.

8.7 Flood Warning Systems: It is recommended that a flood warning system is considered for the Town of Saratoga. Sirens or an emergency alert system could be used to alert citizens of flood danger. The Town has a Code Red alert system that could be promoted to citizens.

8.8 Evacuation Planning: It is recommended that an evacuation plan is developed for areas that could be inundated by a flood event. The community should consider the areas that could be impacted by a breach of the Boozer Creek temporary berm, as well as overbank flooding from the North Platte River. The planning process should consider areas that should be evacuated at various stream levels. A thorough evacuation plan should include:

- Conditions that will activate the plan
- Chain of command
- Emergency functions and who will perform them
- Specific evacuation procedures, including routes and exits
- Equipment for personnel

It is recommended that the plan is exercised to ensure that emergency responders and community officials know what to do in the case of a flood and that the plan is updated to include lessons learned from exercises.

9. Future Studies and Projects

It is recommended that the North Platte River through Saratoga is studied to determine long term solutions to improving river function and reducing flood risk. The North Platte River Conceptual Design report dated September 5, 2014 and the Geomorphology and River Assessment dated July 2 2014 prepared for the Town of Saratoga by Stantec and Wildland Hydrology both can be used as a basis for future river restoration projects. It is recommended that areas upstream of the temporary berm at Boozer Creek are evaluated for the potential to stabilize the streambanks and improve sediment transport. There may also be opportunities to create high water overflows into the floodplain to reduce damages to property and infrastructure and improve the riparian ecosystem. In addition to the recommendations included in the Stantec and Wildland Hydrology reports, the community could consider structural and nonstructural flood risk reduction projects to address the potential for flood damages to buildings and infrastructure. There are several federal programs that could assist the community with these efforts. The following section describes these programs.

9.1 Silver Jackets - USACE

Silver Jackets are state-led interagency teams that facilitate collaborative solutions to state flood risk priorities. Silver Jackets teams in states across the United States bring together multiple state, federal, and sometimes tribal and local agencies to learn from one another in reducing flood risk and other natural disasters. By applying their shared knowledge, the teams enhance response and recovery efforts when such events do occur.

Silver Jackets teams can pursue interagency flood risk reduction projects, which could include flood awareness, education, identification, and nonstructural flood risk reduction assessment. Interagency work promotes participation by USACE staff in small efforts undertaken in conjunction with other partners in order to achieve flood risk management benefits that could not be achieved by any one party alone. Nonstructural flood risk assessments can help communities identify opportunities for floodproofing, elevation, acquisition, and relocation of floodprone structures. The assessments can also help guide communities to incorporate flood risk reduction into planning and land use decisions.

For more information, visit http://silverjackets.nfrmp.us/

For more information about the Silver Jackets program, please contact:

Ms. Jamie Prochno
Civil Engineer
Engineering Division
U.S. Army Corps of Engineers – Omaha District
Office Phone: (402) 995-2348

9.2 Section 205 - Small Flood Risk Management Projects - USACE

The Small Flood Risk Management Project program provides local flood risk management by the construction or improvement of flood control works or nonstructural measures. The types of studies and

projects are tailored to be site specific. Typical flood risk management projects may include levees, floodwalls, impoundments, pumping stations, and channel modifications as well as nonstructural measures. Examples of nonstructural measures include floodproofing, relocation of structures, and flood warning and preparedness systems. The Corps of Engineers oversees planning, design, and construction of flood risk management projects in close coordination with the project sponsor. For more information about Section 205, please contact

Mr. Greg Johnson
Chief, Plan Formulation Section
Planning Division
U.S. Army Corps of Engineers – Omaha District
Office Phone: (402) 995-2701

9.3 Planning Assistance to States Section 22 - USACE

The USACE can assist states, local governments, other non-federal entities and eligible Native American Indian tribes with preparation of comprehensive plans for the development, use and conservation of water and related land resources. Studies and analyses are conducted at a planning-level of detail only. They do not include feasibility-level studies or detailed design that support or lead to project construction. USACE assistance is authorized by Section 22 of the Water Resources Development Act of 1974 (P.L. 93-251), as amended, also referred to as Planning Assistance to States (PAS) program. Studies completed under this program include flood inundation mapping, dam safety and failure modeling, water supply and demand analysis, water quality assessments, environmental restoration concepts, flood damage reduction assessments, wetlands delineation and biological assessments. For more information about Section 22, Planning Assistance to States, please contact:

Mr. Greg Johnson
Chief, Plan Formulation Section
Planning Division
U.S. Army Corps of Engineers – Omaha District
Office Phone: (402) 995-2701

9.4 Hazard Mitigation Assistance Grant Programs – FEMA

The Federal Emergency Management Agency (FEMA) administers three programs that provide funding for eligible mitigation planning and projects that reduces disaster losses and protect life and property from future disaster damages. The three programs are the Hazard Mitigation Grant Program (HMGP), the Flood Mitigation Assistance (FMA) Program, and the Pre-Disaster Mitigation (PDM) Program.

- HMGP assists in implementing long-term hazard mitigation planning and projects following a Presidential major disaster declaration
- PDM provides funds for hazard mitigation planning and projects on an annual basis
- FMA provides funds for planning and projects to reduce or eliminate risk of flood damage to buildings that are insured under the National Flood Insurance Program (NFIP) on an annual basis

For more information, visit https://www.fema.gov/hazard-mitigation-assistance