Big Sky Sustainable Water Solutions Forum
Stakeholder Meeting
Agenda

June 15, 2017
12:30-3:30 pm
Big Sky Water & Sewer District

Meeting Objective:

· Discuss and analyze options and alternatives to address goals. Provide initial recommendations on priorities and strategies and identify questions.
· Discuss desired qualities in watershed stewardship plan implementation framework

12:30: Welcome

12:35-12:40: Public Comment
12:40-12:50: Communication Plan
· Brief overview of communication plan and input from group

12:50-1:50: Analysis of Issues and Options
· Brief overview of analysis from May 24 meeting, alternatives matrix and priorities to address today.
· Small group assignments – by focal area
- Discuss and identify short and long-term priorities and, where possible, proposed tools
- Identify unanswered questions necessary for making decisions
- Bring list to full group

1:50-3:25: Analysis of Issues and Options – Large Group
· Present focus area priorities
· Discuss as large group
· Make recommendations on priorities as a group and identify unanswered questions
· Discuss desired qualities for implementation framework

3:25-3:30: Public Comment

4:00: Closing

BSSWS Adopted Goals and Draft Objectives

Goals were adopted on 3/30/17. Objectives were discussed and approved by focus groups on 4/27/17, but have not been formally adopted.

Overall Vision Statement

Big Sky strives to be a model mountain community by protecting and improving water resources, sustaining ecological health of the watersheds, and supporting a vibrant local economy.

Ecological Health of the Rivers

Goal

A healthy and resilient river system sustained through a principled approach to watershed stewardship that includes human activities and natural processes that maintain and enhance stream, riparian and wetland conditions and connections, ensuring water remains clean and cold.

Objectives

- Maximize water quantity, protect existing high quality and improve degraded water quality
- Identify, sustain, and enhance high-value riparian corridors and wetland areas
- Sustaining aquatic communities while enhancing native populations.

Water Supply and Availability

Goal

Manage and balance surface and groundwater supplies for a vibrant community sustaining a broad spectrum of uses and values including fisheries, wildlife, recreation, agriculture, municipal and domestic needs.

Objectives

- Maximize existing ground water and surface water resources by conservation, efficient management, and reuse of reclaimed water
- Maintain sufficient, high quality year-round in-stream flows to meet ecological needs (quality and quantity)
- Increase system resiliency to address drought and climate variability

Wastewater Treatment and Reuse

Goal

Develop and implement holistic wastewater and stormwater management, utilizing best available technologies and practices, to meet Big Sky's long-term community needs and protect and improve the ecological health of the river systems.

Objectives

- Ensure wastewater does not have a negative impact on the ecological health of the river systems and groundwater resources
- Address onsite septic systems in sensitive areas
- Identify alternative strategies for land application of treated wastewater

Big Sky Sustainable Water Solutions Forum
Stakeholder Meeting
Agenda

May 24, 2017
1:00-4:00 pm
Big Sky Chapel Basement
510 Little Coyote Road

Attending: Guy Alsentzer, Upper Missouri Waterkeeper; Brad Bauer, Greater Gallatin Watershed Council; Scott Bosse, American Rivers; Pat Byorth, Trout Unlimited; Rich Chandler, Yellowstone Club, GRTF Board; Mike DuCuennois, Yellowstone Club, BSWSD Board; Susan Duncan, Association of Gallatin Agricultural Irrigators; Ron Edwards, Big Sky Water and Sewer District, GRTF Board; Kristin Gardner, Gallatin River Task Force; Kevin Germain, Lone Mountain Land Company, Big Sky Chamber Board, Resort Tax Board; Ethan Kunard, Madison Conservation District, Madison County Planning Board; Peter Manka, Alpine Water; Dave Moser, FWP; David O'Connor, Buck's T-4 Lodge, Big Sky Chamber; Mike Richter, MT Bureau of Mines and Geology, GRTF Board; Kerri Strasheim, DNRC; Tammy Swinney, Gallatin Local Water Quality District; Eric Urban, DEQ; Brian Wheeler, Big Sky Resort, BSWSD Board; Steve White, Gallatin County Commissioner; Jessie Wiese, Montana Land Reliance; Ennion Williams, Big Sky Trout, Big Sky Vacation Rentals; Ciara Wolfe, Big Sky Community Organization; Bob Zimmer, Greater Yellowstone Coalition.

Public Attending: Britt Ide, Big Sky Chamber Board; Kris Inman, Wildlife Conservation Service; Steve Johnson; Stephanie Lynn, GRTF; Jenelle Johnson; Margo Magnant, Big Sky Chamber of Commerce.

Notes and Support: Karen Filipovich, Jeff Dunn, Elizabeth Schneider

Detailed Notes

Public Comment:

There were no comments.

Analysis of Issues and Options:

Groups were assigned to the three focus areas: ecological health of river systems, water supply and availability, and wastewater treatment and reuse. Participants were asked to further analyze the options in continuation of the discussion begun at the April 27 meeting, prior analysis, reports, and stakeholder input. Participants used an alternatives matrix that reflected opportunities and challenges in the four criteria areas (technical, laws and regulations, cost, and community support and interest), environmental analysis, and timeframe for the major areas in each of the focus groups. Participants were also invited to add further tools or question.

These notes represent further analysis and consideration within each of the focus areas.

Wastewater Supply and Application

Protect Meadow Aquifer:

This group's goal is to ensure that water quality and quantity is maintained in the Meadow Village aquifer.

- Explore potential of groundwater control area (GCA): Some analysis will be needed to determine whether or not this is useful.
    - Add to definition: "reduce the impact of future wells"
    - Benefits may include limiting future exempt wells
- Implement a Source Water Protection Plan
    - A study for the Canyon may be needed
    - Cost effective, may be useful for funding and grant purposes since source water can be considered "existing infrastructure"
- Utilize Bureau of Mines study data
- Stream depletion plan (New tool group would like to add) – need to petition DNRC
- Implement Canyon Modeling

Stormwater Capture:

- MS4 – Municipal Separate Storm Sewer System:
    - Can grant authority to an entity equal to or more than 10K residents or history of water impairment
    - Petition DEQ to grant MS4 to sewer department district
    - Study MS4 costs, who regulates plan?
    - Compare MS4 to existing state law
- Water Balance Study pre/post development
    - Theory: will more water be available post development and with better practices?
- Grey water right area of capture < .1 ac-ft. and has a negligible impact on local water, unless you have a water right

The group thought MS4 is worth looking into further.

Wastewater Reuse:

- Continue studying use of snowmaking for effluent irrigation/distribution.
- Greywater reuse
- Consider flow parameters as a goal of aquifer as related to stormwater

Add new topic: Use streamflow parameters of study area tributaries as an indicator of aquifer health/depletion.

Outreach and Incentives for Conservation:

- Outreach – blend xeriscaping with firewise landscaping to optimize for both water and fire control. “Trout” and “wildlife certified” could incorporate work done at the Wildlife Conservation Society (WCS). “Code of Big Sky” could be another tool to help landowners know what is expected.
- Collaborate with other NPO’s or HOA on “certified status”
- HOA’s have significant say in requirements for greywater, conservation, limiting ponds and landscaping. However, contact can be a challenge.

The group thought that putting together one certification would be helpful, since it would make it easier for landowners and managers to do. Working with other non-profits in the area would be useful to get local buy-in.

Mitigation:

- Mitigation is difficult and variable, with significant limitations. Some avenues for further investigation include:
  - Turn some of the fully consumed water rights to less consumptive (e.g. snowmaking to increase future rights)
  - Return underutilized water rights
  - Use non-perfected water rights perfected and use mitigation for future water rights

No general conclusion was reached.

Ecological Health of the River Systems

Watershed Status and Trends Monitoring:

Focus group discussed measures that would be useful to track progress and report trends to the community. This discussion is a continuation of what was started in April.

- Develop baseline data for fish populations – healthy populations of wild trout
- Addition gaging for Q
- Additional SNOTEL and precipitation
- Stormwater mapping
- Wetland and riparian mapping
- Quality and temperature of water
- Q should be times for optimal temperature and time
- Downstream Gallatin water quality monitoring
- High Q monitoring and synoptic monitoring
- Wetted perimeter measurements
- Suite of restoration practices and techniques

Conservation and Restoration:

- Regulations: Mapping stormwater at subdivision platting
- Hot tub disposal management
- Setback and buffers
- Green certification for great practices (or the converse – public release of high users)

Wastewater Treatment and Reuse

Land Application:

What is the maximum amount of treated wastewater that can be land applied?

- 120-145 million gallons annually (in the Meadow)
- Current BSWSD wastewater is roughly 140 million gallons annually. The BSWSD is roughly 50% build out compared to the lots within its boundaries.
- The projection for 2035 is 313 million gallons annually within the BSWSD and YC and Moonlight will be roughly 136.8 million gallons annually.
- Hotel occupancy and amount of year homeowners spend in Big Sky could affect predicted wastewater generated.
- Are the existing levels for disposal capacity too high? (much build for full occupancy)
- Land application is contributing to elevated nutrients in the Middle Fork/West Fork
- BSWSD is revisiting treatment and disposal capacity (soil work, groundwater capacity, etc. (and this may affect how much, where and when golf course is irrigated.

Additional Wastewater Reuse:

- **Purple Pipe:** Town Center, subdivisions, Town Center Park
    - **Challenges for Purple Pipe:** Cost, institutional, private property, discharge permit, potential public perception
- **Snowmaking (could be 30-40 million gallons annually):**
    - **Challenges:** property, discharge permit, potential PR, expensive to apply in some areas (e.g. Lone Peak Ranch not near any pipes)
    - **Opportunities:** larger mixing zone than other forms of discharge, added benefit of water storage and instream flow, may substitute for ground water supply
- **Considerations:** Timing, on vs. off terrain, cost benefit, marketing

Treatment Levels:

- Current aquatic life standards are .3 mg/l of Total Nitrogen (TN) and .03 mg/l of Total Phosphorus (TP) – This is higher than drinking water standards
    - This is summer only (July 1-September 30)
- Current DEQ end of mixing zone regulations (not end of pipe)
- Would “floating islands” for nutrient uptake in storage ponds? (ex: Joliet)

- Public Perception: treatment level may not matter; standards discussed are actually higher than drinking water standards for total nitrogen, but that still may not matter for public perception. This matter seems to be a question to ask community members.
- EPA considers of 3-4 mg/l of TN is to "limits of technology" treatment plants. Butte plant is an example in Montana of a treatment plant that can reach this level.
    - Reverse osmosis might be able to reach this level or even higher, but it is high cost, uses very high amounts of energy and leaves a significant part of the water as waste (high levels of treatment)
- **Messages** – Big Sky will have to employ new solutions to continue growing
    - "We all benefit from the recreation economy." Development brings dollars for all.
    - Stopping development is not the answer. (Still lots of potential growth on private land and private property rights must be considered.)
    - "Set the bar high."

Canyon – septic and/or centralized treatment expansion

- Current zoning: If fully build, it could be 1 million gallons/day – this level can't be built with current well and septic technology in general use.
- This build up is seen as potential work force housing areas.
- How would you expand centralized sewer services?
    - Separate county water and sewer district
    - Become part of Big Sky Water and Sewer District (Expand continuous areas with vote of board or expand with vote of constituents)/ cost and votes are both considerations
    - Expansion could be done in phases: lift station installed at the corner of Big Horn and Conoco – pump to BSWSD plant
- Scenarios for current well and septic property owners:
    - DEQ can model existing loads from septic
    - Three scenarios:
        - Continue with septic
        - Full build out on centralized sewer
        - Limited build out with zoning changes

Discussion and Follow-up Ideas

1) Public Survey for input over the summer. Question was asked how best to gather information: Suggestions included to HOA leaders and electronically.
2) Trigger Flows: Tie into drought planning with some minimum in-stream flow. Ecological Health and supply both saw use in some level. EH suggested that the wetted perimeter as a measure.
3) A question on fishing regulations came up. The Gallatin River has a 5-fish limit/day. The question was whether this needs to be looked at? Dave Moser of FWP said that even if some take the limit, this has not impacted fish populations.

Community Models for Watershed Stewardship Implementation

Participants were briefly presented with models for implementing watershed stewardship. This Water Forum is expected to end in its current form once it has accomplished its goal of developing a watershed stewardship plan, but part of that plan will include how to implement it.

Good Neighbor Agreement

A good neighbor agreement is a legally contract written between entities to address environmental and community concerns. It also allows the industries involved to publicly demonstrate their commitment. The Stillwater Mine, Northern Plains Resources Council, Cottonwood Resource Council, and Stillwater Protective Association. The agreement has been in place seventeen years and has been updated three times. This form of agreement has been used primarily in partnership with mining or oil and environmental and community groups.

Benefits of these agreements can include:

- Clear statement of desired outcomes and targets for environmental and community benefits that are monitored and enforced.
- Avoided lawsuits and less contentious permitting processes.
- Business benefits in terms of better public relations and potential to market products as green.

Translating this model to the circumstances in Big Sky has potential, but challenges include crafting an agreement with many participants, finding a way to include agencies and local governments that may be reluctant or unable to sign a contractual agreement, and ensuring that ongoing monitoring and enforcement is implemented over time. MOUs tied to the watershed stewardship plan could be an alternative, though those would not have the legal force of a signed contract.

Watershed Group Based Approaches

<u>Blackfoot Community Conservation Area:</u>

The Blackfoot Challenge established a fifteen-member committee to work on joint management that includes forest management, invasive species, and multi-use of the 41,000+ acres of public and private land in the designated area. These stakeholders, who represent a diverse set of public and private perspectives, guide the process as a set committee under the auspices the Blackfoot Challenge watershed group.

This effort is voluntary, guided by the goals set by stakeholders. Big Sky has an existing watershed group that could be a host for this form of effort. Since boundaries and goals are set for the area in this model, it could work across the multiple counties, private and public lands in the area.

<u>Flathead Basin Commission:</u>

The Flathead Basin Commission was established in 1983 by the legislature to cut across boundaries and address environmental issues. At its inception, coal mining in British Columbia was a major concern. That concern has receded over time, but the FBC still maintains activities on issues that of concern across the basin, such as invasive species.

Its enabling legislation outlines its mission, provides for base funding, and provides for information sharing at the state level. Challenges to establishing such a model now include an unknown legislative appetite to assign special status to the Big Sky area and potential perceived competition with other watershed interests in the area.

Clean Water Services

In 1970, 26 municipal wastewater entities combined to form a unified system, in response to a building moratorium due to pollution entering the Tualatin River in Oregon. The area has grown rapidly since then, from about 157,000 people in 1970 to 560,000 people in 2010. Clean Water Services has evolved significantly in that time period, from early efforts at consolidation and reaction to the initial and further pollution and subsequent lawsuits. However, over time, it was able to develop into a proactive, award-winning public utility coupled with a non-profit Clean Water Institute that produced further innovations that partners well with other community organizations.

This model has merit for Big Sky. The existing water and sewer district could take on more of this approach and potentially expand, and the watershed group has potential to take on some of the functions. There is also widespread interest in proactive approaches to address water resources issues. Challenges for implementing this model include the current small population compared to the Tualatin River area and the fact that there is not a single entity that currently oversees public water utility services in the area.

Montana Water Conservancy District

Montana law established the ability to form water conservancy districts in 1969. Districts are granted the ability to work across political boundaries, to tax and bond, and to oversee water management. Other states, such as Colorado, established conservancy districts earlier and have used them very successfully. Montana has yet to establish a water conservancy district, primarily because of the challenges associated with an initial feasibility study and the voting requirements to establish one. B

Big Sky has significantly more ability to conduct feasibility studies, due to local expertise and more funding streams than past efforts in Montana, but the voting requirements may still pose a difficult barrier. If these issues could be overcome, establishment of this governmental entity could provide a way to overcome the fragmented nature of current water resources oversight in Big Sky.

Public Comment

There were no public comments.

Participants were asked to write any priorities or ideas they had on index cards. Four cards were returned with these comments:

- Water conservancy district?
- I think it would be great for public engagement to have a field trip open to the public – or maybe a series of them – to show what's currently being done and what is needed moving forward
- Most important strategies:
    - Promote water conservation and water saving fixtures

    - Build an anti-irrigation of lawns mindset
    - Gather cost/practicality options for wastewater disposal/use
    - Pursue stormwater MS4 fact finding.
- Biggest Opportunities:
    - Water conservation education
    - Establish surface water/ground water monitoring program
    - Biggest challenges – conversion to xeriscaping
    - Wastewater infrastructure investment plan/direction
- The Forum must decide what action(s) are necessary to create discrete plans addressing wastewater treatment levels and types of disposal, including addressing the Canyon.
- The Forum should create a plan to address developments, stormwater impacts, whether through creation of an MS4 authority or otherwise.

The meeting adjourned at 4:00pm. The next meeting is at the Big Sky Water & Sewer District conference room on June 15 from 12:30-3:30.

Ecological Health of the River Systems

Water Quality

The *West Fork Gallatin River Watershed Total Maximum Daily Loads (TMDLs) and Framework Watershed Water Quality Improvement Plan* completed in 2010 identifies the maximum amount of a pollutant a water body can receive and still meet water quality standards. Within the West Fork Gallatin River watershed, three streams have been identified as impaired, including the Middle Fork West Fork Gallatin River, South Fork West Fork Gallatin River, and West Fork Gallatin River (**Table 1**). In addition to establishing TMDLs, the 2010 TMDL document includes an assessment of road densities, traction sand application, riparian buffer conditions, instream habitat conditions, and fish passage through culverts. Ongoing water quality monitoring conducted by the Gallatin River Task Force has identified the following spatial trends: nitrogen and chloride are elevated in the Middle Fork West Fork Gallatin River and West Fork Gallatin River, while algae growth is elevated in the Middle Fork West Fork Gallatin River, South Fork West Fork Gallatin River, and West Fork Gallatin River. Seasonal trends identified by the Gallatin River Task Force indicate that chloride is highest pre-snowmelt (March/April), turbidity is highest at runoff, nitrate is highest in the winter, and *E. coli* is highest in the summer. Wastewater has been identified as a major source of nitrogen in summer and winter, while soil and atmospheric sources of nitrogen are predominant during spring runoff. In the summer, biological uptake by algae masks nitrogen concentrations. Recent research conducted by Montana State University indicates there is a significant diurnal fluctuation of nitrogen, with concentrations lowest during the day when algae are photosynthesizing and using nitrogen. Outside of the West Fork Gallatin River watershed, many streams have not been assessed and conditions aren't known.

Table 1. Percent Reductions in Pollutant Loading Required by TMDL

Stream Segment	Nitrate+ Nitrite	Total Nitrogen	E. coli	Sediment
Middle Fork West Fork Gallatin River	33%	n/a	55%	29%
South Fork West Fork Gallatin River	0%*	n/a	n/a	0%**
West Fork Gallatin River	33%	36%	n/a	0%**

*Current nitrate+nitrite load not calculated; total load allocations developed

**Current estimated total sediment load equals total allowable sediment load; percent reductions required for sediment loads from roads, streambank erosion and upland erosion

Stormwater

During the West Fork Gallatin River watershed TMDL assessment, four sub-watershed drainage areas within the Mountain Village and Meadow Village were delineated in GIS using color aerial imagery. The Mountain Village was divided into two stormwater source areas, with the area draining directly into Lake Levinsky (LL) examined separately from the area that drains into the Middle Fork West Fork Gallatin River (MFWF). The Meadow Village was divided into two stormwater source areas, with the portion located to the north of the Big Sky Spur Road draining into the West Fork Gallatin River (WF) and the portion located to the south of the Big Sky Spur Road draining into the South Fork West Fork Gallatin River (SFWF).

Table 2. Sub-watershed Stormwater Source Areas

GIS Delineated Areas	Mountain Village (MFWF)	Mountain Village (LL)	Meadow Village (WF)	Meadow Village (SFWF)
Total Area (acres)	341	155	409	240
Developed Area (acres)	93	88	60	98

Wetland and Riparian Areas

The primary public source of wetland information is the National Wetland Inventory (NWI) created by the U.S. Fish and Wildlife Service, which provides geospatial information on wetland extent, type and change using remote sensing techniques. In addition, many wetlands in the Big Sky area have been mapped on-the-ground within areas where development is occurring. During the TMDL process, riparian buffer conditions were assessed using National Agricultural Imagery Program (NAIP) color imagery from 2005 for several streams in the West Fork Gallatin River watershed and classified as healthy (good), moderately disturbed (fair), or heavily disturbed (poor) (**Table 3**). An aerial assessment of the mainstem Gallatin River was conducted in 2005 using aerial imagery from 1999. The recently completed *Gallatin Canyon River Access Site Assessment* (RESPEC 2015) also documents areas where riparian vegetation has been degraded along the Gallatin River due to recreational use, while also identify sites were traction sand has a direct pathway into the Gallatin River.

Table 3. Riparian Buffer Health

Stream Segment	Good	Fair	Poor
Middle Fork West Fork Gallatin River	15%	84%	1%
Beehive Creek	60%	40%	0%
North Fork West Fork Gallatin River	71%	29%	0%
Muddy Creek	77%	19%	4%
Third Yellow Mule Creek	73%	27%	0%
Second Yellow Mule Creek	44%	56%	0%
First Yellow Mule Creek	79%	21%	0%
South Fork West Fork Gallatin River	44%	54%	2%
West Fork Gallatin River	14%	61%	25%

Fisheries

Fisheries monitoring on the mainstem Gallatin River conducted above (Porcupine Section) and below the confluence of the West Fork Gallatin River (Jack Smith Section) indicates that rainbow trout populations double downstream of the confluence with the West Fork Gallatin River. Fisheries monitoring also indicates that rainbow trout populations have been increasing over the past 30 years. There is a significant amount of upwelling near the confluence with the West Fork Gallatin River, which provides increased streamflow and more stable temperatures. Mild nutrient enrichment contributed from the West Fork Gallatin River may also play a role in increased rainbow trout densities downstream of the West Fork. Westslope cutthroat are still found in the upper Gallatin River watershed, including the upper South Fork West Fork Gallatin River watershed, the Gallatin River mainstem and Porcupine Creek in the Big Sky area. While westslope cutthroat inhabit about 25% of the system, only 3% are considered non-hybridized and contain over 90% cutthroat genes.

Precipitation

Annual precipitation data is collected at the Natural Resource Conservation Service (NRCS) Lone Mountain SNOTEL site and the Western Region Climate Center (WRCC) Big Sky 3 S (COOP) site.

Streamflow

Streamflow monitoring has been conducted at four sites within the West Fork Gallatin River watershed by the Gallatin River Task Force since 2006 and on the mainstem of the Gallatin River since 1889 by the U.S Geological Survey.

Water Supply

Water Supply Wells

The primary water supply source in the Big Sky area is groundwater obtained from wells operated by the Big Sky County Water and Sewer District (BSCWSD), Yellowstone Club, Spanish Peaks, and Moonlight Basin (**Table 1**). Within the BSCWSD boundary, the recently completed *Water System Source Capacity Plan Update* (Western Groundwater Services 2015) identifies opportunities for maximizing capacity from existing wells and constructing new sources. Outside of the BSCWSD boundary, numerous individual wells provide water for small community systems, homes and businesses. There are no water quality regulations for these individual wells, except during the planning process when siting septic tank location relative to well location. There are several geologic formations from which groundwater is drawn in the Big Sky area, including sand and gravel aquifers, sandstone and shale aquifers, Madison limestone aquifers, and fractured bedrock aquifers. Local aquifers are generally recharged annually during snowmelt and water quality within these aquifers varies. Sand and gravel aquifers and fractured bedrock aquifers, in which the BSCWSD wells are located, provide high quality water, while sandstone and shale aquifers, in which many private wells are located, provide lower quality water. In general, the water supply of the Big Sky area is high in total hardness, which results in "lime scale" that is often treated by individual home owners using water softeners.

Table 1. Water Supply Wells

Entity	Number of Wells	Existing (gpm)	Existing (MGY)	Water Right Date Range (Groundwater)
BSCWSD - Mountain Village	9	1,155	135.8	1971-2002
BSCWSD - Meadow Village	5	995	138.5	
Spanish Peaks	4	670	52.8	2004-2010
Yellowstone Club	13	592		2001-2014
Moonlight	3	260	19.6	1968-2014
Total	**34**	**3,672**	**346.7**	

Water Supply Storage Reservoirs

Water obtained from groundwater wells is stored in water tanks located throughout the West Fork Gallatin River and Jack Creek watershed (**Table 2**) for use throughout the year. While peak visitation occurs during the winter recreation season, summer water use exceeds winter water use due to irrigation demands.

Table 2. Existing Storage Reservoirs (Water Tanks)

Entity	Gallons	MG
BSCWSD - Cascade (Big Sky)	1,500,000	1.50
BSCWSD - Mountain Village (Big Sky)	500,000	0.50
BSCWSD - Lone Moose	450,000	0.45
BSCWSD - Aspen Groves	240,000	0.24
BSCWSD - Sweetgrass	250,000	0.25
BSCWSD - Sweetgrass	50,000	0.05
BSCWSD - Hidden Village	1,000,000	1.00

Table 2. Existing Storage Reservoirs (Water Tanks)

Entity	Gallons	MG
BSCWSD - Total	**3,990,000**	**3.99**
Spanish Peaks	832,000	0.83
Yellowstone Club - Andesite	600,000	0.60
Yellowstone Club - Phase 3A	275,000	0.28
Yellowstone Club - Lower Pioneer	400,000	0.40
Yellowstone Club - Lower Pioneer	275,000	0.28
Yellowstone Club - Lower Pioneer	320,000	0.32
Yellowstone Club - Settlement	275,000	0.28
Moonlight	318,000	0.32
Grand Total	**7,285,000**	**7.29**

Water Rights

The Upper Missouri Basin is a closed basin, which means there is no more surface water legally-available for appropriation. In addition, groundwater is considered connected to surface water and the development of new water resources will require mitigation for any water that is consumed. Mitigation water is available when water is no longer needed for its original purpose and can be obtained by purchasing historical water rights, with pre-1890 irrigation claims typically providing the most water for mitigation. However, mitigation is challenging in a mountain environment since there are relatively few irrigation water rights available for conversion. Relative to instream flows, Montana Fish, Wildlife and Parks (FWP) holds Murphy Rights on the mainstem of the Gallatin River with a priority date of 1970 (**Table 3**). In addition, FWP has instream flow reservations on several streams in the Big Sky area that were calculated based on the wetted perimeter method, which targets riffles at minimum flows to maintain aeration. The FWP instream flow reservations provide an indicator of the minimum flows required to maintain fish populations.

Table 3. Murphy Rights and Instream Flow Water Reservations

Stream	Reach	Dates Granted	Amount Allowed (cfs)
Murphy Rights			
West Gallatin River	Yellowstone Park to Gallatin Gateway	5/16-7/15	800
		7/16-5/15	400
Instream Flow Water Reservations			
Gallatin River #1	Yellowstone NP boundary to WF Gallatin River	Jan 1-Dec 31	170
Gallatin River #2	WF Gallatin River to East Gallatin River	Jan 1-Dec 31	400
MF of the WF Gallatin River	Headwaters to NF of the WF Gallatin River	Jan 1-Dec 31	3
SF of the WF Gallatin River	Headwaters to mouth	Jan 1-Dec 31	5
WF Gallatin River	Middle and North forks to mouth	Jan 1-Dec 31	26
Porcupine Creek	NF Porcupine Creek to mouth	Jan 1-Dec 31	4.5
Jack Creek	Lone Creek to mouth	Jan 1-Dec 31	24

Wastewater Treatment and Disposal

Treatment Capacity

Within the West Fork Gallatin River watershed, the Big Sky County Water and Sewer District (BSCWSD) is the largest provider of wastewater treatment. The BSCWSD service area includes Big Sky Resort and Spanish Peaks, along with businesses, private residences and home owners associations. Yellowstone Mountain Club is currently constructing a wastewater treatment plant for the new lodge, while individual lots have onsite septic systems. Outside of the BSCWSD boundary, wastewater is treated by small community systems and individual onsite septic systems. Within the Jack Creek watershed, Moonlight Basin provides wastewater treatment to the majority of the development, though some residences have onsite septic systems. The recently completed *Resort Area Wastewater Analysis, Big Sky, MT* (WGM 2015) and *Wastewater System Master Plan Update for Big Sky County Water and Sewer District 363* (DOWL 2015) provide an estimate for the amount of wastewater generated at full build-out, which is anticipated to occur by 2035 and is summarized in **Table 1**. Within the Canyon area, there are several small community systems, including treatment systems at Ophir School, Ramshorn subdivision, and Buck's T4, along with numerous individual onsite septic systems. Within Gallatin County, a total of 963 septic permits have been approved in the Big Sky area since 1966.

Table 1. Wastewater Generation and Treatment

Entity	Existing (MGY)	Capacity (MGY)	Predicted - 2035 (MGY)
BSCWSD	139.1	219.0	313.8
Yellowstone Club	7.3	18.3	23.4
BSCWSD and YC Total	**146.4**	**237.3**	**337.2**
Moonlight	9.2	36.5	113.4
Grand Total	**155.6**	**273.8**	**450.6**

Septic and other On-site Systems in the Canyon

The canyon area is not served by any central wastewater treatment plant, so estimates of total wastewater generated and treated through septic and small systems must be estimated. The Gallatin City-County Health department did a preliminary calculation based on current septic permits and estimated that at least **123.7 million gallons of wastewater/ year (MGY)** is generated and treated through septic systems in the area from Karst and Cinnamon Lodge. **At full build-out** of zoning, an estimate of over **1 million gallons/day of wastewater** could be generated in the Canyon from all sources. (Dowl HKM, 2008) No current septic system treats wastewater to the same level at the current treatment at the Big Sky Water & Sewer District.

Storage Capacity

Wastewater generated in the West Fork Gallatin River watershed is stored in a series of ponds and then applied to area golf courses during the summer irrigation season (May-October). Storage is provided by three ponds at the BSCWSD wastewater treatment plant, along with a pond at the Yellowstone Mountain Club and a pond that is being constructed at Spanish Peaks (**Table 2**). Under an agreement signed in 2001, the Yellowstone Mountain Club is committed to provide storage for 130 MG of treated wastewater from BSCWSD, which would require the development of approximately 50 MG of additional storage. Within the Jack Creek watershed, wastewater is stored in two ponds maintained by Moonlight Basin. Within the Canyon, Buck's T4 provides storage for wastewater generated from their public water system.

Table 2. Existing Storage Capacity

Entity	MG
BSCWSD - Pond 1 (SBR Effluent)	8.2
BSCWSD - Pond 2 (Large)	60.1
BSCWSD - Pond 3 (Small)	19.6
BSCWSD - Pond Total	**87.9**
BSCWSD - Yellowstone Club*	80
BSCWSD - Spanish Peaks	27
BSCWSD - Grand Total	**194.9**
Moonlight - Primary Pond	11.5
Moonlight - Backup Pond	2.5
Grand Total	**208.9**

* Additional 50 MG of storage required under 2001 agreement

Disposal Capacity

Wastewater stored in ponds is primarily applied to area golf courses during the summer irrigation season, though some is also applied to forested areas. Within the West Fork Gallatin River watershed, treated wastewater is currently applied to the Big Sky Golf Course and the Yellowstone Club Golf Course and will be applied to the Spanish Peaks Golf Course in the future. Within the Jack Creek watershed, wastewater is applied to forested areas, with future plans to apply to the Moonlight Basin Golf Course. Golf course irrigation capacities are estimated in the recently completed *Wastewater System Master Plan Update for Big Sky County Water and Sewer District 363* (DOWL 2015) and summarized in **Table 3**. Wastewater generated by Buck's T4 in the Canyon is applied to a forested area.

Table 3. Existing Disposal Capacity using Land Application of Treated Wastewater

Entity	Wet Year (MGY)	Dry Year (MGY)
BSCWSD - Big Sky Golf Course	140	160
BSCWSD - Yellowstone Club Golf Course	22	28
BSCWSD - Spanish Peaks Golf Course	20	30
BSCWSD - Total	**182**	**218**
Moonlight Golf Course*	20	52
Grand Total	**202**	**270**

* Moonlight currently irrigating 17 acres of forest