Hume Draw Watershed Assessment

Master Improvement Plan Report – May 31, 2024

City of Sheridan, Wyoming

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1 Introduction and Background

1.1 Scope of Work

Water & Environmental Technologies (WET) was tasked to complete a comprehensive assessment and evaluation of the Hume Draw Drainage within the City of Sheridan. The following actions were completed:

- Gathered existing site data, researched reservoir permit status, and obtained municipal infrastructure information.
- Located and performed an assessment of all reservoirs, including control infrastructure, such as culverts, valves, inlets, outlets, and channels/ditch for the development to aid operations and maintenance activities.
- Developed recommendations for future environmental sampling and analysis along with recommendations on infrastructure improvements.
- Developed an improvement plan for Hume Draw that includes a description of the existing conditions and outlines proposed recommendations with associated cost estimates.

1.2 Site Description

The Hume Draw watershed is located within T56N, R84W, Sections 21, 22, 23, and 28, within the city of Sheridan, Wyoming. The upper portion of Hume Draw contains three separate tributaries: Deadman Gulch, Sheridan Heights Draw, and Tie Down Draw that together occupy a drainage area that is approximately 2.5 square miles. The Alliance Lateral Ditch upstream and adjacent to these subwatersheds contributes a significant amount of surface water flow to the Hume Draw drainage (Figure 1). Surface water that Alliance Lateral Ditch contributes to Hume Draw is influenced by upstream agriculture. The lower portion of the watershed contains a series of 12 stormwater control reservoirs, 11 reservoirs are permitted and approved through the Wyoming State Engineer's Office (SEO) and one reservoir is currently unpermitted. The assessment area associated with this report more particularly extends from the Sheridan County Fairgrounds Reservoir and continues downstream approximately 1.2 miles to the confluence of Goose Creek (Figure 2). The lower portion of Hume Draw within this assessment area contains numerous stormwater control features associated with the 12 stormwater retention reservoirs, and contains both wetland and riparian habitats, that are interconnected by stormwater conveyance channels and constructed ditch flow paths. This area also contains many park-like amenities that provide recreational opportunities and are frequented by local residents. These amenities include a concrete walking path, park benches, gazebos, and access sites for fishing opportunities. The Hume Draw drainage is surrounded primarily by residential development, including Sheridan Memorial Hospital, Sheridan High School, and portions of Sheridan County Fairgrounds. Stormwater associated with the adjacent urban development is conveyed into the Hume Draw drainage through existing municipal storm sewer outlets, where the water is collected and eventually discharged to Goose Creek (Figure 3).

2 Inventory and Assessment

2.1 Inventory

For a comprehensive understanding of the assessment area within the Hume Draw drainage, background environmental data, existing municipal stormwater data, and the reservoir permits

from the Wyoming State Engineer's Office (SEO) were obtained, analyzed and included in the assessment. A summary of the pertinent information contained in the SEO permits is provided in Tables 1 and 2 and an electronic copy of the permits will accompany this report. Aerial imagery spanning several decades along with land ownership records and development plans were reviewed to quantify changes in land use associated with the urbanization of the agricultural lands upgradient of the assessment area. Flood hazard data, water rights permit information, mapped wetlands and invasive species data was compiled from the various municipal, county, state, and federal agencies. Additionally, field surveys were conducted to document current conditions, existing stormwater infrastructure, reservoir impoundments and associated storage capacities, surface hydrology, ecology, invasive species, and dense vegetation. Valuable input was obtained from stakeholders including interested residents and agency personnel during two public meetings, specifically regarding current use and recreational enjoyment, historic observations, issues of public importance and potential improvements within the study area. The input gathered at these stakeholder meetings was assessed and incorporated into the recommendations discussed below.

2.1.1 Background Data

The inventoried data is useful in defining the hydrologic setting and provides a timeline for the changes in land use, and documents water development projects that have affected the hydrologic function and ecology within the Hume Draw assessment area. The information indicates reservoirs within the Hume Draw study area were first developed as perennial water supplies for livestock and irrigation use in the 1940s. Much of the area within the northern and western extents of the greater Hume Draw drainage basin remained in agriculture use through the mid-1970s and has since been gradually affected by urbanization. Some of the existing reservoirs were reconstructed and enlarged as late as 2013.

2.1.1.1 Regulatory Permitting

Existing water rights permit information for each reservoir was acquired through the Wyoming State Engineer's Office (SEO) electronic database. The permit information includes reservoir name, permit number, name of permittee, approved water use, initial construction details for the reservoir, dam, inlets, outlets, flood spillway, and constructed storage capacity. The permit records also contain documented changes associated with enlargements and confirm the status of the water right and designated water use. An inventory of relevant permit data is presented in Tables 1 and 2. For convenience and ease of access to the data, an electronic file of the entire permit database will be provided to the City of Sheridan.

2.1.1.2 Agency Data

Other available data was acquired from local, state and federal agencies and includes existing municipal infrastructure and stormwater control geospatial data from the City of Sheridan, previously delineated noxious weed abatement efforts from the Sheridan County Weed and Pest, fish stocking locations and fishery suggested improvement opportunities from the Wyoming Game and Fish Department (WGFD), flood hazard zones from Federal Emergency Management Agency (FEMA), mapped wetland areas from United States Fish and Wildlife Service (USFWS), National Wetland Inventory (NWI), and surface hydrology from

the United States Geological Survey (USGS) National Hydrography Dataset (NHD).

2.1.2 Field Surveys

Field surveys were conducted during the summer of 2023 to assess hydrology, ecology, and the existing stormwater infrastructure within the assessment area. Surveys recorded conditions relating to surface hydrology, inflow and discharge, water quality, habitat characterization associated with vegetation communities noting invasive species, and existing stormwater infrastructure functionality. Reservoir impoundments were inspected for structure integrity, inlet and outlet functionality, reservoir capacity, and spillway condition, noting any maintenance issues observed during the inspections. A summary of the reservoir field measurements is presented in Table 3. Observations were also recorded to document adjacent vegetated habitats, visual water quality indicators, and presence of wildlife (Table 4). Reservoir depth measurements were collected to develop bathymetry data to estimate current reservoir holding capacities which were then compared to the original permitted capacities (Table 5). Maintenance and repair items were assessed then categorized and prioritized with operation objectives to produce a matrix that is detailed in Table 6. Photographs collected within the assessment area are provided in Appendix A to document current site conditions and to record apparent maintenance and repair items.

2.2 Assessments

After acquiring background data and completing field surveys, an assessment of the Hume Draw hydrologic setting, inflow and discharge data, impoundment characteristics including the existing stormwater infrastructure, and ecology was presented at two stakeholder meetings on November 28, 2023 to elicit public and agency feedback.

2.2.1 Hydrologic Setting, Inflow, Discharge, and Impoundments

The Hume Draw assessment area is primarily influenced by perennial groundwater discharged from local terrace deposits along the upper slopes of the watershed. These deposits consist primarily of sand and gravel and are underlaid with fine-grained sediment (Lowry & Cummings, 1994). During the spring and summer months, the aquifer receives supplemental recharge from unlined agricultural canals and irrigation ditches. At several locations, groundwater was also observed discharging from thin alluvial deposits near the bottom of drainage. These discharges drain into the channel and into several of the reservoirs of Hume Draw. Occasionally, the drainage receives significant stormwater or snowmelt runoff discharged from adjacent agricultural areas, municipal streets, and permeable and impermeable parking areas. Incurring some losses to evaporation, transpiration, and infiltration, the remaining surface flows are discharged from a municipal storm sewer into Goose Creek near the 8th Street bridge after flowing through the drainage system. Flows within segments of the drainage occasionally become intermittent during extended dry periods. The constructed impoundments within the assessment area are currently functioning in various degrees of effectiveness, and overall system maintenance is required. Some impoundments within the assessment area appear to function as

designed, however others contain damaged or nonfunctioning infrastructure that negatively affect overall flow and water quality.

2.2.2 Assessment Ecology

The natural ecology within Hume Draw assessment area is heavily influenced by anthropogenic disturbances primarily to manage stormwater and flood control. This has affected the natural flow regime through the assessment area and has created artificially ponded environments, wetlands and backwater areas where dense riparian vegetation has developed. The dense vegetation restricts surface flow even further. During the assessment, several non-functioning stormwater infrastructure features were identified as further reducing surface flows through the system. These reduced flows can create stagnate ponded water during the summer months that is susceptible to solar radiation and higher than normal water temperatures. This in turn causes algal blooms and dense aquatic vegetation which reduces overall fish habitat. Blockages in the system such as plugged culverts, flood deposited wood debris and deteriorated infrastructure have caused excess, unnatural ponding which has created artificial wetland environments, dense vegetation, and mosquito breeding habitats. It appears that the restrictive flows found throughout the system have been present for some time, and this has affected the overall ecology within the lower drainage. Increasing surface water flow through the system would improve the overall ecological function of the drainage. Increased flow would decrease reservoir temperatures, increase water oxygen content, and reduce the persistence of algal blooms. The presence of noxious weeds and adjacent vegetation was recorded at each reservoir along with visual water quality indicators, wildlife observations, and surface flow concerns. A summary matrix of these observations are provided in Table 4.

2.2.2.1 Wetlands

According to the USFWS National Wetland Inventory there are both wetland and open water habitats present with the Hume Draw assessment area, that include:

- Palustrine, Emergent, Persistent, Seasonally Flooded, Dike/Impounded (PEM1Ch) (5.3 acres),
- Palustrine, Emergent, Persistent, Seasonally Flooded (PEM1C) (1.5 acres), and
- Palustrine, Aquatic Bed, Semipermanently Flooded, Dike/Impounded (PABFh) (9.6 acres).

Goose Creek, the receiving water of Hume Draw is classified as a Riverine, Lower Perennial, Unconsolidated Bottom, Permanently Flooded, Excavated (R2UBHx) stream (USFWS, 2024).

Wetland habitats are primarily restricted to the reservoir fringes and along the ditch lines that connect the reservoirs (Figure 4). These areas contain dense hydrophytic vegetation primarily consisting of *Juncus, Carex, Typha, Salix Spp.* The reservoir fringes contain emergent vegetation while the ditch lines are dominated by scrub-shrub habitats. The soil components mapped in the

assessment area are shown on the United States Department of Agriculture (USDA) - Natural Resources Conservation Service (NRCS) National Cooperative Soil Survey Map included in Appendix B (NRCS, 2024). According to the Web Soil Survey, the majority of the assessment area contains soils that do not meet hydric soil criteria. However, soil components classified by the USDA-NRCS are mapped at a large scale; therefore, site-specific soil surveys would be required to determine the presence or absence of hydric soils.

When conducting stormwater infrastructure improvements where fill material is required within a surface water or adjacent wetland area a United State Army Corps of Engineers (Corps) permit may be required. For a wetland to be considered jurisdictional under Section 404 of the Federal Clean Water Act (CWA), three wetland characteristics are required: 1) hydrophytic vegetation, hydric soils, and 3) wetland hydrology. Wetland areas must also meet the definition of a Waters of The United States (WOTUS). It is anticipated that some infrastructure maintenance items will require site specific wetland delineations and Corps permitting, which will likely be permitted under a *Nationwide Permit 3 – Maintenance*.

2.2.2.2 Floodplains

According to the Federal Emergency Management Agency (FEMA) Flood Map Service Center (FEMA, 2024), the Hume Draw drainage is not within a mapped flood hazard zone (Figure 4). Goose Creek located at the confluence of Hume Draw contains a mapped regulatory floodway with a flood hazard Zone AE containing known Base Flood Elevations (BFEs). A flood analysis of Hume Draw was not conducted due to several non-functioning infrastructure features associated with the system and several unknown infrastructure design parameters that would be required to develop an appropriate hydraulic model. Once the overall system is functioning as designed, a functional hydraulic model can incorporate a designed storage capacity to determine the number of reservoirs required to achieve the desired flood control within the system.

2.2.2.3 Ditches, Flow Paths

The natural streambed morphology within the Hume Draw assessment area has been heavily impacted and primarily exhibits channel characteristics associated with irrigation ditches. There are approximately 6,700 linear feet of ditches connecting the 12 reservoirs within the assessment area (Figure 5). The ditches have been straightened and have lost natural sinuosity within the drainage, which has caused channel incision and loss of floodplain connectivity. These channels experience excess amounts of flow energy with limited relief from adjacent floodplain terrace formations, resulting in downcutting. Increasing channel sinuosity through grading techniques while following the natural drainage contours, creating gradually sloped channel profiles, and strategically placing rock check dams within the channel would increase floodplain connectivity and promote

natural wetland development. Regrading the channel segments to more naturally sloping and more sinuous profiles would increase floodplain connectivity and promote natural wetland development, especially with the addition of strategically placed rock check dams. This would disperse high flows to adjacent riparian habitats thus reducing channel flow velocities and scour potential. However, channel regrading will be limited to areas with sufficient floodplain development and shallow gradients. Where grading is not a viable option, the use of constructed check dams, stilling basins, appropriately sized rip rap, or channel bottom armoring may be considered.

2.2.2.4 Dense Vegetation and Noxious Weeds

The assessment identified several areas of dense riparian vegetation that have choked the drainage bottom and associated ditches and are currently restricting flow (Figure 5). These areas consist primarily of willows, dogwood, and other native and non-native shrubs with robust hydrophytic ground cover. Noxious weeds seem to be lacking within these dense native shrub patches and primarily occur along the walking trails and disturbed habitats located within the dry reservoir bottoms. Recent weed control locations are identified in Figure 4 and predominately consist of cheatgrass, loosestrife, and spurge. Weed control is an ongoing maintenance item and removal of dense vegetation in areas that restrict channel flow should be considered as part of the overall vegetation management program.

2.2.2.5 Water Quality

The collection of water quality data was outside the scope and budget of this assessment. WET did not acquire an approved Sampling and Analysis Plan (SAP) through Wyoming Department of Environmental Quality (WDEQ); therefore, quantitative water quality parameters of the reservoirs and associated ditches were not collected. However, qualitative visual observations of water quality were noted and are provided in Table 4. Field observations were recorded at each site/reservoir to document algal growth and sedimentation/turbidity. Based on the field observations, the water quality within the upper reservoirs displayed relatively less turbidity than the lower sections of Hume Draw. It is anticipated that water quality will improve following the implementation of the maintenance recommendations associated with the stormwater infrastructure within the Hume Draw system. However, water quality is a vital ecological component to assessing the overall vitality and health of the system; therefore, quantitative water quality sampling may be beneficial and aid in future management decisions.

2.2.2.6 Bathymetry & Sedimentation

WET conducted bathymetric surveys on the nine reservoirs that were impounding water to compare the current capacities to the permitted capacities to determine if the reservoirs are receiving a significant amount of sedimentation. It was observed that the majority of measured reservoirs were impounding larger amounts of water than permitted, indicating that sedimentation is not a primary concern in Hume

Draw currently (Table 5). However, significant erosion is occurring at or below some of the reservoir embankments, and in some of the spillways, ditches and drainage channels, resulting in higher rates of sedimentation than would otherwise occur under stable channel conditions.

3 Site Conditions and Infrastructure Function (Summer 2023)

3.1 Sheridan County Fairgrounds Reservoir (Site 1)

General Description:

The Sheridan County Fairground Reservoir (Site 1) is the uppermost reservoir within the Hume Draw assessment area. It is located on the south side of 5th Street and is readily accessible to the public. The reservoir and its adjoining recreational area have improvements for public use, including park benches, a picnic area, and a fishing dock. The pond is stocked with catchable fish by the Wyoming Fish and Game Department. For much of the year, Site 1 likely receives shallow groundwater inflow which may influence general water quality. The pond also receives stormwater from the adjacent gravel parking lot areas from at least two subsurface storm drains (Figure 3). One drain found near the west side of the reservoir is not contained within the records obtained from the City of Sheridan. This pond also receives direct stormwater runoff from the paved parking lot of the neighboring multi-unit apartment building to the west. During the assessment, the impounded water was observed to be turbid several days after a precipitation event. Downstream a short distance below Site 1 is a large diameter culvert that transmits discharge beneath 5th Street, directly into Holly No. 1 Reservoir (Site 2).

Permit Comparison:

The pond construction appears to be consistent with SEO as-built permit records. However, the reservoir permitted capacity of 6.1 acre-feet is less than the measured 7.8 acre-feet.

3.2 Holly No. 1 Reservoir (Site 2)

General Description:

Holly No. 1 Reservoir lies on the north side of 5th Street, downstream from Sheridan County Fairgrounds Reservoir. This reservoir is currently not easily accessible via the improved walking path and the property development occurring nearby may reduce opportunities to improve public utilization and may hinder future access for maintenance. Discharge from the Fairgrounds Reservoir, stormwater drains from nearby paved roads, and parking lot surfaces contribute inflow to Site 2, along with additional shallow groundwater discharge. The banks and channels below the drainage inlets appear well vegetated, with some accumulation of sediment in the lower section of the large diameter transfer pipe below 5th Street.

Permit Comparison:

Currently, the only outlet consists of an unregulatable high-density polyethylene (HDPE) culvert which functions as a horizontal decant (trickle tube). It is installed immediately below the crest of the dam near its south abutment. This configuration is not consistent with SEO as-built permit records and has resulted in significant erosion of the embankment and channel immediately below the outlet. In its current configuration, the measured capacity of the reservoir is 5.9 acre-feet compared to the permitted capacity of 6.6 acre-feet.

3.3 Holly Ponds No. 5 Reservoir (Site 3)

General Description:

Holly Ponds No. 5 Reservoir is a small pond constructed north of Site 2 in the Tie Down Draw tributary. This reservoir discharges a short distance downstream into Holly Ponds No. 3 Reservoir (Site 5). Direct public access to the pond is restricted by adjoining residential dwellings, however the dam can be accessed by foot through dense brush from the downstream outlet. Storm drains on Long Drive contribute surface water runoff to this reservoir and it receives groundwater inflow. The primary outlet is controlled by a sliding gate valve that appears intact but was untested. A vertical decant (trickle tube) with an attached trash rack functions as the secondary outlet. All other structural components of the reservoir appear to be in good operating condition. While groundwater discharge likely contributes continuous inflow, the brief influxes of stormwater runoff during precipitation events may be inadequate to thoroughly mix and flush contents of the reservoir if it is maintained at full capacity. Therefore, the impounded water may become anerobic or nutrient rich. The adjoining property owners contributed to the installation of a reservoir aeration system in an attempt to improve water clarity, control odor, and enhance overall aesthetics. During the public meeting, it was indicated that the reservoir harbors ducks nearly year-round, but large flocks of waterfowl typically congregate when other adjacent reservoirs freeze late in the fall, thereby exacerbating poor water quality conditions. Additionally, an American bullfrog, an invasive species, was observed during the inspection.

Permit Comparison:

The dam, inlet, and outlet appear consistent with permitted as-built details. The permitted capacity and measured capacity are nearly the same with capacities of 0.465 acre-feet and 0.5 acre-feet respectively.

3.4 Holly Ponds No. 4 Reservoir (Site 4)

General Description:

Holly Ponds No. 4 Reservoir is located north of Site 3 in Sheridan Heights Draw. It is easily accessible from the pathway but contains no other improvements for public use. For part of the year, inflow to this reservoir is routed through the Alliance Lateral Ditch. The Alliance Lateral Ditch transfers surface water runoff and irrigation tailwater from upstream agricultural hay land and pastureland. Urban stormwater runoff and groundwater also contribute inflow to the reservoir. The primary outlet is controlled by a sliding gate valve that appears intact but was untested. A vertical decant with attached trash rack functions as the secondary outlet. The condition of the dam appears satisfactory, but the trash rack is prone to clogging and there is notable erosion in the stream channel below the outlet. This erosion likely contributes to higher turbidity, suspended solids, and an accumulation of transported sediment into Site 6. From public input, water quality aesthetics deteriorate during periods of low inflow due to reduced clarity from suspended particulate and algal growth.

Permit Comparison:

The constructed dam and outlet configurations appear consistent with permit as-built specifications. The bathymetric survey results indicate it currently contains about 1.2 acre-feet of water and it is permitted for 1.63.

3.5 Holly Ponds No. 3 Reservoir (Site 5)

General Description:

Holly Ponds No. 3 Reservoir is located east of Site 3 in Hume Draw and receives discharge from Site 2 and Site 3. Some additional groundwater inflow is evident. The reservoir is about 200 feet from the nearest pathway and is not easily accessed by foot during wet conditions. As constructed, the gate valve mechanism at this location may be subject to ice damage. Therefore, the mechanism to operate the sliding gate valve is damaged, inoperable, and is currently in a closed position. Much of the perimeter of the reservoir is lined with dense cattails and conditions in the reservoir are conducive for notable seasonal algal growth and subsequent biological decay, thus reducing water quality aesthetics. The trash rack above the vertical decant structure is prone to clogging with dead vegetation and requires a long handle tool to clear.

Permit Comparison:

The dam, inlet, and outlet configurations appear consistent with the permitted as-built details. The bathymetric survey results indicate there is currently 5.1 acre-feet capacity in the reservoir verses a permitted capacity of 3.17 acre-feet.

3.6 Holly Ponds #2 Reservoir (Site 6)

General Description:

Holly Ponds #2 Reservoir is located east of Site 4, it receives discharge from Sites 4 and Site 5 and is likely augmented by groundwater inflow. This reservoir is relatively easy to access from the pathway system by foot, during dry conditions, but it does not contain improvements for public use. The mechanism for the slide gate appears to be intact (without a hand wheel), but testing is needed to verify its condition and operation. The trash rack on top of the vertical decant structure is susceptible to clogging with dead vegetation, with limited access for cleaning.

Permit Comparison:

The dam, inlet, and outlet appear consistent with permitted as-built details. The bathymetric survey results show the capacity is 1.9 acre-feet, as compared to the permitted capacity of 1.7 acre-feet.

3.7 Holly Ponds No. 1 Reservoir (Site 7)

General Description:

Holly Ponds No. 1 Reservoir is east of Site 6 and receives discharge from Site 6, municipal stormwater, and is likely augmented by groundwater. This reservoir is accessible from the pathway system but does not contain improvements for public use. The sliding gate valve beneath the foot bridge is severely damaged and inoperable and a portion of the dam is eroded around the outlet pipe. This prevents the reservoir from impounding water. The bottom of the reservoir is densely vegetated with a narrow, deeply incised, meandering channel, indicating the reservoir has not functioned as designed for several years. As permitted, the surface area of the reservoir is relatively large in comparison to its constructed depth, and it is situated to receive direct sunlight for much of the day. These conditions likely contributed to increased evaporative loss and higher water temperatures when the reservoir was functional. Notable erosion is occurring in the channel below the dam outlet. A stormwater outlet located below the walking path and northwest of the reservoir discharges into the steep draw above the reservoir. High

velocity discharge from the stormwater outlet has resulted in erosion headcutting beneath a short segment of the walking path, and excessive erosion in the draw below (Figure 3).

Permit Comparison:
The dam, inlet, and outlet appear consistent with permitted as-built details. However, the sliding gate valve is inoperable, and it was not possible to conduct a bathymetric survey for comparison of the reservoir's current and permitted capacity. The original permitted capacity of the reservoir is 5.22 acre-feet.

3.8 Holly No. 2 Reservoir (Site 8)

General Description:
Holly No. 2 Reservoir is located east of Site 7. Site 8 receives discharge from Site 7, a stormwater outlet located north of the southern end on the reservoir, and runoff from Sheridan Memorial Hospital parking lot (Figure 3). The reservoir is near the pathway, but it is not easily accessed and there are no improvements for public use. The slide gate outlet is significantly damaged and allows for a very small amount of water to be impounded. Trees and shrubs are present on the dam and in the emergency spillway. A large amount of wood debris was observed around the damaged outlet.

Permit Comparison:
The dam, inlet, and damaged outlet appear consistent with permitted as-built details. A bathymetric survey was not conducted as the reservoir was nearly dry.

3.9 Hume No. 1 Reservoir (Site 9)

General Description:
Hume No. 1 Reservoir is located east of Site 8. It receives discharge from Site 8 and two stormwater outlets (Figure 3). The reservoir can be accessed from the north during dry conditions. Beaver have constructed a dam across the spillway and along the crest of the dam. As a result, water levels in the reservoir were elevated approximately 1½ feet. The elevated water levels inundated the gate valve and operating mechanism and reduced much of the designed freeboard along the dam. At the time of the inspection, much of the discharge was routed through the partially obstructed spillway. Trees and brush are present on the dam and in the emergency spillway, and within the downstream channel. Additionally, there is significant accumulation of deadfall and wood debris in the spillway and downstream channel that increases turbulent flow, resulting in significant erosion, high turbidity, and increased sediment transport.

Permit Comparison:
The permit describes a controllable slide gate valve with an 8-inch steel outlet pipe as the primary outlet with a secondary open channel spillway. However, during the survey, the controllable outlet structure was obscured by high water. As a result of the elevated water level, the bathymetric survey yielded 3.6 acre-feet capacity, as compared to 2.1 acre-feet permitted capacity.

3.10 Unpermitted Reservoir (Site 10)

General Description:

The Unpermitted Reservoir is located east of Hume No. 1 and upgradient of the Sam Mavrakis Fishing Pond. It receives discharge from Hume No. 1 with additional inflow from shallow groundwater. Trees are growing on the upstream and downstream faces of the dam, and erosion is occurring downstream of the spillway. The outlet consists of a single open channel spillway and the capacity of the reservoir is approximately 2.0 acre-feet. The north side of the reservoir can be accessed by foot during dry conditions from the pathway, but there are currently no improvements for public use. In its current configuration, the reservoir appears to have functioned for many decades, and it is sufficiently shaded which may help to moderate high water temperatures during the summer months. Two options are offered for consideration to comply with SEO regulations. The first option involves removal of the dam and stabilization of the downstream channel. The second option involves implementing maintenance, constructing needed improvements, and permitting the reservoir with transferred water rights to ensure long term function within the hydrologic setting. If implemented, this option would also allow for the opportunity to expand fishing opportunities to the public.

Permit Comparison:

Site 10 is unpermitted; no comparison is possible.

3.11 Sam Mavrakis Fishing Pond (Site 11)

General Description:

Sam Mavrakis Fishing Pond is located to the east of Site 10. It receives discharge from Site 10, shallow groundwater, and numerous stormwater outlets. The permit indicates the original reservoir was later enlarged and upgraded to its current outlet configurations, consisting of a functioning primary gate valve and a secondary vertical decant. An emergency spillway is located near the south abutment of the dam. The sliding gate valve is known to function correctly as the reservoir was drained briefly during the fall of 2023 to facilitate downstream maintenance by the City of Sheridan. Site 11 is well maintained and very accessible to the public for year-round recreation. It adjoins the walking path, with multiple park benches and an improved parking area that is maintained for bicycles and licensed vehicles. The reservoir is stocked with catchable fish by the Wyoming Game and Fish Department, and it is popular with local enthusiasts and out of town visitors. The site is well maintained, but two minor maintenance issues have been identified. The emergency spillway near the south abutment has been modified and shows recent minor erosion downstream. Also, the culvert associated with the reservoir inlet is currently obstructed or damaged and reduces flow into the reservoir. Water quality aesthetics associated with this reservoir deteriorate during periods of low inflow due to suspended particulate matter and algal growth, water stagnation is an issue at this site. Though the surveyed reservoir capacity is comparable to the permitted capacity, shallow water depths and excess sediment accumulation affect recreational and fishing opportunities. Invasive bullfrogs were reported as a concern by both the public and Wyoming Game and Fish.

Permit Comparison:
The dam, inlet, and outlet appear consistent with permitted as-built details. The bathymetric survey results yielded a capacity of 13.4 acre-feet, which is comparable to its permitted capacity of 12.79 acre-feet.

3.12 Hume No. 3 Reservoir (Site 12)

General Description:
Hume No. 3 Reservoir is the farthest downstream reservoir. It receives discharge from Site 11 and a stormwater outlet located north of the reservoir (Figure 3). There is currently no public infrastructure for easy access. The dam and sliding gate outlet configurations appear consistent with permitted as-built details, but both are damaged and are not functional. There are many well established trees and brush on the undamaged portion of the dam and in the bottom of the reservoir. SEO records indicate the reservoir has permitted rights for irrigation, but the obvious means of conveyance are dilapidated, and there are no land parcels listed for the point of use.

Permit Comparison:
The condition of the dam and outlet prevents impoundment of water; therefore, a bathymetric survey was not performed. The original permitted capacity of the reservoir is 3.2 acre-feet.

4 Recommended Infrastructure Improvements

Significant changes to historic land use associated with urban development in the greater Hume Draw drainage basin have altered the time of concentration of stormwater runoff, flow paths, sources of inflow, stream conveyance, discharge locations, and the total amount of water discharged from the drainage basin. Considering the various ages and operating history of the series of reservoirs within the Hume Draw assessment area the associated infrastructure is in various states of function or disrepair. Some need repairs, alterations, and changes in operation to ensure safety, maintain desired hydrologic function, protect established sensitive habitats, and maintain or enhance water quality chemistry and aesthetics for fish, wildlife, and public enjoyment. Recommended maintenance, repairs, and alterations involving significant costs for planning, permitting, and implementation are prioritized below and condensed in Table 6. Non-binding estimates for identified maintenance and improvements are outlined in Table 7.

4.1 Maintenance and Repair Priorities

A list of prioritized recommended maintenance, repairs, or reconstruction, along with targeted objectives is presented as Table 6 and further discussed below. The maintenance is broken into three levels of prioritization: High, Medium, and Low. In most cases, high priority actions are recommended to promptly ensure safety of the dam in question and protect other reservoirs and public areas further downstream. Proposed actions that do not mitigate an existing safety threat but can be implemented to better control discharge or restore desired hydrologic and ecologic function are considered medium priority. Low priority actions may be implemented occasionally, or as needed, to improve or enhance water quality in an individual pond or those downstream.

4.1.1 Maintenance Prioritization

High priority actions are recommended at eleven of the existing reservoirs and several associated drainage channels within the assessment area, medium priority actions are recommended at seven sites, with an additional seven low priority actions recommended

at various sites. These recommended maintenance items are detailed in a prioritization matrix provided in Table 6. Estimated costs associated with maintenance and repair recommendations are found in Table 7.

4.1.1.1 Sheridan County Fairgrounds Reservoir (Site 1)

High Priority:

The open channel outlet at Site 1 is prone to blockage from large branches and debris that can artificially raise the water level in the reservoir and result in increased velocity of discharge through the outlet channel. Large debris is also transported downstream into the trash rack attached to the inlet of the 60-inch diameter culvert underlying Fifth Street where it accumulates and is difficult to remove. A wide trash rack placed in front of the reservoir outlet would prevent large debris from entering the outlet channel. The gradient in the open channel spillway and adjoining short section of channel above the 60-inch culvert are steep and susceptible to erosion.

Medium Priority:

The open channel outlet at this location should be repaired and riprapped to reduce flow velocity. Placement of suitable check dams or riprap within these sections would reduce flow velocity, prevent further erosion, and reduce the amount of sediment that is transported downstream into Holly No. 1 Reservoir.

Low Priority:

The judicious use of a biological agent is advised to help mitigate algae during summer months. This should improve reservoir aesthetics, reduce turbidity, and reduce accumulation of organic residue.

4.1.1.2 Holly No. 1 Reservoir (Site 2)

High Priority:

The poorly placed and inadequately protected horizontal decant pipe at Site 2 functions as the only constructed outlet for the reservoir. It is located near the dam's south abutment and discharges onto the high, steep, and unprotected downstream abutment area. This results in deep active erosion below the outlet pipe and continues for a significant distance downstream. The existing trash rack does not adequately prevent clogging of the decant pipe, and this maintenance issue has recently resulted in highwater overtopping the crest of the dam near its north abutment. Significant deep active erosion of the downstream face of the north abutment is also evident at this location. At a minimum, an improved trash rack should be installed in front of the inlet to the horizontal decant pipe to prevent impedance and highwater from overtopping the dam. Suitable imported material should also be placed and compacted on the crest of the dam to replace material lost during overtopping. Additionally, all active erosion should be repaired, and rock armored as soon as practical to prevent potential failure of the dam.

Medium Priority:
To ensure satisfactory long-term operation of the reservoir, the City of Sheridan should consider installation of a designed gate valve and secondary outlet, in place of the existing configuration, after high priority actions to stabilize the dam have been completed. The current reservoir configuration does not match the permitted SEO as-built details; therefore, the SEO permit should be updated to reflect the current or modified as-built construction.

Low Priority:
Periods of low precipitation runoff and high ambient temperatures result in stagnation and warm water temperatures contribute to algal blooms at this site. Therefore, judicious use of a biological agent may help mitigate algae during summer months. This should improve reservoir aesthetics, reduce turbidity, and reduce accumulation of organic residue.

4.1.1.3 Holly Ponds No. 5 Reservoir (Site 3)

High Priority:
The dam and outlets at Site 3 appear to be in satisfactory condition. To ensure overall design functionality it is recommended that the gate valve be tested to verify that it operates correctly and should be repaired if necessary.

Medium Priority:
No medium priority maintenance items were identified during the assessment.

Low Priority:
Discontinue operation of the reservoir aeration system in late fall and winter months to allow water to freeze. This should contribute to improved water clarity, and reduction in elevated concentrations of nutrients and Fecal coliform bacteria by seasonally high numbers of migratory waterfowl. Additional measures may include maintaining varied water levels in the reservoir to allow better mixing and flushing with stormwater runoff. If the abovementioned maintenance items do not improve the overall flow and water quality of the site, then judicious use of a biological agent is advised to help mitigate algae during summer months. Voluntary reductions in fertilizers from area institutions and residences may also help mitigate algal blooms.

4.1.1.4 Holly Ponds No. 4 Reservoir (Site 4)

High Priority:
The dam and outlets at Site 4 appear to be generally in satisfactory condition. However, the large concrete blocks associated with the gate valve have settled and should be releveled to prevent deterioration. As routine maintenance, the slide gate valve should be tested, and the trash rack cleared of accumulated debris.

Medium Priority:
Repair and install riprap in the channel erosion downstream of the Site 4 spillway near the south end of the dam to prevent dam deterioration and to reduce turbidity, suspended solids, and sedimentation. Implemented measures to reduce the flow rate and stabilize channel erosion downstream from the outlet will reduce sediment transport and improve water quality aesthetics downstream.

Low Priority:
Increased mixing and flushing of the reservoir could occur during brief periods of stormwater influx if water levels in the reservoir are occasionally varied during the summer months. If the high and medium priority maintenance items do not improve the overall flow and water quality of the site, thus limiting algal blooms, then judicious use of a biological agent is advised to help mitigate algae during summer months. This should improve reservoir aesthetics, reduce turbidity, and reduce accumulation of organic residue.

4.1.1.5 Holly Ponds No. 3 Reservoir (Site 5)

High Priority:
The gate valve and supporting structure at Site 5 is damaged and needs to be repaired or replaced, possibly with a different design to prevent damage from ice. The trash rack should be routinely cleared to prevent artificially high-water levels in the reservoir and subsequent damage.

Medium Priority:
Install riprap or armor in the emergency spillway to prevent deterioration of the dam and reduce turbidity, suspended solids and sedimentation.

Low Priority:
If the high and medium priority maintenance items do not improve the overall flow and water quality of the site, thus limiting algal blooms, then judicious use of a biological agent is advised to help mitigate algae during summer months. This should improve reservoir aesthetics, reduce turbidity, and reduce accumulation of organic residue.

4.1.1.6 Holly Ponds #2 Reservoir (Site 6)

High Priority:
The gate valve and supporting structure at Site 6 are damaged and need to be repaired, or possibly replaced with a different design to prevent damage from ice.

Medium Priority:
No medium priority maintenance items were identified during the assessment.

Low Priority:
If the high and medium priority maintenance items do not improve the overall flow and water quality of the site, thus limiting algal blooms, then judicious use of a

biological agent is advised to help mitigate algae during summer months. This should improve reservoir aesthetics, reduce turbidity, and reduce accumulation of organic residue.

4.1.1.7 Holly Ponds No. 1 (Site 7)

High Priority:

Site 7 does not currently impound water due to its damaged gate valve and there is possibly additional damage to the vertical decant which functions as a secondary outlet. Its current condition does not present a notable safety threat and multiple options for this site are included as proposed medium priority actions. One safety item was identified in the native drainage that discharges into the north side of this reservoir, near its midsection. Significant erosion is migrating farther upgradient from an existing storm drain outlet and may eventually undercut the walking path. The deep erosion extends downgradient towards the reservoir. Given the steep gradient in the drainage and observed deep erosion, measures to repair and stabilize the area with riprap should be implemented as a high priority. This effort will also contribute appreciably to reduced sediment transport and lower turbidity downstream.

Medium Priority:

The inoperable condition of this reservoir does not create a safety hazard; however, one of several options may be implemented to improve hydrologic conditions within Hume Draw. These include:

- Option A) Repair or replace existing slide gate to restore hydrologic function and maintain permit compliance.
- Option B) Abandon the reservoir and transfer the permitted water rights downstream to Site 10, the unpermitted reservoir. Remove slide gate, breach and reclaim dam, riprap outlet, and allow channel and banks to reestablish.
- Option C) Abandon the reservoir and transfer the permitted water rights downstream to Site 11 and enlarge Sam Mavrakis Pond. Remove slide gate, breach and reclaim dam, riprap outlet, and allow channel and banks to reestablish.
- Option D) Abandon Site 7 and remove slide gate, breach and reclaim dam, riprap outlet, and allow channel and banks to reestablish.

Low Priority:

No low priority maintenance items were identified during the assessment.

4.1.1.8 Holly No. 2 Reservoir (Site 8)

High Priority:

To ensure long-term function, the gate valve at Site 8 should be replaced, possibly with a different design to prevent damage from ice. The woody vegetation growing on the dam should be removed. This may result in the need for significant

reconstruction of the embankment. Finally, the open channel functioning as a secondary spillway is partially obstructed by wood debris that should be cleared and the downstream channel stabilized.

Medium Priority:
No medium priority maintenance items were identified during the assessment.

Low Priority:
No low priority maintenance items were identified during the assessment.

4.1.1.9 Hume No. 1 Reservoir (Site 9)

High Priority:
Beaver activity has created unsafe conditions and artificially elevated water levels and efforts should be implemented for removal of the beaver dams from the crest of the dam and along the emergency spillway. Animal removal is a sensitive topic; therefore, this may be a long-term frequently occurring maintenance item. Beavers are a catalyst for creating ecologically diverse habitats and in a more natural setting would help improve overall ecological function within the drainage; however, with the heavily engineered nature of this drainage and desire to increase surface flows through the system, beaver activity may hinder overall management goals. After beaver dam removal and water levels subside, an inspection of the existing sliding gate valve outlet is needed to determine options for repair or replacement. Removal of woody plants and debris is needed to stabilize the dam and outlets. Placement of riprap will reduce flow velocity and stabilize erosion in the spillway and downstream channel and will reduce turbidity and sediment transport farther downstream.

Medium Priority:
No medium priority maintenance items were identified during the assessment.

Low Priority:
No low priority maintenance items were identified during the assessment.

4.1.1.10 Unpermitted Reservoir (Site 10)

High Priority:
Although Site 10 was never permitted through the SEO, it appears to have functioned satisfactorily over many years, but some maintenance to the dam and spillway is needed. Therefore, implementing one of the two available options for abandonment and reclamation, or permitting and maintenance should be of high prioritization.

- Option A) Drain, breach and reclaim dam, riprap outlet, and allow channel and banks to re-establish.

- Option B) Permit the reservoir with transferred water rights from Site 7 Option B, or Site 12 Option B. Install a controllable primary outlet or modify existing outlet and riprap as needed.

Medium Priority:
No medium priority maintenance items were identified during the assessment.

Low Priority:
Should Option B be implemented and algal blooms persist, judicious use of a biological agent may help mitigate algae during summer months. This should improve reservoir aesthetics, reduce turbidity, and reduce accumulation of organic residue.

4.1.1.11 Sam Mavrakis Fishing Pond (Site 11)

High Priority:
Identified maintenance items include replacement of the culvert near the inlet and minor repairs and placement of riprap in the eroded drainage below the open channel emergency spillway and walking path.

Medium Priority:
Design and permit an enlargement to Site 11, and move sufficient water rights; refer to Site 7 Option C, or Site 12 Option B. Accommodate the increase in permit capacity by incising the inlet area and reservoir bottom.

Low Priority:
Cumulatively, the implemented recommendations upstream to enhance flow, reduce turbidity and sediment transport, moderate water temperature, and increase dissolved oxygen are expected to significantly improve water aesthetics at this location. However, judicious use of a biological agent may algae be required during extended hot and dry periods.

4.1.1.12 Hume No. 3 Reservoir (Site 12)

High Priority:
No high priority maintenance items were identified during the assessment.

Medium Priority:
No medium priority maintenance items were identified during the assessment.

Low Priority:
Given Site 12's current state and location, two options are offered as low priority consideration.

- Option A) Replace existing non-functional slide gate, repair breached dam, remove woody vegetation from dam and reservoir bottom. Extend walking path for access from Site 12.

- Option B) Seek abandonment or transfer of existing water rights associated with the reservoir and proceed with reclamation of the dam.

4.1.1.13 Tree and Brush Mitigation (Site Wide)

Medium Priority:

Thin dense trees and brush and remove deadfall from channels, channel banks, and reservoirs to improve flow through drainage and improve channel and bank stability.

4.1.1.14 Flow Reduction (Site Wide)

Medium Priority:

Install stone check dams at locations of steep channel gradients to reduce water velocity, prevent erosion, and to further reduce turbidity suspended solids and sediment transport.

4.2 Routine Inspection and Maintenance

Based on the assessment data and identified current maintenance needs, it is recommended that routine inspections and maintenance are implemented to preserve the long-term functionality of stormwater infrastructure within the Hume Draw drainage.

4.2.1 GIS Inspection Map and Inspection Forms

It is recommended that the stormwater infrastructure identified in Figure 3 should be inspected and maintained at least bi-annually and after abnormal precipitation/melting events. To aid with the recommended inspection effort, an interactive, web-based, geospatial database along with inspection forms has been created through ArcGIS software to aid the City of Sheridan with future inspections. The digital inspection forms will be tied to existing stormwater infrastructure and will contain pre-determined dropdown lists to help consistently assess the functionality and maintenance requirements. Completed inspection forms will be stored in an on-line database easily accessed by City planners and managers.

4.3 Future Improvement Recommendations

Following the assessment, several future improvement recommendations have been identified for the Hume Draw drainage that the City of Sheridan may be interested in pursuing.

4.3.1 Water Quality

It is assumed that with the appropriate maintenance addressing the sediment sources and water flow issues identified in Section 4.1 that overall water quality aesthetics will improve within the Hume Draw Drainage. Additionally, significant improvement in water quality aesthetics is expected by varying the water level, in each reservoir in the series, on a rotational schedule. This will induce mixing and flushing during periods of stormwater influx. However, after the maintenance items are addressed and consistent flow is restored to the system, if water turbidity and algal blooms persist, additional water quality sampling may be required. Water quality sampling would entail collecting samples from

each reservoir in the system, as well as samples from Goose Creek that are upstream and downstream of the Hume Draw confluence. Any future water quality sampling should be performed minimally on a bi-annual basis (spring and fall). Proposed water quality parameters should include flow rate, water temperature, pH, conductivity, dissolved oxygen, turbidity, E. coli, phosphorus, and nitrogen compounds.

The cost of the proposed bi-annual sampling and lab analysis is estimated to cost $10,000-$15,000 per year.

4.3.2 Flood Control Analysis

Determining the anticipated peak flood flow rates and volumes associated with a designed storm event within the greater Hume Draw drainage basin compared to the required flood storage capacity within the Hume Drew reservoirs may be warranted following maintenance and restoring functionality to the system. This report has identified several reservoirs that are not functional and has offer serval maintenance options for city planners to consider. The City of Sheridan may want to consider soliciting the appropriate hydraulic models during their decision-making process when determining the fate of these nonfunctioning reservoirs. Hydraulic modeling of the system in its current state would have been problematic and would have had to rely on assumptions that would have created enough uncertainty to limit its usefulness for future planning. To assess if the current series of reservoirs contain the desired flood control capacity for anticipated future land uses upgradient of Hume Draw, a detailed flood control analysis study would be required.

The cost of a detailed flood control analysis for the entire Hume Draw drainage basin is estimated to cost $150,000-$225,000.

4.3.3 Sediment Accumulation Study

Traditional bathymetric surveys were conducted on the nine reservoirs impounding water during the summer of 2023 to determine the current storage capacity of each reservoir (Table 5). The bathymetric survey results were compared to the SEO permitted storage capacities to provide insight on sediment accumulation within the Hume Draw reservoirs. In general, it was found that SEO permitted capacities were comparable to the bathymetric survey results, highlighting that sedimentation may be less of a factor impacting water quality than surface water flow. However, to refine and quantify sediment accumulation, a sonar bathymetric survey would produce more accurate results and better quantify sediment accumulation and may be warranted when planning future dredging operations for areas like the Sam Mavrakis Pond.

The cost of a sediment accumulation study using sonar and associated sediment core sampling is estimated to cost $10,000-$20,000.

5 Conclusions

A comprehensive assessment was conducted by WET to evaluate the lower Hume Draw drainage and associated stormwater infrastructure. The goal of this assignment was to gather existing studies/data, inspect and assess dams, control structures, site ecology, develop an operations and maintenance plan, and provide recommendations for improving the hydrologic function and general improvement of water quality and aesthetics for wildlife and public enjoyment.

The assessment included compilation and review of current and historic aerial imagery, land ownership records, municipal infrastructure, flood maps, development plans, and water rights permits. Field surveys were utilized to verify current conditions associated with infrastructure, hydrology, ecology, and observations of invasive plant and animal species. These data were utilized to evaluate functionally of the existing infrastructure and develop prioritized targets for maintenance, improvement, and regulatory compliance. Prioritization is based upon safety, ecological concerns, and public and agency input. Cumulatively, the recommended improvements will increase surface water flow through the system to improve the overall ecological function of the drainage, resulting in lower water temperatures, higher dissolved oxygen content, and less persistent algal blooms.

To aid in operation and maintenance, WET developed a fully transferrable ArcGIS based program which includes a toolset of specific geospatial data identifying the existing infrastructure and other targets of interest or concern within lower Hume Draw. This toolset includes inspections forms for reservoir dams, inlets and outlets, trash racks and emergency spillways, as well as stormwater infrastructure, points of concern, and mapping capabilities to delineate new areas of concern, should they occur. The City of Sheridan will be responsible for defining and implementing the inspection frequency and recommended infrastructure improvements.

Where possible, approximate non-binding cost estimate ranges for implementing the recommended prioritized improvements or maintenance are provided. However, in considering City of Sheridan's personnel recently reporting locally inflated contract rates for personnel equipment, and for material, in addition to actual completion timelines and potential constraints in accessing many of the sites, some of these estimates may be conservative.

6 References

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Tables

Table 1. Reservoir Permit Information

Site Identification	Facility Name	Permit	Permitee	Status	OR/CR	Uses	Twn	Rng	Sec	QQ	Stream	Total (Ac-Ft)	HWL Area	Active	Inactive	Total Capacity (Ac-Ft)
Site 1	Sheridan County Fairgrounds Reservoir	P9880.0R	Sheridan County Fair Assoc.	Complete/Fully Adjudicated	OR107/237 CR27/044	IRR_SW	056N	084W	28	NW1/4NE1/4	Deadman Gulch	6.1	0.98	4.68	1.42	6.1
Site 2	Holly No. 1 Reservoir	P5622.0R	Holly Sugar Corporation	Complete/Fully Adjudicated	OR11/628 CR01/376	DOM_SW; FIS; IRR_SW; STO	056N	084W	21	SW1/4SE1/4	Deadman Gulch	6.6	1.45	6.6	0	6.6
Site 3	Holly Ponds No. 5 Reservoir	P10829.0R	Holly Ponds LLC	Complete/Fully Adjudicated	OR64/348 CR18/017	FIS; REC	056N	084W	21	SW1/4SE1/4	Tie Down Draw	0.465	0.17	0.465	0	0.465
Site 4	Holly Ponds No. 4 Reservoir	P10828.0R	Holly Ponds LLC	Complete/Fully Adjudicated	OR64/347 CR18/015	FIS; REC	056N	084W	21	SW1/4SE1/4	Sheridan Heights Draw	0.51	0.239	0.51	0	0.51
	Holly Ponds No. 4 Reservoir Enlargement	P12815.0R	Holly Ponds LLC	Complete/Fully Adjudicated	OR64/348 CR18/016	FIS; REC	056N	084W	21	SW1/4SE1/4	Sheridan Heights Draw	0.144*	0.236	0.654	0	0.654
	Holly Ponds No. 4 Reservoir Enlargement	P14056.0R	Holly Ponds LLC	Complete/Fully Adjudicated	OR88/033 CR23/065	FIS; REC	056N	084W	21	SW1/4SE1/4	Sheridan Heights Draw	0.98*	0.49	1.63	0	1.63
Site 5	Holly Ponds No. 3 Reservoir	P10827.0R	Holly Ponds LLC	Complete/Fully Adjudicated	OR64/347 CR18/013	FIS; REC	056N	084W	21	SW1/4SE1/4	Deadman Gulch	1.898	0.703	1.898	0	1.898
	Holly Ponds No. 3 Reservoir Enlargement	P14055.0R	Holly Ponds LLC	Complete/Fully Adjudicated	OR88/033 CR23/064	FIS; REC	056N	084W	21	SW1/4SE1/4	Deadman Gulch	1.272*	0.95	3.170	0	3.17
Site 6	Holly Ponds #2 Reservoir	P10826.0R	Holly Ponds LLC	Complete/Fully Adjudicated	OR64/346 CR18/012	FIS; REC	056N	084W	21	SW1/4SE1/4	Deadman Gulch	0.701	0.44	0.701	0	0.701
	Holly Ponds #2 Reservoir Enlargement	P12814.0R	Holly Ponds LLC	Complete/Fully Adjudicated	OR64/347 CR18/014	FIS; REC	056N	084W	21	SW1/4SE1/4	Deadman Gulch	0.025*	0.413	0.726	0	0.726
	Holly Ponds #2 Reservoir Enlargement	P14054.0R	Holly Ponds LLC	Complete/Fully Adjudicated	OR88/033 CR23/063	FIS; REC	056N	084W	21	SW1/4SE1/4	Deadman Gulch	1.0*	0.75	1.7	0	1.7
Site 7	Holly Ponds No. 1 Reservoir	P10825.0R	Holly Ponds LLC	Complete/Fully Adjudicated	OR64/346 CR18/011	FIS; REC	056N	084W	21	NE1/4SE1/4	Deadman Gulch	1.527	0.959	1.527	0	1.527
	Holly Ponds No. 1 Enlargement	P14053.0R	Holly Ponds LLC	Complete/Fully Adjudicated	OR88/33 CR23/062	FIS; REC	056N	084W	21	NE1/4SE1/4	Deadman Gulch	3.693*	1.5	5.22	0	5.22
Site 8	Holly No. 2 Reservoir	P5623.0R	Holly Sugar Corporation	Complete/Fully Adjudicated	CR01/377 OR11/627-629	DOM_SW; FIS; IRR_SW; STO	056N	084W	21	NE1/4SE1/4	Deadman Gulch	4.4	1.2	4.4	0	4.4
Site 9	Hume No. 1 Reservoir	P5624.0R	B.B. Hume	Complete/Fully Adjudicated	OR 11/628 CR CR01/378	DOM_SW; FIS; IRR_SW; STO	056N	084W	22	SW1/4SW1/4	Deadman Gulch	2.1	0.66	2.1	0	2.1
Site 10	Unpermitted Pond East of Hume No. 1	N/A	N/A	N/A	N/A	N/A	056N	084W	22	NW1/4SW1/4	Deadman Gulch	N/A	N/A	N/A	N/A	N/A
Site 11	Hume No. 2 Reservoir **(Sam Mavrakis Fishing Pond)**	P5625.0R	B.B. Hume	Complete/Fully Adjudicated	OR 11/628; CR01/379 OR 37/374; CR13/046	DOM_SW; FIS; IRR_SW; STO	056N	084W	22	NE1/4SW1/4	Deadman Gulch	6.1	1.45	6.1	0	6.1
	Sam Mavrakis Fishing Pond Enlargement	P9807.0R	City of Sheridan	Complete/Fully Adjudicated	OR46/428 CR14/149	FIS	056N	084W	23	NE1/4SW1/4	Deadman Gulch	6.69*	1.73	12.79	0	12.79
Site 12	Hume No. 3 Reservoir	P5626.0R	B.B. Hume	Complete/Fully Adjudicated	OR11/628 CR01/380	DOM_SW; FIS; IRR_SW; STO	056N	084W	22	SE1/4SW1/4	Deadman Gulch	3.2	1.00	3.2	0	3.2

* Enlargement Size

Table 2. Reservoir Design Specifications

Site Identification	Facility Name	Dam Height	Dam Top Width	Dam Base Width	Dam Length	Dam Type	Pond Length	Pond Width	Max Pond Depth	Inlet	Flood Spillway Depth	Flood Spillway Width	Control Outlet Type	Outlet Material	Outlet Diameter	Outlet Length	Design Comments
Site 1	Sheridan County Fairgrounds Reservoir	N/A	N/A	N/A	N/A	N/A	300 ft	200 ft	10 ft	Storm Drain Culvert	60 in	60 in	Valve	Reinforced Concrete Pipe	8 in Outlet Pipe into 60" RCP Spillway	Not Specified in As-built	No Dam design
Site 2	Holly No. 1 Reservoir	15 ft	8 ft	82 ft	80 ft	Earth Fill	260 ft	80 ft	10 ft	Culvert	5 ft	6 ft	Slide Headgate	CMP	15 in	82 ft	Limited As-built Drawings
Site 3	Holly Ponds No. 5 Reservoir	10.4 ft	12 ft	73 ft	78 ft	Earth Fill	230 ft	100 ft	6.75 ft	Channel	1.5 ft	5 ft	Slide Gate	HDPE	12 in	78 ft	
Site 4	Holly Ponds No. 4 Reservoir	16.97 ft	12 ft	70 ft	100 ft	Earth Fill	300 ft	85 ft	6.75 ft	Channel	3 ft	10 ft	Slide Gate	HDPE	24 in	70 ft	
	Holly Ponds No. 4 Reservoir Enlargement	16.97 ft	10 ft	80 ft	135 ft	Earth Fill	300 ft	85 ft	6.4 ft	Channel	3 ft	10 ft	Slide Gate	HDPE	24 in	85 ft	
	Holly Ponds No. 4 Reservoir Enlargement	16.97 ft	10 ft	80 ft	135 ft	Earth Fill	370 ft	110 ft	10 ft	Channel	3 ft	10 ft	Slide Gate	HDPE	24 in	85 ft	
Site 5	Holly Ponds No. 3 Reservoir	13.5 ft	12 ft	85 ft	170 ft	Earth Fill	300 ft	125 ft	8.75 ft	Culvert	1.5 ft	12 ft	Slide Gate	HDPE	24 in	92 ft	
	Holly Ponds No. 3 Reservoir Enlargement	16.28 ft	12 ft	85 ft	135 ft	Earth Fill	360 ft	140 ft	9.6 ft	Culvert	2.5 ft	12 ft	Slide Gate	HDPE	24 in	92 ft	
Site 6	Holly Ponds #2 Reservoir	14.83 ft	12 ft	75 ft	65 ft	Earth Fill	270 ft	90 ft	4.75 ft	Culvert	1.5 ft	20 ft	Slide Gate	HDPE	36 in	75ft	
	Holly Ponds #2 Reservoir Enlargement	14.83 ft	12 ft	66 ft	75 ft	Earth Fill	270 ft	90 ft	4.93 ft	Culvert	3 ft	20 ft	Slide Gate	HDPE	36 in	66 ft	
	Holly Ponds #2 Reservoir Enlargement	14.83 ft	12 ft	65 ft	80 ft	Earth Fill	300 ft	75 ft	2.5 ft	Culvert	3 ft	20 ft	Slide Gate	HDPE	36 in	75 ft	
Site 7	Holly Ponds No. 1 Reservoir	16.51 ft	12 ft	81 ft	70 ft	Earth Fill	515 ft	60 ft	6.75 ft	Culvert	1.5 ft	20 ft	Slide Gate	HDPE	36 in	81 ft	
	Holly Ponds No. 1 Enlargement	16 ft	10 ft	78 ft	40 ft	Earth Fill	650 ft	60 ft	8.7 ft	Culvert	2.78 ft	43 ft	Slide Gate	HDPE	36 in	78 ft	
Site 8	Holly No. 2 Reservoir	20 ft	8 ft	62 ft	170 ft	Earth Fill	240 ft	80 ft	15 ft	Culvert	5 ft	10 ft	Slide Headgate	CMP	15 in	62 ft	Limited As-built Drawings
Site 9	Hume No. 1 Reservoir	15 ft	8 ft	82 ft	60 ft	Earth Fill	320 ft	120 ft	10 ft	Open Channel	5 ft	10 ft	Gate Valve	Steel	8 in	82 ft	Limited As-built Drawings
Site 10	Unpermitted Pond East of Hume No. 1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Site 11	Hume No. 2 Reservoir **(Sam Mavrakis Fishing Pond)**	15 ft	8 ft	82 ft	77 ft	Earth Fill	500 ft	160 ft	10 ft	Open Channel	5 ft	6 ft	Gate Valve	Steel	6 in	82 ft	Limited As-built Drawings
	Sam Mavrakis Fishing Pond Enlargement	20 ft	12 ft	116 ft	200 ft	Earth Fill	500 ft	160 ft	13 ft	Culvert	4 ft	15 ft	Slice Gate	Metal	24 in	116 ft	
Site 12	Hume No. 3 Reservoir	15 ft	8 ft	62 ft	140 ft	Earth Fill	325 ft	140 ft	10 ft	Culvert	5 ft	6 ft	Slide Headgate	CMP	15 in	62 ft	Limited As-built Drawings

Table 3. Reservoir Field Measurements

Site Identification	Facility Name	Dam Width	Dam Length	Dam Type	NOTES ON DAM	Pond Length	Pond Width	Max Pond Depth	NOTES ON POND	Inlet Type	Inlet Dimensions	NOTES ON INLET	Control Outlet Type	Controlled Outlet Material	Controlled Outlet Diameter	NOTES ON CONTROL STRUCTURE	Total Capacity (Ac-ft)
Site 1	Sheridan County Fairgrounds Reservoir	N/A	N/A	N/A	Impounding feature is a berm on the north end of pond	305 ft	215 ft	7.9 ft		Storm Drain Culvert	Unknown		N/A	N/A	N/A	Non-controllable outlet	7.8 ac-ft
Site 2	Holly No. 1 Reservoir	15 ft	75 ft	Earth Fill		375 ft	225 ft	8.9 ft		Culvert	60 in		Culvert	HDPE	24 in	Non-controllable outlet	5.9 ac-ft
Site 3	Holly Ponds No. 5 Reservoir	12 ft	85 ft	Earth Fill		150 ft	80 ft	5.9 ft		Channel	N/A		Slide Gate	HDPE	12 in	Operation Unknown	0.5 ac-ft
Site 4	Holly Ponds No. 4 Reservoir	18 ft	135 ft	Earth Fill		340 ft	145 ft	8.1 ft		Channel	N/A		Slide Gate	HDPE	24 in	Operation Unknown	1.2 ac-ft
Site 5	Holly Ponds No. 3 Reservoir	15 ft	130 ft	Earth Fill		360 ft	140 ft	10.2 ft		Culvert	24 in		Slide Gate	HDPE	24 in	Damaged slide gate	5.1 ac-ft
Site 6	Holly Ponds #2 Reservoir	19 ft	80 ft	Earth Fill		312 ft	90 ft	6.7 ft		Culvert	24 in		Slide Gate	HDPE	36 in	Operation unknown	1.9 ac-ft
Site 7	Holly Ponds No. 1 Reservoir	15 ft	70 ft	Earth Fill		N/A	N/A	N/A	Pond not impounding water	Culvert	36 in		Slide Gate	HDPE	36 in	Damaged slide gate	N/A
Site 8	Holly No. 2 Reservoir	20 ft	150 ft	Earth Fill		N/A	N/A	N/A	Pond not impounding water	Culvert	36 in		Slide Headgate	CMP	16 in	Damaged slide headgate	N/A
Site 9	Hume No. 1 Reservoir	12 ft	140 ft	Earth Fill		317 ft	83 ft	7.9 ft		Open Channel	N/A		N/A	N/A	N/A	No visible controllable outlet structure at time of survey	3.6 ac-ft
Site 10	Unpermitted Pond East of Hume No. 1	12 ft	90 ft	Earth Fill		250 ft	115 ft	6.5 ft		Channel	Unknown		N/A	N/A	N/A	No visible controllable outlet structure at time of survey	2.0 ac-ft
Site 11	Hume No. 2 Reservoir **(Sam Mavrakis Fishing Pond)**	20 ft	205 ft	Earth Fill		390 ft	220 ft	11.1 ft		Culvert	Unknown	Inlet culvert not visible at time of survey	Slice Gate	Metal	24 in		13.4 ac-ft
Site 12	Hume No. 3 Reservoir	N/A	N/A	Earth Fill	Dam Breached	N/A	N/A	N/A	Pond not impounding water	Culvert	24 in		Slide Headgate	CMP	15 in	Damaged do to dam breach	N/A

Table 4. Field Observation

Site Identification	Facility Name	Weeds Present	Adjacent Vegetation	Appearance of Water Quality	Terrestrial/Aquatic Species	Areas of Concern
Site 1	Sheridan County Fairgrounds Reservoir		Russian Olive, Cattails, Peach Leaf Willow	Reservoir water visibly turbid, no algae growth	Geese	No visible controllable outlet; Debris in outlet trash rack
Site 2	Holly No. 1 Reservoir	Loosestrife, Cheatgrass	Russian Olive, Cattails, Peach Leaf Willow	Reservoir water visibly turbid, algae growth present	Bull frogs, Beaver	Non-controllable outlet, non-engineered spillway, active erosion present on east side of dam
Site 3	Holly Ponds No. 5 Reservoir	Loosestrife	Russian Olive, Cattails, Peach Leaf Willow	Reservoir water realitvely clear	Bull frogs	Outlet operation unknown
Site 4	Holly Ponds No. 4 Reservoir	Loosestrife, Spurge	Russian Olive, Cattails, Peach Leaf Willow	Reservoir water visibly turbid, no algae growth	Bull frogs	Outlet operation unknown, clogged trash rack
Site 5	Holly Ponds No. 3 Reservoir	Loosestrife, Spurge, Cheatgrass	Russian Olive, Cattails, Peach Leaf Willow	Reservoir water visibly turbid, algae growth present	Bull frogs, Beaver	Damaged outlet, clogged trash rack
Site 6	Holly Ponds #2 Reservoir	Loosestrife, Cheatgrass	Russian Olive, Cattails, Peach Leaf Willow, Plains Cottonwood	Reservoir water visibly turbid, algae growth present	Bull frogs	Outlet operation unknown, clogged trash rack
Site 7	Holly Ponds No. 1 Reservoir	Loosestrife, Cheatgrass	Russian Olive, Cattails	Water in channel visibly turbid	Ducks, Bull frogs	Damaged outlet, not impounding water, eroded channel below walking path
Site 8	Holly No. 2 Reservoir	Loosestrife, Spurge	Russian Olive, Cattails	Water in channel visibly turbid	Bull frogs	Damaged outlet, not impounding water
Site 9	Hume No. 1 Reservoir	Loosestrife, Spurge, Cheatgrass	Russian Olive, Cattails, Peach Leaf Willow	Reservoir water visibly turbid, algae growth present	Ducks, Bull frogs	No visible controllable outlet, beaver dam in spillway
Site 10	Unpermitted Pond East of Hume No. 1	Loosestrife	Russian Olive, Cattails, Peach Leaf Willow, Plains Cottonwood	Reservoir water visibly turbid, algae growth present	Ducks, Bull frogs	Reservoir not permitted, no controllable outlet, active erosion at reservoir outlet
Site 11	Hume No. 2 Reservoir **(Sam Mavrakis Fishing Pond)**	Loosestrife	Russian Olive, Cattails, Peach Leaf Willow, Plains Cottonwood	Reservoir water visibly turbid, algae growth present	Ducks, Fish, Bullfrogs	Inlet culvert appears to be plugged
Site 12	Hume No. 3 Reservoir		Russian Olive, Cattails, Plains Cottonwood	Water in channel visibly turbid	Bull frogs	Dam Breached, not impounding water

Table 5. Comparisons of Area Capacity (Permitted vs. Current)

Site Identification	Facility Name	Permitted Total Capacity (Ac-Ft)	Current Total Capacity (Ac-ft)
Site 1	Sheridan County Fairgrounds Reservoir	6.1	7.8
Site 2	Holly No. 1 Reservoir	6.6	5.9
Site 3	Holly Ponds No. 5 Reservoir	0.465	0.5
Site 4	Holly Ponds No. 4 Reservoir	1.63	1.2
Site 5	Holly Ponds No. 3 Reservoir	3.17	5.1
Site 6	Holly Ponds #2 Reservoir	1.7	1.9
Site 7	Holly Ponds No. 1 Reservoir	5.22	N/A
Site 8	Holly No. 2 Reservoir	4.4	N/A
Site 9	Hume No. 1 Reservoir	2.1	3.6
Site 10	Unpermitted Pond East of Hume No. 1	N/A	2.0
Site 11	Hume No. 2 Reservoir **(Sam Mavrakis Fishing Pond)**	12.79	13.4
Site 12	Hume No. 3 Reservoir	3.2	N/A

Note:
Sites 7, 8 and 12 do not currently impound water.

Table 6. Repair and Maintenance Prioritization

Site Identification	Location	High	Objective	Medium	Objective	Low	Objective
Site 1	Sheridan County Fair Grounds Reservoir	Fabricate and install trash rack in front of spillway channel.	Prevent obstructions in culvert beneath 5th Street.	Riprap outlet channel.	Prevent erosion. Reduce turbidity, suspended solids, and sedimentation. downstream.	As needed biological treatment for algae control during summer months.	Improve pond esthetics, reduce turbidity and reduce accumulation of organic residue.
Site 2	Holly No. 1 Reservoir	Confirm horizontal outlet pipe size requirements for existing outlet. Replace if necessary.	Prevent water level from overtopping dam.	Install gate valve as a primary outlet or install new trickle tube.	To better regulate pond water levels.	As needed biological treatment for algae control during summer months.	Improve pond esthetics, reduce turbidity and reduce accumulation of organic residue.
		Fabricate and install trash rack in front of outlet pipe.	Replace current inadequate trash rack.	Update SEO permit record to reflect current or future outlet configuration.	Regulatory compliance.		
		Repair and riprap erosion below outlet pipe.	Reduce discharge velocity and prevent erosion from further impacting dam. Reduce turbidity and suspended solids.				
		Repair and riprap overtop erosion below north end of dam. Import suitable material to restore top of dam elevation near north end.	Restore and prevent further deterioration of dam.				
Site 3	Holly Ponds No. 5 Reservoir	Verify function of primary gate valve, repair if needed.	To ensure safety, permit compliance, maintain water quality.			Recommend discontinuation of pond aeration in late fall and winter months and allowing pond to freeze. Encourage judicious use of chemical fertilizers upstream.	Significantly reduce seasonal presence of water fowl to reduce fecal bacterial concentrations, nutrient load, and turbidity.
						As needed biological treatment for algae control during summer months.	Improve pond esthetics, reduce turbidity and water fowl fecal bacterial concentrations, reduce accumulation of organic residue.
Site 4	Holly Ponds No. 4 Reservoir	Shore up tilted large concrete blocks associated with gate valve. Verify function of primary gate valve, repair if needed.	To ensure safety, maintain permit compliance, maintain water quality.	Repair and riprap channel erosion downstream of emergency spillway near south end of dam.	Prevent deterioration of dam and reduce turbidity, suspended solids and sedimentation.	As needed biological treatment for algae control during summer months.	Improve pond esthetics, reduce turbidity and reduce accumulation of organic residue.
Site 5	Holly Ponds No. 3 Reservoir	Rebuild or replace existing gate valve, possibly with different design.	To ensure safety, maintain permit compliance, maintain water quality.	Riprap or armor emergency spillway.	Prevent deterioration of dam and reduce turbidity, suspended solids and sedimentation.	As needed biological treatment for algae control during summer months.	Improve pond esthetics, reduce turbidity and reduce accumulation of organic residue.
Site 6	Holly Ponds #2 Reservoir	Rebuild or replace existing gate valve, possibly with different design.	To ensure safety, maintain permit compliance, maintain water quality.			As needed biological treatment for algae control during summer months.	Improve pond esthetics, reduce turbidity and reduce accumulation of organic residue.
Site 7	Holly Ponds No. 1 Reservoir			Consider options for future use. Option A: Repair or replace existing non-functional gate valve. Remove accumulated sediment to restore capacity. Gate valve is damaged and not functional. Does not impound water.	To ensure safety, maintain permit compliance and restore hydrologic function.		
				Consider options for future use. Option B: Move permitted water rights downstream to the Unpermitted Reservoir (Site 10) and abandon reservoir. Remove gate valve, breach and reclaim dam, riprap outlet disturbance and allow channel and banks to re-establish.	The permitted configuration likely contributes to elevated water temperature in summer months. Site 10 is currently deeper, better shaded from sunlight, and likely helps to maintains cooler summer water temperatures downstream. This option requires significant permitting, redesign and reconstruction costs to utilize Site 10.		
				Consider options for future use. Option C: Move water rights to (enlarged) Sam Mavrakis Pond and abandon reservoir. Remove gate valve, breach and reclaim dam, riprap outlet disturbance and allow channel to naturally re-establish.	Shallow designed water level in current permitted pond likely contributes to elevated water temperature in summer months. The Sam Mavrakis Pond could possibly be permitted with an enlargement with additional incised capacity near the inlet.		
				Consider options for future use. Option D: Abandonment, remove gate valve, breach and reclaim dam, riprap outlet disturbance and possibly install rock check dam(s) to reduce flow rate, and allow channel and banks to naturally re-establish.	Help to maintain lower summer water temperature without incurring significant additional permitting and long term maintenance expenses.		
		Repair and riprap eroded channel below walking path in drainage to northwest mid-section of Holly Ponds No. 1. Repair and rip rap channel below dam outlet.	Prevent additional erosion. Reduce turbidity, suspended solids, and sedimentation. downstream.				
Site 8	Holly No. 2 Reservoir	Replace existing gate valve and repair dam.	Ensure dam safety, maintain permit compliance, maintain water quality.				
		Clear emergency spillway of brush and riprap channel. Remove woody vegetation and roots from dam.	Re-establish emergency spillway function. Ensure safety of dam.				
Site 9	Hume No. 1 Reservoir	Remove beaver dam from spillway. Remove or relocate animals.	Restore safe operating level and reduce erosion downstream. Reduce turbidity, suspended solids and sedimentation.				
		Remove woody vegetation and roots from dam. Reconstruct and riprap spillway and downstream channel.	Ensure dam safety. Reduce turbidity, suspended solids and sedimentation.				
Site 10	Unpermitted Reservoir			Consider options for future use. Option A: Drain, breach and reclaim dam and spillway. Riprap dam disturbance area as needed.	Ensure compliance with SEO and prevent future maintenance or dam failure.	As needed biological treatment for algae control during summer months.	Improve pond esthetics, reduce turbidity and reduce accumulation of organic residue.
				Consider options for future use. Option B: Permit reservoir and move sufficient water rights; see Holly Ponds No. 1 Reservoir Option B. Design and construct new primary outlet or modify existing outlet and riprap as needed.	Permit a functioning reservoir.		
Site 11	Hume No. 2 Reservoir **(Sam Mavrakis Fishing Pond)**	Replace culvert and resurface road near inlet area.	Restore function.	Consider option for future use. Option A: Design and permit an enlargement to the reservoir, and move sufficient water rights; see Holly Ponds No. 1 Reservoir Option C. Accommodate increased permitted capacity by incising the bottom of pond near its inlet.	Increase reservoir capacity for fish and wildlife habitat. Increase opportunities for public use.		
		Minor repairs and riprap portion of emergency spillway channel, immediately below walking path, near south side of dam.					
Site 12	Hume No. 3 Reservoir					Consider options for future use. Option A: Replace existing non-functional gate valve and repair dam. Remove woody vegetation from within the inundated footprint. Extend walking path for access from Sam Mavrakis pond.	Restore permitted functions.
						Consider options for future use. Option B: Transfer existing irrigation rights through SEO, if possible. Abandon other water rights, remove damaged headgate and reclaim dam and stabilize the disturbance.	Restore flow through drainage. Remove long term maintenance costs.
	Tree and Brush Deadfall Mitigation			Remove significant fraction of deadfall from channel, ponds, and channel banks.	Improve flow through drainage and improve channel and bank stability. Reduce erosion and scouring of channel during high flows. Reduce turbidity, suspended solids and sedimentation.		
	Flow reduction through steep sections of side drainages and channel.			Install stone check dams.	Reduce turbidity, suspended solids and sedimentation.		

Table 7. Preliminary Cost Estimate for Improvements

Site Identification	Location	High Priority	Medium Priority		Low Priority	
		Estimate	Low Estimate	High Estimate	Low Estimate	High Estimate
Site 1	Sheridan County Fair Grounds Reservoir	$ 1,500.00	$ 1,500.00	$ 1,500.00	$ 1,100.00	$ 1,100.00
Site 2	Holly No. 1 Reservoir	$ 1,500.00	$ 10,000.00	$ 30,000.00	$ 1,100.00	$ 1,100.00
		$ 9,000.00	$ 7,500.00	$ 7,500.00		
Site 3	Holly Ponds No. 5 Reservoir				$ 1,100.00	$ 1,100.00
Site 4	Holly Ponds No. 4 Reservoir	$ 2,000.00	$ 2,500.00	$ 2,500.00	$ 1,100.00	$ 1,100.00
Site 5	Holly Ponds No. 3 Reservoir	$ 15,000.00	$ 1,700.00	$ 1,700.00	$ 1,100.00	$ 1,100.00
Site 6	Holly Ponds #2 Reservoir	$ 15,000.00	$ 1,700.00	$ 1,700.00	$ 1,100.00	$ 1,100.00
Site 7	Holly Ponds No. 1 Reservoir	$ 7,200.00	$ 25,000.00	$ 30,000.00		
			$ 30,000.00	$ 35,000.00		
			$ 20,000.00	$ 25,000.00		
			$ 10,000.00	$ 15,000.00		
Site 8	Holly No. 2 Reservoir	$ 15,000.00				
		$ 4,000.00				
Site 9	Hume No. 1 Reservoir	$ 2,500.00				
		$ 5,000.00				
Site 10	Unpermitted Reservoir	$ 10,000.00	$ 10,000.00	$ 15,000.00		
			$ 20,500.00	$ 26,000.00		
Site 11	Hume No. 2 Reservoir **(Sam Mavrakis Fishing Pond)**	$ 6,000.00	$ 10,000.00	$ 15,000.00		
		$ 2,200.00				
Site 12	Hume No. 3 Reservoir				$ 30,000.00	$ 35,000.00
					$ 10,000.00	$ 20,000.00
	Tree and Brush Deadfall Mitigation		$ 30,000.00	$ 30,000.00		
	Flow reduction through steep sections of side drainages and channel.		$ 30,000.00	$ 30,000.00		
		High Priority Totals $95,900	Medium Priority Low Estimate Totals $210,400	Medium Priority High Estimate Totals $265,900	Low Priority Low Estimate Totals $46,600	Low Priority High Estimate Totals $61,600

Figures

Hume Draw Assessment Area
T56N; R84W
Sections: 21, 22, 23, & 28

Feet
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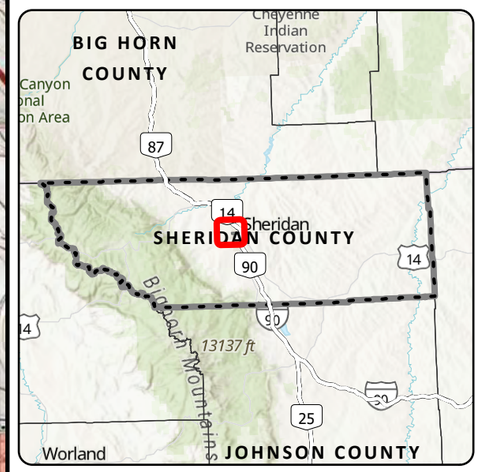

Legend

- County Boundary
- Project Area

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NO.	DESCRIPTION	DATE	DRAFT	REVIEW
1				
2				
3				
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NOTES

GENERAL LOCATION MAP

HUME DRAW

FIGURE 1

JOB#: 2023.1750

DATE:3/29/2024

Path: M:\HumeDraw\M01\GIS\Hume Draw Inspection Map\Hume Draw Inspection Map.aprx, Author: spassini

Water & Environmental TECHNOLOGIES

Legend

- Ditch
- Reservoir Not Impounding Water
- Reservoir Impounding Water

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ALLIANCE LATERAL DITCH
HOLLY PONDS NO. 4 RESERVOIR (SITE 4)
HOLLY PONDS NO. 1 RESERVOIR (SITE 7)
HOLLY NO. 2 RESERVOIR (SITE 8)
TIE DOWN DRAW
HOLLY PONDS #2 RESERVOIR (SITE 6)
HOLLY PONDS NO. 5 RESERVOIR (SITE 3)
HOLLY PONDS NO. 3 RESERVOIR (SITE 5)
HOLLY NO. 1 RESERVOIR (SITE 2)
SHERIDAN COUNTY FAIRGROUNDS RESERVOIR (SITE 1)
Long Drive
Sheridan Memorial Hospital
Highland Avenue
5th Street
8th Street
UNPERMITTED RESERVOIR (SITE 10)
HUME NO. 1 RESERVOIR (SITE 9)
HUME NO. 2/SAM MAVRAKIS POND (SITE 11)
HUME NO. 3 RESERVOIR (SITE 12)
Goose Creek

0 300 600 1,200 Feet

1 2 3 4 5

NOTES

PROJECT AREA MAP

HUME DRAW

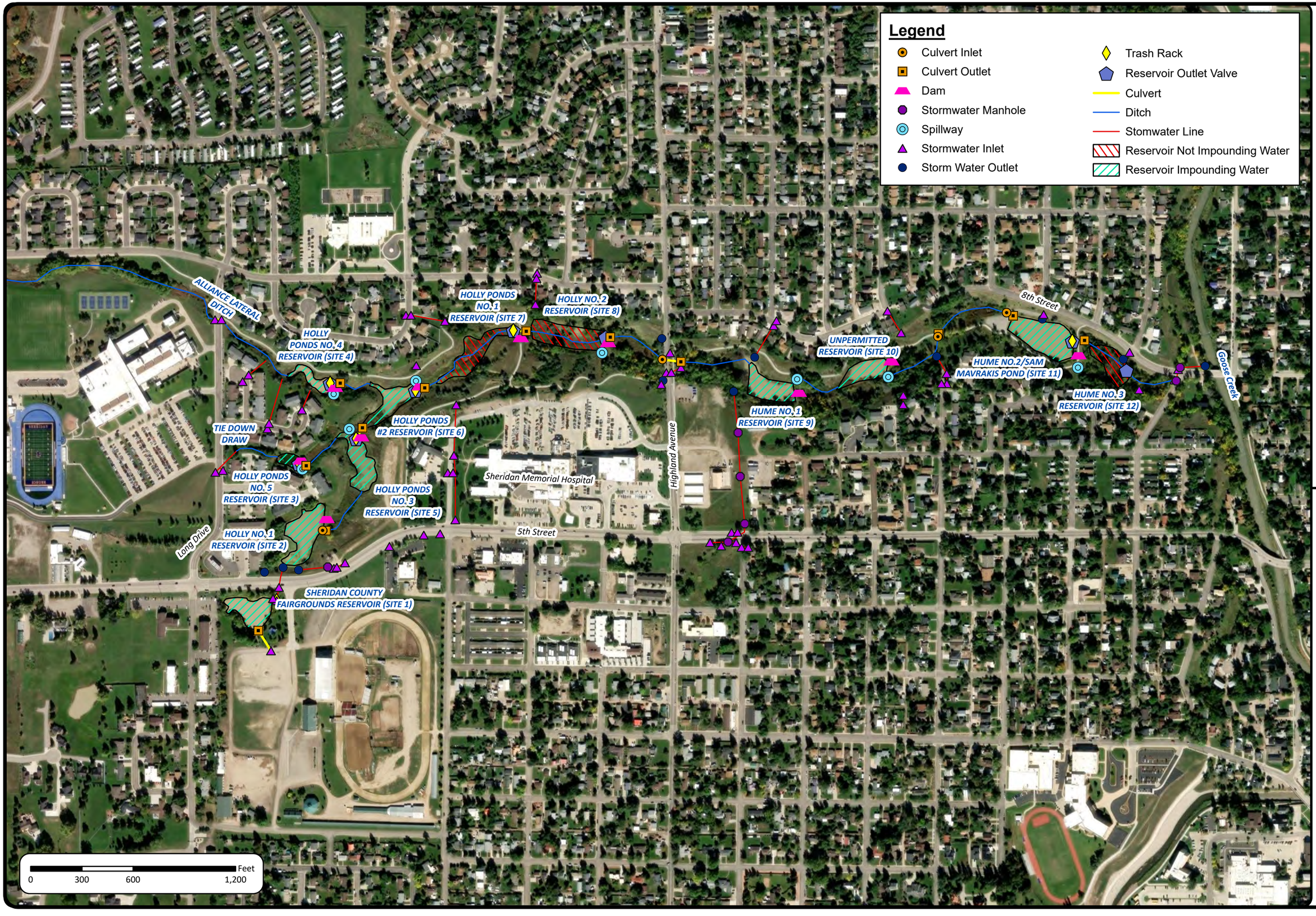
FIGURE 2

JOB#: 2023.1750

DATE:4/1/2024

Path: M:\HumeDraw\M01\GIS\Hume Draw Inspection Map\Hume Draw Inspection Map.aprx, Author: spassini

Water & Environmental TECHNOLOGIES



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NOTES

INVENTORY ASSESSMENT MAP

HUME DRAW

FIGURE 3

JOB#: 2023.1750

DATE:4/1/2024

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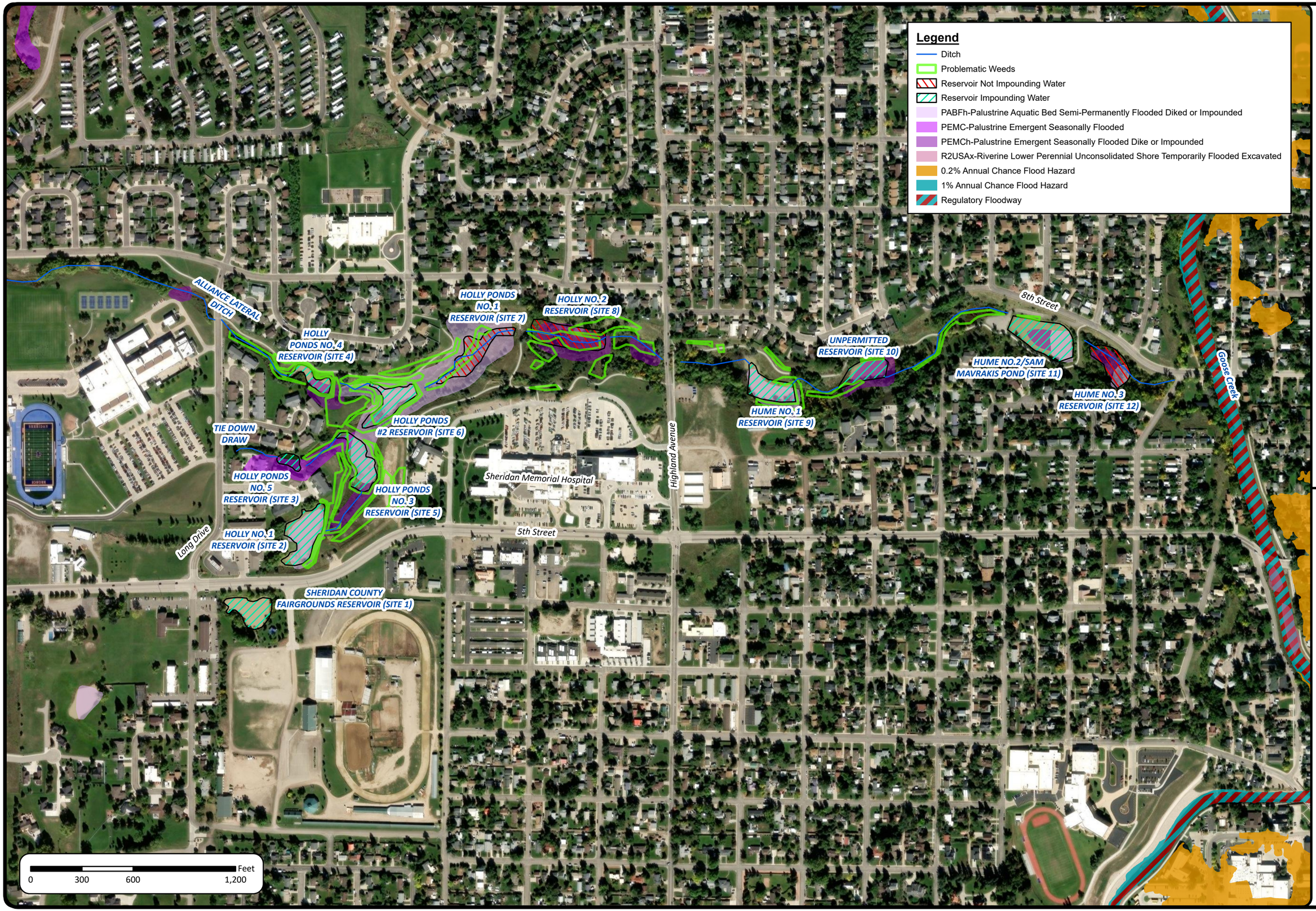
Water & Environmental TECHNOLOGIES



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NOTES

NATURAL RESOURCES MAP

HUME DRAW

FIGURE 4

JOB#: 2023.1750

DATE:5/31/2024

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Water & Environmental TECHNOLOGIES


ALLIANCE LATERAL DITCH
HOLLY PONDS NO. 4 RESERVOIR (SITE 4)
HOLLY PONDS NO. 1 RESERVOIR (SITE 7)
HOLLY NO. 2 RESERVOIR (SITE 8)
TIE DOWN DRAW
HOLLY PONDS #2 RESERVOIR (SITE 6)
HOLLY PONDS NO. 5 RESERVOIR (SITE 3)
HOLLY PONDS NO. 3 RESERVOIR (SITE 5)
HOLLY NO. 1 RESERVOIR (SITE 2)
SHERIDAN COUNTY AIRGROUNDS RESERVOIR (SITE 1)
Long Drive
Sheridan Memorial Hospital
Highland Avenue
5th Street
8th Street
UNPERMITTED RESERVOIR (SITE 10)
HUME NO. 1 RESERVOIR (SITE 9)
HUME NO. 2/SAM MAVRAKIS POND (SITE 11)
HUME NO. 3 RESERVOIR (SITE 12)
Goose Creek
Legend
Breached Dam
Beaver Dam
Obstructed Culvert
Erosion
Obstructed Trash Rack
Damaged Outlet Valve
Ditch
Incised Channel
Dense Vegetation
Reservoir Not Impounding Water
Reservoir Impounding Water
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3
4
5
Feet
0
300
600
1,200
NOTES
MAINTENANCE ITEM RECOMMENDATIONS
HUME DRAW
FIGURE 5
JOB#: 2023.1750
DATE:4/2/2024
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Water & Environmental TECHNOLOGIES

NOTES

RECREATIONAL AMENITIES MAP

HUME DRAW

FIGURE 6

JOB#: 2023.1750

DATE:4/2/2024

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Water & Environmental TECHNOLOGIES

Appendix A—Site Photos

1.1 Sheridan County Fairgrounds Reservoir - Inlet (Looking South)

1.2 Sheridan County Fairgrounds Reservoir - Water Appearance (Looking North)

1.3 Sheridan County Fairgrounds Reservoir - Eroded Spillway (Looking Southeast)

1.3 Sheridan County Fairgrounds Reservoir - Eroded Spillway (Looking Southeast)

2.1 Holly No. 1 Reservoir - South End of Reservoir (Looking West)

2.2 Holly No. 1 Reservoir - View of Dam (Looking Northeast)

2.3 Holly No. 1 Reservoir - Reservoir Outlet (Looking Southwest)

2.4 Holly No. 1 Reservoir - Erosion on North End of Dam On East Side (Looking Southwest)

3.1 Holly No. 5 Reservoir - South End of Reservoir (Looking West)

Appendix A - Photos

Site 4-Holly Ponds No. 4 Reservoir

4.1 Holly Ponds No. 4 Reservoir - Reservoir Overview (Looking West)

4.2 Holly Ponds No. 4 Reservoir - Outlet Structure (Looking West)

4.3 Holly Ponds No. 4 Reservoir - Outlet On Downstream Side of Dam (Looking North)

5.1 Holly Ponds No. 3 Reservoir - Outlet Structure (Looking West)

5.2 Holly Ponds No. 3 Reservoir - Emergency Spillway (Looking Northeast)

5.3 Holly Ponds No. 3 Reservoir - View of Dam (Looking Northwest)

5.4 Holly Ponds No. 3 Reservoir - Outlet Culvert (Looking Northwest)

6.1 Holly Ponds #2 Reservoir - Trash Rack (Looking West)

6.2 Holly Ponds #2 Reservoir - Outlet Culvert (Looking East)

7.1 Holly Ponds No. 1 Reservoir - Reservoir Channel (Looking East)

7.2 Holly Ponds No. 1 Reservoir - Outlet (Looking East)

7.3 Holly Ponds No. 1 Reservoir - Gate Valve (Looking Southwest)

8.1 Holly No. 2 Reservoir - Reservoir View (Looking West)

8.2 Holly No. 2 Reservoir - Emergency Spillway (Looking Southeast)

8.3 Holly No. 2 Reservoir - Gate Valve (Looking Southwest)

8.4 Holly No. 2 Reservoir - Outlet (Looking East)

9.1 Hume No. 1 Reservoir - Reservoir View (Looking South)

9.2 Hume No. 1 Reservoir - Emergency Spillway (Looking South)

9.3 Hume No. 1 Reservoir - Surrounding Vegetation (Looking South)

9.4 Hume No. 1 Reservoir - Emergency Spillway (Looking East)

10.1 Unpermitted Reservoir - Reservoir View (Looking East)

10.2 Unpermitted Reservoir - Emergency Spillway (Looking South)

10.3 Unpermitted Reservoir - Emergency Spillway Erosion (Looking South)

10.4 Unpermitted Reservoir - Emergency Spillway Erosion (Looking South)

11.1 Mavrakis Pond - Reservoir View (Looking West)

11.2 Mavrakis Pond - Inlet Culvert (Looking West)

11.3 Mavrakis Pond - Emergency Spillway (Looking Southeast)

11.4 Mavrakis Pond - Trash Rack (Looking East)

12.1 Hume No. 3 Reservoir - Reservoir View (Looking South)

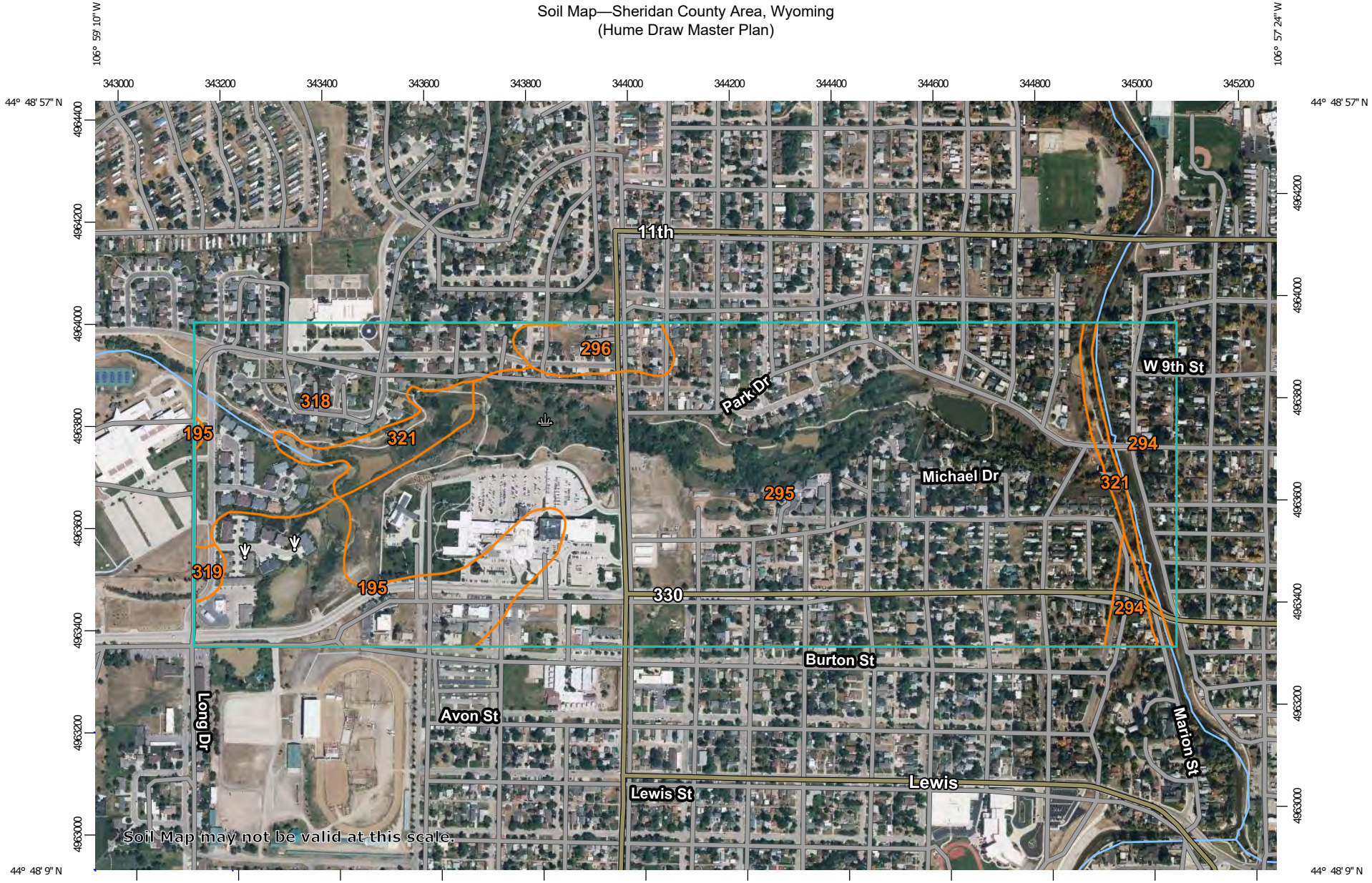
12.2 Hume No. 3 Reservoir - Surrounding Vegetation (Looking South)

12.3 Hume No. 3 Reservoir - Channel View (Looking South)

12.4 Hume No. 3 Reservoir - Dam Breach (Looking South)

Appendix B— USDA - NRCS Soils Data

Soil Map—Sheridan County Area, Wyoming
(Hume Draw Master Plan)



Map Scale: 1:10,600 if printed on A landscape (11" x 8.5") sheet.

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Meters: 0 150 300 600 900

Feet: 0 500 1000 2000 3000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Sheridan County Area, Wyoming
Survey Area Data: Version 24, Sep 6, 2023

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jun 22, 2021—Sep 27, 2021

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
195	Nuncho clay loam, 0 to 3 percent slopes	32.3	10.6%
294	Urban land-Kishona, moist-Clarkelen complex, 0 to 3 percent slopes	19.1	6.3%
295	Urban land-Platsher-Wolfvar complex, 0 to 6 percent slopes	193.2	63.6%
296	Urban land-Wyarno-Nuncho complex, 0 to 3 percent slopes	7.1	2.3%
318	Kishona-Zigweid-Cambria complex, moist, 0 to 3 percent slopes	39.4	13.0%
319	Kishona-Zigweid-Cambria complex, moist, 3 to 6 percent slopes	1.3	0.4%
321	Water	11.4	3.7%
Totals for Area of Interest		**303.9**	**100.0%**

Map Unit Description (Brief, Generated)

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions in this report, along with the maps, provide information on the composition of map units and properties of their components.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

The Map Unit Description (Brief, Generated) report displays a generated description of the major soils that occur in a map unit. Descriptions of non-soil (miscellaneous areas) and minor map unit components are not included. This description is generated from the underlying soil attribute data.

Additional information about the map units described in this report is available in other Soil Data Mart reports, which give properties of the soils and the limitations, capabilities, and potentials for many uses. Also, the narratives that accompany the Soil Data Mart reports define some of the properties included in the map unit descriptions.

Report—Map Unit Description (Brief, Generated)

Sheridan County Area, Wyoming

Map Unit: 195—Nuncho clay loam, 0 to 3 percent slopes

Component: Nuncho (85%)

The Nuncho component makes up 85 percent of the map unit. Slopes are 0 to 3 percent. This component is on alluvial fans, fan remnants. The parent material consists of alluvium derived from sedimentary rock. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches (or restricted depth) is high. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. This component is in the R043BY404WY Clayey (Cy) 15-19" Northern Plains Precipitation Zone ecological site. Nonirrigated land capability classification is 3e. Irrigated land capability classification is 3e. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 10 percent. There are no saline horizons within 30 inches of the soil surface.

Component: Nuncho, sand substratum (5%)

Generated brief soil descriptions are created for major soil components. The Nuncho, sand substratum soil is a minor component.

Component: Recluse (5%)

Generated brief soil descriptions are created for major soil components. The Recluse soil is a minor component.

Component: Nuncho, very clayey (5%)

Generated brief soil descriptions are created for major soil components. The Nuncho, very clayey soil is a minor component.

Map Unit: 294—Urban land-Kishona, moist-Clarkelen complex, 0 to 3 percent slopes

Component: Urban land (35%)

Generated brief soil descriptions are created for major soil components. The Urban land is a miscellaneous area.

Component: Kishona, moist (25%)

The Kishona, moist component makes up 25 percent of the map unit. Slopes are 0 to 3 percent. This component is on alluvial fans, fan remnants. The parent material consists of alluvium derived from sandstone. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is high. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. This component is in the R058BY122WY Loamy (Ly) 10-14" PZ ecological site. Nonirrigated land capability classification is 3e. Irrigated land capability classification is 3e. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 8 percent. There are no saline horizons within 30 inches of the soil surface. The soil has a maximum sodium adsorption ratio of 3 within 30 inches of the soil surface.

Component: Clarkelen (15%)

The Clarkelen component makes up 15 percent of the map unit. Slopes are 0 to 3 percent. This component is on flood plains, drainageways. The parent material consists of alluvium derived from sandstone. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is rarely flooded. It is not ponded. A seasonal zone of water saturation is at 60 inches during March, April, May. Organic matter content in the surface horizon is about 2 percent. This component is in the R058BY122WY Loamy (Ly) 10-14" PZ ecological site. Nonirrigated land capability classification is 3e. Irrigated land capability classification is 3e. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 3 percent. There are no saline horizons within 30 inches of the soil surface. The soil has a maximum sodium adsorption ratio of 3 within 30 inches of the soil surface.

Component: Recluse (5%)

Generated brief soil descriptions are created for major soil components. The Recluse soil is a minor component.

Component: Nuncho (5%)

Generated brief soil descriptions are created for major soil components. The Nuncho soil is a minor component.

Component: Havertel (5%)

Generated brief soil descriptions are created for major soil components. The Havertel soil is a minor component.

Component: Haverdad (5%)

Generated brief soil descriptions are created for major soil components. The Haverdad soil is a minor component.

Component: Cut and fill - made land (4%)

Generated brief soil descriptions are created for major soil components. The Cut and fill - made land soil is a minor component.

Component: Freq. flooded soils (1%)

Generated brief soil descriptions are created for major soil components. The Freq. flooded soils soil is a minor component.

Map Unit: 295—Urban land-Platsher-Wolfvar complex, 0 to 6 percent slopes

Component: Platsher (31%)

The Platsher component makes up 31 percent of the map unit. Slopes are 0 to 6 percent. This component is on alluvial fans, fan remnants. The parent material consists of alluvium derived from sedimentary rock. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. This component is in the R043BY404WY Clayey (Cy) 15-19" Northern Plains Precipitation Zone ecological site. Nonirrigated land capability classification is 3e. Irrigated land capability classification is 3e. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 25 percent. The soil has a very slightly saline horizon within 30 inches of the soil surface. The soil has a maximum sodium adsorption ratio of 3 within 30 inches of the soil surface.

Component: Urban land (29%)

Generated brief soil descriptions are created for major soil components. The Urban land is a miscellaneous area.

Component: Wolfvar (20%)

The Wolfvar component makes up 20 percent of the map unit. Slopes are 0 to 6 percent. This component is on fan remnants, alluvial fans. The parent material consists of alluvium derived from sedimentary rock. Depth to a root restrictive layer, strongly contrasting textural stratification, is 20 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. This component is in the R043BY422WY Loamy (Ly) 15-19" Northern Plains Precipitation Zone ecological site. Nonirrigated land capability classification is 3e. Irrigated land capability classification is 3e. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 27 percent. There are no saline horizons within 30 inches of the soil surface. The soil has a maximum sodium adsorption ratio of 3 within 30 inches of the soil surface.

Component: Platsher variant (4%)

Generated brief soil descriptions are created for major soil components. The Platsher variant soil is a minor component.

Component: Wolf (4%)

Generated brief soil descriptions are created for major soil components. The Wolf soil is a minor component.

Component: Nuncho (4%)

Generated brief soil descriptions are created for major soil components. The Nuncho soil is a minor component.

Component: Recluse (4%)

Generated brief soil descriptions are created for major soil components. The Recluse soil is a minor component.

Component: Cut and fill - made land (3%)

Generated brief soil descriptions are created for major soil components. The Cut and fill - made land soil is a minor component.

Component: Somewhat poorly drained soils (1%)

Generated brief soil descriptions are created for major soil components. The Somewhat poorly drained soils soil is a minor component.

Map Unit: 296—Urban land-Wyarno-Nuncho complex, 0 to 3 percent slopes

Component: Wyarno (36%)

The Wyarno component makes up 36 percent of the map unit. Slopes are 0 to 3 percent. This component is on alluvial fans, fan remnants. The parent material consists of clayey alluvium derived from sandstone and shale. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches (or restricted depth) is high. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. This component is in the R043BY404WY Clayey (Cy) 15-19" Northern Plains Precipitation Zone ecological site. Nonirrigated land capability classification is 3e. Irrigated land capability classification is 3e. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 10 percent. There are no saline horizons within 30 inches of the soil surface. The soil has a maximum sodium adsorption ratio of 3 within 30 inches of the soil surface.

Component: Urban land (34%)

Generated brief soil descriptions are created for major soil components. The Urban land is a miscellaneous area.

Component: Nuncho (15%)

The Nuncho component makes up 15 percent of the map unit. Slopes are 0 to 3 percent. This component is on alluvial fans, fan remnants. The parent material consists of alluvium derived from sedimentary rock. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches (or restricted depth) is high. Shrink-swell potential is high. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. This component is in the R043BY404WY Clayey (Cy) 15-19" Northern Plains Precipitation Zone ecological site. Nonirrigated land capability classification is 3e. Irrigated land capability classification is 3e. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 10 percent. There are no saline horizons within 30 inches of the soil surface.

Component: Recluse (3%)

Generated brief soil descriptions are created for major soil components. The Recluse soil is a minor component.

Component: Zigweid (3%)

Generated brief soil descriptions are created for major soil components. The Zigweid soil is a minor component.

Component: Cut and fill - made land (3%)

Generated brief soil descriptions are created for major soil components. The Cut and fill - made land soil is a minor component.

Component: Platsher (3%)

Generated brief soil descriptions are created for major soil components. The Platsher soil is a minor component.

Component: Grv-s substratum soils (2%)

Generated brief soil descriptions are created for major soil components. The Grv-s substratum soils soil is a minor component.

Component: Somewhat poorly drained soils (1%)

Generated brief soil descriptions are created for major soil components. The Somewhat poorly drained soils soil is a minor component.

Map Unit: 318—Kishona-Zigweid-Cambria complex, moist, 0 to 3 percent slopes

Component: Kishona, moist (31%)

The Kishona, moist component makes up 31 percent of the map unit. Slopes are 0 to 3 percent. This component is on hills, alluvial fans, sedimentary plains. The parent material consists of slope alluvium derived from sandstone and shale. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is high. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. This component is in the R043BY422WY Loamy (Ly) 15-19" Northern Plains Precipitation Zone ecological site. Nonirrigated land capability classification is 4e. Irrigated land capability classification is 4e. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 10 percent. There are no saline horizons within 30 inches of the soil surface. The soil has a maximum sodium adsorption ratio of 5 within 30 inches of the soil surface.

Component: Zigweid, moist (29%)

The Zigweid, moist component makes up 29 percent of the map unit. Slopes are 0 to 3 percent. This component is on alluvial fans, sedimentary plains. The parent material consists of alluvium derived from sandstone and shale. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is high. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. This component is in the R043BY422WY Loamy (Ly) 15-19" Northern Plains Precipitation Zone ecological site. Nonirrigated land capability classification is 4e. Irrigated land capability classification is 4e. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 10 percent. There are no saline horizons within 30 inches of the soil surface. The soil has a maximum sodium adsorption ratio of 5 within 30 inches of the soil surface.

Component: Cambria, moist (25%)

The Cambria, moist component makes up 25 percent of the map unit. Slopes are 0 to 3 percent. This component is on alluvial fans, hills, sedimentary plains. The parent material consists of alluvium derived from sandstone and shale. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is very high. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. This component is in the R043BY422WY Loamy (Ly) 15-19" Northern Plains Precipitation Zone ecological site. Nonirrigated land capability classification is 3e. Irrigated land capability classification is 3e. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 10 percent. There are no saline horizons within 30 inches of the soil surface. The soil has a maximum sodium adsorption ratio of 2 within 30 inches of the soil surface.

Component: Wyarno, moist (5%)

Generated brief soil descriptions are created for major soil components. The Wyarno, moist soil is a minor component.

Component: Forkwood, moist (5%)

Generated brief soil descriptions are created for major soil components. The Forkwood, moist soil is a minor component.

Component: Haverdad, moist (5%)

Generated brief soil descriptions are created for major soil components. The Haverdad, moist soil is a minor component.

Map Unit: 319—Kishona-Zigweid-Cambria complex, moist, 3 to 6 percent slopes

Component: Kishona, moist (31%)

The Kishona, moist component makes up 31 percent of the map unit. Slopes are 3 to 6 percent. This component is on hills, sedimentary plains. The parent material consists of slope alluvium derived from sandstone and shale. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is high. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. This component is in the R043BY422WY Loamy (Ly) 15-19" Northern Plains Precipitation Zone ecological site. Nonirrigated land capability classification is 4e. Irrigated land capability classification is 4e. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 10 percent. There are no saline horizons within 30 inches of the soil surface. The soil has a maximum sodium adsorption ratio of 5 within 30 inches of the soil surface.

Component: Zigweid, moist (29%)

The Zigweid, moist component makes up 29 percent of the map unit. Slopes are 3 to 6 percent. This component is on alluvial fans, sedimentary plains. The parent material consists of alluvium derived from sandstone and shale. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is high. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. This component is in the R043BY422WY Loamy (Ly) 15-19" Northern Plains Precipitation Zone ecological site. Nonirrigated land capability classification is 4e. Irrigated land capability classification is 4e. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 10 percent. There are no saline horizons within 30 inches of the soil surface. The soil has a maximum sodium adsorption ratio of 5 within 30 inches of the soil surface.

Component: Cambria, moist (25%)

The Cambria, moist component makes up 25 percent of the map unit. Slopes are 3 to 6 percent. This component is on hills, sedimentary plains. The parent material consists of slope alluvium derived from sandstone and shale. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is very high. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. This component is in the R043BY422WY Loamy (Ly) 15-19" Northern Plains Precipitation Zone ecological site. Nonirrigated land capability classification is 3e. Irrigated land capability classification is 3e. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 10 percent. There are no saline horizons within 30 inches of the soil surface. The soil has a maximum sodium adsorption ratio of 2 within 30 inches of the soil surface.

Component: Wyarno, moist (5%)

Generated brief soil descriptions are created for major soil components. The Wyarno, moist soil is a minor component.

Component: Forkwood, moist (5%)

Generated brief soil descriptions are created for major soil components. The Forkwood, moist soil is a minor component.

Component: Theedle, moist (5%)

Generated brief soil descriptions are created for major soil components. The Theedle, moist soil is a minor component.

Map Unit: 321—Water

Component: Water (100%)

Generated brief soil descriptions are created for major soil components. The Water is a miscellaneous area.

Data Source Information

Soil Survey Area: Sheridan County Area, Wyoming
Survey Area Data: Version 24, Sep 6, 2023

Rangeland and Forest Vegetation Classification, Productivity, and Plant Composition

In areas that have similar climate and topography, differences in the kind and amount of rangeland or forest understory vegetation are closely related to the kind of soil. Effective management is based on the relationship between the soils and vegetation and water.

This table shows, for each soil that supports vegetation, the ecological site, plant association, or habitat type; the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic vegetation; and the average percentage of each species. An explanation of the column headings in the table follows.

An *ecological site, plant association, or habitat type* is the product of all the environmental factors responsible for its development. It has characteristic soils that have developed over time throughout the soil development process; a characteristic hydrology, particularly infiltration and runoff that has developed over time; and a characteristic plant community (kind and amount of vegetation). The hydrology of the site is influenced by development of the soil and plant community. The vegetation, soils, and hydrology are all interrelated. Each is influenced by the others and influences the development of the others. The plant community on an ecological site, plant association, or habitat type is typified by an association of species that differs from that of other ecological sites, plant associations, or habitat types in the kind and/or proportion of species or in total production. Descriptions of ecological sites are provided in the Field Office Technical Guide, which is available in local offices of the Natural Resources Conservation Service (NRCS). Descriptions of plant associations or habitat types are available from local U.S. Forest Service offices.

Total dry-weight production is the amount of vegetation that can be expected to grow annually in a well managed area that is supporting the potential natural plant community. It includes all vegetation, whether or not it is palatable to grazing animals. It includes the current year's growth of leaves, twigs, and fruits of woody plants. It does not include the increase in stem diameter of trees and shrubs. It is expressed in pounds per acre of air-dry vegetation for favorable, normal, and unfavorable years. In a favorable year, the amount and distribution of precipitation and the temperatures make growing conditions substantially better than average. In a normal year, growing conditions are about average. In an unfavorable year, growing conditions are well below average, generally because of low available soil moisture. Yields are adjusted to a common percent of air-dry moisture content.

Characteristic vegetation (the grasses, forbs, shrubs, and understory trees that make up most of the potential natural plant community on each soil) is listed by common name. Under *rangeland composition and forest understory*, the expected percentage of the total annual production is given for each species making up the characteristic vegetation. The percentages are by dry weight for rangeland. Percentages for forest understory are by either dry weight or canopy cover. The amount that can be used as forage depends on the kinds of grazing animals and on the grazing season.

Range management requires knowledge of the kinds of soil and of the potential natural plant community. It also requires an evaluation of the present range similarity index and rangeland trend. Range similarity index is determined by comparing the present plant community with the potential natural plant community on a particular rangeland ecological site. The more closely the existing community resembles the potential community, the higher the range similarity index. Rangeland trend is defined as the direction of change in an existing plant community relative to the potential natural plant community. Further information about the range similarity index and rangeland trend is available in the "National Range and Pasture Handbook," which is available in local offices of NRCS or on the Internet.

The objective in range management is to control grazing so that the plants growing on a site are about the same in kind and amount as the potential natural plant community for that site. Such management generally results in the optimum production of vegetation, control of undesirable brush species, conservation of water, and control of erosion. Sometimes, however, an area with a range similarity index somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

Reference:
United States Department of Agriculture, Natural Resources Conservation Service, National range and pasture handbook.

Report—Rangeland and Forest Vegetation Classification, Productivity, and Plant Composition

Rangeland and Forest Vegetation Classification, Productivity, and Plant Composition–Sheridan County Area, Wyoming								
Map unit symbol and soil name	**Ecological Site, Plant Association, or Habitat Type**	**Total dry-weight production**			**Characteristic rangeland or forest understory vegetation**	**Composition**		
		Favorable year	**Normal year**	**Unfavorable year**			**Rangeland**	**Forest understory**
		Lb/ac	*Lb/ac*	*Lb/ac*		*Pct dry wt*	*Pct dry wt*	
195—Nuncho clay loam, 0 to 3 percent slopes								
Nuncho	Clayey (Cy) 15-19" Northern Plains Precipitation Zone (R043BY404WY)	2,900	2,100	1,400	green needlegrass	40		
					western wheatgrass	20		
					Idaho fescue	10		
					sideoats grama	10		
					spike fescue	5		
294—Urban land-Kishona, moist-Clarkelen complex, 0 to 3 percent slopes								
Urban land	—	—	—	—	—			
Kishona, moist	Loamy (Ly) 10-14" PZ (R058BY122WY); NONE (null)	1,500	1,200	700	needle and thread	25		
					western wheatgrass	25		
					blue grama	15		
					green needlegrass	15		
Clarkelen	Loamy (Ly) 10-14" PZ (R058BY122WY); NONE (null)	1,500	1,200	700	needle and thread	25		
					western wheatgrass	25		
					blue grama	15		
					green needlegrass	15		

Rangeland and Forest Vegetation Classification, Productivity, and Plant Composition–Sheridan County Area, Wyoming								
Map unit symbol and soil name	**Ecological Site, Plant Association, or Habitat Type**	**Total dry-weight production**			**Characteristic rangeland or forest understory vegetation**	**Composition**		
		Favorable year	**Normal year**	**Unfavorable year**			**Rangeland**	**Forest understory**
		Lb/ac	*Lb/ac*	*Lb/ac*		*Pct dry wt*	*Pct dry wt*	
295—Urban land-Platsher-Wolfvar complex, 0 to 6 percent slopes								
Platsher	Clayey (Cy) 15-19" Northern Plains Precipitation Zone (R043BY404WY); NONE (null)	2,900	2,100	1,400	western wheatgrass	25		
					Idaho fescue	20		
					spike fescue	20		
					green needlegrass	15		
Urban land	—	—	—	—	—			
Wolfvar	Loamy (Ly) 15-19" Northern Plains Precipitation Zone (R043BY422WY); NONE (null)	3,000	2,200	1,500	Idaho fescue	15		
					spike fescue	15		
					green needlegrass	10		
					western wheatgrass	10		
296—Urban land-Wyarno-Nuncho complex, 0 to 3 percent slopes								
Wyarno	Clayey (Cy) 15-19" Northern Plains Precipitation Zone (R043BY404WY); NONE (null)	2,900	2,100	1,400	green needlegrass	50		
					western wheatgrass	20		
					blue grama	10		
					Idaho fescue	10		
					sideoats grama	10		
Urban land	—	—	—	—	—			
Nuncho	Clayey (Cy) 15-19" Northern Plains Precipitation Zone (R043BY404WY); NONE (null)	2,900	2,100	1,400	green needlegrass	40		
					western wheatgrass	20		
					Idaho fescue	10		
					sideoats grama	10		
					spike fescue	5		

Rangeland and Forest Vegetation Classification, Productivity, and Plant Composition–Sheridan County Area, Wyoming								
Map unit symbol and soil name	**Ecological Site, Plant Association, or Habitat Type**	**Total dry-weight production**			**Characteristic rangeland or forest understory vegetation**	**Composition**		
		Favorable year	**Normal year**	**Unfavorable year**			**Rangeland**	**Forest understory**
		Lb/ac	*Lb/ac*	*Lb/ac*		*Pct dry wt*	*Pct dry wt*	
318—Kishona-Zigweid-Cambria complex, moist, 0 to 3 percent slopes								
Kishona, moist	Loamy (Ly) 15-19" Northern Plains Precipitation Zone (R043BY422WY)	3,000	2,200	1,500	green needlegrass	25		
					Idaho fescue	25		
					spike fescue	25		
					western wheatgrass	20		
Zigweid, moist	Loamy (Ly) 15-19" Northern Plains Precipitation Zone (R043BY422WY)	3,000	2,200	1,500	green needlegrass	25		
					Idaho fescue	25		
					spike fescue	25		
					western wheatgrass	20		
Cambria, moist	Loamy (Ly) 15-19" Northern Plains Precipitation Zone (R043BY422WY)	3,000	2,200	1,500	green needlegrass	25		
					Idaho fescue	25		
					spike fescue	25		
					western wheatgrass	20		

Rangeland and Forest Vegetation Classification, Productivity, and Plant Composition–Sheridan County Area, Wyoming								
Map unit symbol and soil name	**Ecological Site, Plant Association, or Habitat Type**	**Total dry-weight production**			**Characteristic rangeland or forest understory vegetation**	**Composition**		
		Favorable year	**Normal year**	**Unfavorable year**			**Rangeland**	**Forest understory**
		Lb/ac	*Lb/ac*	*Lb/ac*		*Pct dry wt*	*Pct dry wt*	
319—Kishona-Zigweid-Cambria complex, moist, 3 to 6 percent slopes								
Kishona, moist	Loamy (Ly) 15-19" Northern Plains Precipitation Zone (R043BY422WY)	3,000	2,200	1,500	green needlegrass	25		
					Idaho fescue	25		
					spike fescue	25		
					western wheatgrass	20		
Zigweid, moist	Loamy (Ly) 15-19" Northern Plains Precipitation Zone (R043BY422WY)	3,000	2,200	1,500	green needlegrass	25		
					Idaho fescue	25		
					spike fescue	25		
					western wheatgrass	20		
Cambria, moist	Loamy (Ly) 15-19" Northern Plains Precipitation Zone (R043BY422WY)	3,000	2,200	1,500	green needlegrass	25		
					Idaho fescue	25		
					spike fescue	25		
					western wheatgrass	20		
321—Water								
Water	—	—	—	—	—			

Data Source Information

Soil Survey Area: Sheridan County Area, Wyoming
Survey Area Data: Version 24, Sep 6, 2023

Hydric Soil List - All Components

This table lists the map unit components and their hydric status in the survey area. This list can help in planning land uses; however, onsite investigation is recommended to determine the hydric soils on a specific site (National Research Council, 1995; Hurt and others, 2002).

The three essential characteristics of wetlands are hydrophytic vegetation, hydric soils, and wetland hydrology (Cowardin and others, 1979; U.S. Army Corps of Engineers, 1987; National Research Council, 1995; Tiner, 1985). Criteria for all of the characteristics must be met for areas to be identified as wetlands. Undrained hydric soils that have natural vegetation should support a dominant population of ecological wetland plant species. Hydric soils that have been converted to other uses should be capable of being restored to wetlands.

Hydric soils are defined by the National Technical Committee for Hydric Soils (NTCHS) as soils that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part (Federal Register, 1994). These soils, under natural conditions, are either saturated or inundated long enough during the growing season to support the growth and reproduction of hydrophytic vegetation.

The NTCHS definition identifies general soil properties that are associated with wetness. In order to determine whether a specific soil is a hydric soil or nonhydric soil, however, more specific information, such as information about the depth and duration of the water table, is needed. Thus, criteria that identify those estimated soil properties unique to hydric soils have been established (Federal Register, 2002). These criteria are used to identify map unit components that normally are associated with wetlands. The criteria used are selected estimated soil properties that are described in "Soil Taxonomy" (Soil Survey Staff, 1999) and "Keys to Soil Taxonomy" (Soil Survey Staff, 2006) and in the "Soil Survey Manual" (Soil Survey Division Staff, 1993).

If soils are wet enough for a long enough period of time to be considered hydric, they should exhibit certain properties that can be easily observed in the field. These visible properties are indicators of hydric soils. The indicators used to make onsite determinations of hydric soils are specified in "Field Indicators of Hydric Soils in the United States" (Hurt and Vasilas, 2006).

Hydric soils are identified by examining and describing the soil to a depth of about 20 inches. This depth may be greater if determination of an appropriate indicator so requires. It is always recommended that soils be excavated and described to the depth necessary for an understanding of the redoximorphic processes. Then, using the completed soil descriptions, soil scientists can compare the soil features required by each indicator and specify which indicators have been matched with the conditions observed in the soil. The soil can be identified as a hydric soil if at least one of the approved indicators is present.

Map units that are dominantly made up of hydric soils may have small areas, or inclusions, of nonhydric soils in the higher positions on the landform, and map units dominantly made up of nonhydric soils may have inclusions of hydric soils in the lower positions on the landform.

The criteria for hydric soils are represented by codes in the table (for example, 2). Definitions for the codes are as follows:

1. All Histels except for Folistels, and Histosols except for Folists.
2. Soils in Aquic suborders, great groups, or subgroups, Albolls suborder, Historthels great group, Histoturbels great group, Pachic subgroups, or Cumulic subgroups that:
   A. Based on the range of characteristics for the soil series, will at least in part meet one or more Field Indicators of Hydric Soils in the United States, or
   B. Show evidence that the soil meets the definition of a hydric soil;
3. Soils that are frequently ponded for long or very long duration during the growing season.
   A. Based on the range of characteristics for the soil series, will at least in part meet one or more Field Indicators of Hydric Soils in the United States, or
   B. Show evidence that the soil meets the definition of a hydric soil;
4. Map unit components that are frequently flooded for long duration or very long duration during the growing season that:
   A. Based on the range of characteristics for the soil series, will at least in part meet one or more Field Indicators of Hydric Soils in the United States, or
   B. Show evidence that the soil meets the definition of a hydric soil;

Hydric Condition: Food Security Act information regarding the ability to grow a commodity crop without removing woody vegetation or manipulating hydrology.

References:

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Report—Hydric Soil List - All Components

Hydric Soil List - All Components–WY633-Sheridan County Area, Wyoming					
Map symbol and map unit name	**Component/Local Phase**	**Comp. pct.**	**Landform**	**Hydric status**	**Hydric criteria met (code)**
195: Nuncho clay loam, 0 to 3 percent slopes	Nuncho	85	Fan remnants,alluvial fans	No	—
	Nuncho-Sand substratum	5	—	No	—
	Recluse	5	—	No	—
	Nuncho-Very clayey	5	—	No	—
294: Urban land-Kishona, moist-Clarkelen complex, 0 to 3 percent slopes	Urban land	35	—	No	—
	Kishona-Moist	25	Fan remnants,alluvial fans	No	—
	Clarkelen	15	Drainageways,flood plains	No	—
	Haverdad	5	—	No	—
	Havertel	5	—	No	—
	Nuncho	5	—	No	—
	Recluse	5	—	No	—
	Cut and fill - made land	4	—	No	—
	Freq. flooded soils	1	Flood plains,stream terraces	Yes	4
295: Urban land-Platsher-Wolfvar complex, 0 to 6 percent slopes	Platsher	31	Fan remnants,alluvial fans	No	—
	Urban land	29	—	No	—
	Wolfvar	20	Alluvial fans,fan remnants	No	—
	Recluse	4	—	No	—
	Nuncho	4	—	No	—
	Wolf	4	—	No	—
	Platsher variant	4	—	No	—
	Cut and fill - made land	3	—	No	—
	Somewhat poorly drained soils	1	—	No	—
296: Urban land-Wyarno-Nuncho complex, 0 to 3 percent slopes	Wyarno	36	Fan remnants,alluvial fans	No	—
	Urban land	34	—	No	—
	Nuncho	15	Fan remnants,alluvial fans	No	—
	Platsher	3	—	No	—

Hydric Soil List - All Components–WY633-Sheridan County Area, Wyoming					
Map symbol and map unit name	**Component/Local Phase**	**Comp. pct.**	**Landform**	**Hydric status**	**Hydric criteria met (code)**
	Cut and fill - made land	3	—	No	—
	Zigweid	3	—	No	—
	Recluse	3	—	No	—
	Grv-s substratum soils	2	—	No	—
	Somewhat poorly drained soils	1	—	No	—
318: Kishona-Zigweid-Cambria complex, moist, 0 to 3 percent slopes	Kishona-Moist	31	Alluvial fans,hills	No	—
	Zigweid-Moist	29	Alluvial fans	No	—
	Cambria-Moist	25	Hills,fan remnants,alluvial fans	No	—
	Haverdad-Moist	5	Draws,drainageways	No	—
	Forkwood-Moist	5	Hills,alluvial fans	No	—
	Wyarno-Moist	5	Stream terraces,fan remnants,alluvial fans	No	—
319: Kishona-Zigweid-Cambria complex, moist, 3 to 6 percent slopes	Kishona-Moist	31	Alluvial fans,hills	No	—
	Zigweid-Moist	29	Alluvial fans	No	—
	Cambria-Moist	25	Alluvial fans,hills	No	—
	Theedle-Moist	5	Hills	No	—
	Forkwood-Moist	5	Hills,alluvial fans	No	—
	Wyarno-Moist	5	Stream terraces,fan remnants,alluvial fans	No	—
321: Water	Water	100	—	No	—

Data Source Information

Soil Survey Area: Sheridan County Area, Wyoming
Survey Area Data: Version 24, Sep 6, 2023