FINAL REPORT

Prepared For

The Colorado Water Conservation Board

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Bureau of Reclamation- Narrows Feasibility Study

Submitted By

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1. BACKGROUND

In 1997, Ducks Unlimited, Inc. (DU) entered into a Memorandum of Understanding (MOU) with the United States Bureau of Reclamation (BOR) to research, develop, and construct wetland resources for waterfowl on Reclamation lands. Through the MOU, DU has been working with the BOR for several years to investigate the feasibility of developing conjunctive use wetlands and traditional shallow water wetland habitats on four properties, referred to as the BOR Narrows Tract. The four properties (Akers, Cook, Kinnaman, and Lantz), commonly referred to as the Narrows tracts, have a long and storied history in eastern Colorado. In 1947, Congress appropriated construction funds to build the Narrows Dam, which set in motion several decades of property acquisition, geologic investigation, and administrative review of the proposed site. The authorized project has yet to be built. On January 20th, 1983, the U.S. Fish and Wildlife Service issued a Biological Opinion stating that construction of the dam would cause significant impairment to the Platte River in Nebraska [Rogers, 2009]. This opinion has been cited as the sole reason for why BOR and State of Colorado delayed the construction of the dam. However, other factors may have confounded the decision and contributed to the tabling of the Narrows Dam Project. Regardless of the reasoning, the Narrows Dam Project has been officially tabled since the mid 1980's despite being a congressionally authorized project under Pick-Sloan Missouri Basin Program. Since the tabling of the Narrows Dam project BOR has continued to manage the four properties for agricultural production and public recreation, though these resources are currently underutilized.

The Narrow properties encompass 2,288 acres in western Morgan County, all within five miles of the South Platte River (Figure 1). The legal descriptions of each property are as follows:

Akers - Township 4N, Range 58W, and all or part of Sections 21 & 28

Cook - Township 5N, Range 60W, and all or part of Sections 28 & 33

Kinnaman - Township 4N, Range 60W, and all or part of Sections 18 & 19

Lantz – Township 4N, Range 59W, and all or part of Sections 24, 26, 27, & 35

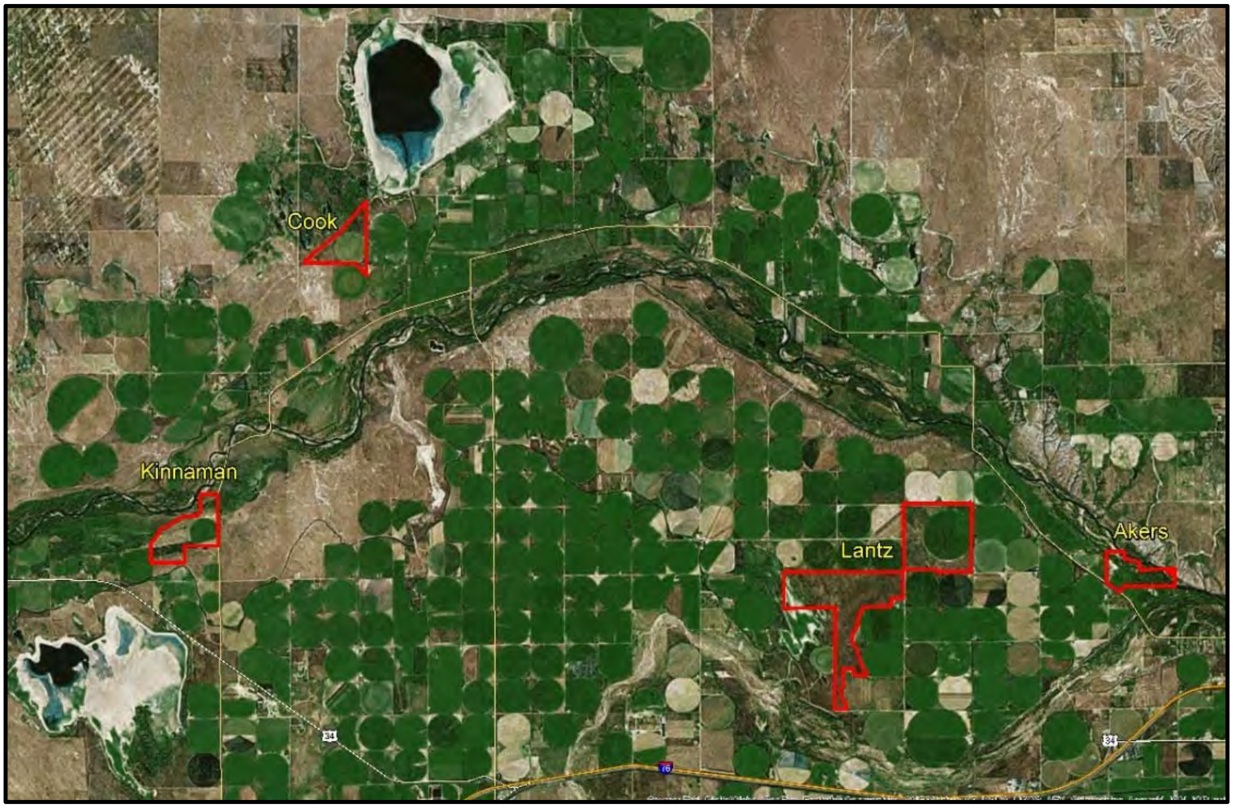

Figure 1. Bureau of Reclamation - Narrows properties

The properties are located within one of the most significant waterfowl complexes in the State, known as the "Golden Triangle," which has been identified by both federal and state waterfowl managers as one of the most important wetland complexes in the Platte River watershed (Figure 2). The Golden Triangle nickname is a result of the abundant resources provided by three major surface water bodies (Riverside Reservoir, Jackson Reservoir, and Empire Reservoir) which provide large expanses of loafing habitat, and the surrounding agricultural practices that provide high energy food sources in the form of carbohydrates (e.g., corn and wheat). Lastly, the South Platte riverine corridor in the area feeds warm water sloughs and seasonal wetlands, which generate abundant protein and mineral food resources (e.g., seeds and arthropods) required by waterfowl.

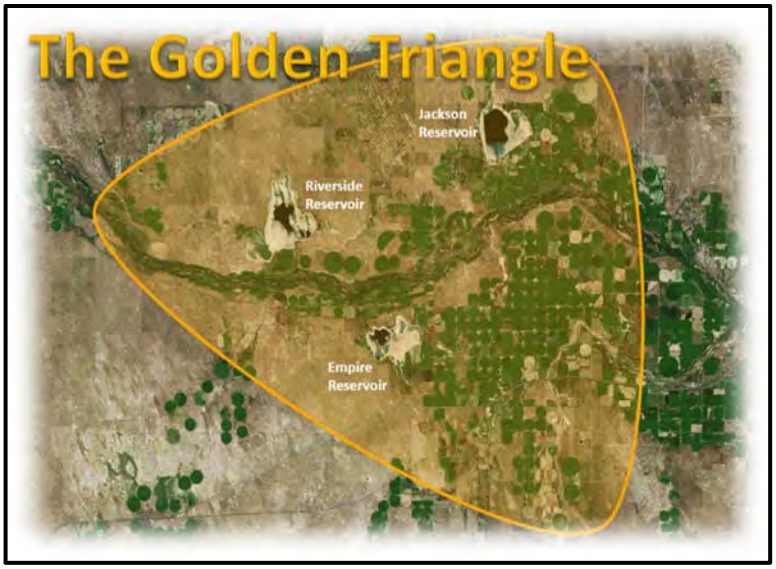

Figure 2. Golden Triangle area of the South Platte River Basin

The Narrows Project location in the middle of the Central Flyway offers an important migratory bird stopover in Colorado. The landscape surrounding the project area serves as bridge between the Prairie Pothole Region of Canada and the wintering grounds for migratory birds in the Southern US, Mexico, and Central America (Figure 3). The Prairie Pothole Region is the core of what was once the largest expanse of grassland in the world. The potholes are rich in plant and aquatic life, and support globally important populations of breeding waterfowl. Over 70% of waterfowl observed along the South Platte during the winter months (October – February) originate from the Prairie Pothole Region.

Figure 3. Project location map within the Central Flyway and in proximity to the Prairie Potholes

2. OBJECTIVES

With Water Supply Reserve Funds and matching funds provided by DU, we completed a two-year feasibility study (Phase-I) on the four Narrows properties. The Cook and Lantz tracts were investigated for the potential groundwater recharge development and the Akers and Kinnaman tracts were investigated for existing shallow water wetland enhancements and additional habitat development. Specifically, the feasibility study was broken down into the following six tasks:

Task 1 – Project administration: Progress reporting and correspondence with CWCB, accounting, and management of subcontractors.

Task 2 – Permitting: Execution of a site-specific agreement with the BOR to develop the properties for program goals. Archaeological clearance was required to obtain the permit.

Task 3 – **Framework for long-term site management:** Engagement with CPW field staff to establish the framework for public lands management and operations.

Task 4 – **Geotechnical investigations:** Soil coring, monitor well drilling, infiltration testing, and cadastral surveys on all four properties. The data collected through the geotechnical investigations forms the basis of the engineering conceptual designs and overall project planning through Phases II and III.

Task 5 – **Framework for water agreements**: Presentation of the geotechnical data to water providers, local agricultural producers, and Colorado Parks and Wildlife (CPW) to develop the framework for water agreements that will be executed in Phase-II.

Task 6 – **Final report to CWCB:** Comprehensive report outlining the results of the feasibility study and the plan for project development.

3. TASK DISCUSSION

3.1 Permitting

The Special Use Permit from the BOR, which allowed DU access to all four properties to conduct the work outlined in the grant application was fully executed on 20 July 2016. The process included obtaining archeological clearance to conduct the geotechnical work and provides guidance for the areas that will be excluded from future project develop. To help expedite the archaeological clearance, DU contracted a private consultant, which was above and beyond the scope of work, to avoid further delays in obtaining the permit due to personnel changeover at the BOR.

3.2 Long-Term Management

Long-term management of the properties will be accomplished via a multi-agency partnership. The two principle agencies who will take the lead are BOR and CPW. DU will facilitate the partnership.

The proposed activities are aligned with a primary goal identified in the CPW's Wetlands Program Strategic Plan:

> **Goal 1** - Improve the distribution and abundance of ducks, and opportunities for public waterfowl hunting. The plan and subsequent infrastructure improvements will maintain and increase the availability of quality migration habitat in a traditionally important migration corridor (subgoals 1a and 1c). CPW fully supports DU's plans to improve the number and diversity of public hunting opportunities in a region heavily used by most Colorado waterfowl hunters enhance and develop the Narrows properties for public hunting.

The BOR's Manual identifies the following management policy:

> To the extent possible, Reclamation will manage recreation facilities and opportunities by entering into management agreements with qualified partners. Reclamation will itself manage recreation areas within the limitations provided by existing authorities if a partner cannot be secured. Every effort will be made to prevent developed recreation areas from being turned back to Reclamation once a partner has been secured.

Currently, all four properties are open to the public for recreation (primarily hunting) via unrestricted walk-in access only. The properties lack a structured framework for managing public access such as hunting and bird watching. Public use on the properties is currently managed passively. The properties also lack basic improvements (e.g., designated parking areas, signage, etc.) that could be used to improve public access and minimize potential conflicts with existing agricultural operations and lessees, as well as with adjoining private landowners that may result from increased public use. The Cook property, is the only one where signage exists and it is limited to a "No Pass Shooting" sign along the Jackson Reservoir inlet canal on the northern boundary. DU, as part of this feasibility study, held several meetings and site visits with CPW field staff, BOR, and adjoining private landowners to discuss the potential to develop a recreation framework for the properties. We discussed encompassing both consumptive (i.e., hunting) and non-consumptive (i.e., birding, hiking, etc.) recreational uses. These discussions focused on balancing needs and opportunities and centered on providing a high-quality recreational experience, improving public access to the properties, and minimizing any potential issues resulting from proposed anticipated recreational activities by the public.

Conversations with CPW, BOR, adjacent private landowners have revealed that developing infrastructure for the public, such as parking lots, additional signage, as well as repairing or installing fencing ought to be a priority to improve long-term management of the properties. All parties agreed that investment in infrastructure was an essential component and would greatly help to minimize any potential issues resulting from increased visitation from the public. However, infrastructure was not the only component that may be needed to successfully manage the public. We also explored and discussed resources that are currently limited such as personnel and processes that must be navigated such as hunting regulations and procurement code of the Department of Natural Resources, and BOR internal procedures to implement different management scenarios.

All parties were supportive in developing a long-term management framework and recognize that implementation of various management alternatives are dependent on project delivery strategies. Meaning, some alternatives (e.g., parking lots) may not be implemented until specific properties are developed. DU will continue conversations with its partners through 2017 and will coordinate with partners to develop a formalized framework. We anticipate this objective to be achieved and gain considerable momentum as the project transitions to delivery.

3.3 Geotechnical Investigations

The project area is comprised of a terrace/floodplain landform developed by the downcutting of the South Plate River and its various tributary streams and has experienced considerable deposition of fine to medium grain eolian sands, which have become vegetated over time. The eolian material mantles the Pleistocene and recent alluvial deposits which are comprised of a heterogenous mixture of well sorted to poorly sorted sand, gravel, and clay lens channel deposits [Bjorkland and Brown, 1957; Warner *et al.*, 1986]. The unconfined alluvial aquifer is underlain by the Tertiary White River Group and the Upper Cretaceous Pierre Shale Formation [Lonsert, 2013]. The White River Group is comprised of the Brule and Chadron Formations and consists of poorly cemented beds of silt and clay which are relatively impermeable and form the base of the aquifer [Pocetta, 2005].

3.3.1 Soil Coring & Monitor Well Drilling

To understand site-specific geologic conditions, DU partnered with the Natural Resource Conservation Service (NRCS) to extract shallow soil cores and Drilling Engineers, Inc. to strategically bore monitor wells across the four properties at key areas of interest. The NRCS soil scientists from the Fort Morgan, CO field office extracted 52 soil cores (up to 12 feet deep) with truck mounted Giddings rigs across the four properties (Figures 4-7). The soil cores were brought to the surface and field analyzed to determine soil textures (percentages of sand, silt, and clay) throughout the profile, and the permeability characteristics of each soil group. The soil scientists provided an expert opinion on the ability of the soil profile to transport water vertically and the location of any horizontal confining layers that would inhibit further downward movement and influence the ability to recharge the alluvial aquifer or enhance shallow wetland habitat, depending on the location. The detailed soil logs and surface soil maps are presented in Appendix-B.

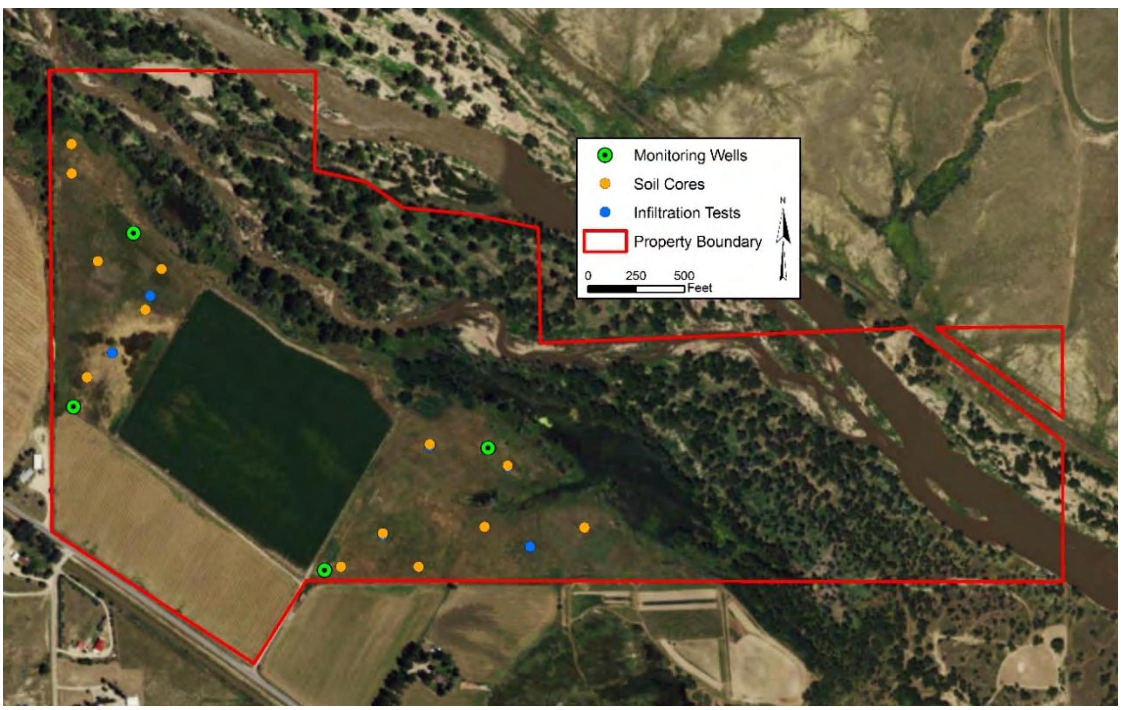

Figure 4. Akers tract geotechnical investigation points

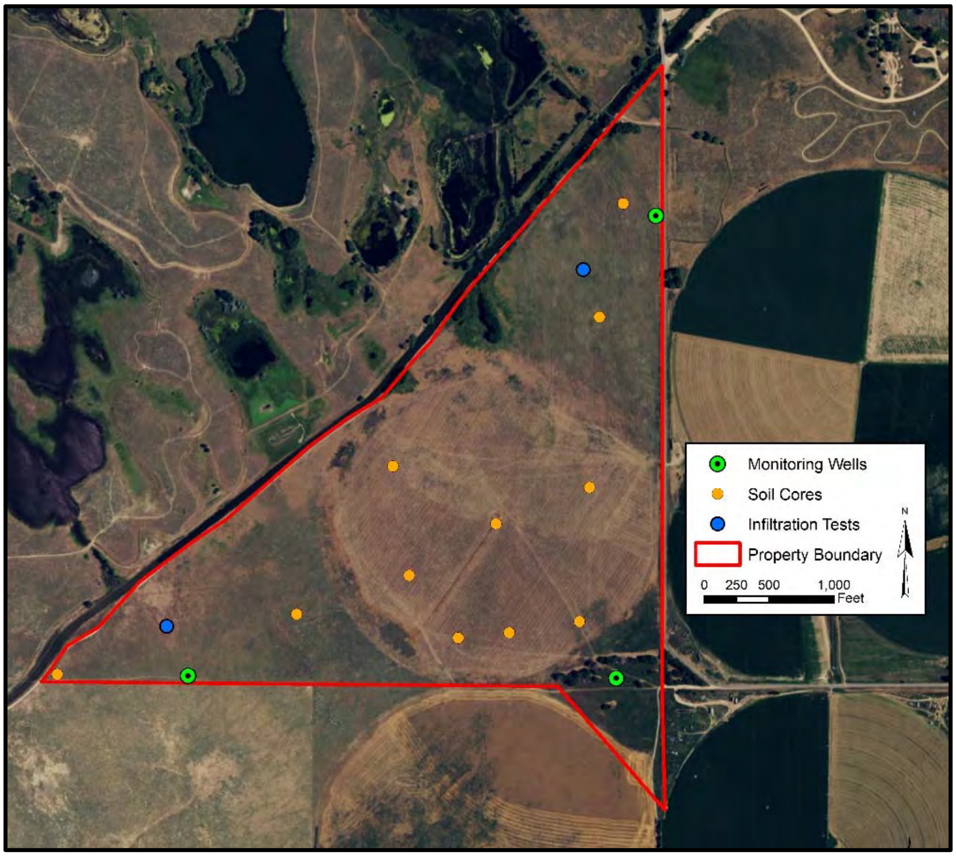

Figure 5. Cook tract geotechnical investigation points

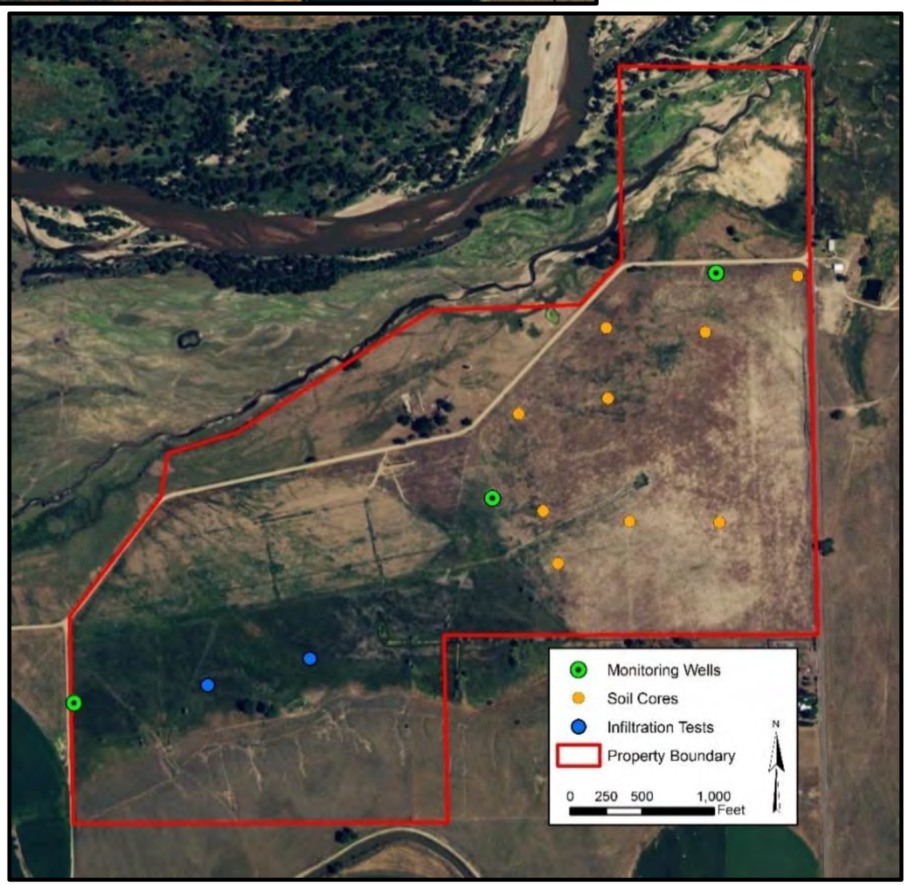

Figure 6. Kinnaman tract geotechnical investigation points

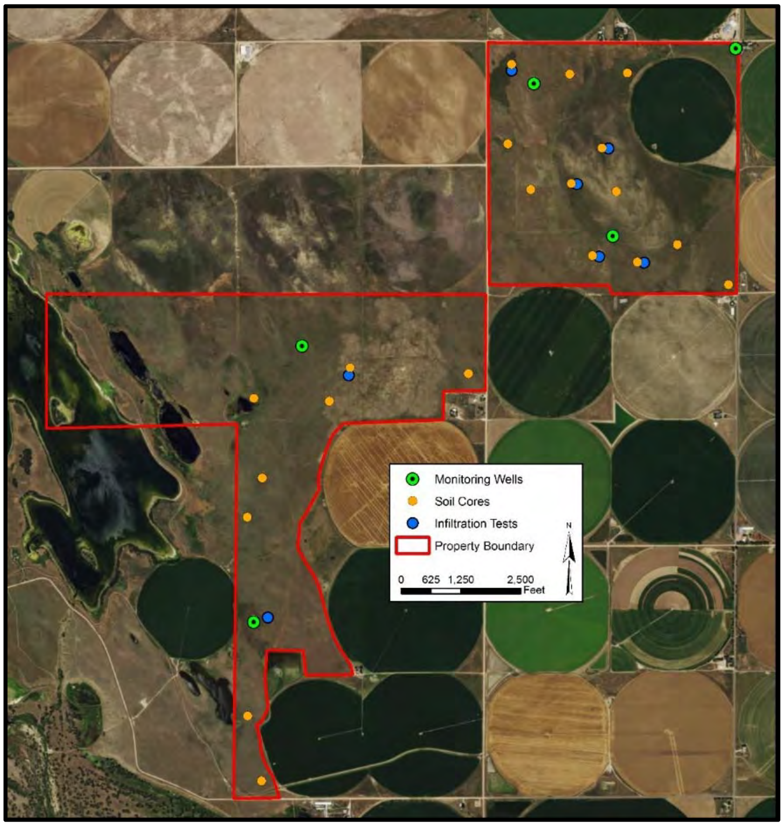

Figure 7. Lantz tract geotechnical investigation points

To assess the deeper alluvial sediments and determine the depth of the confining units and water table, DU contracted Drilling Engineers, Inc. to bore and install 15 monitoring wells across the four properties (Figures 4-7). A CME-75 drill rig was used, advancing 4.25-inch hollow stem augers to depths ranging from 20 to 120 feet. Soil samples were obtained every five feet with a standard spilt spoon an assessed for texture and moisture. The monitoring wells were constructed using two-inch diameter PVS factory slotted well screen, such that the screened interval bisected the water table at each location. Four-inch square by five-foot long locking well covers were installed and set in two-foot square concrete pads (figure x). Each well was developed using a surge block, bailer and submersible pump. The completion depths of each well and June 2017 water table elevations are presented in Table 1.

Table 1. Installed monitoring wells

Well Name	Completion Depth (ft)	June 2017 Water Table Elevation (ft)
Akers-1	29	2.02
Akers-2	12	7.28
Akers-3	15	2.82
Akers-4	25	4.05
Cook-1	42	16.10
Cook-2	26	13.75
Cook-3	22	13.65
Kinnaman-1	20	5.30
Kinnaman-2	30	6.48
Kinnaman-3	30	9.37
Lantz-1	100	49.31
Lantz-2	120	63.45
Lantz-3	112	45.65
Lantz-4	98	13.00
Lantz-5	35	10.41

Figure 8. Monitoring well completion picture

3.3.2 Infiltration Testing

Infiltration tests were conducted using an in-hole constant-head Permeameter on all four properties (Figures 4-7) to estimate field-saturated hydraulic conductivity, employing the Mariotte Principle. The method involves measuring the quasi steady-state rate of water recharge into unsaturated soil from a cylindrical well hole, in which constant depth (head) is maintained for 30-60 minutes. All holes were bored to a depth of eight-inches, using a 2.125-inch diameter soil auger. A constant pond depth of 2.75 inches was maintained for all tests.

Field saturated water flow parameters tend to be highly variable due to the spatial and temporal changes in pore characteristics due to changes in soil texture, structure, horizonation, and root growth [Reynolds *et al.*, 1986]. The parameters also exhibit a wide range of variability based on the antecedent water content of the soil, therefore we categorized each site based on the range of hydraulic conductivities measured at each location (Table 2).

Table 2. Permeability classification based on measured infiltration

Permeability	Range of Infiltration Rates (ft/d)
Very High	>5
High	2 - 5
Medium	0.5 - 2
Low	0.1-0.5
Very Low	<0.1

3.3.3 Land Surveys

In addition to the soils investigations, DU also completed comprehensive cadastral surveys on each of the four properties to develop surface models depicting project site topography. The surveys captured the detailed topography of existing ditches, irrigation infrastructure, drains, roads, ditches, gates, locations of power poles, and fences. Maps illustrating two-foot contours of the site developed from the survey are found on figures 9-13.

3.4 Framework for Water Agreements

Because hydrology is the principal ecological driver of wetland habitat condition, recreational opportunity, and management cost, its supply and control is of utmost concern to effective project development and management on the properties. Through this study, DU investigated the potential for improving hydrological control on the existing Akers and Kinnaman tract wetlands such that inundations during the spring and fall migrations would not interfere with existing agricultural operations on the sites. On a broad scale, small infrastructure improvements are needed to manage seasonal availability of water supplies in order to sustain larger, more diverse populations of waterfowl, shorebirds, and waterbirds as well as improve waterfowl hunting opportunity and quality on the properties. At this time, we do not expect to have complex water agreements on the Akers and Kinnaman tracts.

The Cook and Lantz tracts have very little to no existing wetlands, respectively, but both properties are comprised of thick sand layers and deep water tables, conducive to alluvial groundwater recharge. To explore the potential for developing recharge ponds under existing adjudicated water rights, DU engaged with CPW and several private entities to discuss their current and future augmentation needs and to present our long-range vision for the properties. The basic purpose of the meetings was to lay out the results of the geotechnical investigations, propose infrastructure improvements, and discuss conveyance routes that will allow water managers options to optimize their augmentation plans, while benefitting targeted populations of waterfowl as well as other species of wildlife. All parties recognize the value in developing additional augmentation in this reach of the South Platte River alluvium, and although an augmentation project of this size is a complex undertaking in Colorado, we believe it is achievable with a collection of partners that all receive benefit. DU will continue augmentation agreement discussions with the partners throughout the remainder of 2017.

4. PROJECT PLAN & CONCEPTUAL ENGINEERING DESIGNS

4.1 Existing Wetland Enhancements on the Akers & Kinnaman Tracts

The development goals of our work on the Akers and Kinnaman tracts are to increase the quality, availability, and persistence of waterfowl foraging habitats on the existing wetlands, while preserving the irrigated row crop and haying agricultural operations. Through a series of conservation actions deemed necessary to reach the habitat and recreational opportunity goals there are four, interrelated objectives that when completed themselves, will assure attainment of our goals. Those objectives are:

1. Hydrologic control of the wetlands in the complex;
2. Appropriate plant community composition and structure;
3. Expansion of the area and diversity of wetland types in the complexes; and,
4. Development of a public access parking area and a recreational use management plan.

To achieve these four goals, the focus of the feasibility study on Akers and Kinnaman centered on gaining a better understanding of the land surface elevations, soil composition, hydrology, and existing plant communities.

Akers tract description

The Akers tract consists of 46 acres of irrigated cropland (alfalfa and corn production), 10 acres of emergent wetlands, 40 acres of uplands, and 248 acres of river channel/riparian habitat (all approximate). The hydrology of the wetlands and wet meadows is driven by ditch seep out of the Fort Morgan Canal and irrigation return flows, and is heavily influenced by the relatively shallow depth of the alluvial confining unit (11-12 feet near the river). The water table is at or near the surface during the irrigation season, which has resulted in monotypic stands of tall emergent vegetation in the shallow water wetlands. The stability of water regimes has, through ecological succession, established these stands of emergent vegetation, including cattail and reed canary grass.

Kinnaman tract description

Similar to the Akers tract, Kinnaman is a mixed-use landscape with 168 acres of agricultural fields (corn and hay production), 56 acres of emergent wetlands, 44 acres of uplands, and 27 acres of river channel/riparian habitat (all approximate). The primary emergent wetland complex (54 acres) located in the southwest corner of the property, where the hydrology is driven primarily by ditch seep from the Bijou canal. The water table is at or near the surface while the canal is running, which has resulted in monotypic stands of tall emergent vegetation in the shallow water wetlands. The stability of water regimes has, through ecological succession, established these stands of emergent vegetation, including cattail and reed canary grass.

Engineering Solutions

Present wetland conditions on both properties call for two strategies to achieve high-quality foraging habitats for waterfowl and other wildlife. First, project development must address the preponderance of monotypic stands of tall emergent vegetation in the shallow water wetland on the properties. The stability of water regimes has, through ecological succession, established these stands of emergent vegetation, including cattail and reed canary grass. DU has utilized several techniques in the past to diminish monotypic stands of tall emergent vegetation, including cattail. These techniques either kill the plant directly (through fire or herbicide application) or work to exhaust the plant's resources such that it cannot continue to dominate the system and is out-competed by other, preferred plant communities. In Colorado, where chemical treatment and fire are often not acceptable treatments, managers are left with two modes of cattail treatment: First, they may attempt to dry out the colonized wetland basin such that more mundane disturbance treatments – like grazing, mowing or disking – can be accomplished. Following these disturbances with water level management can promote the growth of preferred forage plants while obstructing further colonization by the cattail; Or, second, managers can attempt to drown cattail by flooding over stands and interrupting the supply of oxygen to the cattail rhizome.

The principal strategy to achieve this end is the installation of water control infrastructure such that independent water delivery and drawdowns can be more easily accomplished. Drawn down to encourage the growth of preferred plant species or to perform management and maintenance activities is essential for maintaining high-quality foraging habitats for waterfowl and other wildlife. Overall, moist soil management of the emergent wetlands will result in lower total consumptive use of groundwater as the hydrology will be drawn down during the summer months to allow for better vegetation management. The areas that DU will seek to enhance through engineering solutions in Phase-II of this project are depicted in Figures 9 and 10.

The maps in Appendix-A present the soil descriptions for the project site and the soil logs provide detailed soil descriptions and qualities for each sampling location. The monitoring well borehole logs are available in Appendix-B.

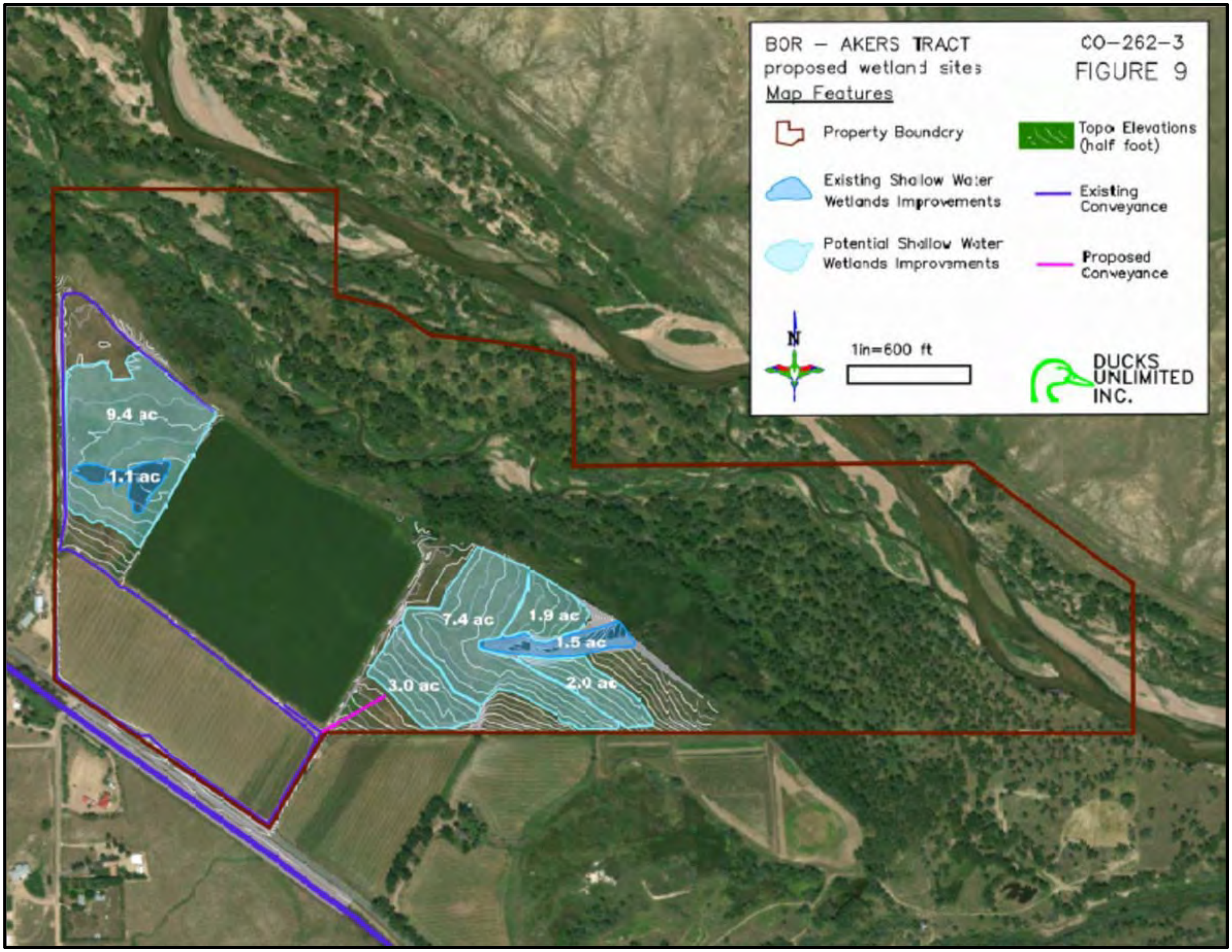

Figure 9. Akers tract conceptual engineering plan

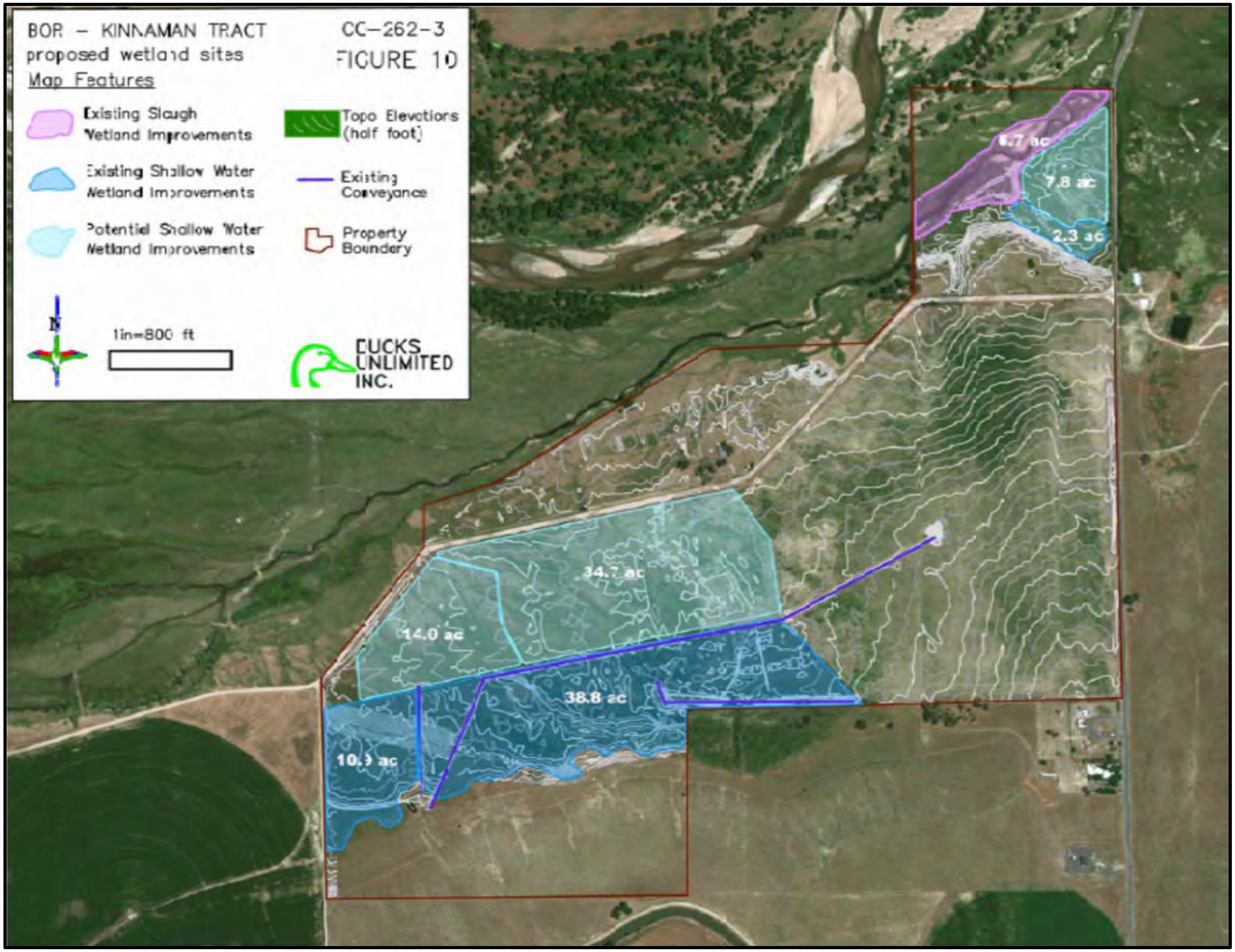

Figure 10. Kinnaman tract conceptual engineering plan

4.2 Recharge Development on The Cook & Lantz Tracts

The development goal on the Cook and Lantz tracts is to increase the availability and persistence of multi-purpose waterfowl foraging habitats through the construction of recharge wetlands. Recharge wetlands are a unique water resource management tool that allow for the addition of shallow water impoundments to the landscape, for use by migratory birds and for the benefit of junior water rights (primarily agriculture) that rely on alluvial groundwater. DU has been following two principal recharge wetland development strategies for over 30 years in the South Platte River alluvium: First, through cadastral surveying, we identify natural depression in the landscape and potential routes for water conveyance to the wetlands, either through ditches or the installation of underground pipelines; and, Second, we partner with water providers and independent agricultural producers to retime their augmentation water. Projects are designed such that the series of impoundments can be operated independently or in concert, as water is available. At the start of the irrigation season, the ponds are dried out to encourage the growth of preferred plant species and to perform management and maintenance activities.

Cook tract description

The Cook tract is a mixed-use property consisting of 110 acres of irrigated cropland (corn production), 110 acres of uplands, and 5 acres of wet meadow and emergent wetland along the Jackson Reservoir inlet canal (all approximate). The monitor well drill cuttings and split spoon soil samples revealed a continuous sand layer ranging from 22 to 42 feet thick and a depth to water ranging between 13 and 18 feet from the land surface. The medium grain sand layer and unsaturated layer great than ten feet thick both indicate good potential to develop groundwater recharge impoundments.

Lantz tract description

The Lantz tract is the largest of the four properties, totaling over 1,400 acres. The landscape is comprised of rolling eolian sand hills, with 90 acres of the northeastern corner under center pivot (corn production). In addition to the 19 soils sampling locations and 7 infiltration tests, DU drilled and completed five monitoring wells on the two parcels (Figure 7) - three on North Lantz (northeastern full Section) and two on South Lantz (t-shaped parcel that intersects Bijou Reservoir).

Very little geotechnical data was available for the site before the investigations so the results were particularly informative on both parcels. The upper Lantz parcel is comprised of think, continuous sand layers (100-120 feet thick), overlaying the shale confining unit. The soil sampling and drill logs indicate that, generally, the site is comprised of well-drained soils, with limited water holding capacities that will allow for a high rate of groundwater transmission. Depth to water in the wells ranged from 49 to 63 feet (from the land surface), indicating excellent subsurface conditions for recharge development. The rolling topography of natural depressions make for natural groundwater recharge ponds that would require minimal earthwork to bring on-line. Through constant-head Permeameter tests, we assessed the ability of the natural depressions to allow surface water infiltration. The tests revealed infiltration rates in excess of 5 feet/day (very high permeability) at all locations, furthering confirming the excellent recharge development potential of the site.

The South Lantz parcel exhibited more spatial variability than the upper parcel with regard to soil textures, depth to water, and infiltration rates. Soil sampling and monitor well drilling on the upper half of the parcel indicated that groundwater seep from Bijou Reservoir is headed in a northeastern direction, extending through the property. The seep direction is further confirmed by the presence of surface water in two locations below the dam, visible from aerial imagery. The heterogeneous composition of the soil samples revealed that infiltrated water will move at a lower velocity than the North Lantz parcel due the presence of clay lenses interspersed with the sandy loam and clay loam soil textures. These findings do not rule out the potential to develop recharge ponds but expectations on performance will not be as ideal as the upper parcel. Soil sampling and monitor well drilling on the southern half of the lower Lantz parcel, indicated a thicker sand layer with less heterogeneity. The monitor well on the lower half was drilled to a depth of 120 feet before hitting shale and the water table was located at 13 feet below the land surface.

The maps in Appendix-A present the soil descriptions for the project site and the soil logs provide detailed soil descriptions and qualities for each sampling location. The monitoring well borehole logs are available in Appendix-B.

Engineering Development

Developing recharge on the Cook and Lantz tracts is a straightforward approach of utilizing the natural depressions on the landscape and supplementing with minimal earthwork where necessary, to form wetlands ranging from 1-inch to 6 feet in depth. The potential water conveyance routes and recharge wetland locations are presented in Figures 11-13. The preliminary conceptual designs call for a flow-through system, where water is delivered to the furthest upgradient pond and allowed to gravity flow through the series of ponds. Typical DU engineering designs incorporate in-line water control structures with 4-6 inch stop logs on each pond to allow for a range of water levels to be managed.

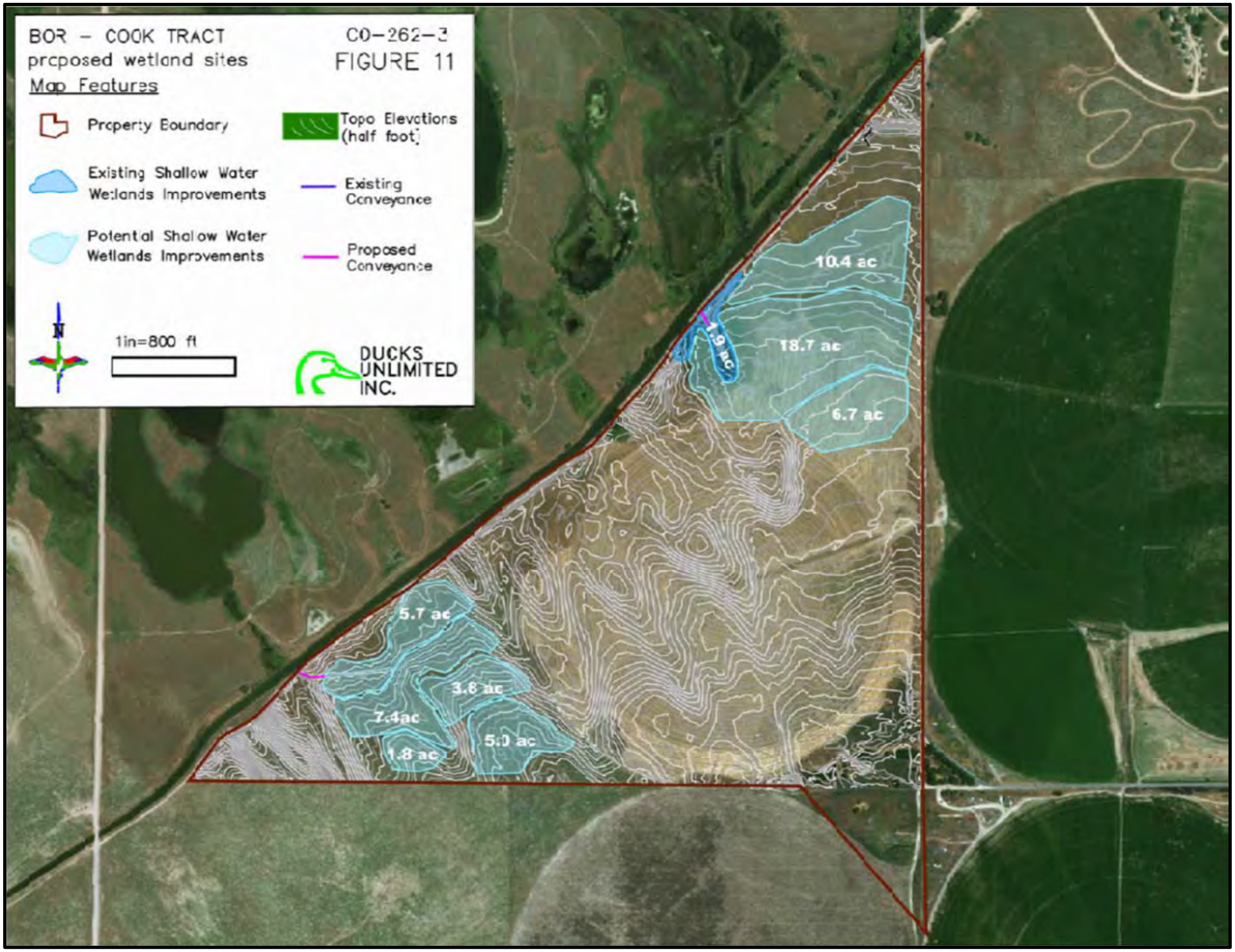

Figure 11. Cook tract conceptual engineering plan

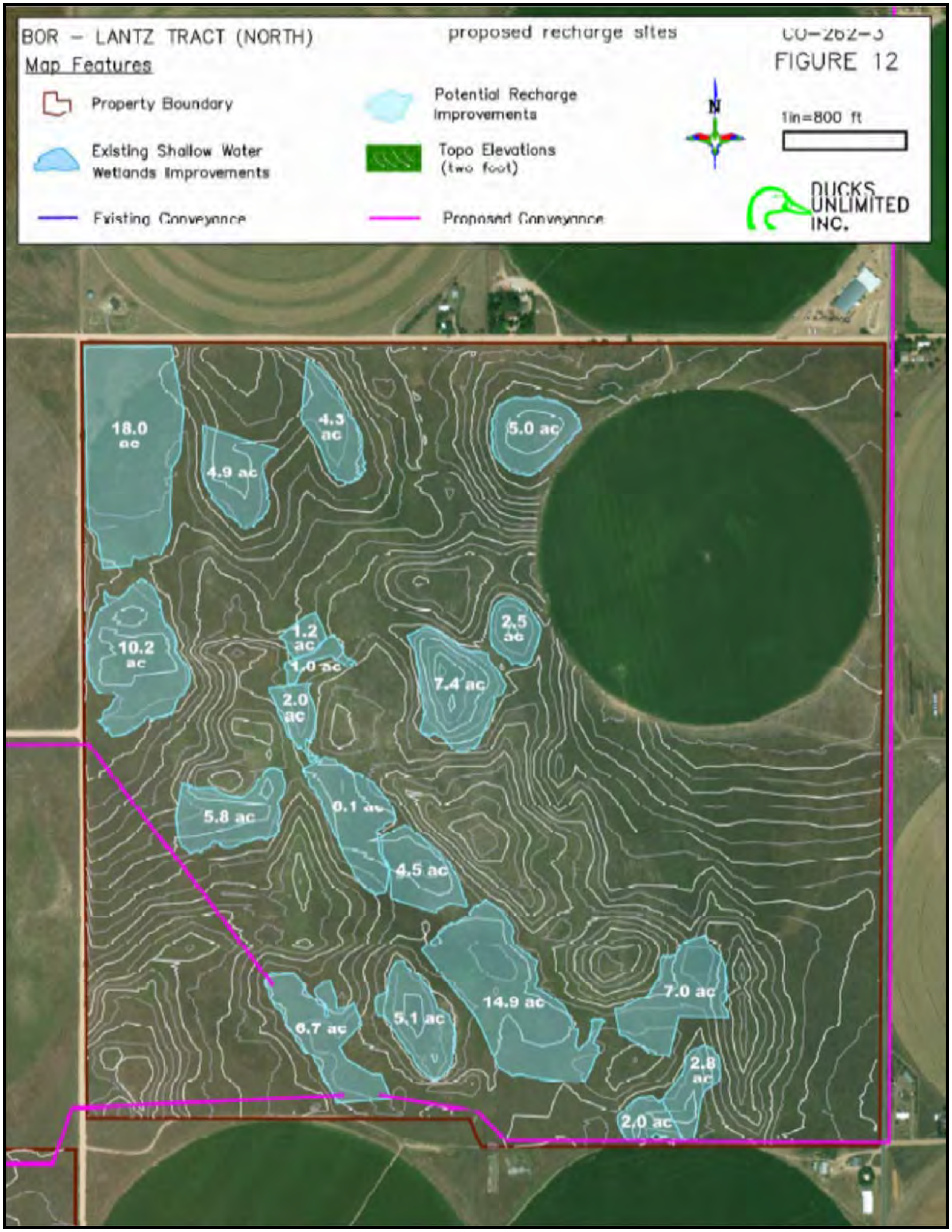

Figure 12. North Lantz tract conceptual engineering plan

Figure 13. South Lantz tract conceptual engineering plan

5. PROJECT DELIVERY

Due to the various complexities of this project and the large scale of the landscape, we anticipate that delivery will be accomplished through multiple phases. With the completion of this feasibility study, DU will immediately transition into developing the delivery strategies. We anticipate that delivery will likely follow two different paths: 1. The existing wetland enhancements on the Akers and Kinnaman tracts are likely to proceed ahead of the Cook and Lantz recharge developments, as wetland enhancements are shovel ready, and; 2. Recharge development of the Lantz and Cook tracts will follow a long-term delivery strategy as the partnerships and agreements become further solidified. Strategies for accomplishing successful delivery of all four properties were identified above, under the task discussion in Section-3, and remain a work in progress. Moving forward, DU will be transitioning into the following next steps:

Project Components and Cost Estimates

This report provides conceptual engineering plan figures of what is potentially feasible to deliver on each property. Some factors may constrain actual delivery (i.e., construction). For example, some locations of the wetlands may not be acceptable (i.e., too close to existing infrastructure) or volume of ponds may exceed availability of water for augmentation. DU will continue to be engaged with the partners and coordinate additional meetings to determine which components on each property are most appealing and viable. Once we have an agreed to final plan for each property, DU will develop cost estimates and final design plans for delivery.

Permitting

The principal permit required is authorization to fill wetlands and waters of the United States under provisions of the Section 404 of the Clean Water Act. These permits are released by the United States Army Corps of Engineers. Acting under the assumption that Narrows wetlands are jurisdictional waters of the United States, a permit to fill those portions of the wetlands within the bounds of the embankments must be secured prior to any earth-moving activities in those water features. Our history with similar types of restoration projects indicates that these activities will be permitted under a General Nationwide Permit No, 27, *Aquatic Habitat Restoration, Establishment, and Enhancement Activities*. These permits are often issued between one week and three months after notification. If the USACE maintains that the work must be permitted under an Individual Permit, then we can expect the permitting process to take a much longer time – beyond 12 months.

Funding

Moving into Phase-II of the project, DU will continue to work with our public and private partners to raise the funds necessary to develop the properties in incremental stages. Through this feasibility study funded by the CWCB, several private landowners and agencies in Colorado have expressed tremendous support for the project concept and are eager to keep the momentum moving forward. Accordingly, public fundraising efforts will be initiated after various delivery components are agreed to by the partners and DU is able to develop cost estimates based on a final design for each property.

6. LITERATURE CITED

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DUCKS UNLIMITED

APPENDIX A

Natural Resource Conservation Service Soil Coring Results

Test Hole Locations
Akers Tract - Narrows Project - Ducks Unlimited
Morgan County, Colorado

USDA United States Department of Agriculture
Natural Resources Conservation Service

Akers Tract - Soil Core Locations
Akers Tract - Field Drain Pipe Locations
Akers Tract - Seep Locations
Soil Survey of Morgan County, CO

Created 10/5/2016 by Andy Steinert
USDA-NRCS NAIP 2013-2015

Ducks Unlimited - Narrows Project - Akers Tract

Soils Log Report

Hole	NRCS Soil Classification	Depth (inches)	Soil Texture	% Clay	% Sand	% Silt	Notes
1	HtA - Heldt clay loam, 0-1% slopes	0-6	clay loam	32	35	33	This test hole was dug using the Giddings hydraulic probe from 0 to 108 inches. The material best suited for the pond liner would be from 0 to 26 inches. The present water table is at 74 inches; however, there were visible redoximorphic features (oxidized iron masses or reduced iron masses) observed within 37 inches of the soil surface and extending to 74 inches. It is unknown when the water table last reached these depths.
		6-26	clay loam	34	40	26	
		26-37	sandy loam	12	70	18	
		37-61	very fine sandy loam	16	60	24	
		61-74	loam	22	50	28	
		74-108	gravelly coarse sand	1	95	4	
2	HtA - Heldt clay loam, 0-1% slopes	0-6	clay	40	25	35	This test hole was dug using the Giddings hydraulic probe from 0 to 63 inches. The material best suited for the pond liner would be from 0 to 21 inches. The material from 21 to 50 inches could be used, but at a much lesser effectiveness than the material above. The present water table is at 50 inches; however, there were visible redoximorphic features (oxidized iron masses or reduced iron masses) observed within 21 inches of the soil surface and extending to 50 inches. It is unknown when the water table last reached these depths.
		6-21	silty clay	45	10	45	
		21-35	loam	22	45	33	
		35-50	loam	22	45	33	
		50-63+	coarse sand	1	95	4	
3	HtA - Heldt clay loam, 0-1% slopes	0-9	clay	40	25	35	This test hole was dug using the Giddings hydraulic probe from 0 to 80 inches. The material best suited for the pond liner would be from 0 to 40 inches. The present water table is at 41 inches; however, there were visible redoximorphic features (oxidized iron masses or reduced iron masses) observed within 32 inches of the soil surface and extending to 72 inches. It is unknown when the water table last reached these depths.
		9-32	silty clay	45	10	45	
		32-40	silty clay	47	5	48	
		40-72	sandy loam	16	65	19	
		72-80+	coarse sand & gravels	1	95	4	
4	HtA - Heldt clay loam, 0-1% slopes	0-13	clay loam	36	25	39	This test hole was dug using the Giddings hydraulic probe from 0 to 60 inches. The material best suited for the pond liner would be from 0 to 53 inches. The present water table is at 53 inches; however, there were visible redoximorphic
		13-32	silty clay	45	10	45	
		32-53	silty clay	48	5	47	

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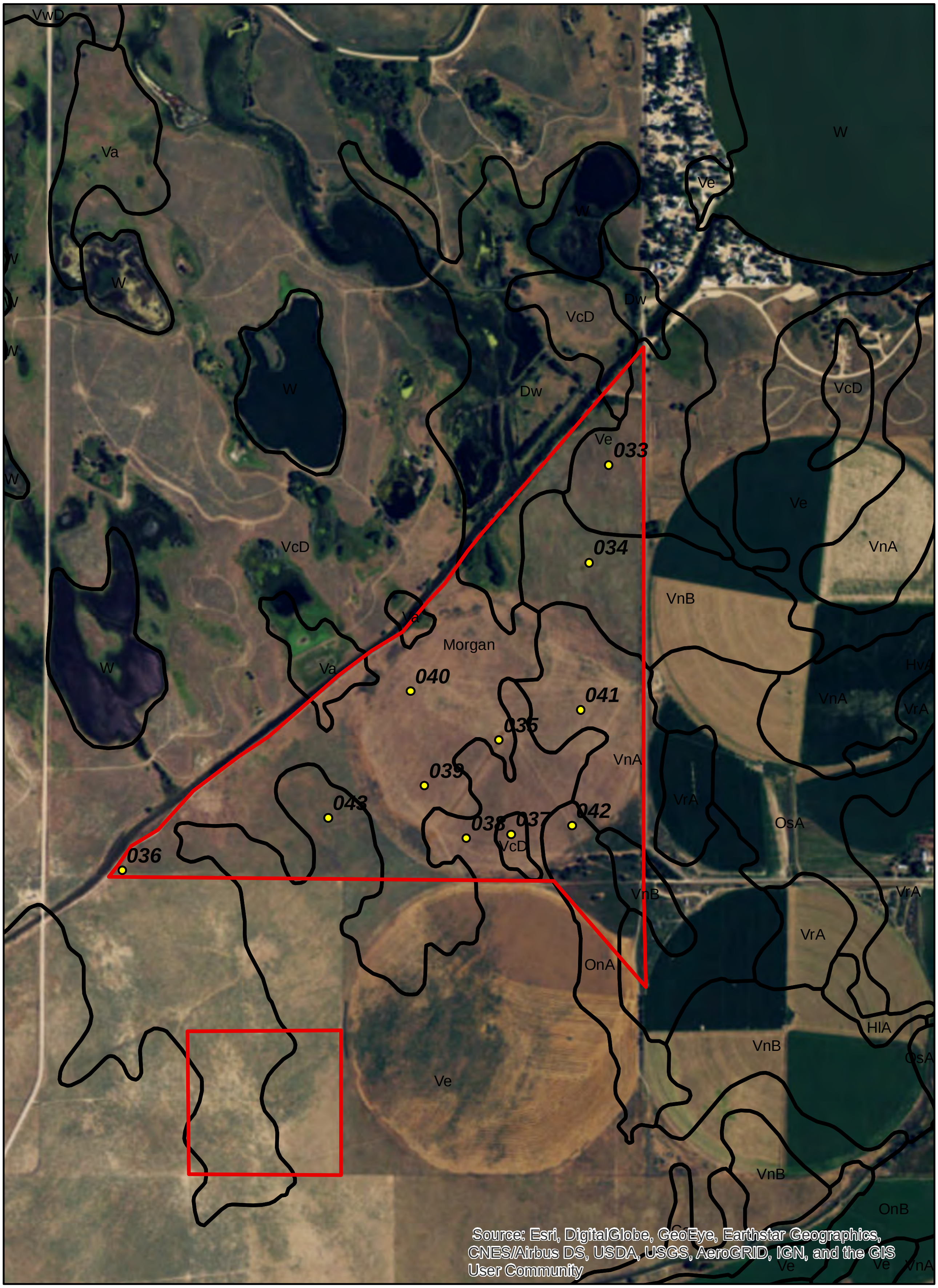
Soils Log Report

Hole	NRCS Soil Classification	Depth (inches)	Soil Texture	% Clay	% Sand	% Silt	Notes
		53-60+	gravelly coarse sand	1	95	4	features iron manganese concentrations) observed within 52 inches of the soil surface. It is unknown when the water table last reached these depths.
5	Hs - Heldt clay, saline	0-17	sandy clay loam	33	55	12	This test hole was dug using the Giddings hydraulic probe from 0 to 120 inches. The material best suited for the pond liner would be from 0 to 72 inches. The present water table is at 72 inches; however, there were visible redoximorphic features (oxidized iron masses or reduced iron masses) observed within 54 inches of the soil surface and extending to 120+ inches. It is unknown when the water table last reached these depths.
		17-41	silty clay	45	5	50	
		41-72	silty clay	45	5	50	
		72-120+	loamy very fine sand to gravelly coarse sand	4 to 1	90 to 95	6 to 4	
6	VrB - Vona sandy loam, terrace, 1-3% slopes	0-6	clay	42	20	38	This test hole was dug using the Giddings hydraulic probe from 0 to 72 inches. The material best suited for the pond liner would be from 0 to 54 inches. The present water table is at 54 inches; however, there were visible redoximorphic features (oxidized iron masses or reduced iron masses) observed within 25 inches of the soil surface and extending to 72 inches. It is unknown when the water table last reached these depths.
		6-16	silty clay	45	10	45	
		16-25	silty clay	47	5	48	
		25-54	silty clay	47	5	48	
		54-72	loamy very fine sand	4	90	6	
		72+	gravelly coarse sand	1	95	4	
7	Ca - Cascajo soils and gravelly land	0-12	clay loam	30	40	30	This test hole was dug using the Giddings hydraulic probe from 0 to 99 inches. The material best suited for the pond liner would be from 0 to 41 inches. The present water table is at 94 inches; however, there were visible redoximorphic features (oxidized iron masses or reduced iron masses) observed within 41 inches of the soil surface and extending to 99 inches. It is unknown when the water table last reached these depths.
		12-22	clay loam	30	40	30	
		22-41	silty clay	45	10	45	
		41-60	loamy fine sand	4	90	6	
		60-99	gravelly coarse sand	1	95	4	
8	VrB - Vona sandy loam, terrace, 1-3% slopes	0-4	silty clay loam	34	18	48	This test hole was dug using the Giddings hydraulic probe from 0 to 72 inches. The material best suited for the pond liner would be from 0 to 32 inches. The present water table

Ducks Unlimited - Narrows Project - Akers Tract
Soils Log Report

Hole	NRCS Soil Classification	Depth (inches)	Soil Texture	% Clay	% Sand	% Silt	Notes
		4-11	silty clay loam	34	15	51	is at 43 inches; however, there were visible redoximorphic
		11-32	silty clay	42	10	48	features (oxidized iron masses or reduced iron masses)
		32-46	loamy fine sand	4	90	6	observed within 30 inches of the soil surface and extending
		46-72+	gravelly coarse sand	1	95	4	to 51 inches. It is unknown when the water table last reached these depths.
9	VrB - Vona sandy loam, terrace, 1-3% slopes	0-8	silty clay loam	30	18	52	This test hole was dug using the Giddings hydraulic probe from 0 to 122 inches. The material best suited for the pond liner would be from 0 to 18 inches. The present water table
		8-18	silty clay loam	32	16	52	is at 93 inches; however, there were visible redoximorphic
		18-36	loamy very fine sand	5	90	5	features (oxidized iron masses or reduced iron masses)
		36-72	loamy very fine sand	3	92	5	observed within 18 inches of the soil surface and extending
		72-80	silty clay	45	5	50	to 117 inches. It is unknown when the water table last
		80-97	loamy very fine sand	2	95	3	reached these depths.
		97-107	loamy very fine sand	2	95	3	
		107-122+	gravelly coarse sand	1	98	1	
10	Ca - Cascajo soils and gravelly land	0-6	loam	16	45	39	This test hole was dug using the Giddings hydraulic probe from 0 to 120 inches. The material in this area is not very
		6-14	loam	23	40	37	well suited for pond liner material. The present water table is
		14-34	very fine sandy loam	16	60	24	at 114 inches; however, there were visible redoximorphic
		34-66	loamy very fine sand	4	90	6	features (oxidized iron masses or reduced iron masses)
		66-74	silty clay loam	38	5	57	observed within 24 inches of the soil surface and extending
		74-100	very fine sandy loam	8	65	27	to 120+ inches. It is unknown when the water table last
		100-120	loamy fine sand	4	90	6	reached these depths.
		120+	gravelly coarse sand	1	98	1	

Cook Tract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Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Ducks Unlimited - Narrows Project - Cook Tract

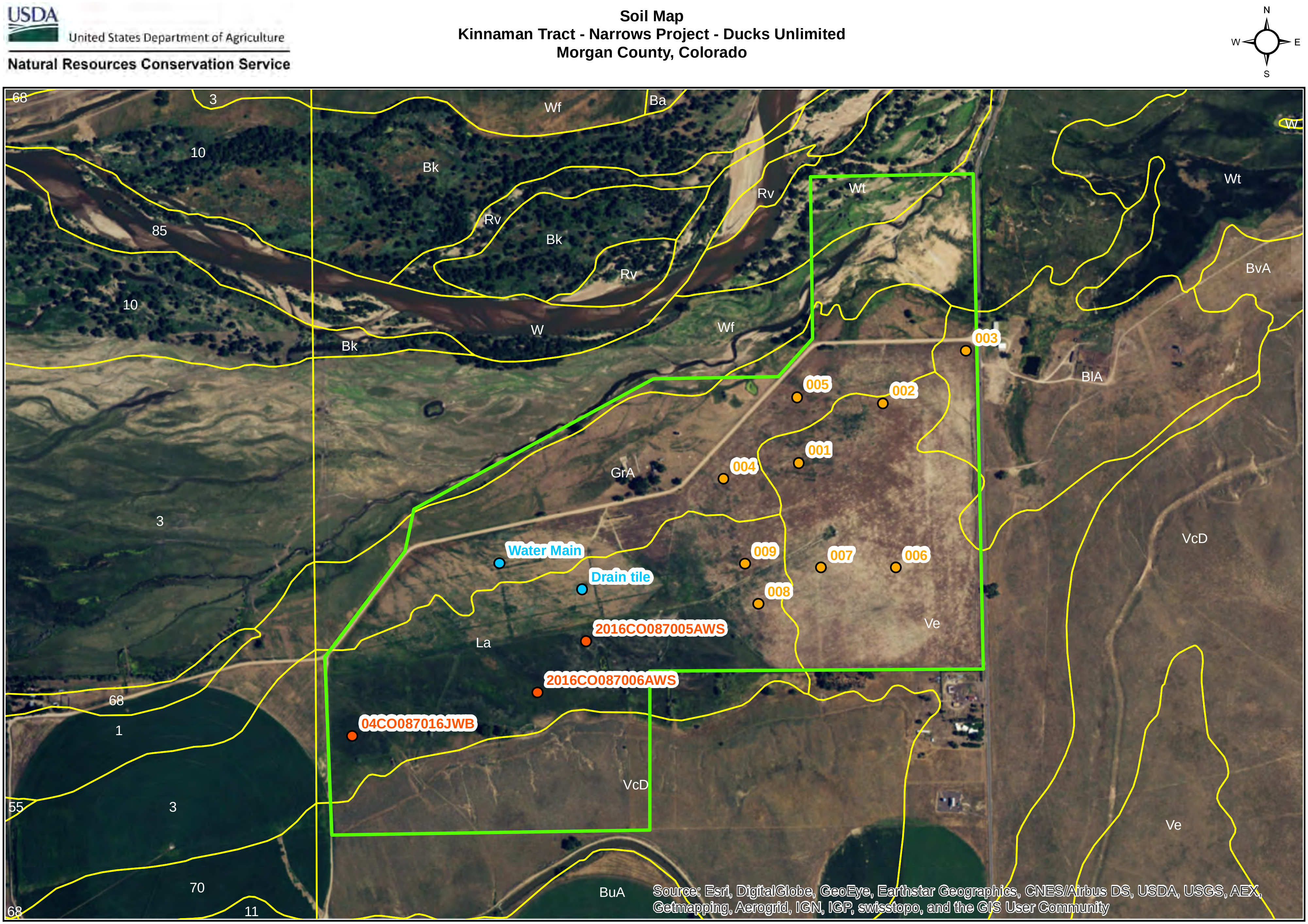
Soils Log Report

Hole	NRCS Soil Classification	Depth (inches)	Soil Texture	% Clay	% Sand	% Silt	Permeability (in./hr.)	Notes
33	Ve - Valentine-Dwyer sands, terrace	0-16	sandy loam	6	65	29	2.0-6.0	This test hole was dug using the Giddings hydraulic probe from 0 to 111 inches. No water table encountered to 111 inches. Permeability is going to be as fast as the slowest layer/horizon; for this test hole that horizon would be from 51 to 69 inches.
		16-29	sandy loam	6	65	29	2.0-6.0	
		29-51	fine sandy loam	6	70	24	2.0-6.0	
		51-69	sandy clay loam	20	68	12	0.6-2.0	
		69-111	loamy fine sand	3	80	17	6.0-20.0	
34	VnB - Vona loamy sand, terrace, 1-3% slopes	0-19	loamy fine sand	4	80	16	6.0-20.0	This test hole was dug using the Giddings hydraulic probe from 0-130 inches.Permeability is going to be as fast as the slowest layer/horizon; for this test hole that horizon would be from 44 to 58 inches. Water table encountered at 110 inches
		19-44	loamy fine sand	3	83	14	6.0-20.0	
		44-58	clay loam	38	35	27	.42-1.41	
		58-110	loamy fine sand	3	85	12	6.0-20.0	
		110-130	loamy sand	3	85	12	6.0-20.0	
35	VcD - Valent sand, 3-9% slopes	0-110	loamy sand	3	85	12	6.0-20.0	This test hole was dug using the Giddings hydraulic probe from 0 to 110 inches. There is no water table within 110 inches. Permeability is going to be as fast as the slowest layer/horizon; this test hole is uniform loamy sand material throughout
36	VcD - Valent sand, 3-9% slopes	0-53	loamy fine sand	2	85	13	6.0-20.0	This test hole was dug using the Giddings hydraulic probe from 0 to 104 inches. Permeability is going to be as fast as the slowest horizon; this test hole is uniform loamy fine sand to 104 inches.
		53-104	loamy fine sand	4	82	14	6.0-20.0	
37	VcD - Valent sand, 3-9% slopes	0-75	loamy fine sand	3	82	15	6.0-20.0	This test hole was dug using the Giddings hydraulic probe from 0 to 140 inches. Water table encountered at 128 inches. Permeability is uniform to 140 inches.
		75-96	loamy fine sand	3	82	15	6.0-20.0	
		96-126	loamy fine sand	3	82	15	6.0-20.0	
		126-140	very gravelly loamy sand	3	85	12	6.0-20.0	
38	Ve - Valentine-Dwyer sands, terrace	0-35	loamy fine sand	2	85	13	6.0-20.0	This test hole was dug using the Giddings hydraulic probe from 0 to 102 inches. Permeability is going to be as fast as the slowest horizon, for this test hole that depth will be 79-86 inches. No water table encountered to 102 inches.
		35-60	sandy loam	12	75	13	2.0-6.0	
		60-79	loamy sand	6	80	14	6.0-20.0	
		79-86	loam	24	50	26	0.6-2.0	
		86-102	vgr coarse sand	1	95	4	>20.0	
39	VcD - Valent sand, 3-9% slopes	0-38	loamy fine sand	3	85	12	6.0-20.0	This test hole was dug using the Giddings hydraulic probe from 0 to 107 inches. Permeability is going to be as fast as the slowest horizon, for this test hole that depth will be 38-45 inches. No water table encountered to 107 inches.
		38-45	sandy loam	5	78	17	2.0-6.0	
		45-99	loamy sand	3	82	15	6.0-20.0	
		99-107	gravelly coarse sand	1	95	4	>20.0	
40	VcD - Valent sand, 3-9% slopes	0-85	loamy fine sand	6	80	14	6.0-20.0	This test hole was dug using the Giddings hydraulic probe from 0 to 113 inches. Permeability is going to be as fast as the slowest horizon, for this test hole that depth will be 85-107 inches. No water table encountered to 113 inches.
		85-107	sandy clay loam	26	62	12	0.6-2.0	
		107-113	gravelly loamy sand	4	83	13	6.0-20.0	

		67-94	silty clay loam	38	5	57	0.06-0.20	This test hole was dug using the Giddings hydraulic probe from 0 to 101 inches. Permeability is going to be as fast as the slowest horizon, for this test hole that depth will be 67-94 inches. No water table encountered to 113 inches.
		94-101	loamy fine sand	3	85	12	6.0-20.0	
		101+	unknown material, very dense, sands and gravel					
42	OnA - Olney loamy sand, terrace, 0-1% slopes	0-78	loamy sand	4	82	14	6.0-20.0	This test hole was dug using the Giddings hydraulic probe from 0 to 121 inches. Permeability is going to be as fast as the slowest horizon, for this test hole that depth will be 78-86 inches. Water table encountered at 103 inches.
		78-86	sandy clay loam	32	65	3	0.6-2.0	
		86-99	loamy sand	3	85	12	6.0-20.0	
		99-111	fine sandy loam	8	75	17	2.0-6.0	
		111-121	gravelly loamy coarse sand	3	83	14	6.0-20.0	
43	VcD - Valent sand, 3-9% slopes	0-35	loamy fine sand	4	82	14	6.0-20.0	This test hole was dug using the Giddings hydraulic probe from 0 to 106 inches. Permeability is going to be as fast as the slowest horizon, for this test hole that depth will be 35-57 inches. No water table encountered to 106 inches.
		35-57	sandy clay loam	25	60	15	0.6-2.0	
		57-99	loamy fine sand	3	82	15	6.0-20.0	
		99-106	loamy sand	3	85	12	6.0-20.0	

USDA United States Department of Agriculture
Natural Resources Conservation Service

Soil Map
Kinnaman Tract - Narrows Project - Ducks Unlimited
Morgan County, Colorado



Kinnaman Tract - Soil Core Locations
Kinnaman Tract - Water Main & Drain Tile Locations
La - Las loam, saline Soil Notes
Soil Survey of Morgan County, CO

Created 10/20/2016 by Andy Steinert
Soil Survey of Morgan County, Colorado
Soil Survey Version 16 - 9/22/2015
USDA-NRCS NAIP 2013-2015

Ducks Unlimited - Narrows Project - Kinnaman Tract
Soils Log Report

Hole	NRCS Soil Classification	Depth (inches)	Soil Texture	% Clay	% Sand	% Silt	Permeability (in./hr.)	Notes
1	Ve - Valentine-Dwyer sands, terrace	0-8	sandy clay loam	30	55	15	0.2 - 0.6	This test hole was dug using the Giddings hydraulic probe from 0 to 106 inches. Water table encountered at 96 inches. Permeability is going to be as fast as the slowest layer/horizon; for this test hole that horizon would be from 8 to 16 inches.
		8-16	clay	42	25	33	0.06 - 0.20	
		16-25	clay loam	36	38	26	0.06 - 0.20	
		25-33	loam	27	45	28	0.6 - 2.0	
		33-41	gravelly sandy clay loam	21	68	11	0.6 - 2.0	
		41-106	gravelly coarse sand	1	95	4	>20.0	
2	Ve - Valentine-Dwyer sands, terrace	0-24	sandy clay loam	25	58	17	0.6 - 2.0	There is a perched water table from 35 to 41 inches. Redoximorphic features are present from 35 to 41 inches. Permeability is going to be as fast as the slowest layer/horizon; for this test hole that horizon would be from 41 to 53 inches. Water table
		24-35	fine sandy loam	6	72	22	2.0 - 6.0	
		35-41	silt loam	14	19	67	2.0 - 6.0	
		41-53	silty clay	65	5	30	0.0014 - 0.06	
		53-118	gravelly coarse sand	2	95	3	>20.0	
3	BIA - Bijou loamy sand, 0-1% slopes	0-17	loamy sand	5	83	12	6.0 - 20.0	This test hole was dug using the Giddings hydraulic probe from 0 to 118 inches. There is no water table within 118 inches. Permeability is going to be as fast as the slowest layer/horizon; for this test hole that horizon would be from 17 to 33 inches.
		17-33	gravelly sandy clay loam	32	58	10	0.2 - 0.6	
		33-118	gravelly coarse sand	1	93	6	>20.0	
4	GrA - Gilcrest sandy loam, 0-1 % slopes	0-9	clay	48	25	27	0.06 - 0.20	This test hole was dug using the Giddings hydraulic probe from 0 to 96 inches. Water table is at 90 inches. Permeability is going to be as fast as the slowest horizon; for this test hole that horizon would be from 0 to 9 inches.
		9-14	loam	22	45	33	0.6 - 2.0	
		14-28	very fine sandy loam	5	60	35	2.0 - 6.0	
		28-96	gravelly coarse sand	1	95	4	>20.0	
5	GrA - Gilcrest sandy loam, 0-1% slopes	0-13	clay	45	38	17	0.06 - 0.2	This test hole was dug using the Giddings hydraulic probe from 0 to 110 inches. Water table encountered within 78 inches. Permeability is going to be as fast as the slowest horizon; for this test hole that horizon would be from 0 to 13 inches.
		13-18	sandy clay loam	32	62	6	0.2 - 0.6	
		18-110	gravelly coarse sand	1	92	7	>20.0	
6	Ve - Valentine-Dwyer sands, terrace	0-8	sandy loam	12	65	23	2.0 - 6.0	This test hole was dug using the Giddings hydraulic probe from 0 to 125 inches. There is no water table within 125 inches. Redoximorphic features are present from 58 to 125 inches. Permeability is going to be as fast as the slowest horizon; for this test hole that
		8-12	sandy loam	12	65	23	2.0 - 6.0	
		12-24	sandy clay loam	28	55	17	0.2 - 0.6	
		24-33	loamy sand	4	80	16	6.0 - 20.0	
		33-58	sand	2	90	8	>20.0	

Ducks Unlimited - Narrows Project - Kinnaman Tract
Soils Log Report

Hole	NRCS Soil Classification	Depth (inches)	Soil Texture	% Clay	% Sand	% Silt	Permeability (in./hr.)	Notes
		58-77	sandy clay	36	50	14	0.06 - 0.2	horizon would be from 85 to 125 inches.
		77-85	sandy loam	8	75	17	2.0 - 6.0	
		85-104	silty clay	45	14	41	0.06 - 0.2	
		104-125	silty clay	45	14	41	0.06 - 0.2	
7	Valentine-Dwyer sands, terrace	0-5	sandy loam	8	75	17	2.0 - 6.0	This test hole was dug using the Giddings hydraulic probe from 0 to 108 inches. A water table is present within 104 inches. Redoximorphic features are present from 83 to 108 inches. Permeability is going to be as fast as the slowest layer/horizon; for this test hole that horizon would be from 44 to 83 inches.
		5-12	sandy loam	12	75	13	2.0 - 6.0	
		12-21	sandy loam	8	75	17	2.0 - 6.0	
		21-44	sand	3	90	7	>20.0	
		44-73	silty clay	45	5	50	0.06 - 0.2	
		73-83	sandy clay	37	50	13	0.06 - 0.2	
		83-92	sandy clay loam	24	60	16	0.6 - 2.0	
		92-108	gravelly coarse sand	1	95	4	>20.0	
8	La - Las loam, saline	0-5	sandy loam	14	75	11	2.0 - 6.0	This test hole was dug using the Giddings hydraulic probe from 0 to 96 inches. A water table is present within 72 inches. Permeability is going to be as fast as the slowest layer/horizon; for this test hole that horizon would be from 34 to 42 inches.
		5-12	sandy loam	18	70	12	2.0 - 6.0	
		12-24	fine sandy loam	12	75	13	2.0 - 6.0	
		24-34	fine sandy loam	12	75	13	2.0 - 6.0	
		34-42	silty clay loam	30	15	55	0.2 - 0.6	
		42-53	loamy fine sand	4	85	11	6.0 - 20.0	
		43-96	gravelly coarse sand	1	95	4	>20.0	
9	La - Las loam, saline	0-6	loam	22	45	33	0.6 - 2.0	This test hole was dug using the Giddings hydraulic probe from 0 to 95 inches. A water table is present within 66 inches. Redoximorphic features are present from 45 to 95 inches. Permeability is going to be as fast as the slowest layer/horizon; for this test hole that horizon would be from 12 to 33 inches.
		6-12	loam	25	45	30	0.6 - 2.0	
		12-23	clay loam	30	25	45	0.2 - 0.6	
		23-33	clay loam	34	25	41	0.2 - 0.6	
		33-45	very fine sandy loam	12	65	23	0.6 - 2.0	
		45-71	coarse sand	1	95	4	>20.0	
		71-95	gravelly coarse sand	1	95	4	>20.0	
2016 CO 087005 AWS	La - Las loam, saline	0-4	silty clay loam	32	10	58	0.2 - 0.6	This test hole was dug using the Giddings hydraulic probe from 0 to 80 inches. A water table is present within 21 inches. Redoximorphic features are present from 4 to 80 inches. Permeability is going to be as fast as the slowest layer/horizon; for this test hole that horizon would be from 4 to 15 inches.
		4-15	silty clay	45	13	42	0.06 - 0.2	
		15-80	gravelly coarse sand	1	95	4	>20.0	

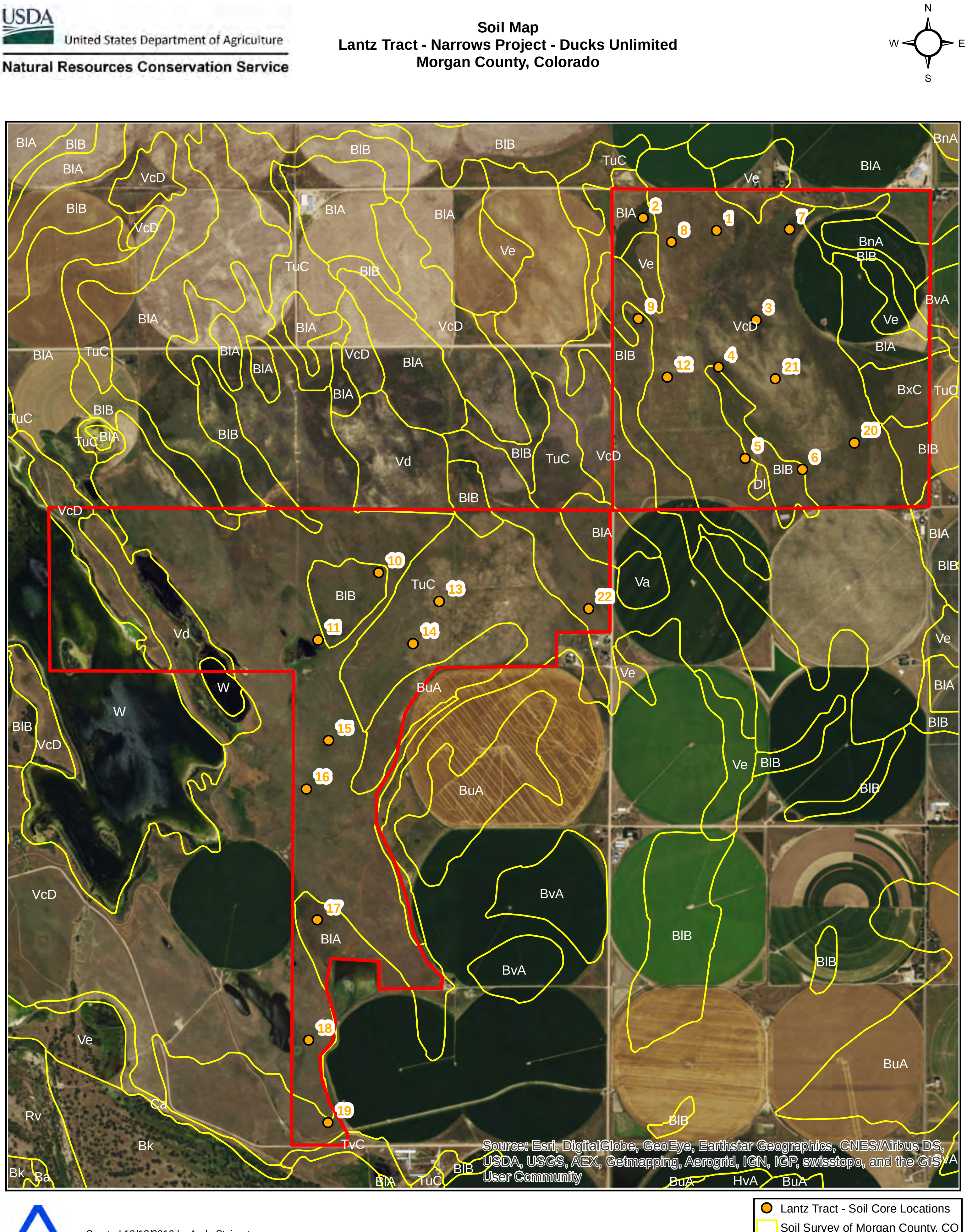
Ducks Unlimited - Narrows Project - Kinnaman Tract

Soils Log Report

Hole	NRCS Soil Classification	Depth (inches)	Soil Texture	% Clay	% Sand	% Silt	Permeability (in./hr.)	Notes
2016 CO 087006 AWS	La - Las loam, saline							This test hole was dug using the Giddings hydraulic probe from 0 to 120 inches. A water table is present within 41 inches. Redoximorphic features are present from 10 to 27 inches. Permeability is going to be as fast as the slowest layer/horizon; for this test hole that horizon would be from 3 to 27 inches.
		0-3	loam	18	35	47	2.0 - 6.0	
		3-10	loam	23	45	32	0.6 - 2.0	
		10-27	loam	23	45	32	0.6 - 2.0	
		27-120	very gravelly coarse sand	1	95	4	>20.0	
04 CO 087016 JWB	La - Las loam, saline	0-1	loam	18			2.0 - 6.0	This test hole was dug using the Giddings hydraulic probe from 0 to 59 inches. A water table is present within 46 inches. Redoximorphic features are present from 6 to 46 inches. Permeability is going to be as fast as the slowest layer/horizon; for this test hole that horizon would be from 1 to 18 inches.
		1-11	sandy clay loam	22			0.6 - 2.0	
		11-18	sandy clay loam	27			0.6 - 2.0	
		18-36	very fine sandy loam	14			2.0 - 6.0	
		36-46	gravelly sand	2			>20.0	
		45-59+	very gravelly coarse sand	1			>20.0	

USDA United States Department of Agriculture
Natural Resources Conservation Service

Soil Map
Lantz Tract - Narrows Project - Ducks Unlimited
Morgan County, Colorado



Created 10/12/2016 by Andy Steinert
Soil Survey of Morgan County, Colorado
Soil Survey Version 16 - 9/22/2015
USDA-NRCS NAIP 2013-2015

Ducks Unlimited - Narrows Project - Lantz Tract

Soils Log Report

Hole	NRCS Soil Description	Depth (inches)	Soil Texture	% Clay	% Sand	% Silt	Permeability (in./hr.)	Notes
1	VcD - Valent sand, 3-9% slopes	0-16	fine sandy loam	5	72	23	2.0 - 6.0	This test hole was dug using the Giddings hydraulic probe from 0 to 90 inches. There is no water table within 90 inches. Permeability is going to be as fast as the slowest layer/horizon; for this test hole that horizon would be from 37 to 42 inches.
		16-37	sandy loam	16	65	19	2.0 - 6.0	
		37-42	sandy clay	38	48	14	0.06 - 0.20	
		42-72	loamy sand	3	85	12	6.0 - 20.0	
		72-90	fine sandy loam	6	74	20	2.0 - 6.0	
2	BIA - Bijou loamy sand, 0-1% slopes	0-6	sandy loam	14	62	24	2.0 - 6.0	This test hole was dug using the Giddings hydraulic probe from 0 to 65 inches. There is a perched water table from 30 to 65 inches. Redoximorphic features are present from 30 to 65 inches. Permeability is going to be as fast as the slowest layer/horizon; for this test hole that horizon would be from 22 to 30 inches.
		6-22	Sandy clay loam	24	58	18	0.6 - 2.0	
		22-30	clay	45	44	11	0.06 - 0.20	
		30-65	loamy coarse sand	3	85	12	6.0 - 20.0	
		65+	shale				0.0 - 0.06	
3	VcD - Valent sand, 3-9% slopes	0-7	sandy loam	8	65	27	2.0 - 6.0	This test hole was dug using the Giddings hydraulic probe from 0 to 119 inches. There is no water table within 119 inches. Permeability is going to be as fast as the slowest layer/horizon; for this test hole that horizon would be from 17 to 56 inches.
		7-12	sandy loam	8	65	27	2.0 - 6.0	
		12-17	loamy sand	5	80	15	6.0 - 20.0	
		17-32	sandy clay loam	32	48	20	0.2 - 0.6	
		32-56	sandy clay loam	30	45	25	0.2 - 0.6	
		56-72	loamy sand	5	85	10	6.0 - 20.0	
		72-94	loamy sand	2	85	13	6.0 - 20.0	
		94-119	loamy coarse sand	4	80	16	6.0 - 20.0	
4	BIB - Bijou loamy sand, 1-3% slopes	0-4	sandy loam	8	65	27	2.0 - 6.0	This test hole was dug using the Giddings hydraulic probe from 0 to 122 inches. There is no water table within 122 inches. Permeability is going to be as fast as the slowest horizon; for this test hole that horizon would be from 59 to 65 inches.
		4-12	sandy loam	12	60	28	2.0 - 6.0	
		12-26	sandy loam	8	70	22	2.0 - 6.0	
		26-45	loamy sand	6	80	14	6.0 - 20.0	
		45-59	sandy loam	8	70	22	2.0 - 6.0	
		59-65	sandy clay loam	23	60	17	0.6 - 2.0	
		65-78	sandy loam	10	70	20	2.0 - 6.0	
		78-92	loamy coarse sand	4	85	11	6.0 - 20.0	
		92-107	fine sandy loam	8	75	17	2.0 - 6.0	
		107-122	loamy sand	3	85	12	6.0 - 20.0	
5	BIB - Bijou loamy sand, 1-3% slopes	0-6	sandy loam	10	65	25	2.0 - 6.0	This test hole was dug using the Giddings hydraulic probe from 0 to 126 inches. There is no water table within 126 inches. Permeability is going to be as fast as the slowest horizon; for this test hole that horizon would be from 101 to 126 inches.
		6-13	sandy loam	12	60	28	2.0 - 6.0	
		13-25	sandy loam	8	70	22	2.0 - 6.0	
		25-66	loamy sand	10	65	25	6.0 - 20.0	
		66-101	sandy loam	10	75	15	2.0 - 6.0	
		101-126	sandy clay loam	2	95	3	0.6 - 2.0	

Ducks Unlimited - Narrows Project - Lantz Tract
Soils Log Report

Hole	NRCS Soil Description	Depth (inches)	Soil Texture	% Clay	% Sand	% Silt	Permeability (in./hr.)	Notes
6	BIB - Bijou loamy sand, 1-3% slopes	0-5	sandy loam	8	75	17	2.0 - 6.0	This test hole was dug using the Giddings hydraulic probe from 0 to 125 inches. There is no water table within 125 inches. Permeability is going to be as fast as the slowest horizon; for this test hole that horizon would be from 23 to 40 inches.
		5-12	sandy loam	8	75	17	2.0 - 6.0	
		12-23	loamy sand	4	80	16	6.0 - 20.0	
		23-40	clay loam	30	30	40	0.2 - 0.6	
		40-55	fine sandy loam	18	55	27	2.0 - 6.0	
		55-76	sandy loam	12	70	18	2.0 - 6.0	
		76-125	loamy coarse sand	4	90	6	6.0 - 20.0	
7	VcD - Valent sand, 3-9% slopes	0-14	sandy clay loam	23	55	22	0.6 - 2.0	This test hole was dug using the Giddings hydraulic probe from 0 to 108 inches. Permeability is going to be as fast as the slowest layer/horizon; for this test hole that horizon would be from 81 to 90 inches.
		14-20	fine sandy loam	8	72	20	2.0 - 6.0	
		20-57	sandy clay loam	32	54	14	0.6 - 2.0	
		57-81	loamy fine sand	4	85	11	6.0 - 20.0	
		81-90	clay	45	33	22	0.06 - 0.20	
		90-108	loamy fine sand	3	85	12	6.0 - 20.0	
8	VcD - Valent sand, 3-9% slopes	0-21	loamy fine sand	5	80	15	6.0 - 20.0	This test hole was dug using the Giddings hydraulic probe from 0 to 98 inches. Permeability is going to be as fast as the slowest layer/horizon; for this test hole that horizon would be from 21 to 42 inches.
		21-42	sandy loam	7	70	23	2.0 - 6.0	
		42-98	loamy sand and coarse sand	2	88	10	6.0 - >20.0	
9	BIB - Bijou loamy sand, 0-1% slopes	0-11	loamy sand	3	85	12	6.0 - 20.0	This test hole was dug using the Giddings hydraulic probe from 0 to 98 inches. Permeability is going to be as fast as the slowest layer/horizon; for this test hole that horizon would be from 11 to 25 inches.
		11-25	sandy clay loam	24	65	11	0.6 - 2.0	
		25-62	loamy fine sand	4	84	12	6.0 - 20.0	
		62-92	silt loam	24	25	51	0.6 - 2.0	
		92-98	fine sand	1	95	4	>20	
10	BIB - Bijou loamy sand, 0-1% slopes	0-9	sandy loam	6	75	19	2.0 - 6.0	This test hole was dug using the Giddings hydraulic probe from 0 to 87 inches. There is a water table at 74 inches. Permeability is going to be as fast as the slowest layer/horizon; for this test hole that horizon would be from 39 to 74 inches.
		9-39	loamy fine sand	3	83	14	6.0 - 20.0	
		39-74	clay	43	30	27	0.06 - 0.20	
		74-87	coarse sand	1	95	4	>20	
11	VcD - Valent sand, 3-9% slopes	0-37	loamy sand	3	85	12	6.0 - 20.0	This test hole was dug using the Giddings hydraulic probe from 0 to 63 inches. There is a perched water table at 41 to 63 inches. Redoximorphic features are present from 25 to 63 inches. Permeability is going to be as fast as the slowest layer/horizon; for this test hole that horizon would be from 63+ inches.
		37-51	sandy clay loam	32	55	13	0.6 - 2.0	
		51-63	loamy sand	3	85	12	6.0 - 20.0	
		63+	silty clay	65	5	30	< 0.06	
12	VcD - Valent sand, 3-9% slopes	0-4	sand	1	95	4	> 20.0	This test hole was dug using the Giddings hydraulic probe from 0 to 121 inches. There is no water table within 121 inches. Permeability is going to be as fast as the slowest horizon; for
		4-9	loamy sand	4	90	6	6.0 - 20.0	

Ducks Unlimited - Narrows Project - Lantz Tract
Soils Log Report

Hole	NRCS Soil Description	Depth (inches)	Soil Texture	% Clay	% Sand	% Silt	Permeability (in./hr.)	Notes
	slopes	9-19	sandy loam	10	75	15	2.0 - 6.0	Permeability is going to be as fast as the slowest horizon; for this test hole that horizon would be from 63 to 70 inches.
		19-46	sandy loam	16	70	14	2.0 - 6.0	
		46-63	loamy sand	6	90	4	6.0 - 20.0	
		63-70	clay loam	32	33	35	0.2 - 0.6	
		70-121	loamy coarse sand	3	90	7	6.0 - 20.0	
13	Truckton loamy sandy, 3-5% slopes	0-33	sandy loam	14	72	14	2.0 - 6.0	This test hole was dug using the Giddings hydraulic probe from 0 to 81 inches. Permeability is going to be as fast as the slowest layer/horizon; for this test hole that horizon would be from 33 to 66 inches.
		33-66	clay	40	35	25	0.06 - 0.20	
		66-81	loamy coarse sand	3	85	12	6.0 - 20.0	
14	TuC - Truckton loamy sandy, 3-5% slopes	0-60	loamy sand	5	80	15	6.0 - 20.0	This test hole was dug using the Giddings hydraulic probe from 0 to 98 inches. Permeability is going to be as fast as the slowest layer/horizon; for this test hole that horizon would be from 60 to 85 inches.
		60-85	clay loam	38	25	37	0.06 - 0.20	
		85-98	coarse sand	2	90	8	>20	
15	VcD - Valent sand, 3-9% slopes	0-49	loamy fine sand	3	80	17	6.0 - 20.0	This test hole was dug using the Giddings hydraulic probe from 0 to 95 inches. Permeability is going to be as fast as the slowest layer/horizon; for this test hole that horizon would be from 49 to 60 inches and 87 to 95 inches.
		49-60	sandy clay loam	24	52	24	0.6 - 2.0	
		60-87	sandy loam	14	68	18	2.0 - 6.0	
		87-95	sandy clay loam	33	52	15	0.6 - 2.0	
16	VcD - Valent sand, 3-9% slopes	0-7	sandy loam	10	70	20	2.0 - 6.0	This test hole was dug using the Giddings hydraulic probe from 0 to 121 inches. There is no water table within 121 inches. Permeability is going to be as fast as the slowest horizon; for this test hole that horizon would be from 15 to 34 inches.
		7-15	sandy loam	10	70	20	2.0 - 6.0	
		15-34	clay loam	32	33	35	0.2 - 0.6	
		34-57	sandy loam	10	75	15	2.0 - 6.0	
		57-121	loamy coarse sand	6	84	10	6.0 - 20.0	
17	BIA - Bijou loamy sand, 0-1% slopes	0-5	loamy sand	6	80	14	6.0 - 20.0	This test hole was dug using the Giddings hydraulic probe from 0 to 124 inches. There is no water table within 124 inches. Permeability is going to be as fast as the slowest horizon; for this test hole that horizon would be from 11 to 50 inches.
		5-11	sandy loam	8	75	17	2.0 - 6.0	
		11-29	sandy clay loam	22	65	13	0.6 - 2.0	
		29-50	sandy clay loam	32	48	20	0.2 - 0.6	
		50-64	sand	2	95	3	> 20.0	
		64-104	coarse sand	2	95	3	> 20.0	
		104-124	coarse sandy loam	18	65	17	2.0 - 6.0	
18	VcD - Valent sand, 3-9% slopes	0-11	loamy sand	3	87	10	6.0 - 20.0	This test hole was dug using the Giddings hydraulic probe from 0 to 123 inches. There is no water table within 123 inches. Permeability is going to be as fast as the slowest horizon; for this test hole that horizon would be from 79 to 103 inches.
		11-18	loamy sand	3	87	10	6.0 - 20.0	
		18-29	loamy sand	5	85	10	6.0 - 20.0	
		29-51	loamy fine sand	3	87	10	6.0 - 20.0	
		51-79	sand	1	95	4	> 20.0	

Ducks Unlimited - Narrows Project - Lantz Tract

Soils Log Report

Hole	NRCS Soil Description	Depth (inches)	Soil Texture	% Clay	% Sand	% Silt	Permeability (in./hr.)	Notes
		79-103	sandy loam	8	80	12	2.0 - 6.0	
		103-123	loamy sand	3	87	10	6.0 - 20.0	
19	BIA - Bijou loamy sand, 0-1% slopes	0-5	sandy loam	10	65	25	2.0 - 6.0	This test hole was dug using the Giddings hydraulic probe from 0 to 122 inches. There is no water table within 122 inches. Permeability is going to be as fast as the slowest horizon; for this test hole that horizon would be from 42 to 71 inches.
		5-25	loamy sand	5	85	10	6.0 - 20.0	
		25-37	loamy sand	3	85	12	6.0 - 20.0	
		37-42	loamy sand	7	80	13	6.0 - 20.0	
		42-71	sandy clay loam	22	65	13	0.6 - 2.0	
		71-92	coarse sandy loam	18	70	12	2.0 - 6.0	
		92-111	loamy coarse sand	3	85	12	6.0 - 20.0	
		111-122	coarse sand	1	95	4	> 20.0	
20	VcD - Valent sand, 3-9% slopes	0-8	loamy sand	4	85	11	6.0 - 20.0	This test hole was dug using the Giddings hydraulic probe from 0 to 114 inches. There is no water table within 114 inches. Permeability is going to be as fast as the slowest horizon; for this test hole that horizon would be from 17 to 33 inches.
		8-17	loamy sand	4	85	11	6.0 - 20.0	
		17-33	clay loam	30	35	35	0.2 - 0.6	
		33-63	sandy loam	8	75	17	2.0 - 6.0	
		63-114	loamy sand	5	90	5	6.0 - 20.0	
21		0-6	loamy sand	3	95	2	6.0 - 20.0	This test hole was dug using the Giddings hydraulic probe from 0 to 114 inches. There is no water table within 114 inches. Permeability is going to be as fast as the slowest horizon; for this test hole that horizon would be from 0 to 14 inches.
		6-14	loamy sand	3	95	2	6.0 - 20.0	
	VcD - Valent sand, 3-9% slopes	14-29	sand	2	96	2	> 20.0	
		29-99	sand	2	96	2	> 20.0	
		99-114	sand	1	97	2	> 20.0	
22	VcD - Valent sand, 3-9% slopes	0-87	loamy sand	4	83	13	6.0 - 20.0	This test hole was dug using the Giddings hydraulic probe from 0 to 98 inches. There is no water table within 98 inches. Permeability is going to be as fast as the slowest horizon; for this test hole that horizon would be from 87 to 98 inches.
		87-98	clay loam	38	42	20	0.06 - 0.20	

APPENDIX B

Monitoring Well Construction Reports

Form No. GWS-31 02/2017	**WELL CONSTRUCTION AND YIELD ESTIMATE REPORT** State of Colorado, Office of the State Engineer 1313 Sherman St., Room 821, Denver, CO 80203 303.866.3581 www.water.state.co.us and dwrpermitsonline@state.co.us	For Office Use Only

1. Well Permit Number: Kinnaman - 1 **Receipt Number:** 0056857A

2. Owner's Well Designation:

3. Well Owner Name: United States Bureau of Reclamation

4. Well Location Street Address:

5. As Built GPS Well Location (required): ☐ Zone 12 ☒ Zone 13 Easting: 572238m Northing: 4461014m

6. Legal Well Location: ____ 1/4, ____ 1/4, Sec., ____ Twp.____ ☐ N or S ☐, Range ____ ☐ E or W ☐, ____ P.M.

County: ____

Subdivision: ____, Lot ____, Block ____, Filing (Unit) ____

7. Ground Surface Elevation: 4433 feet **Date Completed:** 6/6/17 **Drilling Method:** Hollow Stem Auger

8. Completed Aquifer Name : South Platte Alluvium **Total Depth:** 20 feet **Depth Completed:** 20 feet

9. Advance Notification: Was Notification Required Prior to Construction? ☐ Yes ☐ No, Date Notification Given: ____

10. Aquifer Type: (Check one) ☐ Type I (One Confining Layer) ☐ Type I (Multiple Confining Layers) ☐ Laramie-Fox Hills ☐ Type II (Not overlain by Type III) ☐ Type II (Overlain by Type III) ☒ Type III (alluvial/colluvial)

11. Geologic Log:

Depth	Type	Grain Size	Color	Water Loc.
0-5'	silty loam	0.1	gray	
5-10'	silty sand	0.2	↓	5'
10-15'	silty gravel	<0.01, 0.4	↓	
15-20'	silty gravel	<0.01, 0.4	↓	

12. Hole Diameter (in.)

Hole Diameter (in.)	From (ft)	To (ft)
8.25 OD	0	20
4.25 ID	0	20

13. Plain Casing

OD (in)	Kind	Wall Size (in)	From (ft)	To (ft)
2.25	PVC	Sch 40	0	5

Perforated Casing Screen Slot Size (in): 0.01

OD (in)	Kind	Wall Size (in)	From (ft)	To (ft)
2.25	PVC	Sch 40	5	20

14. Filter Pack:
Material washed silica sand
Size 10/20
Interval 3 - 20

15. Packer Placement:
Type ____
Depth ____

16. Grouting Record

Material	Amount	Density	Interval	Method

Remarks:
3' steel casing stick up, bentonite seal, concrete pad

17. Disinfection: Type Amt. Used

18. Well Yield Estimate Data: ☐ Check box if Test Data is submitted on Form Number GWS-39, Well Yield Test Report

Well Yield Estimate Method: ____

Static Level: 5.3' Estimated Yield (gpm) ____

Date/Time measured: 6/9/17 Estimate Length (hrs) ____

Remarks:

19. I have read the statements made herein and know the contents thereof, and they are true to my knowledge. This document is signed (or name entered if filing online) and certified in accordance with Rule 17.4 of the Water Well Construction Rules, 2 CCR 402 2. The filing of a document that contains false statements is a violation of section 37 91 108(1)(e), C.R.S., and is punishable by fines up to $1,000 and/or revocation of the contracting license. If filing online the State Engineer considers the entry of the licensed contractor's name to be compliance with Rule 17.4.

Company Name:	Email:	Phone w/area code:	License Number:
Ducks Unlimited, Inc.	kwarner@ducks.org	(970) 297-7279	47794

Mailing Address: 1825 Sharp Point Drive, Fort Collins, CO 80525

Sign (or enter name if filing online)	Print Name and Title	Date:
[signature]	Kevin Warner, PE	07/14/2017

Form No. GWS-31 02/2017	**WELL CONSTRUCTION AND YIELD ESTIMATE REPORT** State of Colorado, Office of the State Engineer 1313 Sherman St., Room 821, Denver, CO 80203 303.866.3581 www.water.state.co.us and dwrpermitsonline@state.co.us	For Office Use Only

1. Well Permit Number: Kinnaman - 2 **Receipt Number:** 0056857B

2. Owner's Well Designation:

3. Well Owner Name: United States Bureau of Reclamation

4. Well Location Street Address:

5. As Built GPS Well Location (required): ☐ Zone 12 ☒ Zone 13 Easting: 573127 m Northing: 4461449 m

6. Legal Well Location: ____ 1/4, ____ 1/4, Sec., ____ Twp.____ ☐ N or S ☐, Range ____ ☐ E or W ☐, ____ P.M.

County: ____

Subdivision: ____, Lot ____, Block ____, Filing (Unit) ____

7. Ground Surface Elevation: 4427 feet **Date Completed:** 6/9/17 **Drilling Method:** Hollow Stem Auger

8. Completed Aquifer Name : South Platte Alluvium **Total Depth:** ____ feet **Depth Completed:** ____ feet

9. Advance Notification: Was Notification Required Prior to Construction? ☐ Yes ☐ No, Date Notification Given: ____

10. Aquifer Type: (Check one) ☐ Type I (One Confining Layer) ☐ Type I (Multiple Confining Layers) ☐ Laramie-Fox Hills ☐ Type II (Not overlain by Type III) ☐ Type II (Overlain by Type III) ☒ Type III (alluvial/colluvial)

11. Geologic Log:

Depth	Type	Grain Size	Color	Water Loc.
0-5'	coarse sand	0.2	tan	
5-10'	coarse sand	0.2	↓	6'
10-15'	med. sand	0.1	↓	
15-20'	silty sand	<0.1	gray	
20-25'	silty sand	<0.1	↓	
25-30'	silty sand	<0.1	↓	

12. Hole Diameter (in.)

Hole Diameter (in.)	From (ft)	To (ft)
8.25 OD	0	30
4.25 ID	0	30

13. Plain Casing

OD (in)	Kind	Wall Size (in)	From (ft)	To (ft)
2.25	PVC	Sch 40	0	5

Perforated Casing Screen Slot Size (in): 0.01

OD (in)	Kind	Wall Size (in)	From (ft)	To (ft)
2.25	PVC	Sch 40	5	30

14. Filter Pack:
Material washed silica sand
Size 10/20
Interval 3-30

15. Packer Placement:
Type ____
Depth ____

16. Grouting Record

Material	Amount	Density	Interval	Method

Remarks: 2' 9" steel casing stick up
bentonite seal, concrete pad

17. Disinfection: Type ____ Amt. Used ____

18. Well Yield Estimate Data: ☐ Check box if Test Data is submitted on Form Number GWS-39, Well Yield Test Report

Well Yield Estimate Method: ____

Static Level: 6.48' Estimated Yield (gpm) ____

Date/Time measured: 6/9/17 Estimate Length (hrs) ____

Remarks:

19. I have read the statements made herein and know the contents thereof, and they are true to my knowledge. This document is signed (or name entered if filing online) and certified in accordance with Rule 17.4 of the Water Well Construction Rules, 2 CCR 402 2. The filing of a document that contains false statements is a violation of section 37 91 108(1)(e), C.R.S., and is punishable by fines up to $1,000 and/or revocation of the contracting license. If filing online the State Engineer considers the entry of the licensed contractor's name to be compliance with Rule 17.4.

Company Name: Ducks Unlimited, Inc.	Email: kwarner@ducks.org	Phone w/area code: (970) 297-7279	License Number: 47794

Mailing Address: 1825 Sharp Point Drive, Fort Collins, CO 80525

Sign (or enter name if filing online)	Print Name and Title	Date:
[signature]	Kevin Warner, PE	07/14/2017

Form No. GWS-31 02/2017	WELL CONSTRUCTION AND YIELD ESTIMATE REPORT State of Colorado, Office of the State Engineer 1313 Sherman St., Room 821, Denver, CO 80203 303.866.3581 www.water.state.co.us and dwrpermitsonline@state.co.us	For Office Use Only

1. Well Permit Number: Kinnaman - 3 Receipt Number: 0056857 C
2. Owner's Well Designation:
3. Well Owner Name: United States Bureau of Reclamation
4. Well Location Street Address:
5. As Built GPS Well Location (required): ☐ Zone 12 ☑ Zone 13 Easting: ~~57603~~ 573603 m Northing: 4461929 m
6. Legal Well Location: ____ 1/4, ____ 1/4, Sec., ____ Twp.____ ☐ N or S ☐, Range ____ ☐ E or W ☐, ____ P.M.
County: ____
Subdivision: ____, Lot ____, Block ____, Filing (Unit) ____
7. Ground Surface Elevation: 4426 feet Date Completed: 6/5/17 Drilling Method: Hollow Stem Auger
8. Completed Aquifer Name: South Platte Alluvium Total Depth: 30 feet Depth Completed: 30 feet
9. Advance Notification: Was Notification Required Prior to Construction? ☐ Yes ☐ No, Date Notification Given: ____
10. Aquifer Type: (Check one) ☐ Type I (One Confining Layer) ☐ Type I (Multiple Confining Layers) ☐ Laramie-Fox Hills ☐ Type II (Not overlain by Type III) ☐ Type II (Overlain by Type III) ☑ Type III (alluvial/colluvial)

11. Geologic Log:

Depth	Type	Grain Size	Color	Water Loc.
0-2'	sandy loam	0.01	tan	
2-5'	Fine sand	0.02	↓	
5-10'	med. sand	0.1	↓	9'
10-15'	med. sand	0.1	↓	
15-20'	coase sand	0.2	↓	
20-25'	med. sand	0.1	↓	
25-30'	med. sand	0.1	↓	

12. Hole Diameter (in.)

Hole Diameter (in.)	From (ft)	To (ft)
8.25 OD	0	30
4.25 ID	0	30

13. Plain Casing

OD (in)	Kind	Wall Size (in)	From (ft)	To (ft)
2.25	PVC	Sch 40	0	5

Perforated Casing Screen Slot Size (in): 0.01

OD (in)	Kind	Wall Size (in)	From (ft)	To (ft)
2.25	PVC	Sch 40	5	30

14. Filter Pack:
Material washed silica sand
Size 10/20
Interval 3 - 30

15. Packer Placement:
Type ____
Depth ____

16. Grouting Record

Material	Amount	Density	Interval	Method

Remarks:
3' 1" steel casing stick up
bentonite seal, concrete pad

17. Disinfection: Type Amt. Used

18. Well Yield Estimate Data: ☐ Check box if Test Data is submitted on Form Number GWS-39, Well Yield Test Report
Well Yield Estimate Method: ____
Static Level: 9.37' Estimated Yield (gpm) ____
Date/Time measured: 6/9/17 Estimate Length (hrs) ____

Remarks:

19. I have read the statements made herein and know the contents thereof, and they are true to my knowledge. This document is signed (or name entered if filing online) and certified in accordance with Rule 17.4 of the Water Well Construction Rules, 2 CCR 402 2. The filing of a document that contains false statements is a violation of section 37 91 108(1)(e), C.R.S., and is punishable by fines up to $1,000 and/or revocation of the contracting license. If filing online the State Engineer considers the entry of the licensed contractor's name to be compliance with Rule 17.4.

Company Name: Ducks Unlimited, Inc.	Email: kwarner@ducks.org	Phone w/area code: (970) 297-7279	License Number: 47794

Mailing Address: 1825 Sharp Point Drive, Fort Collins, CO 80525

Sign (or enter name if filing online)	Print Name and Title	Date:
[signature]	Kevin Warner, PE	07/14/2017

Form No. GWS-31 02/2017	**WELL CONSTRUCTION AND YIELD ESTIMATE REPORT** State of Colorado, Office of the State Engineer 1313 Sherman St., Room 821, Denver, CO 80203 303.866.3581 www.water.state.co.us and dwrpermitsonline@state.co.us	For Office Use Only

1. Well Permit Number: cook-1 **Receipt Number:** 0056857 D

2. Owner's Well Designation:

3. Well Owner Name: United States Bureau of Reclamation

4. Well Location Street Address:

5. As Built GPS Well Location (required): ☐ Zone 12 ☒ Zone 13 Easting: 576176m Northing: 4467809m

6. Legal Well Location: ____ 1/4, ____ 1/4, Sec., ____ Twp. ____ ☐ N or S ☐, Range ____ ☐ E or W ☐, ____ P.M.

County: ____

Subdivision: ____, Lot ____, Block ____, Filing (Unit) ____

7. Ground Surface Elevation: 4442 feet **Date Completed:** 6/21/17 **Drilling Method:** Hollow Stem Auger

8. Completed Aquifer Name: South Platte Alluvium **Total Depth:** 42 feet **Depth Completed:** 42 feet

9. Advance Notification: Was Notification Required Prior to Construction? ☐ Yes ☐ No, Date Notification Given: ____

10. Aquifer Type: (Check one) ☐ Type I (One Confining Layer) ☐ Type I (Multiple Confining Layers) ☐ Laramie-Fox Hills ☐ Type II (Not overlain by Type III) ☐ Type II (Overlain by Type III) ☒ Type III (alluvial/colluvial)

11. Geologic Log:

Depth	Type	Grain Size	Color	Water Loc.
0-10'	fine sand	0.01	tan	
10-40'	silty med. sand	0.2	tan	16'
40-42	Shale	—	black	

Remarks: 3'5" - steel casing stick up bentonite seal, concrete pad

12. Hole Diameter (in.)

Hole Diameter (in.)	From (ft)	To (ft)
8.25 OD	0	42
4.25 ID	0	42

13. Plain Casing

OD (in)	Kind	Wall Size (in)	From (ft)	To (ft)
2.25	PVC	Sch 40	0	5

Perforated Casing Screen Slot Size (in): 0.01

OD (in)	Kind	Wall Size (in)	From (ft)	To (ft)
2.25	PVC	Sch 40	5	42

14. Filter Pack:
Material washed silica sand
Size 10/20
Interval 3-42

15. Packer Placement:
Type ____
Depth ____

16. Grouting Record

Material	Amount	Density	Interval	Method

17. Disinfection: Type Amt. Used

18. Well Yield Estimate Data: ☐ Check box if Test Data is submitted on Form Number GWS-39, Well Yield Test Report

Well Yield Estimate Method: ____

Static Level: 16.1 Estimated Yield (gpm) ____

Date/Time measured: 6/30/17 Estimate Length (hrs) ____

Remarks:

19. I have read the statements made herein and know the contents thereof, and they are true to my knowledge. This document is signed (or name entered if filing online) and certified in accordance with Rule 17.4 of the Water Well Construction Rules, 2 CCR 402 2. The filing of a document that contains false statements is a violation of section 37 91 108(1)(e), C.R.S., and is punishable by fines up to $1,000 and/or revocation of the contracting license. If filing online the State Engineer considers the entry of the licensed contractor's name to be compliance with Rule 17.4.

Company Name:	Email:	Phone w/area code:	License Number:
Ducks Unlimited, Inc.	kwarner@ducks.org	(970) 297-7279	47794

Mailing Address: 1825 Sharp Point Drive, Fort Collins, CO 80525

Sign (or enter name if filing online)	Print Name and Title	Date:
[signature]	Kevin Warner, PE	07/14/2017

Form No. GWS-31 02/2017

WELL CONSTRUCTION AND YIELD ESTIMATE REPORT
State of Colorado, Office of the State Engineer
1313 Sherman St., Room 821, Denver, CO 80203 303.866.3581
www.water.state.co.us and dwrpermitsonline@state.co.us

For Office Use Only

1. Well Permit Number: Cook - 2 Receipt Number: 0056857E
2. Owner's Well Designation:
3. Well Owner Name: United States Bureau of Reclamation
4. Well Location Street Address:
5. As Built GPS Well Location (required): ☐ Zone 12 ☒ Zone 13 Easting: 577275m Northing: 4468889m
6. Legal Well Location: ____ 1/4, ____ 1/4, Sec., ____ Twp. ____ ☐ N or S ☐, Range ____ ☐ E or W ☐, ____ P.M.
County:
Subdivision: ____, Lot ____, Block ____, Filing (Unit) ____
7. Ground Surface Elevation: 4443 feet Date Completed: 6/21/17 Drilling Method: Hollow Stem Auger
8. Completed Aquifer Name: South Platte Alluvium Total Depth: 26 feet Depth Completed: 26 feet
9. Advance Notification: Was Notification Required Prior to Construction? ☐ Yes ☐ No, Date Notification Given:
10. Aquifer Type: (Check one) ☐ Type I (One Confining Layer) ☐ Type I (Multiple Confining Layers) ☐ Laramie-Fox Hills ☐ Type II (Not overlain by Type III) ☐ Type II (Overlain by Type III) ☒ Type III (alluvial/colluvial)

11. Geologic Log:

Depth	Type	Grain Size	Color	Water Loc.
0-10'	silty fine sand	0.01	tan	
10-25	silty med. sand	0.2	tan	
26	shale	—	black	

12. Hole Diameter (in.)

Diameter	From (ft)	To (ft)
8.25 OD	0	26
4.25 ID	0	26

13. Plain Casing

OD (in)	Kind	Wall Size (in)	From (ft)	To (ft)
2.25	PVC	Sch 40	0	5

Perforated Casing Screen Slot Size (in): 0.01

OD (in)	Kind	Wall Size (in)	From (ft)	To (ft)
2.25	PVC	Sch 40	5	26

14. Filter Pack:
Material washed silica sand
Size 10/20
Interval 3 - 26

15. Packer Placement:
Type
Depth

16. Grouting Record

Material	Amount	Density	Interval	Method

Remarks: 2' 10" - steel casing stickup
bentonite seal, concrete pad

17. Disinfection: Type Amt. Used
18. Well Yield Estimate Data: ☐ Check box if Test Data is submitted on Form Number GWS-39, Well Yield Test Report
Well Yield Estimate Method:
Static Level: 13.75 Estimated Yield (gpm)
Date/Time measured: 6/21/17 Estimate Length (hrs)
Remarks:

19. I have read the statements made herein and know the contents thereof, and they are true to my knowledge. This document is signed (or name entered if filing online) and certified in accordance with Rule 17.4 of the Water Well Construction Rules, 2 CCR 402 2. The filing of a document that contains false statements is a violation of section 37 91 108(1)(e), C.R.S., and is punishable by fines up to $1,000 and/or revocation of the contracting license. If filing online the State Engineer considers the entry of the licensed contractor's name to be compliance with Rule 17.4.

Company Name:	Email:	Phone w/area code:	License Number:
Ducks Unlimited, Inc.	kwarner@ducks.org	(970) 297-7279	47794

Mailing Address: 1825 Sharp Point Drive, Fort Collins, CO 80525

Sign (or enter name if filing online): [signature]
Print Name and Title: Kevin Warner, PE
Date: 07/14/2017

Form No. GWS-31 02/2017	**WELL CONSTRUCTION AND YIELD ESTIMATE REPORT** State of Colorado, Office of the State Engineer 1313 Sherman St., Room 821, Denver, CO 80203 303.866.3581 www.water.state.co.us and dwrpermitsonline@state.co.us	For Office Use Only

1. Well Permit Number: Cook - 3 **Receipt Number:** 0056857F

2. Owner's Well Designation:

3. Well Owner Name: United States Bureau of Reclamation

4. Well Location Street Address:

5. As Built GPS Well Location (required): ☐ Zone 12 ☒ Zone 13 Easting: 577182m Northing: 4467803m

6. Legal Well Location: ____ 1/4, ____ 1/4, Sec., ____ Twp. ____ ☐ N or S ☐, Range ____ ☐ E or W ☐, ____ P.M.

County: ____

Subdivision: ____, Lot ____, Block ____, Filing (Unit) ____

7. Ground Surface Elevation: 4422 feet **Date Completed:** 6/21/17 **Drilling Method:** Hollow Stem Auger

8. Completed Aquifer Name : South Platte Alluvium **Total Depth:** 22 feet **Depth Completed:** 22 feet

9. Advance Notification: Was Notification Required Prior to Construction? ☐ Yes ☐ No, Date Notification Given: ____

10. Aquifer Type: (Check one) ☐ Type I (One Confining Layer) ☐ Type I (Multiple Confining Layers) ☐ Laramie-Fox Hills ☐ Type II (Not overlain by Type III) ☐ Type II (Overlain by Type III) ☒ Type III (alluvial/colluvial)

11. Geologic Log:

Depth	Type	Grain Size	Color	Water Loc.
0-10'	fine sand	0.01	tan	
10-22'	silty med. sand	0.2	tan	13'
22'	shale	—	black	

Remarks: 2' 9" - steel casing stick up bentonite seal, concrete pad

12. Hole Diameter (in.)

Hole Diameter (in.)	From (ft)	To (ft)
8.25 OD	0	22
4.25 ID	0	22

13. Plain Casing

OD (in)	Kind	Wall Size (in)	From (ft)	To (ft)
2.25	PVC	Sch 40	0	5

Perforated Casing Screen Slot Size (in): 0.01

OD (in)	Kind	Wall Size (in)	From (ft)	To (ft)
2.25	PVC	Sch 40	5	22

14. Filter Pack:
Material washed silica sand
Size 10/20
Interval 3-22

15. Packer Placement:
Type ____
Depth ____

16. Grouting Record

Material	Amount	Density	Interval	Method

17. Disinfection: Type ____ Amt. Used ____

18. Well Yield Estimate Data: ☐ Check box if Test Data is submitted on Form Number GWS-39, Well Yield Test Report

Well Yield Estimate Method: ____

Static Level: 13.65 Estimated Yield (gpm) ____

Date/Time measured: 6/21/17 Estimate Length (hrs) ____

Remarks:

19. I have read the statements made herein and know the contents thereof, and they are true to my knowledge. This document is signed (or name entered if filing online) and certified in accordance with Rule 17.4 of the Water Well Construction Rules, 2 CCR 402 2. The filing of a document that contains false statements is a violation of section 37 91 108(1)(e), C.R.S., and is punishable by fines up to $1,000 and/or revocation of the contracting license. If filing online the State Engineer considers the entry of the licensed contractor's name to be compliance with Rule 17.4.

Company Name:	Email:	Phone w/area code:	License Number:
Ducks Unlimited, Inc.	kwarner@ducks.org	(970) 297-7279	47794

Mailing Address: 1825 Sharp Point Drive, Fort Collins, CO 80525

Sign (or enter name if filing online)	Print Name and Title	Date:
[signature]	Kevin Warner, PE	07/14/2017

Form No. GWS-31 02/2017

WELL CONSTRUCTION AND YIELD ESTIMATE REPORT

State of Colorado, Office of the State Engineer
1313 Sherman St., Room 821, Denver, CO 80203 303.866.3581
www.water.state.co.us and dwrpermitsonline@state.co.us

For Office Use Only

1. Well Permit Number: Lantz - 1   Receipt Number: 0056857 G
2. Owner's Well Designation:
3. Well Owner Name: United States Bureau of Reclamation
4. Well Location Street Address:
5. As Built GPS Well Location (required): ☐ Zone 12 ☒ Zone 13 Easting: 591479 m Northing: 4462109 m
6. Legal Well Location: ____ 1/4, ____ 1/4, Sec., ____ Twp.____ ☐ N or S ☐, Range ____ ☐ E or W ☐, ____ P.M.
County: ____
Subdivision: ____, Lot ____, Block ____, Filing (Unit) ____
7. Ground Surface Elevation: 4399 feet Date Completed: 6/12/17 Drilling Method: Hollow Stem Auger
8. Completed Aquifer Name: South Platte Alluvium Total Depth: 100' feet Depth Completed: 100' feet
9. Advance Notification: Was Notification Required Prior to Construction? ☐ Yes ☐ No, Date Notification Given: ____
10. Aquifer Type: (Check one) ☐ Type I (One Confining Layer) ☐ Type I (Multiple Confining Layers) ☐ Laramie-Fox Hills ☐ Type II (Not overlain by Type III) ☐ Type II (Overlain by Type III) ☒ Type III (alluvial/colluvial)

11. Geologic Log:

Depth	Type	Grain Size	Color	Water Loc.
0-5'	sandy loam	<0.01	drk brwn	
5-20'	fine sand	0.01	tan	
20-98'	medium sand	0.1	tan	50'
98-100	shale	—	black	

Remarks: 3' 1" - steel casing stickup
bentonite seal, concrete pad

12. Hole Diameter (in.)

Hole Diameter (in.)	From (ft)	To (ft)
8.25 OD	0	100
4.25 ID	0	100

13. Plain Casing

OD (in)	Kind	Wall Size (in)	From (ft)	To (ft)
2.25	PVC	Sch 40	0	35

Perforated Casing Screen Slot Size (in): 0.01

OD (in)	Kind	Wall Size (in)	From (ft)	To (ft)
2.25	PVC	Sch 40	35	100

14. Filter Pack:
Material washed silica sand
Size 10/20
Interval 30-100

15. Packer Placement:
Type ____
Depth ____

16. Grouting Record

Material	Amount	Density	Interval	Method

17. Disinfection: Type   Amt. Used
18. Well Yield Estimate Data: ☐ Check box if Test Data is submitted on Form Number GWS-39, Well Yield Test Report
Well Yield Estimate Method: ____
Static Level: 49.31   Estimated Yield (gpm) ____
Date/Time measured: 6/20/17   Estimate Length (hrs) ____
Remarks:

19. I have read the statements made herein and know the contents thereof, and they are true to my knowledge. This document is signed (or name entered if filing online) and certified in accordance with Rule 17.4 of the Water Well Construction Rules, 2 CCR 402 2. The filing of a document that contains false statements is a violation of section 37 91 108(1)(e), C.R.S., and is punishable by fines up to $1,000 and/or revocation of the contracting license. If filing online the State Engineer considers the entry of the licensed contractor's name to be compliance with Rule 17.4.

Company Name: Ducks Unlimited, Inc.
Email: kwarner@ducks.org
Phone w/area code: (970) 297-7279
License Number: 47794
Mailing Address: 1825 Sharp Point Drive, Fort Collins, CO 80525
Sign (or enter name if filing online): [signature]
Print Name and Title: Kevin Warner, PE
Date: 07/14/2017

Form No. GWS-31 02/2017	WELL CONSTRUCTION AND YIELD ESTIMATE REPORT State of Colorado, Office of the State Engineer 1313 Sherman St., Room 821, Denver, CO 80203 303.866.3581 www.water.state.co.us and dwrpermitsonline@state.co.us	For Office Use Only

1. Well Permit Number: Lantz - 2 Receipt Number: 0056857H
2. Owner's Well Designation:
3. Well Owner Name: United States Bureau of Reclamation
4. Well Location Street Address:
5. As Built GPS Well Location (required): ☐ Zone 12 ☒ Zone 13 Easting: 590696m Northing: 4460912 m
6. Legal Well Location: ____ 1/4, ____ 1/4, Sec., ____ Twp.____ ☐ N or S ☐, Range ____ ☐ E or W ☐, ____ P.M.
County: ____
Subdivision: ____, Lot ____, Block ____, Filing (Unit) ____
7. Ground Surface Elevation: 4419 feet Date Completed: ____ Drilling Method: Hollow Stem Auger
8. Completed Aquifer Name : South Platte Alluvium Total Depth: 120 feet Depth Completed: 110 feet
9. Advance Notification: Was Notification Required Prior to Construction? ☐ Yes ☐ No, Date Notification Given: ____
10. Aquifer Type: (Check one) ☐ Type I (One Confining Layer) ☐ Type I (Multiple Confining Layers) ☐ Laramie-Fox Hills ☐ Type II (Not overlain by Type III) ☐ Type II (Overlain by Type III) ☒ Type III (alluvial/colluvial)

11. Geologic Log:

Depth	Type	Grain Size	Color	Water Loc.
0-5'	fine sand	0.01	tan	
5-110'	medium sand	0.1	tan	63'

Remarks: 3' steel stickup
bentonite seal, concrete pad

12. Hole Diameter (in.)

Hole Diameter (in.)	From (ft)	To (ft)
8.25 OD	0	120
4.25 ID	0	110

13. Plain Casing

OD (in)	Kind	Wall Size (in)	From (ft)	To (ft)
2.25	PVC	Sch 40	0	10

Perforated Casing Screen Slot Size (in): 0.01

OD (in)	Kind	Wall Size (in)	From (ft)	To (ft)
2.25	PVC	Sch 40	10	110

14. Filter Pack:
Material washed silica sand
Size 10/20
Interval 5-110

15. Packer Placement:
Type ____
Depth ____

16. Grouting Record

Material	Amount	Density	Interval	Method

17. Disinfection: Type Amt. Used
18. Well Yield Estimate Data: ☐ Check box if Test Data is submitted on Form Number GWS-39, Well Yield Test Report
Well Yield Estimate Method: ____
Static Level: 63.45' Estimated Yield (gpm) ____
Date/Time measured: 6/19/17 Estimate Length (hrs) ____
Remarks:

19. I have read the statements made herein and know the contents thereof, and they are true to my knowledge. This document is signed (or name entered if filing online) and certified in accordance with Rule 17.4 of the Water Well Construction Rules, 2 CCR 402 2. The filing of a document that contains false statements is a violation of section 37 91 108(1)(e), C.R.S., and is punishable by fines up to $1,000 and/or revocation of the contracting license. If filing online the State Engineer considers the entry of the licensed contractor's name to be compliance with Rule 17.4.

Company Name:	Email:	Phone w/area code:	License Number:
Ducks Unlimited, Inc.	kwarner@ducks.org	(970) 297-7279	47794

Mailing Address: 1825 Sharp Point Drive, Fort Collins, CO 80525

Sign (or enter name if filing online)	Print Name and Title	Date:
[signature]	Kevin Warner, PE	07/14/2017

Form No. GWS-31 02/2017	WELL CONSTRUCTION AND YIELD ESTIMATE REPORT State of Colorado, Office of the State Engineer 1313 Sherman St., Room 821, Denver, CO 80203 303.866.3581 www.water.state.co.us and dwrpermitsonline@state.co.us	For Office Use Only

1. Well Permit Number: Lantz - 3 Receipt Number: 0056857I

2. Owner's Well Designation:

3. Well Owner Name: United States Bureau of Reclamation

4. Well Location Street Address:

5. As Built GPS Well Location (required): ☐ Zone 12 ☒ Zone 13 Easting: 590192 m Northing: 4461885 m

6. Legal Well Location: ____ 1/4, ____ 1/4, Sec., ____ Twp. ____ ☐ N or S ☐, Range ____ ☐ E or W ☐, ____ P.M.

County: ____

Subdivision: ____, Lot ____, Block ____, Filing (Unit) ____

7. Ground Surface Elevation: 4401 feet Date Completed: 6/13/17 Drilling Method: Hollow Stem Auger

8. Completed Aquifer Name: South Platte Alluvium Total Depth: 112 feet Depth Completed: 112 feet

9. Advance Notification: Was Notification Required Prior to Construction? ☐ Yes ☐ No, Date Notification Given: ____

10. Aquifer Type: (Check one) ☐ Type I (One Confining Layer) ☐ Type I (Multiple Confining Layers) ☐ Laramie-Fox Hills ☐ Type II (Not overlain by Type III) ☐ Type II (Overlain by Type III) ☒ Type III (alluvial/colluvial)

11. Geologic Log:

Depth	Type	Grain Size	Color	Water Loc.
0-5'	sandy loam	<0.01	drk brown	
5-112'	medium sand		tan	45'
112	shale	—	black	

12. Hole Diameter (in.)

Hole Diameter (in.)	From (ft)	To (ft)
8.25 OD	0	112
4.25 ID	0	112

13. Plain Casing

OD (in)	Kind	Wall Size (in)	From (ft)	To (ft)
2.25	PVC	Sch 40	0	12

Perforated Casing Screen Slot Size (in): 0.01

OD (in)	Kind	Wall Size (in)	From (ft)	To (ft)
2.25	PVC	Sch 40	12	112

14. Filter Pack:
Material washed silica sand
Size 10/20
Interval 10-112

15. Packer Placement:
Type ____
Depth ____

16. Grouting Record

Material	Amount	Density	Interval	Method

Remarks: 3' 1" - steel casing stick up bentonite seal, concrete pad

17. Disinfection: Type Amt. Used

18. Well Yield Estimate Data: ☐ Check box if Test Data is submitted on Form Number GWS-39, Well Yield Test Report

Well Yield Estimate Method: ____

Static Level: 45.65' Estimated Yield (gpm) ____

Date/Time measured: 6/19/17 Estimate Length (hrs) ____

Remarks:

19. I have read the statements made herein and know the contents thereof, and they are true to my knowledge. This document is signed (or name entered if filing online) and certified in accordance with Rule 17.4 of the Water Well Construction Rules, 2 CCR 402 2. The filing of a document that contains false statements is a violation of section 37 91 108(1)(e), C.R.S., and is punishable by fines up to $1,000 and/or revocation of the contracting license. If filing online the State Engineer considers the entry of the licensed contractor's name to be compliance with Rule 17.4.

Company Name: Ducks Unlimited, Inc.	Email: kwarner@ducks.org	Phone w/area code: (970) 297-7279	License Number: 47794

Mailing Address: 1825 Sharp Point Drive, Fort Collins, CO 80525

Sign (or enter name if filing online)	Print Name and Title	Date:
[signature]	Kevin Warner, PE	07/14/2017

Form No. GWS-31 02/2017

WELL CONSTRUCTION AND YIELD ESTIMATE REPORT

State of Colorado, Office of the State Engineer
1313 Sherman St., Room 821, Denver, CO 80203 303.866.3581
www.water.state.co.us and dwrpermitsonline@state.co.us

For Office Use Only

1. Well Permit Number: Lantz - 4 Receipt Number: 0056857J
2. Owner's Well Designation:
3. Well Owner Name: United States Bureau of Reclamation
4. Well Location Street Address:
5. As Built GPS Well Location (required): ☐ Zone 12 ☒ Zone 13 Easting: 588405m Northing: 4458450n
6. Legal Well Location: ____ 1/4, ____ 1/4, Sec., ____ Twp.____ ☐ N or S ☐, Range ____ ☐ E or W ☐, ____ P.M.
County: ____
Subdivision: ____, Lot ____, Block ____, Filing (Unit) ____
7. Ground Surface Elevation: 4450 feet Date Completed: 6/22/17 Drilling Method: Hollow Stem Auger
8. Completed Aquifer Name: South Platte Alluvium Total Depth: 98 feet Depth Completed: 43 feet
9. Advance Notification: Was Notification Required Prior to Construction? ☐ Yes ☐ No, Date Notification Given: ____
10. Aquifer Type: (Check one) ☐ Type I (One Confining Layer) ☐ Type I (Multiple Confining Layers) ☐ Laramie-Fox Hills ☐ Type II (Not overlain by Type III) ☐ Type II (Overlain by Type III) ☒ Type III (alluvial/colluvial)

11. Geologic Log:

Depth	Type	Grain Size	Color	Water Loc.
0-10'	silty fine sand	<0.01	drk brown	
10-98'	silty sand	<0.01	drk brwn	13'
98'	shale	—	black	

Remarks: 3' steel casing stickup, bentonite seal, concrete pad. Hole collapsed to 43' and was set accordingly

12. Hole Diameter (in.)

Hole Diameter (in.)	From (ft)	To (ft)
8.25 OD	0	43
4.25 ID	0	43

13. Plain Casing

OD (in)	Kind	Wall Size (in)	From (ft)	To (ft)
2.25	PVC	Sch 40	0	5

Perforated Casing Screen Slot Size (in): 0.01

OD (in)	Kind	Wall Size (in)	From (ft)	To (ft)
2.25	PVC	Sch 40	5	43

14. Filter Pack:
Material washed silica sand
Size 10/20
Interval 3-43

15. Packer Placement:
Type ____
Depth ____

16. Grouting Record

Material	Amount	Density	Interval	Method

17. Disinfection: Type Amt. Used
18. Well Yield Estimate Data: ☐ Check box if Test Data is submitted on Form Number GWS-39, Well Yield Test Report
Well Yield Estimate Method:
Static Level: 13'
Date/Time measured: 6/22/17
Estimated Yield (gpm) ____
Estimate Length (hrs) ____
Remarks:

19. I have read the statements made herein and know the contents thereof, and they are true to my knowledge. This document is signed (or name entered if filing online) and certified in accordance with Rule 17.4 of the Water Well Construction Rules, 2 CCR 402 2. The filing of a document that contains false statements is a violation of section 37 91 108(1)(e), C.R.S., and is punishable by fines up to $1,000 and/or revocation of the contracting license. If filing online the State Engineer considers the entry of the licensed contractor's name to be compliance with Rule 17.4.

Company Name:	Email:	Phone w/area code:	License Number:
Ducks Unlimited, Inc.	kwarner@ducks.org	(970) 297-7279	47794

Mailing Address: 1825 Sharp Point Drive, Fort Collins, CO 80525

Sign (or enter name if filing online)	Print Name and Title	Date:
[signature]	Kevin Warner, PE	07/14/2017

Form No. GWS-31 02/2017	**WELL CONSTRUCTION AND YIELD ESTIMATE REPORT** State of Colorado, Office of the State Engineer 1313 Sherman St., Room 821, Denver, CO 80203 303.866.3581 www.water.state.co.us and dwrpermitsonline@state.co.us	For Office Use Only

1. Well Permit Number: Lantz - 5 **Receipt Number:** 0056857K

2. Owner's Well Designation:

3. Well Owner Name: United States Bureau of Reclamation

4. Well Location Street Address:

5. As Built GPS Well Location (required): ☐ Zone 12 ☒ Zone 13 Easting: 588713 m Northing: 4460212 m

6. Legal Well Location: ____ 1/4, ____ 1/4, Sec., ____ Twp.____ ☐ N or S ☐, Range ____ ☐ E or W ☐, ____ P.M.

County: ____

Subdivision: ____, Lot ____, Block ____, Filing (Unit) ____

7. Ground Surface Elevation: 4416 feet **Date Completed:** 6/15/17 **Drilling Method:** Hollow Stem Auger

8. Completed Aquifer Name: South Platte Alluvium **Total Depth:** 35 feet **Depth Completed:** 35 feet

9. Advance Notification: Was Notification Required Prior to Construction? ☐ Yes ☐ No, Date Notification Given: ____

10. Aquifer Type: (Check one) ☐ Type I (One Confining Layer) ☐ Type I (Multiple Confining Layers) ☐ Laramie-Fox Hills ☐ Type II (Not overlain by Type III) ☐ Type II (Overlain by Type III) ☒ Type III (alluvial/colluvial)

11. Geologic Log:

Depth	Type	Grain Size	Color	Water Loc.
0-5'	fine sand	0.01	tan	
5-7'	silty sand	<0.01	↓	
7-10'	medium sand	0.2	↓	10'
10-15	medium sand	0.2	↓	
15-20	medium sand	0.2	↓	
20-25	silty sand	<0.01	gray	
25-30	silty sand	<0.01	↓	
30-35	silty sand	<0.01	↓	

12. Hole Diameter (in.)

Hole Diameter (in.)	From (ft)	To (ft)
8.25 OD	0	35
4.25 ID	0	35

13. Plain Casing

OD (in)	Kind	Wall Size (in)	From (ft)	To (ft)
2.25	PVC	Sch 40	0	5

Perforated Casing Screen Slot Size (in): 0.01

OD (in)	Kind	Wall Size (in)	From (ft)	To (ft)
2.25	PVC	Sch 40	5	35

14. Filter Pack:
Material washed silica sand
Size 10/20
Interval 3-35

15. Packer Placement:
Type ____
Depth ____

16. Grouting Record

Material	Amount	Density	Interval	Method

Remarks: 3' 3" - steel casing stickup bentonite seal, concrete pad

17. Disinfection: Type Amt. Used

18. Well Yield Estimate Data: ☐ Check box if Test Data is submitted on Form Number GWS-39, Well Yield Test Report

Well Yield Estimate Method: ____

Static Level: 10.41' Estimated Yield (gpm) ____

Date/Time measured: 6/15/17 Estimate Length (hrs) ____

Remarks:

19. I have read the statements made herein and know the contents thereof, and they are true to my knowledge. This document is signed (or name entered if filing online) and certified in accordance with Rule 17.4 of the Water Well Construction Rules, 2 CCR 402 2. The filing of a document that contains false statements is a violation of section 37 91 108(1)(e), C.R.S., and is punishable by fines up to $1,000 and/or revocation of the contracting license. If filing online the State Engineer considers the entry of the licensed contractor's name to be compliance with Rule 17.4.

Company Name: Ducks Unlimited, Inc.	Email: kwarner@ducks.org	Phone w/area code: (970) 297-7279	License Number: 47794

Mailing Address: 1825 Sharp Point Drive, Fort Collins, CO 80525

Sign (or enter name if filing online)	Print Name and Title	Date:
[signature]	Kevin Warner, PE	07/14/2017

Form No. GWS-31 02/2017

WELL CONSTRUCTION AND YIELD ESTIMATE REPORT
State of Colorado, Office of the State Engineer
1313 Sherman St., Room 821, Denver, CO 80203 303.866.3581
www.water.state.co.us and dwrpermitsonline@state.co.us

For Office Use Only

1. Well Permit Number: Akers - 1 Receipt Number: 0056857L
2. Owner's Well Designation:
3. Well Owner Name: United States Bureau of Reclamation
4. Well Location Street Address:
5. As Built GPS Well Location (required): ☐ Zone 12 ☒ Zone 13 Easting: 594691 m Northing: 4460489 m
6. Legal Well Location: ____ 1/4, ____ 1/4, Sec., ____ Twp.____ ☐ N or S ☐, Range ____ ☐ E or W ☐, ____ P.M.
County:
Subdivision: ____, Lot ____, Block ____, Filing (Unit) ____
7. Ground Surface Elevation: 4328 feet Date Completed: 6/20/17 Drilling Method: Hollow Stem Auger
8. Completed Aquifer Name: South Platte Alluvium Total Depth: 29 feet Depth Completed: 29 feet
9. Advance Notification: Was Notification Required Prior to Construction? ☐ Yes ☐ No, Date Notification Given:
10. Aquifer Type: (Check one) ☐ Type I (One Confining Layer) ☐ Type I (Multiple Confining Layers) ☐ Laramie-Fox Hills ☐ Type II (Not overlain by Type III) ☐ Type II (Overlain by Type III) ☒ Type III (alluvial/colluvial)

11. Geologic Log:

Depth	Type	Grain Size	Color	Water Loc.
0-5'	silty loam	<0.01	dark brown	2'
5-10'	silty loam	<0.01	↓	
10-15'	silty sand	<0.01	↓	
15-20'	med. sand	0.01	light brown	
20-25'	coarse sand	0.1	↓	
25-29'	coarse sand	0.1	↓	
29'	Shale	—	black	

Remarks: 3' 5" steel casing stick up bentonite seal, concrete pad

12. Hole Diameter (in.)

Hole Diameter (in.)	From (ft)	To (ft)
8.25 OD	0	29
4.25 ID	0	29

13. Plain Casing

OD (in)	Kind	Wall Size (in)	From (ft)	To (ft)
2.25	PVC	Sch 40	0	4

Perforated Casing Screen Slot Size (in): 0.01

OD (in)	Kind	Wall Size (in)	From (ft)	To (ft)
2.25	PVC	Sch 40	4	29

14. Filter Pack:
Material washed silica sand
Size 10/20
Interval 3-29

15. Packer Placement:
Type
Depth

16. Grouting Record

Material	Amount	Density	Interval	Method

17. Disinfection: Type Amt. Used
18. Well Yield Estimate Data: ☐ Check box if Test Data is submitted on Form Number GWS-39, Well Yield Test Report
Well Yield Estimate Method:
Static Level: 2.02 Estimated Yield (gpm)
Date/Time measured: 6/20/2017 Estimate Length (hrs)
Remarks:

19. I have read the statements made herein and know the contents thereof, and they are true to my knowledge. This document is signed (or name entered if filing online) and certified in accordance with Rule 17.4 of the Water Well Construction Rules, 2 CCR 402 2. The filing of a document that contains false statements is a violation of section 37 91 108(1)(e), C.R.S., and is punishable by fines up to $1,000 and/or revocation of the contracting license. If filing online the State Engineer considers the entry of the licensed contractor's name to be compliance with Rule 17.4.

Company Name:	Email:	Phone w/area code:	License Number:
Ducks Unlimited, Inc.	kwarner@ducks.org	(970) 297-7279	47794

Mailing Address: 1825 Sharp Point Drive, Fort Collins, CO 80525

Sign (or enter name if filing online)	Print Name and Title	Date:
[signature]	Kevin Warner, PE	07/14/2017

Form No. GWS-31 02/2017

WELL CONSTRUCTION AND YIELD ESTIMATE REPORT

State of Colorado, Office of the State Engineer
1313 Sherman St., Room 821, Denver, CO 80203 303.866.3581
www.water.state.co.us and dwrpermitsonline@state.co.us

For Office Use Only

1. Well Permit Number: Akers-2 Receipt Number: 0056857M
2. Owner's Well Designation:
3. Well Owner Name: United States Bureau of Reclamation
4. Well Location Street Address:
5. As Built GPS Well Location (required): ☐ Zone 12 ☒ Zone 13 Easting: 594786 m Northing: 4460764 m
6. Legal Well Location: ____ 1/4, ____ 1/4, Sec., ____ Twp. ____ ☐ N or S ☐, Range ____ ☐ E or W ☐, ____ P.M.
County:
Subdivision: ____, Lot ____, Block ____, Filing (Unit) ____
7. Ground Surface Elevation: 4325 feet Date Completed: 6/7/17 Drilling Method: Hollow Stem Auger
8. Completed Aquifer Name: South Platte Alluvium Total Depth: 12 feet Depth Completed: 12 feet
9. Advance Notification: Was Notification Required Prior to Construction? ☐ Yes ☐ No, Date Notification Given:
10. Aquifer Type: (Check one) ☐ Type I (One Confining Layer) ☐ Type I (Multiple Confining Layers) ☐ Laramie-Fox Hills ☐ Type II (Not overlain by Type III) ☐ Type II (Overlain by Type III) ☒ Type III (alluvial/colluvial)

11. Geologic Log:

Depth	Type	Grain Size	Color	Water Loc.
0-5'	sandy loam	<0.1	gray	
5-10'	medium sand	0.1	Tan	7'
10-12'	Shale	—	Black	

Remarks: 2'7" steel casing stick up
Bentonite seal, concrete pad

12. Hole Diameter (in.)

Hole Diameter (in.)	From (ft)	To (ft)
8.25 OD	0	12
4.25 ID	0	12

13. Plain Casing

OD (in)	Kind	Wall Size (in)	From (ft)	To (ft)
2.25	PVC	Sch 40	0	3

Perforated Casing Screen Slot Size (in): 0.01

OD (in)	Kind	Wall Size (in)	From (ft)	To (ft)
2.25	PVC	Sch 40	3	12

14. Filter Pack:
Material washed silica sand
Size 10/20
Interval 3-12

15. Packer Placement:
Type
Depth

16. Grouting Record

Material	Amount	Density	Interval	Method

17. Disinfection: Type Amt. Used
18. Well Yield Estimate Data: ☐ Check box if Test Data is submitted on Form Number GWS-39, Well Yield Test Report
Well Yield Estimate Method:
Static Level: 7.28 Estimated Yield (gpm)
Date/Time measured: 6/19/17 Estimate Length (hrs)
Remarks:

19. I have read the statements made herein and know the contents thereof, and they are true to my knowledge. This document is signed (or name entered if filing online) and certified in accordance with Rule 17.4 of the Water Well Construction Rules, 2 CCR 402 2. The filing of a document that contains false statements is a violation of section 37 91 108(1)(e), C.R.S., and is punishable by fines up to $1,000 and/or revocation of the contracting license. If filing online the State Engineer considers the entry of the licensed contractor's name to be compliance with Rule 17.4.

Company Name:	Email:	Phone w/area code:	License Number:
Ducks Unlimited, Inc.	kwarner@ducks.org	(970) 297-7279	47794

Mailing Address: 1825 Sharp Point Drive, Fort Collins, CO 80525

Sign (or enter name if filing online)	Print Name and Title	Date:
[signature]	Kevin Warner, PE	07/14/2017

Form No. GWS-31 02/2017	WELL CONSTRUCTION AND YIELD ESTIMATE REPORT State of Colorado, Office of the State Engineer 1313 Sherman St., Room 821, Denver, CO 80203 303.866.3581 www.water.state.co.us and dwrpermitsonline@state.co.us	For Office Use Only

1. Well Permit Number: Akers - 3 Receipt Number: 0056857 N
2. Owner's Well Designation:
3. Well Owner Name: United States Bureau of Reclamation
4. Well Location Street Address:
5. As Built GPS Well Location (required): ☐ Zone 12 ☒ Zone 13 Easting: 595348 m Northing: 4460424 m
6. Legal Well Location: ____ 1/4, ____ 1/4, Sec., ____ Twp.____ ☐ N or S ☐, Range ____ ☐ E or W ☐, ____ P.M.
County: ____
Subdivision: ____, Lot ____, Block ____, Filing (Unit) ____
7. Ground Surface Elevation: 4322 feet Date Completed: 6/7/17 Drilling Method: Hollow Stem Auger
8. Completed Aquifer Name: South Platte Alluvium Total Depth: 15 feet Depth Completed: 13 feet
9. Advance Notification: Was Notification Required Prior to Construction? ☐ Yes ☐ No, Date Notification Given: ____
10. Aquifer Type: (Check one) ☐ Type I (One Confining Layer) ☐ Type I (Multiple Confining Layers) ☐ Laramie-Fox Hills ☐ Type II (Not overlain by Type III) ☐ Type II (Overlain by Type III) ☒ Type III (alluvial/colluvial)

11. Geologic Log:

Depth	Type	Grain Size	Color	Water Loc.
0 - 2'	Silty Loam	<0.01	gray	
2 - 5'	clay	<0.01	↓	3'
5 - 10	silty sand	0.01	↓	
10 - 12	silty sand	0.01	↓	
12 - 13	Shale	—	Black	

Remarks: 2' steel casing stick up
Bentonite seal, concrete pad

12. Hole Diameter (in.)

Hole Diameter (in.)	From (ft)	To (ft)
8.25 OD	0	15
4.25 ID	0	13

13. Plain Casing

OD (in)	Kind	Wall Size (in)	From (ft)	To (ft)
2.25	PVC	Sch 40	0	3

Perforated Casing Screen Slot Size (in): 0.01

OD (in)	Kind	Wall Size (in)	From (ft)	To (ft)
2.25	PVC	Sch 40	3	13

14. Filter Pack:
Material washed silica sand
Size 10/20
Interval 2 - 15

15. Packer Placement:
Type ____
Depth ____

16. Grouting Record

Material	Amount	Density	Interval	Method

17. Disinfection: Type Amt. Used
18. Well Yield Estimate Data: ☐ Check box if Test Data is submitted on Form Number GWS-39, Well Yield Test Report
Well Yield Estimate Method: ____
Static Level: 2.82' Estimated Yield (gpm) ____
Date/Time measured: 6/19/17 Estimate Length (hrs) ____
Remarks:

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Company Name:	Email:	Phone w/area code:	License Number:
Ducks Unlimited, Inc.	kwarner@ducks.org	(970) 297-7279	47794

Mailing Address: 1825 Sharp Point Drive, Fort Collins, CO 80525

Sign (or enter name if filing online)	Print Name and Title	Date:
[signature]	Kevin Warner, PE	07/14/2017

Form No. GWS-31 02/2017	WELL CONSTRUCTION AND YIELD ESTIMATE REPORT State of Colorado, Office of the State Engineer 1313 Sherman St., Room 821, Denver, CO 80203 303.866.3581 www.water.state.co.us and dwrpermitsonline@state.co.us	For Office Use Only

1. Well Permit Number: Akers - 4 Receipt Number: 00568570

2. Owner's Well Designation:

3. Well Owner Name: United States Bureau of Reclamation

4. Well Location Street Address:

5. As Built GPS Well Location (required): ☐ Zone 12 ☒ Zone 13 Easting: 595089m Northing: 4460230 m

6. Legal Well Location: ____ 1/4, ____ 1/4, Sec., ____ Twp.____ ☐ N or S ☐, Range ____ ☐ E or W ☐, ____ P.M.

County: ____

Subdivision: ____, Lot ____, Block ____, Filing (Unit) ____

7. Ground Surface Elevation: 4329 feet Date Completed: 6/7/17 Drilling Method: Hollow Stem Auger

8. Completed Aquifer Name: South Platte Alluvium Total Depth: 25 feet Depth Completed: 25 feet

9. Advance Notification: Was Notification Required Prior to Construction? ☐ Yes ☐ No, Date Notification Given: ____

10. Aquifer Type: (Check one) ☐ Type I (One Confining Layer) ☐ Type I (Multiple Confining Layers) ☐ Laramie-Fox Hills ☐ Type II (Not overlain by Type III) ☐ Type II (Overlain by Type III) ☒ Type III (alluvial/colluvial)

11. Geologic Log:

Depth	Type	Grain Size	Color	Water Loc.
0-5'	silty loam	<0.01	gray	4'
5-10'	med. sand	0.1	tan	
10-15'	med. sand	0.1	↓	
15-20'	med. sand	0.1	↓	
20-25'	med. sand	0.1	↓	

12. Hole Diameter (in.)

Hole Diameter (in.)	From (ft)	To (ft)
8.25 OD	0	25
4.25 ID	0	25

13. Plain Casing

OD (in)	Kind	Wall Size (in)	From (ft)	To (ft)
2.25	PVC	Sch 40	0	5

Perforated Casing Screen Slot Size (in): 0.01

OD (in)	Kind	Wall Size (in)	From (ft)	To (ft)
2.25	PVC	Sch 40	5	25

14. Filter Pack: Material washed silica sand; Size 10/20; Interval 3-25

15. Packer Placement: Type ____ Depth ____

16. Grouting Record

Material	Amount	Density	Interval	Method

Remarks: Bentonite seal, concrete pad
3'4" steel casing stick up

17. Disinfection: Type Amt. Used

18. Well Yield Estimate Data: ☐ Check box if Test Data is submitted on Form Number GWS-39, Well Yield Test Report

Well Yield Estimate Method:

Static Level: 4.05' Estimated Yield (gpm) ____

Date/Time measured: 6/19/17 Estimate Length (hrs) ____

Remarks:

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Ducks Unlimited, Inc.	kwarner@ducks.org	(970) 297-7279	47794

Mailing Address: 1825 Sharp Point Drive, Fort Collins, CO 80525

Sign (or enter name if filing online)	Print Name and Title	Date:
[signature]	Kevin Warner, PE	07/14/2017