Groundwater Hydrology Monitoring & Wetland Delineation Report

Hogan Pancost Property

Boulder County, Colorado

submitted to:

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prepared for:

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1.0 Introduction

MacKenzie House, LLC has plans to develop the 22.17 acre Hogan Pancost property located in Boulder County, Colorado, southwest of the East Boulder Community Park (Figure 1). 55th Street bisects the property to create a 2.73 acre East Parcel and a 19.44 acre West Parcel. Specifically, the property is located in parts of Sections 3 and 4 of Township 1 North and Range 70 West in Boulder County (Figure 2). A wetland delineation has been completed to provide information for project planning. Historically, the property was extensively flood irrigated beginning with settlement in the late 1800's (Hogan 2008). Therefore, flood irrigation activities were terminated on the West Parcel but not the East Parcel during the course of the study, and a groundwater hydrology monitoring study was implemented on both parcels to measure the depth to groundwater and to determine if wetlands present are due to a natural high groundwater table, a groundwater table elevated by irrigation ditches and laterals, or due to flood irrigation practices.

Please note, Figures are located in Section 7.0, Tables are in Section 8.0 and Photographs are in Section 9.0.

2.0 Environmental Setting

2.1 Topography & Drainage

The West Parcel ranges from a high of 5,323 feet on the south to a low of 5,312 feet on the northwest. This parcel, which slopes and drains to the north, is characterized by numerous small swales 12-24 inches deep. The relatively flat East Parcel extends from a high of 5,325 feet on the southwest to a low of 5,319 feet on the north along 55th Street, and thus slopes and drains to the north. There are no streams on the project site. However, South Boulder Creek flows north 180 feet east of the East Parcel.

2.2 Irrigation Ditches & Laterals

Dry Creek Ditch #2 (Ditch) parallels the western boundary of the West Parcel, and the Howard Super-phosticle Ditch bisects the East Parcel, the east end of the West Parcel, and the northwest corner of the West Parcel. The CD Bodam Lateral (Lateral) occurs along the south boundary of the West Parcel.

2.2.1 Dry Creek Ditch #2 & CD Bodam Lateral

Dry Creek Ditch #2 (Photo 1) conveys water from a headgate on South Boulder Creek near Marshall to South Boulder Creek near Valmont Butte (Figure 3). This Ditch flows from about mid-May through August with an estimated maximum flow of 23 cubic feet per second (cfs), but flows of 12-18 cfs are more typical (Hogan 2008). The Ditch often has a flow of about 1 cfs during the winter months.

The Hogan Pancost property owner has three shares of water in Dry Creek Ditch #2. This water is delivered to the project site via a lateral from a headgate on the Ditch just northeast of U.S. Highway 36 (Figure 3). The lateral proceeds north through City open space and then generally parallels 55th Street, sometimes underground, until it reaches the southwest corner of the West Parcel where it enters the portion of the Lateral referred to as the CD Bodam Lateral (Photo 2) which extends west along the southern property boundary to join Dry Creek Ditch #2 again. Both the Hogan Pancost West Parcel and the adjoining seven acre CD Bodam Parcel along the south boundary of the West Parcel receive irrigation water from this Lateral.

Historically, the West Parcel was flood irrigated throughout the growing season (Hogan 2008) by blocking the Lateral and forcing water into small diversion ditches and north-trending swales. The depth of water on the irrigated fields was often up to 18 inches deep in the swales, and all of the West Parcel was irrigated (CD Bodam 2008). Typically, flood irrigation extended throughout the

growing season (Hogan 2008). The total estimated water flow in the CD Bodam Lateral in 2006 and 2007 was 3,320,723 gallons, or 10.19 acre feet (Appendix A). This huge volume of water elevates the groundwater table, especially in areas adjacent to ditches and laterals.

The property owner along the south boundary of the West Parcel, CD Bodam, owns two shares of water in the Ditch. He uses this water to sprinkle irrigate his entire seven acres throughout the growing season. He has an ornamental pond just south of the Lateral and west of his residence. Further west, he has a pumping system to pump water from the Lateral for irrigations of his property. During the summer, he stated that through irrigation, he can raise the water level on his entire seven acre property to the height of the water in the pond. The sprinkle irrigation system along the north boundary of the CD Bodam property sprays water on the southern edge of the West Parcel along the north bank of the Lateral and moistens the soil throughout the growing season.

The East Parcel is flood irrigated via a small lateral along the south property boundary. This lateral gets water from the CD Bodam Lateral via a diversion pipe under 55th Street.

2.2.2 Howard Super-phosticle Ditch

The East Parcel is bisected by the Howard Super-phosticle Ditch. A significant volume of water, estimated at 10-15 cfs, flows from South Boulder Creek to a small pond on the south boundary of the East Parcel, and then northwest across the East Parcel and the east end of the West Parcel. It then flows through ponds, pipes and ditches along the northeast property line, crosses the Ditch via a culvert at the northwest corner of the property, and flows into vaults on the City of Boulder property. Currently, much of the water in this ditch is diverted to Dry Creek Ditch #2. The Howard Super-phosticle Ditch flows year-round. See Photo 3.

2.3 Land Use

The project site is undeveloped except for several small sheds associated with an agricultural land use. Numerous barbed wire steel fences partition the property into various sized lots. Historically, the parcel has had an agricultural land use which likely extends back to the settlement era in the late 1800's (Hogan 2008). Recent agricultural uses include hay production and livestock grazing.

2.4 Vegetation

The vegetation of the project area is characterized by an upland pasture, disturbed weedy areas, small man-induced wetlands, and one small stand of plains cottonwood trees *(Populus deltoides)* on the east end of the East Parcel. The upland pasture areas are best developed in swales just north of the CD Bodam Lateral where they have been historically flood irrigated, often with up to 18 inches of standing water (CD Bodam 2008) and receive subsurface water from the unlined Lateral. Please note, this Lateral has now been permanently lined (Photo 2) and the flood irrigation has been permanently terminated. These areas are characterized by wetland and facultative plants such as meadow fescue *(Festuca pratensis),* redtop *(Agrostis gigantea),* Baltic rush *(Juncus arcticus subsp. ater)* and numerous upland species, including timothy *(Phleum pratense),* Kentucky bluegrass *(Poa pratensis),* chicory *(Cichorum intybus),* narrow-leaf birds-foot trefoil *(Lotus tenuis),* curly dock *(Rumex crispus),* and red clover *(Trifolium pratense).* Numerous groundwater hydrology monitoring wells were installed in these areas which documented that this habitat lacks a wetland hydrology except for small areas along Dry Creek Ditch #2 which are topographically lower than the elevation of the irrigation flows in the Ditch. The wetland plants in this habitat were supported by the historic flood irrigation practices and will not persist in this area now that flood irrigation practices have been permanently terminated. In fact, the lack of flood irrigation water during the current growing season affected the vigor of these wetland plants (less robust and less flowering) and resulted in an increase in weedy plant cover. Please note, some small areas directly adjacent to the CD Bodam Lateral generally support obligate wetland vegetation comprised of Macoun's buttercup *(Ranunculus macounii)* and water smartweed

(Persicaria amphibia ssp. stipulaceum), however these areas, high on the elevated bank of the lined Lateral, lack a wetland hydrology and are instead supported by overspray from sprinklers on the CD Bodam property. When sprinklers are adjusted in the 2009 growing season to correct the overspray, these areas will be colonized by upland species.

Weedy areas occur in the slightly higher elevations of the project site where prairie dogs have created disturbed habitats. The weed areas have significantly increased in size due to the termination of flood irrigation and the increased prairie dog activity. These areas have a low vegetation cover composed of a diversity of Colorado state listed noxious weeds and other introduced plants. The most abundant weeds in the West Parcel include Scotch thistle *(Onopordum acanthium),* diffuse knapweed *(Acosta diffusa),* Canada thistle *(Cirsium arvense),* mullein *(Verbascum thapsus),* chicory, and field bindweed *(Convolvulus arvensis).* The East Parcel has large stands of teasel *(Dipsacus fullonum)* intermixed with the wetland plants, as well as stands of Canada thistle and a few Russian olive *(Elaeagnus angustifolia)* trees. See Photo 4.

Finally, a small stand of plains cottonwood trees occur in the eastern portion of project area. The understory is comprised of upland and facultative plants such as smooth brome *(Bromus inermis),* meadow fescue *(Festuca pratensis),* Canada goldenrod *(Solidago canadensis),* and goldenbanner *(Thermopsis divaricarpa).* Table 1 provides a complete list of plant species observed on the project site.

2.5 Wildlife

The project site has a long history of agricultural land uses and is located in an urban setting. The site provides habitat for urban adapted species, including songbirds and small mammals. Prairie dogs occur on the site, and with termination of flood irrigation practices this growing season, the population has exploded and now occupies a greater portion of the West Parcel. The prairie dogs are enlarging the areas of disturbance and increasing the abundance of undesirable noxious weeds.

2.6 Federally Listed Species

Bill Jennings' letter of July 25, 2008 documents a field survey, the fourth on this property, in which he concludes that the Ute ladies' tresses orchid *(Spiranthes diluvialis)* is not present, and suitable habitat for this plant is minimal.

Robert Stoecker visited the project site on July 14, 2008, to update his 2003 report on the habitat conditions for the Preble's meadow jumping mouse *(Zapus hudsonius preblei).* He concluded as before that field trapping surveys are not needed as there is no appropriate habitat on the site.

3.0 Groundwater Hydrology Monitoring Study

A groundwater hydrology monitoring study was conducted throughout the 2008 growing season in accordance with the "Technical Standard for Water-Table Monitoring of Potential Wetland Sites" (U.S. Army Corps of Engineers 2005). This standard is the currently accepted method for delineating man-induced wetlands in the State of Colorado.

3.1 Well Locations

As illustrated by Figure 4, 29 wells were installed on the West Parcel and three were installed on the East Parcel. Wells 1-27 were installed in the April 18-22 time period, and Wells 28-32 were installed on May 13. The water level was also monitored in three deep wells (A, B & C) previously installed by the Applicant's engineers.

3.2 Well Installation

The groundwater hydrology monitoring wells (Photo 5) were installed according to details of Figure 5 by David Buscher, a professional soil scientist with Buscher Soil and Environmental Consulting, Inc. Briefly, a 25 inch deep borehole was augured into the selected monitoring site. Next, silica sand (20-40 size) was added to the lower 2 to 3 inches of the borehole. A 1½ inch diameter PVC (Schedule 40) was then inserted into the hole and the space around the pipe was filled with silica sand to four inches below the ground surface. The lower 18 inches of the PVC pipe is slotted (0.010 inch size), while the upper 18 inches of the PVC pipe is unslotted and extends above the ground surface approximately one foot. Finally, the upper 4 inches of soil was sealed with bentonite clay to prevent surface water from entering the well. After installation, the location and surface elevation of each well site was surveyed by Drexel, Barrell & Co. of Boulder, Colorado.

3.3 Soil Profile Descriptions

As outlined in the 2005 Technical Standard (U.S. Army Corps of Engineers 2005), the soil profile of each 25 inch deep monitoring well was characterized as to the horizon depth, texture, color, induration (cementation), redoximorphic features, and roots by David Buscher. Data forms for each well are in Appendix B. The soil scientist also examined each soil for any strata that could restrict the downward movement of water and create a perched water table, however none were found.

3.4 Ditch & Lateral Management

The West Parcel was not flood irrigated from the CD Bodam Lateral during the course of the study. This Lateral was deepened in the winter of 2008, and on May 28 and 29, 2008 was permanently lined with a synthetic fabric (Photo 2). Also, the fabric liner was added to a portion of the feeder ditch which extends south from the CD Bodam Lateral to an ornamental pond on the property. However, water flowed under this liner and extended north to the area of Well 5. These subsurface irrigation flows likely elevated the groundwater table, but not high enough to saturate the upper 12 inches of the soil profile. Dry Creek Ditch #2 (Photo 1) and the Howard Super-phosticle Ditch (Photo 3) were not lined.

Irrigation water started flowing in Dry Creek Ditch #2 and in the CD Bodam Lateral on May 23. However, on May 27 the Ditch and Lateral flows were terminated and water was pumped from the Lateral in order to install the fabric. By June 6, water was again flowing in both the Ditch and the Lateral. The flows in both the Ditch and Lateral were stopped on August 25. Water flowed in the Ditch and Lateral on August 29 through September 2. Water again flowed in the Lateral on September 26 through October 3, and in the Ditch from September 29 through October 2. See Table 2.

3.5 Monitoring

3.5.1 Water Levels

All 32 wells and the three existing deep wells were either monitored daily, or every two to seven days from April 28 till October 8, 2008, depending on the flow of water in the Ditch and Lateral. Water levels were measured with an electronic water level indicator, the Heron Instruments Dipper-T model, and levels were recorded to the nearest hundredth of a foot.

3.5.2 Irrigation Ditches & Laterals

The Ditch and Lateral were observed during each well monitoring trip to determine if irrigation water was flowing. Also, periods of flood irrigation on the East Parcel were noted.

3.5.3 Soil Temperature

Soil temperature was measured during the groundwater hydrology monitoring well installations and during most monitoring visits at Well 2. The soil temperature was measured with a soil thermometer at 20″ below the soil surface.

3.5.4 Precipitation

The National Climatic Data Center (NCDC) tracks precipitation, temperature, wind, and other climate features at a weather station in Boulder located near Baseline Road and Broadway, approximately 2.2 miles from the project site at an elevation of 5,484 feet. Data from the Boulder Climate Station was used to determine if normal precipitation occurred during the 2008 monitoring period.

3.6 Analysis of Data

Per requirements of the 2005 Technical Standard, the hydrology monitoring data was analyzed in concert with the annual precipitation and the depth to groundwater necessary for a wetland hydrology.

3.6.1 Determination of Growing Season Start & End Dates

The 1987 Corps Manual and subsequent guidance defines growing season as:

> "The portion of the year when soil temperature (measured 20 inches below the soil surface) is above biological zero (5° C or 41°F). This period can be approximated by the number of frost-free days. Estimated starting and ending dates for the growing season are based on 28° F air temperature thresholds at a frequency of 5 years in 10 (HQUSACE, 6 Mar 92). This information is available in NRCS county soil survey reports or from the NRCS Water and Climate Center..." (Page 29).

According to the NRCS Water and Climate Center WETS Table for Boulder (Appendix C) the average length of the growing season is 172 days and the beginning and ending dates, as defined by air temperature, are April 21 and October 10, during which time the monitoring study took place. In order to further refine the growing season for the project site, soil temperature readings were taken on each monitoring visit. However, soil temperatures ranged from 38° to 64° throughout the duration of the study, and were not a good indicator of the beginning and end of the growing season.

3.6.2 Determination of Normal Precipitation

Table 3 summarizes the monthly precipitation data for January through September of 2008, and also identifies the normal precipitation, the variation from normal, as well as the monthly mean temperature.

The average growing season commences on April 21 and ends on October 10. Thus, only about nine days in April and ten days in October were within the growing season. Total precipitation in April was 1.13 inches, or 1.75 inches below the 2.88 inch normal precipitation for the month. May, however, received 4.21 inches of precipitation, which was 1.16 inches above the 3.05 inch normal. Precipitation in June was 1.58 inches, which is only 0.41 inches below the 1.99 inch normal. July was very dry, with only 0.09 inches of precipitation, as compared to the normal of 1.88 inches. August, however, was very wet, with 2.97 inches of precipitation, which was 1.34 inches above the 1.63 inch normal. September precipitation was 1.84 inches, which is 0.02 inches above normal. The first half of October received 1.10 inches of precipitation.

The May through September period, which encompasses almost all of the growing season, received 10.69 inches of precipitation, which is 0.35 inches above the 10.34 inch normal for this time period. Thus, it is concluded that normal precipitation occurred during the monitoring period.

3.6.3 Definition of a Wetland Hydrology

The 2005 Technical Standard states that the Corps Manual, "does not provide a hydrology criterion suitable for use in interpreting monitoring well data" (p. 12). Instead, a different standard is used which is based on recommendations from the National Academy of Sciences (National Research Council 1995). This definition states that wetland hydrology is considered to be present on an atypical or problem site if:

> *The site is inundated (flooded or ponded) or the water table is ≤ 12 inches below the soil surface for ≥ 14 consecutive days during the growing season at a minimum frequencies of 5 years in 10 (≥ 50% probability). Corps, 2005 p. 12.*

Using this definition, those monitoring wells with a water table in the upper 12 inches of soil for a minimum of 14 consecutive days during the growing season were classified as having a wetland hydrology.

3.7 Results

3.7.1 Well Water Levels – West Parcel

Well Water Levels Prior to Irrigation Flow in Ditch and Lateral. The results of the groundwater hydrology study are summarized in Table 2. Please note, water did not flow in the Ditch and Lateral until May 23. None of the wells on the West Parcel had water within the upper 12 inches of the soil profile for the first four monitorings on April 28 and on May 5, 9 and 16. In fact, all of the monitoring wells, except 1, 3, 4 and 5, were dry during this period. The deep monitoring Wells A, B and C, located 82, 135 and 75 feet, respectively, north of the Lateral, provide information on the depth to groundwater during this period. Deep Well A had water at a depth of 2.75 feet, 2.48 feet, 2.39 feet, and 2.22 feet for the first four readings. Deep Well B had water at a depth of 3.84 feet, 3.57 feet, 3.43 feet and 3.25 feet below the soil surface on those dates. Deep Well C had water at a depth of 4.30 feet on April 28, but was dry for the next three readings. May and June is the period of the growing season which characteristically would have the highest groundwater elevations, as the peak runoff and stream elevations are at their maximum during this time period. If a natural wetland hydrology, defined as inundation or water within the upper 12 inches of the soil profile, occurs on the site, it should have been present during May. In fact, the site does not have a natural wetland hydrology.

Wells 10, 11, 12, 13, 14, 16, 17, 19 & 21. When water flows in the Ditch, wells (12, 13, 14, 16, 17, 19 & 21) located along the Ditch and elevationally lower than the height of the irrigation flows in the Ditch (Table 4) generally had a wetland hydrology. See Figures 8-13. Also, Wells 10 and 11 have surface elevations that are only slightly higher (0.03 and 0.43 feet, respectively) than the elevation of the water level in the Ditch (Figure 7). The surface elevation of Well 10 was almost equal to the elevation of water in the Ditch and the surface elevation of Well 11 was slightly higher than the elevation of the water in the Ditch. However, the highest elevation of the water in these two wells was slightly lower than the elevation of the water in the Ditch, so that water still seeped from the Ditch and provided water to these wells. When the Ditch had irrigation flows, the water level in all adjacent wells (10, 11, 12, 13, 14, 16, 17, 19 and 21) rose quickly and significantly. However, when the Ditch ceased flowing, the water level in all these wells immediately dropped, and after a few days were dry.

Numerous monitoring dates illustrate the impact of irrigation flows on the rise and fall of water levels in Wells 10, 11, 12, 13, 14, 16, 17, 19 and 21. When irrigation water started flowing in the Ditch and Lateral on May 23, Wells 10, 11, and 12 had water in the upper 12 inches of the soil profile. However, when the water ceased flowing on May 27, the water in Wells 10, 11, and 12 dropped significantly, and all three wells were dry on May 30. When a large volume of water started flowing in the Ditch on June 6, Wells 10, 11, 12, 13, 16, 17 and 19 immediately had water in the upper 12 inches of the soil profile, and by June 19, Wells 14 and 21 also had water in the upper 12 inches of the soil profile. However, on August 25, water was not flowing in the Ditch and the water level in all wells, except Well 17, immediately dropped to more than 12 inches

below the soil surface. The water level in Well 17 dropped to more than one foot below the soil surface within three days, on August 28.

On August 29, when the water again started flowing in the Ditch, Wells 10, 12 and 17 had water within the upper 12 inches of the soil profile on that date, and by September 2, Wells 13 and 19 also had water within the upper 12 inches of the soil profile. Again on September 3, the water in the Ditch stopped flowing and only Well 17 had water within the upper 12 inches of the soil profile. By September 6, the water level in Well 17 was 1.21 feet below the soil surface. All wells except for 17 were dry from September 7 to 26. Well 17 went dry on September 18.

Irrigation water was again flowing in the Ditch on September 29, and Well 12 had a water depth of 0.88 feet below the soil surface. On September 30, Wells 10 and 19 had a water depth of 0.95 feet and 0.96 feet, respectively, and on October 1, Well 17 had a water depth of 0.94 feet below the soil surface. The water stopped flowing in the Ditch on October 3, and by October 8, Wells 10, 12, 17 and 19 all had a water depth greater than one foot below the soil surface. In fact, Well 19 was dry on that date.

In summary, Wells 10, 11, 12, 13, 14, 16, 17, 19, and 21 all had water in the upper 12 inches of the soil profile for 14 consecutive days or more and hence all have a wetland hydrology due solely to seepage from irrigation flows in the adjacent Ditch.

Well 5. Well 5, (Figure 6) located 109 feet north of the Lateral, was dry on April 28, then had water at a depth of 1.76 feet, 1.63 feet and 1.43 feet on May 5, 9 and 16, respectively. This well had water in the upper 12 inches of the soil profile on May 23 and 27 when water started flowing in the unlined Lateral. However, when the Lateral was lined on May 29 and 30, the water level dropped rapidly to 1.35 feet below the soil surface on May 30. Well 5 is located in a small depression and the clay seal which prevents water from precipitation events running into the well was cracked and defective. Therefore, the heavy rains on June 5 (1.56") caused the water level to rise to 0.66 feet on June 6, but it dropped back to 1.39 feet by June 10. Similarly, the heavy rains on August 15 (0.87"), 16 (1.31") and 17 (0.38") caused the water level in Well 5 to rise to 0.74 feet by August 20. However, it dropped to 1.24 feet by August 25. Finally, the heavy rain on September 12 (1.24") caused the water level in Well 5 to go from dry on September 11 to 0.96 feet below the soil surface on September 12. However, by September 13, the water level had dropped to 1.21 feet below the soil surface.

Well 5 does not have either a natural or a man-induced wetland hydrology because it did not have water in the upper 12 inches of the soil profile for 14 continuous days.

It should be noted that the portion of the project area immediately north of the ornamental pond on the CD Bodam property is impacted by the water stored in this pond (Figure 3). Specifically, the Lateral was lined on May 29 and 30, and the lining extended south along the inlet to the pond. However, the lining did not extend all the way to the pond. Therefore, water flowed under the lining and north to the area of Wells 4 and 5. This seepage caused the groundwater table to rise in this area, but the water did not rise high enough to be within the upper 12 inches of the soil profile. This inlet will be lined all the way to the pond before the 2009 growing season.

Other Wells. None of the other wells on the West Parcel had water in the upper 12 inches of the soil profile. In addition, none of the deep monitoring wells had water in the upper 12 inches of the soil profile.

3.7.2 Well Water Levels – East Parcel

First, it should be noted that much of the East Parcel was flood irrigated throughout the growing season. Water is diverted from the CD Bodam Lateral under 55th Street to a small lateral which extends east along the south boundary of the East Parcel. Most of the flood irrigation occurred on that portion of the parcel west of the Howard Super-phosticle Ditch.

Wells 30 and 32 were dry for the first groundwater hydrology monitoring on May 16 and the water level in Well 31, located 45 feet west of the Howard Super-phosticle Ditch which was not flowing with irrigation water, was 1.2 feet below the soil surface. When flood irrigation and the irrigation flows in the ditch commenced on May 23, Wells 30 and 31 had water at depths of 0.67 feet and 0.81 feet, respectively, below the soil surface. Well 32 was dry throughout the monitoring period and Well 30 was dry except during the periods of flood irrigation. Well 30 had water in the upper 12 inches of the soil profile continuously from August 8 through 25, and hence had an artificially induced flood irrigation hydrology during that time period. Well 31 had water in the upper 12 inches of the soil profile or had standing water to a depth of 0.30 feet from August 20 to 29 and again from September 12 to October 1. This well also has an artificially induced wetland hydrology.

3.8 Conclusion

3.8.1 West Parcel

The groundwater table of the West Parcel is influenced by irrigation flows in the Ditch and by the extensive sprinkle irrigation activities on the seven acre CD Bodam property to the south. However, the water table on the West Parcel is not high enough to create a natural wetland hydrology. Irrigation flows in the Ditch create an artificial wetland hydrology only on those small isolated topographies that are elevationally lower than the height of the irrigation flows in the Ditch. In order to have a wetland hydrology, water must be within 12 inches of the soil surface for 14 consecutive days. Based on this criteria, Wells 10, 11, 12, 13, 14, 16, 17, 19, and 21 have a wetland hydrology, however the data clearly demonstrates that the wetland hydrology is due to seepage from the Ditch.

3.8.2 East Parcel

The groundwater table of the East Parcel is influenced by flows in the Howard Super-phosticle Ditch and flood irrigation from the lateral which parallels the south boundary. This parcel was extensively flood irrigated throughout the monitoring period which impacted the elevation of water in Wells 30 and 31. Both of the wells had water in the upper 12 inches of the soil profile for more than 14 consecutive days, and therefore it must be concluded that they had a wetland hydrology. However, it is highly likely that Well 30 has an artificial wetland hydrology because it was dry when the monitoring study commenced on May 16 and went dry between the periods of flood irrigation. Well 31 is 45 feet from the Howard Super-phosticle Ditch and has a wetland hydrology due to this ditch. However, in order to demonstrate the absence of a natural wetland hydrology at Wells 30 and 31, flood irrigation practices must be terminated during the growing season, the ditch must be lined, and the study must be repeated.

4.0 Wetland Delineation

Wetlands were delineated by Rea Orthner of Western Ecological Resource, Inc. and David Buscher of Buscher Soil and Environmental Consulting, Inc. in accordance with the U.S. Army Corps of Engineers Wetland Delineation Manual (1987) in September 2008. Specifically, wetland boundaries were delineated and flagged based upon the prevalence of hydrophytic vegetation, hydric soils, and groundwater hydrology data produced by the groundwater hydrology monitoring study (See Section 3.0). In general, plant species names follow Weber and Whitmann (1992). The wetland status of plants follows the 1988 National List for the Intermountain Region. Classification of wetlands follows Cowardin, et al. (1979). The wetland survey was completed by Drexel, Barrell & Co. of Boulder, Colorado.

The project area has five wetlands and contains segments of two irrigation ditches. Table 1 lists the plant species observed in and adjacent to the wetlands, Table 5 provides the acreage of each wetland area, and Figure 14 illustrates the wetlands on a topographic basemap. Appendix D contains copies of the wetland delineation field data forms.

4.1 Wetland A

4.1.1 Location & Landform

The 0.227 acre Wetland A is located in a topographically low area in the southwest corner of the project area near the intersection of the CD Bodam Lateral and the Dry Creek Ditch #2 (Photo 6).

4.1.2 Classification

According to Cowardin et. al. (1979) this wetland is classified as a Palustrine system, emergent wetland class, persistent subclass, with a saturated water regime.

4.1.3 Vegetation

This herbaceous wetland is dominated by water smartweed *(Persicaria amphibia var. stipulaceum)* and Macoun's buttercup *(Ranunculus macounii)* which are both wetland plants. Other wetland species commonly found within the wetland and along its periphery include field mint *(Mentha arvensis),* Nebraska sedge *(Carex nebrascensis),* redtop *(Agrostis gigantea),* and white panicle aster *(Aster lanceolatus ssp. hesperius).* Kentucky bluegrass (*Poa pratensis)* and prickly lettuce *(Lactuca serriola),* both non-native plants, occur as well.

4.1.4 Soils

Three soils were examined in this wetland, one at Soil Pit 12, one at Well 10 and the other at Well 11. The soil at Pit 12 is a *Fluvaquentic Endoaquoll*, which is a hydric soil with redoxymorphic features in the upper 10 inches. The soil texture is a loam for the upper 4 inches and then a sandy loam and cobbly sand from 4 to 14 inches below the soil surface. The soils at Wells 10 and 11 are also hydric and are loams and sandy loams in the upper horizons and gravelly to very gravelly loamy sands in the lower soil horizons.

4.1.5 Hydrology

Wetland A is supported by a man-induced wetland hydrology as evidenced by monitoring data at Wells 10 and 11. These wells had a wetland hydrology only when water was flowing in the Ditch. When water was diverted from the Ditch for extended periods of time, the wells dried up. See Section 3.7.1.

4.2 Wetland B

4.2.1 Location & Landform

The 0.21 acre Wetland B is located in a swale approximately 150 feet north of Wetland A (Photo 7). The wetland is next to the Dry Creek Ditch #2 and is lower in elevation than the irrigation flows in the Ditch.

4.2.2 Classification

According to Cowardin et. al. (1979) this wetland is classified as a Palustrine system, emergent wetland class, persistent subclass, with a saturated water regime. There are also portions which would be classified as the scrub-shrub wetland class, broadleaf deciduous subclass.

4.2.3 Vegetation

Wetland B supports both herbaceous and scrub-shrub wetland types. The majority of the wetland is comprised of herbaceous species such as Nebraska sedge and Macoun's buttercup, although water smartweed, redtop, and field mint also occur. Near the northern end of the wetland, a stand of sandbar willow *(Salix exigua)* occurs.

4.2.4 Soils

The soil at Pit 3 is classified as a *Fluvaquentic Endoaquoll*, which is a hydric soil with mottles and oxidized root channels in the Ac soil horizon from 5 to 13 inches below the soil surface. The texture is sandy loam in the upper 5 inches and a very gravelly sandy loam from 5 to 13 inches. The soils described from the four monitoring wells (12, 13, 17, 19) in this wetland are all hydric with the presence of redoxymorphic features, but are variable in texture. For example, Well 12

has a clay loam horizon from 11 to 15 inches below the soil surface, but all others lack any clay layers. In general, the soil textures range from loams at the upper soil horizon to sandy loams and gravelly loamy sands in the lower soil horizons.

4.2.5 Hydrology

Wetland B is supported by a man-induced wetland hydrology as evidenced by monitoring data at Wells 12, 13, 17, and 19. These wells had a wetland hydrology only when water was flowing in the Ditch. When water was diverted from the ditch for extended periods of time, the wells dried up. In addition, this wetland is lower in elevation than the Ditch, such that when water flows in this ditch it seeps out to saturate the soils of this wetland. See Section 3.7.1.

4.3 Wetland C

4.3.1 Location & Landform

The 0.28 acre Wetland C is located in a swale approximately 65 feet east of Wetland B (Photo 8).

4.3.2 Classification

According to Cowardin et. al. (1979) this wetland is classified as a Palustrine system, emergent wetland class, persistent subclass, with a saturated water regime.

4.3.3 Vegetation

This wetland is dominated by Nebraska sedge, small wing sedge *(Carex microptera),* and rushes *(Juncus spp.).* Meadow barley *(Hordeum jubatum),* smartweeds *(Persicaria spp.),* and various upland grasses and weeds are also present. This wetland has been impacted by the termination of flood irrigation, as upland plants are encroaching into the wetland.

4.3.4 Soils

The soil at Pit 13 is a *Fluvaquentic Endoaquoll*, a hydric soil with mottles and oxidized root channels throughout the 14 inch deep soil profile. The soil texture ranges from a loam in the upper4 inches to a sandy loam from 4 to 14 inches. Soils examined at Wells 14 and 16 are also hydric. Well 14 has a clay loam surface layer 6 inches thick, and then a sandy loam (with 18% clay) A2 horizon from 6 to 19 inches. Below 19 inches, the soil texture is a cobbly sandy loam and a cobbly loamy sand. Well 16 is loam in texture for the upper 8 inches and then has a sandy loam A2 horizon from 8 to 13 inches, and a very gravelly loamy sand and a very gravelly sand C1 and C2 layers from 13 to 24 inches below the soil surface.

4.3.5 Hydrology

Wetland C is supported by a man-induced wetland hydrology as evidenced by data at Wells 14 and 16. Water was present in the upper 12 inches of soil in these monitoring wells only during those periods when irrigation water flowed in the Ditch. This wetland is topographically lower than the elevation of irrigation flows in the Ditch. See Section 3.7.1.

4.4 Dry Creek Ditch #2

4.4.1 Location & Landform

The 0.228 acre Dry Creek Ditch #2 occurs along the western edge of the project area and flows to the north (Photo 9).

4.4.2 Classification

According to Cowardin et. al. (1979) the wetlands along the Ditch are classified as a Palustrine system, emergent wetland class, persistent subclass, with a saturated water regime. However, there are scrub-shrub wetlands along the Ditch as well.

4.4.3 Vegetation

The wetland vegetation along the Ditch is comprised of a mosaic of wetland graminoids and forbs. The most common wetland forbs include Macoun's buttercup, water speedwell, northern

willowherb, and jewelweed *(Impatiens campestris).* Common wetland graminoids include clustered field sedge *(Carex praegracilis),* Nebraska sedge, and American mannagrass *(Glyceria grandis).* Riparian shrubs and trees occur along portions of the ditch and include plains cottonwood *(Populus deltoides),* crack willow *(Salix fragilis),* sandbar willow, chokecherry *(Prunus virginiana ssp. melanocarpa),* box elder *(Acer negundo),* and green ash *(Fraxinus pensylvanica).*

4.4.4 Soils

No soils were described from within the wetland boundaries adjacent to Dry Creek Ditch #2. However, the soils are likely hydric and similar in texture to the adjacent soil pits.

4.4.5 Hydrology

This Ditch has irrigation flows from mid-May through August, with an estimated normal flow of 12-18 cfs.

4.5 Howard Super-phosticle Ditch

4.5.1 Location & Landform

The Howard Super-phosticle Ditch bisects the East Parcel, the east end of the West Parcel, and the northwest corner of the West Parcel (Photos 10 & 11).

4.5.2 Classification

According to Cowardin et. al. (1979), this wetland is classified as a Palustrine system, emergent wetland class, persistent subclass, with a saturated water regime.

4.5.3 Vegetation

The northwest corner of this ditch supports a small wetland dominated by red top, meadow foxtail), smartweeds, Macoun's buttercup, Nebraska sedge, woolly sedge *(Carex lanuginosa),* and northern willowherb. In the ponded water area behind the culvert, a few broadleaf cattails (Typha latifolia) and hardstem bulrush (Scirpus acutus) occur.

The portion of the Howard Super-phosticle Ditch on the east end of the West Parcel is about two feet wide and is bordered by wetland plants such as water smartweed, woolly sedge, Macoun's buttercup, northern willowherb *(Epilobium ciliatum),* and brookgrass *(Catabrosa aquatica).* Less common are reed canarygrass *(Phalaris arundinacea),* rushes, and curly dock.

4.5.4 Soils

No soils were described from within this wetland, however two soils were described approximately 25 feet southwest of this wetland. The soil at Well 27 is not hydric and has a 2 inch loam A horizon and a very gravely sandy loam C1 and C2 horizons from 2 to 24 inches. The soil at Well 28, on the other hand, is hydric, and has loam, clay loam, and sandy clay loam soil horizons.

4.5.5 Hydrology

The Howard Super-phosticle Ditch receives water from a diversion on South Boulder Creek located southeast of the project area. This ditch flows year-round with an estimated flow of 10-15 cfs.

4.6 East Wetland

4.6.1 Location & Landform

The 1.622 acre East Wetland, located on the East Parcel, includes the Howard Super-phosticle Ditch and adjacent herbaceous wetlands (Photo 12).

4.6.2 Classification

According to Cowardin et. al. (1979) the East Wetland is classified as a Palustrine system, emergent wetland class, persistent subclass, with a saturated water regime. However, there are

also forested wetlands in the eastern portion of the project area that are part of the plains cottonwood stand.

4.6.3 Vegetation

The vegetation is the East Wetland is mainly comprised of dense stands of Nebraska sedge and woolly sedge. Largeleaf avens *(Geum macrophyllum),* Baltic rush, Macoun's buttercup, and reed canarygrass also occur. Much of the wetland includes stands of teasel, a facultative weed that can persist in wetland situations. Along the southern boundary, there are mature stands of crack willow, and along the eastern portion of the wetland, stands of plains cottonwood occur.

4.6.4 Soils

Five soils were described from the East Wetland. Two of the soils (Pits 18 and 19) are classified as *Fluvaquentic Endoaquolls*, which are hydric soils that contain oxidized root channels and mottles in the upper soil surface. The soil textures are sandy loams and sandy clay loams. The three other soils, Pits, 20, 21, and 22 are non-hydric and lack any redoxymorphic features. These soils are classified as *Fluvaquentic Haplustolls* and have textures of loams, sandy loams, or gravelly sandy clay loams.

4.6.5 Hydrology

The Howard Super-phosticle Ditch flows year round. See Section 3.8.2.

5.0 Analysis of Jurisdictional Status

On September 23, 2008, Terry McKee of the U.S. Army Corps of Engineers met with David Johnson and Rea Orthner of Western Ecological Resource, Inc. and David Steinmann of Professional Wetlands Consulting, Inc. at the project site to review the wetland boundaries and determine the jurisdictional status of the wetlands.

Mr. McKee concluded that Wetlands A, B and C are not jurisdictional because they are topographically lower than Dry Creek Ditch #2 and do not provide flows to this Ditch. Dry Creek Ditch #2 is jurisdictional because it flows north to South Boulder Creek. Similarly, the Howard Super-phosticle Ditch is jurisdictional as long as flows from this ditch are diverted to Dry Creek Ditch #2. If these flows to Dry Creek Ditch #2 are terminated, and if it can be demonstrated that water in this ditch does not flow to waters of the U.S. features, it would not be jurisdictional.

The East Wetland, excluding the Howard Super-phosticle Ditch, on the East Parcel had a wetland hydrology because flood irrigation practices were not terminated and the Howard Super-phosticle Ditch was not lined. Therefore, it was not possible to differentiate these man-induced hydrologies from any naturally occurring wetland hydrology. Under these circumstances, it is concluded that the East Wetland may have a natural wetland hydrology and be jurisdictional, until data is provided to demonstrate otherwise.

6.0 References

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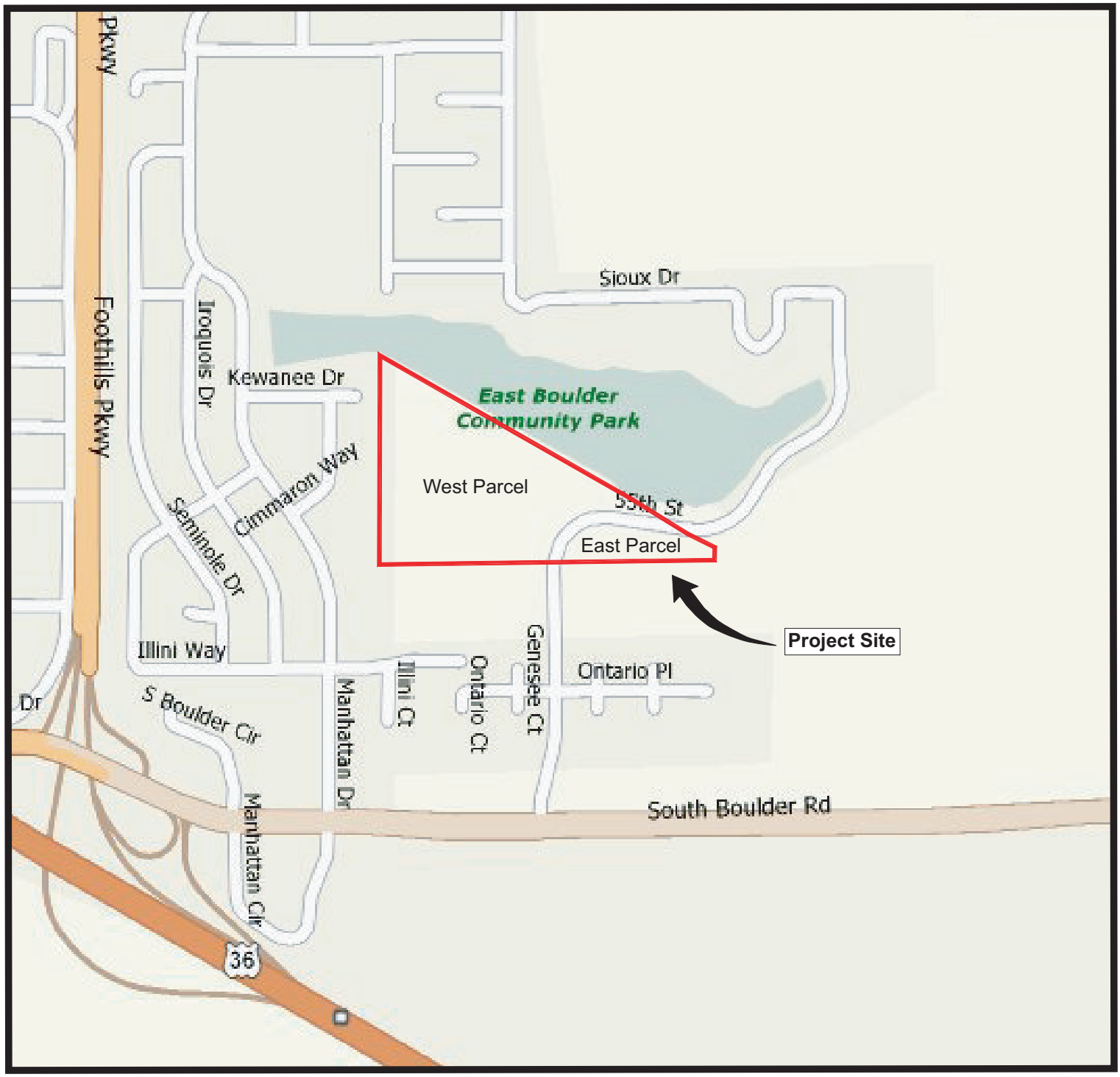
7.0 Figures



BASE: Map Data Mapquest 2008 NAVETQ or TeleAtlas

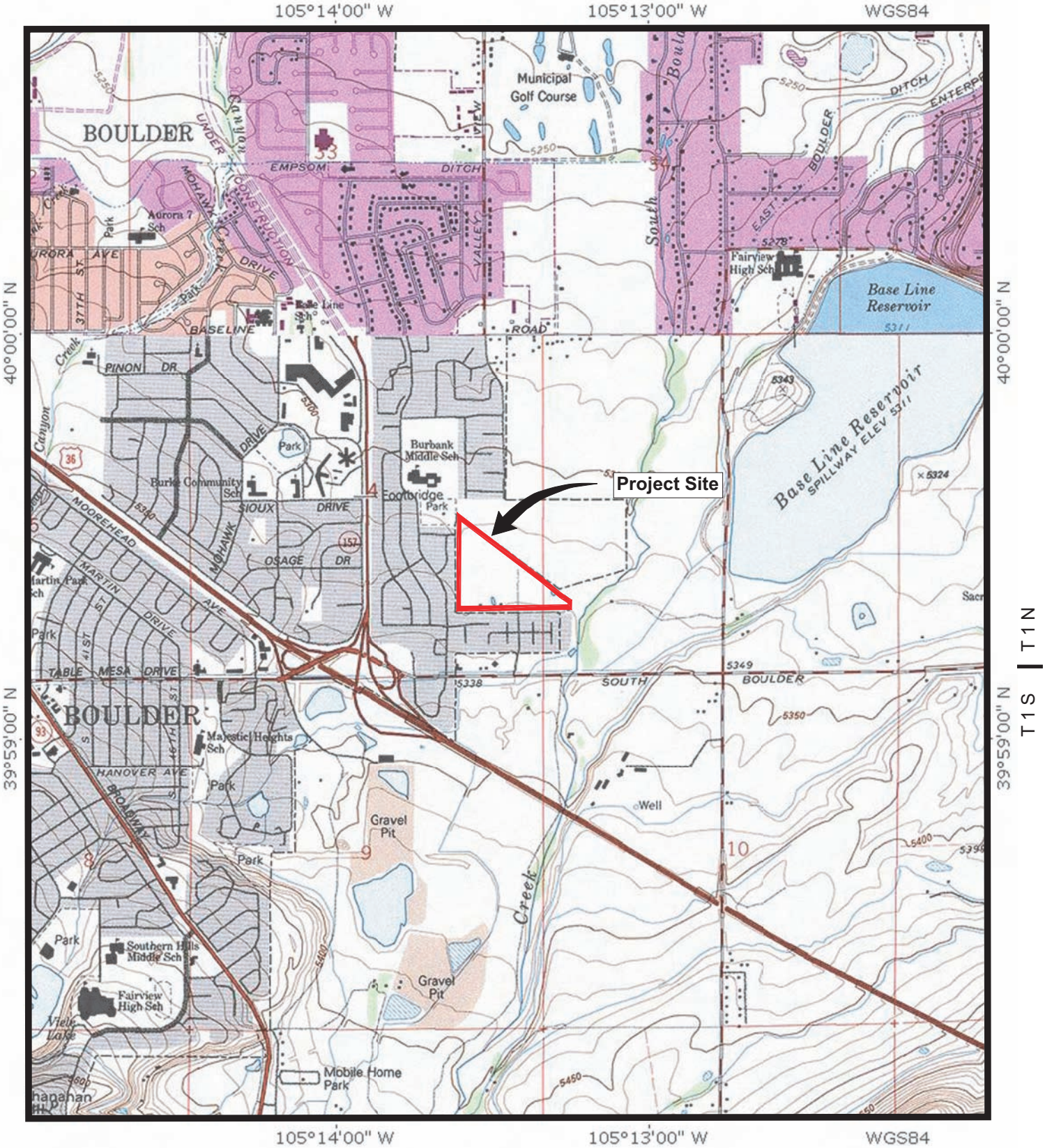
FIGURE 1. Vicinity Map
Hogan Pancost Property

N

Scale 1" = 600'

WESTERN
ECOLOGICAL
RESOURCE, INC.
711 Walnut Street • Boulder, CO 80302

R 70 W



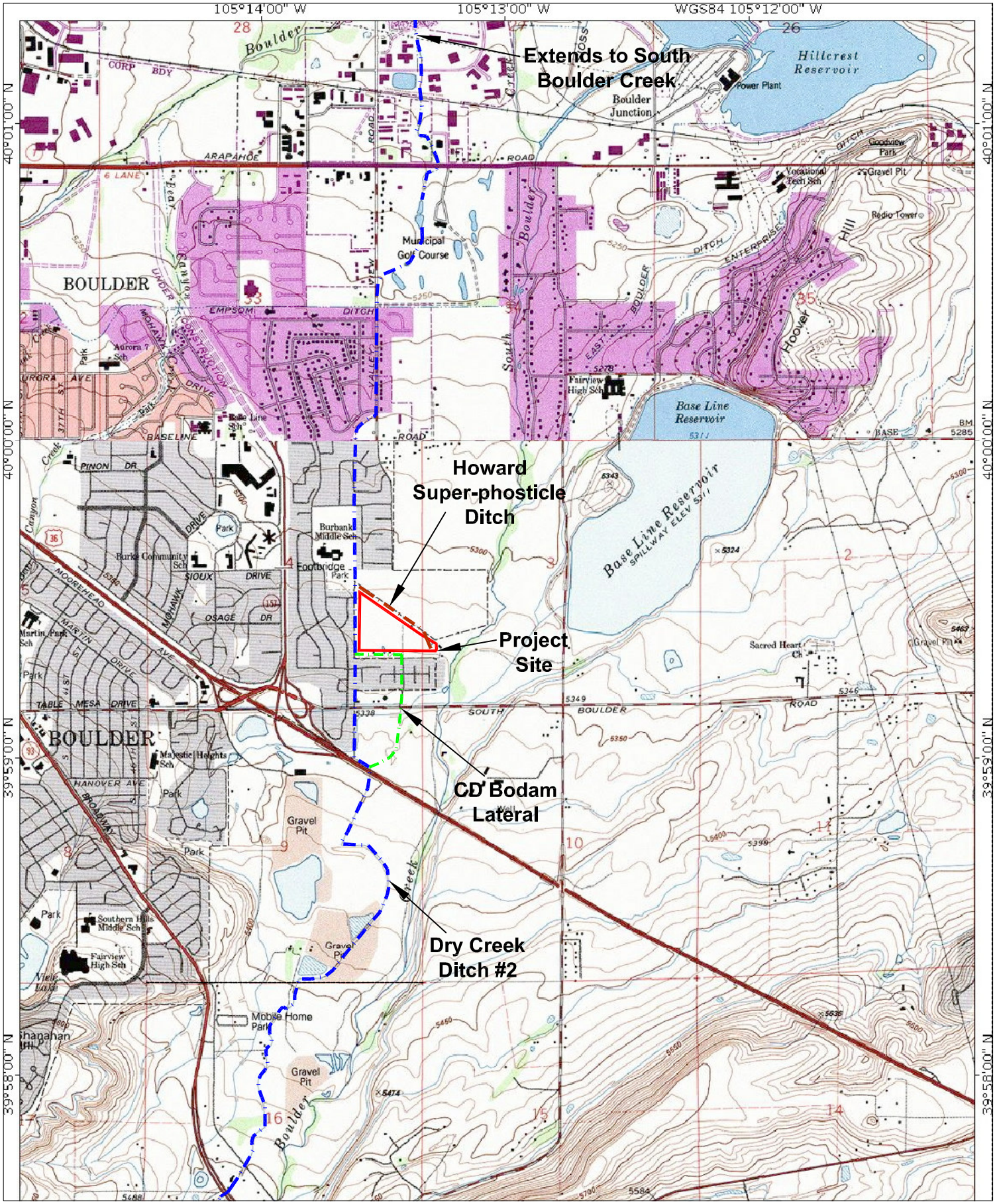
BASE: USGS 7.5 Minute Louisville, Colorado Quadrangle
Photorevised: 1990

FIGURE 2. Project Location Map
Hogan Pancost Property

WESTERN ECOLOGICAL RESOURCE, INC.
711 Walnut Street • Boulder, CO 80302

N

Scale 1" = 2000'
Contour Interval = 10'



Base: USGS 7.5 Minute Louisville, Colorado Quadrangle
Photo Revised: 1990

Figure 3. Ditches & CD Bodam Lateral

Date: October 2008
1" = 2600'

prepared by:
Western Ecological Resource, Inc.
711 Walnut Street
Boulder, CO 80302
(303) 449-9009 FAX (303) 449-9038

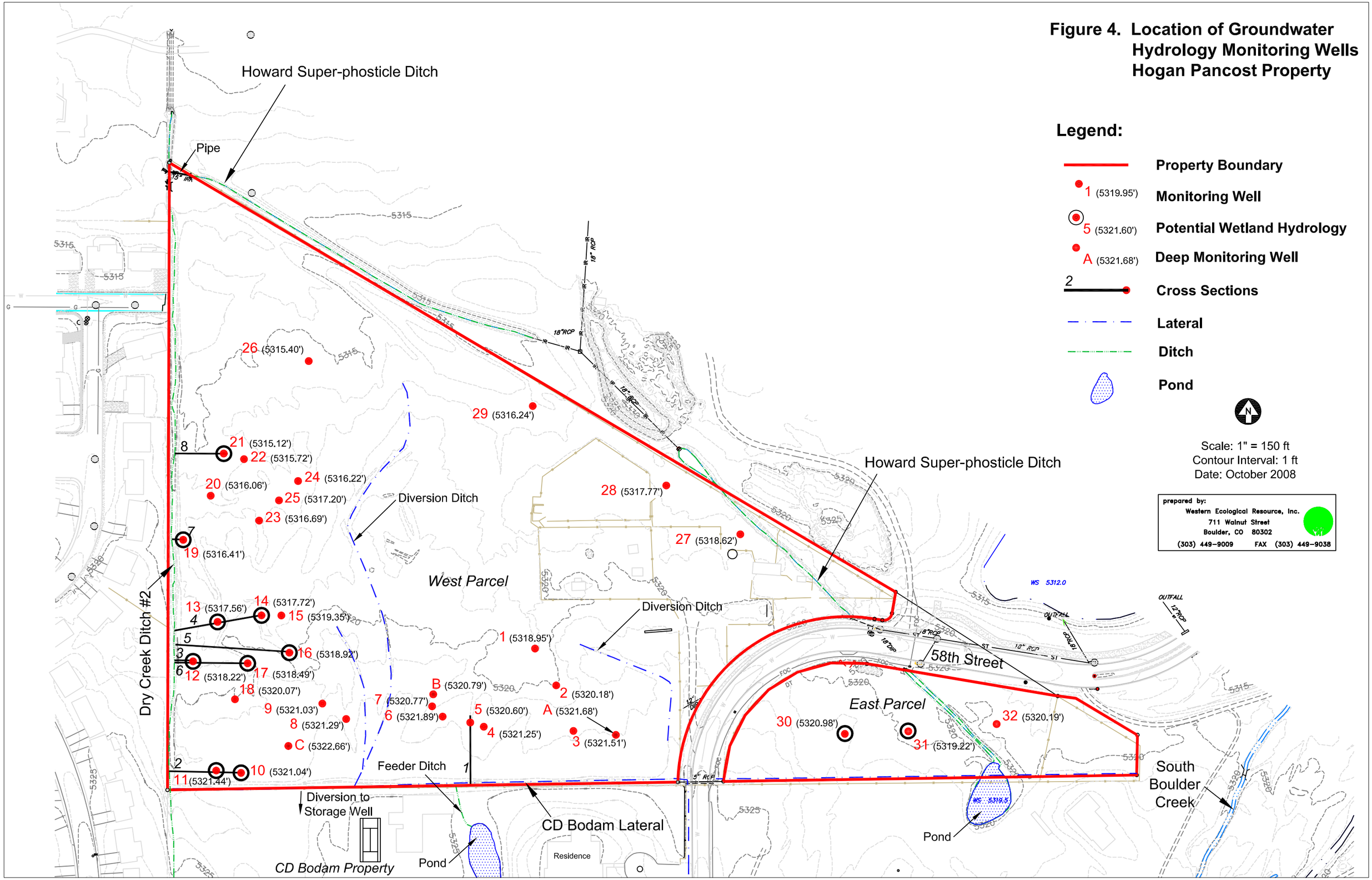


Figure 4. Location of Groundwater Hydrology Monitoring Wells Hogan Pancost Property

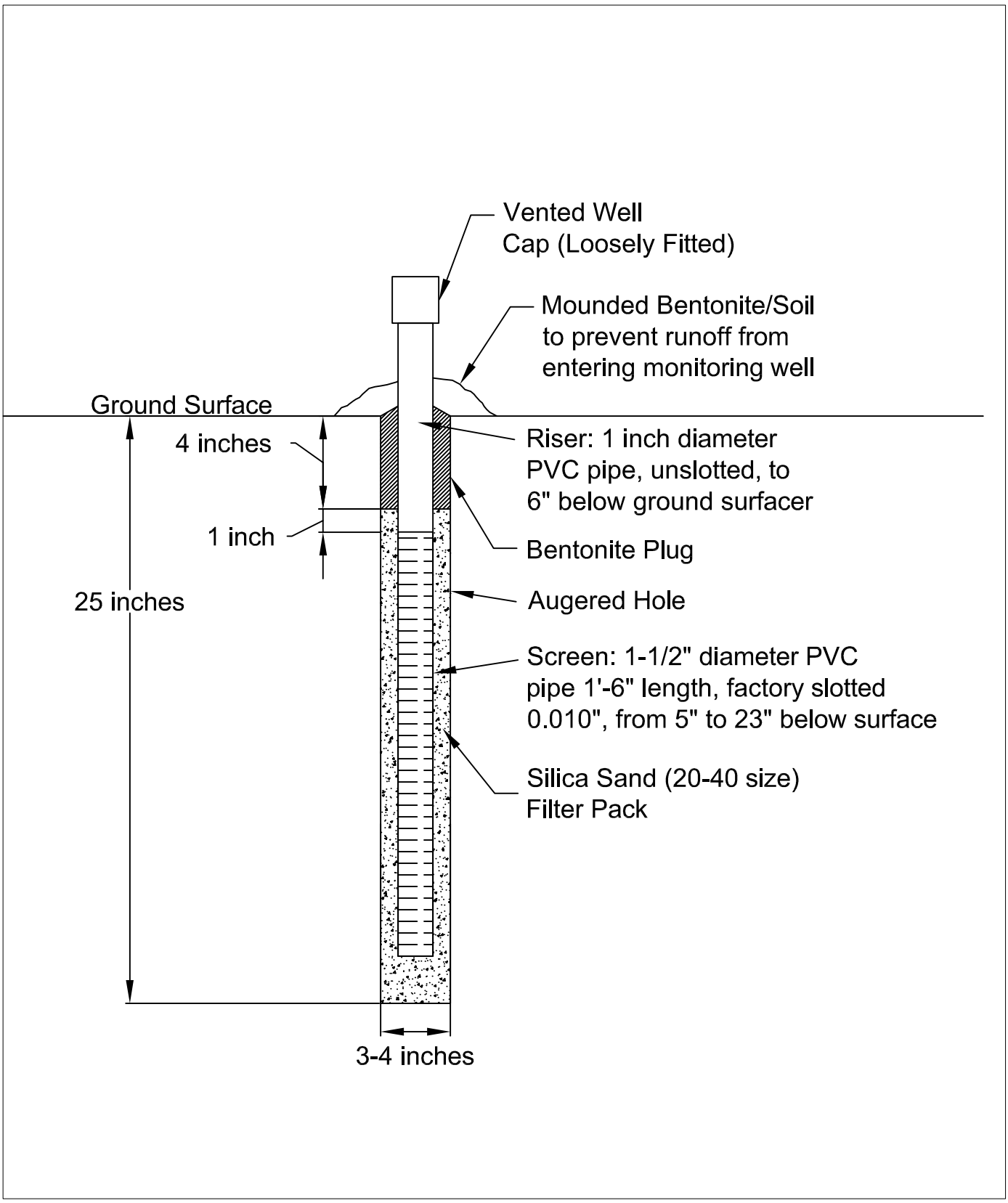
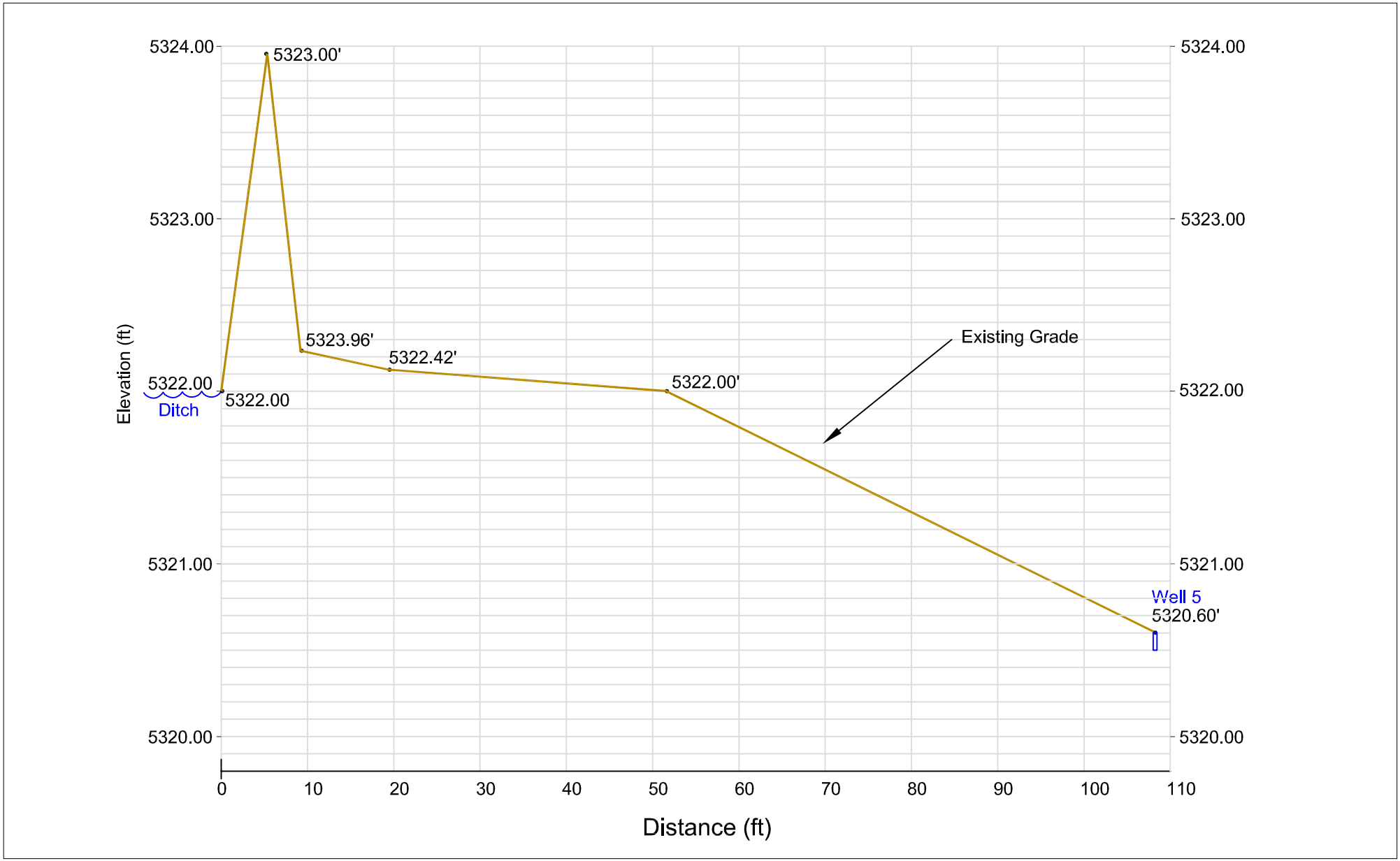


Figure 5. Hydrology Monitoring Well Design

prepared by:
Western Ecological Resource, Inc.
711 Walnut Street
Boulder, CO 80302
(303) 449-9009 FAX (303) 449-9038

Scale: 1 inch = 6 inches
Date: October 2008



Date: October 2008
Not to Scale

Figure 6. Cross-Section 1
Dry Creek Ditch to Well 5

prepared by:
Western Ecological Resource, Inc.
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Boulder, CO 80302
(303) 449-9009 FAX (303) 449-9038

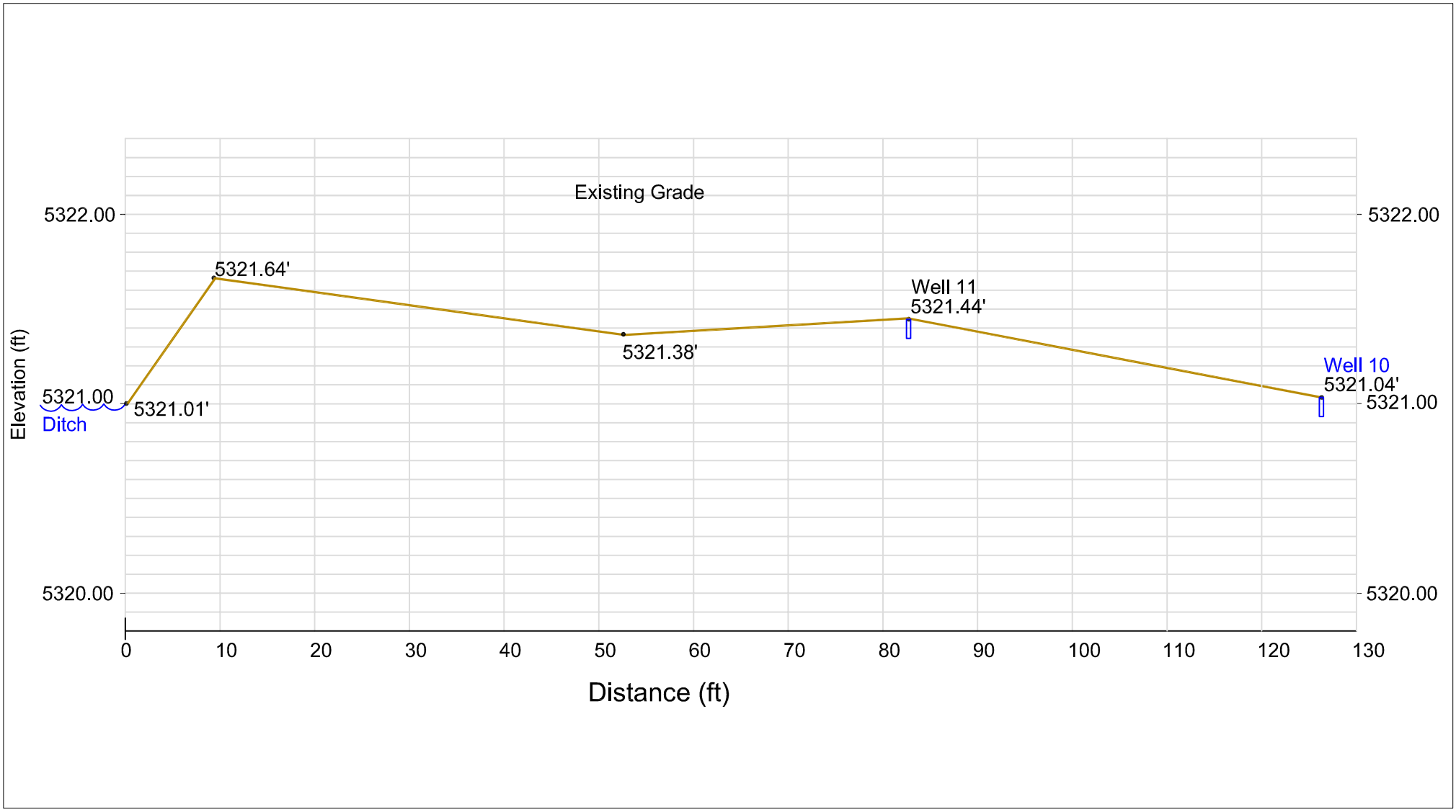

Figure 7. Cross-Section 2
Dry Creek Ditch to Wells 10 & 11

Date: October 2008
Not to Scale

prepared by:
Western Ecological Resource, Inc.
711 Walnut Street
Boulder, CO 80302
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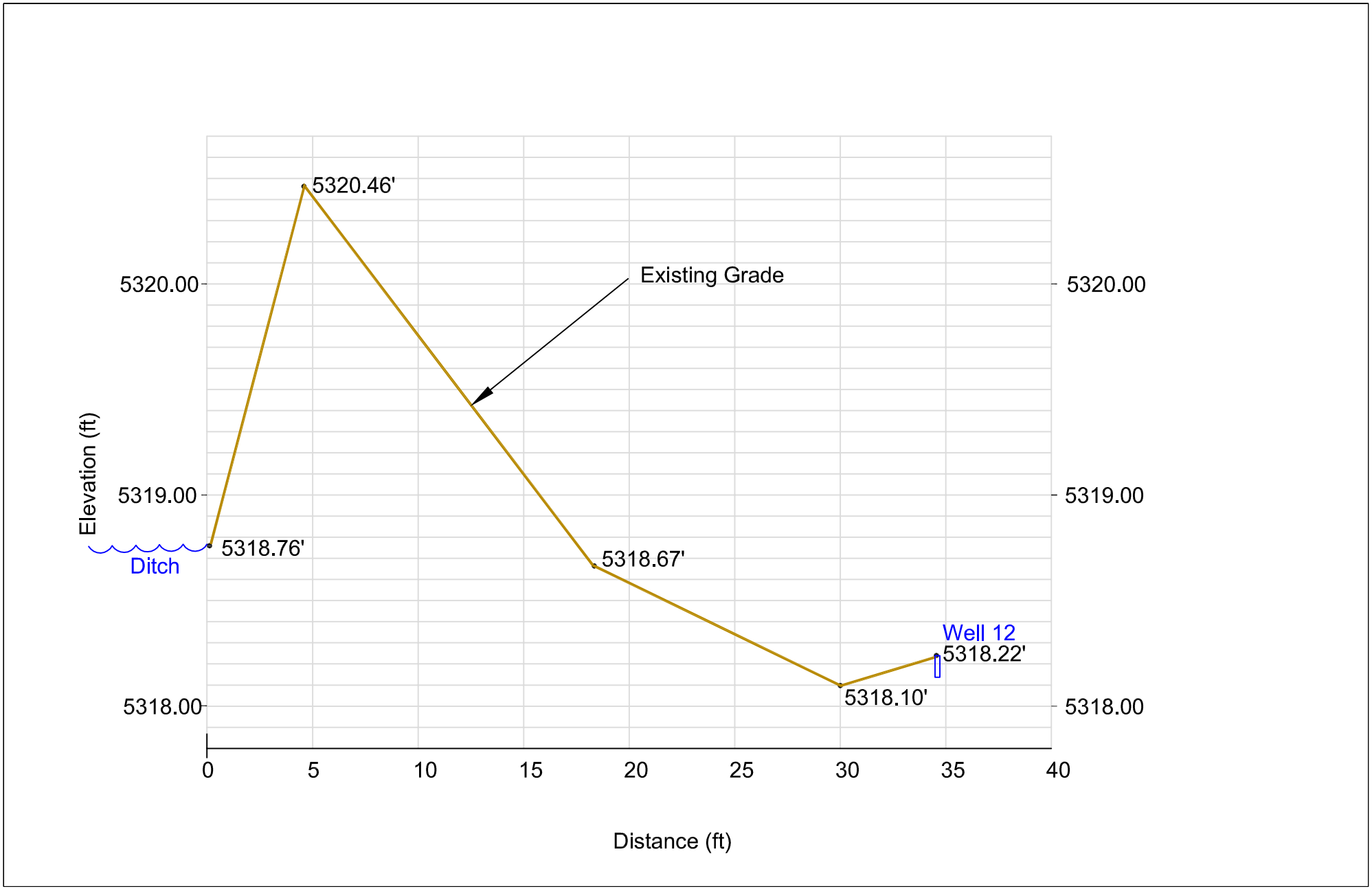

Figure 8. Cross-Section 3
Dry Creek Ditch to Well 12

Date: October 2008
Not to Scale

prepared by:
Western Ecological Resource, Inc.
711 Walnut Street
Boulder, CO 80302
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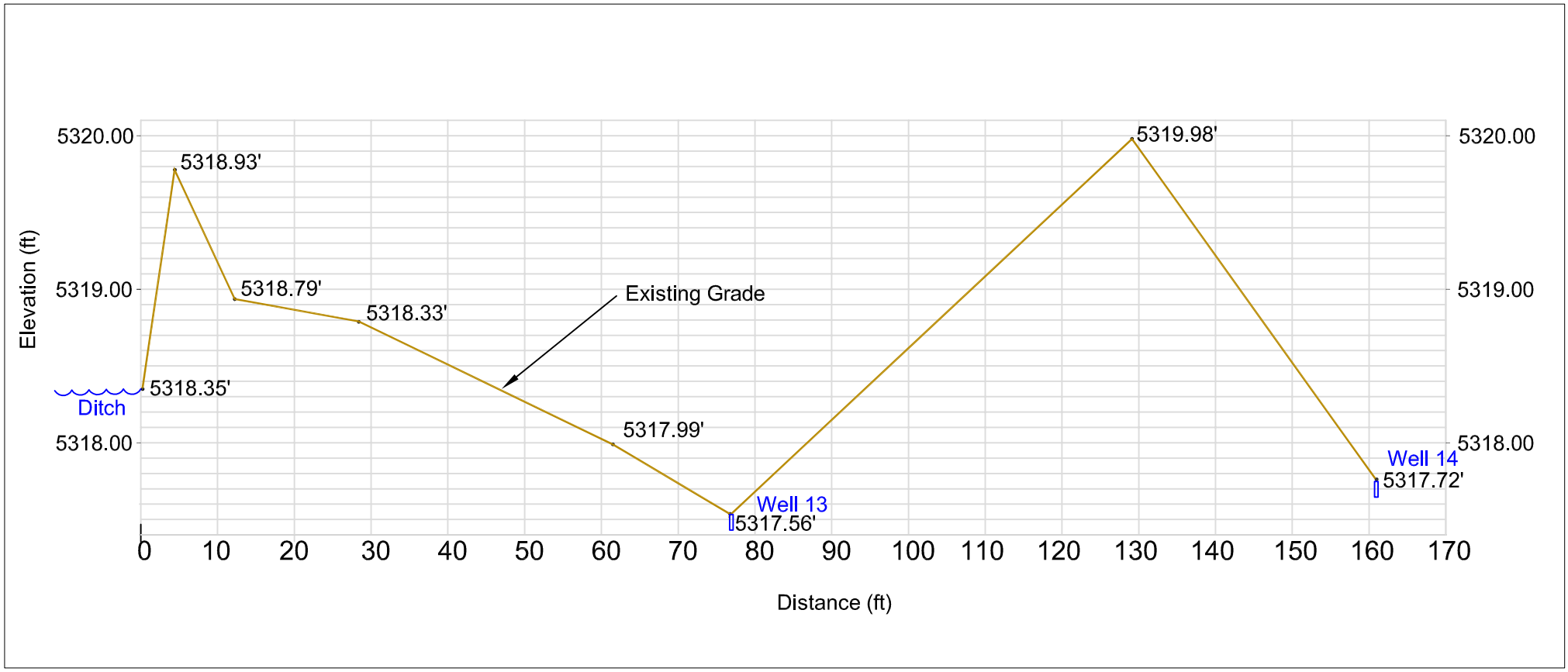

Figure 9. Cross-Section 4
Dry Creek Ditch to Wells 13 & 14

Date: October 2008
Not to Scale

prepared by:
Western Ecological Resource, Inc.
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Boulder, CO 80302
(303) 449-9009 FAX (303) 449-9038

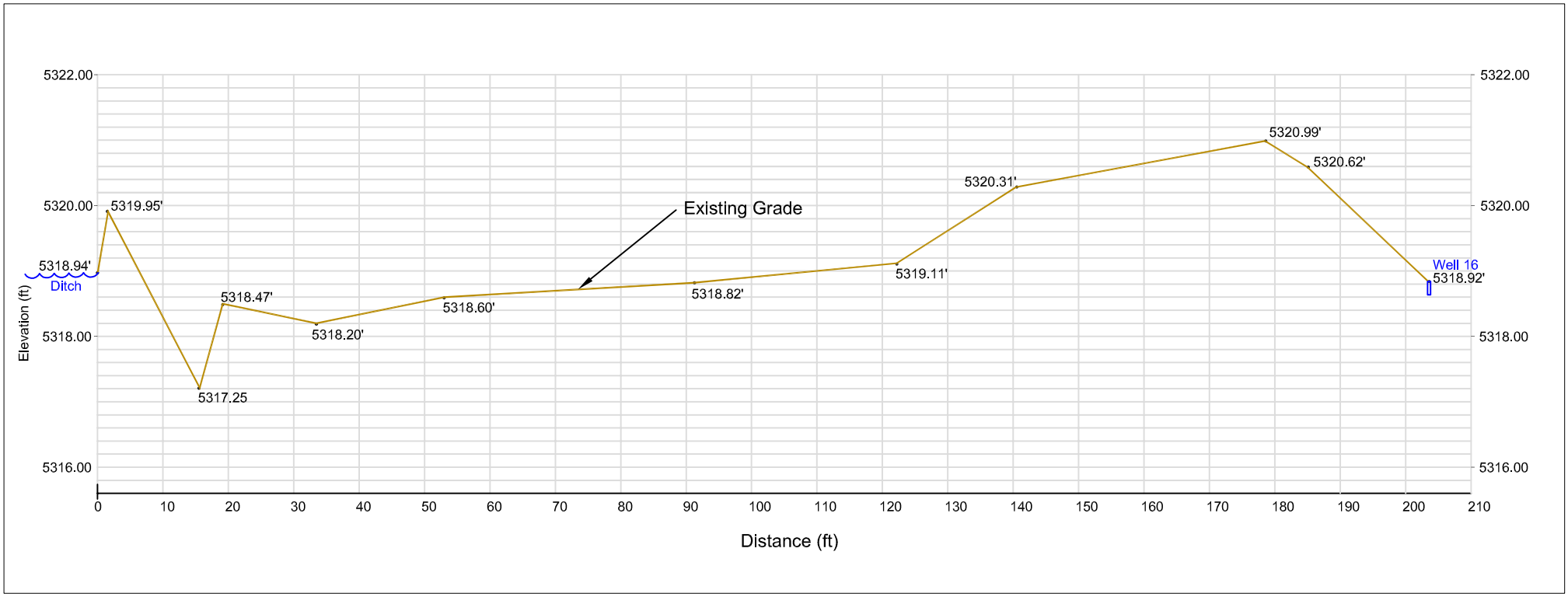

Figure 10. Cross-Section 5
Dry Creek Ditch to Well 16

Date: October 2008
Not to Scale

prepared by:
Western Ecological Resource, Inc.
711 Walnut Street
Boulder, CO 80302
(303) 449-9009 FAX (303) 449-9038

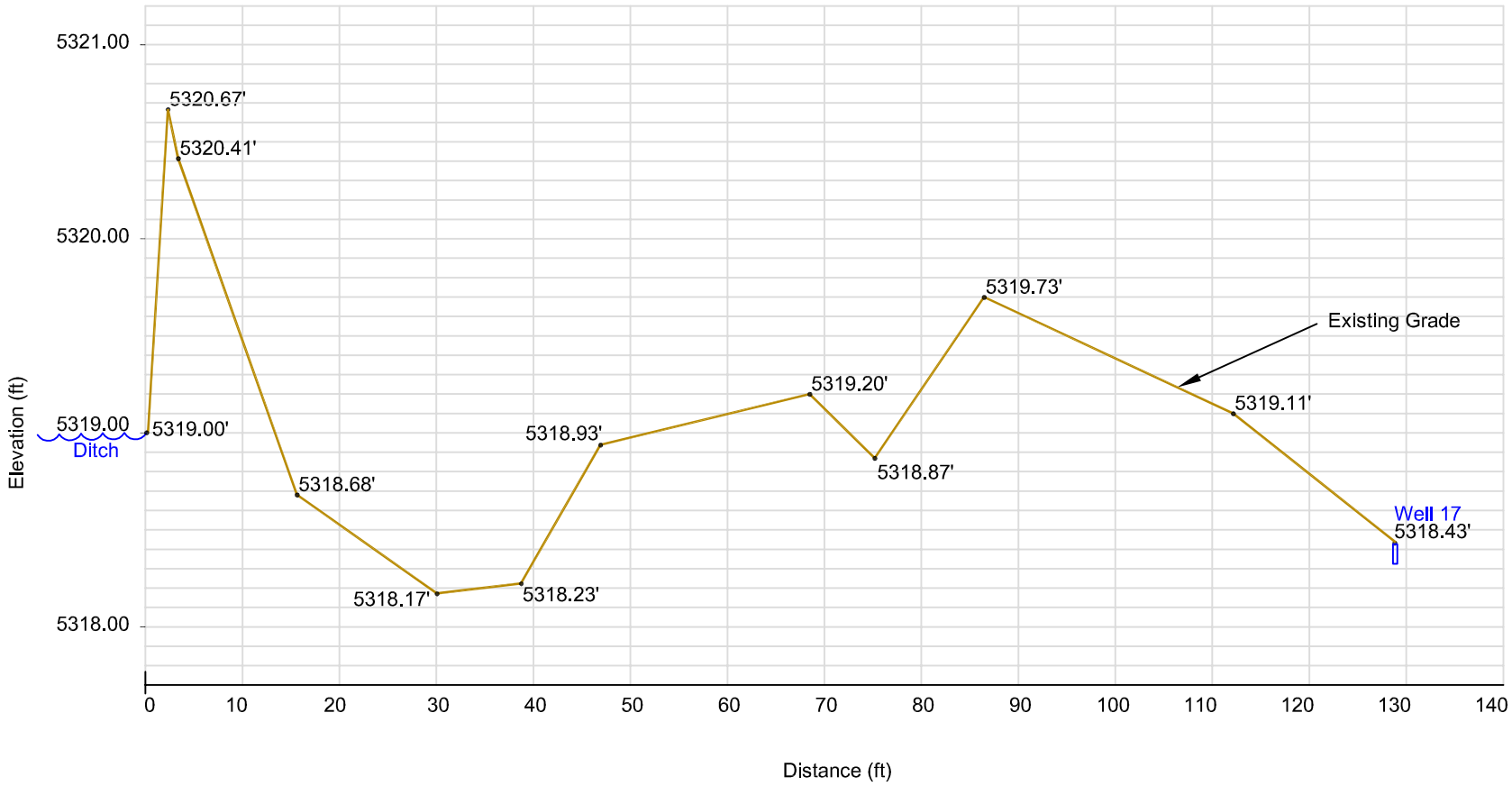

Figure 11. Cross-Section 6
Dry Creek Ditch to Well 17

Date: October 2008
Not to Scale

prepared by:
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711 Walnut Street
Boulder, CO 80302
(303) 449-9009 FAX (303) 449-9038

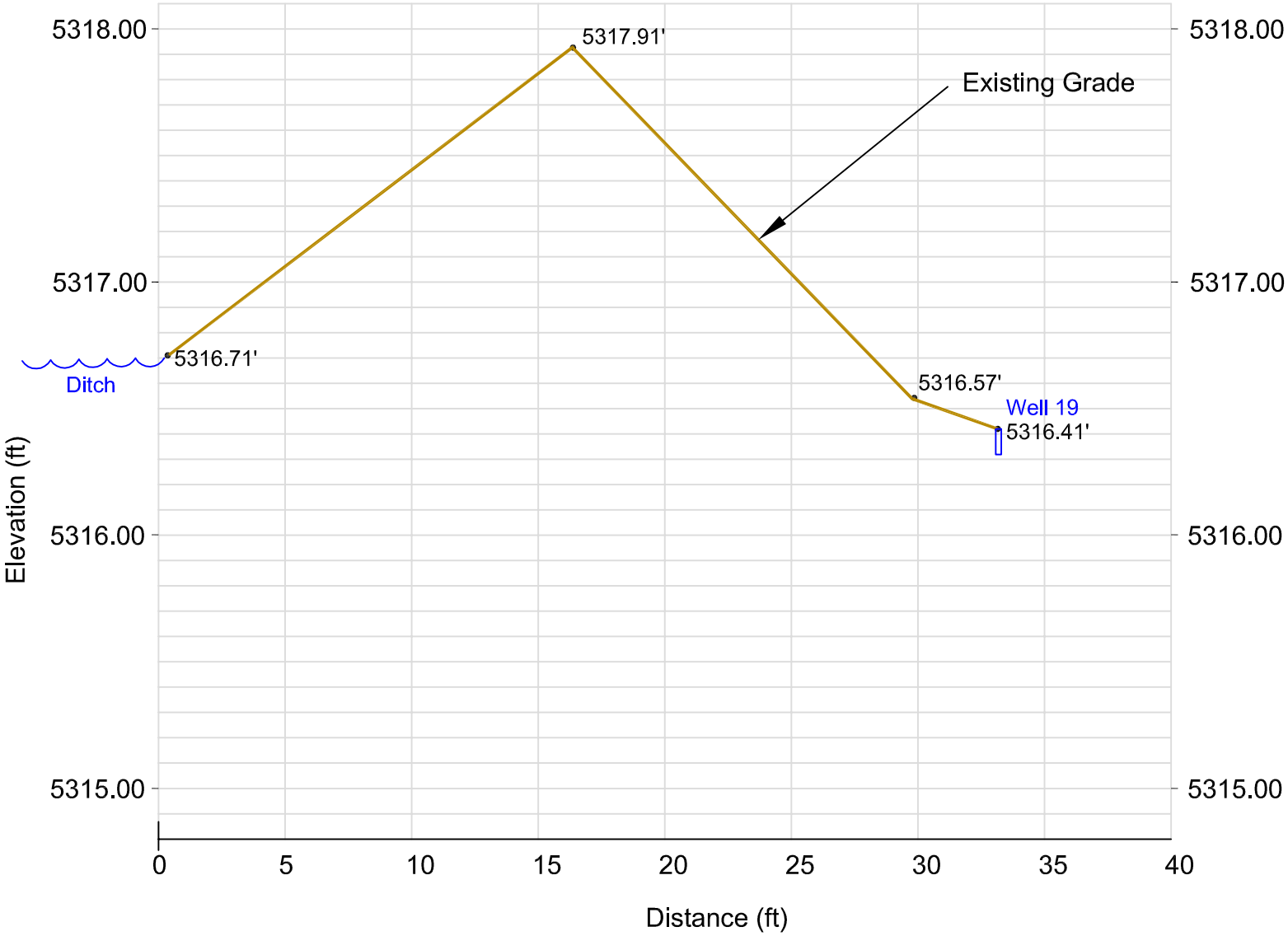


Figure 12. Cross-Section 7
Dry Creek Ditch to Well 19

Date: October 2008
Not to Scale

prepared by:
Western Ecological Resource, Inc.
711 Walnut Street
Boulder, CO 80302
(303) 449-9009 FAX (303) 449-9038

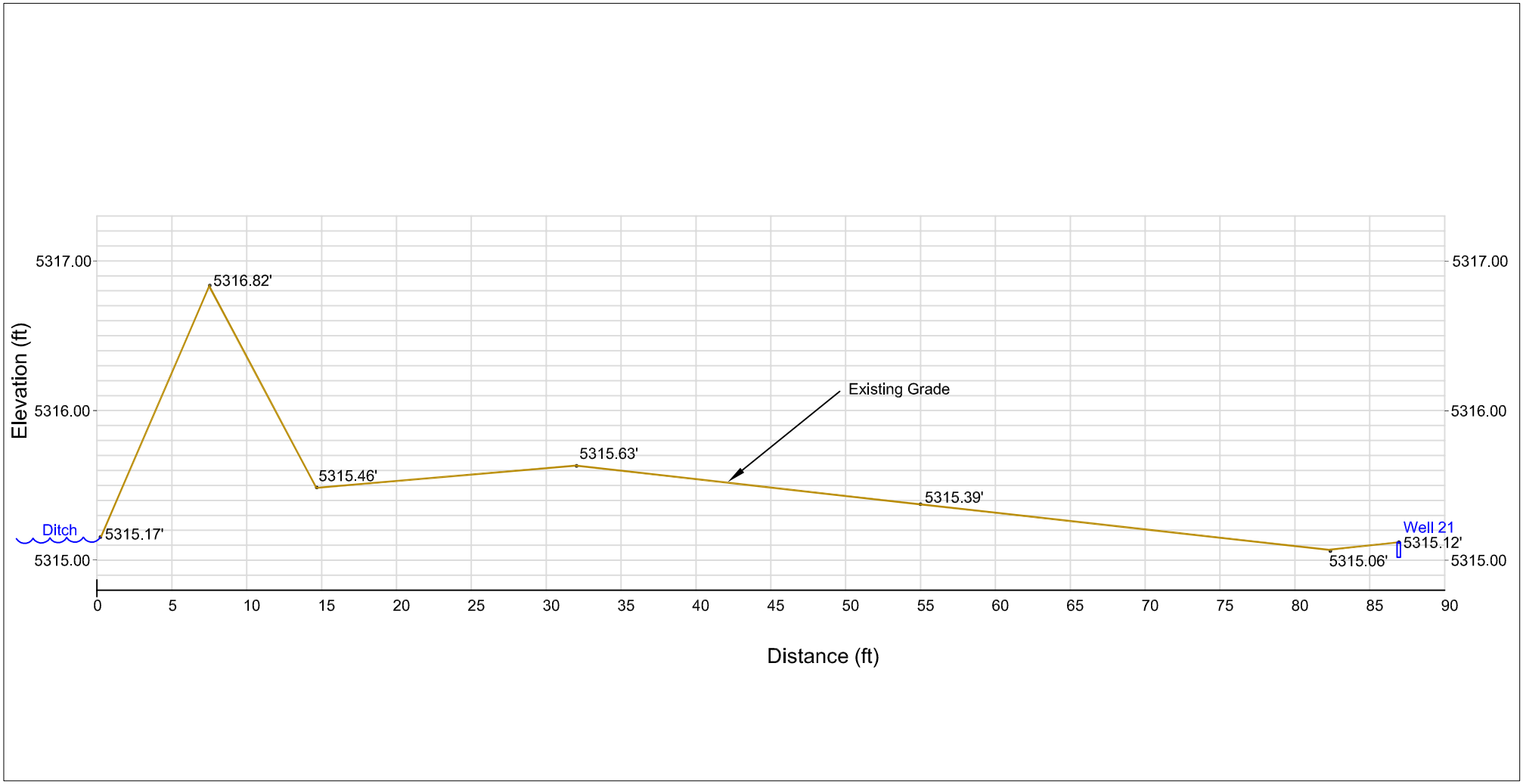


Figure 13. Cross-Section 8
Dry Creek Ditch to Well 21

Date: October 2008
Not to Scale

prepared by:
Western Ecological Resource, Inc.
711 Walnut Street
Boulder, CO 80302
(303) 449-9009 FAX (303) 449-9038

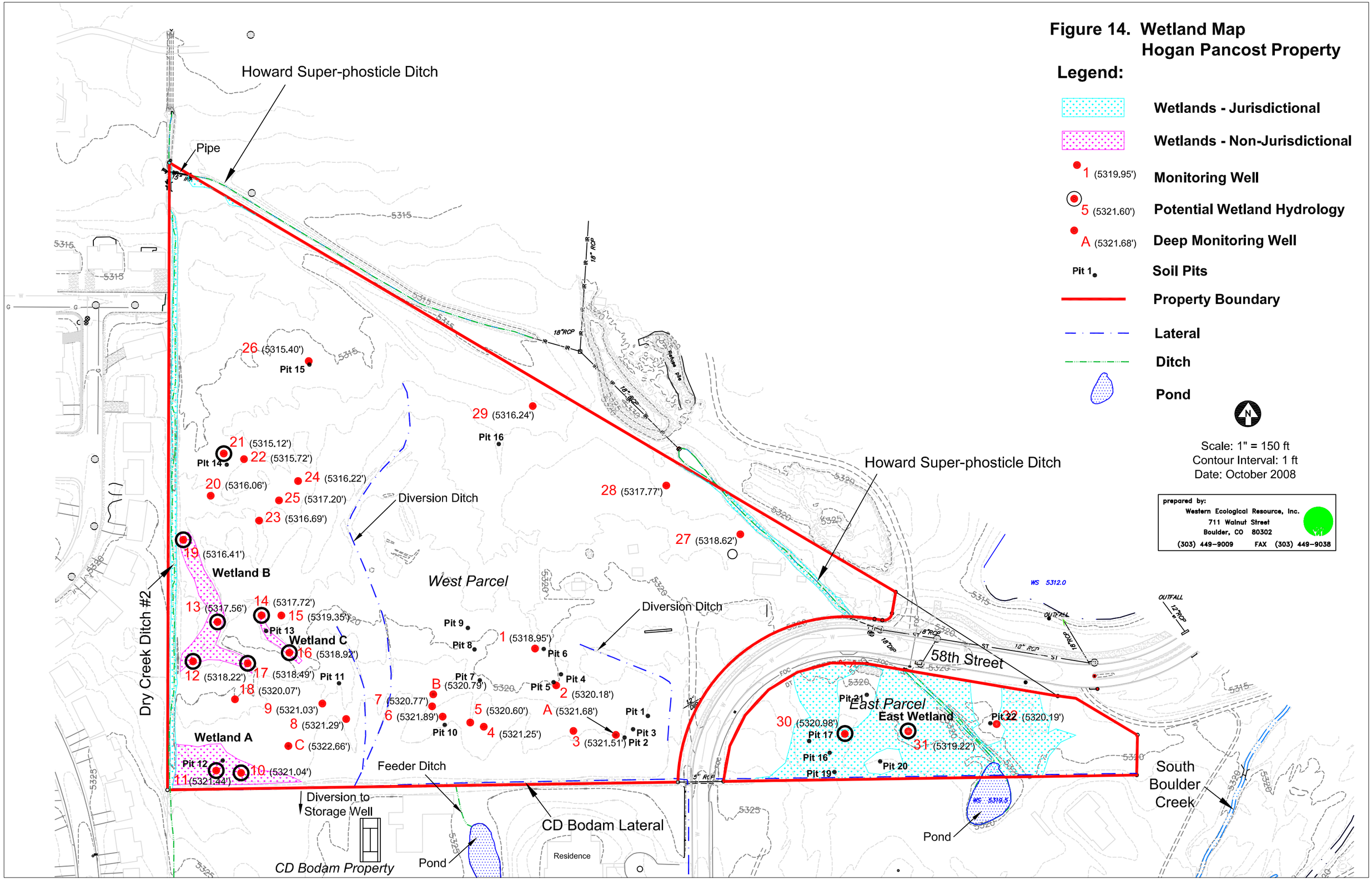


Figure 14. Wetland Map
Hogan Pancost Property
Legend:
Wetlands - Jurisdictional
Wetlands - Non-Jurisdictional
1 (5319.95')
Monitoring Well
5 (5321.60')
Potential Wetland Hydrology
A (5321.68')
Deep Monitoring Well
Pit 1
Soil Pits
Property Boundary
Lateral
Ditch
Pond
Scale: 1" = 150 ft
Contour Interval: 1 ft
Date: October 2008
prepared by:
Western Ecological Resource, Inc.
711 Walnut Street
Boulder, CO 80302
(303) 449-9009 FAX (303) 449-9038
Howard Super-phosticle Ditch
Pipe
Diversion Ditch
West Parcel
Wetland B
Wetland C
Wetland A
Dry Creek Ditch #2
Diversion Ditch
Howard Super-phosticle Ditch
58th Street
East Parcel
East Wetland
South Boulder Creek
Feeder Ditch
CD Bodam Lateral
Diversion to Storage Well
CD Bodam Property
Pond
Residence
Pond
26 (5315.40')
Pit 15
29 (5316.24')
Pit 16
21 (5315.12')
Pit 14
22 (5315.72')
24 (5316.22')
20 (5316.06')
25 (5317.20')
23 (5316.69')
28 (5317.77')
27 (5318.62')
19 (5316.41')
14 (5317.72')
13 (5317.56')
15 (5319.35')
Pit 13
16 (5318.92')
12 (5318.22')
17 (5318.49')
Pit 11
18 (5320.07')
9 (5321.03')
8 (5321.29')
C (5322.66')
Pit 12
10 (5321.04')
11 (5321.44')
Pit 9
Pit 8
1 (5318.95')
Pit 6
Pit 7
B (5320.79')
Pit 5
Pit 4
2 (5320.18')
7 (5320.77')
6 (5321.89')
5 (5320.60')
A (5321.68')
Pit 1
Pit 10
4 (5321.25')
3 (5321.51')
Pit 3
Pit 2
Pit 21
30 (5320.98')
Pit 17
Pit 16
Pit 19
Pit 20
31 (5319.22')
Pit 22 (5320.19')
WS 5312.0
WS 5319.5
OUTFALL
12" RCP
18" RCP
8" RCP
5" RCP

8.0 Tables

TABLE 1
Plant Species List
Hogan-Pancost Property
Boulder, Colorado

Scientific Name	Common Name	Family	Origin+	Wetland Status++
Trees				
Acer negundo	Boxelder	Aceraceae	N	FACW*
Elaeagnus angustifolia	Russian olive	Eleangnaceae	I+	FAC
Fraxinus pensylvanica	Green Ash	Oleaceae	I	FACW
Populus deltoides	Plains cottonwood	Salicaceae	N	FAC
Salix fragilis	Crack willow	Salicaceae	I	FAC
Ulmus pumila	Chinese elm	Ulmaceae	I	NL
Shrubs/Subshrubs				
Prunus virginiana var. melanocarpa	Native chokecherry	Rosaceae	N	FACU
Rosa woodsii	Wood rose	Rosaceae	N	FACU
Salix exigua	Sandbar willow	Salicaceae	N	OBL
Perennial Graminoids				
Agrostis gigantea (alba)	Redtop	Poaceae	I	FACW
Alopecurus pratensis	Meadow foxtail	Poaceae	I	FACW
Andropogon gerardii	Big bluestem	Poaceae	N	FAC-
Bromus inermis	Smooth brome	Poaceae	I	NL
Carex bebbii	Bebb sedge	Cyperaceae	N	OBL
Carex emoryi	Emory sedge	Cyperaceae	N	OBL
Carex lanuginosa	Woolly sedge	Cyperaceae	N	OBL
Carex nebrascensis	Nebraska sedge	Cyperaceae	N	OBL
Carex praegracilis	Clustered field sedge	Cyperaceae	N	FACW
Carex vulpinoidea	Fox sedge	Cyperaceae	N	OBL
Catabrosa aquatica	Brook grass	Poaceae	N	OBL
Chondrosum gracile	Blue grama	Poaceae	N	NL
Dactylis glomerata	Orchardgrass	Poaceae	I	FACU
Eleocharis macrostachya (=E. palustris)	Creeping spikerush	Cyperaceae	N	OBL
Elytrigia repens	Quackgrass	Poaceae	I+	FAC
Festuca pratensis	Meadow fescue	Poaceae	I	FAC
Glyceria grandis (maxima)	American mannagrass	Poaceae	N	OBL
Juncus arcticus subsp. ater (=J. balticus)	Baltic rush	Juncaceae	N	OBL
Juncus articulatus	Jointed rush	Juncaceae	I	NO, (OBL)
Juncus tennis	Slender rush	Juncaceae	N	FAC
Panicum virgatum	Switchgrass	Poaceae	N	FAC

TABLE 1
Plant Species List
Hogan-Pancost Property
Boulder, Colorado

Scientific Name	Common Name	Family	Origin+	Wetland Status++
Pascopyrum smithii (Agropyron)	Western wheatgrass	Poaceae	N	FACU
Phalaris arundinacea	Reed Canarygrass	Poaceae	[N]	FACW+
Phleum pratense	Timothy	Poaceae	I	FACU
Poa pratensis	Kentucky bluegrass	Poaceae	I	FACU
Scirpus acutus	Hardstem bulrush	Cyperaceae	N	OBL
Sorghastrum nutans	Indian grass	Poaceae	N	FACU
Typha latifolia	Broadleaf cattail	Typhaceae	N	OBL
Perennial Forbs				
Achillea lanulosa	Yarrow	Asteraceae	N	FACU
Ambrosia psilostachya	Naked spike ragweed	Asteraceae	N	FAC
Asclepias speciosa	Showy milkweed	Asclepiadaceae	N	FAC
Asparagus officinalis	Asparagus	Liliaceae	I	FACU-
Aster lanceolatus ssp. hesperius	Siskiyou aster	Asteraceae	N	OBL
Barbarea orthoceras	Wintercress	Brassicaceae	N	OBL
Cardaria draba	Hoary cress; Whitetop	Brassicaceae	I+	
Cichorum intybus	Chicory	Asteraceae	I+	NL
Cirsium arvense (Breea)	Canada thistle	Asteraceae	I+	FACU
Convolvulus arvensis	Field bindweed	Convolvulaceae	I+	NL
Daucus carota	Wild carrot	Apiaceae	I	
Epilobium ciliatum	Northern willowherb	Onagraceae	N	OBL
Erigeron flagellaris	Running fleabane	Asteraceae	N	FAC
Gaura mollis (parviflora)	Velvetleaf butterfly weed	Onagraceae	N	NI
Geum macrophyllum var. perincisum	Largeleaf avens	Rosaceae	N	OBL
Glycyrrhiza lepidota	Wild licorice	Fabaceae	N	FACU
Grindelia squarrosa	Sticky gumweed	Asteraceae	N	FACU-
Heterotheca villosa	Golden aster	Asteraceae	N	NL
Leucanthemum vulgare (Chrysanthemum leucanthemum)	Ox-eye daisy	Asteraceae	I+	NL
Linaria genistifolia subsp. dalmatica (L. dalmatica)	Dalmatian toadflax	Scrophulariaceae	I+	NL
Lotus tenuis	Narrow-leaf birds-foot trefoil	Fabaceae	I	NL
Malva neglecta	Cheeseweed	Malvaceae	I	NL
Marrubium vulgare	Horehound	Lamiaceae	I	NL
Mentha arvensis	Field mint	Lamiaceae	N	FACW

TABLE 1
Plant Species List
Hogan-Pancost Property
Boulder, Colorado

Scientific Name	Common Name	Family	Origin+	Wetland Status++
Persicaria mphibian var. stipulaceum	Water smartweed	Polygonaceae	N	OBL
Plantago lanceolata	English plantain	Plantaginaceae	I	FAC
Plantago major	Common plantain	Plantaginaceae	I	FAC
Potentilla recta	Sulphur cinquefoil	Rosaceae	I+	
Ranunculus macounii	Macoun's buttercup	Ranunculaceae	N	OBL
Rumex crispus	Curly dock	Polygonaceae	I	FACW
Securigera varia	Crown vetch	Fabaceae	I	NL
Solidago canadensis	Canada goldenrod	Asteraceae	N	FACU
Tanacetum vulgare	Common tansy	Asteraceae	I+	
Thermopsis divaricarpa	Spreading goldenbanner	Fabaceae	N	NL
Trifolium pratense	Red clover	Fabaceae	I	FACU
Trifolium repens	White Dutch clover	Fabaceae	I	FACU
Verbena hastata	Blue vervain	Verbenaceae	N	FACW
Ferns and Fern Allies				
Equisetum arvense	Field horsetail	Equisetaceae	N	FAC
Hippochaete hyemalis	Scouring rush	Equisetaceae	N	FACW
Cacti				
Opuntia polyacantha	Prickly pear	Cactaceae	N	NL
Annual/Biennial Forbs				
Acosta diffusa (Centaurea)	Diffuse knapweed	Asteraceae	I+	NL
Alyssum desertorum	Desert madwort	Brassicaceae	I	
Amaranthus retroflexus	Red-root pigweed	Amaranthaceae	I	FACU
Arctium minus	Common burdock	Asteraceae	I+	NL
Bidens cernua	Nodding beggar tick	Asteraceae	N	OBL
Camelina microcarpa	False flax	Brassicaceae	I	NL
Carduus nutans ssp. macrolepis	Musk thistle	Asteraceae	I+	NL
Chenopodium album	Lambs quarters	Chenopodiaceae	I	FAC
Conyza canadensis	Canada horseweed	Asteraceae	I	FACU-
Cynoglossum officinale	Houndstongue	Boraginaceae	I+	NL
Dipsacus fullonum (D. sylvestris)	Common Teasel	Dipsacaceae	I+	
Erodium cicutarium	Redstem filaree	Geraniaceae	I+	NL
Impatiens capensis	Jewelweed	Balsaminaceae	N	FACW
Lactuca serriola	Prickly lettuce	Asteraceae	I	FAC

TABLE 1
Plant Species List
Hogan-Pancost Property
Boulder, Colorado

Scientific Name	Common Name	Family	Origin+	Wetland Status++
Oenothera villosa	Hairy evening primrose	Onagraceae	N	FAC
Onopordum acanthium	Scotch thistle	Asteraceae	I+	NL
Persicaria lapathifolia	Curlytop knotweed	Polygonaceae	N	OBL
Persicaria pensylvanica	Pennsylvania smartweed	Polygonaceae	N	FACW+
Rorippa sphaerocarpa	Roundfruit yellowcress	Brassicaceae	N	NO
Sisymbrium altissimum	Tumble mustard	Brassicaceae	I	FACU
Thlaspi arvense	Pennycress	Brassicaceae	I	NI
Tragopogon dubius	Salsify	Asteraceae	I	NL
Verbascum thapsus	Common mullein	Scrophulariaceae	I+	NL
Annual Graminoids				
Anisantha tectorum (Bromus)	Cheatgrass; Downy brome	Poaceae	I+	NL

+ Origin
N = Native; [N] = Naturalized, native?
I = Introduced
I+ = Colorado State Noxious Weed

++ Wetland Status (R5 Great Plains Region)
OBL = Obligate Wetland
FACW = Facultative Wetland
FAC = Facultative
FACU = Facultative Upland
UPL = Obligate Upland
NL = Not listed on USFWS Regional Hydrophyte List
NI = No Indicator (insufficient information)
NO = Non-occurrence (species does not occur in this region)
* = tentative assignment
+ = frequency toward the higher end of the category
- frequency toward the lower end of the category

TABLE 2. Groundwater Hydrology Monitoring Well Data

DATE:	4/28/2008	5/5/2008	5/9/2008	5/16/2008	5/23/2008	5/27/2008	5/30/2008	6/6/2008	6/10/2008	6/13/2008	6/19/2008	6/26/2008	7/2/2008	7/9/2008	7/16/2008	7/23/2008	7/30/2008	8/4/2008	8/6/2008	8/8/2008	8/11/2008	8/13/2008	8/20/2008	8/25/2008	8/26/2008	8/27/2008	8/28/2008
Well Number	Depth to Water (feet)	Depth to Water (feet)	Depth to Water (feet)	Depth to Water (feet)	Depth to Water (feet)	Depth to Water (feet)	Depth to Water (feet)	Depth to Water (feet)	Depth to Water (feet)	Depth to Water (feet)	Depth to Water (feet)	Depth to Water (feet)	Depth to Water (feet)	Depth to Water (feet)	Depth to Water (feet)	Depth to Water (feet)	Depth to Water (feet)	Depth to Water (feet)	Depth to Water (feet)	Depth to Water (feet)	Depth to Water (feet)	Depth to Water (feet)	Depth to Water (feet)	Depth to Water (feet)	Depth to Water (feet)	Depth to Water (feet)	Depth to Water (feet)
N-1	Dry	Dry	Dry	1.88	1.73	___	1.64	1.46	___	1.81	1.74	1.92	1.87	Dry	Dry	Dry	Dry	Dry	Dry	1.80	1.63	1.73	1.11	1.38	2.45	1.51	1.55
N-2	Dry	Dry	Dry	Dry	Dry	___	Dry	1.66	___	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	1.28	1.70	1.75	Dry	Dry
N-3	Dry	Dry	Dry	1.84	1.35	___	Dry	1.20	___	1.72	1.49	1.64	1.54	1.75	1.85	1.68	1.76	Dry	1.83	1.49	1.35	1.56	1.02	1.56	1.65	1.83	1.87
N-4	Dry	Dry	Dry	1.85	1.40	___	1.86	1.15	___	1.79	1.61	1.72	1.65	1.84	Dry	1.78	Dry	Dry	Dry	1.66	1.58	1.86	1.24	1.76	1.85	Dry	Dry
N-5	Dry	1.76	1.63	1.40	0.96	0.65	1.35	0.66	1.39	1.34	1.09	1.22	1.16	1.32	1.45	1.26	1.38	1.49	1.41	1.20	1.11	1.40	0.74	1.24	1.30	1.42	1.50
N-6	Dry	Dry	Dry	Dry	Dry	___	Dry	Dry	___	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
N-7	Dry	Dry	Dry	Dry	Dry	___	Dry	Dry	___	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
N-8	Dry	Dry	Dry	Dry	Dry	___	Dry	Dry	___	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
N-9	Dry	Dry	Dry	Dry	Dry	___	Dry	Dry	___	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
N-10	Dry	Dry	Dry	Dry	0.74	1.30	Dry	0.58	0.61	0.57	0.49	0.49	0.46	0.55	0.55	0.48	0.53	0.62	0.62	0.62	0.70	0.69	0.74	1.06	1.20	1.38	1.29
N-11	Dry	Dry	Dry	Dry	0.90	1.56	Dry	0.76	0.82	0.81	0.71	0.70	0.67	0.78	0.71	0.68	0.75	0.81	0.85	0.88	0.95	0.97	1.06	1.43	1.54	Dry	1.74
N-12	Dry	Dry	Dry	Dry	0.50	1.70	Dry	0.04	0.06	0.02	-0.11	0.08	0.05	0.31	0.28	0.01	0.40	0.91	0.71	0.49	0.50	0.66	0.54	1.12	1.25	1.63	1.21
N-13	Dry	Dry	Dry	Dry	1.62	___	Dry	0.69	0.74	0.67	0.45	0.59	0.59	0.76	0.80	0.51	0.82	1.12	1.05	0.84	0.82	0.98	0.74	1.05	1.32	1.48	1.42
N-14	Dry	Dry	Dry	Dry	Dry	___	Dry	1.10	___	1.02	0.84	0.92	0.91	1.08	1.16	0.85	1.10	1.36	1.33	1.11	1.09	1.26	0.93	1.43	1.46	1.60	1.65
N-15	Dry	Dry	Dry	Dry	Dry	___	Dry	Dry	___	Dry	Dry	Dry	Dry	Dry	Dry		Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
N-16	Dry	Dry	Dry	Dry	Dry	___	1.67	0.96	0.96	0.91	0.77	0.84	0.83	0.94	1.02	0.81	0.96	1.08	1.08	0.92	0.88	1.03	0.73	1.09	1.15	1.50	1.31
N-17	Dry	Dry	Dry	Dry	1.23	___	1.61	0.38	0.50	0.36	0.34	0.40	0.33	0.53	0.55	0.30	0.45	0.70	0.74	0.52	0.46	0.68	0.31	0.76	0.86	0.92	1.02
N-18	Dry	Dry	Dry	Dry	Dry	___	Dry	1.33	___	1.36	1.20	1.30	1.28	1.39	1.48	1.23	1.41	1.56	1.53	1.34	1.36	1.49	1.25	1.64	1.68	Dry	Dry
N-19	Dry	Dry	Dry	Dry	1.44	___	Dry	0.71	0.69	0.66	0.48	0.59	0.56	0.68	0.61	0.48	0.61	0.98	0.84	0.75	0.76	0.86	0.83	1.41	1.60	Dry	1.54
N-20	Dry	Dry	Dry	Dry	Dry	___	Dry	1.29	___	1.26	1.01	1.17	1.14	1.37	1.34	1.08	1.29	1.62	1.60	1.43	1.41	1.55	1.40	Dry	Dry	Dry	Dry
N-21	Dry	Dry	Dry	Dry	Dry	___	Dry	1.18	___	1.18	0.81	0.91	0.88	1.06	Dry	0.82	1.10	1.28	1.27	1.10	1.06	1.20	0.97	1.48	1.54	Dry	1.69
N-22	Dry	Dry	Dry	Dry	Dry	___	Dry	Dry	___	Dry	1.59	1.63	1.61	1.78	Dry	1.55	1.71	Dry	Dry	1.75	1.73	Dry	1.55	Dry	Dry	Dry	Dry
N-23	Dry	Dry	Dry	Dry	Dry	___	Dry	Dry	___	Dry	1.63	1.68	1.67	1.83	Dry	1.63	1.80	Dry	Dry	Dry	Dry	Dry	1.66	Dry	Dry	Dry	Dry
N-24	Dry	Dry	Dry	Dry	Dry	___	Dry	Dry	___	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
N-25	Dry	Dry	Dry	Dry	Dry	___	Dry	Dry	___	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
N-26	Dry	Dry	Dry	Dry	Dry	___	Dry	Dry	___	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
N-27				Dry	Dry	___	Dry	Dry	___	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
N-28				Dry	Dry	___	Dry	Dry	___	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
N-29				Dry	Dry	___	Dry	Dry	___	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
N-30				Dry	0.67	___	1.82	Dry	___	0.42	Dry	Dry	Dry	Dry	Dry	0.55	Dry	Dry	1.26	0.85	0.71	0.65	0.46	0.86	1.13	1.42	1.68
N-31				1.20	0.81	___	0.93	0.88	___	-0.50	1.08	1.59	0.61	Dry	Dry	-0.27	Dry	Dry	Dry	1.26	0.98	1.08	0.44	-0.28	Standing water	-0.30	0.11
N-32				Dry	Dry	___	Dry	Dry	___	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
A	2.75	2.48	2.39	2.22	1.66	___	2.12	1.43	___	1.85	1.68	1.81	1.72	1.95	2.10	1.83	1.91	1.98	2.02	1.61	1.45	1.55	1.07	1.56	1.65	1.84	1.89
B	3.84	3.57	3.43	3.25	2.96	___	2.94	2.67	___	2.91	2.81	2.88	2.85	2.93	3.04	2.94	2.92	3.06	2.99	2.87	2.85	2.94	2.38	2.73	2.77	2.83	2.91
C	4.30	Dry	Dry	Dry	4.50	___	4.20	3.27	___	3.27	3.15	3.18	3.19	3.30	3.36	3.12	3.16	3.40	3.37	3.22	3.16	3.33	3.06	3.41	3.45	3.63	3.69
Soil Temp#			60	52	56	___	56	56	___	56	58	60	60	62	62	60	64	64	64	64	64	64	62	64	64	63	63
CD Bodam Lateral																											
Dry Creek Ditch #2																											
Rain* (date/inches)			5/7 1.1"	5/13 0.72" 5/15 0.25"	5/22 0.06"	5/26 0.64" 5/27 0.87"		6/5 1.56"											8/6 0.02"	8/7 0.27" 8/8 0.01"	8/11 0.04"		8/15 0.87" 8/16 1.31" 8/17 0.38"				

Legend

Indicates water within upper 12" of soil profile

Water Flowing in CD Bodam Lateral

Water flowing in Dry Creek Ditch #2

*Record of Climatological Observations, Boulder Station

Please note, when the monitoring wells N1-N26 were installed on April 18, the soil temperatures ranged from 38°-40° F

TABLE 2. Groundwater Hydrology Monitoring Well Data

DATE:	8/29/2008	9/2/2008	9/3/2008	9/4/2008	9/5/2008	9/6/2008	9/7/2008	9/8/2008	9/9/2008	9/10/2008	9/11/2008	9/12/2008	9/13/2008	9/14/2008	9/15/2008	9/17/2008	9/18/2008	9/19/2008	9/22/2008	9/23/2008	9/26/2008	9/29/2008	9/30/2008	10/1/2008	10/2/2008	10/3/2008	10/8/2008
Well Number	Depth to Water (feet)	Depth to Water (feet)	Depth to Water (feet)	Depth to Water (feet)	Depth to Water (feet)	Depth to Water (feet)	Depth to Water (feet)	Depth to Water (feet)	Depth to Water (feet)	Depth to Water (feet)	Depth to Water (feet)	Depth to Water (feet)	Depth to Water (feet)	Depth to Water (feet)	Depth to Water (feet)	Depth to Water (feet)	Depth to Water (feet)	Depth to Water (feet)	Depth to Water (feet)	Depth to Water (feet)	Depth to Water (feet)	Depth to Water (feet)	Depth to Water (feet)	Depth to Water (feet)	Depth to Water (feet)	Depth to Water (feet)	Depth to Water (feet)
N-1	1.47	1.46	1.53	1.60	1.48	1.61	1.68	1.59	1.62	1.76	1.74	0.76	1.02	1.33	1.42	1.60	1.66	1.68	1.85	Dry	Dry	Dry	Dry	1.89	1.83	1.79	1.79
N-2	Dry	1.72	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	1.11	1.42	1.63	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
N-3	1.70	1.33	1.60	1.84	Dry	Dry	Dry	Dry	Dry	Dry	Dry	1.12	1.52	1.79	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	1.83	1.89	Dry	Dry
N-4	Dry	1.60	1.77	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	1.32	1.64	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	1.79	1.76	Dry
N-5	1.42	1.14	1.29	1.44	1.48	1.59	1.72	1.73	1.78	Dry	Dry	0.96	1.21	1.45	1.70	Dry	Dry	Dry	Dry	Dry	Dry	Dry	1.74	1.46	1.38	1.32	1.46
N-6	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
N-7	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
N-8	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
N-9	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
N-10	0.99	0.97	1.32	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	1.04	0.95	0.89	0.95	0.98	1.19
N-11	1.46	1.39	1.74	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	1.24	1.14	1.10	1.17	1.22	1.46
N-12	0.96	0.51	1.20	1.59	1.75	Dry	Dry	Dry	Dry	Dry	Dry	1.75	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	0.88	0.62	0.37	0.70	1.10	1.77
N-13	1.31	0.92	1.24	1.48	1.49	1.73	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	1.47	1.13	1.30	1.36	1.78
N-14	1.57	1.24	1.41	1.62	1.73	1.79	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	1.58	1.58	1.58	Dry
N-15	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
N-16	1.28	1.10	1.19	1.32	1.40	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	1.39	1.27	1.24	1.45
N-17	0.88	0.70	0.76	0.82	0.99	1.21	1.64	1.35	1.44	1.61	1.67	0.54	1.26	1.44	1.61	1.72	Dry	Dry	Dry	Dry	Dry	1.41	1.19	0.94	0.90	0.90	1.15
N-18	Dry	1.56	1.70	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	1.74	1.67	1.66	Dry
N-19	1.24	0.85	1.54	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	1.24	0.96	0.83	1.40	1.65	Dry
N-20	Dry	1.64	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
N-21	1.62	1.26	1.44	1.64	1.76	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	1.85	Dry	Dry	Dry
N-22	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
N-23	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
N-24	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
N-25	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
N-26	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
N-27	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
N-28	Dry	Dry	Dry	Dry	Dry	Dry	Dry										Broke	Broke	Dry	Dry	Dry	Dry	Dry	---	---	---	---
N-29	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
N-30	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	0.88	1.27	1.46	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
N-31	0.25	1.06	1.21	1.25	0.94	1.17	1.23	0.78	0.94	1.31	1.10	-0.06	0.12	0.33	0.67	0.92	0.65	0.14	0.90	0.41	0.34	-0.14	-0.14	0.65	0.94	1.09	0.13
N-32	1.53	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
A	1.71	1.48	1.73	1.95	2.01	2.14	2.29	2.32	2.37	2.51	2.58	1.34	1.72	1.95	2.14	2.40	2.52	2.58	2.70	2.82	2.88	2.42	2.28	2.10	2.10	2.13	2.29
B	2.92	2.87	2.90	2.97	3.01	3.06	3.12	3.18	3.21	3.29	3.35	3.13	3.07	3.16	3.23	3.37	3.42	3.46	3.62	3.66	3.74	3.55	3.44	3.28	3.16	3.08	3.06
C	3.62	3.45	3.55	3.74	3.89	4.05	4.18	4.32	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	3.95	3.83	3.55	3.54	3.51	3.70
Soil Temp#	63	63								62	62					58				59							
CD Bodam Lateral																											
Dry Creek Ditch #2																											
Rain* (date/inches)					9/5 0.07"			9/8 0.24"		9/10 0.01"	9/11 0.04"	9/12 1.24"		9/14 0.20"													

Legend

Indicates water within upper 12" of soil profile

Water Flowing in CD Bodam Lateral

Water flowing in Dry Creek Ditch #2

*Record of Climatological Observations, Boulder Station

Please note, when the monitoring wells N1-N26 were installed on April 18, the soil temperatures ranged from 38°-40° F

TABLE 3
2008 Monthy Precipitation Data*
Boulder, Colorado

Month	2008 Monthly Total (inches)	Precipitation Normals (inches)	+/- Normal Precipitation (inches)	2008 Mean Temp (°F)
Jan	0.46	0.70	-0.24	31.6
Feb	0.63	0.75	-0.12	36.1
March	1.47	1.78	-0.31	41.0
April	1.13	2.88	-1.75	47.8
May	4.21	3.05	1.16	57.0
June	1.58	1.99	-0.41	66.0
July	0.09	1.88	-1.79	75.0
August	2.97	1.63	1.34	69.6
September	1.84	1.79	0.05	67.4
October 1-15	1.10			

Total Precipitation Jan-Sept 2008	14.38
Normal Precipitation Jan-Sept	16.45
Amount Below Normal Jan-Sept 2008	-2.07

Total Precipitation May-Sept	10.69
Normal Precipitation May-Sept	10.34
Amount Above Normal May-Sept	0.35

*Preliminary Data
Source: National Climatic Data Center. 2008. Record of Climatological Observations, Boulder Station, Boulder Colorado.

TABLE 4
Dry Creek Ditch Water Elevation
Comparison to Surface Elevation at Well

Well No.	Dry Creek Ditch #2 Water Elevation (ft)	Well Elevation (ft)	Elevation Difference (ft)	Distance from Ditch to Well (ft)	Cross-Section Figure
10	5321.01	5321.04	+0.03*	126	7
11	5321.01	5321.44	+0.43*	82	7
12	5318.76	5318.22	-0.54	34	8
13	5318.35	5317.56	-0.59	78	9
14	5318.35	5317.72	-0.63	160	9
16	5318.94	5318.92	-0.42	204	10
17	5319.00	5318.49	-0.92	129	11
19	5316.71	5316.41	-0.30	33	12
21	5315.17	5315.12	-0.05	87	13

* The surface elevation of Well 10 was almost equal to the elevation of water in the Ditch and the surface elevation of Well 11 was slightly higher than the elevation of the water in the Ditch. However, the highest elevation of the water in these two wells was only slightly lower than the elevation of the water in the Ditch. Ditch water still seeped down gradient to both these wells.

Table 5
Wetland Areas
Hogan-Pancost Property

Wetland Name	Area (sq. ft.)	Area (acres)	Jurisdictional?
West Parcel			
Wetland A	9,908	0.227	No
Wetland B	9,154	0.210	No
Wetland C	1,220	0.028	No
Dry Creek Ditch	9,942	0.228	Yes
Howard Super-phosticle Ditch	4,670	0.107	Yes
Total West Parcel	**34,894**	**0.801**	
East Parcel			
East Wetland*	70,663	1.622	Yes
Total East & West Parcels	**105,557**	**2.423**	

* Includes the Howard Super-phosticle Ditch

9.0 Photographs

Photo 1. Dry Creek Ditch #2 looking north. (May 16, 2008)

Photo 2. CD Bodam Lateral as lined. (October 21, 2008)

Photo 3. Portion of the Howard Super-phosticle Ditch through the East Wetland, looking south (July 2, 2008).

Photo 4. Population of the noxious weed Scotch thistle on the West Parcel, looking south (October 2, 2008).

Photo 5. Shallow groundwater hydrology monitoring wells N1-N27 were installed on April 18, 2008.

Photo 6. Wetland A, looking west (September 29, 2008).

Photo 7. Wetland B, looking southeast (September 29, 2008).

Photo 8. Wetland C, looking south (September 29, 2008).

Photo 9. Dry Creek Ditch #2, looking north. Photo taken from near the southern end of the ditch (September 29, 2008).

Photo 10. Northwest portion of the Howard Super-phosticle Ditch, looking west at culvert over Dry Creek Ditch #2 (October 2, 2008).

Photo 11. Northeast portion of the Howard Super-phosticle Ditch on the West Parcel, looking southeast (October 2, 2008).

Photo 12. West portion of East Wetland, looking northwest (October 2, 2008).

11.0 Appendices

Appendix A. Observed & Measured Irrigation Flows

APPENDIX A

Observed and Measured Irrigated Water Flows - Pancost & Hogan, 2006 & 2007

JUNE, 2006 & 2007	East. Connection S. Dry Cr. Lateral	West. Connection S. Dry Cr. Lateral
Measured Water Flow (in Gallons per day x number days in month)	581645	349402
JULY, 2006 & 2007		
Measured Water Flow (in Gallons per day)	601033	361048
AUGUST, 2006 & 2007		
Measured Water Flow (in Gallons per day)	601033	361048
SEPTEMBER, 2006 & 2007		
Measured Water Flow (in Gallons per day)	290822	174701

TOTALS ESTIMATED IRRIGATION WATER FLOWS FOR SUMMER, 2006 AND 2007

Daily Water Flows:

June	931047	30 days this month
July	962081	31 days this month
August	962081	31 days this month
September	465523	15 days this month

Summer Water Flows (TOTAL) **3,320,732** **GALLONS**

Data from Water Measurement Manual - U.S. Dept. of Interior

Detail of Flow Measurement:	East Weir	West Weir
Length of Weir(s) - width of opening	2.5	2
Observed Head(s) - height of opening	0.333	0.25
Equation Output (in CFS):		
Water Meas. Manual example: observed head	0.41	0.41
Therefore, the ratio of Pancost/Hogan weirs to WMM example	1.3537	0.813
WMM example flow	1.24	1.24
Therefore, the assumed flows of each Pancost/Hogan weir (CFS)	1.6786	1.0081
CFS converted to Gallons:		
US Gallon in cubic feet (Wikipedia)	0.13368	0.13368
Pancost/Hogan Weir flows, using all above caluclations and measures:		
Weir flows, in cubic gallon/second	0.2244	0.1348
Weir flows, in cubic gallons/hour	807.84	485.28
Weir flows, in cubic gallons/day	**19388.16**	**11646.72**

Appendix B. Monitoring Well Data Forms

APPENDIX B. MONITORING WELL INSTALLATION DATA FORM

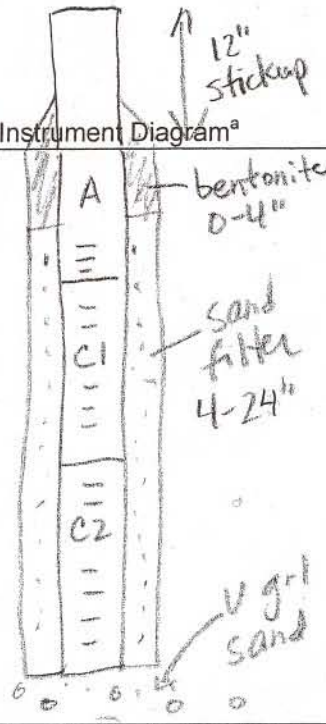
MW 1

Monitoring Well Installation Data Form

Project Name Hogan - Pancost Property Date of Installation 4/18/08
Project Location Boulder Personnel DPB
Well Identification Code MW 1
Attach map of project, showing well locations and significant topographic and hydrologic features.

Characteristics of Instrument:
Source of instrument/well stock
Material of well stock PVC Diameter of pipe 1.5"
Slot width 0.01" Slot spacing 0.25"
Kind of well cap PVC slip Kind of well point/end plug open

Installation:
Was well installed by augering or driving? Shovel
Kind of filter sand 30 silica Kind of bentonite granular
Depth to lowest screen slots 23" Riser height above ground 12"
Was bentonite wetted for expansion? yes
Method of measuring water levels in instrument tape
How was instrument checked for clogging after installation? bath

Instrument Diagram[a]	Soil Characteristics: Texture	Matrix Color	Redoximorphic Features: Color	Redoximorphic Features: Abundance	Induration (none, weak, strong)	Roots
	grl L (0-8")	10YR 2/2	7.5YR 3/4	10%	none	2 vf, f m 1 c
	v. grl LS (8-14")	10YR 3/2	7.5YR 3/4	1-2% ? (See below)	none	1 vf, f m
	vgrl S (14"-24")	10YR 3/3	—	5-10% sand grains 7.5YR 4/6 (See below)	none	1 vf f m

A 0-8"
C1 8-14
C2 14-24"

[a]Show depths (heights) of riser, well screen, sand pack, and bentonite in relation to soil horizons.

WCS Soil is mod. moist below 18". Common oxidized root channels & mottles in A horizon & few in C1.
No saturation.

Well is in lowest spot of swale.
— Some iron-stained sand grains are from weathering rinds from transported igneous ~~& metamorphic~~ rocks and are not related to saturation. Few mottles in C1 horizon but common iron-stained sand grains.

7.5YR 4/6

APPENDIX B. MONITORING WELL INSTALLATION DATA FORM

MW 2

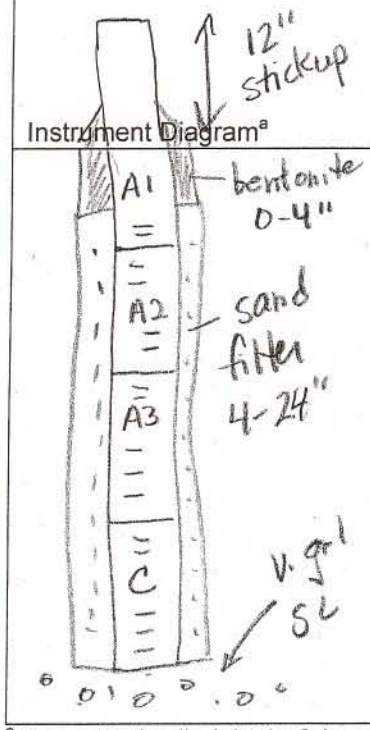
Monitoring Well Installation Data Form

Project Name: Hogan-Pancost Property
Date of Installation: 4/18/08
Project Location: Boulder
Personnel: QPB
Well Identification Code: 2
Attach map of project, showing well locations and significant topographic and hydrologic features.

Characteristics of Instrument:
Source of instrument/well stock:
Material of well stock: PVC
Diameter of pipe: 1.5"
Slot width: 0.01"
Slot spacing: 0.25"
Kind of well cap: PVC slip
Kind of well point/end plug: open

Installation:
Was well installed by augering or driving? Shovel
Kind of filter sand: 30 Silica
Kind of bentonite: granular
Depth to lowest screen slots: 23"
Riser height above ground: 12"
Was bentonite wetted for expansion? yes
Method of measuring water levels in instrument: tape
How was instrument checked for clogging after installation? lath

Instrument Diagram[a]	Soil Characteristics: Texture	Matrix Color	Redoximorphic Features: Color	Redoximorphic Features: Abundance	Induration (none, weak, strong)	Roots
A1 (0-7")	grl SCL (20% clay) 0-7"	10YR2/2	7.5YR 3/4	5-7%	none	2vff m
A2 (7-13)	grl scL 7-13	10YR3/2	7.5YR 3/4	7%	none	1vff 2m
A3 (13-18)	cbl sL 17% clay 13-18"	10YR 3/2	7.5YR 3/4	4%	none	1vf, f 2m
C (18-24")	v.grl SL 10% clay 18-24"	10YR 4/3	—	10% goethite staining on coarse frags 10YR 5/6	none	1vff m



[a]Show depths (heights) of riser, well screen, sand pack, and bentonite in relation to soil horizons.

In mid-portion of shallow swale, up from well 1. Soil is mod moist below 20". No saturation

mottles + oxidized root channels 2-18"

much of the goethite staining is from weathering rinds on transported igneous ~~+ met.~~ rocks, and is not saturation related. Some may be saturation related.

APPENDIX B. MONITORING WELL INSTALLATION DATA FORM

M.W. 3

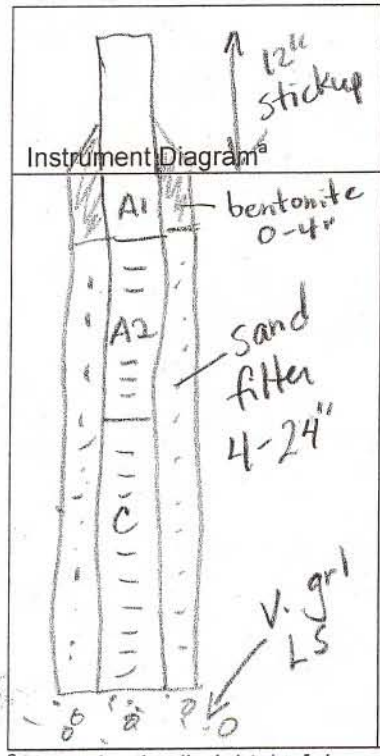
Monitoring Well Installation Data Form

Project Name: Hogan-Pancost Property
Date of Installation: 4/18/08
Project Location: Boulder
Personnel: OPB
Well Identification Code: 3
Attach map of project, showing well locations and significant topographic and hydrologic features.

Characteristics of Instrument:
- Source of instrument/well stock:
- Material of well stock: PVC
- Diameter of pipe: 1.5"
- Slot width: 0.01"
- Slot spacing: 0.25"
- Kind of well cap: PVC slip
- Kind of well point/end plug: open

Installation:
- Was well installed by augering or driving? Shovel
- Kind of filter sand: 30 Silica
- Kind of bentonite: granular
- Depth to lowest screen slots: 22.5"
- Riser height above ground: 12"
- Was bentonite wetted for expansion? yes
- Method of measuring water levels in instrument: tape
- How was instrument checked for clogging after installation? lath

Instrument Diagram[a]	Soil Characteristics: Texture	Matrix Color	Redoximorphic Features: Color	Redoximorphic Features: Abundance	Induration (none, weak, strong)	Roots
A1 (0-4")	L 0-4"	10YR 2/2	—	—	none	3vf, f m
A2 (4-13")	grl scL 4-13"	10YR 3/2	7.5YR 3/4	1-2%	none	2vff m
C (13-24")	V.grl LS 13-24"	10YR 3/2.5	10YR 5/6 → 7.5YR 3/4	5% goethite staining on coarse frags. → 1% mottles	none	1vff m



[a]Show depths (heights) of riser, well screen, sand pack, and bentonite in relation to soil horizons.

goethite staining on coarse frags from weathering rinds → probably not saturation related.

In upper end of shallow swale, up from well 2, soil is marginally hydric.

Soil temp @ 20" = 38°F
Soil temp @ 12" = 38°F

V. few oxidized root channels 4-13" and few mottles

Soil is mod moist below 20"18, No saturation

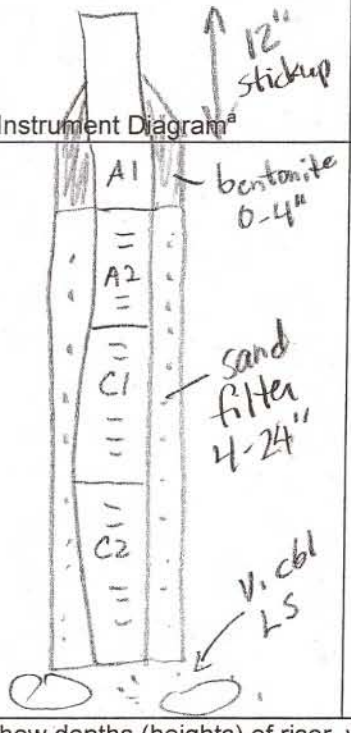
M. W. 4

APPENDIX B. MONITORING WELL INSTALLATION DATA FORM

Monitoring Well Installation Data Form

Project Name Hogan- Pancost Property Date of Installation 4/18/08
Project Location Boulder Personnel DPB
Well Identification Code 4
Attach map of project, showing well locations and significant topographic and hydrologic features.

Characteristics of Instrument:
Source of instrument/well stock
Material of well stock PVC Diameter of pipe 1.5"
Slot width 0.01" Slot spacing 0.25"
Kind of well cap PVC slip Kind of well point/end plug open
Installation:
Was well installed by augering or driving? shovel
Kind of filter sand 30 silica Kind of bentonite granular
Depth to lowest screen slots 22.75" Riser height above ground 12"
Was bentonite wetted for expansion? yes
Method of measuring water levels in instrument tape
How was instrument checked for clogging after installation? lath

Instrument Diagram[a]	Soil Characteristics					
	Texture	Matrix Color	Redoximorphic Features		Induration (none, weak, strong)	Roots
			Color	Abundance		
	L 0-4"	10YR2/2	—	—	none	3vff m
	cbl L 4-9"	10YR 2/2	7.5YR 3/4	1-4%	none	"
	V cbL SL 9-15"	10YR 3/2	—	—	none	2vff m
	V.cbl LS 15-24"	10YR 3/2.5	—	10% staining on sand grains from weathering rinds.	none	1vff

A1 (0-4") A2 (4-9") C1 (9-15") C2 (15"-24")

not saturation related

[a]Show depths (heights) of riser, well screen, sand pack, and bentonite in relation to soil horizons.

Eastern most well in E-W transect.
Slightly higher than well 5, which is in narrow, shallow drainage. Few oxidized root channels 4-9" + some mottles
Soil is mod. moist below 20". No saturation

MW 5

APPENDIX B. MONITORING WELL INSTALLATION DATA FORM

Monitoring Well Installation Data Form

Project Name Hogan - Pancost Property Date of Installation 4/18/08
Project Location Boulder Personnel DPB
Well Identification Code 5
Attach map of project, showing well locations and significant topographic and hydrologic features.

Characteristics of Instrument:
Source of instrument/well stock
Material of well stock PVC Diameter of pipe 1.5"
Slot width 0.01" Slot spacing 0.25"
Kind of well cap PVC Slip Kind of well point/end plug open

Installation:
Was well installed by augering or driving? auger
Kind of filter sand grade 30 silica Kind of bentonite granular
Depth to lowest screen slots 22.75" Riser height above ground 12"
Was bentonite wetted for expansion? yes
Method of measuring water levels in instrument tape
How was instrument checked for clogging after installation? lath

Instrument Diagram[a]	Soil Characteristics					
	Texture	Matrix Color	Redoximorphic Features: Color	Redoximorphic Features: Abundance	Induration (none, weak, strong)	Roots
A1 (0-2") A2 (2-6") C1 (6-14") C2 (14-20") Ab (20-26")	L 0-2"	10YR 2/2	—	—	none	3 vf f 2 m
	L 2-6"	10YR 2/2	7.5YR 3/4	7-10%	none	3 vf f m
	LS/L (6-14")	10YR 4/2 10YR 3/1	7.5YR 3/4	10-15%	none	2 vf f 1 m
	V. grl co. sand 14-20"	10YR 3/3	7.5YR 3/4 →	10-15% on coarse fragments	none	1 vf, f
	SL 20-26"	10YR 2/2	7.5YR 3/4	5%	none	1 vf, f

[a]Show depths (heights) of riser, well screen, sand pack, and bentonite in relation to soil horizons.

In E-W transect. In bottom of narrow drainage swale, mottles + oxidized root channels from 2-25".

C1 - alternating 1-3" layers of LS (10YR 4/2) + L (10YR 3/1)

* Soil is wet below 20", nearly saturated.
- Some iron stained sand grains in C2 horizon (14-20") are from weathering rinds — not saturation related.

MW6

APPENDIX B. MONITORING WELL INSTALLATION DATA FORM

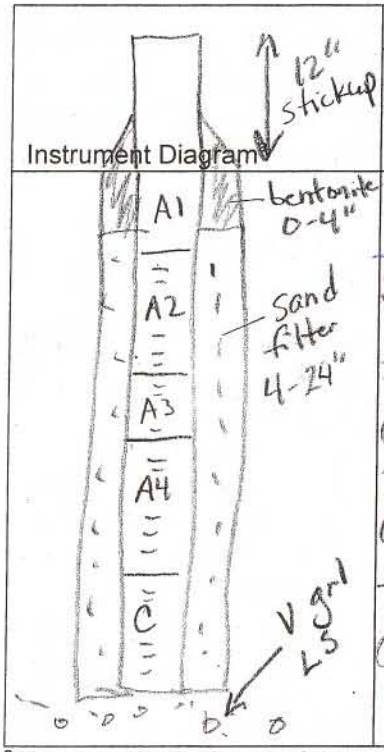
Monitoring Well Installation Data Form

Project Name: Hogan - Pancost Prop
Date of Installation: 4/18/08
Project Location: Boulder
Personnel: JPB
Well Identification Code: 6
Attach map of project, showing well locations and significant topographic and hydrologic features.

Characteristics of Instrument:
- Source of instrument/well stock:
- Material of well stock: PVC
- Diameter of pipe: 1.5"
- Slot width: 0.01"
- Slot spacing: 0.25"
- Kind of well cap: PVC slip
- Kind of well point/end plug: open

Installation:
- Was well installed by augering or driving? shovel
- Kind of filter sand: 30 grade silica
- Kind of bentonite: granular
- Depth to lowest screen slots: 22.75"
- Riser height above ground: 12"
- Was bentonite wetted for expansion? yes

Method of measuring water levels in instrument: tape
How was instrument checked for clogging after installation? lath



A1 (0-5")
A2 (5-10")
A3 (10-14")
A4 (14-17")
C (17-24")

Soil Characteristics						
Texture	Matrix Color	Redoximorphic Features: Color	Redoximorphic Features: Abundance	Induration (none, weak, strong)	Roots
L (0-5)	10YR 2/2	—	—	none	3vff 2m
grl L (5-10)	10YR 2/2	7.5YR 3/4	1-3%	none	2vff m
vgrl SL (10-14")	10YR 3/2	7.5YR 3/4	5%	none	2vff m
V grL SL (14"-17")	10YR 3/2	—	—	none	2vff m
V grL LS (17-24")	10YR 3/3	—	—		

[a]Show depths (heights) of riser, well screen, sand pack, and bentonite in relation to soil horizons.

At highest point in E-W transect. Mottles + oxidized root channels in A2 + A3 horizons.

Soil temp @ 20" = 39°F
Soil temp @ 12" = 40°F

Soil is mod. moist below 16"
No saturation

C (17-24") 5-10% 10YR5/6 + 7.5YR 3/4 iron stained sand grains from weathering rinds from transported igneous + ~~metamorphic~~ rocks — not saturation related.

MW7

APPENDIX B. MONITORING WELL INSTALLATION DATA FORM

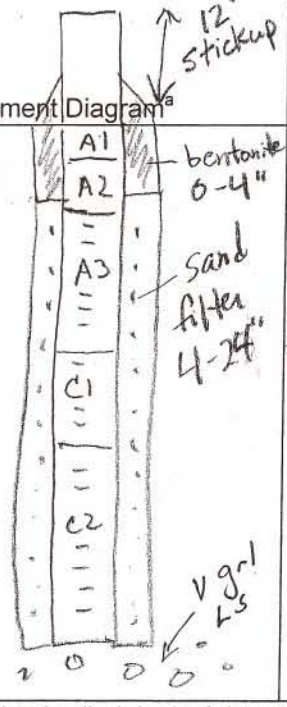
Monitoring Well Installation Data Form

Project Name Hogan - Pancost Prop
Date of Installation 4/18/08
Project Location Boulder
Personnel DPB
Well Identification Code 7
Attach map of project, showing well locations and significant topographic and hydrologic features.

Characteristics of Instrument:
Source of instrument/well stock
Material of well stock PVC
Diameter of pipe 1.5"
Slot width 0.01"
Slot spacing 0.25"
Kind of well cap PVC slip
Kind of well point/end plug open

Installation:
Was well installed by augering or driving? Shovel
Kind of filter sand 30 grade Silica
Kind of bentonite granular
Depth to lowest screen slots 23.5"
Riser height above ground 12"
Was bentonite wetted for expansion? yes
Method of measuring water levels in instrument tape
How was instrument checked for clogging after installation? lath

Instrument Diagram[a]	Soil Characteristics: Texture	Matrix Color	Redoximorphic Features: Color	Redoximorphic Features: Abundance	Induration (none, weak, strong)	Roots
A1 (0-2")	L 0-2"	10YR 2/2	—	—	none	3 vf-f
A2 (2-5")	L 2-5"	10YR 2/2	7.5YR 3/4	5%	none	3 vf-f lm
A3 (5-12")	grl SL 5-12"	10YR 3/2	7.5YR 3/4	2-5%	none	2 vf-f m
C1 (12-16")	v grL LS 12-16"	10YR 3/2	—	—	none	2 vf f lm
C2 (16-24")	v grL LS 16-24"	10YR 3/3	—	—	none	1 vf f m



[a]Show depths (heights) of riser, well screen, sand pack, and bentonite in relation to soil horizons.

Western most well in E-W transect. In drainage swale. oxidized root channels & mottles 2-12".

5% goethite staining on sand grains in C horizons. Soil is mod moist below 16". No saturation.

APPENDIX B. MONITORING WELL INSTALLATION DATA FORM

MW 8

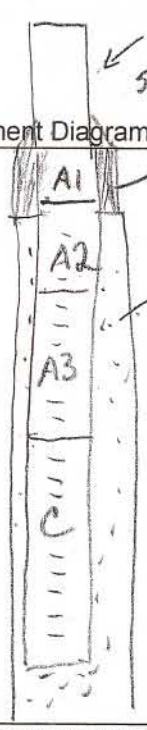
Monitoring Well Installation Data Form

Project Name Hogan - Pancost Prop
Date of Installation 4/18/08
Project Location Boulder
Personnel DPB
Well Identification Code 8
Attach map of project, showing well locations and significant topographic and hydrologic features.

Characteristics of Instrument:
Source of instrument/well stock
Material of well stock PVC
Diameter of pipe 1.5"
Slot width .01"
Slot spacing 0.25"
Kind of well cap PVC Slip
Kind of well point/end plug open

Installation:
Was well installed by augering or driving? auger
Kind of filter sand 30 grade Silica
Kind of bentonite granular
Depth to lowest screen slots 22.75"
Riser height above ground 12"
Was bentonite wetted for expansion? yes
Method of measuring water levels in instrument tape
How was instrument checked for clogging after installation? lath

Instrument Diagram[a]	Soil Characteristics: Texture	Matrix Color	Redoximorphic Features: Color	Redoximorphic Features: Abundance	Induration (none, weak, strong)	Roots
A1 (0-3")	SL (0-3")	10YR 2/2	7.5YR 3/4	1-3%	none	3 vf f 2 m
A2 (3-8")	L (3-8")	10YR 2/2	5YR 3/3 7.5YR 3/4	7-10%	none	3 vf f 1 m
A3 (8-19")	SL (8-19")	10YR 2/2	7.5YR 3/4	1-3%	none	2 vf f 1 m
C (19-26")	SL (19-26")	10YR 3/2	7.5YR 3/4	5-10%	none	1 vf f m



[a]Show depths (heights) of riser, well screen, sand pack, and bentonite in relation to soil horizons.

In upper end of shallow drainage swale.
Mod. moist below 20". No saturation
mottles + oxidized root channels 1 - 26"

MW9

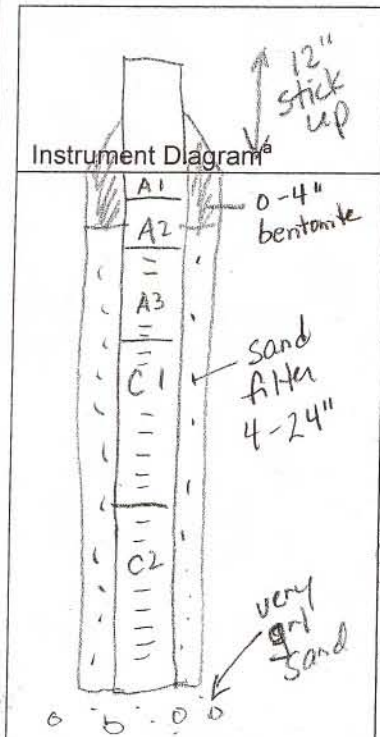
APPENDIX B. MONITORING WELL INSTALLATION DATA FORM

Monitoring Well Installation Data Form

Project Name: Hogan - Pancost Prop
Date of Installation: 4/19/08
Project Location: Boulder
Personnel: DPB
Well Identification Code: 9
Attach map of project, showing well locations and significant topographic and hydrologic features.

Characteristics of Instrument:
- Source of instrument/well stock: I
- Material of well stock: PVC
- Diameter of pipe: 1.5"
- Slot width: 0.01"
- Slot spacing: 0.25"
- Kind of well cap: PVC slip
- Kind of well point/end plug: open

Installation:
- Was well installed by augering or driving? Shovel
- Kind of filter sand: 30 grade silica
- Kind of bentonite: granular
- Depth to lowest screen slots: 23"
- Riser height above ground: 12"
- Was bentonite wetted for expansion? yes
- Method of measuring water levels in instrument: tape
- How was instrument checked for clogging after installation? lath



	Soil Characteristics					
	Texture	Matrix Color	Redoximorphic Features: Color	Redoximorphic Features: Abundance	Induration (none, weak, strong)	Roots
A1 (0-2")	L 0-2"	10YR 2/2	—	—	none	3 vf f m
A2 (2-5")	L (2-5")	10YR 2/2	7.5YR 3/4	7-10%	none	3 vf f m
A3 (5-10")	Vgrl SL (5-10")	10YR 2/2	—	—	none	2 of f m
C1 (10-16")	V grl LS (10-16")	10YR 3/2	—	—	none	2 of f m
C2 (16-24")	V grl S. (16-24")	10YR 3/2.5	—	—		

[a]Show depths (heights) of riser, well screen, sand pack, and bentonite in relation to soil horizons.

No saturation. Mottles + oxidized root channels from 2-5"

C2 - some iron-stained sand grains from weathering rinds of transported Boulder Grandodiorite.

MW 10

APPENDIX B. MONITORING WELL INSTALLATION DATA FORM

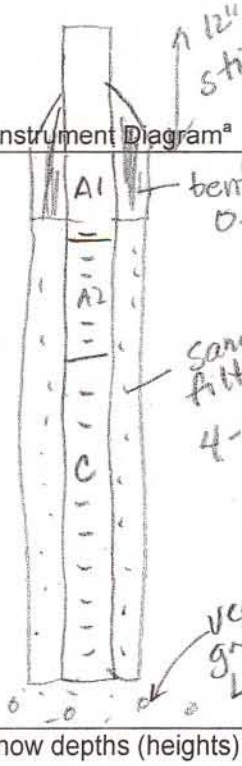
Monitoring Well Installation Data Form

Project Name Hogan- Pancoast Prop
Date of Installation 4/19/08
Project Location Boulder
Personnel DPB
Well Identification Code 10
Attach map of project, showing well locations and significant topographic and hydrologic features.

Characteristics of Instrument:
Source of instrument/well stock
Material of well stock PVC
Diameter of pipe 1.5"
Slot width 0.01"
Slot spacing 0.25"
Kind of well cap PVC slip
Kind of well point/end plug open

Installation:
Was well installed by augering or driving? Shovel / auger
Kind of filter sand 30 silica
Kind of bentonite granular
Depth to lowest screen slots 23"
Riser height above ground 12"
Was bentonite wetted for expansion? yes
Method of measuring water levels in instrument tape
How was instrument checked for clogging after installation? lath

Instrument Diagram[a]	Soil Characteristics					
	Texture	Matrix Color	Redoximorphic Features		Induration (none, weak, strong)	Roots
			Color	Abundance		
A1 (0-5")	SL (0-5")	10YR 2/2	7.5YR 3/4	5%	none	3vf f m
A2 (5-13")	SL (5-13")	N3	7.5YR 3/4	10%	none	2vf f m
C (13-24")	v gr L S (13-24")	10YR 3/3	—	—	none	1vf f m



[a]Show depths (heights) of riser, well screen, sand pack, and bentonite in relation to soil horizons.

C horizon contains 5% iron-stained sand grains.

No saturation, but soil is mod moist below 20". Mottles + oxidized root channels from 0 - 13". In swale.

MW 11

APPENDIX B. MONITORING WELL INSTALLATION DATA FORM

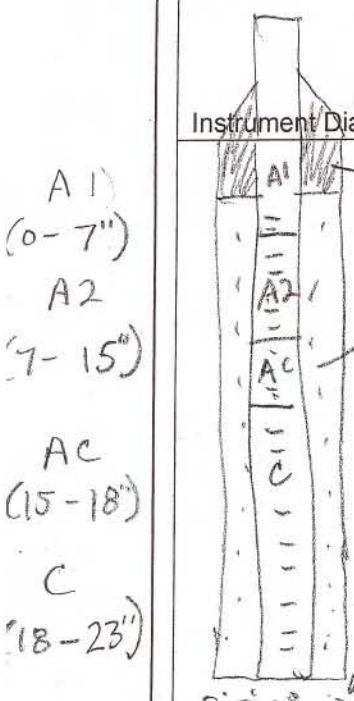
Monitoring Well Installation Data Form

Project Name: Hogan-Pancost Prop
Date of Installation: 4/19/08
Project Location: Boulder
Personnel: OPB
Well Identification Code: 11
Attach map of project, showing well locations and significant topographic and hydrologic features.

Characteristics of Instrument:
- Source of instrument/well stock:
- Material of well stock: PVC
- Diameter of pipe: 1.5"
- Slot width: 0.01"
- Slot spacing: 0.25"
- Kind of well cap: PVC slip
- Kind of well point/end plug: open

Installation:
- Was well installed by augering or driving? shovel / auger
- Kind of filter sand: 30- silica
- Kind of bentonite: granular
- Depth to lowest screen slots: 22"
- Riser height above ground: 13"
- Was bentonite wetted for expansion? yes

Method of measuring water levels in instrument: tape
How was instrument checked for clogging after installation? lath



Instrument Diagram[a]	Soil Characteristics: Texture	Matrix Color	Redoximorphic Features: Color	Redoximorphic Features: Abundance	Induration (none, weak, strong)	Roots
A1 (0-7")	L (0-7")	10YR 2/2	7.5YR 3/4	5-7%	none	3vf-f m
A2 (7-15")	SL (7-15")	10YR 3/2	7.5YR 4/4 3/4	5-7%	none	2vf-f 3m
AC (15-18")	grl LS (15-18")	10YR 3/2	7.5YR 3/4	1%	none	2vf-f m
C (18-23")	vgrl LS (18-23")	10YR 3/3	—	—	none	1vf-f m

[a]Show depths (heights) of riser, well screen, sand pack, and bentonite in relation to soil horizons.

C horizon contains 5-10% iron-stained sand grains.
Mottles from 1-18", oxidized root channels from 1-15".

Large cobble at 23".
No saturation. Soil is mod moist below 15"

APPENDIX B. MONITORING WELL INSTALLATION DATA FORM

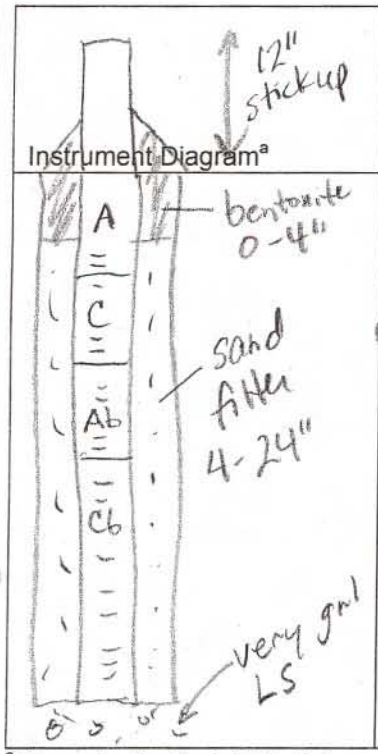
MW 12

Monitoring Well Installation Data Form

Project Name: Hogan - Pancost Prop
Date of Installation: 4/19/08
Project Location: Boulder
Personnel: DPB
Well Identification Code: 12
Attach map of project, showing well locations and significant topographic and hydrologic features.

Characteristics of Instrument:
- Source of instrument/well stock:
- Material of well stock: PVC
- Diameter of pipe: 1.5"
- Slot width: 0.01"
- Slot spacing: 0.25"
- Kind of well cap: PVC Slip
- Kind of well point/end plug: open

Installation:
- Was well installed by augering or driving? auger / shovel
- Kind of filter sand: 30- silica
- Kind of bentonite: granular
- Depth to lowest screen slots: 23"
- Riser height above ground: 12"
- Was bentonite wetted for expansion? yes
- Method of measuring water levels in instrument: tape
- How was instrument checked for clogging after installation? lath



A (0-7")
C (7-11")
Ab (11-15")
Cb (15-24")

Soil Characteristics						
Texture	Matrix Color	Redoximorphic Features: Color	Redoximorphic Features: Abundance	Induration (none, weak, strong)	Roots
L (0-7")	10YR 2/2	7.5YR 3/4	5-7%	none	3vf-f m
Sand (7-11")	10YR 4/2.5	—	—	none	2vff m
CL (11-15")	10YR 2/1	7.5YR 3/4	5%	none	2vff m
vgrL LS (15-24")	10YR 3/2	—	—	none	2vf.f m 1vf-f 2m

[a]Show depths (heights) of riser, well screen, sand pack, and bentonite in relation to soil horizons.

Soil is mod. moist below 11", No saturation.
Mottles + oxidized root channels from 0 - 7" + from 11-15"

~~good spot for shallow well.~~
Minor iron staining on sand grains.
In lowest spot in drainage swale.

MW 13

APPENDIX B. MONITORING WELL INSTALLATION DATA FORM

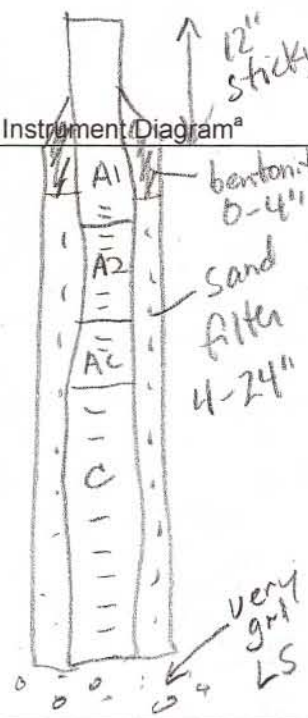
Monitoring Well Installation Data Form

Project Name Hogan Pancost prop
Date of Installation 4/19/08
Project Location Boulder
Personnel DPB
Well Identification Code 13
Attach map of project, showing well locations and significant topographic and hydrologic features.

Characteristics of Instrument:
Source of instrument/well stock
Material of well stock PVC
Diameter of pipe 1.5"
Slot width 0.01"
Slot spacing 0.25"
Kind of well cap PVC Slip
Kind of well point/end plug open

Installation:
Was well installed by augering or driving? shovel
Kind of filter sand 30- Silica
Kind of bentonite granular
Depth to lowest screen slots 23"
Riser height above ground 12"
Was bentonite wetted for expansion? yes
Method of measuring water levels in instrument lath
How was instrument checked for clogging after installation? tape

Instrument Diagram[a]	Soil Characteristics					
	Texture	Matrix Color	Redoximorphic Features		Induration (none, weak, strong)	Roots
			Color	Abundance		
A1 (0-6")	L (0-6")	10YR 2/2	7.5YR 3/4	5-7%	none	3vff m
A2 (6-11")	grl L (6-11")	10YR 3/1	7.5YR 3/4	15%	none	"
AC (11-13")	vgrl sL (11-13")	10YR 3/2	7.5YR 3/4	3%	none	2vff m
C (13-24")	vgrl LS (13-24")	10YR 3/2	—	—	none	1vff



[a]Show depths (heights) of riser, well screen, sand pack, and bentonite in relation to soil horizons.

Soil is mod moist below 15". No saturation. Mottles + oxidized root channels from 0-13".

MW 14

APPENDIX B. MONITORING WELL INSTALLATION DATA FORM

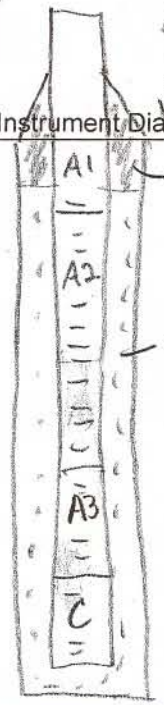
Monitoring Well Installation Data Form

Project Name: Hogan - Pancost property
Date of Installation: 4/19/08
Project Location: Boulder
Personnel: OPB
Well Identification Code: 14
Attach map of project, showing well locations and significant topographic and hydrologic features.

Characteristics of Instrument:
Source of instrument/well stock:
Material of well stock: PVC
Diameter of pipe: 1.5"
Slot width: 0.01"
Slot spacing: 0.25"
Kind of well cap: PVC slip
Kind of well point/end plug: open

Installation:
Was well installed by augering or driving? shoved
Kind of filter sand: Silica -30
Kind of bentonite: granular
Depth to lowest screen slots: 23"
Riser height above ground: 12"
Was bentonite wetted for expansion? yes
Method of measuring water levels in instrument: tape
How was instrument checked for clogging after installation? lath

Instrument Diagram[a]	Soil Characteristics: Texture	Matrix Color	Redoximorphic Features: Color	Redoximorphic Features: Abundance	Induration (none, weak, strong)	Roots
A1 (0-6")	CL (0-6")	10YR 2/1	7.5YR 3/4 5YR 3/4	5-7%	none	3vfc m
A2 (6-19")	SL 18% clay 6-19"	10YR 3/1	7.5YR 3/4 5YR 3/4	10%	none	3vfc m
A3 (19-22")	C6|SL (19-22")	10YR 3/2	7.5YR 3/4	3-5%	none	2vfc m
C (22-25")	C6|LS 22-25'	10YR 3/2	7.5YR 3/4	1%	none	1vfc m



[a]Show depths (heights) of riser, well screen, sand pack, and bentonite in relation to soil horizons.

In drainage swale, mottles & oxidized root channels throughout. No saturation. Soil is very moist below 20".

Soil temp @ 12" = 40°F
Soil temp @ 20" = 39°F

MW 15

APPENDIX B. MONITORING WELL INSTALLATION DATA FORM

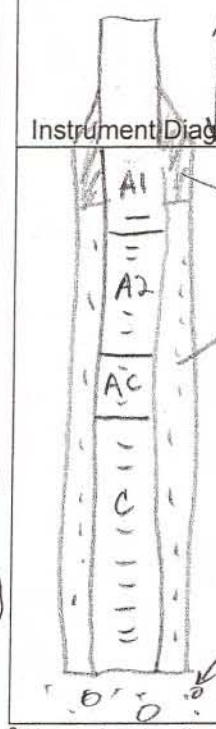
Monitoring Well Installation Data Form

Project Name Hogan - Pancost property
Date of Installation 4/19/08
Project Location Boulder
Personnel DPB
Well Identification Code 15
Attach map of project, showing well locations and significant topographic and hydrologic features.

Characteristics of Instrument:
Source of instrument/well stock
Material of well stock PVC
Diameter of pipe 1.5"
Slot width 0.01"
Slot spacing 0.25"
Kind of well cap PVC slip
Kind of well point/end plug open

Installation:
Was well installed by augering or driving? shovel
Kind of filter sand 30 silica
Kind of bentonite granular
Depth to lowest screen slots 23"
Riser height above ground 12"
Was bentonite wetted for expansion? yes
Method of measuring water levels in instrument tape
How was instrument checked for clogging after installation? lath

Instrument Diagram[a]	Soil Characteristics					
	Texture	Matrix Color	Redoximorphic Features		Induration (none, weak, strong)	Roots
			Color	Abundance		
A1 (0-6")	L (0-6")	10YR 2/2	7.5YR 3/4	3%	none	3vf-f 1m
A2 (6-11")	Cbl L (6-11")	10YR 2/2	—	—	none	3vf-f 1m
AC (11-13")	Vgrl SL (11-13)	10YR 2/2	—	—	none	2vf-f 1m
C (13-24")	Vgrl LS (13-24")	10YR 3/2.5	—	—	none	



[a]Show depths (heights) of riser, well screen, sand pack, and bentonite in relation to soil horizons.

About 2' higher than well 14. Few mottles + oxidized root channels in A1 horizon (1-6").

Soil is relatively dry throughout.

MW 16

APPENDIX B. MONITORING WELL INSTALLATION DATA FORM

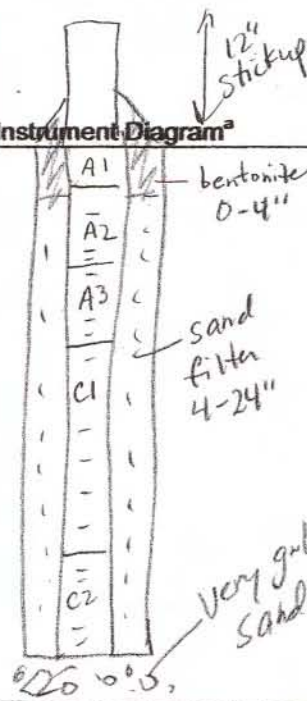
Monitoring Well Installation Data Form

Project Name: Hogan- Pancost property
Date of Installation: 4/19/08
Project Location: Boulder
Personnel: DPB
Well Identification Code: 16
Attach map of project, showing well locations and significant topographic and hydrologic features.

Characteristics of Instrument:
Source of instrument/well stock: P
Material of well stock: PVC
Diameter of pipe: 1.5"
Slot width: 0.01"
Slot spacing: 0.25"
Kind of well cap: PVC Slip
Kind of well point/end plug: open

Installation:
Was well installed by augering or driving? Shovel
Kind of filter sand: 30 silica
Kind of bentonite: granular
Depth to lowest screen slots: 22.75"
Riser height above ground: 12"
Was bentonite wetted for expansion? yes
Method of measuring water levels in instrument: tape
How was instrument checked for clogging after installation? lath

Instrument Diagram[a]	Soil Characteristics: Texture	Matrix Color	Redoximorphic Features: Color	Redoximorphic Features: Abundance	Induration (none, weak, strong)	Roots
A1 (0-3")	L (0-3")	10YR 2/2	—	—	none	3vf f m
A2 (3-8")	L (3-8")	10YR 3/1	7.5YR 3/4	5-7%	none	"
A3 (8-13")	SL (8-13")	10YR 3/2	7.5YR 4/4	1-3%	none	2vf f m
C1 (13-20")	vgrl LS (13-20")	10YR 3/2	—	—	none	1vf f m
C2 (20-24")	vgrl cg Sand (20-24")	10YR 3/2.5	—	—	none	"



[a]Show depths (heights) of riser, well screen, sand pack, and bentonite in relation to soil horizons.

Soil is very moist below 24"!
Mottles + oxidized root channels from 3-13".

Soil temp @ 12" = 38°F
Soil temp @ 20" = 38°F
Some iron-stained sand grains in C horizons.
In same drainage swale + up from well 14.

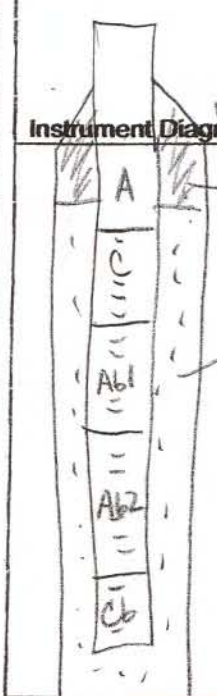
APPENDIX B. MONITORING WELL INSTALLATION DATA FORM MW 17

Monitoring Well Installation Data Form

Project Name Hogan - Parrost property
Date of Installation 4/21/08
Project Location Boulder
Personnel DPB
Well Identification Code 17
Attach map of project, showing well locations and significant topographic and hydrologic features.

Characteristics of Instrument:
Source of instrument/well stock
Material of well stock PVC
Diameter of pipe 1.5"
Slot width 0.01"
Slot spacing 0.25"
Kind of well cap PVC Slip
Kind of well point/end plug open

Installation:
Was well installed by augering or driving? auger
Kind of filter sand 30 silica
Kind of bentonite granular
Depth to lowest screen slots 23"
Riser height above ground 12"
Was bentonite wetted for expansion? yes
Method of measuring water levels in instrument tape
How was instrument checked for clogging after installation? lath



Instrument Diagram[a]	Texture	Matrix Color	Redoximorphic Features: Color	Redoximorphic Features: Abundance	Induration (none, weak, strong)	Roots
A (0-5")	L 0-5"	10YR 2/2	7.5YR 3/4	3-5%	none	3vff 2m
C (4-9")	Co. Sand 4-9"	10YR 4/3	7.5YR 3/4	>1%	none	2vff m
Ab1 (9-14")	L	10YR 2/1	7.5YR 3/4	5%	none	"
Ab2 (14-22)	SL 14-22	10YR 3/1	7.5YR 3/4	10%	none	1vff
Cb (22-26")	LS 22-26	10YR 3/2	7.5YR 3/4	1-2%	none	1vff

[a]Show depths (heights) of riser, well screen, sand pack, and bentonite in relation to soil horizons.

Mottles + oxidized root channels throughout.
* Soil is saturated below 25" + is very moist from 22-25"
Soil temp @ 12" = 41°F
Soil temp @ 20" = 46°F
- In low area of drainage swale.

MW 18

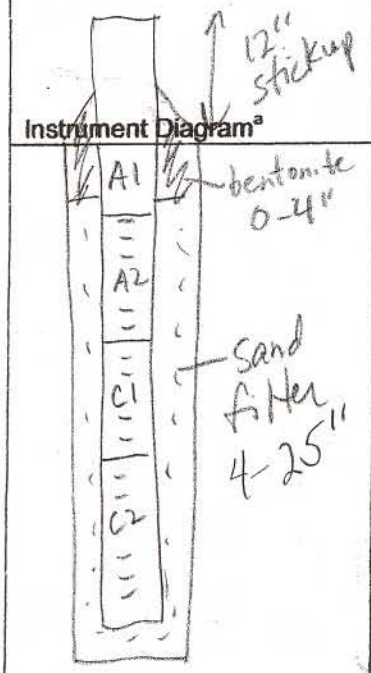
APPENDIX B. MONITORING WELL INSTALLATION DATA FORM

Monitoring Well Installation Data Form

Project Name: Hogan-Pancost property
Date of Installation: 4/21/08
Project Location: Bowden
Personnel: DPB
Well Identification Code: 18
Attach map of project, showing well locations and significant topographic and hydrologic features.

Characteristics of Instrument:
Source of instrument/well stock:
Material of well stock: PVC
Diameter of pipe: 1.5"
Slot width: 0.01"
Slot spacing: 0.25"
Kind of well cap: PVC Slip
Kind of well point/end plug: open

Installation:
Was well installed by augering or driving? Shovel
Kind of filter sand: 30 silica
Kind of bentonite: granular
Depth to lowest screen slots: 23"
Riser height above ground: 12"
Was bentonite wetted for expansion? yes
Method of measuring water levels in instrument: tape
How was instrument checked for clogging after installation? lath



A1 (0-5)
A2 (5-12")
C1 (12-18")
C2 (18-25")

Instrument Diagram[a]	Soil Characteristics: Texture	Matrix Color	Redoximorphic Features: Color	Redoximorphic Features: Abundance	Induration (none, weak, strong)	Roots
	L 0-5"	10YR 2/2	7.5YR 3/4	7-10%	none	3vf 6 2m
	SCL 5-12" 22% Clay	10YR 2/2	7.5YR 3/4	7-10%	none	2vf 1m
	vgrSL 18% Clay 12-18	10YR 3/3	7.5YR 3/4	1-3%	none	1vff m
	vgrSL 18-25"	10YR 3/3	–	–	none	1vff m

[a]Show depths (heights) of riser, well screen, sand pack, and bentonite in relation to soil horizons.

In upper end of drainage swale, up from MW 17. Soil is mod moist below 15". No saturation.

Mottles + oxidized root channels from 1-18".
Some iron-stained sand grains in C horizons (5-10%) most are from weathering rinds on transported igneous rocks.

MW 19

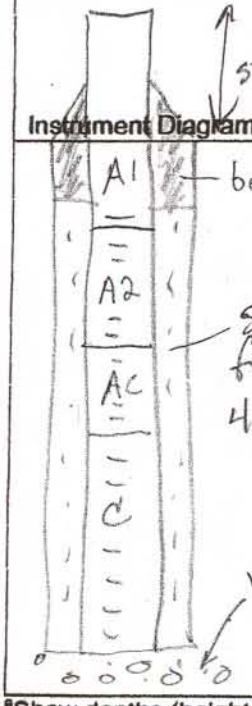
APPENDIX B. MONITORING WELL INSTALLATION DATA FORM

Monitoring Well Installation Data Form

Project Name: Hogan - Pancost property
Date of Installation: 4/21/08
Project Location: Boulder
Personnel: DPB
Well Identification Code: 19
Attach map of project, showing well locations and significant topographic and hydrologic features.

Characteristics of Instrument:
Source of instrument/well stock:
Material of well stock: PVC
Diameter of pipe: 1.5"
Slot width: 0.01"
Slot spacing: 0.25"
Kind of well cap: PVC slip
Kind of well point/end plug: open

Installation:
Was well installed by augering or driving? Shovel
Kind of filter sand: 30 silica
Kind of bentonite: granular
Depth to lowest screen slots: 22.5"
Riser height above ground: 12"
Was bentonite wetted for expansion? yes
Method of measuring water levels in instrument: tape
How was instrument checked for clogging after installation? lath



A1 (0-6)
A2 (6-12")
AC (12-15")
C (15-24")

Instrument Diagram[a]	Soil Characteristics: Texture	Matrix Color	Redoximorphic Features: Color	Redoximorphic Features: Abundance	Induration (none, weak, strong)	Roots
A1	L 0-6"	10YR 2/2	7.5YR 3/4	10%	none	3 vff m 3 c
A2	L 6-12"	10YR 3/1	7.5YR 3/4	10%	none	"
AC	vgrl SL 12-15"	10YR 2/2	7.5YR 3/4	1%	none	2 vff m, c
C	vgrl co. sand 15"-24	10YR 3/2	—	—	none	1 vff m, c

[a]Show depths (heights) of riser, well screen, sand pack, and bentonite in relation to soil horizons.

In drainage swale west side of property, in willows.
A2 contains thin lenses of SL.
Some iron-stained sand grains in C horizon.
Soil is mod. moist below 15".
Mottles + oxidized root channels from 0 - 15"

MW 20

APPENDIX B. MONITORING WELL INSTALLATION DATA FORM

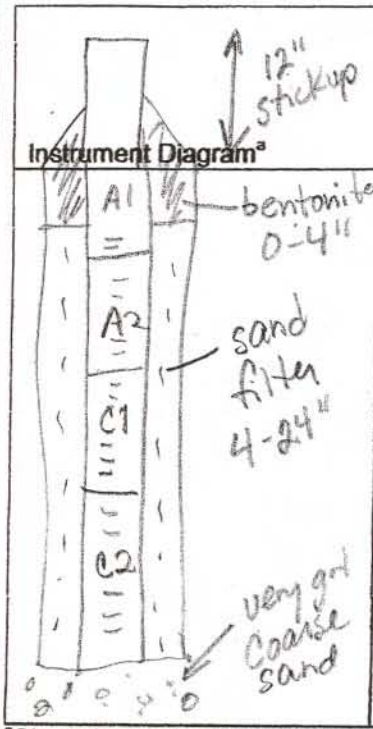
Monitoring Well Installation Data Form

Project Name Hogan-Pancost Property
Date of Installation 4/21/08
Project Location Boulder
Personnel OPB
Well Identification Code 20
Attach map of project, showing well locations and significant topographic and hydrologic features.

Characteristics of Instrument:
Source of instrument/well stock
Material of well stock PVC
Diameter of pipe 1.5"
Slot width 0.01"
Slot spacing 0.25"
Kind of well cap PVC Slip
Kind of well point/end plug open

Installation:
Was well installed by augering or driving? Shoval
Kind of filter sand 30 silica
Kind of bentonite granular
Depth to lowest screen slots 23.5"
Riser height above ground 12"
Was bentonite wetted for expansion? yes
Method of measuring water levels in instrument tape
How was instrument checked for clogging after installation? lath

Instrument Diagram[a]	Soil Characteristics: Texture	Matrix Color	Redoximorphic Features: Color	Redoximorphic Features: Abundance	Induration (none, weak, strong)	Roots
A1 (0-7")	L 0-7"	10YR 2/2	7.5YR 3/4	7-10%	none	3vff m
A2 (7-11")	v gr sL 7-11"	10YR 2/2	7.5YR 3/4	3%	none	2vff m
C1 (11-16")	v gr LS 11-16"	10YR 3/2.5	7.5YR 3/4	1%	none	1vff m
C2 (16-24")	v gr co. S. 16-24"	10YR 3/3	—	—	none	1vff



[a]Show depths (heights) of riser, well screen, sand pack, and bentonite in relation to soil horizons.

In drainage swale. No saturation. Soil is only slightly moist. C horizons contains 10% iron-stained sand grains.

Mottles from 0-16". Oxidized root channels 0-11", very few below 11".

MW 21

APPENDIX B. MONITORING WELL INSTALLATION DATA FORM

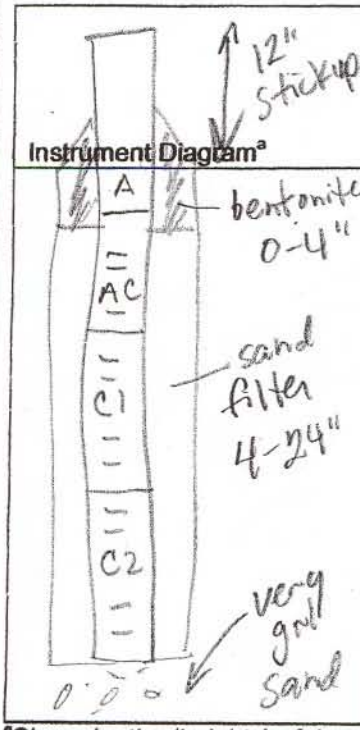
Monitoring Well Installation Data Form

Project Name Hogan-Pancost Property
Date of Installation 4/21/08
Project Location Boulder
Personnel ARB
Well Identification Code 21
Attach map of project, showing well locations and significant topographic and hydrologic features.

Characteristics of Instrument:
Source of instrument/well stock
Material of well stock PVC
Diameter of pipe 1.5"
Slot width 0.01"
Slot spacing 0.25"
Kind of well cap PVC Slip
Kind of well point/end plug open

Installation:
Was well installed by augering or driving? Shovel
12"
Kind of filter sand 30 Silica
Kind of bentonite granular
Depth to lowest screen slots 23"
Riser height above ground
Was bentonite wetted for expansion? yes
Method of measuring water levels in instrument tape
How was instrument checked for clogging after installation? lath

Instrument Diagram[a]	Texture	Matrix Color	Redoximorphic Features: Color	Redoximorphic Features: Abundance	Induration (none, weak, strong)	Roots
A (0-4")	L 0-4"	10YR 2/2	7.5YR 3/4	7-10%	none	2vff m
AC (4-7")	Vgel LS 4-7"	10YR 2/2	7.5YR 3/4	1-2%	none	2vff m
C1 (7-16)	Vgel Coarse Sand	10YR 3/2.5	—	—	none	1vff m
C2 (16-24")	V gel med. sand 16-24"	10YR 3/3	—	—	none	1vff



[a]Show depths (heights) of riser, well screen, sand pack, and bentonite in relation to soil horizons.

Soil is slightly moist. No saturation. Mottles + oxidized root channels from 1-7". C horizons contain 5-10% (10YR 5/6) iron-stained sand grains. Many are from weathering rinds of transported igneous rocks.

Upper end of swale.

MW 22

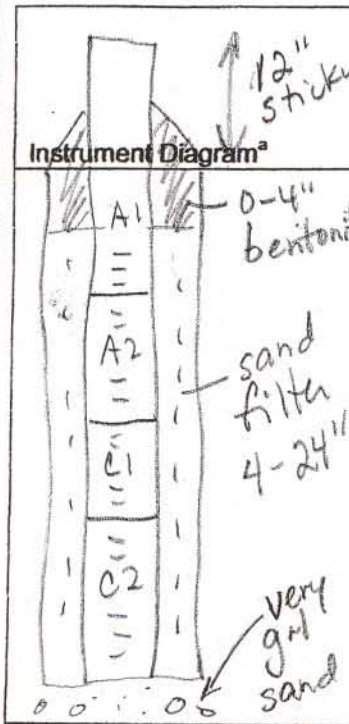
APPENDIX B. MONITORING WELL INSTALLATION DATA FORM

Monitoring Well Installation Data Form

Project Name Hogan - Pancost Prop. Date of Installation 4/21/08
Project Location Boulder Personnel DPB
Well Identification Code 22
Attach map of project, showing well locations and significant topographic and hydrologic features.

Characteristics of Instrument:
Source of instrument/well stock
Material of well stock PVC Diameter of pipe 1.5"
Slot width 0.01" Slot spacing 0.25"
Kind of well cap PVC Slip Kind of well point/end plug open
Installation:
Was well installed by augering or driving? Shovel
Kind of filter sand 30 Silica Kind of bentonite granular
Depth to lowest screen slots 22.5" Riser height above ground 12"
Was bentonite wetted for expansion? yes
Method of measuring water levels in instrument tape
How was instrument checked for clogging after installation? lath

Instrument Diagram[a]	Soil Characteristics: Texture	Matrix Color	Redoximorphic Features: Color	Redoximorphic Features: Abundance	Induration (none, weak, strong)	Roots
A1 (0-8")	L 0-8"	10YR 2/2	7.5YR 3/4	7-10%	none	3vf f 2m
A2 (8-14")	SL/LS 8-14"	10YR 2/2	7.5YR 4/6 7.5YR 3/4	10-20%	none	2vf f m
C1 (14-18")	med Sand	10YR 3/2	7.5YR 3/4	5%	none	1vf f m
C2 (18-24")	V grl med Sand	10YR 3/2.5	7.5YR 3/4	<1%	none	1vf f



[a]Show depths (heights) of riser, well screen, sand pack, and bentonite in relation to soil horizons.

Soil is slightly moist. No saturation, oxidized root channels + mottles from 1-18". Observed a couple mottles >18".

Soil temp @ 12" = 42°F
Soil temp @ 20" = 41°F

C2 horizon contains 10% iron-stained sand grains, most are from weathering rinds.
Slightly higher than MW 21.

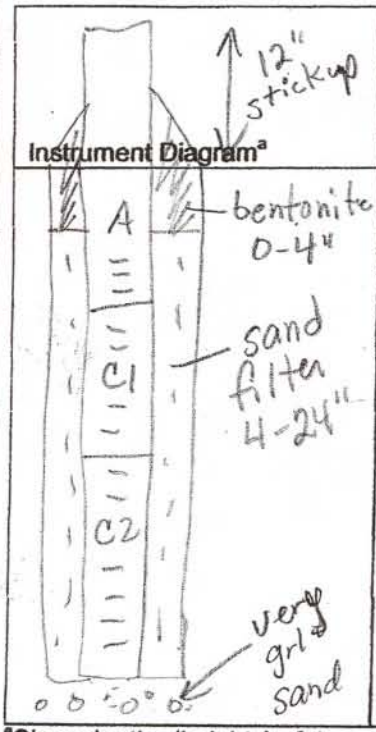
APPENDIX B. MONITORING WELL INSTALLATION DATA FORM MW 23

Monitoring Well Installation Data Form

Project Name Hogan-Pancost property
Date of Installation 4/21/08
Project Location Boulder
Personnel DPB
Well Identification Code 23
Attach map of project, showing well locations and significant topographic and hydrologic features.

Characteristics of Instrument:
Source of instrument/well stock
Material of well stock PVC
Diameter of pipe 1.5"
Slot width 0.01"
Slot spacing 0.25"
Kind of well cap PVC slip
Kind of well point/end plug open

Installation:
Was well installed by augering or driving? Shovel
Kind of filter sand 30 silica
Kind of bentonite granular
Depth to lowest screen slots 22.5"
Riser height above ground 12"
Was bentonite wetted for expansion? yes
Method of measuring water levels in instrument tape
How was instrument checked for clogging after installation? lath



	Instrument Diagram[a]	Soil Characteristics: Texture	Matrix Color	Redoximorphic Features: Color	Redoximorphic Features: Abundance	Induration (none, weak, strong)	Roots
A (0-10")		L 0-10"	10YR 2/2	7.5YR 3/4	5-7%	none	3vf-f 1m
C1 (10-15")		v gr SL 10-15"	10YR 3/2	7.5YR 3/4	1%	none	2vf-f 1m
C2 (15-24")		v grl sand 15-24"	10YR 3/2.5	—	—	none	1vf-f m

[a]Show depths (heights) of riser, well screen, sand pack, and bentonite in relation to soil horizons.

In shallow drainage swale, Oxidized root Channels 0-10", C horizon contains ≈ 10% iron-stained sand grains
No saturation, soil is slightly moist.

MW 24

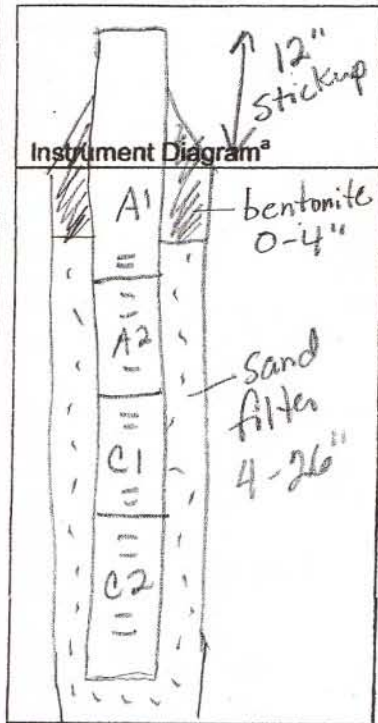
APPENDIX B. MONITORING WELL INSTALLATION DATA FORM

Monitoring Well Installation Data Form

Project Name Hogan-Pancost Property
Date of Installation 4/21/08
Project Location Boulder
Personnel DPB
Well Identification Code 24
Attach map of project, showing well locations and significant topographic and hydrologic features.

Characteristics of Instrument:
Source of instrument/well stock
Material of well stock PVC
Diameter of pipe 1.5"
Slot width 0.01"
Slot spacing 0.25"
Kind of well cap PVC slip
Kind of well point/end plug open

Installation:
Was well installed by augering or driving? Shovel
Kind of filter sand 30 Silica
Kind of bentonite granular
Depth to lowest screen slots 22.5"
Riser height above ground 12"
Was bentonite wetted for expansion? yes
Method of measuring water levels in instrument tape
How was instrument checked for clogging after installation? lath

Instrument Diagram[a]	Soil Characteristics: Texture	Matrix Color	Redoximorphic Features: Color	Redoximorphic Features: Abundance	Induration (none, weak, strong)	Roots
	L 0-9"	10YR 2/1	7.5YR 3/4	3-5%	none	3vf f
	SL 9-13"	10YR 2/2	7.5YR 3/4	5-7%	none	2vf f
	vgrl LS 13-17"	10YR 3/2	7.5YR 3/4	3-5%	none	2vf f
	vgrl LS 17-26"	10YR 3/2	—	—	none	1vf f

A1 (0-9")
A2 (9-13")
C1 (13-17")
C2 (17-26")

[a]Show depths (heights) of riser, well screen, sand pack, and bentonite in relation to soil horizons.

In upper drainage swale. No saturation. Soil is slightly moist. C horizons contain 5% iron-stained sand grains (7.5YR 4/6 + 10YR 4/6) most of which, or all, are from weathering rinde from transported igneous rocks.
Mottles + oxidized root channels from 1-17".

APPENDIX B. MONITORING WELL INSTALLATION DATA FORM MW 25

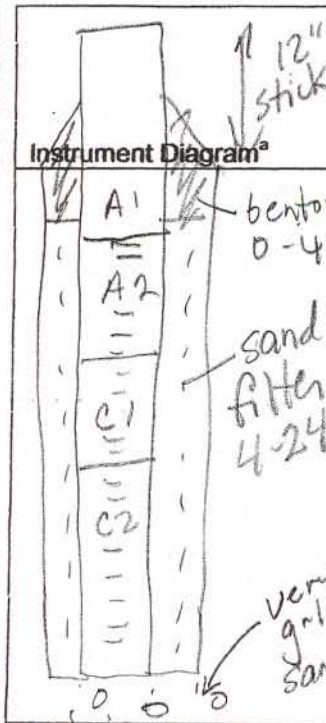
Monitoring Well Installation Data Form

Project Name Hogan-Pancost property
Date of Installation 4/22/08
Project Location Boulder
Personnel DPB
Well Identification Code 25
Attach map of project, showing well locations and significant topographic and hydrologic features.

Characteristics of Instrument:
Source of instrument/well stock
Material of well stock PVC
Diameter of pipe 1.5"
Slot width 0.01"
Slot spacing 0.25"
Kind of well cap PVC slip
Kind of well point/end plug open

Installation:
Was well installed by augering or driving? Shovel
Kind of filter sand Silica-30
Kind of bentonite granular
Depth to lowest screen slots 23"
Riser height above ground 12"
Was bentonite wetted for expansion? yes
Method of measuring water levels in instrument tape
How was instrument checked for clogging after installation? lath

Instrument Diagram[a]	Soil Characteristics: Texture	Matrix Color	Redoximorphic Features: Color	Redoximorphic Features: Abundance	Induration (none, weak, strong)	Roots
A1 (0-5")	Cbl L 0-5"	10YR 2/2	7.5YR 3/4	5%	none	3vff
A2 (5-11")	v. grl sL 5-11"	10YR 2/2	—	—	none	2vff
C1 (11-16)	V. grl LS 11-16"	10YR 3/2	—	—	none	1vff
C2 (16-24")	V grl Co. Sand 16-24"	10YR 3/3	—	—	none	1vff



[a]Show depths (heights) of riser, well screen, sand pack, and bentonite in relation to soil horizons.

on slight rise between wells 23 + 24, which are in shallow drainage swales. Soil is slightly moist.

Soil temp @ 12" = 43°F
Soil temp @ 20" = 42°F

No saturation.
Mottles + oxidized root channels 0-5".

C horizons contain 5-10% iron-stained sand grains.

* used plastic bag for cap *

MW 26

APPENDIX B. MONITORING WELL INSTALLATION DATA FORM

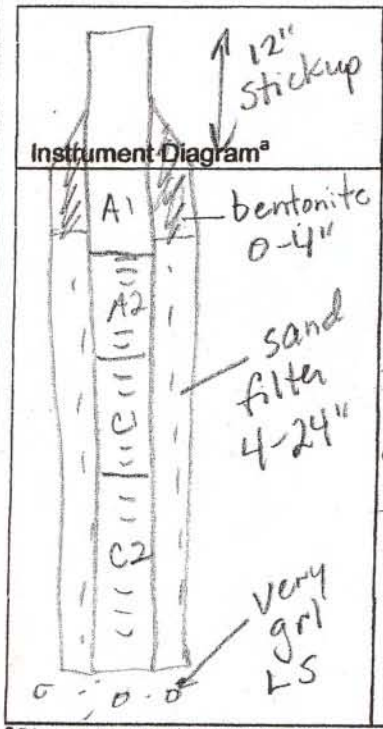
Monitoring Well Installation Data Form

Project Name _____
Project Location Boulder
Well Identification Code 26
Date of Installation 4/22/08
Personnel DPB

Attach map of project, showing well locations and significant topographic and hydrologic features.

Characteristics of Instrument:
Source of instrument/well stock _____
Material of well stock PVC
Diameter of pipe 1.5"
Slot width 0.01"
Slot spacing 0.25"
Kind of well cap _____
Kind of well point/end plug open

Installation:
Was well installed by augering or driving? Shovel
Kind of filter sand Silica - 30
Kind of bentonite granular
Depth to lowest screen slots 23.5"
Riser height above ground 12"
Was bentonite wetted for expansion? yes
Method of measuring water levels in instrument tape
How was instrument checked for clogging after installation? lath



	Soil Characteristics					
Instrument Diagram[a]	Texture	Matrix Color	Redoximorphic Features: Color	Redoximorphic Features: Abundance	Induration (none, weak, strong)	Roots
A1 (0-5")	L 0-5"	10YR 2/2	7.5YR 3/4	7-10%	none	3vff 2m
A2 (5-9")	grl SL 5-9"	10YR 2/2	7.5YR 3/4	5-7%	none	3vff 2m
C1 (9-19")	vgrl co. sand 9-19"	10YR 3/3	—	—	none	2vff 1m
C2 (19-24")	V grl LS 19-24"	10YR 3/3	—	—	none	1vff m

[a]Show depths (heights) of riser, well screen, sand pack, and bentonite in relation to soil horizons.

Northern most well, in baltic rush. Soil is slightly moist, no saturation. Mottles + oxidized root channels from 0-9"

Soil temp @ 12" = 42°F
Soil temp @ 20" = 41°F

C horizons contain 5-10% 18 iron-stained sand grains.

MW 27

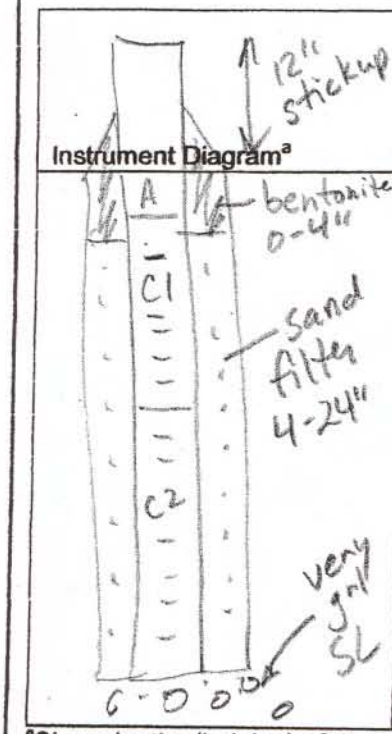
APPENDIX B. MONITORING WELL INSTALLATION DATA FORM

Monitoring Well Installation Data Form

Project Name Hogan - Pancost Property
Date of Installation 5/13/08
Project Location Boulder
Personnel DPB
Well Identification Code 27
Attach map of project, showing well locations and significant topographic and hydrologic features.

Characteristics of Instrument:
Source of instrument/well stock
Material of well stock PVC
Diameter of pipe 1.5"
Slot width 0.01"
Slot spacing 0.25"
Kind of well cap PVC slip
Kind of well point/end plug open

Installation:
Was well installed by augering or driving? shovel
Kind of filter sand Silica - 30
Kind of bentonite granular
Depth to lowest screen slots 23"
Riser height above ground 12"
Was bentonite wetted for expansion? Yes
Method of measuring water levels in instrument tape
How was instrument checked for clogging after installation? lath

Instrument Diagram[a]	Soil Characteristics					
	Texture	Matrix Color	Redoximorphic Features		Induration (none, weak, strong)	Roots
			Color	Abundance		
	L 0-2"	10YR 2/2	—	—	none	3vf f
	V. gr SL 2-15"	10YR 4/2	—	—	none	2vf f
	v gr SL 15-24"	10YR 3/2	—	—	none	1vf f

A (0-2")
C1 (2-15")
C2 (15-24")

[a]Show depths (heights) of riser, well screen, sand pack, and bentonite in relation to soil horizons.

About 30' from irrigation ditch, which has flowing water. Some iron-stained sand grains in C horizons.

0-2" very moist from rain, slighty moist below.

SE of well 28.

APPENDIX B. MONITORING WELL INSTALLATION DATA FORM

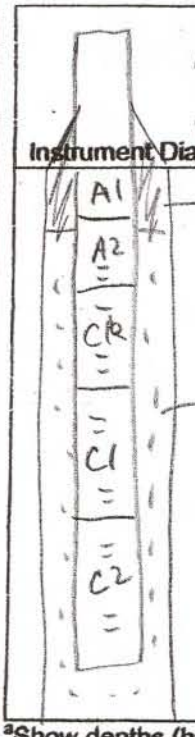
MW 28

Monitoring Well Installation Data Form

Project Name Hogan - Pancost Property
Date of Installation 5/13/08
Project Location Boulder
Personnel DPB
Well Identification Code 28
Attach map of project, showing well locations and significant topographic and hydrologic features.

Characteristics of Instrument:
Source of instrument/well stock
Material of well stock PVC
Diameter of pipe 1.5"
Slot width 0.01"
Slot spacing 0.25"
Kind of well cap PVC slip
Kind of well point/end plug open

Installation:
Was well installed by augering or driving? auger
Kind of filter sand Silica - 30
Kind of bentonite granular
Depth to lowest screen slots 23"
Riser height above ground 12"
Was bentonite wetted for expansion? yes
Method of measuring water levels in instrument tape
How was instrument checked for clogging after installation? lath



Instrument Diagram[a]	Texture	Matrix Color	Redoximorphic Features: Color	Redoximorphic Features: Abundance	Induration (none, weak, strong)	Roots
A1 0-4"	L/CL 0-4"	10YR 2/2	—	—	none	3 vf-f
A2 4-7"	gr CL 4-7	10YR 3/2	7.5YR 3/4	1%	none	2 vf-f
CR 7-12"	CL 4-12"	10YR 4/2	7.5YR 3/4	3%	none	2 vf-f
C1 12-18"	SCL 12-18"	10YR 4/3	7.5YR 4/4	1%	none	1 vf-f
C2 18-26"	SCL 18-26"	10YR 5/4	7.5YR 4/6	5%	none	1 vf-f

[a]Show depths (heights) of riser, well screen, sand pack, and bentonite in relation to soil horizons.

About 40' South of pond. 5-10% $CaCO_3$ in Ck.
Upper 2" very moist from rain, slightly moist below.

Probably all fill. Mottles + few oxidized root channels from 4-26".

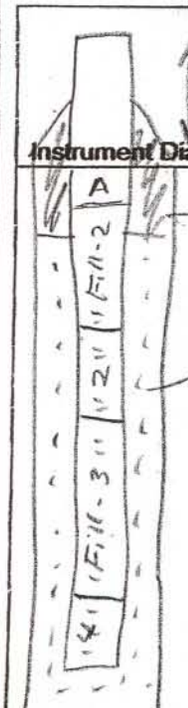
APPENDIX B. MONITORING WELL INSTALLATION DATA FORM

MW 29

Monitoring Well Installation Data Form

Project Name Hogan - Pancost Property **Date of Installation** 5/13/08
Project Location Boulder **Personnel** DRB
Well Identification Code 29
Attach map of project, showing well locations and significant topographic and hydrologic features.

Characteristics of Instrument:
Source of instrument/well stock
Material of well stock PVC **Diameter of pipe** 1.5"
Slot width 0.01" **Slot spacing** 0.25"
Kind of well cap PVC Slip **Kind of well point/end plug** open
Installation:
Was well installed by augering or driving? auger
Kind of filter sand Silica 30 **Kind of bentonite** granular
Depth to lowest screen slots 23" **Riser height above ground** 12"
Was bentonite wetted for expansion? yes
Method of measuring water levels in instrument tape
How was instrument checked for clogging after installation? lath

Instrument Diagram[a]	Soil Characteristics: Texture	Matrix Color	Redoximorphic Features: Color	Redoximorphic Features: Abundance	Induration (none, weak, strong)	Roots
	L 0-2	10YR 2/2	—	—	none	3 vf, f m
	CL 2-11"	2.5Y 4/2	10YR 4/4	3-5%	none	2 vf f
	grL SCL 11-15"	7.5YR 4/3	—	—	none	1 vf f
	SL 15-22"	10YR 2/2	7.5YR 3/4	5%	none	1 vf f
	SiL	10YR 8/1	10YR 4/4	3%	none	—

A (Fill) 0-2"
Fill-1 2-11"
Fill-2 11-15"
Fill 3 15-22
Fill 4 22-27"

[a]Show depths (heights) of riser, well screen, sand pack, and bentonite in relation to soil horizons.

Fill-1 contains asphalt fragments. NW of well 28.
Fill-4, wet, not saturated, non-calcareous.

All fill. Some mottles + oxidized root channels in fill, some mottles may be inherent from original location.

Well 24' + sand swelled 2" up into bottom of well.

MW 30

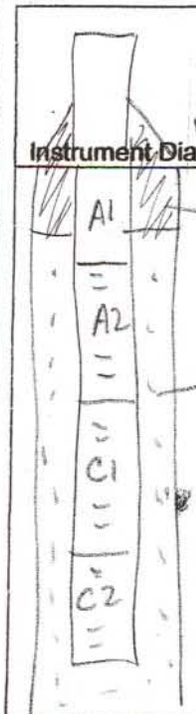
APPENDIX B. MONITORING WELL INSTALLATION DATA FORM

Monitoring Well Installation Data Form

Project Name Hogan-Pancost Property
Date of Installation 5/13/08
Project Location Boulder
Personnel APB
Well Identification Code 30
Attach map of project, showing well locations and significant topographic and hydrologic features.

Characteristics of Instrument:
Source of instrument/well stock
Material of well stock PVC
Diameter of pipe 1.5"
Slot width 0.01"
Slot spacing 0.25"
Kind of well cap PVC Slip
Kind of well point/end plug open

Installation:
Was well installed by augering or driving? auger
Kind of filter sand Silica 30
Kind of bentonite granular
Depth to lowest screen slots 23"
Riser height above ground 12"
Was bentonite wetted for expansion? yes
Method of measuring water levels in instrument tape
How was instrument checked for clogging after installation? lath



A1 (0-6")
A2 (6-12")
C1 (12-22")
C2 (22-26")

Instrument Diagram[a]	Soil Characteristics: Texture	Matrix Color	Redoximorphic Features: Color	Redoximorphic Features: Abundance	Induration (none, weak, strong)	Roots
A1	L 0-6"	10YR 2/2	—	—	none	3vf f 2m
A2	grL SL 6-12"	10YR 2/2	—	—	none	2vff m
C1	grL SCL 12-22"	10YR 4/3	—	—	none	2vff m
C2	grL SL 22-26"	10YR 4/3 4/2 (50%)	7.5YR 4/4	1-2%	none	1vff

[a]Show depths (heights) of riser, well screen, sand pack, and bentonite in relation to soil horizons.

East of 55 Ave on shallow ridge. No saturation. C2 horizon is mod. moist. Few mottles in C2 horizon.

MW 31

APPENDIX B. MONITORING WELL INSTALLATION DATA FORM

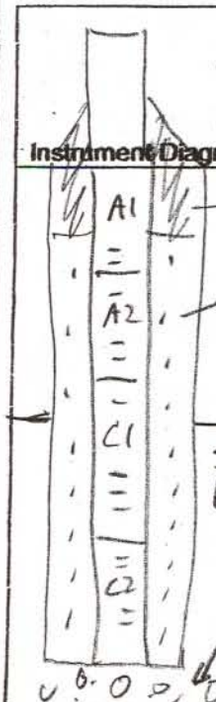
Monitoring Well Installation Data Form

Project Name Hogan - Pancost property
Date of Installation 5/13/08
Project Location Bowden
Personnel DPB
Well Identification Code 31
Attach map of project, showing well locations and significant topographic and hydrologic features.

Characteristics of Instrument:
Source of instrument/well stock
Material of well stock PVC
Diameter of pipe 1.5"
Slot width 0.01"
Slot spacing 0.25"
Kind of well cap PVC Slip
Kind of well point/end plug open

Installation:
Was well installed by augering or driving? auger
Kind of filter sand Silica 30
Kind of bentonite granular
Depth to lowest screen slots 23
Riser height above ground 12"
Was bentonite wetted for expansion? yes
Method of measuring water levels in instrument tape
How was instrument checked for clogging after installation? lath

Instrument Diagram[a]	Soil Characteristics: Texture	Matrix Color	Redoximorphic Features: Color	Redoximorphic Features: Abundance	Induration (none, weak, strong)	Roots
A1 0-7"	L 0-7	10YR 2/2	7.5YR 3/4	3-5%	none	3vf f m
A2 7-12"	L 7-12"	10YR 3/1	7.5YR 3/4	10%	none	2vf f m
C1 12-20"	v. gel SL 12-20	10YR 3/2	7.5YR 3/4	3-5%	none	1vf f m
C2 20-24"	v gel LS 20-24"	10YR 3/3	10YR 4/6	5%	none	1vf f



[a]Show depths (heights) of riser, well screen, sand pack, and bentonite in relation to soil horizons.

Saturated below 13". Mottles throughout.
oxidized root channels 0-15", few roots below.

In swale. Sand rose up in well 1.5"
East of 55 Ave.

MW 32

APPENDIX B. MONITORING WELL INSTALLATION DATA FORM

Monitoring Well Installation Data Form

Project Name Hogan - Pancost Property
Date of Installation 5/13/08
Project Location Boulder
Personnel OPB
Well Identification Code 32
Attach map of project, showing well locations and significant topographic and hydrologic features.

Characteristics of Instrument:
Source of instrument/well stock
Material of well stock PVC
Diameter of pipe 1.5"
Slot width 0.01"
Slot spacing 0.25"
Kind of well cap PVC slip
Kind of well point/end plug open

Installation:
Was well installed by augering or driving? Shovel
Kind of filter sand Silica 30
Kind of bentonite granular
Depth to lowest screen slots 23"
Riser height above ground 12"
Was bentonite wetted for expansion? yes
Method of measuring water levels in instrument tape
How was instrument checked for clogging after installation? lath

Instrument Diagram[a]	Texture	Matrix Color	Redoximorphic Features: Color	Redoximorphic Features: Abundance	Induration (none, weak, strong)	Roots
A1 (0-9") — bentonite 0-4"	L 0-9"	10YR 2/2	—	—	none	3vf f 2m
A2 (9-18") — sand filter 4-24"	V.grl SL 9-18"	10YR 3/2	—	—	none	2vf f 2m
C1 (18-22")	V.grl LS 18-22"	10YR 3/2	—	—	none	1vf f
C2 (22-24") — very grl co. sand	V.grl co. Sand 22-24"	10YR 3/3	—	—	none	1vf f

12" stickup

[a]Show depths (heights) of riser, well screen, sand pack, and bentonite in relation to soil horizons.

East of 55 Ave, on shallow ridge.
No saturation. Soil is slightly moist.
No mottles, no oxidized root channels.

Appendix C. WETS Table for Boulder, Colorado

WETS Station : BOULDER, CO0848 Creation Date: 08/29/2002
Latitude: 4000 Longitude: 10516 Elevation: 05480
State FIPS/County(FIPS): 08013 County Name: Boulder
Start yr. - 1971 End yr. - 2000

Month	Temperature (Degrees F.) avg daily max	avg daily min	avg	Precipitation (Inches) avg	30% chance will have less than	more than	avg # of days w/.1 or more	avg total snow fall
January	44.7	19.5	32.1	0.70	0.33	0.86	2	11.0
February	48.3	23.2	35.8	0.76	0.40	0.95	2	9.9
March	55.1	28.7	41.9	1.79	1.10	2.16	4	15.9
April	62.2	35.1	48.7	2.76	1.78	3.32	5	12.0
May	71.3	43.3	57.3	2.92	1.73	3.61	6	1.1
June	81.8	51.8	66.8	1.99	1.12	2.42	4	0.0
July	86.8	56.9	71.9	1.95	1.28	2.34	4	0.0
August	84.9	56.0	70.5	1.66	0.76	2.03	4	0.0
September	76.7	47.6	62.2	1.82	0.88	2.22	4	2.3
October	66.2	37.9	52.1	1.30	0.68	1.59	3	4.5
November	51.8	27.2	39.5	1.46	0.67	1.79	3	16.1
December	46.2	21.8	34.0	0.78	0.38	0.95	2	12.0
Annual	-----	-----	-----	------	16.41	20.61	--	----
Average	64.7	37.4	51.0	------	------	------	--	----
Total	-----	-----	-----	19.89	------	------	43	84.8

GROWING SEASON DATES

Probability	Temperature: 24 F or higher	28 F or higher	32 F or higher
	Beginning and Ending Dates Growing Season Length		
50 percent *	4/ 8 to 10/20 195 days	4/21 to 10/10 172 days	5/ 3 to 9/30 150 days
70 percent *	4/ 3 to 10/26 206 days	4/17 to 10/15 181 days	4/30 to 10/ 4 158 days

* Percent chance of the growing season occurring between the Beginning and Ending dates.

Appendix D. Field Data Forms

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 Wetland Delineation Manual)

Project/Site HOGAN-PANKOST	DATE 8/29/08
Applicant/Owner MACKENZIE	COUNTY BOULDER
Investigator ORTHMAN/BUSCHER	STATE CO
Do Normal Circumstances exist on the site? (YES) NO	Plot ID 1
Is the site significantly disturbed (Atypical Situation)? (YES) NO	Community ID baltic rush/mdw foxt.
Is the area a potential Problem Area? YES (NO)	Location ID NE of MWA
(If needed, explain on reverse)	

VEGETATION

Dominant Plant Species	Relative Cover % Overstory	% Understory	Indicator Status
1. Juncus balticus	–	60	OBL
2. Festuca pratensis	–	20	FAC
3. Agrostis gigantea	–	10	FACW
4. Poa pratensis	–	10	FACU
5.			
6.			
7.			
8.			
9.			
10.			

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-) — Total % Overstory – — Total % Understory 100

Remarks: Abs. veg cover = 95%

HYDROLOGY

✓ Recorded Data (Describe in Remarks):
- ____ Stream, Lake or Tide Gauge
- ____ Aerial Photographs
- ✓ Other
- ____ No Recorded Data Available

Field Observations:
- Depth of Surface Water N/A (in.)
- Depth to Free Water in Pit ____ (in.)
- Depth to Saturated Soil ____ (in.)

Remarks: may be within mapped 100 yr floodplain. No indicators of a wetland hydrology.

Wetland Hydrology Indicators:

Primary Indicators: none
- ____ Inundated
- ____ Saturated In Upper 12 Inches
- ____ Water Marks
- ____ Drift Lines
- ____ Sediment Deposits
- ____ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required): none
- ____ Oxidized Root Channels in Upper 12 Inches
- ____ Water-Stained Leaves
- ____ Local Soil Survey Data
- ____ FAC Neutral Test
- ____ Other (Explain in Remarks)

SOILS Pit 1 8/29/08 Hogan Parcost Prop.

Map Unit Name
(Series and Phase): _____

Drainage Class: Mod well

Field Observations
Confirm Mapped Type? Yes No

Taxonomy (Subgroup): Fluvaquentic Haplustolls

Profile Description:

Depth (Inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-3	A	10YR 2/2	—	—	L, 2 f gr
3-14	AC	10YR 3/2	—	—	v. gr SCL

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- ___ Reducing Conditions
- ___ Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer in Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ___ Listed on Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks: Few oxidized sand grains from weathering rinds on gravels + cobbles. No saturation.

WETLAND DETERMINATION

Hydrophytic Vegetation Present?	Yes (circled)	No	(Circle)
Wetland Hydrology Present?	Yes	No (circled)	
Hydric Soils Present?	Yes	No (circled)	
Is this Sampling Point Within a Wetland?	Yes	No (circled)	(Circle)

Remarks:

Approved by HQUSAC 3/92

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 Wetland Delineation Manual)

Project/Site HOGAN-PANCOST	DATE 8/29/08
Applicant/Owner MACKENZIE	COUNTY BOULDER
Investigator ORTHMAR / BUSCHER	STATE CO
Do Normal Circumstances exist on the site? (YES) NO	Plot ID 2
Is the site significantly disturbed (Atypical Situation)? (YES) NO	Community ID Mdw Desc./Redtop
Is the area a potential Problem Area? YES (NO)	Location ID SW of #1; By MWA
(If needed, explain on reverse)	

VEGETATION

Dominant Plant Species	Relative Cover % Overstory	% Understory	Indicator Status
1. Festuca pratensis	—	40	FAC
2. Agrostis gigantea	—	40	OBL
3. Phleum pratense	—	10	FACU
4. Trifolium pratense	—	10	FACU
5.			
6.			
7.			
8.			
9.			
10.			

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-) Total % Overstory _____ Total % Understory 80

Remarks: Absolute veg cover = 100%

HYDROLOGY

✓ Recorded Data (Describe in Remarks):
- ____ Stream, Lake or Tide Gauge
- ✓ Aerial Photographs
- ✓ Other
- ____ No Recorded Data Available

Field Observations:
- Depth of Surface Water N/A (in.)
- Depth to Free Water in Pit ____ (in.)
- Depth to Saturated Soil ____ (in.)

Remarks: MWA is 17 ft to W and 0.11 ft lower in elevation and did not have a wetland hydrology. ∴ no wetland hydrology here

Wetland Hydrology Indicators:

Primary Indicators: none
- ____ Inundated
- ____ Saturated In Upper 12 Inches
- ____ Water Marks
- ____ Drift Lines
- ____ Sediment Deposits
- ____ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- X Oxidized Root Channels in Upper 12 Inches
- ____ Water-Stained Leaves
- ____ Local Soil Survey Data
- ____ FAC Neutral Test
- ____ Other (Explain in Remarks)

SOILS Pit 2 8/29/08 Hogan Pancost Prop

Map Unit Name (Series and Phase): _____

Drainage Class: Somewhat poorly

Field Observations Confirm Mapped Type? Yes No

Taxonomy (Subgroup): Fluvaquentic Epiaquolls

Profile Description:

Depth (Inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0 - 5	A1	10YR 2/2	7.5YR 3/4	2%, d	SL, 2 f gr
5 - 16	A2	10YR 3/2	7.5YR 3/4 10YR 4/4	5%, d	SCL, 2 m sbk

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- ___ Reducing Conditions
- X Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer in Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ___ Listed on Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks: Most redox features are oxidized roots + root channels, likely from saturation coming from surface — irrigation. No saturation.

WETLAND DETERMINATION

Hydrophytic Vegetation Present? Yes No (Circle)

Wetland Hydrology Present? Yes No

Hydric Soils Present? Yes No

(Circle)

Is this Sampling Point Within a Wetland? Yes No

Remarks:

Approved by HQUSAC 3/92

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 Wetland Delineation Manual)

Project/Site HOGAN PANCOST	DATE 8/29/08
Applicant/Owner MACKENZIE	COUNTY BOULDER
Investigator ORTHNER / BUSCHER	STATE CO
Do Normal Circumstances exist on the site? (YES) NO	Plot ID 3
Is the site significantly disturbed (Atypical Situation)? (YES) NO	Community ID mdw fescue / redtop
Is the area a potential Problem Area? YES (NO)	Location ID between #1 + #3
(If needed, explain on reverse)	

VEGETATION

Dominant Plant Species	Relative Cover % Overstory	% Understory	Indicator Status
1. Festuca pratensis	–	60	FAC
2. Agrostis gigantea	–	20	FACW
3. Trifolium pratense	–	10	FACU
4. Plantago lanceolata	–	5	FAC
5. Phleum pratense	–	5	FACU
6.			
7.			
8.			
9.			
10.			
Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-)	Total % Overstory –	Total % Understory 90	

Remarks: Abs veg = 100% cover

HYDROLOGY

✓ Recorded Data (Describe in Remarks):	Wetland Hydrology Indicators:
____ Stream, Lake or Tide Gauge	Primary Indicators:
✓ Aerial Photographs	____ Inundated
✓ Other	____ Saturated In Upper 12 Inches
____ No Recorded Data Available	____ Water Marks
Field Observations:	____ Drift Lines
Depth of Surface Water N/A (in.)	____ Sediment Deposits
Depth to Free Water in Pit ____ (in.)	____ Drainage Patterns in Wetlands
Depth to Saturated Soil ____ (in.)	Secondary Indicators (2 or more required):
Remarks: As shown by MNA, located 33 ft to W + 0.53 ft lower in elevation, there is no wetland hydrology in this area.	X Oxidized Root Channels in Upper 12 Inches
	____ Water-Stained Leaves
	____ Local Soil Survey Data
	____ FAC Neutral Test
	____ Other (Explain in Remarks)

SOILS Pit 3 8/29/08 Hogan Pancost

Map Unit Name (Series and Phase): _____

Drainage Class: Somewhat poorly

Field Observations

Taxonomy (Subgroup): Fluvaquentic Endoaquolls

Confirm Mapped Type? Yes No

Profile Description:

Depth (Inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-5	A	10YR 2/2	—	—	SL, 2 f gr
5-13	Ac	10YR 3/2	10YR 4/4 7.5YR 4/4	5%, d	V gr SL

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- ___ Reducing Conditions
- ✓ Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer in Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ___ Listed on Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks: No saturation. Few oxidized root channels. Many oxidized sand grains, some probably from weathering rinds. Flood irrigation has some influence on the hydrology. <1% oxidized root channels.

WETLAND DETERMINATION

Hydrophytic Vegetation Present?	Yes	No	(Circle)		(Circle)
Wetland Hydrology Present?	Yes	No			
Hydric Soils Present?	Yes	No		Is this Sampling Point Within a Wetland?	Yes No

Remarks:

Approved by HQUSAC 3/92

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 Wetland Delineation Manual)

Project/Site HOGAN - PANCOST	DATE 8/29/08
Applicant/Owner MACKENZIE	COUNTY BOULDER
Investigator ORTHMER / BOSCHER	STATE CO
Do Normal Circumstances exist on the site? (YES) NO	Plot ID 4
Is the site significantly disturbed (Atypical Situation)? (YES) NO	Community ID
Is the area a potential Problem Area? YES (NO)	Location ID N of pit 2
(If needed, explain on reverse)	

VEGETATION

Dominant Plant Species	Relative Cover % Overstory	% Understory	Indicator Status
1. Agrostis gigantea	–	50	FACW
2. Festuca pratensis	–	40	FAC
3. Trifolium pratense	–	10	FACU
4.			
5.			
6.			
7.			
8.			
9.			
10.			

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-) Total % Overstory ____ Total % Understory 90

Remarks: Absolute veg cove = 100%

HYDROLOGY

✓ Recorded Data (Describe in Remarks):
____ Stream, Lake or Tide Gauge
✓ Aerial Photographs
____ Other
____ No Recorded Data Available

Field Observations:
Depth of Surface Water N/A (in.)
Depth to Free Water in Pit ____ (in.)
Depth to Saturated Soil ____ (in.)

Remarks: No indicators of a wetland hydrology MW #2, 21 ft to South, did not have a wetland hydrology.

Wetland Hydrology Indicators:
Primary Indicators: none
____ Inundated
____ Saturated In Upper 12 Inches
____ Water Marks
____ Drift Lines
____ Sediment Deposits
____ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required): none
____ Oxidized Root Channels in Upper 12 Inches
____ Water-Stained Leaves
____ Local Soil Survey Data
____ FAC Neutral Test
____ Other (Explain in Remarks)

SOILS Pit 4 8/29/08 Hogan Pancost

Map Unit Name
(Series and Phase): _____

Drainage Class: Mod Well

Field Observations
Confirm Mapped Type? Yes No

Taxonomy (Subgroup): Fluvaquentic Haplustolls

Profile Description:

Depth (Inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-7	A	10YR 2/2	—	—	L, 2 fgr
7-14	Bw	10YR 4/3	10YR 4/4	<1%, f	scl, 2 m sbk

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- ___ Reducing Conditions
- ✓ Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer in Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ___ Listed on Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks: On gentle slope above swale bottom.

WETLAND DETERMINATION

Hydrophytic Vegetation Present? Yes No (Circle)
Wetland Hydrology Present? Yes No
Hydric Soils Present? Yes No

(Circle)
Is this Sampling Point Within a Wetland? Yes No

Remarks:

Approved by HQUSAC 3/92

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 Wetland Delineation Manual)

Project/Site HOGAN PANCOST	DATE 8/29/08
Applicant/Owner MACKENZIE	COUNTY BOULDER
Investigator ORTHMER / BUSCHER	STATE CO
Do Normal Circumstances exist on the site? (YES) NO	Plot ID 5
Is the site significantly disturbed (Atypical Situation)? (YES) NO	Community ID
Is the area a potential Problem Area? YES (NO)	Location ID
(If needed, explain on reverse)	

VEGETATION

Dominant Plant Species	Relative Cover % Overstory	% Understory	Indicator Status
1. Agrostis gigantea	—	40	FACW
2. Festuca pratensis	—	40	FAC
3. Phleum pratense	—	10	FACU
4. Poa pratensis	—	10	FACU
5.			
6.			
7.			
8.			
9.			
10.			
Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-)	Total % Overstory —	Total % Understory 80	

Remarks:

HYDROLOGY

✓ Recorded Data (Describe in Remarks):
- ___ Stream, Lake or Tide Gauge
- ___ Aerial Photographs
- ✓ Other

✓ No Recorded Data Available

Field Observations:
- Depth of Surface Water N/A (in.)
- Depth to Free Water in Pit ___ (in.)
- Depth to Saturated Soil ___ (in.)

Remarks: MW #2, located 7' to SE, + similar elevation did not have a wetland hydrology.

Wetland Hydrology Indicators:

Primary Indicators: none
- ___ Inundated
- ___ Saturated In Upper 12 Inches
- ___ Water Marks
- ___ Drift Lines
- ___ Sediment Deposits
- ___ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- X Oxidized Root Channels in Upper 12 Inches
- ___ Water-Stained Leaves
- ___ Local Soil Survey Data
- ___ FAC Neutral Test
- ___ Other (Explain in Remarks)

SOILS Pit 5 8/29/08 Hogan Pancost

Map Unit Name
(Series and Phase): _____

Drainage Class: Somewhat poorly

Field Observations
Confirm Mapped Type? Yes No

Taxonomy (Subgroup): Fluvaquentic Endoaquolls

Profile Description:

Depth (Inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-7	A	10YR2/2	7.5YR3/4	5-7%, d	
7-13	AC	10YR3/2	10YR4/6	3-5%, d	vgl LS/SL

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- ___ Reducing Conditions
- X Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer in Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ___ Listed on Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks: In bottom of swale. Many of the redox features in A horizon are oxidized root channels (≈ 4-5%). Many oxidized sand grains in AC but some mottles.

WETLAND DETERMINATION

Hydrophytic Vegetation Present? Yes No (Circle)
Wetland Hydrology Present? Yes No
Hydric Soils Present? Yes No

(Circle)
Is this Sampling Point Within a Wetland? Yes No

Remarks:

Approved by HQUSAC 3/92

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 Wetland Delineation Manual)

Project/Site HOGAN-PANCOST	DATE 8/29/08
Applicant/Owner MACKENZIE	COUNTY BOULDER
Investigator ORTHMER/BUSCHER	STATE CO
Do Normal Circumstances exist on the site? (YES) NO	Plot ID 6
Is the site significantly disturbed (Atypical Situation)? (YES) NO	Community ID
Is the area a potential Problem Area? YES (NO)	Location ID 8d MW 1
(If needed, explain on reverse)	

VEGETATION

Dominant Plant Species	Relative Cover % Overstory	% Understory	Indicator Status
1. Persicaria amphibia	—	80	NI OBL
2. Lactuca serriola	—	10	FAC
3. Elymgra repens	—	10	NL
4.			
5.			
6.			
7.			
8.			
9.			
10.			
Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-)	Total % Overstory	Total % Understory	

Remarks: #1 = Polygonum pensylvanicum (OBL)
Absolute veg cover = 100%

HYDROLOGY

✓ Recorded Data (Describe in Remarks):
- ___ Stream, Lake or Tide Gauge
- ___ Aerial Photographs
- ✓ Other

___ No Recorded Data Available

Field Observations:
- Depth of Surface Water N/A (in.)
- Depth to Free Water in Pit ___ (in.)
- Depth to Saturated Soil ___ (in.)

Remarks: MW #1 located 15' to W + same elevat. did not have a wetland hydrology ∴ none here.

Wetland Hydrology Indicators:

Primary Indicators:
- ___ Inundated
- ___ Saturated In Upper 12 Inches
- ___ Water Marks
- ___ Drift Lines
- ___ Sediment Deposits
- ___ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- X Oxidized Root Channels in Upper 12 Inches
- ___ Water-Stained Leaves
- ___ Local Soil Survey Data
- ___ FAC Neutral Test
- ___ Other (Explain in Remarks)

SOILS Pit 6 . 8/29/08 Hogan-Pancost Prop

Map Unit Name (Series and Phase): _____

Drainage Class: Somewhat poorly

Field Observations Confirm Mapped Type? Yes No

Taxonomy (Subgroup): Fluvaquentic Endoaquolls

Profile Description:

Depth (Inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-7	A	10YR 2/2	7.5YR 3/4	10-15%, d	SL 2 fgr
7-12	Bw	10YR 3/2	10YR 4/6	25%, p	SCL, 2 m sbk

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- ___ Reducing Conditions
- X Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer in Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ___ Listed on Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks: edge of swale, No saturation. Most redox features in A horizon are oxidized root channels suggesting saturation coming from surface. Many redox features in Bw are in soil matrix — no good indication of saturation source

WETLAND DETERMINATION

Hydrophytic Vegetation Present?	Yes No (Circle)		(Circle)
Wetland Hydrology Present?	Yes No		
Hydric Soils Present?	Yes No	Is this Sampling Point Within a Wetland?	Yes No

Remarks:

Approved by HQUSAC 3/92

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 Wetland Delineation Manual)

Project/Site HOGAN PANCOST	DATE 8/29/08
Applicant/Owner MACKENZIE	COUNTY BOULDER
Investigator ORTHWER/BUSCHER	STATE CO
Do Normal Circumstances exist on the site? (YES) NO	Plot ID 7
Is the site significantly disturbed (Atypical Situation)? (YES) NO	Community ID
Is the area a potential Problem Area? YES (NO)	Location ID
(If needed, explain on reverse)	

VEGETATION

Dominant Plant Species	Relative Cover % Overstory	% Understory	Indicator Status
1. Juncus balticus	–	60	OBL
2. Agrostis gigantea	–	30	FACW
3. Plantago lanceolata	–	5	FAC
4. Carex aquatilis	–	5	OBL
5.			
6.			
7.			
8.			
9.			
10.			
Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-)	Total % Overstory –	Total % Understory 100	

Remarks:

HYDROLOGY

✓ Recorded Data (Describe in Remarks):	Wetland Hydrology Indicators:
___ Stream, Lake or Tide Gauge	Primary Indicators: none
✓ Aerial Photographs	___ Inundated
✓ Other	___ Saturated In Upper 12 Inches
___ No Recorded Data Available	___ Water Marks
Field Observations:	___ Drift Lines
Depth of Surface Water N/A (in.)	___ Sediment Deposits
Depth to Free Water in Pit ___ (in.)	___ Drainage Patterns in Wetlands
Depth to Saturated Soil ___ (in.)	Secondary Indicators (2 or more required):
Remarks: MW #6, 7, 1 + 2 in vicinity of this area, did not have a wetland hydrology; ∴ none here.	✓ Oxidized Root Channels in Upper 12 Inches
	___ Water-Stained Leaves
	___ Local Soil Survey Data
	___ FAC Neutral Test
	___ Other (Explain in Remarks)

SOILS Pit 7 8/29/08 Hogan-Pancost Prop

Map Unit Name (Series and Phase): _____

Drainage Class: somewhat poorly

Field Observations

Taxonomy (Subgroup): Fluvaquentic Endoaquolls

Confirm Mapped Type? Yes No

Profile Description:

Depth (Inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-7	A	10YR2/2	7.5YR3/4	7%, d	SL 2 f gr
7-14	C	10YR3/3 10YR3/2	7.5YR 3/4 10YR4/6	10%, d+p	stratified SL/LS

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- ___ Reducing Conditions
- X Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer in Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ___ Listed on Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks: Most redox features in A horizon are oxidized root channels + in C horizon are in both soil matrix + oxidized root channels. See explanation for Pit 6 - same here. No saturation. In lower area.

WETLAND DETERMINATION

Hydrophytic Vegetation Present? Yes No (Circle)

Wetland Hydrology Present? Yes No

Hydric Soils Present? Yes No

(Circle)

Is this Sampling Point Within a Wetland? Yes No

Remarks:

Approved by HQUSAC 3/92

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 Wetland Delineation Manual)

Project/Site HOGAN PANCOST	DATE 8/29/08
Applicant/Owner MACKENZIE	COUNTY BOULDER
Investigator ORTHMER/BUSCHER	STATE Co
Do Normal Circumstances exist on the site? (YES) NO	Plot ID 8
Is the site significantly disturbed (Atypical Situation)? (YES) NO	Community ID
Is the area a potential Problem Area? YES (NO)	Location ID
(If needed, explain on reverse)	

VEGETATION

Dominant Plant Species	Relative Cover % Overstory	% Understory	Indicator Status
1. Elytrigia repens		40	NL
2. Lolus tenuis		20	NL
3. Festuca pratensis		10	FAC
4. Trifolium Repens		10	FACU
5. Juncus balticus		10	OBL
6. Plantago lanceolata		10	FAC
7.			
8.			
9.			
10.			

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-) Total % Overstory ____ Total % Understory 30

Remarks: Abs. veg cover = 95%

HYDROLOGY

✓ Recorded Data (Describe in Remarks):
- ____ Stream, Lake or Tide Gauge
- ____ Aerial Photographs
- ✓ Other
- ____ No Recorded Data Available

Field Observations:
- Depth of Surface Water N/A (in.)
- Depth to Free Water in Pit ____ (in.)
- Depth to Saturated Soil ____ (in.)

Remarks: All hydrology monitoring wells in this vicinity did not have a wetland hydrology.

Wetland Hydrology Indicators:

Primary Indicators: none
- ____ Inundated
- ____ Saturated In Upper 12 Inches
- ____ Water Marks
- ____ Drift Lines
- ____ Sediment Deposits
- ____ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- X Oxidized Root Channels in Upper 12 Inches
- ____ Water-Stained Leaves
- ____ Local Soil Survey Data
- ____ FAC Neutral Test
- ____ Other (Explain in Remarks)

SOILS Pit 8 8/29/08 Hogan-Pancost Prop

Map Unit Name
(Series and Phase): _____

Drainage Class: mod well

Field Observations
Confirm Mapped Type? Yes No

Taxonomy (Subgroup): Fluvaquentic Epiaquolls

Profile Description:

Depth (Inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-6	A	10YR2/2	7.5YR3/4	3-5%, d pl	SL, 2 f gr
6-14	Bw	10YR3/2	—	—	pl SCL, 2 m sbk

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- ___ Reducing Conditions
- X Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer in Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ___ Listed on Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks: Up from Pit 7. Most redox features in A horizon are along root channels suggesting saturation is coming from the surface — irrigation. No mottles below the A horizon.

No saturation.

WETLAND DETERMINATION

Hydrophytic Vegetation Present? Yes (No) (Circle)
Wetland Hydrology Present? Yes (No)
Hydric Soils Present? (Yes) No

(Circle)
Is this Sampling Point Within a Wetland? Yes (No)

Remarks:

Approved by HQUSAC 3/92

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 Wetland Delineation Manual)

Project/Site HOGANN - DANCOST	DATE 8/29/08
Applicant/Owner MACKENZIE	COUNTY BOULDER
Investigator ORTHMER / BUSCHER	STATE CO
Do Normal Circumstances exist on the site? (YES) NO	Plot ID 9
Is the site significantly disturbed (Atypical Situation)? (YES) NO	Community ID
Is the area a potential Problem Area? YES (NO)	Location ID N of 7+8
(If needed, explain on reverse)	

VEGETATION

Dominant Plant Species	Relative Cover % Overstory	% Understory	Indicator Status
1. Festuca pratensis	–	40	FAC
2. Carex nebrascensis	–	40	OBL
3. Trifolium pratense	–	10	FACU
4. Lolus tenuis	–	10	NL
5.			
6.			
7.			
8.			
9.			
10.			

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-) — Total % Overstory — — Total % Understory 80

Remarks: Sedge looks dried up looking; no flts or fruits seen area may be drying up

HYDROLOGY

✓ Recorded Data (Describe in Remarks):	Wetland Hydrology Indicators:
____ Stream, Lake or Tide Gauge	Primary Indicators: none
____ Aerial Photographs	____ Inundated
✓ Other	____ Saturated In Upper 12 Inches
____ No Recorded Data Available	____ Water Marks
Field Observations:	____ Drift Lines
Depth of Surface Water N/A (in.)	____ Sediment Deposits
Depth to Free Water in Pit ____ (in.)	____ Drainage Patterns in Wetlands
Depth to Saturated Soil ____ (in.)	Secondary Indicators (2 or more required): none
Remarks: All hydrology monitoring wells in this area lacked a wetland hydrology. Therefore none here.	____ Oxidized Root Channels in Upper 12 Inches
	____ Water-Stained Leaves
	____ Local Soil Survey Data
	____ FAC Neutral Test
	____ Other (Explain in Remarks)

SOILS Pit 9 8/29/08 Hogan-Pancost Prop.

Map Unit Name
(Series and Phase): _____

Drainage Class: well

Field Observations
Confirm Mapped Type? Yes No

Taxonomy (Subgroup): Fluvaquentic Haplustolls

Profile Description:

Depth (Inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-6	A	10YR 2/2	—	—	gl SL, 2 f gr
6-14	Bw	10YR 3/2	10YR 4/4	<1%,	gl scl, 2 m sbk

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- ___ Reducing Conditions
- ___ Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer in Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ___ Listed on Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks: Up from Pit 8. Observed two small mottles but << 1%. No oxidized root channels observed.

WETLAND DETERMINATION

Hydrophytic Vegetation Present? Yes No (Circle)
Wetland Hydrology Present? Yes No
Hydric Soils Present? Yes No

(Circle)
Is this Sampling Point Within a Wetland? Yes No

Remarks:

Approved by HQUSAC 3/92

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 Wetland Delineation Manual)

Project/Site HOGAN-PANCOST	DATE 8/29/08
Applicant/Owner MACKENZIE	COUNTY BOULDER
Investigator ORTHNER / BUSCHER	STATE CO
Do Normal Circumstances exist on the site? (YES) NO	Plot ID 10
Is the site significantly disturbed (Atypical Situation)? (YES) NO	Community ID
Is the area a potential Problem Area? YES (NO)	Location ID
(If needed, explain on reverse)	

VEGETATION

Dominant Plant Species	Relative Cover % Overstory	% Understory	Indicator Status
1. Agrostis gigantea	–	20	FACW
2. Chicorium intybus	–	10	NL
3. Plantago lanceolata	–	20	FAC
4. Trifolium repens	–	10	FACU
5. Juncus balticus	–	20	OBL
6. Phleum pratense	–	10	FACU
7. Alopecurus pratensis	–	10	NI [FACW]
8.			
9.			
10.			
Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-)	Total % Overstory –	Total % Understory 70	

Remarks: Vegetation is marginally hydrophytic here, but does meet criteria

HYDROLOGY

✓ Recorded Data (Describe in Remarks):	Wetland Hydrology Indicators:
____ Stream, Lake or Tide Gauge	Primary Indicators: none
____ Aerial Photographs	____ Inundated
✓ Other	____ Saturated In Upper 12 Inches
____ No Recorded Data Available	____ Water Marks
Field Observations:	____ Drift Lines
Depth of Surface Water N/A (in.)	____ Sediment Deposits
Depth to Free Water in Pit ____ (in.)	____ Drainage Patterns in Wetlands
Depth to Saturated Soil ____ (in.)	Secondary Indicators (2 or more required):
Remarks: MW #6+7, located 16-40' ft NW of this area on either same elevation or 1' lower did not have a wetland hydrology ∴ none here	X Oxidized Root Channels in Upper 12 Inches
	____ Water-Stained Leaves
	____ Local Soil Survey Data
	____ FAC Neutral Test
	____ Other (Explain in Remarks)

SOILS Pit 10 8/29/08 Hogan-Pancost Prop.

Map Unit Name
(Series and Phase): _____

Drainage Class: Somewhat poorly

Field Observations
Confirm Mapped Type? Yes No

Taxonomy (Subgroup): Fluvaquentic Endoaquolls

Profile Description:

Depth (Inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-7	A	10YR2/2	7.5YR3/4	3%, d	Vgl SL
7-12	C	10YR3/2	7.5YR 4/4 10YR 4/6	3-7%, d+p	Vgl LS

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- ___ Reducing Conditions
- ✓ Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer in Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ___ Listed on Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks: On small mound. No saturation, 1-2% oxidized root channels in A horizon. Many iron stained sand grains in C horizon.

WETLAND DETERMINATION

Hydrophytic Vegetation Present?	Yes (circled) No	(Circle)	(Circle)
Wetland Hydrology Present?	Yes No (circled)		
Hydric Soils Present?	Yes (circled) No	Is this Sampling Point Within a Wetland?	Yes No (circled)

Remarks:

Approved by HQUSAC 3/92

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 Wetland Delineation Manual)

Project/Site HOLAN · PANCOST	DATE 8/29/08
Applicant/Owner MACKENZIE	COUNTY BOULDER
Investigator ORTHWER / BUSCHER	STATE CO
Do Normal Circumstances exist on the site? (YES) NO	Plot ID 11
Is the site significantly disturbed (Atypical Situation)? (YES) NO	Community ID
Is the area a potential Problem Area? YES (NO)	Location ID
(If needed, explain on reverse)	

VEGETATION

Dominant Plant Species	Relative Cover % Overstory	% Understory	Indicator Status
1. Festuca pratensis	—	70	FAC
2. Trifolium repens	—	10	FACU
3. Plantago lanceolata	—	5	FAC
4. Juncus balticus	—	5	OBL
5. Agrostis gigantea	—	5	FACW
6. Lotus tenuis	—	5	NL
7.			
8.			
9.			
10.			
Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-)	Total % Overstory —	Total % Understory 85	

Remarks:

HYDROLOGY

✓ Recorded Data (Describe in Remarks):	Wetland Hydrology Indicators:
____ Stream, Lake or Tide Gauge	Primary Indicators:
____ Aerial Photographs	____ Inundated none
✓ Other	____ Saturated In Upper 12 Inches
____ No Recorded Data Available	____ Water Marks
Field Observations:	____ Drift Lines
Depth of Surface Water N/A (in.)	____ Sediment Deposits
Depth to Free Water in Pit ____ (in.)	____ Drainage Patterns in Wetlands
Depth to Saturated Soil ____ (in.)	Secondary Indicators (2 or more required):
Remarks: MW 9 located 45' to the SW and same elevation was dry entire season ∴ no wetland hydrology here.	____ Oxidized Root Channels in Upper 12 Inches
	____ Water-Stained Leaves
	____ Local Soil Survey Data
	____ FAC Neutral Test
	____ Other (Explain in Remarks)

SOILS Pit 11 8/29/08 Hogan-Pancoot Prop

Map Unit Name (Series and Phase): _____

Drainage Class: somewhat poorly

Field Observations Confirm Mapped Type? Yes No

Taxonomy (Subgroup): Fluvaquentic Epiaquolls

Profile Description:

Depth (Inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-5	A1	10YR 2/2	—	—	SL, 2 f sbk
5-14	A2	10YR 2/2	7.5YR 3/4	5-10%, d	SL, 2 m sbk

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- ___ Reducing Conditions
- ✓ Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer in Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ___ Listed on Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks: No saturation. Most of the redox features in A2 horizon are along root channels, suggesting saturation is from the surface → possibly from irrigation.

WETLAND DETERMINATION

Hydrophytic Vegetation Present? Yes No (Circle)

Wetland Hydrology Present? Yes No

Hydric Soils Present? Yes No

(Circle)

Is this Sampling Point Within a Wetland? Yes No

Remarks:

Approved by HQUSAC 3/92

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 Wetland Delineation Manual)

Project/Site HOGAN-PANCOST	DATE 8/29/08
Applicant/Owner MACKENZIE	COUNTY BOULDER
Investigator ORTHMAN/BUSCHER	STATE Co
Do Normal Circumstances exist on the site? (YES) NO	Plot ID 12
Is the site significantly disturbed (Atypical Situation)? (YES) NO	Community ID
Is the area a potential Problem Area? YES (NO)	Location ID wetland B
(If needed, explain on reverse)	

VEGETATION

Dominant Plant Species	Relative Cover % Overstory	% Understory	Indicator Status
1. Persicaria amphibia	–	70	NL [OBL]
2. Ranunculus macounii	–	20	OBL
3. Carex nebrascensis		10	OBL
4.			
5.			
6.			
7.			
8.			
9.			
10.			
Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-)	Total % Overstory	Total % Understory 100	

Remarks: #1 = P. pennsylvanica

HYDROLOGY

✓ Recorded Data (Describe in Remarks):
- ___ Stream, Lake or Tide Gauge
- ___ Aerial Photographs
- ✓ Other
- ___ No Recorded Data Available

Field Observations:
- Depth of Surface Water N/A (in.)
- Depth to Free Water in Pit ___ (in.)
- Depth to Saturated Soil ___ (in.)

Remarks: Non-induced artificial wetland hydrology. MW 10+11 located 30-40 ft to south + 4-6" elevationally above did have a wetland hydrology.

Wetland Hydrology Indicators:

Primary Indicators: none
- ___ Inundated
- ___ Saturated In Upper 12 Inches
- ___ Water Marks
- ___ Drift Lines
- ___ Sediment Deposits
- ___ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- X Oxidized Root Channels in Upper 12 Inches
- ___ Water-Stained Leaves
- ___ Local Soil Survey Data
- ___ FAC Neutral Test
- X Other (Explain in Remarks)

SOILS Pit 12 8/29/08 Hogan-Pancost Prop.

Map Unit Name
(Series and Phase): _____

Drainage Class: poorly

Field Observations
Confirm Mapped Type? Yes No

Taxonomy (Subgroup): Fluvaquentic Endoaquolls

Profile Description:

Depth (Inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-4	A1	10YR 2/2	7.5YR 3/4	5%, d	L, 2 fgr
4-10	A2	10YR 3/1	7.5YR 3/4 10YR 4/6	20%, d+p	SL, 1 m sbk
10-14	C	10YR 6/2	10YR 4/6	30%, p	co sand, sg

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- ___ Reducing Conditions
- ✓ Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer in Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ___ Listed on Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks: No saturation in SW corner. Redox features in soil matrix + along root channels in upper 10". Many iron coatings on sand grains in C horizon.

WETLAND DETERMINATION

Hydrophytic Vegetation Present? Yes No (Circle)
Wetland Hydrology Present? Yes No
Hydric Soils Present? Yes No

(Circle)
Is this Sampling Point Within a Wetland? Yes No

Remarks:

Approved by HQUSAC 3/92

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 Wetland Delineation Manual)

Project/Site HOGAN PANCOST	DATE 8/29/08
Applicant/Owner MACKENZIE	COUNTY BOULDER
Investigator ORTHMER / BOSCHER	STATE CO
Do Normal Circumstances exist on the site? (YES) NO	Plot ID 13
Is the site significantly disturbed (Atypical Situation)? (YES) NO	Community ID
Is the area a potential Problem Area? YES (NO)	Location ID Wetland C
(If needed, explain on reverse)	

VEGETATION

Dominant Plant Species	Relative Cover % Overstory	% Understory	Indicator Status
1. Carex lanuginosa		40	OBL
2. Carex sp. colored		40	OBL
3. Lactuca serriola		5	FAC
4. Cirsium arvense		5	FACU
5. Agrostis gigante		5	FACW
6. Conyza canadensis		5	FACU-
7.			
8.			
9.			
10.			
Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-)	Total % Overstory	Total % Understory 90	

Remarks: #1 not in Pl n hd

HYDROLOGY

✓ Recorded Data (Describe in Remarks):	Wetland Hydrology Indicators:
____ Stream, Lake or Tide Gauge	Primary Indicators: none
____ Aerial Photographs	____ Inundated
✓ Other	____ Saturated In Upper 12 Inches
____ No Recorded Data Available	____ Water Marks
Field Observations:	____ Drift Lines
Depth of Surface Water NA (in.)	____ Sediment Deposits
Depth to Free Water in Pit ____ (in.)	____ Drainage Patterns in Wetlands
Depth to Saturated Soil ____ (in.)	Secondary Indicators (2 or more required):
Remarks: Between MW 14 + 16 that did have a wetland hydrology + but it is seepage from ditch	X Oxidized Root Channels in Upper 12 Inches
	____ Water-Stained Leaves
	____ Local Soil Survey Data
	____ FAC Neutral Test
	____ Other (Explain in Remarks)

SOILS Pit 13 8/29/08 Hogan-Pancost Prop.

Map Unit Name
(Series and Phase): _____

Drainage Class: poorly

Field Observations
Confirm Mapped Type? Yes No

Taxonomy (Subgroup): Fluvaquentic Endoaquolls

Profile Description:

Depth (Inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-4	A1	10YR 2/2	7.5YR 3/4	3-5%, d	L, 2 f gr
4-14	A2	10YR 2/1	7.5YR 3/4 10YR 4/4	10-15%, d	SL, 1 m sbk

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- ___ Reducing Conditions
- ✓ Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer in Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ___ Listed on Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks: In narrow swale, No saturation, Redox features occur in matrix + along root channels,

WETLAND DETERMINATION

Hydrophytic Vegetation Present? Yes No (Circle)
Wetland Hydrology Present? Yes No
Hydric Soils Present? Yes No

(Circle)
Is this Sampling Point Within a Wetland? Yes No

Remarks:

Approved by HQUSAC 3/92

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 Wetland Delineation Manual)

Project/Site HOGAN-PANCOST	DATE 8/29/08
Applicant/Owner MACKENZIE	COUNTY BOULDER
Investigator ORTHMER/BUSCHER	STATE CO
Do Normal Circumstances exist on the site? YES NO	Plot ID 14
Is the site significantly disturbed (Atypical Situation)? YES NO	Community ID
Is the area a potential Problem Area? YES NO	Location ID
(If needed, explain on reverse)	

VEGETATION

Dominant Plant Species	Relative Cover % Overstory	% Understory	Indicator Status
1. Juncus balticus		30	OBL
2. Conyza canadensis		20	FACU-
3. Onopordum acanthium		20	NL
4. Lactuca serriola		10	FAC
5. Grindelia squarrosa		10	FACU-
6. Trifolium repens		10	FACU
7.			
8.			
9.			
10.			

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-) — Total % Overstory — Total % Understory 40

Remarks: Abs. veg = 95%; -note this area extending to S + N to MW21 + 22 is extremely weedy and lacks a predominance of hydrophytes. 9/29/08 FIELD VISIT BY CORPS AGREED.

HYDROLOGY

✓ Recorded Data (Describe in Remarks):
- ___ Stream, Lake or Tide Gauge
- ✓ Aerial Photographs
- ✓ Other
- ___ No Recorded Data Available

Field Observations:
- Depth of Surface Water ___ (in.)
- Depth to Free Water in Pit ___ (in.)
- Depth to Saturated Soil ___ (in.)

Remarks: Near MW 21 + 22 ~20 ft away. MW 21 (4" lower) has a wetland hydrology, MW 22 (4" higher) does not. Water levels @ MW 21 indicate that there would not be one here.

Wetland Hydrology Indicators:

Primary Indicators:
- ___ Inundated
- ___ Saturated In Upper 12 Inches
- ___ Water Marks
- ___ Drift Lines
- ___ Sediment Deposits
- ___ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- X Oxidized Root Channels in Upper 12 Inches
- ___ Water-Stained Leaves
- ___ Local Soil Survey Data
- ___ FAC Neutral Test
- ___ Other (Explain in Remarks)

SOILS Pit 14 8/29/08 Hogan-Pancoast Prop.

Map Unit Name
(Series and Phase): _____

Drainage Class: poorly
Field Observations
Confirm Mapped Type? Yes No

Taxonomy (Subgroup): Fluvaquentic Endoaquolls

Profile Description:

Depth (Inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-6	A1	7.5YR 2.5/1	7.5YR3/4	15%	L, 2 f gr
6-9	A2	10YR3/2 10YR2/1	7.5YR3/4 10YR4/6	20%	SL, 1 m SBK
9-13	C	10YR3/2	10YR4/6	10%	LS, sg

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- ___ Reducing Conditions
- X Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer in Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ___ Listed on Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks: No saturation. Redox features throughout occur along root channels + in soil matrix.

WETLAND DETERMINATION

Hydrophytic Vegetation Present? Yes No (Circle) (Circle)
Wetland Hydrology Present? Yes No
Hydric Soils Present? Yes No Is this Sampling Point Within a Wetland? Yes No

Remarks:

Approved by HQUSAC 3/92

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 Wetland Delineation Manual)

Project/Site HOGAN-PANROST	DATE 8/29/08
Applicant/Owner MACKENSTIE	COUNTY BOULDER
Investigator ORTHMER / BUSCHER	STATE CO
Do Normal Circumstances exist on the site? (YES) NO	Plot ID 15
Is the site significantly disturbed (Atypical Situation)? (YES) NO	Community ID
Is the area a potential Problem Area? YES (NO)	Location ID near MW 26
(If needed, explain on reverse)	

VEGETATION

Dominant Plant Species	Relative Cover % Overstory	% Understory	Indicator Status
1. Juncus balticus	–	94	OBL
2. Plantago lanceolata	–	2	FAC
3. Rosa woodsii	–	2	FACU
4. Cardaria draba	–	2	NL
5.			
6.			
7.			
8.			
9.			
10.			
Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-)	Total % Overstory –	Total % Understory 96	

Remarks: all Juncus balticus looks dried up; upper 1/2 dried – not in ptr – Abs veg cover ~ 60%.

HYDROLOGY

✓ Recorded Data (Describe in Remarks):
- ___ Stream, Lake or Tide Gauge
- ✓ Aerial Photographs
- ✓ Other
- ___ No Recorded Data Available

Field Observations:
- Depth of Surface Water N/A (in.)
- Depth to Free Water in Pit ___ (in.)
- Depth to Saturated Soil ___ (in.)

Remarks: MW 26 is 6' away at same elevation and was Dry entire monitoring period ∴ no wetland hydrology here.

Wetland Hydrology Indicators:

Primary Indicators:
- ___ Inundated none
- ___ Saturated In Upper 12 Inches
- ___ Water Marks
- ___ Drift Lines
- ___ Sediment Deposits
- ___ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- ✓ Oxidized Root Channels in Upper 12 Inches
- ___ Water-Stained Leaves
- ___ Local Soil Survey Data
- ___ FAC Neutral Test
- ___ Other (Explain in Remarks)

SOILS Pit 15 8/29/08 Hogan Pancot Prop

Map Unit Name
(Series and Phase): _____

Drainage Class: Somewhat poorly

Field Observations
Confirm Mapped Type? Yes No

Taxonomy (Subgroup): Fluvaquentic Epiaquolls

Profile Description:

Depth (Inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-7	A	7.5YR 2.5/1	7.5YR 3/4	15%, d	SL 2 f gr
7-12	C	7.5YR 3/2	7.5YR 3/4	5%,	V. gr LS

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- ___ Reducing Conditions
- ✓ Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer in Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ___ Listed on Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks: No saturation. Most redox features occur along root channels suggesting saturation is from surface → irrigation.

WETLAND DETERMINATION

Hydrophytic Vegetation Present? Yes No (Circle)
Wetland Hydrology Present? Yes No
Hydric Soils Present? Yes No

(Circle)
Is this Sampling Point Within a Wetland? Yes No

Remarks:

Approved by HQUSAC 3/92

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 Wetland Delineation Manual)

Project/Site HOGAN-PANCOST	DATE
Applicant/Owner MACKENZIE	COUNTY BOULDER
Investigator ORTHNER / BUSCHER	STATE CO
Do Normal Circumstances exist on the site? (YES) NO	Plot ID 16
Is the site significantly disturbed (Atypical Situation)? (YES) NO	Community ID
Is the area a potential Problem Area? YES (NO)	Location ID near MW 29
(If needed, explain on reverse)	

VEGETATION

Dominant Plant Species	Relative Cover % Overstory	% Understory	Indicator Status
1. Carex C. lanuginosa		80	OBL
2. Juncus balticus		10	OBL
3. Cirsium arvense		5	FACU
4. Lactuca serriola		5	FAC
5.			
6.			
7.			
8.			
9.			
10.			
Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-)	Total % Overstory	Total % Understory 95	

Remarks: sedges + baltic rush dried-up today, veg cover (absolute) ≈ 70%
#1 not in air area

HYDROLOGY

✓ Recorded Data (Describe in Remarks):	Wetland Hydrology Indicators:
___ Stream, Lake or Tide Gauge	Primary Indicators: none
✓ Aerial Photographs	___ Inundated
✓ Other	___ Saturated In Upper 12 Inches
___ No Recorded Data Available	___ Water Marks
Field Observations:	___ Drift Lines
Depth of Surface Water NA (in.)	___ Sediment Deposits
Depth to Free Water in Pit ___ (in.)	___ Drainage Patterns in Wetlands
Depth to Saturated Soil ___ (in.)	Secondary Indicators (2 or more required):
Remarks: 4 inches higher + 90' SW of MW 29, which was dry entire monitoring pd. ∴ no wetland hydrology here	✓ Oxidized Root Channels in Upper 12 Inches
	___ Water-Stained Leaves
	___ Local Soil Survey Data
	___ FAC Neutral Test
	___ Other (Explain in Remarks)

SOILS Pit 16 8/29/08 Hogan-Pancost Prop

Map Unit Name
(Series and Phase): _____

Drainage Class: Somewhat poorly

Field Observations
Confirm Mapped Type? Yes No

Taxonomy (Subgroup): Humaquentic Epiaquolls

Profile Description:

Depth (Inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-5	A	10YR 2/2	7.5YR 3/4	10%, d	gr sl, 2 f gr
5-12	AC	10YR 3/2	7.5YR 3/4	5%, d	v. gr sl

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- ___ Reducing Conditions
- ✓ Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer in Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ___ Listed on Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks: In shallow swale. Most redox features are along root channels suggestion saturation is from surface → probably irrigation.

WETLAND DETERMINATION

Hydrophytic Vegetation Present? Yes No (Circle)
Wetland Hydrology Present? Yes No
Hydric Soils Present? Yes No

(Circle)
Is this Sampling Point Within a Wetland? Yes No

Remarks:

Approved by HQUSAC 3/92

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 Wetland Delineation Manual)

Project/Site HOWN. PANCOST	DATE 8/29/08
Applicant/Owner MACKONTICO	COUNTY BOULDER
Investigator ORTHMER / BUSCHER	STATE CO
Do Normal Circumstances exist on the site? YES NO	Plot ID 17
Is the site significantly disturbed (Atypical Situation)? YES NO	Community ID
Is the area a potential Problem Area? YES NO	Location ID
(If needed, explain on reverse)	

VEGETATION

Dominant Plant Species	Relative Cover % Overstory	% Understory	Indicator Status
1. Carex cl. lanuginosa	—	45	OBL
2. Carex nebrascensis	—	45	OBL
3. Agrostis gigantea	—	5	FACW
4. Eleocharis palustris	—	5	OBL
5.			
6.			
7.			
8.			
9.			
10.			

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-) Total % Overstory _____ Total % Understory 100

Remarks: Abs. veg cover = 100% #1 not in Cr looks like C. vulpinoidea as well

HYDROLOGY

✓ Recorded Data (Describe in Remarks):
- ____ Stream, Lake or Tide Gauge
- ✓ Aerial Photographs
- ✓ Other
- ____ No Recorded Data Available

Field Observations:
- Depth of Surface Water N/A (in.)
- Depth to Free Water in Pit ____ (in.)
- Depth to Saturated Soil ____ (in.)

Remarks: Near MW #30 which did have wetland hydrology in August. We suspect it may be due to ditch water to south, but no evidence.

Wetland Hydrology Indicators:

Primary Indicators: none
- ____ Inundated
- ____ Saturated In Upper 12 Inches
- ____ Water Marks
- ____ Drift Lines
- ____ Sediment Deposits
- ____ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- ✓ Oxidized Root Channels in Upper 12 Inches
- ____ Water-Stained Leaves
- ____ Local Soil Survey Data
- ____ FAC Neutral Test
- X Other (Explain in Remarks)

SOILS Pit 17 8/29/08 Hogan Pancast Prop.

Map Unit Name
(Series and Phase): _____

Drainage Class: poorly

Field Observations
Confirm Mapped Type? Yes No

Taxonomy (Subgroup): Fluvaquentic Endoaquolls

Profile Description:

Depth (Inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-7	A	10YR 2/2	7.5YR 3/4	5%, d	SL, 2 f gr
7-14	Bw	10YR 4/2	7.5YR 3/4 7.5YR 3/1	5%, d	SCL, 2 m SBK

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- ___ Reducing Conditions
- X Gleyed ~~or Low-Chroma~~ Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer in Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ___ Listed on Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks: E side of road. Most redox features in A horizon are along root channels. Redox features, including reduction features (7.5YR 3/1), occur in soil matrix + along root channels.

WETLAND DETERMINATION

Hydrophytic Vegetation Present? Yes No (Circle)
Wetland Hydrology Present? Yes No
Hydric Soils Present? Yes No

(Circle)
Is this Sampling Point Within a Wetland? Yes No

Remarks:

Approved by HQUSAC 3/92

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 Wetland Delineation Manual)

Project/Site Hogan- pancost	DATE 8/29/08
Applicant/Owner MACKENZIE	COUNTY BOULDER
Investigator ORTHMER / BUSCHER	STATE CO
Do Normal Circumstances exist on the site? (YES) NO	Plot ID 18
Is the site significantly disturbed (Atypical Situation)? (YES) NO	Community ID
Is the area a potential Problem Area? YES (NO)	Location ID
(If needed, explain on reverse)	

VEGETATION

Dominant Plant Species	Relative Cover % Overstory	% Understory	Indicator Status
1. Festuca pratensis	—	40	FAC
2. Agrostis gigantea	—	40	FACW
3. Ambrosia psilostachya	—	5	FAC
4. Equisetum hyemale	—	5	FACW
5. Lotus tenuis	—	5	NL
6. Juncus balticus	—	5	OBL
7.			
8.			
9.			
10.			

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-) Total % Overstory — Total % Understory 95

Remarks:

HYDROLOGY

✓ Recorded Data (Describe in Remarks):	Wetland Hydrology Indicators:
___ Stream, Lake or Tide Gauge	Primary Indicators:
___ Aerial Photographs	___ Inundated none
✓ Other	___ Saturated In Upper 12 Inches
___ No Recorded Data Available	___ Water Marks
Field Observations:	___ Drift Lines
Depth of Surface Water N/A (in.)	___ Sediment Deposits
Depth to Free Water in Pit ___ (in.)	___ Drainage Patterns in Wetlands
Depth to Saturated Soil ___ (in.)	Secondary Indicators (2 or more required):
Remarks: near MW 30 which had a wetland hydrology in August, we suspect wetness is due to irrigation, but no evidence.	✓ Oxidized Root Channels in Upper 12 Inches
	___ Water-Stained Leaves
	___ Local Soil Survey Data
	___ FAC Neutral Test
	✓ Other (Explain in Remarks)

SOILS Pit 18, 8/29/08 Hogan Pancost Prop.

Map Unit Name
(Series and Phase): _____

Drainage Class: poorly
Field Observations
Confirm Mapped Type? Yes No

Taxonomy (Subgroup): Fluvaquentic Endoaquolls

Profile Description:

Depth (Inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-8	A	10YR 2/2	7.5YR 3/4	7%, d	SL, 2 fgr
8-15	Bw	10YR 3/2	7.5YR 3/4 10YR 4/6	5%, d+p	gpl SCL/SC

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- ___ Reducing Conditions
- X Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer in Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ___ Listed on Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks: No saturation. Most redox features in A horizon are along root channels. Redox features in Bw horizon occur in soil matrix + along root channels.

WETLAND DETERMINATION

Hydrophytic Vegetation Present? Yes No (Circle)
Wetland Hydrology Present? Yes No
Hydric Soils Present? Yes No

(Circle)
Is this Sampling Point Within a Wetland? Yes No

Remarks:

Approved by HQUSAC 3/92

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 Wetland Delineation Manual)

Project/Site HOGAN-PANCOST	DATE 8/29/08
Applicant/Owner MACKENZIE	COUNTY BOULDER
Investigator ORTHNER/BUSCHER	STATE CO
Do Normal Circumstances exist on the site? (YES) NO	Plot ID 19
Is the site significantly disturbed (Atypical Situation)? (YES) NO	Community ID
Is the area a potential Problem Area? YES (NO)	Location ID S 1 18
(If needed, explain on reverse)	

VEGETATION

Dominant Plant Species	Relative Cover % Overstory	% Understory	Indicator Status
1. Festuca pratensis		70	FAC
2. Agrostis gigantea		10	FACW
3. Poa pratensis		10	FACU
4. Lotus tenuis		10	NL
5.			
6.			
7.			
8.			
9.			
10.			
Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-)	Total % Overstory —	Total % Understory 80	

Remarks:

HYDROLOGY

✓ Recorded Data (Describe in Remarks):	Wetland Hydrology Indicators:
____ Stream, Lake or Tide Gauge	Primary Indicators: none
____ Aerial Photographs	____ Inundated
✓ Other	____ Saturated In Upper 12 Inches
____ No Recorded Data Available	____ Water Marks
Field Observations:	____ Drift Lines
Depth of Surface Water N/A (in.)	____ Sediment Deposits
Depth to Free Water in Pit ____ (in.)	____ Drainage Patterns in Wetlands
Depth to Saturated Soil ____ (in.)	Secondary Indicators (2 or more required):
Remarks: Pit is 6" higher than MW,30 which had water 8-12" from soil surface in August. We suspect hydrology is related to ditch water, if present at all.	✓ Oxidized Root Channels in Upper 12 Inches
	____ Water-Stained Leaves
	____ Local Soil Survey Data
	____ FAC Neutral Test
	✓ Other (Explain in Remarks)

Soil very marginal + hydrology very marginal

SOILS Pit 19 8/29/08 Hogan - Pancost prop.

Map Unit Name (Series and Phase): _____

Drainage Class: Somewhat poorly

Field Observations

Taxonomy (Subgroup): Fluvaquentic Endoaquolls

Confirm Mapped Type? Yes No

Profile Description:

Depth (Inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-6	A	10YR2/2	—	—	SCL 2 f gr
6-13	Bw	10YR3/2	10YR4/6	1-2%, p	gr SCL

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- ___ Reducing Conditions
- X Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer in Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ___ Listed on Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks: Few mottles + oxidized root channels below 6". Soil is marginally hydric. No saturation.

WETLAND DETERMINATION

Hydrophytic Vegetation Present?	Yes	No	(Circle)		(Circle)
Wetland Hydrology Present?	Yes	No			
Hydric Soils Present?	Yes	No		Is this Sampling Point Within a Wetland?	Yes No

Remarks:

Approved by HQUSAC 3/92

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 Wetland Delineation Manual)

Project/Site	DATE 8/29/08
Applicant/Owner	COUNTY BOULDER
Investigator DR TANNER / DASCHOR	STATE CO
Do Normal Circumstances exist on the site? (YES) NO	Plot ID 20
Is the site significantly disturbed (Atypical Situation)? (YES) NO	Community ID
Is the area a potential Problem Area? YES (NO)	Location ID
(If needed, explain on reverse)	

VEGETATION

Dominant Plant Species	Relative Cover % Overstory	% Understory	Indicator Status
1. Festuca pratensis	–	75	FAC
2. Glycerrhiza lepiodota	–	25	FACU
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-) — Total % Overstory – — Total % Understory 75

Remarks: Couple of Russ. olives nearby

HYDROLOGY

✓ Recorded Data (Describe in Remarks):
- ___ Stream, Lake or Tide Gauge
- ___ ✓ Aerial Photographs
- ___ ✓ Other

___ No Recorded Data Available

Field Observations:
- Depth of Surface Water N/A (in.)
- Depth to Free Water in Pit ___ (in.)
- Depth to Saturated Soil ___ (in.)

Remarks: not a wetland hydrology
no indicators 1° or 2° present

Wetland Hydrology Indicators:

Primary Indicators: none
- ___ Inundated
- ___ Saturated In Upper 12 Inches
- ___ Water Marks
- ___ Drift Lines
- ___ Sediment Deposits
- ___ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required): none
- ___ Oxidized Root Channels in Upper 12 Inches
- ___ Water-Stained Leaves
- ___ Local Soil Survey Data
- ___ FAC Neutral Test
- ___ Other (Explain in Remarks)

SOILS Pit 20 8/29/08 Hogan Pancost Prop.

Map Unit Name
(Series and Phase): _____

Drainage Class: somewhat poorly

Field Observations
Confirm Mapped Type? Yes No

Taxonomy (Subgroup): Fluvaquentic Haplustolls

Profile Description:

Depth (Inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-7	A	10YR 2/2	—	—	SL, 2 fgr
7-14	Bw	10YR 3/2	—	—	gr SCL

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- ___ Reducing Conditions
- ___ Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer in Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ___ Listed on Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks: No saturation. No redox features.

WETLAND DETERMINATION

Hydrophytic Vegetation Present? Yes No (Circle)
Wetland Hydrology Present? Yes No
Hydric Soils Present? Yes No

(Circle)
Is this Sampling Point Within a Wetland? Yes No

Remarks:

Approved by HQUSAC 3/92

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 Wetland Delineation Manual)

Project/Site HOGAN PANCOST	DATE 8/29/08
Applicant/Owner MACKENZIE	COUNTY BOULDER
Investigator ORTAMER/BUSCHER	STATE CO
Do Normal Circumstances exist on the site? (YES) NO	Plot ID 21
Is the site significantly disturbed (Atypical Situation)? (YES) NO	Community ID
Is the area a potential Problem Area? YES (NO)	Location ID
(If needed, explain on reverse)	

VEGETATION

Dominant Plant Species	Relative Cover % Overstory	% Understory	Indicator Status
1. Festuca pratensis	–	65	FAC
2. Juncus balticus	–	10	OBL
3. Lotus denis	–	20	NL
4. Cirsium arvense	–	5	FACU
5.			
6.			
7.			
8.			
9.			
10.			

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-) — Total % Overstory ___ — Total % Understory 75

Remarks:

HYDROLOGY

✓ Recorded Data (Describe in Remarks):
- ___ Stream, Lake or Tide Gauge
- ___ Aerial Photographs
- ✓ Other
- ___ No Recorded Data Available

Field Observations:
- Depth of Surface Water ___ (in.)
- Depth to Free Water in Pit ___ (in.)
- Depth to Saturated Soil ___ (in.)

Remarks: no indicators of a wetland hydrology

Wetland Hydrology Indicators:

Primary Indicators: none
- ___ Inundated
- ___ Saturated In Upper 12 Inches
- ___ Water Marks
- ___ Drift Lines
- ___ Sediment Deposits
- ___ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required): none
- ___ Oxidized Root Channels in Upper 12 Inches
- ___ Water-Stained Leaves
- ___ Local Soil Survey Data
- ___ FAC Neutral Test
- ___ Other (Explain in Remarks)

SOILS Pit 21 8/29/08 Hogan-Pancoot Prop

Map Unit Name
(Series and Phase): _____

Drainage Class: Somewhat poorly

Field Observations
Confirm Mapped Type? Yes No

Taxonomy (Subgroup): Fluvaquentic Haplustolls

Profile Description:

Depth (Inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-7	A	10YR2/2	—	—	L, 2 fgr
7-14	Bw	10YR3/2	—	—	gsl scl

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- ___ Reducing Conditions
- ___ Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer in Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ___ Listed on Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks: No saturation, no redox features.

WETLAND DETERMINATION

Hydrophytic Vegetation Present? Yes No (Circle)
Wetland Hydrology Present? Yes No
Hydric Soils Present? Yes No

(Circle)
Is this Sampling Point Within a Wetland? Yes No

Remarks:

Approved by HQUSAC 3/92

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 Wetland Delineation Manual)

Project/Site HOGAN-PANCOST	DATE
Applicant/Owner MACKENZIE	COUNTY BOULDER
Investigator ORTHNER / BUSCHER	STATE CO
Do Normal Circumstances exist on the site? (YES) NO	Plot ID 22
Is the site significantly disturbed (Atypical Situation)? (YES) NO	Community ID
Is the area a potential Problem Area? YES (NO)	Location ID near well #32
(If needed, explain on reverse)	

VEGETATION

Dominant Plant Species	Relative Cover % Overstory	% Understory	Indicator Status
1. Juncus balticus	–	45	OBL
2. Thermopsis C. rhombifolia	–	45	FACW
3. Festuca pratensis	–	10	FAC
4.			
5.			
6.			
7.			
8.			
9.			
10.			
Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-)	Total % Overstory –	Total % Understory 55	

Remarks: Abs veg cover is ~ 85%;

HYDROLOGY

✓ Recorded Data (Describe in Remarks):	Wetland Hydrology Indicators:
____ Stream, Lake or Tide Gauge	Primary Indicators:
✓ Aerial Photographs	____ Inundated none
____ Other	____ Saturated In Upper 12 Inches
____ No Recorded Data Available	____ Water Marks
Field Observations:	____ Drift Lines
Depth of Surface Water N/A (in.)	____ Sediment Deposits
Depth to Free Water in Pit ____ (in.)	____ Drainage Patterns in Wetlands
Depth to Saturated Soil ____ (in.)	Secondary Indicators (2 or more required): none
Remarks: NO indicators of a wetland hydrology here. Also 11' away from MW 32 which was dry entire mon period	____ Oxidized Root Channels in Upper 12 Inches
	____ Water-Stained Leaves
	____ Local Soil Survey Data
	____ FAC Neutral Test
	____ Other (Explain in Remarks)

SOILS Pit 22 8/29/08 Hogan-Pancost Prop

Map Unit Name
(Series and Phase): _____

Drainage Class: mod well

Field Observations
Confirm Mapped Type? Yes No

Taxonomy (Subgroup): Fluvaquentic Haplustolls

Profile Description:

Depth (Inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
0-4	A	10YR2/2	—	—	L, 2 f gr
4-12	AC	10YR2/2	—	—	V. gr SL

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- ___ Reducing Conditions
- ___ Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer in Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ___ Listed on Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks: No saturation, no redox features. On shallow ridge

WETLAND DETERMINATION

Hydrophytic Vegetation Present? Yes No (Circle) (Circle)
Wetland Hydrology Present? Yes No
Hydric Soils Present? Yes No

Is this Sampling Point Within a Wetland? Yes No

Remarks:

Approved by HQUSAC 3/92